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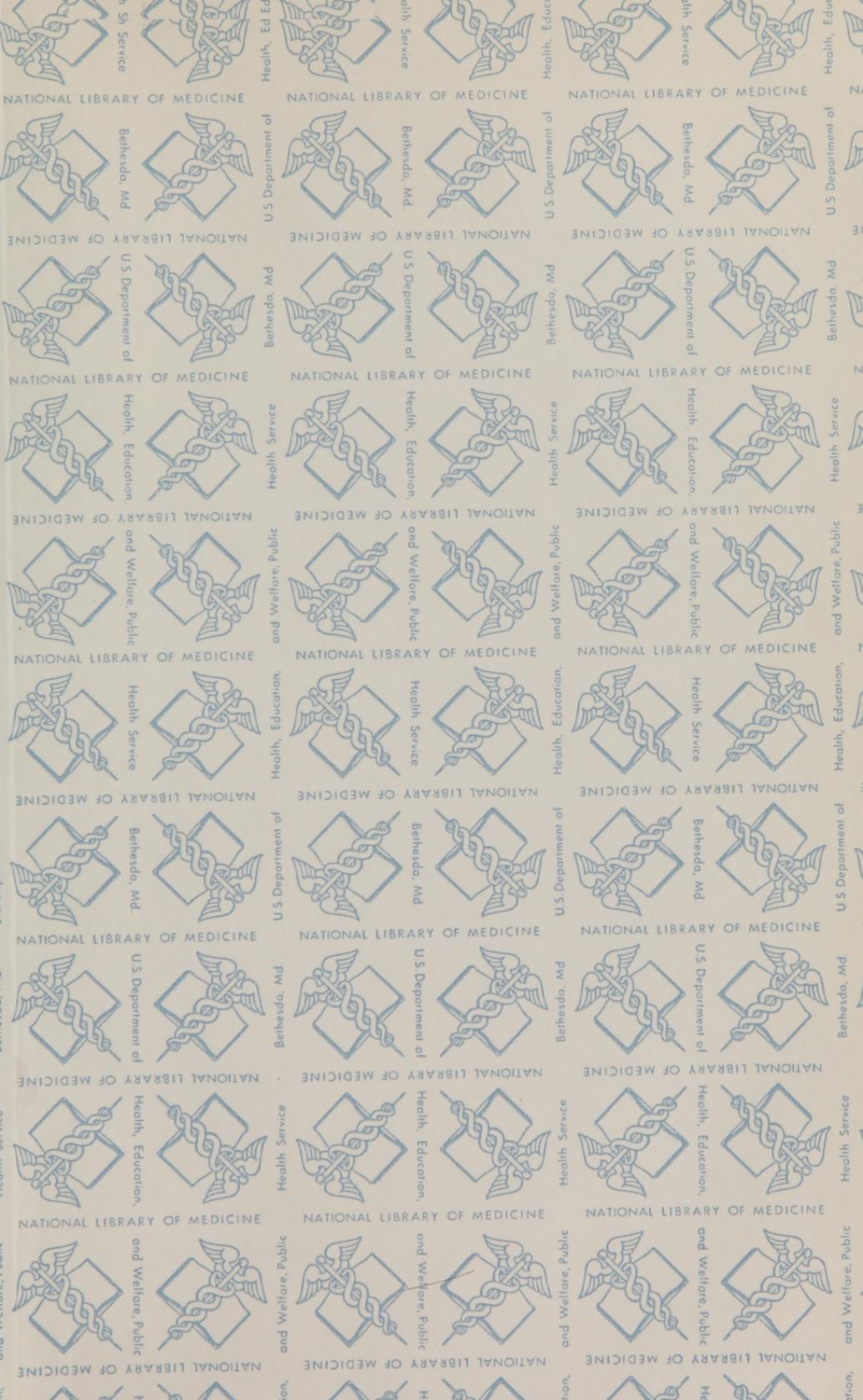
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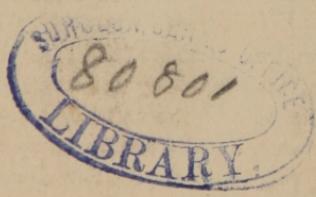
# ANALYSIS

OF

FOUR HUNDRED AND THIRTY-NINE RECOVERED  
AMPUTATIONS IN THE CONTINUITY OF  
THE LOWER EXTREMITY.

BY

STEPHEN SMITH, M. D.



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## EXPLANATION OF THE PLATES.

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### PLATE I.

*Gangrenous Ulcer of Finger of Confederate Soldier. Case VII. W. J. Black, pp. 248-250.*

At the time of the appearance of the gangrene, the patient was acting as a nurse in the Gangrene Hospital, at Vineville, near Macon, Georgia. A small blister appeared upon the third finger of the right hand, which gave much pain, assumed a dark gray and greenish color, and was surrounded by a purplish and blue border in the skin. Concentrated nitric acid did not arrest the progress of the gangrene; and this failure of the local treatment appeared to be due to the gradual poisoning of the system during the continued residence of this nurse in the infected atmosphere of the gangrene hospital.

The drawing was executed on the thirteenth day after the appearance of the gangrene.

The gangrene spread progressively along the borders, under the blue discolored skin. Notwithstanding the comparatively small surface involved, the constitutional symptoms in this case were well marked.

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### PLATE II.

*General Appearance and Extent of Gangrenous Wound of Thigh of Confederate Soldier. Case VIII. Thomas Paine, pp. 250-256.*

This patient was wounded on the 17th of August, 1864, at Atlanta, Georgia. A fragment of lead weighing about one pound projected from a rifle shell, struck the middle of the left thigh, upon the external surface, and lacerated the parts, but did not fracture the bone. Gangrene attacked the wound on the tenth day. The drawing was executed on the thirty-first day after the appearance of the gangrene, and at this time the wound in the thigh was about eight inches in diameter, nearly circular, deeply and irregularly excavated, and coated with dark greenish gray and bluish and brown matter. No healthy pus was discernible; but in its stead the wound discharged a foetid sanious fluid. The large muscles of the thigh were exposed, and could frequently be observed quivering, especially after the application of nitric acid, which caused intense pain. Patient restless and nervous, with trembling hands and quivering distressed eyes.

## EXPLANATION OF THE PLATES.

### PLATE III.

*General Appearance of Wound of Thigh of Thomas Paine, after the Disappearance of Hospital Gangrene. Case VIII. pp. 250-256.*

This drawing was executed twenty days after Plate No. 2. At this time the wound was improving, presenting a bright red granulating surface, and discharging healthy pus. By a comparison with the drawing of the wound during the state of gangrene (Plate No. 2), it will be seen that the parts surrounding the wound have greatly diminished in size, and that with the disappearance of the gangrene, and the improvement of the wound, the swelling and effusion have also disappeared.

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### PLATE IV.

*Appearance of Internal Surface of Portion of Femoral Vein in Case of Pyæmia. Case XLVI.<sup>1</sup> Ira Parker, Confederate Soldier, pp. 415-439.*

The femoral vein was distended with thick yellow pus. Many of the venous branches were in like manner filled with yellow pus. The popliteal vein and its branches, the anterior and posterior tibial veins, were traced to the disorganized tissues, and were in like manner distended with thick, cream-like yellow pus. At various intervals, but chiefly at the junction of the large vessels with the main trunk, and also in the region of the semi-lunar valves, clots of blood were found mingled with the pus, and firmly attached to the sides of the veins. At such points the walls of the veins appeared to be discolored by the coloring matter of the blood, and to be more softened than in those positions where no clots had been formed. The veins were traced directly to the disorganized tissues of the calf and leg; and in the diseased, broken-down diffluent tissues and pus, the walls of the veins were rotten, and gave way upon the slightest touch. The femoral vein, near where it is continuous with the popliteal, and where several branches were received, and where there were semi-lunar valves, was much distended, and presented upon its exterior a dark blue gangrenous appearance. This portion of the femoral vein is represented in the Plate by 1, 2. The remnants of the coagula at the mouths of several vessels, and also attached to the semi-lunar valves, were here visible. The internal surface of this portion of the vein was covered with a tenacious fibrinous exudation, of a greenish yellow and bluish gray color, as represented in the Plate (1, 2), which adhered with tenacity. When this was scraped off, the walls of the vein presented a grayish-blue and black color, and evidently appeared to be gangrenous. The odor of the pus as well as of this portion of the vein was similar to that of tissues affected with hospital gangrene.

<sup>1</sup> The Plate is incorrectly numbered Case XLIV.

## EXPLANATION OF THE PLATES.

### PLATE V.

*Microscopical Appearance of Dark Gray, Green and Black Portions of the Exudation upon Surface of Femoral Vein in Case of Pyæmia. Cass XLVI. Ira Parker, p. 425.*

Exhibiting granular masses, with dark masses of the altered hæmatin of the blood, together with pus globules and masses of fibrous tissue, broken capillaries and fragments of muscular tissue: many of the particles of coloring matter presenting a smooth angular fracture, as if they were crystallized.

# ANALYSIS OF RECOVERED AMPUTATIONS.

## GENERAL REMARKS.

AMPUTATIONS have been the subject of more discussion than any other branch of military surgery. At one period we find them regarded as the true method of treatment of every considerable wound of the extremities, and at another period they have been rejected altogether, and the injured limbs have been left to the rude appliances of the time. Their value has generally been estimated by the mortality that has followed, and this has varied with nearly every campaign. Hence have arisen those remarkable fluctuations of opinion which are recorded in the earlier history of military surgery. It is but a century since that Bilguer, the Surgeon-General of the Prussian army, alarmed at the great fatality of amputations in the wars of that age, prohibited them altogether, preferring to leave the wounded to the then almost unaided efforts of nature. The results of this expectant plan of treatment, or non-operative interference, as reported by him, were so favorable when compared with amputations, that professional opinion for a long period favored an adoption of the expectant method.

Former opinions as to the value of amputations in military surgery.

The fallacy of the reasoning of Bilguer, and of those who advocated his practice, is now very apparent. They made no distinction as to the time at which the amputation was performed after the receipt of the injury. Nor were the circumstances relating to the patient and his subsequent surroundings duly considered. When at a later period the causes of the fatality of amputations began to be more thoroughly understood, and the time of the operation more judiciously selected, the mortality was much reduced, and the operation again became the popular method of treating severe wounds of the extremity.

Fallacy of the reasoning.

But the great advance in practical surgery within the last quarter of a century, has again modified the opinions of surgeons as to the necessity and value of amputations for gunshot wounds. Compound fractures are now treated with a

Effect of conservative measures.

success formerly unknown, and many limbs are saved that a century ago were incontinently sacrificed. The remarkable success which has attended exsections for gunshot injuries of bone, both in saving life and in securing a useful limb, has rescued another large class of cases formerly condemned to amputation. Every campaign has enlarged the experience of military surgeons in the application of conservative measures, and thereby limited more and more the field of amputations. The Crimean and Schleswig-Holstein wars gave a powerful impulse to conservatism in military surgery, the former by its frightful mortality after amputations, and the latter by the great successes which attended conservative measures, especially exsections.

But notwithstanding these great improvements in the treatment of gunshot wounds of the extremities, whereby many lives and limbs are saved that were formerly sacrificed, it cannot be denied that amputations must still occupy an important place in modern military surgery. The liability of the extremities to wounds and injuries is rather increased than diminished by the improved methods of warfare, while their severity is greatly enhanced by the destructive nature of the missiles employed. These facts may be illustrated by the records of the late war; of 87,822 wounds and injuries classified by the Surgeon-General from official returns, 55,245, or nearly two thirds, were located in the extremities, and from the same source it appears that of 17,125 operations of various kinds, 13,397, or about three fourths, were amputations. While it may be true that many of these amputations might have been avoided by the judicious employment of conservative means, it is nevertheless equally certain that in a vast majority of cases the wounds were amenable to no other form of treatment than amputation. We can scarcely believe it possible that a campaign will ever again be inaugurated with an official order from the chief medical officer prohibiting *all* amputations.

The position of the various questions relating to amputations at the commencement of the late war can be stated only in general terms. Many questions which had hitherto divided surgeons were now definitely settled. There was no longer any doubt as to the success of primary when compared with secondary amputations. A broad distinction was very properly drawn between amputations in the upper and lower extremities, based upon the difference in their functions. Every possible effort was advised to save the upper limb by con-

Absolute necessity of amputations in military surgery.

Position of the various questions relating to amputations at commencement of the war.

servative measures. Exsection was well adapted to preserve the functions of the upper extremity, and was strongly recommended at any of its articulations involved in a gunshot injury in preference to amputation. Lesions of the shafts of the long bones were also treated conservatively to the utmost practicable limit. In the lower extremity far less importance was attached to conservative measures; exsection here became a formidable operation, and not only imminently endangered life, but at best its results were doubtful as regarded the serviceableness of the resulting limb. Gunshot fractures of the long bones, especially when severe, were generally condemned to amputation unless occurring under the most favorable circumstances for treatment.

The propriety of amputation at the articulations of the upper extremity was well established; but the same operation in the lower extremity was regarded with little favor. Amputation at the ankle-joint had attracted some attention, but in general surgeons preferred amputation through the leg, and practiced the old routine.

The point of amputation was still determined by the old rule of operating as far from the trunk as possible, or certain points of election were selected, originally fixed by circumstances or conditions long since become obsolete. The methods of operation were altogether unsettled, the preference being generally given to the circular and the flap.

Formerly amputations were regarded as veritable mutilations. They were the dernier ressort, the only alternative of which was death. The operation was repugnant alike to surgeon and patient, as by it the latter seemed reduced to an almost helpless condition. No appliance could compensate for the loss of either an upper or lower extremity. For a hand nothing had yet been invented which even preserved the form, while the clumsy peg-leg was a substitute only in length. But in our time limb-making has been carried to such a state of perfection that both in form and function they so completely resemble the natural extremity that those who wear them pass unobserved and unrecognized in walks of business and of pleasure.

The conservatism of artificial appliances has, therefore, become a most important department of both civil and military surgery. Amputations are no longer to be regarded as mutilations, especially in military surgery, as the government, in its munificent care of its soldiers, gratuitously furnishes every form of artificial substitutes for lost parts. In this respect amputations have become eminently a conservative measure. The surgeon has

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mutilations.

Compensa-  
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not only to consider the probabilities of saving life by his operation, but also the possibilities of giving his patient a better limb with an artificial appliance than he would have if the injured limb were retained.

From this statement it is apparent that there was ample room for improvement in this field of operative surgery, and we readily perceive in what direction we are to look for the results of the experience in the late war. In the first place we should expect to have all the circumstances and conditions which determine a resort to conservative measures, rather than to amputation, more accurately defined. When amputation becomes the alternative, the period after the injury best adapted to secure successful results, as regards the mortality, would be thoroughly investigated and definitely fixed. The old landmarks which defined the boundary between primary and secondary amputations could scarcely fail of being removed, and others more discriminating established. Again, the much disputed question in regard to the propriety of amputation at the articulations would now find a practical solution. Not only should we expect to have the general question as to the comparative dangers of these operations settled, but equally should we have a fixed value placed upon amputation at each individual articulation. Another and not less important subject is the determination of the influence which the point of amputation and the methods of operation has upon the usefulness of the stump in the final adjustment of artificial appliances. This is a new question and of the greatest importance to the future happiness and comfort of the patient.

How far the reasonable anticipations of the profession of the final settlement of the various questions relating to amputations have been realized by the vast experience of the late war, we are not in a position to decide. These final conclusions will be developed only when the accumulated facts of the entire surgical service are reduced and systematized by the Central Official Bureau.

The following paper is a contribution to our knowledge of the results of amputation in the lower extremity. It is based upon the careful study of the stumps of patients when prepared for the application of artificial limbs. Many of them came under our own observation at the U. S. General Hospital, at Central Park, New York. This hospital was, for upwards of two years, the rendezvous of soldiers who had lost their limbs by amputation, and, while inmates, large numbers were supplied with artificial limbs by Dr. E. D. Hudson, of New York, who held a

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article.

government commission for the manufacture and adjustment of appliances to compensate for losses, deformities, etc., resulting from the service. In the practice of mechanical surgery, Dr. Hudson combines the learning and experience of an educated practical surgeon, with a high degree of mechanical skill and ingenuity. In the adjustment of artificial limbs his observations have extended beyond the mere mechanics or art of his profession, and he has made careful studies of subjects relating to stumps, of great practical interest to surgeons.

The records from which the following tables are compiled, were made by Dr. Hudson upon blanks at the bedside of each patient preparatory to the adjustment of each limb. The measurements were all made with great care, and with that accuracy which only a mechanic after long experience can attain to, and they may be relied upon as nearly absolutely correct.

While the view which we take of amputations must necessarily be quite limited, it nevertheless involves some points which are novel and of very great importance. Never before have we had an opportunity of studying on a large scale the final results of amputation. These tables enable us to estimate with great precision the absolute and relative value of the various methods of operation, and of the stumps in different parts of the limb, and of the serviceableness of artificial limbs under every varying condition of stump.

TABLE OF ONE HUNDRED AND FIFTY-EIGHT CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
T. D.	7th Conn.	Sailor	L.	Middle third	Anterior flap	At Post Hospital	One hour	Fragment of shell
R. S.	9th U. S. C. T.	Farmer	R.	Lower third	Lateral skin flaps and circular	On the field	Four hours	Fragment of shell
C. H. S.	1st N. Y. A.	Farmer	R.	Middle third	Circular	On the field	Three hours	Fragment of shell
J. C.	11th Conn.	Farmer	L.	Lower third	Lateral flaps	On the field	Immediately	Solid shot
G. B. F.	14th N. Y. Vols.	Teamster	R.	Lower third	Circular	On the field	One day	Minie-ball
E. J.	1st U. S. A.	Farmer	L.	Lower third	Ant. post. flaps	On the field	One hour	Fragment of shell
S. C. T.	159th N. Y. Vols.	Clerk	L.	Lower third	Ant. post. flap	On the field	Twenty-fo'r hours	Rifle-ball
B. B.	180th N. Y. Vols.	Farmer	L.	Middle third	Circular	On the field	Six hours	Fragment of shell
W. C.	14th U. S. Infantry	Farmer	L.	Lower third	Circular	On the field	Six hours	Minie-ball
G. S.	1st U. S. Cavalry	Laborer	L.	Lower third	Ant. post. flap	On the field	One hour	Minie-ball
R. A.	1st U. S. S. Shooters	Military	R.	Lower third	Ant. post. flap	On the field	Five hours	Musket-ball
A. H.	8th Harris Cavalry	Carpenter	L.	Lower third	Circular	On the field	Nine hours	Minie-ball
J. McG.	4th U. S. Cavalry	Laborer	L.	Middle third	Ant. post. flaps	State Hospital, Columbus, Ga.	Two weeks	Piece of shell
H. E. P.	7th Verm't Vols.	Machinist	R.	Lower third	Ant. post. flap	On the field	Thirty h'rs	Solid shot
T. P.	20th Ind.	Cooper	R.	Lower third	Ant. post. flap	Rebel camp	Twenty-fo'r hours	Musket-ball
J. F. E.	U. S. S. C.	Clerk	L.	Middle third	Ant. post. flaps	On the field	Twenty h'rs	Rifle-ball
C. J. O'B.	24th N. Y. Vols.	Tinman	R.	Middle third	Circular	Field hospital	Two hours	Rifle-ball
A. G. I.	9th N. Y. M.	None	R.	Middle third	Circular	In Frederick Hospital, Md.	-	Musket-ball
T. P.	5th U. S. A.	Laborer	R.	Middle third	Ant. post. flap	On the field	Immediately	Solid shot
N. A. U.	48th N. Y. Vols.	Military	R.	Lower third	Bilateral flaps	On the field	One and a half hour	Minie-ball
R. B.	U. S. Navy	Landsm'n	L.	Middle third	Ant. post. flap	U. S. gun-boat	Twenty-fo'r hours	-
J. D.	69th N. Y. Vols.	Carpenter	R.	Middle third	Ant. post. flap	Frederick City Hosp'l	Thirty-seven days	Minie-ball
G. D.	51st N. Y.	Laborer	L.	Lower third	Ant. post. flap	Field hosp'l, St. Joseph's, Governor's Island	Twenty-fo'r hours	Shell
A. T.	9th N. Y.	Joiner	R.	Upper third	Ant. post. flap	Falmouth	Twenty-fo'r hours	Grape-shot
T. W. D.	82d N. Y.	Clerk	L.	Upper third	Ant. post. flap	On the field	Three days	Shell
H. D.	28th Mass.	Tailor	R.	Lower third	Post flap	On the field, 2d Staunton Hospital	Eight days	Minie-ball 2d time, in suffic'nt flap

OF RECOVERED AMPUTATION OF THIGH.

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Compound comminuted fracture of knee-joint	Fort Wagner, S. C.	Oct. 8, 1863	6 mos.	8 mos.	7½ inches	None	2 inches	Stump healed, very well formed, efficient.
Destruction of foot and ankle-joint	Chapin's Bluff or Farm, Va.	Sept. 29, 1864	4 mos.	9 mos.	11 inches	½ inch	2 inches	Very good, compact, well formed, healed by the first intention.
Comp'd comminut. fract. of lower third of thigh	Chancellorsville	May 1, 1863	6 mos.	6 mos.	6 inches	¾ inch	1 inch	Stump not healed, end of femur not well covered.
Comp'd comminuted fracture of knee-joint and condyles of femur	Antietam, Md.	Sept. 17, 1862	9 mos.	10 mos.	10 inches	1½ inches	None	Good, sm'th stump, well cicatrized.
Comp'd fract. lower third of thigh	—	June 1, 1864	13 mos.	14 mos.	7 inches	1 inch	2 inches	Well healed.
Destruction of knee and leg . . . . .	Port Hudson, La.	May 28, 1863	9 mos.	10 mos.	9½ inches	1 inch	3 inches	Stump well covered by anterior flap, posterior flap redundant, flaccid.
Comp'd com. fract. of middle leg, knee uninjured	Port Hudson, La.	May 2, 1863	7 mos.	15 mos.	12½ in.	1 inch	4 inches	Stump diseased, eczema.
Nearly dissevering limb at knee-joint	Port Hudson, La.	May 27, 1863	6 mos.	7 mos.	6½ inches	None	½ inch	Stump muscles retracted, femur protrudes, not entirely healed, ordered bandaging from above downward.
Comp'd com. fracture of knee-joint	Petersburg, Va.	Aug. 18, 1864	9 mos.	11 mos.	10 inches	2½ inches	2 inches	Considerably atrophied, femur good.
Comp'd com. fracture of knee-joint	Deep Bottom, Va.	July 28, 1864	4 mos.	6 mos.	9½ inches	None	None	Healed, very good.
Comp'd com. fract. low. th'd of thigh	Deep Bottom, Va.	Aug. 15, 1864	5 mos.	—	9½ inches	½ inch	2 inches	Healed, very good.
Comp'd com. fracture of knee-joint	Bull Run, Va.	Aug. 29, 1862	13 mos.	1 year & 11 mos.	10½ in.	3 inches	3 inches	Stump healed.
Muscular tis. of leg entirely denuded fr. ankle to knee	Columbus, Ga.	April 16, 1863	8 mos.	—	7½ inches	1 inch	2½ inches	Injured by necrosis, bone removed, not entirely healed.
Comp'd com. fract. low. th'd of femur	Spanish Fort, Md.	M'ch 29, 1862	8 mos.	9 mos.	11 inches	2 inches	2 inches	Excellent.
Comp'd fracture of knee-joint . . . . .	Fair Oaks, Va.	June 25, 1862	6 mos.	9 mos.	10 inches	3 inches	3 inches	—
Wound of knee . . . . .	Fair Oaks, Va.	June, 1862	6 mos.	—	9½ inches	2 inches	¾ inches	Not yet sound, ulcer and fetid discharges.
Comp'd fracture of knee-joint . . . . .	Antietam, Md.	Sept. 17, 1862	3 mos. & 1 year	—	7 inches	1¼ inches	None	Diseased, herpes, enlarged.
Wound of knee-joint . . . . .	Antietam, Md.	Sept. 17, 1862	3 mos.	—	6½ inches	½ inch	None	Stump unsound, retraction muscles, bone exposed, necrosis, exfoliations in process.
Destruct. of knee-joint . . . . .	Port Hudson, Miss.	May 29, 1863	1 year	16 mos.	6 inches	None	1 inch	Healed in good order.
Comp'd com. fracture of knee-joint	Wilmington, N. C.	Feb. 21, 1863	5 mos.	7 mos.	9 inches	3½ inches	½ inch	Some thickening of the periosteum.
Comp'd com. fracture of tibia, fibula, and femur . . . . .	Wilmington, N. C.	Sept. 3, 1864	6 mos.	8 mos.	7½ inches	½ inch increase	3 inches increase	Damaged by extr. sloughs along front and half the stump.
Wound of lower third of thigh . . . . .	Antietam, Md.	Sept. 17, 1862	9 mos.	11 mos.	7 inches	¾ inches	None	—
Destruct. low. third of leg occasioned by sloughing . . . . .	Fredericksburg, Va.	Dec. 13, 1862	6 mos.	9 mos.	8½ inches	½ inch	None	Extensive cicatrization.
A com. fract. of the knee, thigh, & leg	Fredericksburg, Va.	Dec. 13, 1862	6 mos.	9 mos.	4½ inches	¾ inches	2 inches	Not healed.
Comp'd com. fract. of upper third of leg and knee-joint	Fredericksburg, Va.	Dec. 13, 1862	5 mos.	7 mos.	3 inches	None	¾ inches increase	Stump very short and flexed upon the body.
Comp'd fracture of knee-joint and head of tibia	Fredericksburg, Va.	Dec. 13, 1862	8 mos.	11 mos.	12½ in.	¾ inches	¾ inches	Cicatrization extensive, stump unnecessarily long for thigh amputation.

TABLE OF ONE HUNDRED AND FIFTY-EIGHT CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
J. K.	76th N. Y.	Machinist	R.	Lower third	Circular	On the field	Two hours	Fragment of shell
W. M.	14th W. Va. Vols.	Sil'rsmith	L.	Middle third	Circular	On the field	Six days	Piece of shell
R. H.	183d Pa. Vols.	Farmer	L.	Lower third	Ant. post. flap	11th Corps hospital	Four days	Minie-ball
C. H. G.	16th Mass.	None	L.	Middle third	Ant. post. flap	On the field	Twenty-fo'r hours	Rifle-ball
A. C.	—	Printer	L.	Middle third	Ant. post. flap	—	One hour	Minie-ball
P. McA.	1st U. S. A.	Laborer	R.	Lower third	Anterior flap	On the field	Five hours	Fragment of shell
R. T.	2d N. Y. Vols.	Farmer	L.	Middle third	Ant. post. flap	Field hospit'l	Two hours and a half	Musket-ball
H. C. M.	12th U. S. Infantry	Captain	L.	Middle third	Circular	On the field	Twenty-fo'r hours	Minie-ball
C. H. B.	11th Maine	Farmer	L.	Lower third	Ant. post. flap	On the field	Two hours	Rifle-ball
J. P.	143d N. Y. Vols.	Farmer	L.	Lower third	Ant. post. flap	On the field	Three hours	Minie-ball
C. S.	7th N. Y. Vols.	Butcher	R.	Middle third	Anterior flap	On the field	Imme- diately	Piece of shell
R. T. W.	76th Penn.	Farmer	L.	Lower third	Ant. post. flap	—	Two days	Rifle-ball
C. I. F.	6th N. Y. Cavalry	Assistant Assessor	R.	Lower third	Circular	On the field	Half an ho'r	Solid shot
A. A. H.	9th N. Y. Cavalry	Farmer	R.	Middle third	Circular	On the field	Eight hours	Minie-ball
J. H.	79th N. Y.	Flagstone-cutter	L.	Middle third	Circular	On the field	Twenty-one hours	Minie-ball
A. H.	7th N. Y. H. Artillery	Glazier	R.	Middle third	Ant. post. flaps	On the field	Forty-eight hours	Minie-ball
U. F.	Venezu'l'n Army	—	R.	Lower third	Circular	—	Five m'nths	Musket-ball
G. L. E.	16th Conn. Vols.	Farmer	L.	Middle third	Circular	—	Two hours	Grape-shot
J. G.	24th N. Y. Vols.	Surveyor	R.	Lower third	Ant. post. flaps	Field hospit'l	Forty-eight hours	Minie-ball
R. L.	176th N. Y. Vols.	Tailor	R.	Lower third	Ant. post. flaps	On the field	Five days	Fragment of shell
J. B.	6th Mo. Vols.	None	L.	Middle third	—	Beaufort, S. C.	Twenty d'ys	Fall of tree
B. B.	22d N. Y. Vols.	Boatman	R.	Middle third	Ant. post. flaps	Field hospit'l	Three hours	Piece of shell
J. W.	137th, or 139th N. Y. Vols.	Carpenter	R.	Lower third	—	On the field	Eighteen hours	Musket-ball
J. S.	3d N. Y. Vols.	Cigar-maker	R.	Middle third	Ant. post. flap	On the field	Twenty-fo'r hours	Minie-ball
E. T.	4th Va. Vols.	Farmer	R.	Lower third	Circular	On the field	Thirty-six hours	Musket-ball
G. W.	34th Mass. Vols.	Farmer	R.	Middle third	Circular	On the field	Seventeen hours	Minie-ball
A. K.	162d N. Y. Vols.	Sash and blindmak.	R.	Lower third	Rectangular flap	On the field	Twelve h'rs	Shell
S. D. S.	7th N. H.	Farmer	L.	Upper third	Circular	Confederate hospital, C. S. C.	Forty hours	Grape-shot

# OF RECOVERED AMPUTATION OF THIGH.

## OF RECOVERED AMPUTATION OF THIGH. — (Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Destruction of leg	Gettysburg, Pa.	July 1, 1863	10 mos.	13 mos.	2½ inches	3 inches	3½ inches	Not healed, stump not well covered.
Comp'd com. fracture of knee-joint	Shenandoah Val.	Aug. 22, 1864	9 mos.	10 mos.	8½ inches	2½ inches	3 inches	Very good.
Comp'd com. fracture of knee-joint	Gettysburg, Pa.	July 1, 1863	14 mos.	15 mos.	10½ inch.	3 inches	3 inches	Healed, extensive contract. of flexor muscles.
Comp'd frac. of low. third of femur . . .	Fair Oaks, Va.	June 18, 1862	7 mos.	11 mos.	6½ inches	2 inches increase	2 inches	Gangrene, convalescing.
Comp'd com. fracture of thigh above knee . . .	Bermuda Hundred	June 29, 1864	5 mos.	6 mos.	8 inches	None	None	Healed in good condition.
Comp'd com. fracture of upper half of leg and knee-joint . . . . .	Bayou Teche, La.	April 12, 1863	7 mos.	10 mos.	9 inches	2 inches	3 inches	Stump good proportions, ant. flap well cicatrized, stump well covered, smooth.
Comp'd fract. lower third of femur . . .	Fair Oaks, Va.	June 25, 1862	6 mos.	—	6½ inches	None	4½ inches	—
Comp'd com. fracture of thigh . . .	Wilder-ness, Va.	May 5, 1864	7 mos.	10 mos.	7½ inches	1½ inches	2½ inches	Creditable though scanty covering.
Comp'd com. fracture of knee-joint	Deep Bottom, Va.	July 21, 1864	6 mos.	7 mos.	10½ inch.	1½ inches	2½ inches	Very good.
Comp'd com. fracture of knee-joint . . .	Bentonville, N. C.	Mch. 19, 1865	7 mos.	7 mos.	9 inches	2 inches	2 inches	Not properly heal'd, otherwise good.
Comp'd com. fracture upper third of leg	Newport News	Mch. 8, 1862	17 mos.	19 mos.	9½ inches	3 inches	2½ inches	Stump well healed, finely covered, cicatrix well b'ck, clean front, a neat stump, full size.
Comp'd com. fracture of the thigh at its lower third and knee-joint	Pocotaligo, S. C.	Oct. 22, 1862	6 mos.	11 mos.	11 inches	½ inch	1 inch	—
Destruction of leg	Winchester, Va.	Sept. 19, 1864	10 mos.	1 year	9 inches	3 inches	2 inches	Very good, back of end damaged by sloughing.
Comp'd com. fracture of knee . . .	Stevensburg, Va.	Oct. 11, 1863	8 mos.	10 mos.	9½ inches	None	2 inches	Healed, badly damaged by sloughings, eczematous.
Comp'd comminuted fracture of femur . . . . .	Blue Springs, E. Tenn.	Oct. 10, 1863	4 mos.	7 mos.	8 inches	½ inch increase	1 inch increase	St'mp healed, some angular pouting in front.
Comp'd com. fracture of low. third	Coal Harbor, Va.	June 3, 1864	6 mos.	7 mos.	6½ inches	½ inch	1½ inches	Healed, very good.
Comp'd com. fracture of upper third of leg . . .	—	1861	4 years	4 years	10½ inch.	1 inch increase	2 inches	Healed, insufficient integumental covering.
Comminuted fracture of knee-joint	Suffolk, Va.	April 24, 1863	5 mos.	6 mos.	4 inches	½ inch	2 inches	Healed.
Comp'd com. fracture of knee-joint	Antietam, Md.	Sept. 17, 1863	1 year	15 mos.	—	1 inch	1 inch	Well healed and sound.
Comp'd com. fract. 4 inch. below knee	Fisher's Hill, Va.	Sept. 22, 1864	10 mos.	1 year	10 inches	½ inch increase	4 inches	Ordinary, healed.
Simple oblique fracture of thigh	Beaufort, S. C.	Feb'y 3, 1865	10 mos.	—	5 inches	None	None	Lack of extension, became sh'rtened and limited.
Comp'd com. fracture of low. third of leg . . . . .	Antietam, Md.	Sept. 17, 1862	4 mos.	4 mos.	5 inches	None	1½ inch	—
Com. fract. of upper third of leg . . . . .	Lookout Valley, Tenn.	Oct. 29, 1863	3 mos.	6 mos.	10½ inch.	1 inch	3 inches	Stump not healed.
Comp'd com. fracture of low. third of thigh . . . . .	Drury's Bluff	May 16, 1864	7 mos.	9 mos.	7 inches	½ inch	3½ inches	Healed, very good.
Comp'd fracture of knee-joint . . .	Cedar Creek, Va.	Oct. 19, 1864	3 mos.	4 mos.	11 inches	1½ inch	1 inch	Healed, very good.
Comp'd com. fracture of low. third of thigh . . . . .	Winchester, Va.	Sept. 19, 1864	4 mos.	5 mos.	9 inches	1 inch	1 inch	Healed, very thinly covered by cicatrix, caused by retraction.
Comp'd com. fracture of knee-joint	Port Hudson, La.	June 14, 1863	3 mos.	15 mos.	10 inches	1 inch	1 inch	—
Compound comminuted fracture of thigh . . . . .	Fort Wagner, S. C.	July 18, 1863	7 mos.	9 mos.	2½ inches	3 inches	1½ inches	Hemorrhage arrested by a cord he had in his pocket, 24 h'rs in a trench, st'mp insufficiently covered owing to sloughing, ex-foliation, and retraction.

TABLE OF ONE HUNDRED AND FIFTY-EIGHT CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
J. B.	100th N. Y. Vols.	Moulder	L.	Lower third	Anterior flap	Morris Island	One hour	Fragment of shell
W. H. H.	17th Mich. Vols.	Farmer	R.	Middle third	Circular	On the field	Eighteen hours	Minie-ball
J. M.	11th N. Y. Cavalry	Seaman	L.	Middle third	Ant. post. flap	—	Twenty-fo'r hours	Minie-ball
H. W.	U. S. Navy	Landsm'n	L.	Middle third	Circular	U. S. Hosp., Norfolk, Va.	Forty-eight days	Fragment of shell
P. S.	46th N. Y. Vols.	Cabinet-maker	R.	Upper third	Circular	On the field	Six hours	Minie-ball
P. D.	3d N. Y. Cavalry	Shoe-maker.	L.	Upper third	Circular	On the field	Two hours	Musket-ball
E. J.	117th N. Y. Vols.	Stone-mason	L.	Lower third	Circular	On the field	Seven hours	Grape-shot
D. W. B.	150th N. Y. Vols.	None	R.	Lower third	Circular	On the field	One hour	Minie-ball
J. C.	14th Maine U. S. Inf'y	Gilder	R.	Lower third	Ant. post. flaps	In hospital	Seven hours	Musket-ball
J. McL.	20th Ind. Vols.	Farmer	R.	Lower third	Ant. post. flap	David's Island	Five months and a half	Musket-ball
C. T. D.	3d Mary'l'd Vols.	None	L.	Upper third	Circular	Hospit'l, Culpepper C. H.	Three days	Minie-ball
G. W. F.	1st V. H. Artillery	Farmer	R.	Middle third	Circular	Armory Sq. General Hospital	Thirteen days	Minie-ball
P. M.	11th Vt. Vols.	Farmer	L.	Lower third	Ant. post. flaps	On the field	Twenty-fo'r hours	Musket-ball
T. F.	3d N. Y. Vols.	Gardener	R.	Lower third	Ant. post. flaps	On the field	Twelve h'rs	Canister-shot
J. J.	U. S. Navy	Ordinary seaman	L.	Lower third	Circular	Hospit'l ship, Ft. Jackson	Twenty-fo'r hours	Musket-ball
E. W.	U. S. Navy	Coal pass'r	R.	Middle third	Circular	Gunboat, Ft. Jackson	Twenty-fo'r hours	Minie-ball
H. M. C.	10th Conn. Vols.	Gardener	R.	Middle third	Ant. post. flaps	On the field	Immediately	Cannon-ball
C. McD.	2d U. S. Artillery	Bar-tend'r	L.	Middle third	Circular	On the field	Twenty-fo'r hours	Musket-ball
W. A. K.	4th R. I. Vols.	—	R.	Middle third	Ant. post. flaps	On the field	Four hours	Minie-ball
W. S.	Freedm'n's Bureau	—	R.	Lower third	Ant. post. flap	On the field	Two hours	Piece of shell
M. H.	76th N. Y. Vols.	Farmer	R.	Lower third	Circular	Middletown Hospit'l, Md.	Four days 2d time One year	Gunshot
J. L.	6th Conn. Vols.	Sailor	R.	Middle third	Circular	Fortress Monroe	Forty-eight hours	Minie-ball
P. K.	37th N. Y. Vols.	Flagger	L.	Middle third	Ant. post. flap	In 3d Army Corps field hospital	Fifteen days	Rifle-ball
J. H. D.	79th N. Y. Vols.	Salesman	L.	Lower third	Anterior flap	On the field	Immediately	Minie-ball
H. D.	7th Mich.	Farmer	R.	Middle third	Ant. post. flap	On the field	Twenty-fo'r hours	Musket-ball
T. McC.	37th N. Y. Vols.	Brick-layer	R.	Middle third	Ant. post. flap	Steam's Daniel Webster	Three days	Rifle-ball

OF RECOVERED AMPUTATION OF THIGH.—(Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump	Atrophy.		REMARKS.
						Proximal Portion.	Distal Portion.	
Destruct. of knee-joint . . . . .	Fort Wagner, S. C.	July 22, 1863	7 mos.	9 mos.	10 inches	1 inch	2 inches	Stump healed, tender, posterior flap atrophied, bone covered.
Comp'd fracture of thigh at middle third . . . . .	South Mountain, Va.	Sept. 14, 1862	9 mos.	11 mos.	4½ inches	¾ inch	1 inch	Stump sound, smooth, efficient.
Comp'd com. fracture of thigh . . . . .	West Louisiana	June 14, 1864	5 mos.	6 mos.	7 inches	2½ inches	2½ inches	Healed, very good.
Comp'd com. fract. of upper third of leg . . . . .	Gunboat Mendota	July 16, 1864	—	7 mos.	6½ inches	¾ inch	1½ inches	End not well cov'd, retraction of muscles, leaving bone exposed.
Comp'nd fracture of middle third of thigh . . . . .	Petersburg, Va.	July 30, 1864	5 mos.	7 mos.	3½ inches	¾ inch	None	Healed, very short, imperfect.
Comp'nd fracture of thigh . . . . .	Richmond, Va.	May 14, 1864	7 mos.	9 mos.	5 inches	1 inch	1 inch	Healed, poorly covered.
Destruct. of knee-joint . . . . .	Fort Fisher, N. C.	Jan'y 15, 1865	9 mos.	10 mos.	10½ inch.	increase 3 inches	5½ inches	Very good, considerably injured by two other shots.
Comp'nd comminuted fracture of upper third of leg . . . . .	Culps Farms, Ga.	June 29, 1864	13 mos.	14 mos.	9 inches	¾ inch	5 inches	Very good, nine inches of sequestra.
Comp'nd comminuted fracture of knee-joint . . . . .	Baton Rouge, La.	Aug. 5, 1862	10 mos.	11 mos.	11 inches	1 inch increase	4½ inches	Scanty covering, extensive cicatrices adhering to bone.
Comp'nd fracture of head of tibia . . . . .	David's Island	Dec. 6, 1862	4 mos.	5 mos.	13 inches	2 inches	2 inches	Length excessive, erysipelatos inflammation, abscesses, ulcers, etc.
Comp'nd fract. of low. third of thigh . . . . .	Cedar Mt., Va.	Aug. 9, 1862	5 mos.	—	4½ inches	None	None	Gangrene, not ready.
Comp'nd comminuted fracture of knee-joint, complicated with compound fracture of left leg . . . . .	Coal Harbor, Va.	June 1, 1864	1 year	13 mos.	7½ inches	2½ inches	2½ inches	Very fair, bone well covered, 4½ inches of bone necrosed, removed whole shaft, periphery, new bone formed, leg bowed, from posterior slough.
Comp'nd comminuted fracture of lower third of femur . . . . .	Coal Harbor, Va.	June 1, 1864	1 year	13 mos.	9½ inches	3 inches	4½ inches	Very good, extensively cicatrized, long flaps.
Comp'nd fracture of lower third of thigh . . . . .	Manassas Gap, Va.	July 23, 1863	7 mos.	13 mos.	9½ inches	1½ inches	3 inches	Stump ulcerated on posterior and upper angle, indications of exfoliat'n, will be efficient.
Comp'nd comminuted fracture of knee-joint . . . . .	Fort Fisher, N. C.	Jan'y 18, 1865	4 mos.	6 mos.	7 inches	None	None	Not healed, on furlough ten days.
Comp'nd comminuted fracture of lower third of thigh . . . . .	Fort Fisher, N. C.	Jan'y 15, 1865	2 mos.	4 mos.	8 inches	2½ inches	¾ inch	Excellent.
Destruction of leg . . . . .	Newbern, N. C.	March 14, 1862	—	—	5½ inches	None	None	—
Wound of knee-joint . . . . .	San Augusta, Me.	—	—	—	6 inches	2 inches	4 inches	Healthy.
Comp'd com. fracture of knee-joint . . . . .	Antietam, Md.	Sept. 17, 1862	14 mos.	16 mos.	9 inches	3 inches	3 inches	Stump sound and vigorous.
Comp'd com. fract. of leg and knee . . . . .	—	Feb'y 2, 1865	9 mos.	9 mos.	10 inches	3½ inches	5½ inches	Excellent.
Comp'd com. fract. middle of leg, 2d necrosis of femur . . . . .	South Mountain, Va.	Sept. 18, 1862	17 mos.	20 mos.	8 inches	1½ inch	3 inches	St'mp healed nearly, not well cushioned.
Wound of knee-joint . . . . .	Chester Station	May 10, 1864	5 mos.	5 mos.	8½ inches	2 inches	3½ inches	Healed.
Fracture of the lower part of the femur . . . . .	Chancellorsville	May 3, 1863	7 mos.	1 year	7 inches	1½ inch	¾ inch	Stump pretty fairly cov'd, not healed perfectly, will be good, habits not good, ulcers on other ankle, sore eyes.
Comp'nd fracture of knee and leg . . . . .	Blue Springs, E. Tenn.	Oct. 10, 1863	4 mos.	7 mos.	10½ inch.	None	1½ inches	Walked with assistance half a mile, st'mp not healed, some granulated will be efficient.
Comp'nd fracture of knee-joint . . . . .	Fair Oaks, Va.	May 31, 1862	8 mos.	10 mos.	8 inches	¾ inches	1½ inches	—
Comp'nd fracture of knee-joint . . . . .	Fair Oaks, Va.	May 31, 1862	7 mos. & 24 days	10 mos.	8 inches	2 inches	2 inches	—

TABLE OF ONE HUNDRED AND FIFTY-EIGHT CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
G. S. P.	24th Mass. Vols.	Shoemaker	R.	Upper third	Circular	On the field	Eight hours	Minie-ball
W. S.	3d Artillery	Farmer	R.	Lower third	Ant. post. flaps	Hospital	Three days	Minie-ball
F. O'B.	4th Regiment	Cart-driver	L.	Middle third	Lateral flaps	—	—	Cut with an axe
J. H. D.	3d N. Y. Artillery	Carpenter & joiner	R.	Upper third	Ant. post. flap	Acad. G. H. Newb'n, N. C.	Four weeks	Musket-ball
J. S.	4th N. Y. Vols.	Brewer	R.	Middle third	Ant. post. flap	On the field	Thirty-six hours	Minie-ball
M. M.	69th N. Y. Vols.	Carpenter	R.	Middle third	Ant. post. flap	On the field	Three days	Rifle-ball
D. C.	26th N. Y. Vols.	L'ngsh're-man	L.	Upper third	Circular	On the field	One hour	Solid shot
G. S.	169th N. Y. Vols.	Teamster	R.	Middle third	Ant. post. flap	On the field	Two hours	Canister-shot
G. S.	11th Conn. Vols.	Hatter	L.	Middle third	Ant. post. flap	On the field	Two hours	Minie-ball
F. S.	74th N. Y. Vols.	Clerk	L.	Middle third	Ant. post. flap	Field	Three days	Rifle-ball
J. H.	5th N. J. Vols.	—	L.	Upper third	Circular	On the field	Six days	Minie-ball
J. C.	5th Wis. Vols.	Farmer	L.	Middle third	Ant. post. flaps	David's Isl- and Hospit'l	Fifteen days	Musket-ball
T. D.	68th N. Y. Vols.	Sailor	R.	Middle third	Ant. post. flaps	Field	Six hours	Minie-ball
I. B. B.	26th Iowa Vols.	Farmer	R.	Lower third	Ant. post. flap	Field	Two hours	Minie-ball
D. McC.	2d Mass. Vols.	Shoemaker	R.	Lower third	Ant. post. flap	U. S. Gener'l Hosp. N. H.	Thirteen months	Fragment of shell
F. I.	2d N. J. Vols.	Blacksmith	L.	Middle third	Anterior flap	On the field in corps Hospital	Eighteen hours	Canister-shot
R. W. G.	84th N. Y. S. M.	Painter	R.	Lower third	Ant. post. flap	In field hospital	Thirty hours	Minie-ball
G. M.	40th N. Y. Vols.	Varnisher	R.	Lower third	Rectangular flap	On the field	Second day	Shell
J. T.	14th N. Y. Vols.	Broker	L.	Lower third	Circular	On the field	Twenty-fo'r hours	Minie-ball
T. H. W.	13th N. J. Vols.	Hatter	L.	Lower third	Ant. post. flap	On the field	Three hours	Minie-ball
J. A.	54th N. Y. Vols.	Sailor	L.	Middle third	Ant. post. flap	At field hospital	Eight days	Minie-ball necrosis
J. C.	104th N. Y. Vols.	None	L.	Upper third	Circular	—	Four days	Minie-ball

## OF RECOVERED AMPUTATION OF THIGH. — (Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Comp'nd comminuted fracture of the middle of the thigh . . . . .	Seabrook Island, S. C.	April 11, 1863	4 mos.	8 mos.	4½ inches	¾ inch	1 inch	Stump not entirely healed, periosteum, some thickened, short, and flexed.
Wound of knee-joint . . . . .	Washington, N. C.	Sept. 9, 1862	—	11 mos.	8½ inches	2 inches	3 inches	Stump healed.
Wound of knee . . . . .	Baltimore, Md.	March, 1862	14 mos.	15 mos.	7 inches	2½ inches	3 inches	Inflammation and gangrene ensued.
Comp'd com. fracture of femur . . . . .	Kinston, N. C.	Dec. 14, 1862	4 mos.	8 mos.	4½ inches	2½ inches increase	2 inches increase	Stump not healed.
Comp'nd fracture of knee . . . . .	Antietam, Md.	Sept. 17, 1862	9 mos.	11 mos.	8 inches	1 inch	2 inches	St'mp uneven, having sloughed, cicatrices large, small ulcers remaining.
Comp'nd comminuted fracture of lower third of the femur . . . . .	Antietam, Md.	Sept. 17, 1862	7 mos.	1 year	8 inches	None	1 inch	Secondary hemorrhage ensued, femoral artery ligated, st'mp nearly healed, and pathological conditions fair, exc'pt cicatrix extensive on anterior part.
Destruct. of knee-joint, etc. . . . .	Antietam, Md.	Sept. 17, 1862	7 mos.	9 mos.	3½ inches	None	¾ inch	—
Comp'nd fracture lower third of thigh . . . . .	Coal Harbor, Va.	June 1, 1864	5 mos.	6 mos.	6½ inches	2½ inches	2 inches	Damaged by gangrene, healed, bone covered by cicatrix only.
Comp'nd comminuted fracture of femur . . . . .	Drury's Bluff, Va.	May 16, 1864	1 year & 14 mos.	1 year & 5 mos.	6 inches	2½ inches	2½ inches	Very good, some damaged by gangrene.
Comp'nd fract. of lower 3d of femur . . . . .	Williamsburg, Va.	May 8, 1862	8 mos.	1 year	7½ inches	1½ inch increase	1 inch increase	Not ready.
Comp'nd fracture of knee-joint . . . . .	Williamsburg, Va.	May 11, 1862	8 mos.	8 mos.	4½ inches	1 inch	None	Ready.
Comp'd fract. lower third of femur . . . . .	Williamsburg, Va.	June 20, 1862	7 mos.	1 year	5½ inches	2 inches increase	¾ inch	—
Comp'nd fracture of thigh . . . . .	Antietam, Md.	Sept. 17, 1862	7 mos.	11 mos.	7 inches	2½ inches	2½ inches	St'mp nearly ready, not healed, ball passing obliquely from the anterior later'l head of tibia, making its exit above the internal condyles of femur, up the left leg, striking the right thigh middle lower third of femur, causing comp'nd fracture.
Comp'nd comminuted fract. lower third thigh . . . . .	Lovejoy Station, Ga.	Sept. 4, 1864	11 mos.	13 mos.	8½ inches	3 inches	3½ inches	Damaged by gangrene, transported one mile, then 4, then 120, not dressed for 4 days, diet very poor.
Destruction of ham . . . . .	Cedar Mountain, Va.	Sept. 15, 1863	8 mos.	1 year	10 inches	1 inch	3½ inches	Nearly healed, some eczema, angulation.
Comp'nd fracture knee and leg . . . . .	Gettysburg, Pa.	July 3, 1863	6 mos.	9 mos.	8½ inches	2 inches	2 inches	Stump irregularly covered, healed, efficient.
Comp'nd comminuted fracture of knee . . . . .	Gettysburg, Pa.	July 1, 1863	5 mos.	7 mos.	10 inches	3 inches	2 inches	Stump admirable, finely cov'rd and proportioned.
Comp'nd comminuted fracture of upper third of leg and knee . . . . .	Gettysburg, Pa.	July 2, 1863	3 mos.	6 mos.	10½ inch.	None	1 inch	Stump favorable, clean in front, healed and serviceable.
Comp'nd comminuted fracture of knee-joint . . . . .	Gettysburg, Pa.	July 1, 1863	6 mos.	8 mos.	10½ inch.	2½ inches	2 inches	Stump healed, efficient.
Comp'nd comminuted fracture of knee-joint . . . . .	Gettysburg, Pa.	July 3, 1863	6 mos.	9 mos.	11 inches	2½ inches	2½ inches	Stump well healed, round, smooth, well covered, extensively cicatrized, stitches sloughed out.
Comp'nd comminuted fracture of lower third of leg . . . . .	Gettysburg, Pa.	July 1, 1863	1 year, 2d time 11 mos.	14 mos. 2d time 13 mos.	8 inches	None	1½ inches	Damaged by sloughing, mainly healed.
Comp'nd fracture of the middle of thigh . . . . .	Gettysburg, Pa.	July 1, 1863	11 mos.	1 year	2 inches	1½ inches increase	None	Some hypertrophy, healed scanty, integumentary covering, some ulceration.

TABLE OF ONE HUNDRED AND FIFTY-EIGHT CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
C. K.	20th N. Y. S. M.	Farmer	R.	Upper third	Circular	Hospital at Gettysburg, Pa.	Seven days	Minie-ball
H. H. E.	16th N. Y.	Farmer	L.	Lower third	Circular	Hospital	Ten days	Gunshot
C. McD.	117th N. Y. Vols.	Clerk	R.	Lower third	Ant. post. flap	On the field	Twenty minutes	Musket-ball
W. S.	15th Ind. Battery	Painter	L.	Lower third	Ant. post. flap	Field	Twenty-four hours	Minie-ball
G. W. S.	14th Conn. Vols.	Salesman	R.	Lower third	Rectangular flap	Field	Tw'nty-one hours	Minie-ball
G. B.	2d N. Y. M. R.	Laborer	R.	Lower third	Ant. post. flaps	On the field	One hour	Musket-ball
G. T.	7th Wis.	Fur-trapper	R.	Lower third	Ant. post. flap	On the field	Twenty-four hours	Fragment of shell
D. B.	97th N. Y. Vols.	None	R.	Lower third	Ant. post. flap	On the field	Tw'nty-one hours	Musket-ball
R. H. P.	7th Wis.	Carpenter	R.	Upper third	Ant. post. flap	On the field	Twenty hours	Minie-ball
J. U.	107th N. Y. Vols.	Farmer	L.	Middle third	Rectangular flap	On the field	Forty-eight hours	Grape-shot
P. T.	24th Mich.	Lumberman	R.	Lower third	Circular	Hospital at Gettysburg, Pa.	Three days	Minie-ball
J. C.	7th Md. Vols.	Miller	L.	Lower third	Circular	On the field	Four hours	Minie-ball
C. J. B.	4th R. I.	Carpenter	L.	Lower third	Anterior flap	On the field	Seven hours	Grape-shot
M. S.	183d Penn. Vols.	None	R.	Lower third	Circular	Douglas's Hospital	Six days	Minie-ball
G. P. S.	21st Conn. Vols.	Farmer	R.	Middle third	Ant. post. flap	On the field	Four hours	Minie-ball
W. K. S.	5th Conn. Vols.	Merchant	R.	Lower third	Ant. post. flaps	On the field	Twelve h'rs	Shell
T. K.	49th N. Y. Vols.	Laborer	L.	Lower third	Ant. post. flap	—	Tw'nty-one hours	Rifle-ball
J. H. V.	107th N. Y. Vols.	Farmer	L.	Lower and middle third	Ant. post. flap	On the field	Seven days 2d time Tw'nty-one days	Rifle-ball, 2d time Extensive sloughings and de-n'ded bone
W. M. V.	28th N. Y. Vols.	Cigar-maker	R.	Lower third	Circular	On the field	Five days	Minie-ball
G. W. P.	21st N. J. Vols.	Book-keeper	R.	Middle third	Circular	On the field	Six days	Musket-ball
J. McW.	20th Conn. Vols.	Student	L.	Lower third	Circular	Acquia Cr. Hospital	Twenty-three days	Minie-ball
J. S. L.	5th N. J. Vols.	—	L.	Lower third	Ant. post. flaps	Potomac Hospital	Four days	Minie-ball
J. H.	8th N. J. Vols.	Silver-plater	R.	Lower third	Circular	Armory Sq. Hospital, D. C.	Six weeks	Minie-ball
J. E. C.	16th Conn. Vols.	Farmer	L.	Middle third	Circular	At his home	Four weeks	Minie-ball
H. S.	26th N. Y. Vols.	Farmer	R.	Lower third	Anterior flap	On the field	Thirty ho'rs	Minie-ball
J. G.	38th N. Y. Vols.	B'nk-note printer	L.	Middle third	Lateral flap	On the field	Five days	Minie-ball
M. R.	63d N. Y. Vols.	Shoemaker	R.	Upper third	Circular	On the field	Forty-eight hours	Rifle-ball
J. P.	69th N. Y. Vols.	Soldier	R.	Upper third	Circular	—	—	—
J. G. W.	37th N. Y. Vols.	Salesman	R.	Lower third	Lateral flap	At home	107 days	Gunshot
J. C.	25th N. Y. Vols.	Lather	R.	Upper third	Ant. post. flaps	In camp-hospital	Five days	Rifle-ball
C. L.	1st Berdan S. Shooters	—	L.	Lower third	Ant. post. flaps	On the field	Two hours	Grape-shot

## OF RECOVERED AMPUTATION OF THIGH. — (Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Comp'nd fracture middle third of thigh . . .	Gettysburg, Pa.	July 7, 1863	11 mos.	13 mos.	3 inches	1½ inches	None	Healed, very short, imperfectly covered.
Comp'd com. fracture of patella . . .	Fredericksburg, Va.	May 3, 1863	8 mos.	13 mos.	None	None	1 inch	Stump damaged by sloughing.
Comp'nd comminuted fracture of knee-joint . . .	Petersburg, Va.	July 4, 1864	8 mos.	11 mos.	9½ inches	2½ inches	2½ inches	Very good, some damaged by sloughing.
Comp'd com. fract. low third of thigh	Petersburg, Va.	June 18, 1864	9 mos.	11 mos.	9 inches	1½ inches	1½ inches	Very good, not perfectly healed.
Comp'nd comminuted fracture of knee-joint . . .	Petersburg, Va.	Sept. 30, 1864	6 mos.	8 mos.	12 inches	3 inches	3 inches	Very good.
Comp'd com. fracture knee-joint . . .	Petersburg, Va.	July 17, 1864	4 mos.	5 mos.	10 inches	2 inches	2 inches	Healed very good.
Comp'd com. fract. of leg near knee	Petersburg, Va.	June 18, 1864	5 mos.	—	11½ inch.	2½ inches	3 inches	Nearly well.
Comp'nd comminuted fracture of knee and leg . . .	Petersburg, Va.	June, 1864	5 mos.	4 mos.	10 inches	¾ inch	None	Healed, very well composed.
Comp'd com. fract. middle of thigh	Petersburg, Va.	M'ch 31, 1865	8 mos.	—	5 inches	½ inch	1 inch increase	Very good.
Comp'd com. fracture of knee-joint . . .	Dallas, Ga.	May 25, 1864	10 mos.	1 year	9½ inches	3½ inches	6¼ inches	Excellent covering, excellent.
Comp'nd fracture condyle of femur, knee involved . . .	Gettysburg, Pa.	July 1, 1863	7 mos.	11 mos.	7½ inches	None	1½ inches	Indications of mortification, stump ulcerated, will be well shaped.
Comp'd com. fracture knee-joint . . .	Petersburg, Va.	July 18, 1864	6 mos.	7 mos.	9 inches	2 inches	4 inches	Healed very good.
Compound comminuted fracture knee-joint . . .	Petersburg, Va.	July 30, 1864	6 mos.	7 mos.	9 inches	2 inches	3 inches	Heal'd. very good, except injury.
Comp'd com. fracture knee-joint . . .	Petersburg, Va.	M'ch 31, 1865	8 mos.	—	9½ inches	2½ inches	2 inches	Very good.
Comp'd com. fracture knee-joint . . .	Petersburg, Va.	June 25, 1864	8 mos.	10 mos.	6½ inches	4 inches	2 inches	Very good.
Destruct. upper part of leg and knee	Chancellorsville	May 3, 1863	3 mos.	14 mos.	9 inches	1 inch	¾ inches	Not healed.
Comp'nd comminuted fracture knee-joint . . .	Chancellorsville	May 4, 1863	13 mos.	—	10 inches	1½ inches	4 inches	Nearly healed, some periostitis, necrosis.
Compound comminuted fracture knee-joint . . .	Chancellorsville	May 3, 1863	11 mos.	14 mos.	8½ inches	3 inches	3½ inches	Stump mainly healed, ulcer on the inferior posterior part, badly cicatrized by sloughing and exfoliations.
Comp'd com. fracture knee-joint . . .	Chancellorsville	May 4, 1863	11 mos.	14 mos.	10½ inch.	3½ inches	1½ inches	Healed.
Compound comminuted fracture knee-joint . . .	Chancellorsville	May 4, 1863	11 mos.	15 mos.	6½ inches	1 inch	2½ inches	Healed, periosteum some thickened, some tenderness, anterior and inferior part, cicatrization.
Compound comminuted fracture knee-joint . . .	Chancellorsville	May 3, 1863	11 mos.	11 mos.	10 inches	1 inch	3½ inches	Stump fair, scantily covered, tenderly healed, will prove efficient.
Fracture . . . .	Chancellorsville	May 3, 1863	8 mos.	14 mos.	9½ inches	3 inches	4½ inches	Mortificati'n fourth day after injury.
Comminuted fracture knee-joint . . .	Chancellorsville	May 3, 1863	8 mos.	11 mos.	7½ inches	1 inch	3 inches	Stump healed, good condition.
Comp'nd fract'ure knee-joint . . .	Antietam, Md.	Sept. 17, 1862	11 mos.	1 year & 20 days	9 inches	4½ inches	4 inches	Bone protrudes, covered only with skin, muscles retracted, stump well, secondary.
Comp'd com. fracture of the upper third of leg . . .	Fredericksburg, Va.	Dec. 13, 1862	1 year	14 mos.	12½ inch.	1 inch	3 inches	Stump imperfectly healed, excessively long.
Comp'nd comminuted fracture of lower third of femur . . . .	Fredericksburg, Va.	Dec. 13, 1862	5 mos.	7 mos.	8 inches	½ inch	½ inch	Stump ulcerated over the end of bone, parts granulating, has sloughed badly.
Comp'd com. fract. of lower and middle third of thigh . . . .	Antietam, Md.	Sept. 17, 1862	13 mos.	15 mos.	4 inches	None	4 inches	Stump short, well healed, will prove vigorous.
Comp'd fracture of femur . . . .	Bull Run, Va.	July, 1861	—	—	3½ inches	None	None	Gangrene.
Comp'd fract. middle third of leg . . .	Bull Run, Va.	July 21, 1861	3 years	3 years & 2 mos.	10 inches	3 inches	3½ inches	Good.
Comp'd fract. lower third of femur	Hanover C. H., Va.	June 2, 1862	7 mos.	10 mos.	3½ inches	None	½ inch	Gangrene, convalescent.
Comp'd fr'ct. knee; destruction of leg	Hanover C. H., Va.	May 27, 1862	8 mos.	9 mos.	8 inches	½ inch	2½ inches	Stump poorly rounded.

TABLE OF ONE HUNDRED AND FIFTY-EIGHT CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
T. G.	36th N. Y. Vols.	Laborer	L.	Middle third	Ant. post. flaps	On the field	Three hours	Grape-shot
R. C.	23d Veteran, Ill.	Builder	R.	Lower third	Ant. post. flaps	On the field	Three hours	Minie-ball
F. R.	3d R. I. Artillery	Laborer	R.	Lower third	Bilateral flaps	In field hospital, Morris Island, S. C.	Two hours and a half	Explosion of torpedo
L. D. P.	5th N. Y. Vols.	Sailor	R.	Middle third	Rectangular flap	Rebel hospital	Twenty-four hours	Minie-ball
A. S.	4th N. H. Vols.	Teamster	L.	Middle third	Lateral flaps	On the field	Five hours	Fragment of shell
F. M.	100th N. Y. Vols.	Farmer	R.	Middle third	Circular	On bo'rd rebel transport, Charleston	Twenty-four hours	Grape-shot
M. K.	1st Vt. Artillery	Farmer	L.	Middle third	Bilateral flaps	On the field	Soon after	Fragment of shell
T. B.	100th N. Y. Vols.	Farmer	R.	Middle third	Ant. post. flaps	Charleston, S. C.	Five days	Grape-shot
G. C.	3d U. S. A. A. Sailor	Soldier	R.	Middle third	Ant. post. flap	Bellevue Hospital	One yr. and nine months	Rifle-ball
J. F. W.	U. S. Navy	Sailor	L.	Middle third	Ant. post. flaps	—	—	Gunshot
R. G.	U. S. Navy	Sailor	R.	Middle third	Ant. post. flap	—	—	Gunshot
M. R.	—	Blacksmith	L.	Middle third	Circular	—	—	Pistol-shot
E. K.	3d N. J. Vols.	Moulder	R.	Lower third	Ant. post. flap	On the field	Six days	Rifle-ball
O. P. R.	10th Penn. Reserve	Carpenter	R.	Middle third	Ant. post. flaps	On hosp. ship Louisiana	One month	Rifle-ball
J. B.	7th Ind. & 13th N. Y. Vols.	Machinist	R.	Lower third	Bilateral skin-flaps and circular	Hampton Hospital	Sixty-eight days	Upsetting caisson
M. Q.	53th N. Y. Vols.	Laborer	L.	Lower third	Anterior flap	On the field	Immediately	Minie-ball
P. H.	40th N. Y. Vols.	Butcher	R.	Lower third	Anterior flaps	On the field	Four hours	Solid shot
J. M. B.	6th N. Y. Artillery	Seaman	R.	Middle third	Ant. post. flaps	Armory Sq. Hosp., D. C.	Fifteen days	With axe
J. M. T.	36th Ill. Infantry	Lieutenant	L.	Lower third	Ant. post. flap	On the field	Thirty ho'rs	Gunshot
M. S. M.	81st N. Y. Vols.	Furnace-man	L.	Lower third	Ant. post. flaps	On the field	Three hours	Minie-ball
M. J. C.	145th Penn.	None	R.	Middle third	Ant. post. flap	On the field	Half an hour	Fragment of shell
J. H.	1st Texas Cavalry	None	L.	Middle third	Circular	Marine Hospital, N. O.	Soon after injury	Musket-ball
J. H. C.	4th N. Y. Vols.	Teamster	R.	Lower third	Circular	On the field	Thirty-six hours	Shell
C. W.	17th N. Y. Vols.	Tinsmith	L.	Middle third	Ant. post. flaps	Ebenezer Church	Five m'nts	Rife-ball
C. H. M.	69th N. Y. Vols.	Waiter	R.	Middle third	Circular	Frederick City Hospital	Six months and a half	Musket-ball

## OF RECOVERED AMPUTATION OF THIGH.—(Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Comp'd com. fract. low. third femur	Malvern Hill, Va.	July 1, 1862	6 mos.	8½ mos.	8½ inches	2 inches	1 inch increase	Not healed.
Compound comminuted fracture upper third of leg	Petersburg, Va.	April 2, 1865	3 mos.	4 mos.	12 inches	½ inch	1½ inch	Disc very good, should have been disarticulation.
Destruction of leg at knee-joint . . .	Morris Island	Sept. 11, 1863	5 mos.	7 mos.	8½ inches	½ inch	None	Stump not healed, will be round and efficient.
Compound comminuted fracture of knee-joint . . .	Petersburg, Va.	Aug. 18, 1864	5 mos.	—	8 inches	1 inch increase	None	Finely formed and covered, swelling on anterior middle of stump, white, painless, size indicative of some disease, 4x3.
Comminuted fracture of knee . . .	Morris Island, S. C.	Sept. 17, 1863	4 mos.	7 mos.	8 inches	2 inches	1 inch	Stump not healed, will be efficient.
Entire leg badly comminuted to knee . . .	Fort Wagner, S. C.	July 19, 1863	10 mos.	1 year	6½ inches	1½ inches	3 inches	Healed, poorly covered, damaged by sloughing.
Destruct. of knee-joint . . .	Port Hudson, La.	May 27, 1863	8 mos.	10 mos.	6 inches	2½ inches increase	3 inches	Stump healed, well covered.
Compound comminuted fracture of middle of leg	Fort Wagner, S. C.	July 18, 1863	3 mos.	7 mos.	9 inches	1 inch	1 inch	Stump healed, periosteum some thickened.
Wound of knee-joint . . . . .	Utah Territory	June 4, 1860	2 years & 5 mos.	—	7½ inches	1 inch	2 inches	—
— . . . . .	Ft. Donel.	1862	—	—	7 inches	None	None	—
— . . . . .	& Philip Ft. Donel.	1862	—	—	4 inches	2 inches	2 inches	—
— . . . . .	Hartford, Conn.	Dec. 26, 1861	—	—	9½ inches	1 inch	1 inch	—
Comp'd com. fracture knee-joint . . .	Gaines's Mill, Va.	June 27, 1863	2 years	3 years & 4 mos.	8½ inches	2½ inches	3 inches	Stump not healed, will be very good.
Comp'd fracture lower third of femur . . . . .	Gaines's Mill, Va.	June 27, 1862	7 mos.	18 mos.	8½ inches	None	None	Not healed.
Comp'd fracture of ankle-joint . . .	Yorkt'wn, Va.	April 30, 1864	7 mos.	9 mos.	10 inches	1½ inches	1 inch	Healed very good.
Comp'd fracture of knee-joint . . .	WhiteOak Swamp	June 27, 1862	6 mos.	—	9½ inches	1½ inch	2½ inches	Atrophy of muscle about union of the flaps, front and end smooth, taken prisoner to Richmond; two months on board Sanitary Ship, then to City Hospital, N. Y.
Destruct. of knee	N. Anna River	May 23, 1864	6 mos.	8 mos.	9½ inches	2 inches	2 inches	Not quite healed, some thickening and exfoliation.
Great toe, erysipelas, gangrene . . .	—	May 27, 1864	6 mos.	7 mos.	9½ inches	2½ inches	3 inches	Nearly healed.
Comp'd fracture of knee-joint . . .	—	May 26, 1864	8 mos.	8 mos.	12 inches	1 inch	1½ inch	Healthy, united by first intention.
Compound comminuted fracture of lower third of thigh . . . . .	—	May 9, 1864	3 mos.	10 mos.	8 inches	1 inch	3 inches	Extensive necrosis, healed, extensively cicatrized, excessive incisions.
Comminuted fracture of knee-joint . . . . .	—	Oct. 14, 1863	8 mos.	1 year	7 inches	1½ inch	1½ inch	Healthy.
Wound of popliteal artery . . . . .	Hudson City, La.	Sept. 1, 1863	7 mos.	10 mos.	8 inches	2 inches	3 inches	Stump healed, some irregular, efficient.
Comp'd com. fract. of entire leg . . .	Frederksburg, Va.	Dec. 13, 1862	9 mos.	1 year	10½ inch.	2½ inches	3 inches	Stump healed.
Comp'd fracture of knee-joint . . .	Bull Run, Va.	Aug. 30, 1862	10 mos.	1 year & 26 days	8 inches	3 inches	1 inch	Stump bruised, ulcerated, good condition, habits in-temperate, leg badly oedematous
Comp'd fract. upper third of leg and knee . . . . .	Antietam, Md.	Sept. 17, 1862	11 mos.	1 year & 1 month	10 inches	1½ inch	3 inches	Stump not perfectly healed.

TABLE OF TWO HUNDRED AND EIGHTY-SEVEN CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
L. H.	10th U. S. Infantry	Farmer	R.	Lower and middle third	Circular	On the field	Two hours	Rifle-ball
W. R. S.	14th U. S. Infantry	Soldier	R.	1st, low. third 2d, middle & upper third	Ant. post. flap	On the field	One hour 2d, forty-one days	Fragment of shell Necrosis
G. K.	140th N. Y. Vols.	Brick-layer	R.	Upper and middle	Posterior flap	Fredericksburg hospital	Sixth day	Grape-shot
P. D.	170th N. Y. Vols.	Blacksmith	L.	Upper and middle third	Ant. post. flap	City Point Hospital	Five days	Musket-ball
P. S.	39th N. Y. Vols.	Farmer	L.	Middle and upper third	Posterior flap	Hampton Hospital	Fourteen days	Musket-ball
S. B. D.	15th N. Y. Vols.	Farmer	L.	Lower third	Ant. post. flaps	On the field	Nine hours	Minie-ball
H. P.	59th N. Y. Vols.	Farmer	L.	Lower third	Circular	Brooklyn, N. Y.	Seventy-seven days	Two musket-balls
F. P. B.	56th Mass. Vols.	Moulder	L.	1st, lower and middle third 2d, middle third	Bilateral skin flaps Circular	On the field	Twelve hrs 2d, seven months	Musket-ball Necrosis of tibia
T. L.	10th N. Y. Vols.	Ship-car-penter	R.	Lower third	Circular	On the field	One hour	Minie-ball
J. M.	10th U. S. Infantry	Farmer	R.	Middle third	Ant. post. flap	On the field	Two hours	Rifle-ball
W. R.	82d N. Y. Vols.	Seaman	R.	Upper third	Circular	On the field	Seventeen hours	Two minie-balls
R. G.	82d N. Y. Vols.	None	R.	Upper third	Ant. post. flap	On the field	Sixteen hours	Fragment of shell
W. C.	5th N. Y. H. Artillery	Brick-layer	R.	Upper and middle third	Ant. post. flaps	On the field	Fifteen hours	Minie-ball
F. F.	5th N. Y. Vols.	None	R.	Lower third	1st, post. flap 2d, bilateral flaps	Winchester Hospital	Thirty days 2d, in hospital	Minie-ball
E. D. N.	11th Conn. Vols.	Tinman	L.	Upper and Middle third	Posterior flap	On the field	Eighteen hours	Musket-ball
R. A.	14th U. S. Infantry	Teamster	L.	Upper and middle third	Circular	On the field	Seven days	Rifle-ball
N. D.	61st N. Y. Vols.	Farmer	L.	Middle third	Posterior flap	On the field	Six hours	Minie-ball
P. S.	—	Mechanic	R.	Middle third	Ant. post. flap	Newtown U. S. Hospital	Sixteen days	Minie-ball
G. W. M.	122d N. Y. Vols.	Farmer	L.	Middle and upper third	Ant. post. flap	McDougal General Hospital	Two m'nths and twelve days	Minie-ball
P. B.	74th N. Y. Vols.	Frenchman	R.	Lower and middle third	Circular	On the field	Forty-eight hours	Musket-ball
J. L.	69th N. Y. Vols.	Laborer	R.	Middle and upper third	Circular	—	Three days	Musket-ball
B. M.	108th N. Y. Vols.	Farmer	R.	Lower third	Posterior flap	—	Twenty-four hours	Fragment of shell
J. F. M. R.	13th N. C. C. S. A.	Student	R.	Middle and lower third	Circular	On the field	Sixteen hours	Grape-shot
T. P.	2d N. Y. S. M.	Military	L.	Lower and middle third	Circular	Hospital 51st, New York	Thirty days	Minie-ball
D. O'S	3d U. S. Infantry	Hatter	L.	Upper third	Circular	On the field	Four hours	Solid shot
M. M.	76th N. Y. Vols.	Farmer	R.	Upper and middle third	Circular	C. H. Hospital, Gettysburg, Pa.	Twenty-two days	Minie-ball

## OF RECOVERED AMPUTATION OF THE LEG.

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS.
						Proximal Portion.	Distal Portion.	
Comp'd com. fract. of leg, lower 3d.	Wilderness, Va.	May 6, 1864	5 mos.	—	10½ inches.	¼ inch	2½ inches	Not healed, will be good.
Disrupture of tarso-metatarsus, ankle joint, second necrosis . . .	Wilderness, Va.	May 3, 1864 June 16, 1864	3 mos. 2d, 2 mos.	—	5½ inches	¾ inch increase	½ inch	Not healed, œdematous.
Comp'd com. fracture of low. third of leg	Wilderness, Va.	May 8, 1864	3 mos.	7 mos.	4½ inches	None	2 inches	Healed badly, composed, redundant flap.
Comp'und fracture of tarsus . . .	Petersburg, Va.	June 16, 1864	5 mos.	6 mos.	7 inches	2½ inches	2½ inches	Healed, some damaged by exfoliations.
Comp'd com. fracture of leg above malleoli . . .	Petersburg, Va.	July 13, 1864	4 mos.	5 mos.	8 inches	¼ inch	2½ inches	Healed, crest cicatrized, flap separated, pendulous, limb very good.
Comp'und fracture of ankle joint . . .	Spottsylvania, Va.	May 12, 1864	10 mos.	1 year	11½ inches.	½ inch	3 inches	Long, damaged by gangrene.
Comp'd com. fract. of tarso-metatarsal bones, thro' the metatarsus and tarsus . . .	Spottsylvania, Va.	May 17, 1864	9 mos.	1 year	11½ inches.	None	2½ inches	Not entirely heal'd, very long, should have been Syme's.
Flesh wound in front of ankle joint by a spent ball, no fracture, ball lodged in muscles, walked a mile . . .	Spottsylvania, Va.	May, 1864	9 mos.	10 mos.	1st, 10½ inches 2d, 7½ inches	¾ inch	3½ inches	First very bad, ulceration, necrosis, second, very fine.
Comp'und fract. of calcaneum, ball lodged in it . . .	Spottsylvania, Va.	May 10, 1864	6 mos.	7 mos.	13 inches atr'phied	1 inch	2½ inches	Good, should have been Syme's.
Comp'd com. fracture of leg, middle third . . .	Spottsylvania, Va.	May 9, 1864	5 mos.	8 mos.	7½ inches	2 inches increase	None	Healed, enlarged, damaged, posterior flap redundant.
Comp'd com. fracture middle and lower third . . .	Spottsylvania, Va.	May 11, 1864	3 mos.	4 mos.	4½ inches	1 inch increase	1½ inches	Healed, some damaged by ulceration, flexed.
Middle third of leg	Spottsylvania, Va.	May 11, 1864	3 mos.	5 mos.	3½ inches	½ inch	3 inches	Healed, fair stump.
External malleoli shattered . . .	Snickers Gap, Va.	July 18, 1864	11 mos.	14 mos.	2 inches	None	None	Walked four miles after injury, healthy, thinly covered, damaged by sloughs.
Comp'd com. fract. of os calcis and tarsus, necrosis . . .	Snickers G p, Va.	July 18, 1864	11 mos.	1 year	11 inches	¾ inch	1½ inches	Excellent, model stump.
Comp'd com. fracture of upper middle of leg . . .	Petersburg Va.	June 16, 1864	6 mos.	11 mos.	4 inches	1½ inches increase	None	Swollen, eczematous.
Comp'und comminuted fracture of ankle joint . . .	Gettysburg, Pa.	July 2, 1863	5 mos.	14 mos.	5½ inches	1 inch	¼ inch	Flaps ul'ghed, st'mp badly ulcerated, will be efficient.
Comp'd com. fract. of middle of leg . . .	Gettysburg, Pa.	July 27, 1863	5 mos.	7 mos.	4½ inches	1 inch	3 inches	Stump ulcerated, redundant flap.
Comp'd com. fract. of ankle joint . . .	Gettysburg, Pa.	July 3, 1863	10 mos.	—	8 inches	1 inch	3 inches	Good.
Comp'd fracture of fibula only, gangrene, secondary hemorrhage . . .	Gettysburg, Pa.	July 2, 1863	3 mos.	6 mos.	4½ inches	None	3 inches	Stump damaged, flexed, will be cicatrized, efficient.
Comp'd com. fract. of ankl. joint . . .	Gettysburg, Pa.	July 1, 1863	13 mos.	15 mos.	8½ inches	¾ inch	4 inches	Not healed, some exfoliation.
Comp'und comminuted fracture of leg . . . . .	Gettysburg, Pa.	July 5, 1863	—	13 mos.	4½ inches	None	2½ inches	Healed, much damaged by sloughing, and cicatrizations on ant. part
Disrupture of ankle joint . . . . .	Gettysburg, Pa.	July 4, 1863	11 mos.	13 mos.	10 inches	1½ inches	4 inches	Healed, damaged by sloughing.
Disrupture of ankle joint . . . . .	Gettysburg, Pa.	July 1, 1863	2 yrs. & 4 mos.	2 yrs. & 5 mos.	7½ inches	¾ inch	3½ inches	Excellent.
Comp'und comminuted fracture of tarsus . . . . .	Gettysburg, Pa.	July 2, 1863	2 years	2 years	9 inches	None	2½ inches	Healed very good
Destruction at its middle third . . . . .	Gettysburg, Pa.	July 2, 1863	5 mos.	7 mos.	1½ inches	Knee	support	A good st'mp, flexed at nearly right angles, smooth and clean front for base of support, not perfectly healed, scabbed over.
Compound comminuted fracture of middle third of leg . . . . .	Gettysburg, Pa.	July 1, 1863	3 mos.	6 mos.	5 inches	¼ inch increase	1 inch	Stump not quite healed, will be smooth and efficient.

TABLE OF TWO HUNDRED AND EIGHTY-SEVEN CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
J. W.	14th N. Y. S. M.	Stone-cutter	R.	Lower third	Ant. post. flaps	On the field	One hour	Shell
G. M.	12th N. Y. Regulars	Heating	L.	Lower third	—	U. S. Hospital, Newark	Five days	Railroad accident
J. S. R.	Cavalry	R. R. Telegraph Superintendent	L.	Middle third	Circu ar	—	Two hours	Fragment of shell
R. S.	4th R. I. Vols.	None	L.	Middle third	Posterior flap	On the field	Twenty-six hours	Grape-shot
T. A. S.	5th Conn.	Mechanic	R.	Lower third	Ant. post. flap	Field hospital	Two days	Minie-ball
T. M.	5th Ohio Vols.	Steam-boatman	R.	Upper third	Ant. post. flap	Hospital, Culpepper C. H.	Ten days	Minie-ball
J. O'L.	8th Infantry	None	L.	Upper third	Ant. post. flap	Alexandria Gen'l Hosp.	Five days	Piece of shell
A. C. H.	28th N. Y. Vols.	Farmer	R.	Upper third	Circular	Culpepper C. H. Hospital	Three days	Minie-ball
J. F. C.	7th Maine Vols.	Cotton spinner	R.	Lower third	Ant. post. flap	On the field	Six hours	Musket-ball
C. H.	65th N. Y. Vols.	—	R.	Upper third	Circular	On the field	Twenty-fo'r hours	Minie-ball
P. McL.	29th Maine	Farmer	L.	Middle third	Circular	On the field	Thirty h'rs	Minie-ball
J. S. S.	9th H. A.	Farmer	R.	Upper third	Posterior flap	On the field	Thirty h'rs	Minie-ball
J. M.	18th Penn. Cavalry	None	R.	Middle third	Circular	On the field	Fifty-five hours	Fragment of shell
W. G. H.	30th Mass. Vols.	House-painter	L.	Lower and middle third	Ant. post. flaps	On the field	Eight hours	Musket-ball
P. McH.	34th Mass. Vols.	Carder of cotton	L.	Upper third	Posterior flap	On the field	Two hours	Fragment of shell
W. S. W.	Confed'rate	Regular army Sailor	L.	Junction up. & middle 3d	Circular	Bermuda Hundred Brooklyn	—	Gunshot
C. P.	U. S. Navy	Sailor	R.	Upper and middle third	Ant. post. flap	—	Twenty-two days	Piece of shell
T. B.	54th N. Y. Vols.	Seaman	R.	Middle and upper third	Ant. post. flap	Hilton Head Hospital	Eighty-five days	Musket-ball
S. R.	55th N. Y. Vols.	None	R.	Lower third	Circular	On board steamer	Fifteen days	Musket-ball
M. T.	38th N. Y. Vols.	Carpenter	L.	Lower third	Lateral flaps	Field hospital	Four hours	By springing back of falling tree
W. G.	29th Conn.	Farmer	L.	Lower third	Circular	On the field	Four hours	Canister-shot
J. W.	56th N. Y.	Farmer	R.	Upper third	Circular	On the field	Three days	Shell
J. K.	12th Mass.	Stone-cutter	R.	Middle and lower third	Posterior flap	On the field	One hour	Railroad cars
C. B.	14th N. Y. Militia	Clerk	L.	Middle and upper third	Posterior flap	On the field	Five days	Musket-ball

OF RECOVERED AMPUTATION OF THE LEG.—(Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, Generally made a Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Dissevering foot at ankle joint.	Gettysburg, Pa.	July 1, 1863	3 mos.	6 mos.	13 inches	½ inch	2 inches	Stump mainly cicatrized, not entirely, will prove efficient, though redundant.
Comminuted fract. of tibia, tarsal articulations . . . . . Disruption of leg at lower third . . . . .	South Brunswick, N. J.	May 10, 1864	6 mos.	—	9½ inches	2 inches increase	½ inch increase	Hypertrophy, nearly healed, œdematous.
	Haws' Shops, Va.	May 28, 1864	4 mos.	—	7½ inches	¾ inch	2½ inches	Some atrophy, nearly healed, crest protruded, cicatrized, otherwise well made.
Comp'd com. fract. of ankle joint and lower third of leg	Antietam, Md.	Sept. 17, 1862	14 mos.	17 mos.	7½ inches	¾ inch	4 inches	Stump ulcerated, dark red, some exfoliation.
	Cedar Mountain, Va.	Aug. 9, 1862	5 mos.	8 mos.	9½ inches effective	¾ inch	None	Posterior flap pendant, anterior denuded, nearly ready.
Comp'd fracture of lower third of leg . . . . .	Cedar Mountain, Va.	Aug. 9, 1862	4 mos.	8 mos.	5½ inches	None	½ inch	Cicatrized, exfoliation, abscess in joint, anterior inferior part.
Comp'd com. fract. of leg about the middle . . . . .	Cedar Mountain, Va.	Aug. 9, 1862	1 mo.	8 mos.	4 inches	½ inch increase	½ inch	Not healed, ulceration on inferior portion, joint inflamed, cicatrized well, exfoliation of tibia.
Comp'und fracture of tibia . . . . .	Cedar Mountain, Va.	Aug. 9, 1862	4 mos.	—	3½ inches	1 inch	½ inch	Scanty, well heal'd, posterior deficient in muscle, some enlargement in knee joint, efficient, serviceable for knee-bearing, six feet high and more.
Comp'd com. fracture of ankle joint . . . . .	Cedar Creek, Va.	Oct. 18, 1864	5 mos.	3 mos.	13½ inch.	None	2 inches	Healed, very good, can lean a little on the end.
Comp'd com. fracture of middle third of leg . . . . .	Cedar Creek, Va.	Oct. 19, 1864	11 mos.	1 year	3½ inches	1¼ inches	None	Very good for short stump.
Comp'd com. fracture of low. third of leg . . . . .	Cedar Creek, Va.	Oct. 19, 1864	6 mos.	8 mos.	7½ inches	None	3 inches	Very good.
Comp'd com. fract. of middle third . . . . .	Cedar Creek, Va.	Oct. 19, 1864	6 mos.	8 mos.	5½ inches effective	½ inch	1½ inches	Not entirely healed.
Severe injury of calcaneum . . . . .	Cedar Creek, Va.	Oct. 19, 1864	5 mos.	7 mos.	8½ inches	1 inch	5 inches	Mainly healed, very good.
Comp'd com. fracture of metatarsus and tarsus . . . . .	Cedar Creek, Va.	Oct. 19, 1864	4 mos.	6 mos.	8½ inches	None	2½ inches	Small ulcer, some exfoliation, will be very fair.
Destruction of leg above joint . . . . .	Cedar Creek, Va.	Oct. 13, 1864	3 mos.	5 mos.	3½ inches	None	None	Enlarged, flap receded, not good, healed, damaged by flap, etc.
—	Bermuda Hundred	May 20, 1864	3 mos.	—	5½ inches	None	None	Excellent.
Comp'd com. fract. lower third of leg	—	Feb. 16, 1865	3 mos.	4 mos.	5 inches	½ inch increase	None	Very good.
Comp'd com. fracture junction of lower and middle third . . . . .	James' Island, S. C.	July 4, 1864	10 mos.	11 mos.	6 inches	½ inch	2½ inches	Very good.
Comp'd fracture of ankle joint . . . . .	Fair Oaks, Va.	June 15, 1862	5 mos.	—	12 inches	¾ inch	4 inches	Flaps, lateral, st'mp good.
Comp'd fract. ab'v'e ankle joint . . . . .	Fair Oaks, Va.	May 27, 1862	7 mos.	—	10 inches	1 inch	4 inches	Gastrocnemii retracted, stump smooth.
Lower back part of thigh and disrup-ture of ankle joint . . . . .	Fair Oaks, Va.	Oct. 27, 1864	13 mos.	—	11 inches	None	4½ inches	Excellent, hard and efficient.
Below the knee . . . . .	Fair Oaks, Va.	May 31, 1862	2 years	2 years	4½ inches	2 inches	1½ inches	—
Comp'und comminuted fracture of leg and ankle joint . . . . .	Manassas, Va.	Aug. 14, 1863	4 mos.	6 mos.	9½ inches	½ inch	2½ inches	Stump not healed, flap pendulous, some damaged by exfoliation and extensive cicatrices.
Comp'd fracture of lower third of leg	Manassas, Va.	Aug. 23, 1862	6 mos.	8 mos.	4½ inches	½ inch	2½ inches	Bad posterior flap, pendulous, badly amputated, sloughing.

TABLE OF TWO HUNDRED AND EIGHTY-SEVEN CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
M. C.	2d Conn.	Moulder	L.	Upper and middle third	Circular	On the field	Five hours	Musket-ball
J. McC.	155th N. Y.	H. A. Shoemaker	L.	Lower third	Bilateral flaps	On the field	Six hours	Minie-ball
J. W.	8th N. Y.	H. A. Farmer	L.	Upper third	Posterior flap	On the field	Twenty-fo'r hours	Minie-ball
D. H.	11th Vt. Vols.	Blacksmith	L.	Lower third	Ant. post. flaps	On the field	Three hours	Solid shot
J. M.	39th Mass.	Laborer	R.	Lower and middle third	Posterior flap	Brooklyn Coll'ge Hosp. On the field	Twelve h'rs	Railroad cars
A. D.	1st Regt.	—	L.	Upper third	Ant. post flaps	On the field	Six hours	Grape-shot
W. S.	8th Regt.	Architect	R.	Lower third	Ant. post. flaps	Harrisburg, Va.	Seventeen days	Musket-ball
S. H.	Colored	Seaman	R.	Lower third	Circular	Port Royal, S. C.	—	Rifle-ball
A. G.	—	Seaman	R.	Upper third	Ant. post. flap	On gunboat John P. Jackson	Twenty-fo'r hours	Shot
H. W.	9th N. Y. Vols.	Cabinet-maker	R.	Lower and middle third	Ant. post. flap	Spring Hospital, Md.	Thirty-five days	Piece of shell
E. G. F.	Confederate	—	R.	Lower third	Ant. post. flap	On the field	Twelve h'rs	Musket-ball
G. W. R.	1st Md. Battery	Farmer	R.	Upper third	Ant. post. flaps	On the field	Two hours	Rifle-ball
J. L.	N. Y. Vols.	Cooper	L.	Upper third	Circular	Bellevue Hospital	Thirteen days	Rifle-ball
C. H. S.	3d Maine	Machinist	R.	Middle and upper third	Ant. post. flap	On the field	Half-hour	Cannon-ball
W. F. W.	Confederate	—	L.	Lower third	Circular	—	—	Gunshot
F. W. K.	1st V. H. Artillery	Farmer	R.	1st, just ab'v'e ankle	Ant. post. flap 2d, circular	On the field 2d, Central Park	Seventeen hours	Minie-ball
J. S.	10th Vt. Vols.	Farmer	L.	Junction of lower and middle third	Circular	Winchester Church	2d, 3 weeks Four days	2d, exfoliation and necrosis Musket-ball
M. D.	14th N. H. Vols.	Farmer	L.	Upper third	Circular	On the field	Sev'nty-seven hours	Grape-shot
M. W.	10th Vt. Vols.	Carpenter	L.	Lower and middle third	Ant. post. flap	On the field	Three hours	Conical-ball
J. W.	8th Conn.	Farmer	R.	1st, amputa. lower third 2d, amputa. upper third	Posterior flap	On the field 2d, Frederick City	Six hours 2d, three months	Musket-ball 2d, exfoliations
W. A. B.	2d Infantry Corps d'Afrique	Tailor	R.	Upper third	Posterior flap	Ship Island, Miss.	Six hours	Rifle-ball
G. W.	Ind. L. I. N. Y.	Laborer	R.	Junction of middle and lower third	Bilateral flaps	In post-hospital	Half hour	Explosion of torpedo
B. F. F.	7th N. H. Vols.	Farmer	R.	Upper and middle third	Posterior flap	—	Sixty days	Rifle-ball
G. G.	67th Ohio Vols.	Farmer	R.	Upper third	Ant. post. flap	Charleston Hosp., S. C.	Five days	Musket-ball
W. D.	5th Artillery	Sailor	L.	Upper and middle third	Circular	On the field	Half hour	Piece of shell
J. DeF. (Indian)	Chief of	Omahas	R.	Middle third	Circular	—	—	Rusty nail

OF RECOVERED AMPUTATION OF THE LEG. — (Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Comp'd com. fracture of ankle joint	Coal Harbor, Va.	June 1, 1864	7 mos.	8 mos.	6 inches	1½ inch	1½ inches	Good, well healed.
Comp'd com. fracture of ankle joint	Coal Harbor, Va.	June 3, 1864	6 mos.	7 mos.	14 inches	½ inch	2 inches	Healed, good.
Comp'd com. fract. of middle upper third of leg	Coal Harbor, Va.	June 3, 1864	1 year	13 mos.	3 inches	None	None	Indifferent, damaged by g'ngrne, knee support.
Disrupt. and carrying away entire foot	Coal Harbor, Va.	June 2, 1864	11 mos.	13 mos.	10½ inch.	1½ inch	2 inches	Excellent.
Passing over ankle joint	Brooklyn, N. Y.	Dec., 1862	4 mos.	6 mos.	8½ inches	1 inch	4½ inches	—
Comp'd fract. middle third of leg	Chantilly, Va.	Aug. 23, 1862	5 mos.	7 mos.	4½ inches	None	None	—
Comp'und fracture of ankle joint	Cross Keys, Va.	June 25, 1862	7 mos.	7 mos.	10½ inch.	1 inch	4½ inches	—
Shattering ankle joint	Port Royal, S. C.	June, 1862	—	—	9 inches	None	None	—
Taking off foot, at the same time wounding other foot	Vicksb'rg, Miss.	June 28, 1863	—	—	—	None	None	—
Dissevering external malleolus, and injuring foot not the tibia and astragalus at articulation, so that he walked with the aid of a rifle.	Antietam, Md.	Sept. 17, 1862	1 year	1 year & 9 mos.	7 inches	1 inch	2½ inches	Stump in good condition.
Comp'und fracture of ankle joint	Malvern Hill, Va.	July 1, 1862	5 mos.	—	10 inches	1 inch	4 inches	Clean, well formed stump, tibio-astragaloid articulation, artificial leg.
Comp'und fracture of the middle of leg	Malvern Hill, Va.	July 1, 1862	4 mos.	—	4 inches	None	2 inches	End of stump irregular, flap oblique.
Wounding soft parts, lower parts of belly, gastrocnemii	Malvern Hill, Va.	July 1, 1862	4 mos.	—	3½ inches	¾ inch	1½ inches	Cicatriz. healthy, well, even, quite efficient, walked to Harrison's Landing, thence to Bellevue per transport, walked about till amputation, secondary hemorrhage.
Lower third of leg severed	Malvern Hill, Va.	July 1, 1862	1 year & 5 mos.	1 year & 5 mos.	2 inches	None	None	Stump good, knee support.
Ankle joint and foot	Malvern Hill, Va.	July 1, 1862	—	6 mos.	9 inches	None	None	Taken prisoner at Malvern Hill, Va.
Comp'und comminuted fracture of ankle joint	Winchester, Va.	Sept. 19, 1864	9 mos.	10 mos.	7 inches	¾ inch	3 inches	Very good, covering angular.
Comp'und comminuted fracture of ankle joint	Winchester, Va.	Sept. 19, 1864	8 mos.	9 mos.	9½ inches	None	4 inches	Very good, end exposed by sloughing.
Comp'und comminuted fracture of middle of leg	Winchester, Va.	Sept. 19, 1864	7 mos.	8 mos.	2½ inches	None	None	Excellent for knee support, flexed.
Comp'und comminuted fracture of lower middle of leg	Winchester, Va.	Sept. 19, 1864	7 mos.	8 mos.	6½ inches	None	3½ inches	Very fair, stump damaged by sloughing.
Comp'und comminuted fracture of ankle joint, abscesses, etc.	Antietam, Md.	Sept. 17, 1862	11 mos. 8 mos.	14 mos. 11 mos.	5 inches 3½ effect.	1 inch	3 inches	Stump damaged by exfoliations and sloughings.
Comp'd com. fract. of lower third of leg	East Pascagoula, Miss.	April 9, 1863	7 mos.	14 mos.	4½ inches 3 effect.	1½ inch increase	1½ inches	St'mp some flexed, healed, will be efficient.
Destruction of lower third of leg, gastrocnemii and biceps badly lacerated	Ft. Wagner, S. C.	Sept. 19, 1863	10 mos.	11 mos.	8½ inches	None	3 inches	Healed mainly some exfoliation stump flexed hamstrings rigid.
Comp'und comminuted fracture of ankle joint	Ft. Wagner, S. C.	July 13, 1863	9 mos.	1 year	4½ inches	¾ inch	2½ inches	Some atrophied, healed, irregular, not well composed.
Comp'und fracture of middle of leg	Ft. Wagner, S. C.	July 21, 1863	11 mos.	13 mos.	3½ inches	1 inch	3½ inches	Healed, flexed, rather short.
Completely carrying away the leg at its middle	Sharpsburg, Md.	Sept. 19, 1862	8 mos.	10 mos.	6½ inches	¾ inch	4 inches	—
Punctured wound, inflammation	—	1859	4 years	4 years	6½ inches	None	2 inches	—

TABLE OF TWO HUNDRED AND EIGHTY-SEVEN CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
M. McG.	27th Mass. Vols.	None	R.	Middle third	Circular	On the field	Three hours	Canister-shot
J. D. T.	23d Mass. Vols.	None	L.	Junction of middle and upper third	Circular	In field hospital	Eight days	Grape-shot
R. T.	6th Mich.	Farmer	R.	Upper and middle third	Posterior flap	On the field	Half hour	Shell from Union gun while in rifle-pits
C. M. P.	U. S. R. A.	Lieutenant	L.	Middle and upper third	Bilateral flaps	Residence, New York	Twenty-one months	Rifle-ball
H. B.	40th N. Y. Vols.	Farmer	L.	Upper and middle third	Posterior flap	Clifborne Hospital	Eight days	Rifle combustible ball
L. H. M.	11th N. Y. Vols.	Clerk	L.	Upper third	Ant. post. flap	Rebel hosp., Richmond	Four days	Gunshot
P. B. C.	14th N. Y. Militia	Blacksmith	L.	Upper third	Ant. post. flap	On the field	Eighteen hours	Minie-ball
W. S.	1st Ellsworth Zouaves	Butcher	L.	Lower third	Circular	Bellevue Hospital	Eleven months	Rifle-ball
L. H. M.	—	—	L.	Upper third	Posterior flap	—	—	Shot
E. LeG.	22d N. Y. Vols.	Shoemaker	L.	Upper third	Ant. post. flap	On the field	Forty-eight hours	Minie-ball
J. R.	20th Conn. Vols.	Farmer	R.	Lower and middle third	Ant. post. flap	On the field	Three days	Fragment of shell
C. W. R.	1st B. I. A.	Carpenter	L.	Lower and middle third	Posterior flap	Portsmouth Grove Hospital	Ten months	Minie-ball
H. T.	6th Maine	Fireman	L.	Upper third	Circular	McDougal U. S. Gen'l Hospital	Four mos.	Musket-ball
H. A. G.	11th Vt. Vols.	Farmer	L.	Lower and middle third	Ant. post. flaps	On the field	Eighteen hours	Musket-ball
A. C.	1st U. S. Artillery	Shoemaker	L.	Junction of middle and upper third	Circular	On the field	Half hour	Fragment of shell
J. H. W.	1st La. Infantry	Negro driver	R.	Upper third	Posterior flap	On the field	Half hour	Grape-shot
M. F. P.	131st N. Y. Vols.	Carpenter	R.	Lower third	Circular	On the field	Half hour	Minie-ball
H. C.	187th Penn. Vols.	Railroad Conductor	R.	Middle third	—	—	Five hours	Canister-shot
H. G.	89th Ill. Infantry	Railroad Manager	R.	Lower third	Anterior flap	In the field hospital	Seven weeks	Erysipelas from cut
F. M. J.	52d N. Y. Vols.	Pianoforte maker	L.	Upper and middle third	Ant. post. flaps	On the field	Twenty-four hours	Grape-shot
W. T.	U. S. Navy	Boatswain's mate	R.	Lower third	Circular	On board ship	Eighteen hours	Caught in turret
C. L.	142d N. Y. Vols.	House-painter	L.	1st, extreme lower third 2d, junct. of low. mid. 3d junct. of upper and middle of leg	1st, Circular 2d, Bilateral flap	On the field 2d, Central Park	Seven months Seven and a half months Ten hours	Piece of shell
J. L.	56th N. Y. Vols.	Carriage-maker	R.	Upper and middle of leg	Bilateral and Circular	On the field	—	Canister-shot
M. G.	107th N. Y. Vols.	None	R.	Middle and lower third	Circular	On the field	Three to four hours	Musket-ball
A. A.	106th N. Y. Vols.	Farmer	L.	Lower and middle third	Ant. post. flap	On the field	Four hours	Fragment of shell

## OF RECOVERED AMPUTATION OF THE LEG. — (Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS. Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Comp'und comminuted fract. lower third of leg . . .	Newbern, N. C.	March 14, 1862	13 mos.	14 mos.	6½ inches	1 inch	4½ inches	Has been wearing a leg with rotatory motion at ankle joint, unreliable and unsatisfactory. Healed.
Comp'und fracture of lower part of leg and ankle . . .	Newbern, N. C.	March 14, 1862	1 year	13 mos.	5½ inches	½ inch	1½ inches	
Comp'd com. fract. lower third of leg, and flesh wound of calf of the other leg . . .	Port Hudson, La.	June 27, 1863	3 mos.	9 mos.	4½ inches	None	1 inch	Stump in bad condition, exfoliation, flap not united, ulceration, etc.
Comp'und fract. of fibula, tibia split, etc.	2d Bull Run, Va.	May 18, 1864	6 weeks	4 mos.	5½ inches	None	None	Healing.
Comp'und comminuted fracture of middle of leg.	Bull Run, Va.	Aug. 28, 1862	7 mos.	9 mos.	5 inches	None	2 inches	Retracted, flexion more than angle of 45 degrees.
Comp'und comminuted fracture of middle third . . .	Bull Run, Va.	July, 1861	8 mos.	1 year & 4 mos.	—	3½ inches	—	Stump vigorous, well healed.
Comp'd fract. lower part of leg . . .	Bull Run, Va.	July 29, 1862	7 mos.	13 mos.	4½ inches	None	1 inch	—
Compound fracture . . . . .	Bull Run, Va.	July 21, 1861	16 mos.	—	9 inches	½ inch	3 inches	Fine stump.
—	Bull Run, Va.	July 21, 1861	—	—	—	None	None	—
Comp'd com. fract. of middle third . . .	Chancellorsville, Va.	April 29, 1863	8 mos.	11 mos.	5½ inches	1½ inches	2 inches	Stump healed and efficient.
Destruction of leg at lower third . . .	Chancellorsville, Va.	May 3, 1863	9 mos.	13 mos.	8 inches	¾ inch	3½ inches	St'mp healed, some damaged by sloughing.
Boring a hole in the tibia antero-posterior without fracture . . . . .	Fred'icksburg, Va.	Dec. 3, 1863	4 mos.	6 mos.	7 inches	1½ inches	2 inches	Stump healed, flap redundant, pendulous two inches.
Comp'und comminuted fracture of 4th and 5th metatarsal bones, of internal and external cuneiform and calcis . . . . .	Fred'icksburg, Va.	May 3, 1863	4 mos.	7 mos.	3½ inches	None	2 inches	Stump smooth, neat, efficient, thoro'ly healed.
Comp'd com. fract. of lower third . . .	Coal Harbor, Va.	June 1, 1864	8 mos.	9 mos.	8½ inches	¾ inch	2½ inches	Well healed, excellent.
Severing leg at its middle and lower third . . . . .	Port Hudson, La.	May 27, 1863	6 mos.	19 mos.	4½ inches	¾ inch	2 inches	Stump well healed, will be vigorous, is well formed.
Comp'und comminuted fracture of middle third of leg . . . . .	Port Hudson, La.	June 14, 1863	5 mos.	14 mos.	4 inches 2½ effective	¾ inch increase	1 inch	Flap redundant, cicatrices extensive, angles pointing, healed, scabby, will do pretty good service.
Lodged in foot, entering back external malleolus, making a circuit of foot . . . . .	Port Hudson, La.	June 3, 1863	5 mos.	15 mos.	12 inches	None	1 inch increase	Stump bad, necrosis of tibia, several ulcers, livid, hypertrophied.
Middle of leg . . . . .	—	June 18, 1864	4 mos.	—	6 inches	None	None	Medium size, swollen, partially healed.
Tarsus metatarsus sundered . . . . .	—	Jan'y 16, 1864	10 mos.	11 mos.	10 inches	None	None	Good.
Comp'd com. fract. of foot, ankle joint, and lower third of tibia . . .	W. Point, Va.	May 8, 1862	6 mos.	—	6 inches	2 inches	4 inches	Stump not healed, subsequent injury, delay.
Comp'd com. fracture of foot, heel, and ankle joint uninjured . . . . .	James River, Va.	Nov. 28, 1864	2 mos.	3 mos.	9½ inches	None	½ inch	Very fine, healed primarily.
Entire destruction of ankle joint, subsequent disease of bone . . . . .	Dilby't'wn	Oct. 27, 1864	11 mos. 3 mos.	—	11½ inch. 9½ inches	None	2½ inches	Two and one half inches reamputated, not entirely healed, sluggish.
Comp'und fracture of upper middle of leg . . . . .	Dingle's Mill, S. C.	April 9, 1865	5 mos.	6 mos.	4 inches	¾ inch	None	Excellent.
Compound comminuted fracture ankle joint . . . . .	—	M'ch 16, 1865	6 mos.	7 mos.	9½ inches	1½ inches	4½ inches	Excellent.
Comp'd com. fracture of ankle . . . . .	Winchester, Va.	Sept. 19, 1864	4 mos.	7 mos.	9 inches	¾ inch increase	2½ inches	Healed good.

TABLE OF TWO HUNDRED AND EIGHTY-SEVEN CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
A. T.	U. S. Navy	Seaman	R.	1st, just ab've malleoli, 2d, junct. lower & mid. third	Circular	On gunboat 2d, at Memphis	Ten min'tes 2d, Twenty-two days	Musket-ball
T. F. F.	157th N. Y. Vols.	Stone-cutter	L.	Lower and middle third	Bilateral flaps	Field	Six hours	Minie-ball
C. G. S.	4th U. S. Infantry	Farmer	L.	Lower third	Circular	On the field	One hour	Grape-shot
M. M.	5th N. H. Vols.	Farmer	R.	Lower third	Circular	On the field	Five hours	Minie-ball
J. H. H.	38th U. S. Artillery	Farmer	R.	Upper third	Anterior flap	On the field	Three hours	Musket-ball
J. A. H.	11th Maine	Sailor	L.	Junction of lower and middle third	Circular	On the field	Five hours	Minie-ball
R. T.	17th Conn. Vols.	Farmer	R.	Lower third	Ant. post. flaps	In the field hospital	One hour	Fragment of shell
H. B.	85th Penn. Vols.	Blacksmith	L.	Lower third	Circular	Beaufort General Hospital	Three days	Fragment of shell
J. S.	100th N. Y. Vols.	Cabinet-maker	R.	Lower third	Circular	Hosp., Morris Island	One hour	Shell
O. C.	63d N. Y. Vols.	Laborer	R.	Lower and middle third	Circular	Frederick City	One month	Musket-ball
J. Y.	53d Penn. Vols.	Farmer	L.	Lower and middle third	Circular	On the field	Five days	Musket-ball
J. S.	93d Penn. Vols.	None	R.	Lower third	Posterior flap	On the field	Four hours	Minie-ball
B. C. C.	67th N. Y. Vols.	Farmer	L.	Lower and middle third	Circular	Annapolis Hospital	Six weeks	Minie-ball
H. M.	45th N. Y. Vols.	Cabinet-maker	L.	Upper third	Ant. post. flap	In a farmhouse, Woodstock, Va.	Two hours	Musket-ball
H. R.	58th Penn.	Farmer	L.	Middle and upper third	Circular	General Hospital, Newbern, N. C.	Nine hours	Minie-ball
P. P.	1st Class	Fireman on gunboat Diana	R.	Upper third	Posterior flap	Pattersonville, La.	Two days	Shell
B. W. B.	U. S. L. Artillery	Farmer	R.	Upper and middle third	Ant. post. flap	Portsmouth Hospital	Three mos.	Minie-ball
F. H. B.	48th N. Y. Vols.	Farmer	R.	Junction of lower and middle third	Ant. post. flaps	On the field	Twelve hours	Musket-ball
T. McQ.	69th N. Y. Vols.	Soldier	L.	Middle third	Circular	U. S. Hospital, Baltimore	Two hours	Railroad cars
J. G. N.	—	Warrior	R.	Lower third	Circular	—	—	Gunshot
F. G. F.	Powder boy	—	L.	Upper middle	Circular	—	Four hours	Shell
E. M.	163d N. Y. Vols.	Locksmith	L.	Lower and middle third	Ant. post. flap	In field hospital	Six hours	Shell
A. K.	4th N. Y. Vols.	Upholsterer	R.	Lower and middle third	Lateral flaps	Field hospital	Three hours	Solid shot

## OF RECOVERED AMPUTATION OF THE LEG.—(Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Comp'd com. fract. of tarso-metatarsus . . . . .	Red River	Aug. 5, 1864	11 mos.	1 year	9 inches	$\frac{3}{4}$ inch	1 $\frac{1}{2}$ inches	Nearly ordinary very good, hardy.
Compound comminuted fracture ankle joint and leg . . . . .	Poplar Grove, Va.	Sept. 30, 1864	9 mos.	1 year	8 inches	None	None	Not healed, three quarters of an inch of necrosis, bone removed, Stump healed.
Destruction of ankle joint . . . . .	Antietam, Md.	Sept. 17, 1862	11 mos.	1 year & 2 mos.	9 inches	1 $\frac{1}{2}$ inches	4 inches	Stump healed.
Comp'd com. fract. of ankle joint . . . . .	Deep Bottom, Va.	July 27, 1864	10 mos.	11 mos.	10 $\frac{1}{2}$ inch.	$\frac{1}{2}$ inch	2 $\frac{1}{2}$ inches	Excellent.
Comp'd com. fract. middle third leg . . . . .	Deep Bottom, Va.	Sept. 29, 1864	11 mos.	—	3 $\frac{1}{2}$ inches	$\frac{1}{2}$ inch	2 inches	Excellent.
Comp'und fracture of ankle joint . . . . .	Deep Bottom, Va.	Aug. 14, 1864	5 mos.	7 mos.	10 inches	1 inch	2 $\frac{1}{2}$ inches	Good, well except slight ulcer.
Comminuted fracture lower third of leg . . . . .	Morris Island, S. C.	Aug. 21, 1863	6 mos.	8 mos.	1 $\frac{1}{2}$ inches	None	3 inches	Stump healed.
Comminuted ankle joint and foot . . . . .	Morris Island, S. C.	Aug. 29, 1863	5 mos.	13 mos.	12 $\frac{1}{2}$ inch.	1 inch	2 inches	Stump long, redundant, some inflamed, ulcerated, will be efficient.
Severing leg at ankle . . . . .	Morris Island, S. C.	Aug. 31, 1863	4 mos.	1 year	12 inches	$\frac{1}{2}$ inch	2 $\frac{1}{2}$ inches	Stump not healed, will be efficient.
Striking leg at junction of lower third, shattering the bone, exit at the heel . . . . .	Antietam, Md.	Sept. 17, 1862	9 mos.	11 mos.	8 $\frac{1}{2}$ inches	2 $\frac{1}{2}$ inches	3 inches	A model stump, healed by first intention, cicatrix hardly perceptible, silver ligatures, stump right proportions. Stump healed, some damaged by sloughing.
Comp'und fracture lower third of leg . . . . .	Fair Oaks, Va.	June 1, 1862	14 mos.	1 year & 5 mos.	9 inches	None	3 inches	Not healed.
Comp'd fracture of ankle and lower third of leg . . . . .	Fair Oaks, Va.	May 31, 1862	14 mos.	1 year & 10 mos.	9 $\frac{1}{2}$ inches	1 inch	4 $\frac{1}{2}$ inches	Not healed.
Comp'd com. fract. of ankle joint, ball entering back of internal malleoli, and exit at anterior lateral portion forward of external malleoli. . . . .	Fair Oaks, Va.	May 31, 1862	11 mos.	1 year & 5 mos.	8 inches	1 $\frac{1}{2}$ inches	2 $\frac{1}{2}$ inches	Ulcer on end.
Comp'd com. fracture middle of leg by accidental discharge of musket . . . . .	Woodstock, Va.	June 3, 1863	16 mos.	19 mos.	4 inches	$\frac{1}{4}$ inch increase	1 $\frac{1}{2}$ inches	Stump healed.
Comp'd com. fracture of tarsus, entrance tarso-metatarsus, exit posterior external malleolus . . . . .	Sandy Ridge	April 17, 1863	6 mos.	8 mos.	13 inches	1 inch	3 $\frac{1}{2}$ inches	Stump smooth, well healed, redundant; query, could parts have been secured from Syme's at ankle, vastly superior.
Entirely severing leg at its middle third . . . . .	Berwick Bay engagement	M'ch 28, 1863	8 mos.	—	—	—	—	—
Compound comminuted fracture of ankle joint . . . . .	Drury's Bluff, Va.	May 16, 1864	8 mos.	9 mos.	6 $\frac{1}{2}$ inches	None	2 inches	Healed, excellent, compact, firm.
Compound fracture of ankle joint . . . . .	Drury's Bluff, Va.	May 16, 1864	7 mos.	8 mos.	9 inches	$\frac{3}{4}$ inch	3 inches	Healed, some damaged by exfoliations.
Comp'd com. fract. of foot and lower part of leg . . . . .	Baltim're, Md.	July 26, 1861	2 years & 8 mos.	3 years	7 $\frac{1}{2}$ inches	$\frac{1}{2}$ inch	1 inch	—
—	Gen. Porter's staff	June, 1861	—	—	9 inches	1 inch	1 inch	—
Comminuted fracture of lower third of leg . . . . .	Fort St. Philip & Jackson	April 24, 1862	10 mos.	10 mos.	5 inches	1 inch	None	—
At ankle joint, lower third of leg, severing the foot from the leg save a few shreds of tissues . . . . .	Fredericksburg, Va.	Dec. 13, 1862	4 mos.	8 mos.	7 inches	$\frac{1}{2}$ inch	3 $\frac{1}{2}$ inches	—
Severing the foot from the leg at the lower third, save by some shreds of muscle . . . . .	Fredericksburg, Va.	Dec. 13, 1862	4 mos.	—	8 $\frac{1}{2}$ inches	$\frac{1}{2}$ inch	1 $\frac{1}{2}$ inches	Stump nearly healed.

TABLE OF TWO HUNDRED AND EIGHTY-SEVEN CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
D. M. M.	35th N. Y. Vols.	Clerk	R.	Upper third	Ant. post. flap	Field hospital	Five hours 2d operation eleven days	Cannon-ball Extensive sloughings simultaneous with 1st dressing Minie-ball
J. H.	9th N. Y. Vols.	—	R.	Lower and middle third	Circular	On the field	Two hours	Minie-ball
G. W. P.	30th N. Y. Militia	Cabinet-maker	L.	Upper third	Posterior flap	On the field	Three hours	Fragment of shell
F. A. G.	75th N. Y. Vols.	Farmer	L.	Junction of middle and lower third	Ant. post. flaps	General Hospital, Baton Rouge	Twenty-one hours	Minie-ball
M. W.	114th N. Y. Vols.	Artist	R.	Lower third	Bilateral flaps	Hospital	Thirty days	Musket-ball
W. B.	9th N. J. Vols.	Foundry	L.	Upper third	Circular	On the field	Half hour	Solid shot
W. G. B.	U. S. Navy	Boat-swain	R.	Lower and middle third	Circular	Naval Hospital, Pensacola, Fla.	Sev'nty-two hours	Explosion of torpedo
B. J. B.	137th N. Y. Vols.	Farmer	R.	1st, middle third 2d, extreme upper third	Ant. post. flap	On the field 2d, in general hospital	Two hours 2d, twenty-three days	Minie-ball
H. R.	16th Ill. Vols.	Brick-layer	L.	Middle third	Circular	On the field	Three hours	Rifle-ball
E. S.	10th Ohio Cavalry	Farmer	R.	Middle third	Posterior flap	On the field	Three hours	Piece of shell
J. R.	U. S. Navy	Ordinary Seaman	R.	Upper third	Bifateral skin-flaps and circular	U. S. gun-boat General Jackson	Twenty-one hours	Musket-ball
H. W.	U. S. Navy	Ordinary seaman	L.	Lower and middle third	Ant. post. flap	Norfolk U. S. Hospital	Sixteen days	Minie-ball
J. B.	U. S. Navy	Sailor	R.	Middle third	Lateral flaps	Ship Maratanza	1st, one hour 2d, caused by sloughing	Shell
A. D.	15th N. Y. Heavy Artillery	Clerk	L.	Lower and middle third	Bilateral skin flaps and circular	On the field	Twelve h'rs	Minie-ball
D. B.	97th N. Y. Vols.	Miller	R.	Lower third	Bilateral flaps	On the field	One day	Grape-shot
J. C.	33d N. Y. Vols.	Cooper	L.	Lower third	Ant. post. flap	On the field	Fifteen hours	Grape-shot
Ista Ma Ga.	Omaha Indian	—	—	—	—	—	—	—
I. O.	11th N. H. Vols.	Farmer & carrier	L.	Lower third	Ant. post. flaps	In Falmouth Hospital	Six days	Musket-ball
J. B.	9th N. Y. Vols.	Farmer	L.	Upper third	Circular	On the field	Half hour	Canister-shot
E. E. W.	144th N. Y. Vols.	Carpenter	L.	Upper and middle third	Flap	Union Chapel Hospital	Three days	Rifle-ball
J. McC.	1st D. C. Vols.	Farmer	L.	Lower third	Circular	On the field	Three hours	Fragment of shell
I. L. S.	4th Mich.	None	L.	Upper third	Ant. post. flap	At Savage's Station	Thirty-six hours	Grape-shot
D. B.	1st Penn.	Farmer	R.	Upper third	Flap	On the field	Twenty-four hours	Musket-ball
C. K.	1st Penn. Reserve	None	R.	Middle third	Flap	In field hospital	Three days	Rifle-ball
S. S.	142d N. Y. Vols.	Farmer	L.	Lower third	Circular	De Camp Hospital	Fifteen days	Minie-ball
J. C.	55th N. Y. Vols.	Farmer	L.	Extreme of upper third	Circular	On the field	Three hours	Rifle-ball & buck-shot
W. H. H.	1st Md. Vols.	Farmer	L.	Middle and upper third	Circular	On the field	Twenty hours	Minie-ball
J. N.	U. S. Navy	Seaman	L.	Upper third	Bilateral skin flaps and circular	On Montauk, U. S. gunboat	One hour	Solid shot

## OF RECOVERED AMPUTATION OF THE LEG. — (Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Comp'd com. fracture lower half of leg, 2d, exposure of tibia, some exfoliations . . .	Fredericksburg, Va.	Dec. 13, 1863	4 mos.	5 mos.	3½ inches	None	1¼ inches	—
Comp'nd commi. fract. lower third	Fredericksburg, Va.	Dec. 13, 1863	4 mos.	4 mos.	9 inches	¼ inch	2¼ inches	—
Severing leg at lower third . . .	Fredericksburg, Va.	Dec. 13, 1862	5 mos.	7 mos.	3 inches	None	None	Stump spread, adhesion.
Comp'nd fracture of tibia, astragalus, etc. . . . .	Baton Rouge	July 7, 1863	7 mos.	9 mos.	9 inches	1½ inches	3 inches	Stump mainly healed, pretty good covering and shape, crest cicatrized, abscesses, etc., will prove very good, some œdema.
Near ankle joint . . . . .	Cleaning gun	June 25, 1865	7 mos.	13 mos.	—	2 inches	3 inches	Healed by first intention, finely composed.
Severing the leg at lower third . . . . .	Goldsb'ro, N. C.	Dec. 17, 1862	9 mos.	1 year	¾ inch	None	2½ inches	Stump healed, sound.
Comp'd com. fracture of ankle joint and foot . . . . .	Mobile Bay, Ala.	M'ch 29, 1865	—	5 mos.	9 inches	1½ inches increase	None	Very œdematous, healed, system debilitated.
Comp'd com. fract. of lower third . . . . .	Atlanta, Ga.	July 20, 1864 Aug. 12, 1864	9 mos. 8 mos.	11 mos. 10 mos.	9 inches 2½ inches	None	None	Very fair, stump flexed for knee support.
Comp'nd comminuted fracture of lower third of leg	Savannah, Ga.	Dec. 13, 1864	3 mos.	5 mos.	7 inches	None	1¼ inches	Very good, scanty covering.
Comp'd com. fract. of leg and ankle joint . . . . .	Macon, Ga.	Nov. 19, 1864	4 mos.	7 mos.	7 inches	None	None	Will be good, not well cicatrized.
Wound of posterior tibial artery, no fracture . . . . .	Ft. Fisher, N. C.	Jan'y 15, 1865	2 mos.	5 mos.	3 inches	None	None	Not healed, doing well, flexed for knee support.
Compound comminuted fracture of ankle joint . . . . .	Fort Fisher, N. C.	Jan'y 15, 1865	6 mos.	9 mos.	8 inches	None	½ inch	Bad, poorly covered, damaged by sloughs.
Comp'nd fracture of lower third of leg . . . . .	Fort Fisher, N. C.	Oct. 11, 1862 Nov. 6, 1862	5 mos. 4 mos.	5 mos. 4 mos.	6¼ inches	3 inches	3 inches	—
Comp'nd comminuted fracture of ankle joint . . . . .	Hatcher's Run, Va.	Mar. 31, 1865	5 mos.	6 mos.	8 inches	¼ inch increase	2½ inches	Very good, crest exfol'd, sloughed.
Comp'nd comminuted fracture of ankle joint . . . . .	Hatcher's Run, Va.	Feb'y 6, 1865	4 mos.	5 mos.	8¾ inches	¾ inch	2¾ inches	Very long, compact, tapering good, healed.
Comp'nd comminuted fracture of tarsus . . . . .	Dallas, Ga.	May 25, 1864	7 mos.	8 mos.	10 inches	½ inch	1½ inches	Healed, very good.
Suppuration, infiltration, and mortification . . . . .	—	—	—	—	—	—	—	—
Comminuted fracture of lower third of leg . . . . .	Rappahannock	Dec. 13, 1862	7 mos.	16 mos.	8 inches	¼ inch	2½ inches	Stump extremely cicatrized.
Carrying away the leg, except a few fibres from upper middle third . . . . .	Roanoke Island, N. C.	Feb'y 8, 1863	16 mos.	17 mos.	3½ inches	None	None	Stump flexed, right angles, partially ankylosed.
Comp'd com. fracture of tibia . . . . .	Falls Ch., Va.	Nov. 29, 1862	8 mos.	10 mos.	6 inches	None	3 inches	—
Entirely destroying the tarsus . . . . .	Richmond, Va.	Sept. 29, 1864	5 mos.	6 mos.	10½ inch.	1 inch	3 inches	Finely healed, excellent.
Comp'd com. fract. of middle of leg	Gaines's Mills, Va.	June 28, 1862	9 mos.	10 mos.	4½ inches ¾ effect.	¼ inch	3 inches	—
Comp'nd fracture of ankle joint . . . . .	WhiteOak Swamp, Va.	June 30, 1862	5 mos.	—	¾ inches	¾ inch	3¾ inches	Stump fair, short, defective, prisoner at Richmond.
Comp'nd fracture lower third of leg	WhiteOak Swamp	June 30, 1862	1 month	5 mos.	7 inches	None	2½ inches	Stump sloughed, exfoliation.
Comp'd com. fract. of ankle joint . . . . .	City Point, Va.	May 26, 1864	7 mos.	9 mos.	10 inches	¾ inch	4 inches	Very good, well formed.
Comp'nd comminuted fracture of middle of leg . . . . .	Meridian, Miss.	Feb. 15, 1864	11 mos.	1 year	1 inch	None	None	Very good, neat, good knee support.
Comp'd com. fracture of low. third of leg . . . . .	Mon'caey, Md.	July 9, 1864	5 mos.	6 mos.	3¾ inches	1 inch	3 inches	Healed.
Destroying leg at middle third . . . . .	Stono, S. C.	July 9, 1864	5 mos.	6 mos.	3½ inches	None	None	Swollen, not entirely healed, rigidly flexed at right angles, knee support.

TABLE OF TWO HUNDRED AND EIGHTY-SEVEN CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
D. T.	42d N. Y. Vols.	Printer	L.	Middle and upper third	Ant. post. flaps	In field hospital	Tw'nty-two days	Rifle-ball
F. R. K.	66th N. Y. Vols.	Barber	R.	Upper and middle third	Lateral flaps	On the field	Two hours	Piece of shell
C. B.	51st N. Y. Vols.	Butcher	L.	Upper third	Ant. post. flap	In field hospital	Twenty-fo'r hours	Musket-ball
J. W.	66th N. Y. Vols.	Cabinet-maker	L.	Upper and middle third	Lateral flaps	In field hospital	Two hours	Rifle-ball
M. W.	162d N. Y. Vols.	Seaman	R.	Junction of lower and middle third	Bilateral flaps	On the field	Two hours	Fragment of shell
C. A. B.	14th N. Y. Vols.	Railroad	R.	Upper and middle	Ant. post. flap	On the field	Three hours	Piece of shell
P. R.	100th N. Y. Vols.	Cigar-maker	R.	Lower and middle third	Circular	Beaufort General Hospital	Four days	Grape-shot
A. W.	6th Conn.	Gilder	L.	Upper third	Circular	Charleston, S. C.	Twenty-fo'r hours	Two canister-shots
J. M.	76th Penn. Vols.	Carpenter	L.	Upper third	Circular	Charleston, S. C.	Forty-eight hours	Minie-ball
M. S.	100th N. Y. Vols.	Laborer	R.	Upper third	Ant. post. flap	On the field	One hour	Shell
F. K.	7th Conn.	Railroad laborer	L.	Upper third	Circular	Confederate hospital, Charleston, S. C.	Ten hours	Grape-shot
R. H. T.	4th E. I. Vols.	Boatman	L.	Upper third	Circular	McDougal Hospital	Eighty-seven days	Musket-ball
S. C. R.	2d Penn. H. Artillery	Moulder	R.	Lower and middle third	Circular	On the field	Three hours	Fragment of shell
J. H. B.	3d U. S. C. T.	Sailor	R.	Lower and middle third	Ant. post. flap	On the field	Five hours	Fragment of shell
C. B.	1st U. S. C. T.	House-servant	R.	Lower and middle third	Circular	Portsmouth U. S. Hosp'l	Sev'nty-two hours	Grape-shot
M. L.	125th N. Y. Vols.	Livery	R.	Upper third	Ant. post. flap	On the field	Three hours	Piece of shell
W. T.	20th Mich.	Farmer	R.	Upper third	Circular	On the field	Three hours	Minie-ball
G. B.	97th Penn.	Clerk	R.	Lower third	Bilateral skin flaps and circular	Knights Hospital, N. H.	Twenty-fo'r hours	Minie-ball
M. M.	6h Wis. Vols.	2d Lieutenant	R.	Middle third	Bilateral flaps	On the field	Twenty-fo'r hours	Musket-ball
M. P. S.	13th N. Y. Vols.	—	R.	Middle third	Ant. post. flaps	Newtown Hospital, Gettysburg	Sixteen days	Rifle-ball
W. T. M.	48th N. Y. Vols.	Seaman	L.	Upper and middle third	Long post. flap	On the field	Two hours	Piece of shell
H. G.	1st Maine Heavy Artillery	Farmer	L.	Upper third	Ant. post. flap	On the field	Twenty-fo'r hours	Musket-ball
J. R.	7th N. Y. Artillery	Potter	L.	Upper third	Circular	On the field	Twenty-fo'r hours	Grape-shot
R. D. P.	9th N. Y. Artillery	Farmer	L.	Middle third	Ant. post. flap	On the field	Four hours	Minie-ball
T. B.	4th N. Y. H. Artillery	—	L.	Lower and middle third	Ant. post. flaps	On the field	Forty-eight hours	Minie-ball

## OF RECOVERED AMPUTATION OF THE LEG.—(Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Comp'und fracture of upper middle third of leg . . .	Antietam, Md.	Sept. 17, 1862	7 mos.	—	—	None	None	Stump healed.
Comp'd com. fracture of lower third of leg . . .	Antietam, Md.	Sept. 6, 1862	6 mos.	6 mos.	6½ inches	¾ inch	3 inches	Ligatures removed, crest of tibia prominent.
Comp'und fracture mid. third of leg	Antietam, Md.	Sept. 17, 1862	5 mos.	1 year & 6 mos.	6 inches	3 inches	3 inches	—
Comp'und fracture of lower third of leg . . .	Antietam, Md.	Sept. 17, 1862	5 mos.	8 mos.	6 inches	None	2 inches	—
Destroying foot at tarsus . . .	Deep Bottom, Va.	July 27, 1864	6 mos.	7 mos.	9¾ inches	None	2 inches	Healed very good, model stump.
Comp'd com. fract. almost destroying low. third of leg	Winchester, Va.	Sept. 19, 1864	15 mos.	—	3½ inches	None	None	Some angles of flaps; in very good condition.
Entrance head of first metatarsal bone, exit beneath external malleolus, comp. com. fracture of tarsus metatarsus, ankle joint not injured . . .	Ft. Wagner, S. C.	July 18, 1863	4 mos.	11 mos.	9 inches	1 inch	3 inches	Stump not healed, damaged by gangrene.
Comp'd com. fracture of ankle and middle third of leg . . .	Ft. Wagner, S. C.	July 18, 1863	4 mos.	11 mos.	3 inches 2½ effect.	None	2½ inches	Tibia shortest, stump well healed, will prove efficient.
Comp'd com. fracture of leg at middle third . . .	Ft. Wagner, S. C.	July 11, 1863	3 mos.	6 mos.	—	None	None	Stump yet ulcerated, enlarged, semi-flexed, knee support, fine stump, highly creditable.
Dissevering leg at its middle third	Ft. Wagner, S. C.	July 18, 1863	3 mos.	7 mos.	4 inches	½ inch increase	1 inch	Stump not yet healed.
Comp'd com. fracture of middle third of leg . . .	Ft. Wagner, S. C.	July 11, 1863	3 mos.	6 mos.	3 inches	1 inch increase	1½ inches	Stump healed, tumefied, cicatrices on the crest by exfoliation, one finger off, arm fractured, inferior maxilla fractured.
Comp'und fracture of tibia, wound of tibial artery . . .	Petersburg, Va.	July 3, 1864	5 mos.	6 mos.	1 inch	None	None	Very good, knee flexed for knee support.
Comp'd com. fract. of ankle joint . . .	Petersburg, Va.	July 6, 1864	6 mos.	8 mos.	9½ inches	None	1 inch	Not healthy, eczematous.
Compound com. fracture of ankle joint . . .	Petersburg, Va.	June 21, 1864	7 mos.	8 mos.	9½ inches	½ inch	3 inches	Healed first rate.
Comp'und comminuted fracture of ankle joint . . .	Petersburg, Va.	June 15, 1864	8 mos.	1 year	9½ inches	None	—	Above diseased part unhealthy, exfoliations.
Comp'd com. fracture of middle of leg . . .	Petersburg, Va.	June 17, 1864	8 mos.	9 mos.	3 inches	None	None	Healed irregular, petty posterior flap.
Comp'und fracture of middle third of tibia . . .	Petersburg, Va.	June 18, 1864	8 mos.	9 mos.	3 inches	None	None	Very good, healed, knee support.
Comp'd com. fracture metatarsus, subsequent gangrene . . .	Petersburg, Va.	Jan'y 17, 1864	11 mos.	19 mos.	11½ inch.	None	1½ inches	Not entirely heal'd, some indications of exfoliation, too long.
Comp'und comminuted fracture of ankle joint . . .	Gettysburg, Pa.	July 2, 1863	10 mos.	1 year	8 inches	¾ inch	4 inches	Eight inches, ordinarily, finely form'd, healthy, finely cicatrized, efficient.
Comp'd fracture of ankle joint . . .	Gettysburg, Pa.	July 19, 1863	10 mos.	1 year	8 inches	1 inch	3 inches	Healed, cicatrized, well formed.
Nearly destroying leg at junction of lower and middle third . . .	Petersburg, Va.	July 30, 1864	8 mos.	10 mos.	6 inches	¾ inch	1½ inches	Pretty good, redundant flap, not strongly cicatrized.
Comp'd com. fracture junction of middle and lower third . . .	Petersburg, Va.	June 18, 1864	9 mos.	10 mos.	3¾ inches	None	None	Strongly cicatrized, fibula spread, prominent crest.
Comp'd com. fract. of middle of leg . . .	Petersburg, Va.	June 17, 1864	9 mos.	10 mos.	3 inches	None	None	Very good, smooth, make good knee support.
Comp'd com. fract. of middle of leg	Coal Harbor, Va.	June 8, 1864	18 mos.	—	3½ inches	None	None	Very good.
Comp'd com. fract. of lower third of leg . . .	Coal Harbor, Va.	June 1, 1864	14 mos.	14 mos.	8½ inches	¾ inch	3 inches	Very good.

TABLE OF TWO HUNDRED AND EIGHTY-SEVEN CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
L. M.	29th Ill.	—	L.	Lower third	Circular	On the field	Two hours	Minie-ball
N. J.	14th N. Y. H. Artillery	Farmer	R.	Lower third	Bilateral skin flaps and circular	On the field	Forty-eight hours	Minie-ball
E. C. L.	8th N. J.	Farmer	R.	Upper and middle third	Circular	On the field	Two hours and a half	Fuse shell
J. R.	6th Conn.	Operative	L.	Lower and middle third	Anterior flaps	On the field	Four hours	Minie-ball
J. O'B.	66th N. Y. Vols.	Shoemaker	R.	Lower and middle third	Circular	On the field	Twenty-fo'r hours	Minie-ball
G. W. G.	6th Md. Vols.	Dry-goods clerk	R.	Upper and middle third	Ant. post. flaps	On the field	Five hours	Minie-ball
J. D. P.	148th N. Y. Vols.	Farmer	R.	Lower and middle third	Circular	On the field	Four hours	Musket-ball
F. H.	8th N. Y. H. Artillery	Moulder	L.	Lower third	Bilateral skin flaps and circular	On the field	One hour	Grape-shot
G. P. C.	1st Mass. Heavy Artillery	Wool carding	R.	Upper third	Bilateral flaps	At hospital	Two m'nths	Minie-ball
J. W.	47th Penn. Vols.	Coverlid weaver	R.	Upper third	Posterior flap	Hilton Head Hospital	Three days	Canister-shot
T. D.	1st Excels'r Brigade	Farmer	L.	Upper and middle third*	Ant. post. flap	Steamer Vanderbilt, June 7 <sup>th</sup>	Seven days	Rifle-ball
W. C.	17th N. Y. Vols.	None	L.	Upper third	Ant. post. flap	—	Twenty-fo'r hours	Solid shot
H. McG.	120th N. Y. Vols.	Laborer	L.	Lower third	Circular	On the field	Thirty hours	Piece of shell
W. D.	59th N. Y. Vols.	None	L.	Upper and middle third	Posterior flap	On the field	Twenty-fo'r hours	Minie-ball
A. J. A.	None	Shoemaker	R.	Upper third	Ant. post. flaps	On the field	Three hours	Gunshot
J. D.	79th N. Y. Vols.	Brick-layer	L.	Lower third	Circular	On the field	Four hours	Minie-ball
T. C.	29th N. J.	Waterman	L.	Lower and middle third	Posterior flap	1st, on the field 2d, Fitzhugh Hospital	Two hours Eighteen days	1st, Frag- ment of shell 2d, bone ex- posed by ex- treme slo'gh- ing
E. B.	145th N. Y. Vols.	Driver	L.	Upper third	Posterior flap	In field hospi- tal, Acquia Creek	Fourteen days	Rifle-ball & extensive suppurati'n after 14 d'ys on the field
W. D.	29th N. Y. Vols.	Carver	R.	Lower and middle third	Circular	On the field	Eight days	Minie-ball
F. H.	73d N. Y. Vols.	Clerk	R.	Middle third	Posterior flap	In field hospi- tal	Twenty-fo'r hours	Minie-ball
T. S.	62d N. Y. Vols.	Hemp-dresser	L.	Middle third	Posterior flap	On the field	Nine hours	Musket-ball
J. B.	57th N. Y. Vols.	Bleacher	R.	Middle and upper third	Circular	On the field	Two hours	Minie-ball
P. P.	3d U. S. Infantry	Farmer	L.	Lower third	Circular	On the field	Eight hours	Piece of shell
H. McN.	5th Mass. Vols.	Farmer	L.	Middle third	Circular	On the field	Two hours	Solid shot
J. R. W.	2d Vt. Vols.	Carrriage-painter	L.	1st, middle third 2d, upper third	Circular	1st, on the field 2d, At Mount Pleasant Hospital	1st, Twenty- four hours 2d, Thirty- four hours	1st, shell 2d, slough- ing and pro- trusion of bone

\* Syme's made at ankle joint, sloughed.

## OF RECOVERED AMPUTATION OF THE LEG.—(Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Comp'd com. fract. of ankle joint . . . . .	Petersburg, Va.	July 30, 1864	16 mos.	—	15 inches	None	2½ inches	Not healed.
Comp'd com. fract. of ankle joint . . . . .	Petersburg, Va.	July 30, 1864	15 mos.	16 mos.	10 inches	1 inch	5 inches	Considerably atrophied, excellent.
Destruct. of leg at low. & mid. third	Petersburg, Va.	April 2, 1865	5 mos.	6 mos.	3 inches	None	None	Very good.
Comp'und comminuted fracture of leg . . . . .	Petersburg, Va.	May 10, 1864	1 year & 3 mos.	16 mos.	7 inches	¾ inch	3½ inches	Some atrophy, four inches of sequestra removed, ¾ shaft of bone cased, new bone, very good.
Comp'd com. fracture of leg and ankle joint . . . . .	Petersburg, Va.	June 22, 1864	13 mos.	15 mos.	9 inches	¼ inch	2¼ inches	Very good, posterior some retracted.
Comp'd com. fract. of middle of leg . . . . .	Petersburg, Va.	June 22, 1864	11 mos.	14 mos.	4¾ inches	½ inch	2 inches	Very good.
Comp'd com. fract. of ankle joint . . . . .	Petersburg, Va.	June 18, 1864	1 year	13 mos.	10½ inch.	1 inch	2½ inches	Some atrophy, very good.
Comp'd com. fract. of ankle joint . . . . .	Petersburg, Va.	June 16, 1864	11 mos.	1 year	11¼ inch.	1 inch	2 inches	Some atrophy, excellent.
Slight flesh wound middle of leg, gangrene.	Petersburg, Va.	June 16, 1864	10 mos.	1 year	3 inches	None	None	Very good.
Comp'd com. fract. lower third of leg . . . . .	Pocotaligo, S. C.	Oct. 22, 1862	4 mos.	6 mos.	4¾ inches 2¼ effective	None	3 inches	Exfoliation, epidemic. flap post. redundant, adhesions now broken up.
Comp'und fracture of tarso and metatarsal bones . . . . .	Fair Oaks, Va.	June 1, 1862	7 mos.	—	6 inches	½ inch	3 inches	—
Destruction of leg at ankle joint . . . . .	—	M'ch 17, 1865	6 mos.	—	3½ inches	½ inch	—	Normal, very good.
Removed the foot, ankle joint not stirred . . . . .	—	Oct. 28, 1864	11 mos.	1 year	10½ inch.	1½ inch	3½ inches	A prisoner three months in Petersburg, one month in Richmond, st'mp firm, heal'd.
Comp'und comminuted fracture of leg . . . . .	—	Aug. 15, 1864	13 mos.	14 mos.	5 inches	None	None	Bad by sloughings, gangrene, eczema.
Comp'und comminuted fracture . . . . .	—	June 22, 1864	—	15 mos.	2 inches	None	2½ inches	Knee flexed for knee support, very good.
Comp'd com. fract. of low. part of leg and ankle joint . . . . .	Blue Springs, E. Tenn.	Oct. 10, 1863	4 mos.	10 mos.	9 inches	¼ inch	1½ inches	Stump not healed, ulcerated.
Comminuted fracture lower third of leg . . . . .	Chancellorsville, Va.	May 2, 1863	11 mos.	1 year	7 inches	None	None	Stump healed, flap pendulous, exfoliations, extensive cicatrization.
Comp'und comminuted fracture of middle third of leg . . . . .	Chancellorsville, Va.	May 3, 1863	6 mos.	14 mos.	3 inches	½ inch increase	None	Stump damaged by sloughing.
Comp'd com. fracture ankle joint . . . . .	Chancellorsville, Va.	May 2, 1863	5 mos.	18 mos.	8¾ inches	½ inch	3 inches	Stump not yet healed, will result favorably.
Comp'd com. fract. of middle of leg . . . . .	Chancellorsville	May 3, 1863	8 mos.	10 mos.	6 inches	¾ inch	2¼ inches	Stump healed, efficient.
Comp'und comminuted fracture of middle of leg . . . . .	Chancellorsville, Va.	May 3, 1863	5 mos.	11 mos.	5 inches 2½ effect.	None	1½ inches	Stump ill conditioned, flap pendulous, extensive cicatrization, mainly healed.
Comp'd com. fracture of middle third of leg . . . . .	Chancellorsville, Va.	May 3, 1863	4 mos.	7 mos.	Knee support	None	None	Stump healthy, condition flexed, clean, good knee support.
Comp'und comminuted fracture of foot and lower part of leg . . . . .	Chancellorsville, Va.	May 1, 1863	4 mos.	6 mos.	10 inches	1 inch	1 inch	Stump healed and well proportioned.
Destruction of leg at lower third . . . . .	Chancellorsville, Va.	May 2, 1863	4 m s.	6 mos.	7¼ inches	None	2 inches	Stump contracted, caused by flesh wound of hip, involving the flexor muscles of leg, healed.
Nearly severing leg at its lower third . . . . .	Fredicksburg, Va.	Dec. 13, 1862	11 mos.	15 mos.	3 inches 2 effect.	½ inch increase	None	Parts nearly healed, badly damaged by abscesses and sloughings below and above knee, stump pretty vigorous.

TABLE OF TWO HUNDRED AND EIGHTY-SEVEN CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
G. A. F.	14th Conn. Vols.	Farmer	L.	Lower and middle third	Circular	On the field	Four days	Minie-ball
J. B.	36th N. Y. Vols.	Laborer	R.	Upper and middle third	Circular	On the field	Half hour	Piece of shell
G. Z.	7th N. Y. Vols.	Joiner	L.	Upper third	Circular	On the field	Five days	Musket-ball
W. W. M.	20th N. Y. Vols.	—	R.	Lower third	Circular	On the field	Three days	Minie-ball
J. H. M.	24 Vt. Vols.	Farmer	L.	Upper third	Ant. post. flap	In hospital, Frederick City	Two hours	Minie-ball
L. R.	29th N. Y. Vols.	None	R.	Middle third	Ant. post. flaps	Infirm'ry H., Wash., D. C.	Twenty-four hours	Fall
S. T.	22d N. Y. Vols.	Sawyer	L.	Upper and middle third	Posterior flap	In field hospital	Three hours	Canister-shot
J. W.	104th N. Y. Vols.	Farmer	R.	Lower third	Ant. post. flaps	On the field	Seven hours	Fragment of shell
H. C. B.	8th Conn.	Baggage-master Hartford Railroad	R.	Lower and middle third	Ant. post. flaps	Willow Springs Hospital	Six weeks	—
W. M.	8th Conn.	Operative	L.	Lower third	Circular	In the field hospital	Three weeks	Minie-ball
F. B.	59th N. Y. Vols.	Painter	R.	Upper third	Ant. post. flap	On the field	Eighteen hours	Rifle-ball
F. H. M.	9th N. Y. Vols.	Clerk	L.	Upper third	Circular	In field hospital, Falmouth, Va.	Eighteen hours	Musket-ball
R. W.	9th N. Y. Vols.	Printer	R.	Middle and lower third	Circular 2d, Bilateral flaps	Stone Hospital 2d, New York	Nine weeks 2d, sev'n teen months	Minie-ball
S. H. G.	18th Conn.	Laborer	L.	Upper third	Posterior flap	On the field	Five hours	Minie-ball
W. H. M.	31st Miss. Vols.	Farmer	L.	Lower third	Ant. post. flaps	On the field	Three hours	Minie-ball
B. B.	75th N. Y. Vols.	Farmer	L.	Middle third	Ant. post. flaps	General Hospital, New Orleans	Eighty-one days	Minie-ball
F. W.	49th Regt.	Sailor	L.	Lower and middle third	Ant. post. flaps	Lee's Mills Hospital	—	Rifle-ball
H. K. D.	114th N. Y. Vols.	Farmer	L.	Upper third	Bilateral skin flaps and circular	Campbell Hospital	Fourteen days	Minie-ball
J. M.	7th Conn. Vols.	Brick layer	L.	1st, middle third, 2d, upper third	— 2d, ant. post. flaps	U. S. Hospital	Eighteen hours	Grape-shot
H. F. D.	12th N. H.	Shoemaker	R.	Upper third	Ant. post. flap	At Jarvis Hospital, Baltimore	Ten months Twenty-seven days	Minie-ball
F. B.	20th Regt. Invalid Corps	—	R.	Lower third	Ant. post. flaps	On the field	Three hours	Minie-ball
E. K.	12th U. S. Infantry	Laborer	L.	Upper third	Circular	On the field	Twelve hours	Canister-shot
C. W.	45th N. Y. Vols.	Printer	L.	Lower and middle third	Circular	Gettysburg Hospital	Twenty-two hours	Fragment of shell
P. J. M.	1st R. I. L. Artillery	Hatter	R.	Middle third	Posterior flap	On the field	Twelve hours	Musket-ball

## OF RECOVERED AMPUTATION OF THE LEG.—(Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Comp'd com. fract. of lower third of leg . . . . .	Fred'icksburg, Va.	Dec. 13, 1862	10 mos.	14 mos.	8 inches	1 inch	2 inches	Stump smooth, well modeled, neuralgia, anterior tibial nerve morbidly sensitive.
Comp'und comminuted fracture of lower third of leg	Fred'icksburg, Va.	May 3, 1863	5 mos.	8 mos.	5½ inches	None	1 inch	Stump some damaged by exfoliation, will be efficient.
Comp'd com. fract. of middle third of leg . . . . .	Fred'icksburg, Va.	Dec. 13, 1862	10 mos.	13 mos.	2½ inches	None	3 inches	Stump all available though short, ulcers on the end.
Comp'd com. fract. of ankle joint . . . . .	Fred'icksburg, Va.	Dec. 13, 1862	—	1 year	7¼ inches	2 inches	2½ inches	Healthy.
Comp'd com. fracture of middle of leg . . . . .	Fred'icksburg, Va.	May 3, 1863	4 mos.	7 mos.	3½ inches	None	2½ inches	Stump not healed, will prove efficient.
Comp'und fracture lower third of leg	Mason's Hill	Oct. 2, 1861	—	—	9 inches	¼ inch	1½ inches	—
Comp'd com. fract. of lower third . . . . .	South Mountain	Sept. 14, 1862	7 mos.	9 mos.	4½ inches	None	1½ inches	—
Entire destruction of the foot at tibia astragalus articulation . . . . .	Antietam, Md.	Sept. 17, 1862	18 mos.	21 mos.	9 inches	1½ inches	4½ inches	Stump healed, scarcely sufficient cicatrix.
—	Antietam, Md.	Sept. 17, 1862	18 mos.	21 mos.	9 inches	1½ inches	2½ inches	Stump nearly well, circulation sluggish, cold, bluish.
Through ankle joint . . . . .	Antietam, Md.	Sept. 17, 1862	15 mos.	19 mos.	—	—	—	Stump entirely healed, but looking very blue and tender, general health good.
Comp'und comminuted fracture of middle and lower third of leg . . . . .	Fred'icksburg, Va.	May 3, 1863	3 mos.	7 mos.	3½ inches	½ inch increase	1 inch	Stump tumefied, partially flexed, rigid at an angle of 45°, cicatrization extensive.
Comp'und comminuted fracture of middle of leg . . . . .	Fred'icksburg, Va.	Dec. 13, 1862	7 mos.	1 year & 5 mos.	3½ inches	None	None	Stump ulcerated, diathesis scrofulous, abscesses, general system impaired, not diseased.
Comp'und comminuted fracture of ankle and tibia . . . . .	Fred'icksburg, Va.	Dec. 13, 1862	7 mos.	20 mos.	8¼ inches	½ inch	¾ inch	Stump good, tumefied, hard, three ulcers on end.
Comp'd com. fract. of lower third of leg . . . . .	Piedmont, Va.	June 5, 1864	9 mos.	10 mos.	2½ inches	None	None	Not good, very angular and redundant.
Comp'und comminuted fracture of tarsus anterior to medio-tarsal line . . . . .	McDonald, Ga.	Nov. 16, 1864	3 mos.	4 mos.	12 inches	None	2 inches	Well cicatrized, very good, excessively long.
Comp'und fracture of ankle joint . . . . .	Teche, La.	April 23, 1863	1 year	14 mos.	7½ inches	1 inch	3 inches	Stump healed, to come latter part of May.
Comp'd fract. middle of leg, parts above not injured . . . . .	Yorkt'wn, Va.	May 12, 1862	7 mos.	7 mos.	9 inches	2½ inches	2½ inches	—
Comp'und comminuted fracture of middle of leg . . . . .	Petersburg, Va.	June 22, 1864	7 mos.	9 mos.	3 inches	None	None	Healed, flexed, ham-strings rigid, otherwise good, wishes knee support.
Comp'd com. fract. of lower third of leg . . . . .	Petersburg, Va.	May 14, 1864	14 mos.	15 mos.	4 inches 3 available	½ inch	2½ inches	Excellent.
Comp'd com. fract. of external ankle and tarsus exclusive of calcaneum . . . . .	Gettysburg, Pa.	July 2, 1863	9 mos.	1 year	3½ inches	None	None	Stump healed, damaged by abscesses, sloughings, exfoliations.
Comp'und comminuted fracture of ankle joint . . . . .	Gettysburg, Pa.	July, 1863	8 mos.	—	11½ inch.	1½ inches	3 inches	Stump neatly formed, healed by first intention.
Comp'und comminuted fracture of middle of leg . . . . .	Gettysburg, Pa.	July 2, 1863	7 mos.	11 mos.	3½ inches	None	2½ inches	Stump healed, spread by infiltration, and long angles of cicatrization.
Comminuted fract. of lower third of leg . . . . .	Gettysburg, Pa.	July 1, 1862	7 mos.	10 mos.	8½ inches	½ inch	3 inches	Stump healed, in pretty good order, damaged by abscesses and exfoliations along line of tibia.
Comp'und fracture of lower third of leg . . . . .	Chancellorsville, Va.	May 3, 1863	13 mos.	14 mos.	6½ inches	1½ inches	3½ inches	Healed, badly composed, efficient.

TABLE OF TWO HUNDRED AND EIGHTY-SEVEN CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
C. W.	68th N. Y. Vols.	Laborer in sugar-house	R.	Upper third	Circular	On the field	Six days	Fragment of shell
J. H. P.	20th Conn.	Gunsmith	L.	Middle and upper third 2d, middle third	Posterior flap	1st, hospital, Gettysburg, Pa. 2d, Prof. Post, New York	Thirty-four days 2d, Four months	Rifle-ball 2d, sequestrum from dead bone
J. R.	66th N. Y. Vols.	Cabinet-maker	R.	Middle of leg	Circular	On the field	Forty-eight hours	Minie-ball
H. D.	82d N. Y. Vols.	Farmer	L.	Lower and middle third	Circular	On the field	Three hours	Grape-shot
D. K.	1st N. Y. Vols.	Iron-worker	R.	Lower third	Circular	On the field	Five hours	Musket-ball
J. W. C.	82d N. Y. Vols.	Moulder	R.	Lower third	Circular	On the field	One hour and a half	Minie-ball
J. C.	10th N. Y. Vols.	Laborer	L.	Lower third	Bilateral flaps	—	One hour	Musket-ball
G. H. G.	122d N. Y. Vols.	Carpenter and joiner	L.	Lower third	Circular	Hospital, D. C.	Five weeks	Fragment of shell
T. C.	42d Ill. Infantry	Farmer	L.	Middle and upper third	Circular	—	Two hours	Musket-ball
L. W.	40th Mass. Vols.	Mechanic	R.	Upper third	Circular	Field hospital	One hour	Fragment of shell
S. W. B.	36th N. Y. Vols.	Hatter	R.	Upper third	Ant. post. flaps	Portsmouth Hospital, Va.	Six weeks	Musket-ball
O. S.	9th Vt. Vols.	Farmer	L.	Upper third	Anterior flap	Field hospital	Twenty-fo'r hours	Minie-ball
A. B.	58th Penn. Vols.	Farmer	L.	Upper third	Posterior flap	On the field	Six hours	Piece of shell
B. McD.	6th N. Y. H. A.	Hotel laborer	R.	Lower third	Circular	On the field	Two hours	Minie-ball
W. H. R.	146th N. Y. Vols.	Farmer	R.	Upper third	Ant. post. flap	On the field	Twenty-fo'r hours	Minie-ball
P. O'R.	7th N. Y. H. A.	Clothes-cutter	L.	Upper third	Circular	Douglass Hospital	Six days	Rifle-ball
G. W. R.	11th Penn. Infantry	Shoe-maker	L.	Upper third	Circular	On the field	Twenty-fo'r hours	Minie-ball
R. A. B.	5th Vt. Vols.	Farmer	L.	Upper third	Posterior flap	Field	Seven days	Minie-ball
G. F. T.	10th N. Y. Vols.	Captain	L.	Middle third	Circular	On the field	Seven hours	Minie-ball
A. H.	49th N. Y. Vols.	Farmer	R.	Lower and middle third	Circular	On the field	Two hours	Fragment of shell
J. U.	U. S. Navy	Landsman	R.	Upper third	Bilateral flaps	On board Boney	Twenty-fo'r hours	Musket-ball
P. E.	15th Mass. Vols.	Spinner	L.	Upper third	Ant. post. flap	On the field	Twenty-fo'r hours	Musket-ball
L. S.	72d N. Y. Vols.	Cigar-maker	L.	Middle third	Ant. post. flap	On Knickerbocker	Twenty-five days	Musket-ball
A. W.	20th N. Y. Vols.	Jewel cases	L.	—	Ant. post. flap	On the field	Four hours	Rifle-ball
R. W.	—	Farmer	—	Middle third	—	—	—	Cannon-ball
J. G.	7th Mich.	Laborer	R.	Middle third	Ant. post. flap	Field hospital	Twenty-eight hours	—
E. P. S.	—	Printer	L.	Upper and middle third	Lateral flaps	Navy Hospital, Baltim re	—	Round musket-ball

## OF RECOVERED AMPUTATION OF THE LEG.—(Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Comminuted fract. of ankle joint and lower tibia; extensive extravasation, mortification . . . . .	Gettysburg, Pa.	July 2, 1863	7 mos.	11 mos.	None	None	None	Stump flexed at angle 35°, not entirely healed, crest angular by ulceration, cicatrization will afford knee base of support.
Comminuted fract. of ankle joint and lower part of tibia . . . . .	Gettysburg, Pa.	July 3, 1863	5 mos. 2d time	9 mos. 2d time 6 mos.	4½ inches	¾ inch	2 inches	Flap very good, healed, stump flexed. 45°.
Comminuted lower leg . . . . .	Gettysburg, Pa.	July 2, 1863	6 mos.	9 mos.	6½ inches	1 inch	¾ inch	Stump insufficiently covered from sloughing, heal'd, tender, will be effective.
Disrupture of leg at ankle joint . . . . .	Coal Harbor, Va.	June 3, 1864	3 mos.	4 mos.	8 inches	None	None	Healthy, well composed.
Compound comminuted fracture of ankle joint . . . . .	Coal Harbor, Va.	June 1, 1864	2 mos.	4 mos.	10½ inch.	¾ inch	1 inch	Beautiful stump, very best, healed by first intention.
Comp'd com. fract. of foot and ankle . . . . .	Coal Harbor, Va.	June 3, 1864	3 mos.	5 mos.	12 inches	1¼ inches	2 inches	Some atrophy, nearly healed.
Comp'und fracture of ankle joint . . . . .	Rapidan	Feb. 6, 1864	2 mos.	5 mos.	12 inches	None	¾ inch	Some atrophied, healed, well formed, etc.
Metatarsus only . . . . .	Rappahannock	Dec., 1863	—	18 mos.	15 inches inordinate	¾ inch	3 inches	Swollen, ulcerated parts inflamed, some exfoliation.
Comminuted fract. of ankle joint . . . . .	Murfreesboro', Ten.	Dec. 31, 1862	20 mos.	22 mos.	5 inches	¾ inch	2½ inches	Healed, well composed.
Comminuted fracture of lower part of leg . . . . .	Morris Island, S. C.	Aug. 19, 1863	10 mos.	13 mos.	3 inches	None	None	Some ulcerated, eczematous.
Comp'und fracture of upper middle of leg . . . . .	Fair Oaks, Va.	May 31, 1862	7 mos. & 24 days	10 mos.	2½ inches	None	None	—
Comp'und comminuted fracture of middle of leg . . . . .	Chapin's Farm, Va.	Sept. 29, 1864	10 mos.	1 year	2 inches	None	None	Very smooth, and even surfaces.
Disrupture of lower half of leg . . . . .	Chapin's Farm, Va.	Sept. 29, 1864	6 mos.	9 mos.	4½ inches	½ inch increase	½ inch	Very fair.
Comp'd com. fract. of ankle joint . . . . .	Chapin's Farm, Va.	Oct. 7, 1864	4 mos.	6 mos.	11½ inch.	1 inch	2½ inches	Much atrophied, excellent.
Comp'und comminuted fracture of middle of leg . . . . .	Wilderness, Va.	May 5, 1864	6 mos.	7 mos.	2½ inches	None	None	Healed, short, irregular.
Comp'und comminuted fracture of middle of leg . . . . .	Wilderness, Va.	May 31, 1861	13 mos.	14 mos.	3 inches	None	None	Very good, damaged some, fibula spread, knee support.
Comp'und comminuted fracture . . . . .	Wilderness, Va.	May 5, 1864	1 year	14 mos.	3½ inches	None	None	Good, not straight.
Comp'und comminuted fracture of middle of leg . . . . .	Wilderness, Va.	May 5, 1864	11 mos.	13 mos.	6 inches 3 available	None	2½ inches	Damaged by neglect.
Comp'd com. fracture of ankle, lower third . . . . .	Wilderness, Va.	May 6, 1864	10 mos.	1 year	8½ inches	¾ inch	2½ inches	Very good, damaged somewhat by sloughing.
Comp'und comminuted fracture of ankle joint . . . . .	Wilderness, Va.	May 6, 1864	8 mos.	9 mos.	7¼ inches	None	2 inches	Very good and efficient, has psoas abscess of right femoral region.
Comp'und fracture lower third both legs . . . . .	Maudm're River, Va.	May 3, 1863	1 year & 3 mos.	1 year & 10 mos.	3 inches	None	1½ inches	Left leg fractured, not healed, right healed, sloughed, partial use, wounded leg not flexible at knee more than 45 degrees.
Comp'und fract. of the middle of leg . . . . .	Antietam, Md.	Sept. 17, 1862	4 mos.	7 mos.	3 inches	¾ inch increase	None	—
Comp'und fracture of ankle joint . . . . .	Malvern Hill, Va.	July 1, 1862	7 mos.	8 mos.	7 inches	1 inch	3 inches	—
Entering under internal malleoli, exit at low middle of leg . . . . .	Antietam, Md.	Sept. 17, 1862	9 mos.	1 year	7½ inches	¾ inch	4½ inches	Good s'm'p, sound, some cicatrices by abscesses, exfoliations.
Comminuted fract. through knee . . . . .	So. Mountain, Va.	Sept. 14, 1862	9 mos.	1 year	6½ inches	¾ inch	1½ inches	—
Comp'd fracture of lower third of leg . . . . .	Antietam, Md.	Sept. 17, 1862	7 mos.	10 mos.	7 inches	¾ inch	2½ inches	Not healed.
Fracture of ankle joint . . . . .	Gaines's Mills, Va.	July 28, 1862	4 mos.	4 mos.	7¼ inches	¾ inch	3½ inches	Artificial leg applied, semitendinous and semimembranosus biceps contracted, improving.

TABLE OF TWO HUNDRED AND EIGHTY-SEVEN CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
J. G.	18th N. Y. Vols.	Butcher	R.	Upper third	Ant. post. flap	N. Y. City Hospital	—	Railroad cars
T. E.	105th N. Y. Vols.	Laborer	L.	Lower and middle third	Ant. post. flap	On the field	Twenty-fo'r hours	Minie-ball
J. I.	1st Penn. Artillery	Laborer	R.	Upper and middle third	Circular	In field hospital	One hour and a half	Piece of shell
C. L.	8th Penn.	Carpenter	R.	Lower and middle third	Ant. post. flap	In Patent Office Hospital	Eight days	Minie-ball
W. F. B.	24th N. Y. Vols.	Ship-carpenter	L.	Lower third	Circular	On the field	Two hours and a half	Shell
L. W. V.	6th Maine	Farmer	L.	Lower third	Ant. post. flap	On the field	Forty-eight hours	Minie-ball
A. L.	2d R. I. Vols.	Blacksmith	R.	Lower and middle third	Ant. post. flap	Camden Hospital, D. C.	Seventeen days	Rifle-ball
A. L.	9th N. Y. S. Militia	Ship-joiner	L.	Lower and middle third	Ant. post. flap	Lincoln Hospital, D. C.	Fourteen days	Rifle-ball
H. C. B.	9th Maine	Farmer	L.	Upper third	Circular	Charleston Hospital, S. C.	Three days	Grape-shot
T. L.	48th N. Y. Vols.	Laborer	R.	Middle and upper third	Circular	General Hospital, Fort Royal, S. C.	Eighteen hours	Grape-shot
L. A. F.	54th Mass.	Hack-driver	L.	Lower third	Ant. post. flap	Hospital at Beaufort, S. C.	Three days	Musket-ball
E. F. B.	76th Penn. Vols.	Tinsmith	L.	Lower third	Circular	In Charleston Hospital	Twenty hours	Musket-ball
W. N.	6th Kansas Vols.	Farmer	L.	Upper and middle third	Ant. post. flap	Camp Taylor	Three days	Minie-ball
R. B.	1st N. Y. M. R.	None	R.	Upper and middle third	Bilateral flaps	U. S. Hospital, Troy	Five months	Burn
E. R.	U. S. gun-boat	Landsman	L.	Lower third	Bilateral flaps	U. S. Hospital, Pensacola	Four days	Explosion of torpedo
W. H. S.	9th Penn. Cavalry	Saddler	L.	Upper third	Posterior flap	Field	Ten hours	Minie-ball
L. H. G.	6th Vt. Vols.	Cabinet-maker	L.	Upper third	Circular	On the field	Six days	Minie-ball
S. J.	4th Vt.	Farmer	R.	Lower and middle third	Circular	Harwood Hospital	Thirty days	Minie-ball
J. R. G.	7th R. I. Vols.	Farmer	R.	Lower and middle third	Ant. post. flap	On the field	Six hours	Rifle-ball
J. L. B.	101st N. Y. Vols.	Farmer	R.	Upper and middle third	Posterior flap	On the field	Four days	Musket-ball
J. P.	20th N. Y. Militia	Farmer	R.	Upper third	Circular	Cliffburne Hospital, D. C.	Twelve days	Minie-ball
T. G.	5th N. Y. Vols.	Machinist	L.	Upper and middle third	Circular	On the field	Four hours	Fragment of shell
J. H.	41st N. Y. Vols.	Clerk	L.	Upper third	Circular	Hospital, Georgetown	Fourteen days	Rifle-ball
P. C.	69th N. Y. Vols.	Farmer	R.	Upper third	Ant. post. flap	On the field	Six hours	Shell
C. F. W.	69th N. Y. Vols.	Porter	L.	Lower and middle third	Circular	On the field	Two days	Minie-ball

## OF RECOVERED AMPUTATION OF THE LEG. — (Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Comp'und comminuted fracture . . . . .	Gaines's Mills, Va.	June 27, 1862	—	—	3½ inches	None	None	Extravasation, etc.
Comp'd com. fract. of lower third of leg . . . . .	Frederksburg, Va.	Dec. 13, 1862	4 mos.	6 mos.	10 inches	½ inch	3 inches	—
Severing the tibia and fibula and entire front part of the leg at its lower third . . . . .	Frederksburg, Va.	Dec. 13, 1862	4 mos.	6 mos.	5 inches	None	1¼ inches	Soleus and gastrocnemius muscles entire.
Comp'd com. fract. of ankle joint and low. third of tibia . . . . .	Frederksburg, Va.	Dec. 13, 1862	4 mos.	10 mos.	8½ inches	None	3½ inches	—
Destruction of foot at ankle joint, etc. . . . .	Frederksburg, Va.	Dec. 13, 1862	8 mos.	1 year & 11 mos.	10½ inch.	½ inch	4½ inches	Good proportions, healed.
Comp'd com. fract. of lower third of leg . . . . .	Frederksburg, Va.	May 3, 1862	3 mos.	5 mos.	8½ inches	None	2½ inches	Stump in pretty good condition.
Compound fracture of ankle joint and tarsus . . . . .	Frederksburg, Va.	May 3, 1862	3 mos.	1 year & 2 mos.	10½ inch.	1 inch increase ¾ inch	4½ inches	Stump unsound, some ulceration and exfoliation, secondary.
Comp'd com. fract. of ankle joint . . . . .	Frederksburg, Va.	Dec. 13, 1862	8 mos.	1 year & 7 mos.	9½ inches	None	4½ inches	Some necrosis, small ulcers and thickening of perosteum, improving.
Comminuted fracture of lower half of leg . . . . .	Ft. Wagner, S. C.	July 18, 1863	6 mos.	18 mos.	—	None	None	Stump flexed on thigh, badly ulcerated, will require knee support.
Comminuted fracture of middle of leg . . . . .	Ft. Wagner, S. C.	July 18, 1863	5 mos.	7 mos.	Knee support	—	—	Stump not healed, flexed at nearly right angles, partial ankylosis, very tender near crest.
Comp'd com. fract. of tarsus and calcaneus, ankle joint not injured . . . . .	Ft. Wagner, S. C.	July 18, 1863	7 mos.	10 mos.	11½ inch.	½ inch	3 inches	Stump mainly healed, well formed.
Compound fracture of tarsus . . . . .	Ft. Wagner, S. C.	July 11, 1863	7 mos.	1 year	8½ inches	1 inch	3 inches	Stump healed.
Comp'd com. fract. of lower third of leg . . . . .	Ft. Smith, Arkansas	Aug. 23, 1864	1 year	1 year	4 inches	¾ inch	3 inches	Slight atrophy, very good.
Foot while feet insensible and in an almost moribund state by fever, gangrene ensuing . . . . .	Hospital Point, Rocks	Dec. 1864	9 mos.	9 mos.	5½ inches	½ inch increase	3½ inches	Very good, not quite healed.
Destruction of foot at ankle joint . . . . .	Mobile, Ala.	April 1, 1865	3 mos.	5 mos.	11¼ inch.	1 inch increase	1 inch	Much infiltrated, not healthy, much enlarged.
Comp'd com. fracture of upper middle of leg . . . . .	Averysboro, N. C.	March 16, 1865	4 mos.	—	2½ inches	None	1½ inches	Bad posterior flap, pendulous, damaged by exfoliation.
Comp'd com. fracture middle third of leg . . . . .	Frederksburg, Va.	May 3, 1863	7 mos.	9 mos.	4 inches	1 inch	2 inches	A prisoner 9 days, stump healed and vigorous.
Comp'und comminuted fracture of ankle joint . . . . .	Frederksburg, Va.	Dec. 1, 1862	11 mos.	14 mos.	9½ inches	1 inch	5 inches	Stump not entirely healed, prognosis favorable.
Compound comminuted fracture of ankle joint . . . . .	Frederksburg, Va.	Dec. 17, 1862	1 year	15 mos.	10½ inch.	None	2 inches	Model stump, general health good.
Comp'd fracture of leg, lower middle . . . . .	Bull Run, Va.	Sept. 1, 1862	11 mos.	1 year & 3 mos.	6 inches	¾ inch	4 inches	Stump flexed, not perfectly healed.
Comp'und fracture lower middle of leg . . . . .	Bull Run, Va.	Aug. 31, 1862	19 mos.	21 mos.	—	None	None	Stump healed, flexed right angle, tendons rigid; good, clean knee support.
Comp'd com. fracture of the entire lower half of the leg . . . . .	2d Bull Run, Va.	Aug. 29, 1862	16 mos.	18 mos.	4½ inches	1 inch	4 inches	Stump healthy.
Comp'und fract. of lower third of leg . . . . .	Bull Run, Va.	Aug. 30, 1862	8 mos.	10 mos.	2½ inches	None	None	Stump ulcerated, not ready.
Comp'und comminuted fracture lower and middle of thigh . . . . .	Antietam, Md.	Sept. 17, 1862	11 mos.	14 mos.	5 inches	2½ inches	3½ inches	Stump well, cicatrices healthy.
Comp'und fracture knee joint and patella . . . . .	Antietam, Md.	Sept. 17, 1862	11 mos.	22 mos.	10 inches	¼ inch	3½ inches	Necrosis of end of bone to be removed, stump sound and smooth.

TABLE OF TWO HUNDRED AND EIGHTY-SEVEN CASES

NAME.	Regiment.	Occupation.	Limb.	Point of Operation.	Method.	Where performed.	Length of Time after Injury.	Cause.
M. M.	9th N. Y. Vols.	Printer	L.	Lower third 1st amputation	Lateral flaps Syme's mode	—	1st. 24 hours 2d. seven months	Solid shot sloughing & want of care
M. H.	63d N. Y. Vols.	Laborer	L.	Lower and middle third	Posterior flap	On the field	Six days	Minie-ball
M. L.	Battery E, N. Y. A.	Clerk	R.	Lower and middle third	Circular	On the field	Six hours	Piece of shell
W. W.	8th Maine Vols.	Farmer	R.	Lower third	Lateral flaps	In field hospital	Twenty-fo'r hours	Piece of shell
J. B. G.	114th N. Y. Vols.	Captain	L.	Middle and upper third	Circular	On the field	Twenty-fo'r hours	Minie-ball
P. H.	46th N. Y. Vols.	Boiler-maker	L.	Upper third	Posterior flap	—	Twelve hours	Minie-ball
J. P. C.	115th N. Y. Vols.	Mason	L.	Middle third	Posterior flap	On the field	Two hours	Fragment of shell
J. M.	52d Penn.	Farmer	L.	Upper and middle third	Ant. post. flap	Stone Hospital, Washington, D. C.	Eight days	Rifle-ball
J. G. S.	7th N. H.	Farmer	R.	Lower third	Circular	In hospital	Three hours	Fragment of shell
W. H. R.	4th N. H.	Shoemaker	L.	Lower third	Ant. post. flap	In field hospital	One hour	Explosion of torpedo
H. S.	8th N. Y. Cavalry	None	L.	Lower third	Ant. post. flap	In Lincoln Hosp., D. C.	Five weeks	Carbine-ball

## OF RECOVERED AMPUTATION OF THE LEG.—(Continued.)

Description of Injury.	Battle.	Date.	Length of time from Amputation to Examination.	Length of time from Amputation to Application.	Length of Stump.	Atrophy.		REMARKS, Generally made at Time of Application of Artificial Limb.
						Proximal Portion.	Distal Portion.	
Shattering the phalanges and metatarsal bones of foot . . . . .	Antietam, Md.	Sept. 17, 1862	9 mos. 2d, 3 mos.	1 year 2d, 5 mos.	12½ inch.	1 inch	3 inches	Stump nearly healed.
Comp'd com. fract. of ankle joint . . . . .	Antietam, Md.	Sept. 17, 1862	9 mos.	—	7½ inches	3½ inches	3½ inches	Stump well cicatrized, neuralgia.
Injury of foot through tarsus . . . . .	James River	Oct. 22, 1864	7 mos.	8 mos.	8½ inches	None	3 inches	Not entirely heal'd, four inches of necrosed fibula removed, March 12, 1865, June 14, healed.
Comp'd com. fracture of the tarsus and end of tibia . . . . .	Jacksonville, Fla.	March 26, 1863	5 mos.	7 mos.	10¼ inch	1 inch	3 inches	Some necrosis, ulcers will recover soon, stump well healed, model shape, excess of length.
Comp'und commi. fract. lower third of leg . . . . .	—	Sept. 10, 1864	5 mos.	7 mos.	5¼ inches	¼ inch	2½ inches	Some atrophied, very good.
Comp'd com. fracture of low. third of leg . . . . .	—	Aug. 1, 1864	5 mos.	7 mos.	4 inches	None	3½ inches	Good stump, flexed.
Comp'd com. fract. of foot and ankle . . . . .	—	July 30, 1864	6 mos.	9 mos.	7½ inches	None	¼ inch	Very good.
Comp'und comminuted fracture of lower third of leg . . . . .	Williamsburg, Va.	May 8, 1862	22 mos.	2 years & 1 month	5½ inches	¼ inch	2 inches	Stump healed, cicatrices extensive, owing to ulceration, fibula longest.
Destruction of leg at lower third . . . . .	On picket duty	Oct. 1, 1863	4 mos.	6 mos.	5 inches	1 inch	3 inches	Stump healed, posterior part pendulous.
Comp'd com. fracture of tibia, astragalus, articulation . . . . .	On picket duty	Sept. 8, 1863	5 mos.	8 mos.	10 inches	1½ inches	4 inches	Stump healed, vigorous.
Comp'und fracture of tarsus . . . . .	Beverly Ford, Va.	June 9, 1863	8 mos.	11 mos.	8½ inches	1 inch	3 inches	St'mp healed, good.

## I.

## LIMB AMPUTATED.

Comparative frequency of amputation of right and left leg.

THE following table gives the frequency of amputation of the limb, whether right or left, in an aggregate of 445 cases of thigh and leg amputations:—

Limb.	Right.	Left.	Total.
Thigh . . . . .	92	66	158
Leg . . . . .	134	153	287
Totals . . . . .	226	219	445

From this table it would appear that there is a difference in the liability of the two lower extremities to those accidents or injuries which necessitate amputation of the thigh or leg in military practice. In a gross number, comprising both thigh and leg amputations, this difference, though not very great, is in favor of the right limb. When, however, we separate the thigh from the leg amputations, we find this discrepancy becomes very marked in regard to both classes of cases. In the thigh amputations the right limb required removal in more than half of the total number of cases; while in the leg the left limb amputations considerably exceed the right.

Nor is this peculiarity in the relation of thigh and leg amputations to the right and left side accidental; for, on referring to other collections of cases, the same difference is traceable. For example, in an aggregate of 484 amputations in the thigh and leg, collated by Chenu<sup>1</sup> from the records of French surgery in the Crimea, the following comparative results are deducible:—

Limb.	Right.	Left.	Total.
Thigh . . . . .	73	61	134
Leg . . . . .	169	181	350
Totals . . . . .	242	242	484

In this table we have results strikingly similar to those which were obtained from the records of American military surgery. Of

<sup>1</sup> *Rapport au Conseil de Santé des Armées.*

the aggregate amputations in the lower extremity, the operation falls about equally on both limbs. But this result is found not to be due to an equality of amputations throughout the entire limbs, but to the fact that an excess of right thigh amputations is counterbalanced by an excess of left leg amputations in a given number of all amputations impartially collated. This result is not vitiated by the statement that the total number of leg amputations greatly exceeds that of the thigh amputations, for the same ratio holds true whether we diminish or increase the number of each.

II.

FREQUENCY OF AMPUTATION IN THE SEVERAL REGIONS OF THE THIGH AND LEG IN 439 RECOVERED CASES.

The comparative frequency of amputation in the various regions of the thigh and leg in a given number of recovered cases, is illustrated by the following table : —

Comparative frequency of amputation in various regions of thigh and leg.

Region.	Thigh.	Leg.
Upper third . . . . .	15	103
Middle third . . . . .	66	75
Lower third . . . . .	74	106
Totals . . . . .	155	284

In regard to thigh amputations, we should infer from this table either that a much less number of amputations are performed in the upper than in the middle third, and in the middle than in the lower third, or that the same number being performed in each division, the proportion of recoveries are largely increased as we pass from above downwards. Both of these inferences are true, as will appear from the following statistical table : —

Region.	British Army, in Crimea.		Confederate Army.		Sherman's Campaign. (Andrews.)	
	Rec'd.	Died.	Rec'd.	Died.	Rec'd.	Died.
Upper third . . . . .	5	34	50	61	5	15
Middle third . . . . .	26	39	87	87	13	16
Lower third . . . . .	26	34	143	126	61	36
Totals . . . . .	57	107	280	274	79	67
Grand totals . . . . .	164		554		146	

This table sustains the inferences drawn from the preceding table, that while amputations in the upper third of the thigh are much less frequent than in either of the other divisions of the thigh, they are also largely more fatal. In the British army in the Crimea, the amputations in the upper third of the thigh were but 23.8 per cent. of the total thigh amputations, while the fatal cases of amputation in this region equal nearly one third of the total mortality of thigh amputations. In the Confederate service, the amputations in the upper third of the thigh were 20 per cent. of the total thigh amputations, and the mortality was 22.2 per cent. of the total mortality. In Sherman's campaign,<sup>1</sup> the amputations in the upper third were but 13.7 per cent of the thigh amputations, but the mortality was in nearly the same ratio to the total mortality as in the British and Confederate service, being 22.2 per cent.

Passing from the upper to the middle third, we find these statistics establish the fact that there is not only a larger gross number of amputations than in the upper third, but that there is a diminished rate of mortality. The fatal cases in the middle third do not greatly exceed the cases of recovery, being 46 per cent., while in the upper third the fatal cases are very largely in excess.

In regard to amputations in the lower third, these tables show that the number in general equals the total number in both of the other regions, with a still further reduction of the proportionate mortality, the successful considerably exceeding the fatal cases, except in the records of the British army.

Applying these facts to the first table, which consists of only recovered cases, and we may safely conclude that the 15 cases of recovery after amputation in the upper third represent a much larger number of fatal cases, and that the 66 amputations in the middle third represent about an equal number of fatal cases, while the 74 amputations in the lower third represent a less number of fatal cases, in the same regions respectively.

In regard to amputation of the leg, the above table gives the largest proportion of recoveries in the lower third, and the least in the middle third; the upper and lower third being nearly equal in numbers, while the middle third furnishes but a little more than one fourth the total number of cases. It is stated in the Surgeon-General's Report,<sup>2</sup> that the majority of cases of amputation of the

<sup>1</sup> *Statistics of Sherman's Campaigns*, by E. Andrews, M. D., p. 64.

<sup>2</sup> Circular No. 6.

leg was in the upper and middle third. In that case this collection shows a partial selection, and most favorable to amputation in the lower third. If, however, we compare it with the following other group of cases in which both the fatal and successful cases are recorded, we shall find a confirmation of the above conclusions:—

FRENCH ARMY.<sup>1</sup>

Region.	Recovered.	Died.
Upper third . . . . .	259	84
Middle third . . . . .	14	3
Lower third . . . . .	21	26

## III.

## NATURE OF MISSILES.

The following table comprises the various missiles with which the wounds were inflicted in 429 cases of amputation of the lower extremity:—

Missile.	Thigh.	Leg.
Minie-ball . . . . .	58	84
Musket-ball . . . . .	22	52
Rifle-ball . . . . .	18	29
Shell . . . . .	26	56
Grape-shot . . . . .	10	20
Canister-shot . . . . .	3	9
Solid shot . . . . .	7	—
Gunshot . . . . .	6	5
Torpedo . . . . .	1	4
Pistol-shot . . . . .	1	—
Cut with an axe . . . . .	1	1
Fall of a tree . . . . .	1	1
Injury by overturning of caisson . . . . .	1	—
Cannon-ball . . . . .	—	3
Railroad injury . . . . .	—	5
Injured in a turret . . . . .	—	1
Explosive ball . . . . .	—	1
Burn . . . . .	—	1
Fall . . . . .	—	1
Rusty nail thrust into foot . . . . .	—	1
Totals . . . . .	155	274
Grand total . . . . .	429	

Nearly two thirds of the injuries which required amputation of the lower extremities, in a total of 429 recovered cases, were

<sup>1</sup> Legouest.

inflicted by the missiles of the infantry, namely, the minie, musket, and rifle balls. Of these, the minie-ball was used much more frequently than both the musket and rifle balls, or was much more destructive, the proportion being, minie-balls 142, musket and rifle balls 121. The difference between the recovered cases of amputation after injuries inflicted upon the thigh and leg by these various missiles is considerable. In the thigh the amputations for injuries inflicted by the minie-ball are 58, and by the musket and rifle balls 40; while in the leg the minie-ball injuries are 84, and by the musket and rifle balls 81.

Recovery from amputations after injuries inflicted by shell are more frequent in the leg than in the thigh, in the following proportion: recovered thigh amputations about one sixth, and recovered leg amputations more than one fifth, of the total number of thigh amputations. It is noticeable that the solid shot gives a number of recovered amputations of the thigh and none of the leg, while the torpedo furnishes more recovered cases of leg amputation than of the thigh.

We may compare the nature of the missiles with which severe wounds of the lower extremities were inflicted, as appears in the above table and in the records of the Crimean War:—

NATURE OF THE MISSILES WITH WHICH THE WOUNDS WERE INFLICTED IN 466 RECOVERED AMPUTATIONS OF THE LOWER EXTREMITY, IN THE FRENCH ARMY IN THE CRIMEA.

Limb.	Ball.	Boulet.	Éclats de Projectiles Biscaïen.
Thigh . . . . .	26	18	86
Leg . . . . .	109	35	192
Totals . . . . .	135	53	278

Missiles which inflicted wounds requiring amputation of thigh and leg in French army in Crimea.

It is apparent from this table that in the Crimean campaign, which partook of the nature of a siege, the most destructive wounds were inflicted by artillery.

Both tables show a preponderance of recovered leg amputations in about the same proportion.

IV.

NATURE AND LOCATION OF THE INJURIES BY VARIOUS MISSILES IN 423 RECOVERED CASES OF AMPUTATION OF THE LOWER EXTREMITY.

	THIGH.						LEG.					
	Fractures.			Wounds.			Fractures.			Wounds.		
	Thigh.	Knee.	Leg.	Thigh.	Knee.	Leg.	Leg.	Ankle.	Foot.	Leg.	Ankle.	Foot.
Minie-ball . . . . .	24	23	5	-	2	-	49	25	9	2	-	-
Musket-ball . . . . .	9	7	1	1	2	1	25	17	7	1	1	-
Rifle-ball . . . . .	7	7	-	-	2	1	18	7	3	1	-	-
Shell . . . . .	1	14	6	1	-	4	34	15	7	-	-	-
Grape-shot . . . . .	3	6	2	-	-	-	11	7	2	-	-	-
Canister-shot . . . . .	2	1	-	-	-	-	8	1	-	-	-	-
Solid-shot . . . . .	1	3	1	-	-	-	6	1	3	-	-	-
Gunshot . . . . .	-	3	1	-	-	-	4	1	-	-	-	-
Torpedo . . . . .	-	-	-	-	-	-	2	2	-	-	-	-
Railroad injury . . . . .	-	1	-	-	-	-	3	1	-	-	-	-
Cannon-ball . . . . .	-	-	-	-	-	-	2	-	1	-	-	-
Cut by axe . . . . .	-	-	-	-	-	-	-	-	-	1	-	-
Fall of tree . . . . .	-	-	-	-	-	-	-	1	-	-	-	-
Injured in turret . . . . .	-	-	-	-	-	-	-	-	1	-	-	-
Explosive ball . . . . .	-	-	-	-	-	-	1	-	-	-	-	-
Burn . . . . .	-	-	-	-	-	-	-	-	-	-	-	1
Fall . . . . .	-	-	-	-	-	-	1	-	-	-	-	-
Nail, wound by . . . . .	-	-	-	-	-	-	-	-	-	1	-	-
<b>Totals . . . . .</b>	<b>47</b>	<b>65</b>	<b>16</b>	<b>2</b>	<b>6</b>	<b>6</b>	<b>164</b>	<b>78</b>	<b>33</b>	<b>6</b>	<b>1</b>	<b>1</b>

Thigh amputation for fractures . . . . .	128	Thigh amputation for wounds . . . . .	14
Leg amputation for fractures . . . . .	275	Leg amputation for wounds . . . . .	8
<b>Total . . . . .</b>	<b>403</b>	<b>Total . . . . .</b>	<b>22</b>

From the preceding table it appears that amputations for fractures are more frequent, in a given number of recovered cases, than for wounds, in the proportion of 18 to 1. And this difference is found, on inquiry, to be far the greatest in the leg. In the thigh the amputations for fractures are to amputations for wounds in the ratio of about 8 to 1, while in the leg amputations the ratio of fractures to wounds is as 34 to 1.

The location of fractures is found in the amputations of the thigh, in largest number involving the knee, and in amputations of the leg, involving the bones of the leg. The

Proportion of amputations for wounds and fractures.

Location of fractures.

largest number of fractures into the knee were produced by the minie-ball, and the next largest by shell. The fractures of the leg necessitating amputation were produced in largest numbers by the minie-ball, and next in frequency is the shell. Injury to the ankle joint was not as frequently the cause of amputation of the leg, in proportion to the total amputations of the leg, as injury to the knee the cause of thigh amputations in proportion to the entire number of amputations in that part. Fractures of the leg were followed by comparatively few amputations of the thigh, being in the ratio of eight amputations for fractures in the knee and thigh to one of the leg. Nearly the same ratio obtains between amputations of the leg for fractures involving the foot, and amputations for fractures of the ankle and leg.

The following table, compiled from Chenu,<sup>1</sup> affords a comparison between the above collection and the French statistics of the army in the Crimea, as to the frequency of amputation of the thigh and leg for fractures in certain regions in recovered cases:—

Region.	AMPUTATION OF	
	Thigh.	Leg.
Fracture of femur . . . . .	48	—
Destruction of thigh or leg . . . . .	13	—
Fracture of knee . . . . .	24	—
Fracture of leg . . . . .	43	196
Fracture of foot . . . . .	1	57
Destruction of leg . . . . .	—	29
Totals . . . . .	129	282

This table presents a striking contrast with the preceding, so far as relates to thigh amputations. In the former, compound fracture of the knee was the form of injury necessitating amputation in nearly half the recovered cases, while in the latter this injury occurred in but about one fifth of the total cases. We are not able to determine to what this discrepancy is to be attributed, as we are not able to give the mortality in the Federal army; but it is probable that there was a much greater mortality among the French, as the percentage of fatal cases in amputations for this injury was thirty-seven.

<sup>1</sup> *Rapport au Conseil de Santé des Armées.*

## V.

## DISTRIBUTION OF INJURIES REQUIRING AMPUTATION OF THE LOWER EXTREMITY IN RECOVERED CASES.

*(a) One hundred and forty-one Amputations of Thigh.*

Compound fracture of femur . . . . .	10
Compound fracture of middle third . . . . .	7
Compound fracture of lower third . . . . .	27
Simple fracture of femur . . . . .	1
Compound fracture of knee . . . . .	59
Compound fracture of knee and upper third of leg . . . . .	12
Destruction of leg . . . . .	6
Compound fracture of leg — upper third . . . . .	3
Compound fracture of leg — middle third . . . . .	5
Compound fracture of leg — lower third . . . . .	9
Destruction of ankle . . . . .	2
Fracture . . . . .	1
Wound of thigh . . . . .	2
Wound of knee . . . . .	5
Wound of leg . . . . .	1
Wound of popliteal artery . . . . .	1
Gangrene of toe . . . . .	1
	<hr/>
Total . . . . .	141

*(b) Two hundred and eighty-seven Amputations of Leg.*

Comminuted fracture of the upper third . . . . .	3
Comminuted fracture of the middle third . . . . .	67
Comminuted fracture of the lower third . . . . .	75
Comminuted fracture of the ankle joint . . . . .	57
Fracture involving the ankle joint . . . . .	2
Destruction of leg . . . . .	20
Destruction of ankle joint . . . . .	14
Destruction of foot . . . . .	8
Destruction of calcaneum . . . . .	1
Compound fracture of calcaneum . . . . .	1
Wound of posterior tibial artery . . . . .	11
Wound of soft parts of leg . . . . .	11
Gangrene following a burn . . . . .	1
Injury of tibia without fracture . . . . .	1
Injury of knee and patella . . . . .	1
Injury of knee (?) . . . . .	11
	<hr/>
Total . . . . .	287

*Injuries requiring Amputation of the Thigh.* — Of the injuries of the thigh requiring amputation, in a given number of recovered cases, compound fracture of the lower third is by far the most frequent; comprising nearly two thirds of all the cases. We have already alluded to the proof that a less number of amputations are performed in the middle and upper third of the thigh, and that they are more fatal in these regions. This fact will account in part for the great discrepancy which this table shows between the total recovered amputations in these different regions.

The injury which necessitates the largest number of amputations of the thigh is seen to be compound fracture of the knee. The total number of these injuries, including those which involve also the upper third of the leg, comprises about one half of all the causes of amputation of the thigh. This subject is deserving of a more critical examination.

At the period of making his Report,<sup>1</sup> the Surgeon-General states that 1,183 cases of gunshot wounds of the knee joint, with or without fracture of the patella, or of the epiphyses of the femur or tibia, had been recorded. Of these, 770 had terminated, and the results were known. The following statement of the treatment and its results, so far as ascertained, is given in the 1,183 cases of knee-joint injury reported: —

Treatment.	No. of Cases.	Recovered.	Died.	Undetermined.
Amputation . . . . .	718	121	331	266
Excision . . . . .	11	1	9	1
Conservative measures	454	50	258	146
Totals . . . . .	1,183	172	598	413

It would appear from these facts that in a little less than two thirds of the wounds of the knee joint amputation was resorted to, and a mortality of 73.23 per cent. occurred in the determined cases. In the 11 cases submitted to exsection the mortality was 90 per cent. In a little more than one third of the total cases, conservative measures were adopted, with a mortality in the terminated cases of 83.76 per cent.

We may safely conclude that in this collection of cases amputation was resorted to in the severest form of injuries, as when the joint was freely opened, with or without fractures of the extremities of bones entering into the joint; while conservative measures were adopted in slighter forms of injury, and when there was

<sup>1</sup> Circular No. 6.

doubt whether the cavity of the joint was involved. And this opinion is confirmed by the Surgeon-General, who states that, "with six or eight exceptions, the fifty recoveries without amputation, classified with gunshot wounds of the knee joint, were examples of fracture of the patella, in which the evidence that the joint was opened was not unequivocal."

It is evident, therefore, that amputation was the acknowledged method of treatment in severe gunshot injuries of the knee joint, during the war. And the comparative results of this treatment justify the rule now so firmly established in military surgery. The mortality was ten per cent. less than when conservative measures were employed, and nearly twenty per cent. more favorable than excision. If we take into consideration the remark of the Surgeon-General that all the successful cases treated conservatively, except six or eight, were so slight as to be of a doubtful character, the comparative results of amputation in grave injuries of the knee joint are far more favorable.

Professor Chisholm, of the Medical College of South Carolina, a surgeon to the insurgent forces, gives statistics<sup>1</sup> of the conservative treatment of gunshot wounds of the knee joint which are altogether more favorable than those compiled by the Surgeon-General. Of 103 cases treated, 50 recovered, and 53 died; the mortality per cent. being but 52.

In answer to the objection that many of these cases must have been of a trivial character, and could not have implicated the cavity of the articulation, he refers to the duration of treatment in the successful cases, which gives an average of 166 days, in proof of the severity of the wounds. The shortest period of treatment was 96 days. He concludes, therefore, that they were cases of the perforation of the joint by balls without the crushing of bones being detected.

This comparison does not invalidate the general conclusion that amputation of the thigh should be the rule of practice in severe gunshot injuries of the knee.

The following tables are instructive, as they illustrate the condition of stump in an amputation at different points of the thigh after gunshot wounds of the knee joint.

<sup>1</sup> *Medical Times and Gazette.* London, December 29, 1866.

## THIRTY-THREE CASES OF RECOVERED AMPUTATIONS OF THE THIGH IN THE LOWER THIRD, FOR GUNSHOT INJURIES OF THE KNEE JOINT.

MISSILE.	No.	Method.	No.	RESULT.		
				Good.	Imperfect.	Unknown.
Minie, rifle, and musket ball . . .	25	{ Flap	19	16	1	2
		{ Circular	6	6	-	-
Cannon-ball, shell, grape, torpedo	8	{ Flap	7	5	1	1
		{ Circular	1	1	-	-

In these 33 cases it will be observed that amputation was successfully performed in the lower third of the thigh in 8 cases of wound of the knee joint by shells, by cannon-ball, by grape-shot, and by torpedo. These were doubtless very grave forms of injury, and attended with more or less destruction of the soft parts. In some instances it is noticed that the limb was nearly severed at the knee. The fact that they still admitted of successful amputation at a point so near the seat of injury is instructive, as it proves that in the severest gunshot wounds of the knee we may still select the most favorable point in the thigh for amputation with a fair prospect of success.

Another fact is noticed, namely, that in all of these cases of amputation for wounds of the knee by shell and solid shot but one, the flap method was preferred. This is the more remarkable as the circular method is generally considered especially adapted to the lower third of the thigh, and to wounds attended with great destruction of the soft parts.

Of these 33 cases, 26 were performed by the flap, and 7 by the circular methods. The results of these cases are more favorable to the circular method, all of which gave good stumps.

## TWENTY-NINE CASES OF RECOVERED AMPUTATIONS AT THE JUNCTION OF THE MIDDLE AND LOWER THIRD OF THIGH.

MISSILE.	No.	Method.	No.	RESULT.			
				Good.	Imperfect.	Very poor.	Unknown.
Musket, minie, and rifle ball	20	{ Flap	9	5	2	1	1
		{ Circular	11	5	6	-	-
Shell, solid, and grape shot	9	{ Flap	8	4	3	1	-
		{ Circular	1	1	-	-	-

In this table we have a larger proportion of cases of wounds

by shells, solid, and grape shot. The ratio of these missiles to the musket, rifle, and minie balls is nearly that of one third. From this it appears that as a rule surgeons amputate higher than the lower third in wounds of the knee joint by these destructive missiles.

But the most interesting feature of this table is the comparatively large proportion of circular operations, and the comparatively unfavorable results of this method, when practiced at the junction of the middle and lower third of thigh after knee-joint injuries. Of the 12 circular amputations, 6, or one half, gave imperfect stumps, while of the flap operations 9, or more than one half, gave good results. The difference between the results in this and the preceding table is striking: in the former the final results of all the amputations were very favorable, and especially of the circular method; in the present table both methods failed of giving generally good results, the circular being the most unsuccessful.

NINETEEN CASES OF RECOVERED AMPUTATIONS AT THE MIDDLE THIRD OF THIGH.

MISSILE.	No.	Method.	No.	RESULT.			
				Good.	Imperfect.	Very poor.	Unknown.
Minie, musket, and rifle ball	10	{ Flap Circular	6	3	1	-	2
			4	3	1	-	-
Shell, grape, canister, cannon, and solid shot . . .	9	Flap	8	7	-	1	-

In this table we find a still greater proportion of injuries of the knee joint by the larger form of missiles; 9 of the 19 cases being injuries by shells and solid shots. We have here still further evidence of the destructive character of the wounds of the knee which called for amputation, and the necessity which frequently existed of amputating at a distance from the wounds.

We have noticed in the preceding tables that amputations in the lower third of the thigh gave good results, while those performed at the junction of the middle and lower third gave much more unfavorable results. In the middle third we find the table reversed, and both forms of amputation are again highly successful as regards the final results.

The proportion of circular to flap amputations is about the same as in the first table.

## FIVE CASES OF AMPUTATION AT THE JUNCTION OF THE UPPER AND MIDDLE THIRD OF THE THIGH.

MISSILE.	No.	Method.	No.	RESULT.		
				Good.	Imperfect.	Very poor.
Shell and grape shot . . . . .	3	{ Flap Circular	- 3	- 2	- 1	- -
Musket-ball . . . . .	2	{ Flap Circular	- 2	- 1	- -	- 1

## FOUR CASES OF AMPUTATION IN THE UPPER THIRD OF THIGH.

MISSILE.	No.	Method.	No.	RESULT.		
				Good.	Imperfect.	Very poor.
Solid and grape shot, and shell . . . . .	3	{ Flap Circular	2 1	- 1	1 -	1 -
Minie-ball . . . . .	1	{ Flap Circular	- 1	- 1	- -	- -

In amputation at the junction of the middle and upper third of the thigh the larger number of wounds were inflicted with solid shot. It is remarkable that in every case the circular operation was performed in preference to the flap method. The result, however, was not favorable in the majority of cases.

Of the four amputations in the upper third, but one was performed for wound by a minie-ball. From this fact we infer that, in general, wounds of the knee joint by a rifle-ball admit of amputation in the lower part of the thigh, and rarely necessitate the removal of the limb high up. It is also apparent that in a given number of cases of amputation in the upper third of the thigh for gunshot wound of the knee, a large majority will be necessitated by the larger and more destructive missiles. The results of the two methods prove the value of the circular method.

From these tables it would appear that in a total number of cases of recovery after amputation of the thigh, for gunshot injury of the knee joint, the operation was performed in the lower third in more than one third of the cases; at the junction of the middle and lower third in a little less than one third of the cases; in the middle third in about one fifth of the cases; and above this point in

a little less than one thirteenth of the cases. The total amputations at and below the junction of the middle and the lower third of the thigh comprise more than two thirds of all the cases.

It is evident, then, that in gunshot injuries of the knee joint successful amputation is far more frequently performed below than above the middle of the thigh. The comparative mortality of this operation, according to the Surgeon-General, was very small. Of 243 amputations in the lower third of the thigh for wounds of the knee, 112 died, being a mortality of 46 per cent.<sup>1</sup> The Confederate army reports give the following statistics of this operation: total number of amputations in the lower third of the thigh for wounds of the knee, 269, of which 126 died, being a mortality of 46 per cent.<sup>2</sup> We have here a striking coincidence in the success of a given operation for the same cause.

It would be interesting to note also the comparative mortality of amputation at other points in the thigh for these wounds, but we have not the data.

The period at which the operation was performed after the injury, in the majority of cases, proves not only the severity of the wound, but the importance of early amputation to insure a successful result. In more than one third of the cases the operation was performed within six hours of the injury, and in nearly one fourth of the cases it occurred between the 6th and 24th hour. In other words, within twenty-four hours of the injury about two thirds of the operations were performed. It should also be noticed that 67 or more than two thirds of the operations were performed on the field. These facts prove both the severity of the original injury, and the necessity of an early operation; for it must be remembered that this is a record of successful cases.

If there were any doubt as to the severity of the wounds which led to amputation in these cases, it would be dispelled by a reference to the record of the nature of the injuries. In all but 13 cases there existed a fracture, generally comminuted; in the remaining cases the joint was freely opened, and the leg nearly dissevered at this point.

Of the missiles with which the wounds were inflicted, in 59 cases the minie, rifle, or musket ball was employed; in 17 it was a fragment of a shell; in 13 it was a solid shot. It follows that the wound must, in one third of the cases, have been of the severest character.

<sup>1</sup> Report of the Surgeon-General (Circular No. 6.)

<sup>2</sup> Chisholm, *London Medical Times and Gazette*, December 29, 1865.

The following opinions of surgeons sustain the conclusions drawn from the preceding statistics, and are worthy of record in this connection.

Professor A. C. Post gives the result of his observations in regard to gunshot wounds of the knee joint as follows : —

“Gunshot wounds penetrating the knee joint are generally fatal, unless the limb be amputated. This is especially the case when, in addition to the wound of the joint, there is extensive fracture of the articular extremity of the femur or tibia.

“The practical rule which I would recommend in gunshot wounds of the knee is this, to amputate in all cases where the ball has passed through the centre of the joint, or where the inferior articular extremity of the femur or the superior articular extremity of the tibia has been fractured, but to make an attempt to save the limb where the ball has not penetrated deeply into the joint, and when the patella only has been fractured. In the class of cases in which I have recommended an attempt to save the limb, the attempt will always be attended with some danger to the life of the patient.”

Surgeon George A. Collamore, 100th Ohio Vols., speaks of the causes of thigh amputation as follows : —

“In gunshot fractures of the femur, amputation will depend on the location of the injury. If the fracture occur in the upper third, I should prefer to trust the case to nature, with such aid from position, splints, etc., as could be obtained. In fractures affecting the lower two thirds of the limb, I should amputate so as to remove the fractured portion. Gunshot wounds involving the knee joint invariably demand amputation, if possible, just above the condyles and below the medullary canal. Gunshot fractures of the tibia, involving much comminution and laceration of the muscles, usually require amputation. It would be a very unusual case that I would attempt to preserve. In my opinion conservative surgery should not be carried too far in gunshot fractures of the lower extremities, admitting amputation. Extensive fractures of the tarsal bones, involving the malleoli or articulation, require amputation at the ankle. Fractures of the fibula do not usually require amputation, as this bone is but slightly instrumental in the support of the body.”

Professor Paul F. Eve, of the Confederate service, makes the following communication in regard to the success of amputation of the thigh during the war, as compared with the same operation in former wars : —

“Ribes examined four thousand veteran soldiers in the Hotel des Invalides in Paris, and found not one who had undergone amputation of the thigh, or who had sustained an injury of the femur by a shot. Pro-

fessor Malgaigne of Paris, with whom I was associated in the war, makes the same report of all similarly wounded during the Polish campaigns of 1831. At the close of the Mexican War in 1847, Dr. McSherry of the United States navy, on detached duty, was permitted to accompany General Scott's army, and declared that, although he remained in the city of Mexico eight months after the battles, and walked the hospitals, he did not see one soldier restored to health after a gunshot wound of the thigh, involving its fracture. Of an almost similar import were my communications to the *Nashville Journal of Med. and Surg.*, after the late Italian campaign. Writing from Turin, July, 1859, it was stated that while the results were good after injuries in the upper extremities, the reverse was true of those involving the inferior, with or without amputation, whenever a compound fracture existed. Dr. Salleron, chief surgeon of the military hospital of that city, assures me that the nearest he came to saving a patient thus wounded, was a Zouave shot in the Crimea, who remained seven months in a hospital at Constantinople before attempting to return to France, and when he did so, finally died of pyæmiæ. In Milan I took notes of five cases of compound fractured thighs, which were all I saw there, fifty-six days after being wounded: in three there was little or no hope of recovery; another had had the limb amputated above the knee, and was doing well; while the fifth was the only one expected to recover with the limb.

“ In amputations of the thigh in the Crimean War, sixty-four in every one hundred died; in the Paris hospitals seventy-five per cent., and in the Polish and Mexican wars one hundred per cent., or every one operated on, died. Of twenty-one disarticulations at the hip-joint, every one was fatal, and eighty-six per cent., according to McLeod, of amputations in the upper third of the thigh died. As late as 1861, Mr. Thomas Bryant, surgeon to Guy's Hospital, one of the best appointed and managed of these institutions in London, reported seventeen cases of thighs requiring treatment. Ten were amputated, seven of them died; seven were attempted to be saved, four died; thus, of the seventeen cases eleven died. The most favorable return ever made, is that of Jules Roux, naval surgeon at Toulon, who saved four of six he amputated at the hip-joint; being by far the best success ever obtained by any one, though the circumstances were very propitious under which he operated. He mentions having seen twelve of these dreadful disarticulations; seven died. He also states that there were twenty-one cases of consolidated fractures of the thigh passing through his hospital from Italy. As Toulon was the only door through which the maimed could reach home (for Marseilles is a commercial and not a military port), it is highly probable that of all the two hundred and fifty thousand men who went to aid the Sardinians, these twenty-one constituted the whole number of all those wounded through the thigh bone who once more returned to la belle France with two legs.

“ In the late terrible civil war our profession has nobly performed her duty, and America has reason to honor her surgeons. With pride and gratulation we point to the hundreds and thousands saved by their skill, even in compound fractures of the femur. Lieutenant-General Ewell survives an amputation through the upper third of the thigh ; and so does Lieutenant-General Hood, performed by Professor Richardson of New Orleans, on the battle-field of Chicamauga. They so fully recovered, as is well known, that subsequently each commanded army corps in person on the field. I have seen as many as three soldiers conversing together in the streets of Augusta, Ga., each having lost a limb above the knee. I think I had two successful amputations of the thigh in Atlanta, and about the same number left under treatment in Columbus, Miss. I regret not having access to my official reports, but there must have passed under my supervision over one hundred of these amputations during two years and a half of hospital service. It is right, however, to say here that the majority of these were fatal.

“ Primary amputations did decidedly best, and, if not before, this question ought now to be considered definitely settled. The majority of those who recovered after injury of the femur were operated on in the field, or before inflammation and its results had ensued. To this rule we have the single exception in those requiring disarticulation at the hip-joint. In these cases it is now ascertained that few constitutions can bear in quick succession such shocks as, first, the injury requiring this operation, and then, secondly, that produced by its performance. The statistics of McLeod in the Crimean War already referred to, giving twenty-one primary operations, followed by twenty-one deaths, contrasted with Roux’s four successful out of six consecutive, or secondary amputations is determinate on this point.”

*Injuries requiring Amputation of the Leg.* — The largest percentage of recoveries after amputation of the leg, occur from injuries in the lower third, and in this respect resemble the recoveries after amputation of the thigh. It is interesting to notice three recoveries after amputation of the leg for compound fractures in the upper third, the amputation being in the immediate vicinity of the injury. Amputation for compound fracture of the middle third gives also a large percentage of recovered cases. Injuries of the ankle joint led to amputation of the leg in about one fourth of the total cases. Injuries of the foot would seem to have been very rarely followed by amputation of the leg, but in the French army in the Crimea it was a frequent operation, there being fifty-seven amputations of the leg for wounds of the foot in a total of two hundred and twenty-five amputations of the leg, or about one fourth.

VI.

METHODS OF OPERATION, AND THE FREQUENCY WITH WHICH THEY WERE PERFORMED IN THE THIGH AND LEG.

The following table comprises the various methods of amputation in the thigh and leg, and shows how frequently they were performed in each division of the extremity: — Methods of amputation.

Methods.	Thigh.	Leg.
Circular . . . . .	54	115
Antero-posterior flaps . . . . .	78	93
Posterior flap . . . . .	—	45
Anterior flap . . . . .	10	2
Lateral flaps . . . . .	6	21
Rectangular flap . . . . .	5	—
Skin flaps and circular of muscles . . . . .	2	8
	155	284

It is apparent that the amputations of the thigh and leg were performed either by the circular method or by some modification of the flap. Of the flap operations that which was generally preferred was the antero-posterior flap; the anterior, posterior, and lateral flaps being but seldom performed, with the exception perhaps of the posterior flap in the leg.

Of the two principal methods, the circular and antero-posterior flap, we notice that the antero-posterior flap was preferred more frequently in the thigh, and the circular in the leg. In the thigh the antero-posterior flap method comprises half the operations, while the circular exceed but little one third. In the leg these methods are nearly reversed, the circular amputations amounting to nearly three sevenths, and the antero-posterior amputations to but about one third.

Of the remaining methods the anterior, posterior, and lateral flaps have long been occasionally practiced, but without any definite results. The rectangular flap of Teale Other methods. seems to have been performed in a few instances in the thigh.

The method by flaps of skin and circular of muscles was performed in ten cases, two in the thigh and eight in the leg. This method seems to have become very popular with many military surgeons, especially with those who were compelled to transport their patients long distances. The surgeons in General Sherman's army came to prefer this operation to all Flaps of skin and circular of muscles.

others. Their method of operating was to make lateral flaps of the skin and a circular incision of the muscles; the lateral flaps brought in apposition gave a cicatrix running vertically on the face of the stump. In dressing the stump the ligatures were all brought out at the lower angle of the wound, and the drainage was perfect, leaving the upper portions of the wound dry. According to the testimony of many surgeons who had great experience in the transportation of the recently amputated, these stumps required dressing much less frequently than other forms, and union by first intention throughout three fourths of the wound was an almost constant result. In some cases it is stated that the stumps would remain so dry that the dressings would not require renewal in four or five days.

TESTIMONY OF SURGEONS AS TO THE VALUE OF DIFFERENT METHODS OF AMPUTATION.

Testimony of surgeons as to value of different methods. The various opinions of surgeons in regard to the special merits of the different methods may be gathered from the following extracts.

Assistant-Surgeon Powers, U. S. Army, says: —

Assistant-Surgeon Powers. “If the patient is obliged to be removed soon after amputation, I prefer the circular operation, as the parts are steadier, and keep their place better; otherwise I generally use the flap operation.”

Assistant-Surgeon N. A. Meacher says: —

Assistant-Surgeon Meacher. “I saw a great deal of trouble with stumps, on account of the flesh sloughing and leaving the end of the bone protruding, and I think the circular operation more liable to that trouble than the ‘Liston flap,’ which I prefer, unless it is in operating near the wrist or ankle.”

Surgeon C. E. Deming, 28th Ohio Vols., prefers the flap only in certain locations, as follows: —

Surgeon Deming. “In amputations of the arm, angle, and upper two thirds of the leg, I prefer the flap operation to the circular. The preference I have for the flap over the other is on several accounts; a more perfect covering is secured for the bone; the integument is only disturbed in the line of the incision, while in the circular the muscles are rarely ever cut close up to the retracted integument; the flap has less cutting and is speedier done, and the size of the flap can always be proportionably estimated to the size of the limb; in the circular it is

more or less guess-work. In the circular again the second cut is never exactly close up to the retracted skin; the third cut more or less haggles or cuts off the ends of the divided muscles of the second cut; the skin when brought over the end of the bone more or less gaps, and the cut ends of the muscles double in over the sawed end of the bone. It suppurates more and is usually longer in healing than the flap.

“At the lower third of the leg the circular is the best.”

Surgeon P. H. Bailhache, 14th Illinois Cav., says:—

“In amputations I prefer the double flap (posterior and anterior) for the arm and thigh, and the ‘combination’ or ‘semi-lunar and flap’ for the leg and fore-arm. I am of opinion that the <sup>Surgeon</sup> <sup>Bailhache.</sup> ‘circular’ amputation injures the integuments by frequent lesion of its nutritious vessels, which is done while dissecting it back upon itself—hence the flabby, waxy appearance of the parts in many instances. Some hold that there is less discharge of pus from a circular than from a flap operation; this may or may not be so; but even were such the case there is no advantage gained, as the drain upon the system is no greater, and the union of the flap is as speedy and as perfect. It is also said there is danger of transfixing or splitting the blood-vessels or nerves; this is mere theory, not substantiated by facts or experience, besides which ordinary care and a knowledge of the parts obviates the risk of doing so. Again, in the circular operation it is almost always necessary to split the integuments on one or both sides before they can be turned back and dissected sufficiently high to prevent the bone from protruding; so it is eventually ‘two flaps’ without the advantage of ‘time’ and at the expense of more or less injury to the integuments; if the muscles are not required as a cushion for the bone they can be readily cut out afterward without destroying the areolar structure,” etc.

Surgeon George A. Collamore, 100th Ohio Vols., expresses nearly the same opinion. Although he formerly employed the circular method, he now prefers the flap, <sup>Surgeon</sup> <sup>Collamore.</sup> believing that it “allows more perfect approximation of the surfaces, and union by the first intention sometimes will take place, but never, so far as I have known, in the circular operation.”

Surgeon E. Batwell, 14th Michigan Vols., draws the following distinctions between the flap and circular:—

“From close observation, I am unable to give preference to either as far as regards healing, both depending on the constitution of your patient, and both healing with equal facility. Hemorrhage took place more frequently in circular operations, owing doubtless to vessels of large size retracting more readily when divided *straight across*, than those cut slanting, as in flap amputation. As soon

as full reaction set in, these vessels poured out blood, and very frequently necessitated the opening of the stump to secure the bleeding artery. Anterior and posterior flaps healed more kindly than lateral ones, notwithstanding the latter possessed less tendency to accumulation of pus, and the sutures held the lips of the flaps together better; but the nervous twitchings of the stump made the bone protrude through the edges of lateral flaps more readily, and tore the newly organized plastic lymph. Any modifications of the above operations, or a combination of both, healed slowly and unsatisfactorily, invariably leaving painful stumps. Short anterior, with long posterior flaps made the process of healing very tedious, always leaving so painful a stump that a secondary amputation became necessary; I have thought that the nerve got under the bone, and was thus pressed on. The above observations were made from a similar number of flap and circular operations, with a view of deciding in my own mind the relative merits of each. I have measured the exposed surface, and was much astonished to find a *larger* extent on a circular than on a flap. In making the second sweep with the Catlin, I found that by inclining the edge of the knife towards the patient's body, so as to have the bottom of the incision an inch and a half or two inches higher up than the external, forming a hollow cone, a far nicer looking stump was formed, and one far better adapted for an artificial limb."

Surgeon W. Manfred, 22d Kentucky Vols., is of opinion that the flap method is more successful than the circular: —

"I generally prefer the flap to the circular operation; it makes a better stump, and there is less waste of muscle in making the flaps, except in certain exceptional cases, when the circular operation is probably the best, as when the muscle is very thick, or when it is injured by the ball so as to make the flap operation inadmissible. Moreover, my flap cases have been uniformly more successful than the circular."

Surgeon  
Manfred.

Surgeon B. T. Kneeland, — New York Cav., says: —

"I prefer flap amputations always, which have the advantage of saving time both in the operation and in the recovery, and as giving better results in every respect."

Surgeon  
Kneeland.

Surgeon H. C. Robbins, 101st Illinois Inf., says: —

"I prefer flap operations in the arm and thighs as more likely to cover the bones and afford a soft cushion for an artificial limb. In the fore-arm and leg I would use the circular operation for similar reasons."

Surgeon  
Robbins.

Surgeon N. Field, 66th Maryland Vols., says: —

"I prefer the flap method, because, as I believe, it makes a better covering for the end of the bone. The circular requires care to prevent trouble afterwards." Surgeon  
Field.

Surgeon J. C. Walton, 21st Kentucky Vols., prefers the flap, but believes that if the patient is transported any considerable distance there is danger that the flaps will separate : —

"I have generally performed the 'flap' operation, except in cases where there was much loss of the soft parts, or much contusion. It is most conveniently performed, and in healthy subjects frequently heals more rapidly. It makes a better covering for the stump, and a softer cushion for an artificial limb. The only objection to this method is that it gives more *suppurating surface*, — provided the patients are kept quiet, and are not required to be moved from place to place; but should the case require transportation several miles over rough roads the flaps are apt to gap open." Surgeon  
Walton.

Surgeon Chaddock, 7th Michigan Vols., says : —

"I prefer the flap; it gives greater mechanical neatness, less exposure of wound to air, and the chances of healing by first intention. I am also satisfied that the cut surface is less with the flap mode of operating, if well made, than it is in the circular." Surgeon  
Chaddock.

Surgeon —, — — —, says : —

"In the arm and thigh I invariably performed the flap operation; making in all cases where practicable antero-posterior flaps. My reasons for this method are several: 1st. The operation is more easily and quickly performed. 2d. The flaps are not so liable to slough as when they are made by the circular method. In the latter the skin and areolar tissue are dissected up to the extent of from two to four inches, cutting off, to a certain degree, their supply of blood; hence lowering their vitality, and making them more liable to slough. In the former, the skin and cellular tissue retain their connections with the more deep-seated tissues, and their vascular supply is not interfered with. 3d. In the flap operation the stump heals more quickly and with less suppuration, because the parts are brought more perfectly in apposition than they can be when the circular method is used. 4th. Because (and this follows as a corollary from the two preceding reasons) the flap method is less liable to be followed by pyæmia, erysipelas, or gangrene. 5th. Because this method gives stumps better adapted to artificial limbs than the other method: the end of the bone is more thickly covered." Surgeon —.

"These reasons, which I think will be found to be good ones, certainly show the immeasurable superiority of the flap over the circular method. Even in the fore-arm and leg, I consider the flap the better operation."

Surgeon —, — —, writes: —

“I prefer the flap in large thighs, because I can judge more nearly  
 Surgeon — the exact amount of covering I will have on the end of the  
 bone, and that there will be less likelihood of sloughing and  
 of protrusion of the bone. There will usually be a better covering for  
 the bone than after circular operations, and the skin will not be so ex-  
 tensively detached from its normal relations to the muscular tissues, and  
 it will not become so pale and so liable to ulcerate and slough where  
 the edges come together over the bone. I believe that in gunshot  
 wounds, particularly of the femur, the operation should generally be  
 made by cutting from without, *i. e.* the antero-posterior, or lateral flaps,  
 as the case may permit, should be made of proper size and shape,  
 and with even edges through the skin and areolar tissue down to the  
 muscles, either with a large scalpel or with the point of an amputating  
 knife, and then the muscular portions of the thigh be quickly and freely  
 divided down to the point where the femur is to be divided. In this  
 way the flaps will be evenly made, the detached pieces of bone will not  
 be caught upon the edge of your knife, as is so very often the case in  
 transfixion, the flaps will come in exact coaptation, and the stump will  
 be of the proper size and shape, and will have every inducement to par-  
 tially adhere by primary adhesion. I look upon this plan of operating,  
 in the army particularly, as worthy of attention, and can recommend it  
 as having come into favor with those whom I have known to perform it.  
 I have operated in this manner occasionally during the last two years.”

Surgeon J. W. Williams prefers a covering without any muscle,  
 and to secure this end he dissects off all muscle from the flap. He  
 says: —

“I think it is new, and better than the common flap method. In the  
 Surgeon  
 Williams. common antero-posterior flap operation in the lower third,  
 the anterior flap is narrow, not equal to its fellow, and in con-  
 sequence of the constant tendency of the thigh to evert, the end of the  
 bone is apt to protrude at the inner angle of the narrow flap. And  
 further, I have found that where the flaps were well relieved of mus-  
 cle, the healing process was more rapid and kind, and that in all of the  
 stumps I have seen, no muscle whatever covered the end of the bone,  
 however much was left by the operator. Hence in these cases I left no  
 muscle with the flap, which for the anterior was made from half the  
 diameter of the thigh by cutting from without inward, making a semi-  
 lunar flap of integument and fascia only, and the posterior by trans-  
 fixion.

“These cases at the time of operation were very low with gangrene  
 and pyæmia, yet three of them healed in less than three weeks with  
 very little discharge, and a heavier covering than I had ever seen over

the end of the stump. The fourth one died of pyæmia in about two weeks, the stump being nearly healed."

Surgeon George J. Potts, 23d North Carolina Inf., prefers the circular operation:—

"I prefer the circular in all parts of the femur and humerus, the flap in the lower thirds of fore-arm and leg; and why? because when dividing the muscles in the thigh and arm the retractions are often so forcible that they assist the surgeon in forming a conical cavity for the covering of the stump. The grand aim in any operation is to save integument enough to cover the muscle, and muscle enough to cover the bone, and not to scrape off the periosteum. I think that there is less difficulty in seizing the arteries in the circular operation for the ligature, and that the surgeon is not so liable to ligate a nerve, or branches or twigs of nerves, as in the flap operation. I do not think that the oblique or straight division of the arteries, in either flap or circular, has anything whatever to do with the weight of testimony in favor of one or the other mode of operation."

Assistant-Surgeon W. P. Moon prefers the oval of skin and circular of muscles:—

"In the majority of my amputations of arm, fore-arm, and leg, I adopted the oval of skin with circular of muscle from an impression that there was more muscular tissue to heal, and I thought I observed more resultant inflammation in the flap operation of my own and other cases."

"The only advantage in the 'oval' over the 'circular,' I conceive to be, that it is a handsome operation, and permits of more expedition. In opposition to this it requires more care and greater precision in making our initial incisions."

Surgeon R. J. Levis thus condemns in emphatic language the circular method:—

"Having had, during the war, under my observation probably a larger number of stumps of a defective character than any one else, I do most emphatically condemn the circular operation as being the method most frequently followed by stumps most tardy in healing, liable to leave an attenuated and tender cicatrix attached to the bone, and least suited to the adaptation of artificial limbs."

Surgeon David P. Smith, United States Vols., makes the following observations in regard to the method of amputation of the leg:—

"Experience in many cases during this war has shown that the usual methods of amputating the leg in continuity are exceedingly faulty and often lead to deplorable results. The

Surgeon  
Potts.

Assistant-  
Surgeon  
Moon.

Surgeon  
Levis.

Surgeon  
D. P. Smith.

leg. being merely a means of progression, and its removal being more nearly compensated for than any other part of the body, will always be condemned to amputation more readily than any portion of the upper extremity. It behooves us therefore to employ the very best manual procedure possible.

“ The mechanical difficulties to be avoided, are, —

“ 1. Protrusion of the spine of the tibia.

“ 2. Tender stump.

“ 3. Redundance of posterior flaps; in some instances forming a pendulous mass, and interfering greatly with adaptation of artificial limb.

“ Protrusion of the spine of the tibia has occurred in every instance that came under the writer's notice during the war in which the posterior flap operation had been performed upon the field of battle. Transportation of the patient is sure to cause this. When we look at this form of operation and carefully observe all its defects, it seems amazing that it should ever have been practiced. The circular and the lateral flap methods are each of them superior to it in every respect.

“ On account of the facility of execution, the complete freedom from all and any tension, the ready exit of pus, the freedom from pressure of all the important vessels and nerves, and the impossibility of any dragging of the flap against the spine of the tibia, the anterior flap method should, in the opinion of the writer, be preferred in all amputations of the leg in its continuity. It is best done in the following manner: —

“ Standing on either side, transfix the limb one inch below the point at which you intend to saw the bones, passing the knife just behind the tibia and fibula, grazing both; then, keeping the flat of the blade closely applied to the bones, cut downwards for about five inches. Next, bringing the knife back to its first position, as when transfixing, cut downwards through the muscles of the calf, forming a flap of two inches in length. Now, carrying the disengaged knife over the front of the limb, connect the two lower extremities of the longitudinal transfixing cut by a curved incision, convexity downwards. Then dissect up the anterior flap from the bones and interosseal membrane, guarding against injury of anterior tibial artery by using the thumb-nail, or handle of the scalpel, to detach the muscle in its neighborhood. Use a small scalpel to cut around the bones and divide the periosteum, which do leisurely. Lastly, put on the retractor, and, as it is tightened, with your thumb-nails scrape upwards from the bones and all around the bones all the periosteum and muscular tissue, so that when the section is made, the same surfaces may be well covered with the one as well as with the other. Divide the bones on exactly the same level, remembering to saw off a very little from the upper and inner angle of the shin. It will now be seen that your anterior flap falls over the stump as naturally as the eyelid over the eye, and the pus finds as ready an exit as the tears.

“Acupressure needles can be used to control the hemorrhage in this amputation as well as in any other, but, inasmuch as they ought to be removed by some one entirely conversant with the subject at as early a period as possible, the carefully tied ligature, in battle-field surgery at least, is most applicable. Metallic sutures, and not plasters, should be used to close the wound.

“In some instances it may not be practicable to give the length herein recommended to the anterior flap. In such instances the posterior flaps can be made of greater length. The peculiar advantages of this form of operation are preserved if the anterior is two inches longer than the posterior flap.

“Many experiments upon the cadaver abroad before the commencement of the late struggle, showed that this was a most facile procedure, and experience in hospitals and on the field since then demonstrate its benefit to the patient.”

It is the opinion of Assistant-Surgeon Leale that patients having amputation of leg suffer more than those who have had the thigh amputated. He says:—

“The patients as a rule with amputations through the tibia suffer more pain than those with amputated femurs, taking those at present in hospital as a guide.”

DISTRIBUTION OF THE VARIOUS METHODS OF AMPUTATION IN THE DIFFERENT REGIONS OF THE THIGH AND LEG.

METHOD.	Upper third.		Middle third.		Lower third.	
	Thigh.	Leg.	Thigh.	Leg.	Thigh.	Leg.
Circular . . . . .	10	3	22	27	20	50
Antero-posterior flaps . . . . .	5	3	35	24	37	34
Posterior flaps . . . . .	—	2	—	17	1	6
Anterior flaps . . . . .	—	1	4	—	7	1
Lateral flaps . . . . .	—	3	3	7	4	11
Rectangular flaps . . . . .	—	—	2	—	3	—
Skin flaps and circular of muscles . . . . .	—	4	—	—	2	4
Totals . . . . .	15	103	66	75	74	106

We learn from this table that the circular operation was more frequently performed in the upper third of the thigh, in a given number of thigh amputations which recovered, than the flap. According to these statistics the former exceed the latter in the ratio of two to one. The number of cases is too few to establish the fact that the circular method gives a greater proportion of recoveries in this region, and we merely

Circular operation more frequent in upper third of thigh.

chronicle the record as an interesting, and perhaps important, conclusion presented by these statistics.

In the middle of the thigh the proportion of circular to flap operations materially changes, and we find the latter pre-dominating, and in the lower third this proportion is increased both by the increase of the flap operations and the diminution of the circular operations. This last result is quite unexpected, for the circular operation is generally regarded as especially adapted to the lower third of the thigh. We must either conclude that the circular operations more frequently proved fatal, or that this method was not so generally adopted at this point as the flap.

The following table of thigh amputations performed by Southern surgeons during the war is of interest in this connection : —

Flap operations most frequent in middle third.

AMPUTATIONS OF THE THIGH IN THE CONFEDERATE SERVICE (CHISHOLM).

METHOD.	Upper Third.		Middle Third.		Lower Third.		Total.
	Rec'd.	Died.	Rec'd.	Died.	Rec'd.	Died.	
Circular . . . . .	21	18	40	28	54	48	209
Flap . . . . .	10	5	18	19	40	16	108

The number of cases of amputation by the circular and flap operations in the upper third of the thigh which recovered, are in nearly the same proportion in this table as in the table already given. But we have also added the fatal cases, and in this collection the circular method gives a large excess of deaths. If this latter table correctly illustrates the comparative mortality after the two operations, the flap is far the most successful method of amputation in the upper third of the thigh. This excess of fatal cases of circular amputations we must consider as exceptional until further investigations prove it more definitely.

It appears from this table that in the Confederate service the circular method was preferred to the flap method in all parts of the thigh. In Baer's consolidated tables,<sup>1</sup> we find 183 cases of thigh amputation recovered, of which 116 were the circular, and 67 the flap operation. These operations were distributed as follows : —

Circular method preferred in all parts of thigh.

<sup>1</sup> Chisholm's *Military Surgery*, 3d ed. p. 395.

Method.	Upper Third.	Middle Third.	Lower Third.	Total.
Circular . . . . .	22	40	54	116
Flap . . . . .	9	18	40	67
Totals . . . . .	31	58	94	183

The influence of the method of operation upon the mortality does not appear in our tables. From the consolidated table quoted from the statistics of the insurgent service, however, the following comparison may be instituted between 134 fatal cases, and the 183 recovered cases above tabulated:—

Method.	Upper Third.	Middle Third.	Lower Third.	Total.
Circular . . . . .	18	28	48	94
Flap . . . . .	5	19	16	40
Totals . . . . .	23	47	64	134

These tables, properly reduced, give the following as the relative frequency of the two operations in the different parts of the thigh in the recovered and fatal cases, as reported by the Confederate surgeons:—

METHOD.	RECOVERED CASES.			FATAL CASES.		
	Upper Third.	Middle Third.	Lower Third.	Upper Third.	Middle Third.	Lower Third.
Circular	1 in 5.2	1 in 2.9	1 in 2.1	1 in 5.2	1 in 3.3	1 in 1.9
Flap	1 in 7.3	1 in 3.7	1 in 1.6	1 in 8	1 in 2.1	1 in 2.5

The almost exact correspondence of the proportion of circular and flap operations in the different regions of the thigh, both in the recovered and fatal cases, would seem to prove conclusively that the mere method of operating did not affect the mortality in the slightest degree.

Of the remaining amputations of the thigh, the anterior and lateral flaps seem to have been adopted in several cases in the middle and lower third. The rectangular flap of Teale was performed five times, twice in the middle third, and three times in the lower third. The operation by flaps of the skin and circular of

the muscles was performed but twice in the thigh, and on each occasion in the lower third.

Passing to the leg, we find the rival operations are the circular and antero-posterior flaps. The circular, in every region of the leg, however, presents the larger number of recovered cases. In the upper and middle third the difference in numbers between the two operations is not very marked; but in the lower third the preponderance of circular over the flap cases is very decided, and emphatically asserts the greater frequency of that operation.

We find here a large number of posterior flap amputations, limited principally to the upper and middle thirds of the leg. This operation is undoubtedly closely allied to the antero-posterior method in the leg, the anterior flap being short, and the posterior flap very long. The method by lateral flaps was performed in twenty cases, the largest number being in the lower third of the leg. In this operation we recognize the method by skin flaps and circular of the muscles, or an operation resembling it, owing to the nature of the tissues and part in which it was performed.

VII.

PERIOD OF AMPUTATION AFTER INJURY.

We have, in this collection, the period of operation fixed with great precision in 155 cases of thigh amputation, and in 276 cases of leg amputation, making a total of 431 cases of amputation in the lower extremity. We will first group them into primary and secondary operations according to the usual plan:—

Limb.	Primary.	Secondary.
Thigh . . . . .	113	42
Leg . . . . .	186	90
Totals . . . . .	299	132

This table, in a striking manner, confirms the now well-established fact that primary amputations in military surgery are far the most successful. In a given number of recovered cases, taken indiscriminately, we find the primary amputations exceed the secondary more than two to one. That this statement may be accepted

as a general truth is proved by the following statistics, which are gathered from various sources, and represent only recovered cases :

	THIGH.		LEG.	
	Primary.	Secondary.	Primary.	Secondary.
Above collection . . . . .	113	42	186	90
Sherman's campaign (Andrews) . . . . .	53	26	60	7
Confederate army . . . . .	224	56	96	18
British army (in Crimea) . . . . .	53	6	61	4
Hospitals on Bosphorus . . . . .	36	6	30	4
	479	136	433	123

Primary amputations 77.8 per cent. of recovered cases of thigh.

Primary amputations 77.8 per cent. of recovered cases of leg.

This table furnishes not only the strongest possible evidence of the success of primary amputations over secondary, but we find in it also a singular coincidence between the results of the primary and secondary amputations in the thigh and leg. It is found on reducing this large collection of cases that there is precisely the same percentage of primary amputations in both the thigh and leg, and that the percentage is more than three fourths of the recovered cases.

But while the success of primary over secondary amputations has been definitely determined, and the principle that the former should always be preferred to the latter has been incorporated as a maxim into military surgery, there has been a growing disposition manifested to study more thoroughly the influence of periods upon the results of amputation, and by a wise discrimination establish new and more practical subdivisions than those hitherto known as primary and secondary. It has long been apparent to careful observers that, after the receipt of a severe gunshot injury of an extremity, the patient passes through several well marked stages or periods, in which his general condition and the wound undergo very material changes. At first he suffers from the shock or *ébranlement*; this is followed by reaction; then succeeds the preliminary stages of inflammation; and finally the inflammatory stage with suppuration supervenes, and the progressive changes through which wounds pass to recovery. The first period can last but a few hours; the second may extend to twenty-four or forty-eight hours; the third may continue several days before the fourth is established; and the fourth may continue

Importance  
of a new di-  
vision of  
periods of  
amputation.

an indefinite period. Competent observers describe still another stage, namely, that which intervenes between the receipt of the injury and the commencement of the shock.

Writers on military surgery have variously divided these periods, but in general they have added only one subdivision, and that has been intermediate between the primary and secondary periods. Boucher, followed by Alcock, made the following distinctions, namely, the *primary*, the *intermediate*, and the *secondary*. H. Larrey distinguished three periods, as follows: the *immediate* or *primitive*, the *consecutive*, and the *ulterior*. Legouest made three divisions, namely, the *immediate*, the *mediate*, and the *ulterior*. J. Roux gave the following titles to his subdivisions, namely, the *immediate* or *primitive*, the *mediate* or *secondary*, and the *ulterior* or *consecutive*. In these new divisions the period which intervenes between the commencement of the inflammation and the commencement of suppuration was regarded as intermediary, consecutive, or mediate. These distinctions have for the most part been made by French writers. Legouest thus defines the meaning and application of the terms which he employed, namely, *immediate*, *mediate*, and *ulterior*: an amputation is immediate when it is practiced before the development of inflammatory phenomena; it is *mediate* when made during the inflammatory period; and it is *ulterior* when practiced at the time that the lesion becomes local, and may be regarded as a chronic affection. It will be perceived that Legouest overlooks altogether the period of shock, and the same is true of the other authors quoted.

Professor Hamilton, of New York, has made a new classification of the periods of amputation, in which he divides the primary period of Boucher, and the immediate period of Legouest, into the *immediate* and *primary*. He remarks of this division:<sup>1</sup> “These periods are divided somewhat arbitrarily into immediate, primary, intermediate, and secondary, which arbitrary divisions have relation to certain supposed physical conditions of the patient during these periods. It is assumed that the conditions correspond, therefore, to certain divisions of time with some degree of accuracy. It being assumed that in a certain proportion of cases within the first six hours the patient is in a condition of shock, this is called the ‘immediate’ period. It being assumed that after the lapse of six hours, and before forty-eight, reaction ensues, but not inflammation, this is called the ‘primary’ period,

Hamilton's  
division of  
periods.

<sup>1</sup> *Med. Record*, September 15, 1866.

or period of reaction. It having been observed that after the lapse of forty-eight hours, and before the interposition of suppuration, which is usually completed by the seventh day, there is inflammatory action or a congestion of the limb, this is called the period of inflammation or of congestion, or the 'intermediate' period, as being intermediate between the primary and secondary. And it being assumed that suppuration takes place, or is pretty well developed, by the seventh day, the period extending from this time on is called the 'secondary' period. This latter period is indefinite as to its extent, and is also called the period of suppuration."

In these several classifications of the periods into which we may divide the stages of progress of gunshot wounds of the extremities, no notice is taken of that still earlier period <sup>Period before shock.</sup> which intervenes between the receipt of the injury and the shock, to which we have already referred. Those writers who recognize this period regard the shock as delayed, giving, thereby, a period more important, with reference to the operation, than any which follow. Paré alluded to this period, though perhaps without recognizing the absence of shock, and urged that amputation should be made while the wounded were in sight of the battle-field. Wiseman refers to it in this emphatic language: "If you decide to operate, do so at once, while the soldier is in heat and in mettle." Larrey recognized it, and declares that amputation should be performed at once. Hutchinson,<sup>1</sup> a distinguished British naval surgeon, proves by a large experience that there was a distinct interval between the injury and the occurrence of shock. His observations were made on shipboard, where he had an opportunity to see the patient from the moment of injury. Quarrier,<sup>2</sup> also a naval surgeon, speaking of a naval action in which he was engaged, says:—

"All our amputations were performed immediately, without waiting for reaction; and it may be necessary to observe, that though many of the men were carried down with their limbs torn from them, others with the most severe lacerations and fractures, . . . yet in no instance could we perceive the dreadful perturbation and constitutional shock so frequently described by authors on gunshot wounds, until some time after the injury was received."

He adds:—

"I have every reason to conceive, that amputation having so promptly followed the wound, was the only effectual means of saving many from its baneful influence."

<sup>1</sup> *Practical Observations in Surgery.*

<sup>2</sup> *Med. Chir. Transact.* vol. viii.

Surgeon Lidell, an accurate observer, and in charge of a large military hospital during the late war, believes that the shock is generally delayed, giving a period favorable for the operation.

Surgeon C. J. Walton, 21st Kentucky Vols., says:—

“In some cases there is a period of time sufficiently long between the reception of the injury and the ‘shock.’ Beyond all doubt this is the most favorable time for an operation. The patient then only receives one ‘shock,’ and the recovery is rapid, and almost invariably successful.”

Surgeon D. F. Leavitt, 3d Massachusetts Cav., writes:—

“Shock after severe injuries has not been frequent under my observation. Two cases only among many hundred severe injuries have suffered in a marked degree from shock — one a compound comminuted fracture of head of tibia by large grape-shot; the other, compound comminuted fracture of femur at trochanter by small grape-shot. Both died without hemorrhage. No operation was performed.”

Finally, we have the evidence of McLeod, not only as to the existence of this stage, but as to its importance with reference to the operation. He says:<sup>1</sup>—

“I know of several well authenticated cases which occurred during the siege, in which the perfect absence of all constitutional prostration after an accident so severe as the carrying off of a limb, and the non-appearance of such shock for some considerable time after, went to prove the same position.”

In view of such testimony it seems important to recognize a fifth period, which becomes truly that of *the immediate* amputation, namely, the period which intervenes between the receipt of the injury and the shock. This period would not ordinarily extend beyond an hour.

It may be stated here that these divisions of time cannot be fixed in any given case. They depend upon physical conditions that change with individuals and with surrounding circumstances. Inflammation may occur within twelve hours of the injury, or by treatment it may be delayed three or four or more days. The

Periods  
should designate  
the condition of the  
patient.

periods that have been fixed, and the terms that have been employed to designate changes, are arbitrary, and are to be taken in the most general and liberal sense.

In the redivision of these periods terms ought to be adopted that clearly define the meaning of those who use them in every individual case. The old terms primary and secondary, though

<sup>1</sup> *Notes on the Surgery of Crimean War.*

applied to two very well understood divisions of time which embraced certain conditions of the local injury, were rarely so employed as to convey a definite meaning. The science of our day demands more positiveness in the nomenclature of diseases.

It would be far better, therefore, in making a new classification of periods, to select terms which explain the existing condition of the patient or wound, and which are not arbitrary. We propose for the purposes of discussion in this paper to so divide the periods as to include all hitherto described, and under such titles as more nearly explain the condition of the patient or part. We name five periods, as follows: *before shock* (one hour or less); *during shock* (one to six hours); *during reaction* (sixth to forty-eighth hour); *primary inflammation* (forty-eighth hour to seventh day); *secondary inflammation* (after seventh day). The first two periods relate to the condition of the patient, and the last two to the condition of the wound.

Much difference of opinion exists among writers as to the propriety of amputations in these different periods. This question can be correctly settled only on the basis of the comparative mortality in each. The preceding collection of cases furnishes us the materials for forming correct conclusions upon this much debated subject. We are able to fix the time of operation in each case with so much exactness that we are enabled to determine the proportion of recoveries, in the different periods, to the total recoveries, and thus determine the most favorable period for the operation. We will first present an analysis according to the divisions of Hamilton.

NUMBER OF CASES IN FOUR HUNDRED AND THIRTY-ONE RECOVERED AMPUTATIONS IN THE IMMEDIATE, PRIMARY, INTERMEDIATE, AND SECONDARY PERIODS, AND THE PER CENT. IN EACH PERIOD OF TOTAL AMPUTATIONS IN THE THIGH AND LEG.

	Immediate.	Primary.	Intermediate.	Secondary.
Thigh, 52, or 33.5 per ct.	49, or 31.6 per ct.	18, or 11.6 per ct.	36, or 23.2 per ct.	
Leg, 104, or 37.6 per ct.	82, or 29.7 per ct.	35, or 12.6 per ct.	55, or 19.9 per ct.	
	156	131	53	91

SUMMARY.

Immediate, 156, or 36.2 per ct. of total.	Intermediate, 53, or 12.3 per ct. of total.
Primary, 131, or 30.4 per ct. of total.	Secondary, 91, or 21.1 per ct. of total.

If we divide the cases included in the *immediate* period into those occurring within one hour, and those occurring between the

first and the sixth hour, we should separate those operated upon before, from those operated upon during the shock, or nearly so, as follows : —

	Before shock.	During shock.
Thigh . . . . .	18, or 11.6 per cent.	34, or 21.6 per cent.
Leg . . . . .	24, or 8.6 per cent.	80, or 28.7 per cent.
	<hr/> 42, or 9.7 per cent. of total.	<hr/> 114, or 26.5 per cent. of total.

In regard to the propriety of amputation immediately after the occurrence of the injury, or before the shock is of any considerable intensity, as within one hour from the gunshot, various opinions are held. Paré and Wiseman evidently approved of immediate amputation in the sense in which we speak of it, namely, *before the shock*. Larrey advocated with great earnestness immediate amputation, and affirms that he lost a great number of patients by delay. He speaks of being most successful in cases where the operation was *peu d'instans apres le coup*. McLeod, speaking of the period which intervenes between the wound and the shock, says: "If this precious moment could be seized at all times, and that operation performed under chloroform, which assists so much in warding off the *ebranlement* we fear, how much more successful would our results prove than under any other circumstances they ever can be!" Hutchinson says: "The operation *ought not to be deferred ONE MOMENT!*"

Guthrie says: "There can be no doubt that if the knife of the surgeon could in all cases follow the ball of the enemy, or the wheel of a railway carriage, and make a clean, good stump, instead of leaving a contused and ragged wound, it would be greatly to the advantage of the sufferer." He approves, in general, of immediate amputation in the arm or below the knee, remarking: "These operations may be done at any time from the moment of infliction until after the expiration of twelve or twenty-four hours, without any detriment being sustained by the sufferer with regard to his recovery." In those cases where the injury renders amputation in the upper third of the thigh or at the hip joint necessary, he is in doubt as to the propriety of immediate amputation, and thinks the subject demands further investigation.

Hamilton<sup>1</sup> believes that the occurrence of delayed shock is rare, and would approve of immediate amputation only in extreme cases, "as, for example, when a limb is nearly torn off, and a dangerous hemorrhage, which cannot be arrested, is occurring; or when spicula of bone, such as neither the forceps nor fingers can

<sup>1</sup> *Med. Record*, September 15, 1866.

extricate, are causing intense suffering." He would also favor immediate amputation "in a considerable number of cases of injuries to larger limbs, when it is clearly seen that the patient is not faint, or depressed, or suffering under great nervous agitation."

The above table shows that amputation was successfully performed during the late war within a period after the injury which implies either that shock had not super-<sup>Results of immediate amputation</sup>vened, or that it was as yet but slight. In many cases the operation is reported to have been performed immediately, and some of these we know were immediately, in the true sense of the word, but a few minutes having elapsed between the receipt of the injury and the operation. It may be stated in regard to the comparatively few cases reported, that they prove that a large mortality must have occurred, or that but few operations were performed. We incline to believe the latter is the true explanation. The opportunity to perform an amputation within an hour after the injury, occurs but infrequently compared with the cases which offer for amputation at subsequent periods.

Various opinions are advanced by military authorities in regard to amputation during the existence of shock. Larrey <sup>Amputation during shock.</sup> went so far as to contend that the nervous "commotion" was rather an indication of the propriety of the operation, because its effects "far from being aggravated, diminish and disappear insensibly after the operation." McLeod, quoting this statement of Larrey, says: "But even although that constitutional disturbance which is the result of injury is present, is it always necessary to wait its subsidence before operating? If it be very decidedly marked, and the patient thus much prostrated, such delay may certainly be called for; but it is an opinion often stated by those who must be well informed on the subject, that such delay is not always advantageous, but manifestly the reverse."

Hamilton decidedly condemns amputations during the stage of shock. He remarks that his experience has been, "after at least twenty years of observation in hospital practice, and after a pretty large experience upon the field, that amputations of large limbs, made after severe injuries and before reaction has fairly been established, have in most cases resulted speedily in the death of the patients." The cases to which Larrey refers, in which the nervous commotion is diminished by an operation, he explains to be those in which the broken bones, fragments of shell, splinters, clothing, or some other foreign substance lying in the track of the wound, are causing pain, and perpetuating the irritation.

The preceding table would seem to definitely settle the question of the advantages of amputation within six hours of the injury. And this period includes the limits set by Hamilton to the stage of shock. Thirty-six per cent. in a total of four hundred and thirty recovered amputations, embracing all periods after the injury, were performed within six hours of the receipt of the wound. These statistics prove that immediate (Hamilton) amputations of the thigh and leg, that is, those performed before and during shock, are six per cent. more successful than those performed after reaction comes on and before inflammatory symptoms appear; three times as successful as those performed in the intermediate period, or in the stage of primary inflammation; and, finally, nearly twice as successful as the secondary operations.

Comparing the thigh and leg amputations, it will be seen that the largest percentage of recovered cases in the immediate period occur in the leg.

If we analyze the immediate amputations by dividing this period into two, the first of one hour, and the second from one to six hours, or into the amputations before the shock, and during the shock, we find that 9.7 per cent. were performed in the first period, and 26.5 per cent. in the second period. It is to be noted also that amputations before the shock were three per cent. more favorable in the thigh than in the leg.

The period of reaction extends from the sixth to the forty-eighth hour. During this time the wound remains in a comparatively quiescent state. The patient rallies and recovers his normal general condition, and seems to be in a proper state for an operation. But these tables prove that the success of amputations in this period is not as great as before, or during the shock, or rather that in a given number of recovered cases the largest percentage occurs in the earlier periods. From this fact we learn that primary amputations are successful in proportion to the number that are performed before the stage of reaction commences. Heretofore the period of primary amputations has included the three periods above designated, namely, that before, and during the shock, and the stage of reaction; and the general opinion of surgeons was that the successful amputations mostly fell in the third period, or were performed in the stage of reaction. By this discrimination of time, and the more careful designation of the periods within which operations were performed, we learn that the real value of primary amputations depends upon whether they were performed before the stage of reaction.

The great fatality of amputations performed in the "intermediary" period, or during the excitement which precedes suppuration, is strikingly illustrated in these tables. By <sup>Intermediary period.</sup> far the smallest percentage of recoveries are reported for this period. This unfavorable result is not so much due to the condition of the wounded parts, as to the general condition of the patient. The system is now suffering from the first onset of inflammatory fever, and there is necessarily a high degree of vascular and nervous excitement. The temperature of all the tissues of the body is raised by the blood surcharged with heat from the inflamed parts, and there is consequently an exalted tissue sensibility. The shock which follows an operation under these circumstances is always most profound, and reaction correspondingly difficult and uncertain. The inflammation which supervenes is also more destructive of tissue, and exhaustive of the patient. These circumstances combine to render the intermediary period more dangerous than any preceding.

The secondary period, which includes all operations performed after the seventh day, is seen to give a larger percentage <sup>Secondary amputations.</sup> of recoveries than the intermediary period, but the results are not as favorable as in either of the two earliest periods, namely, before, and during the shock. We have in this result only the general conclusions of military surgeons, long since established, that the secondary amputations are more fatal than the primary; but we had not before so discriminated the divisions of the stages through which the patient passes, included in the primary period, as to determine at what precise time the least and greatest mortality occurred. We now discover that secondary amputations are not as successful as primary amputations at any period within the first forty-eight hours.

We may conclude in regard to the success of amputations at the different periods as follows:—

1. Immediate amputations, or those performed *before the shock*, give good results in military surgery.
2. Amputations performed between the first and sixth hour after the injury, or *during the shock*, are more successful than when performed at a later period, but are not probably more successful than when performed immediately.
3. Amputations performed between the sixth and forty-eighth hour, or in the period of reaction, are more successful than at any subsequent period, but are not nearly as successful as amputations performed previously to the sixth hour.

General conclusions in regard to success of amputation at different periods.

4. Amputations performed between the forty-eighth hour and seventh day, or in the intermediary period, are more fatal than at any time prior or subsequent to that period.

5. Amputations performed after the seventh day, or in the secondary period, are more fatal than amputations performed at any time prior to the forty-eighth hour after the receipt of the injury.

TESTIMONY OF SURGEONS AS TO THE PERIOD AT WHICH AMPUTATIONS SHOULD BE PERFORMED.

Surgeon D. F. Leavitt, 3d Massachusetts Cav., says : —

“Amputation immediately after injury I think affords the best chance of recovery. If the patient is suffering from shock, I think sulphuric ether should be administered whether operation is required or not, it being, so far as I have observed, the best treatment for that condition. If time for primary operation has passed, and there are no urgent reasons for early secondary operation, such operation need not be performed until sufficient reasons aside from the ultimate usefulness of the limb exist. In capital operations such a course affords most chances of recovery. Other things being equal, a late secondary operation furnishes better chances of recovery than an early one performed while inflammation is acute, and the system has not had time to adapt itself to the burden it already has to bear.”

Surgeon C. J. Walton, 21st Kentucky Vols., says : —

“The earlier an amputation is performed after the injury is received, the more successful will it be, unless the ‘shock’ is too great to justify operating immediately ; then, of course, we should wait for reaction.”

Surgeon P. H. Bailhache, 14th Illinois Cav., says : —

“Primary amputations are almost always successful, while intermediary and secondary are generally fatal, particularly in general hospital practice. Of some thirty-five primary operations only two deaths occurred, one of these from malarial poison ; while of ten cases of secondary amputation eight died.”

Surgeon B. W. Avent writes : —

“I have for many years advocated the immediate procedure in uncomplicated shock. The experience afforded during the last few years has greatly strengthened my former convictions. The principle which controls me in this selection is not alluded to by yourself or those to whom you refer ; nor have I been able to find it elsewhere. Larrey

may mean something of the kind, when he speaks of loss of patients, because his operations were, in some instances, too long deferred; but his language is not explicit. In the limits of a letter I can merely mention the grounds upon which I act. The premises may be untrue, but the results have been more satisfactory, as a general rule, than in either the primary or secondary selection. I give it as follows:—

“1. Shock, following gunshot wounds, or other injuries of a kindred character, is purely nervous. 2. The impression is both local and constitutional. 3. Susceptibility to further impression is suspended proportionally to the recognized manifestation upon the subject. 4. Loss of blood is not essential to the production of nervous shock, but to a limited extent may be regarded as remedial in its effects. 5. Anæsthesia may be employed with entire safety during any period of shock, though in many instances where the operation is near the wound, owing to the absence of sensation, this agent might be dispensed with.

“I never adopt the immediate procedure when there has been serious loss of blood. Many of the failures incident to it, in my judgment, are referable to a want of discrimination at this point. The respective conditions from shock and loss of blood are so entirely dissimilar that but little experience is required to detect them. They are, however, often overlooked.

“I remarked just now that loss of blood when limited is remedial in shock. I think there is no principle in surgery more conclusive.”

## VIII.

### INFLUENCE OF THE PLACE OF AMPUTATION UPON THE AMOUNT OF ATROPHY OF THE STUMP.

Among the final results of amputations, atrophy of the stump must be regarded as of the first consideration. Next in value to a firm and durable covering to the stump is <sup>Atrophy of stump.</sup> a well nourished extremity. If the stump undergo progressive atrophy, the artificial limb requires much more care to maintain its adaptation. The constant shrinkage of the extremity renders the appliance loose, and hence it requires readjustment by continuous padding of the socket. This padding of the socket is not required when the limb maintains its full dimensions.

The accompanying tables enable us to determine how far the method of operating, and the point of the limb at which the amputation is performed, influence the subsequent nourishment of the stump. The measurements were made when the stump was healed, and prepared for the final adjustment of the artificial limb. The first or proximal measurement was made, in the thigh, at the high-

est point where the circumference could be taken, and in the leg, immediately below the knee. The second, or distal measurement, was made directly around the extremity of the stump, at a point where the margins of the flap begin to incline towards the cicatrix. The figures entered in the tables under the head "atrophy," express the difference in inches and fractions of an inch between the measurement at the points above indicated of the mutilated and uninjured limb.

COMPARATIVE AMOUNT OF ATROPHY OF STUMPS IN THE UPPER, MIDDLE, AND LOWER THIRDS OF THE THIGH AND LEG, IN AN AGGREGATE OF 430 CASES.

(In inches and fractions of inches.)

LIMB.	Upper Third.		Middle Third.		Lower Third.	
	Proximal.	Distal.	Proximal.	Distal.	Proximal.	Distal.
Thigh . . . . .	0.45	1.05	1.56	1.70	1.34	2.08
Leg . . . . .	0.97	1.70	0.71	1.42	0.57	2.26

It must be borne in mind that the proximal measurements in the thigh are all made at the same point; and the same is true of the leg. It would appear from this table that the point of amputation exercises a very marked influence upon the degree of atrophy of the stump, both in the thigh and leg. In general, the amount of atrophy progressively increases as we recede from the trunk, an exception, however, being noticed in the middle third of both the leg and thigh, which we shall presently notice. In the thigh the proximal atrophy is least in amputation in the upper third, and greatest in amputations in the middle third. In amputations in the lower third of the thigh, the proximal atrophy is slightly less than in those performed in the middle third, but still it is three times as great as after those in the upper third. This fact proves a progressive proximal atrophy as the point of amputations in the thigh recedes from the trunk. In the leg this rule is reversed, and the proximal atrophy diminishes as the point of amputation recedes. And this atrophy diminishes in regular order, being least in amputations in the lower third of the leg.

It must not be supposed that the proximal atrophy is influenced by the amount of inflammatory thickening subsequent to the operation, for in that case the degree of atrophy would in general depend upon the proximity of the amputation to the point of measurement. But this is by no means the case.

Proximal atrophy not increased by inflammation.

Amputations in the middle third of the thigh, near the point of measurement, are followed by a greater amount of atrophy than those in the lower third, remote from that point; while in the leg the largest amount of atrophy is in amputations near, and the least in amputations remote from the point of measurement.

The distal atrophy, or that which occurs at the extremity of the stump, has in the thigh a progressive increase as we proceed from the trunk, being about twice as great in the lower as in upper third. In the leg, on the contrary, the least distal atrophy occurs in the middle third, while that of the lower extremity is not so great compared with that of the upper extremity, as was found existing between the upper and lower thirds of the thigh.

Di-stal  
atrophy in  
thigh and  
leg.

Comparing the atrophy of the stumps in thigh and leg amputations, we notice that the proximal atrophy is greater in amputations in the upper third of the leg than in the same region of the thigh, while in the middle third it is more than twice as great in the thigh as in the leg, and in the lower third the excess of atrophy is greater in the thigh in proportion than in the leg. The distal atrophy varies very markedly as follows, namely: in the upper third it is greater in the leg; in the middle third it is greater in the thigh; and in the lower third it is greater again in the leg.

These facts may be stated in general terms as follows:—

1. In the thigh, the farther amputation is performed from the trunk the greater will be the atrophy of the entire stump.

Conclusions  
in regard to  
atrophy.

2. In the leg, the farther amputation is performed from the trunk the greater will be the atrophy of the extremity of the stump, and the less the atrophy of the body of the stump.

## IX.

### INFLUENCE OF THE METHOD OF AMPUTATION UPON THE ATROPHY OF THE STUMP.

We next proceed to inquire as to the influence of different methods of amputation upon the nourishment of the stump. The following table contains a distribution of the several methods of amputation in the thigh and leg, with a computation of the average amount of atrophy following each:—

Influence of  
method of  
amputation  
upon  
atrophy.

## COMPARATIVE AMOUNT OF ATROPHY OF STUMPS AFTER AMPUTATION BY VARIOUS METHODS IN THE UPPER, MIDDLE, AND LOWER THIRDS OF THE THIGH AND LEG.

*(In inches and fractions of an inch.)*

## THIGH. (Total number of stumps, 157.)

METHOD.	Upper Third.		Middle Third.		Lower Third.	
	Proximal.	Distal.	Proximal.	Distal.	Proximal.	Distal.
Circular . . . . .	0.7	0.7	1.4	1.9	1.6	2.5
Antero-posterior flaps . . . . .	0.2	1.4	1.1	1.6	1.6	2.4
Lateral flaps . . . . .	-	-	1.8	1.8	1.6	2.3
Anterior flap . . . . .	-	-	2.5	2.2	1.3	2.4
Rectangular flap . . . . .	-	-	1.0	0.0	2.0	2.8
Skin flaps and cir. muscles . . . . .	-	-	-	-	0.6	1.5
Posterior flap . . . . .	-	-	-	-	0.7	0.7

## LEG. (Total number of stumps, 287.)

Circular . . . . .	1.1	1.5	1.0	2.3	0.5	2.3
Antero-posterior flaps . . . . .	1.1	1.3	0.4	1.1	0.1	2.7
Posterior flap . . . . .	1.3	1.1	0.5	2.2	1.	2.6
Lateral flaps . . . . .	0.4	2.9	1.0	1.0	0.7	2.6
Skin flaps and circular . . . . .	-	-	-	-	0.5	1.1

This table illustrates in a very striking manner the influence of the various methods of forming the covering of the stump upon the nourishment of its cicatricial tissue. The difference in the amount of atrophy of the distal extremity evidently depends upon the extent to which the arterial supply has been sacrificed. In the thigh the arteries which are distributed to the muscles are principally in the upper third, from the femoral branches immediately below Poupart's ligament, and in the middle and lower third from the profunda.

In the upper third of the thigh, therefore, a circular amputation would divide the branches of the femoral at a higher point than an antero-posterior flap, — in which the posterior flap is usually longer than the anterior, — and hence the atrophy would be greater in a stump formed by a circular than in one formed by an antero-posterior flap. The same rule would apply to these operations in other parts of the thigh, though perhaps not so markedly.

The method of operation by lateral flaps does not differ materially, in respect to the degree of atrophy, from the circular, and the results of the two are seen to be very similar.

The method of operation by making an anterior and a rectangular flap, differs in this important respect from the preceding methods, namely, that the flap is made wholly from Rectangular flap. the anterior part of the limb, while the tissues are completely divided to the bone in a perpendicular direction on the posterior aspect of the limb. By these methods the principal covering of the stump is poorly supplied with nourishment, and hence atrophy would be more likely to occur. This is seen to be the case especially in the anterior flap method in the middle third, and the rectangular flap in the lower third.

The methods which give the least atrophy of the stump, both in its proximal and distal portions, are the skin flaps and Skin flap and circular of muscle. circular of the muscles, and the posterior flap. It is not difficult to understand why the posterior flap method gives results so favorable; it leaves quite intact the full vascular supply to the entire covering of the stump. In this respect it might well be regarded as the best method of operation in the thigh, but these advantages are so counterbalanced by the tendency of the flap to retain pus, its heavy and unsuitable position for transportation, etc., that it has but few advocates. The method by skin flaps and circular of the muscles gives results nearly as favorable as the posterior flap, and much more favorable than any other of the preceding methods. It is greatly preferable to the posterior flap method, both on account of the facility of drainage, and the neat apposition and lightness of the flaps, thus adapting it to transportation.

The influence of the various methods of operation upon the nourishment of the stump is not so well marked in the leg as in the thigh. This is unquestionably due to the peculiarity of the arterial distribution. Effect of various methods in the leg. The larger trunks are numerous, and are deeply situated in immediate relations with the bones. They are not, therefore, liable to division until the operation is about to be completed. There would therefore be but little difference among these operations as regards the vascular supply of the flaps, except so far as the extent of the flap should modify the ultimate distribution of arteries. A long flap would necessarily have less supply than a short flap, and would be more liable to immediate death and future atrophy. Of the different methods it will be noticed that the skin flaps and circular of the muscles gives the least atrophy in the leg as well as in the thigh.

Many of the disastrous results of amputation in the lower extremities have been attributed to immediate transportation. Effect of transportation. To this cause have been referred sloughing of flaps, gaping

of wounds, protrusion of bone, etc. There is, undoubtedly, some truth in this very prevalent opinion, and yet the statement must undergo certain modifications. There were innumerable instances in which men suffering from recent amputations of the lower extremity, had their wounds so imperfectly dressed and supported, were so crowded and confined, and were so rudely transported, that the most unfortunate consequences ensued. But unfavorable results under such circumstances are not justly due to simple transportation, but rather to that want of care in the preparation of the patient, and the conditions surrounding him, which military exigencies necessitate or which are the result of negligence.

There are abundant facts to prove that the transportation of recent amputations, when judiciously managed, is attended with the most happy results. During the long marches of Sherman's army from Atlanta to Savannah, and from the latter place northward, an opportunity was offered of determining the effects of transportation upon recent amputations. As soon as the amputation was performed, and the wound properly dressed, the patient was placed in the ambulance or army wagon, and there remained until the army reached its destination. It is the testimony of surgeons who had the care of these men, that their wounds healed with but little suppuration, sloughing did not occur, and scarcely a case proved fatal. Most of the amputations, made on the first, second, or third day's march, were entirely healed when the army reached Savannah. It should be stated that the army marched through a pleasant country, and with good roads; the men were in good physical and mental condition, and the supply of fresh food of every description was abundant.

The following testimony of surgeons upon the question of the dangers of transportation to the recently amputated is important: —

Surgeon J. C. Walton, 21st Kentucky Vols., says: —

“My observation proves that soldiers laboring under wounds not involving fracture of the long bones, or who have undergone amputation, bear transportation remarkably well, and often express themselves as feeling improved, after being moved several miles over rough roads.”

Surgeon  
Walton.

Surgeon P. H. Bailhache, 14th Illinois Cav., writes: —

“It is surprising with what ease recent cases of amputation bear transportation. I have witnessed little or no bad effects therefrom in some twenty-five or thirty cases.”

Surgeon  
Bailhache.

Surgeon Charles E. Deming, 28th Ohio Vols., says : —

“ In nothing have I been more astonished than the very inconsiderable injurious effects of transportation upon recent amputations of the inferior extremities. I have seen men with amputated thighs, legs, and arms, transported sixty or seventy miles over the roughest of roads, in wagons, without producing any very serious consequences. Care should be taken to keep the stump constantly wet with cold water by an attendant, whose duty it should be to steady the limb when passing over very uneven places.

Surgeon  
Deming.

“ Wagons filled with hay afford the best means of transportation over roads ; ambulances jolt and rock too much.”

Surgeon E. Batwell, 14th Michigan Vols., says : —

“ No point of practice was so difficult to decide as the treatment of gunshot fractures. On one side we had what seemed to be a simple compound fracture, with no great apparent comminution or laceration of the soft tissues, whilst on the other, we had statistical evidence of the fatality arising from endeavoring to save the limb. Out of six cases of compound fracture arising from gunshot wounds, after the battle of Jonesboro', but *one* recovered, and that too under the most favorable circumstances. The transportation to Atlanta was over a level sand road, and the dressing of the wounds was performed by skillful and efficient surgeons, *regularly every day*. Every requisite was furnished to mitigate suffering or to afford comfort, by the Sanitary Commission ; but the result proved that if the limbs had been removed, a very different state of things would have followed ; for out of thirty-five cases of amputation but *four* proved fatal, and two of these were secondary operations. Such success in operation we consider unprecedented, and we feel some just pride at the results gained.

Surgeon  
Batwell.

“ I look on immediate transportation as not productive of half the danger to a patient as if necessity required us to remove them at a later period. The request I would myself make, if I had received a compound fracture from a gunshot wound, would be to have immediate amputation performed.

“ When Sherman swung his army to the south of Atlanta, a man was brought to hospital, and his left leg taken off at the upper third of the thigh, and before he was well out from the influence of chloroform, he was put into an ambulance, and continued to move with the army daily for seven days. He improved rapidly, and his wound was almost united on arriving at Atlanta, and in sixteen days he was sitting up, and in twenty was on crutches.

“ When obliged to move cases of amputation of the lower extremities, I placed the stumps in slings suspended from the top of the ambulance ; by this all jolting was lessened, and the patients could save themselves much agony by holding and raising themselves ; besides, they

could move and change position with far greater facility, and turn on their side without hurting or knocking the stump. I found that in our stationary hospitals this same plan, carried out by a simple frame across the cot, afforded the very greatest ease to our patients, both as regards facility of movement and dressing; besides, the wounds were very easily protected from flies, and the subsequent effects of maggots were thus obviated. You also had a better chance of applying cold water without drenching the bed, or any other application deemed necessary."

Surgeon B. T. Kneeland, — New York Cav., says: —

"My experience in transportation of those who have suffered amputations is limited to army wagons, and I was frequently surprised to witness the improvement of patients when thus removed, often exceeding that of patients confined to hospitals."

Surgeon  
Kneeland.

## X.

### THE INFLUENCE OF DIFFERENT METHODS OF AMPUTATION IN THE SEVERAL REGIONS OF THE THIGH AND LEG, ON THE RAPIDITY OF THE HEALING PROCESS.

There is an opinion very prevalent among surgeons, both in civil and military practice, that there is a marked difference in the rapidity with which amputation-wounds heal, depending upon, 1st, the region in which the operation is performed; and, 2d, the method employed. It is necessary, of course, in estimating this difference, to discriminate carefully the cases selected, and place them upon precisely the same basis as regards their condition. If two operations are compared in this particular, the patients must be equal quantities in every respect, otherwise our conclusion will be vitiated by a preponderance of favorable or unfavorable conditions. Nothing would be more difficult than to select two patients thus equally balanced.

It is quite impossible to determine whether any, and what, differences exist in the healing of these wounds, except as we take the averages of large numbers situated under nearly the same circumstances; and even then our deductions can only approximate the truth. In this collection we are able to group together a large experience in amputations of the lower extremity, and determine in a somewhat definite manner the period of healing of the amputation-wounds. It is true that there are many circumstances incident to the healing of wounds in military surgery, which tend to vitiate our conclusions, such as injurious transportation, insufficient food, sloughing of flaps from gangrene, necrosis, etc., etc. But in grouping together a large number of cases, all

Sources of  
error.

Influence of  
different  
methods of  
amputation  
on healing.

having been subjected to the same untoward influences in a greater or less degree, the average results are rendered in a certain degree truthful.

Amputations are frequently pronounced cured when the wound is not completely closed, the surgeon having reference rather to the safety of the patient and his ability to leave his bed than to the actual condition of the stump. But in the sense in which we are to regard the patient as cured, the condition of the stump alone is to be considered. No stump can, in this connection, be pronounced cured when the wound is not healed, and the cicatrix is not so far perfected as to admit the adaptation of an artificial limb.

In the preceding tables a note is made of two examinations of the stump, the first, when the patient first came under observation, and the second, when the stump was ready for the adjustment of the artificial leg. In regard to the first examination, it should be stated that in general it was made when the surgeon discharged the case as cured, and when the stump was thought to be sufficiently healed for the proper measurements for the artificial limb. In many instances the wound was already completely cicatrized when the patient first presented himself for examination. In such cases the date of the completion of the cure is not stated. This column gives, therefore, merely approximate results. We can learn from it only that within given periods a certain number of stumps were completely cicatrized, and that a certain other number were not healed. The condition of the stump is generally noted, and the causes which led to its non-cicatrization are briefly specified.

In the second column the date of the application of the artificial limb is given. At this period the stump was healed and in a condition suitable for use. This period did not always mark the exact date of the perfection of the cure, as in some instances the stump had been healed for a considerable time. But in general it may be assumed that the date of the adjustment of the artificial limb marks the period of the completion of the cure, and the final discharge of the patient.

The following table contains the results of a computation of the average periods of the healing and non-healing of stumps in various parts of the thigh and leg, and by different methods. Although the deductions are necessarily imperfect and want that scientific accuracy that is desirable, still, considering the large number of cases, they are worthy of record.

AVERAGE PERIODS OF HEALING AND NON-HEALING OF AMPUTATION WOUNDS OF THIGH AND LEG.

REGION AND METHOD.	THIGH.				LEG.			
	Healed.		Not healed.		Healed.		Not healed.	
	No.	Av. No. months.	No.	Av. No. months.	No.	Av. No. months.	No.	Av. No. months.
<b>UPPER THIRD.</b>								
Antero-posterior flaps . . . . .	1	7	3	8 $\frac{1}{3}$	14	11 $\frac{1}{4}$	9	9 $\frac{1}{3}$
Circular . . . . .	4	11	1	8	25	11 $\frac{1}{2}$	5	7 $\frac{1}{2}$
Posterior flap . . . . .	-	-	-	-	9	10 $\frac{1}{9}$	5	10 $\frac{1}{9}$
<b>UPPER AND MIDDLE THIRD.</b>								
Antero-posterior flaps . . . . .	6	9 $\frac{2}{3}$	6	10	11	11 $\frac{1}{11}$	-	-
Circular . . . . .	11	9 $\frac{7}{8}$	2	8	15	10	2	6 $\frac{1}{2}$
Posterior flap . . . . .	-	-	-	-	9	9 $\frac{2}{9}$	5	10
<b>MIDDLE THIRD.</b>								
Antero-posterior flaps . . . . .	15	9 $\frac{5}{4}$	11	11 $\frac{2}{11}$	6	9 $\frac{1}{6}$	1	10
Circular . . . . .	9	9	4	9 $\frac{1}{4}$	9	10 $\frac{8}{9}$	-	-
Posterior flap . . . . .	-	-	-	-	7	10 $\frac{7}{7}$	-	-
<b>MIDDLE AND LOWER THIRD.</b>								
Antero-posterior flaps . . . . .	12	11 $\frac{1}{3}$	14	9 $\frac{7}{8}$	14	10 $\frac{1}{7}$	3	10 $\frac{2}{3}$
Circular . . . . .	9	9 $\frac{7}{9}$	5	12 $\frac{2}{5}$	19	13 $\frac{1}{19}$	7	12 $\frac{7}{7}$
Posterior flap . . . . .	-	-	-	-	3	10 $\frac{3}{3}$	-	-
<b>LOWER THIRD.</b>								
Antero-posterior flaps . . . . .	22	9	4	10 $\frac{1}{2}$	22	9 $\frac{1}{2}$	4	10 $\frac{1}{4}$
Circular . . . . .	9	11 $\frac{8}{9}$	1	13	18	11 $\frac{1}{6}$	6	13 $\frac{1}{2}$
Posterior flap . . . . .	-	-	-	-	2	13	-	-

In regard to retracted flaps, so frequently noticed, Surgeon Hodgen makes some practical observations.

He states that he "has observed a great number of cases of retracted flaps, following almost every variety of amputation, and given the subject some study. Most of them having been transported in ambulances, army wagons, railroad cars, and steamboats, were so often disturbed that there was little chance for a speedy union, and every possible facility offered for retraction of the soft parts, and the protrusion of bones. Amputations are performed during anæsthesia. The muscular tissue, which forms a larger part than any other element of the covering of the bones after amputation, is completely relaxed, and the dressing is

Surgeon  
Hodgen on  
treatment of  
retracted  
flaps.

performed before the anæsthetic influence passes off; and when it does pass off, the muscles, resuming their original tonicity and irritability, contract, thus retracting the flaps, and either forcing the bone between the flaps or so firmly against them that ulceration rapidly follows, and the bone protrudes. Another cause is the manner of dressing stumps; thus, strips of adhesive plaster are heated and applied, one end on one surface of the limb, and the flap is drawn by this strip, which is carried firmly over the end of the stump, and the remaining end fixed tightly to the highest possible point upon the opposite surface of the limb, and so on, one after another, until a sufficient number of strips is applied to hold the lips of the wound together. It is apparent to any thinking man that these freshly cut surfaces are pressed tightly against the bone, and this is favorable to ulceration. Perhaps, the most frequent cause of protruding bones is careless handling in applying dressings after the first dressing. The surgeon observes a limb requires dressing, for the bandages are saturated with pus. The bandages are removed, and perhaps also the adhesive strips, without having the parts properly supported by a competent assistant, so that newly formed attachments are broken up and the flaps fall asunder, allowing the bones to protrude." He recommends a method of treatment which he has followed with success, namely, extension of the retracting flaps by adhesive strips with a weight.

His rule is — when flaps are to unite by granulation, apply extension; when the bones protrude, apply extension; and when the cicatrix is tense and firm and slow to heal, apply extension. Never saw off protruding bones in these cases.

## XI.

### ADAPTATION OF COMPENSATIVE APPLIANCES.

In the adaptation of an artificial limb to the stump we have the final results of amputation in the lower extremity. Second only in importance to the life of the individual is the value of the stump for compensative appliances. The great aim of the surgeon now is, when the first question is answered and the safety of the patient is duly considered, at what point and by what method shall amputation be performed to secure a stump most favorable to the application of the best form of artificial limb. We have no longer the rich and poor man's stump; these artificial aids are now brought within the means of every man; the poorest soldier and sailor, through the wise munificence of government,



AMPUTATIONS  
AT THE  
ANKLE JOINT IN MILITARY SURGERY.

BY  
STEPHEN SMITH, M. D.



## AMPUTATIONS AT THE ANKLE JOINT.

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AMPUTATION at the ankle joint seems to have been a comparatively infrequent operation during the late war. In a total of 9,705 amputations, but 67 ankle-joint amputations have as yet been fully ascertained at the Surgeon-General's office. The record is, however, stated to be far from complete. Whatever may prove to be the total number of these operations, we are satisfied that ankle-joint amputations, by any of the recognized methods, were not regarded with favor by the surgeons of either the Federal or insurgent armies, at the close of the war. On a very extensive personal inquiry of army surgeons of large experience, there was found to be great unanimity of opinion in the total rejection of these operations from military surgery.

At the commencement of the war, amputation at the ankle joint was considered a legitimate procedure in civil practice. In some one of the several methods of operation it was almost universally regarded not only as free from danger as any amputation in that vicinity, but as yielding admirable results as respects the future usefulness of the limb. So much importance was attached to this amputation at that time that one of the oldest and most experienced army surgeons, C. S. Tripler, instructed the surgeons of the division of the army of which he was then medical director (the Army of the Potomac), to amputate at the ankle joint by Pirogoff's method in preference to amputation through the leg, when practicable.<sup>1</sup>

The objections of army surgeons to ankle-joint amputations are various. In the experience of some, sloughing of the flap is the chief source of mischief; others allege that extensive suppuration, or necrosis, generally follow, necessitating reamputation; while a few did not regard the stump as the most serviceable, and rejected it without trial. Considering the importance which civil surgeons generally attach to these operations, both on account of their comparative safety and the value of the stump for future usefulness, it becomes a matter of considerable

Frequency  
of the operation.

Its estimate  
in civil  
practice.

Objections to  
this operation.

<sup>1</sup> Consult Tripler's order.

importance to determine on what grounds the unfavorable opinion of army surgeons is based, and what should be the status of ankle-joint amputations in military surgery.

It must be observed, *in limine*, that amputation at the ankle joint is always an alternative operation. It is selected in preference to an amputation at a point higher up in the limb. It should also be added that it is an operation of expediency. It is not a dernier ressort. If it fails of success the surgeon may still, with rare exceptions, perform the alternative amputation through the leg with the prospect of as favorable results as when the latter is the first operation.

In determining the value of ankle-joint amputations, therefore, the following questions naturally arise for our consideration: —

I. The comparative success of this amputation.

(a.) As regards mortality.

(b.) As regards the necessity of reamputation.

(c.) As regards the comparative frequency of sloughing, necrosis, etc.

II. The comparative serviceableness of the resulting stump.

(a.) As regards the ability for unaided locomotion.

(b.) As regards the adaptation of the stump for an artificial limb.

## I.

### COMPARATIVE SUCCESS OF ANKLE-JOINT AMPUTATIONS.

(a.) *Comparative Mortality.* — From the Surgeon-General's Report<sup>1</sup> we learn that in a total of 67 amputations at the ankle joint, 9 proved fatal, and 58 recovered. This statement gives a mortality in this operation of 13.43 per cent. From the same source it appears that in 2,348 amputations of the leg, 611 proved fatal, and 1,737 recovered, being a mortality of 26.02 per cent. Again, the total amputations of the lower extremities, including the toes, partial amputations of the foot, etc., were 5,058, as reported to the Surgeon-General, and of this number 34.55 per cent. proved fatal.

The results of amputation in the British army during the Crimean war do not differ materially from those given above. Amputation at the ankle joint proved fatal in about 18 per cent. of the cases operated upon, while amputations of the leg gave a mortality of 36 per cent.<sup>2</sup>

<sup>1</sup> Circular No. 6, Surgeon-General's office.

<sup>2</sup> *Medical and Surgical History of the British Army, etc.*

The surgical records of the insurgent armies furnish some collateral evidence. A consolidated table of amputations from June 1, 1862, to February 1, 1864, is published,<sup>1</sup> from which it appears that ankle-joint amputations were fatal in 20 per cent., and amputations of the leg were fatal in 27 per cent. of the cases operated upon.

From these statistics it appears that amputation at the ankle joint is 50 per cent. less fatal than the alternative amputation through the leg. Compared with the mortality after the total amputations of the lower extremity, including the most trivial, it is but a little more than one third as fatal. If we were to decide the merits of this operation, then, by its comparative fatality, or by the dangers to life which it involves, we should give it the preference, unhesitatingly, over all other forms of amputation of the leg.

But the absolute value of an amputation cannot be decided alone by its mortality. We have to consider, also, —

(b.) *The Comparative Frequency of Reamputation after Amputations at the Ankle Joint.* — It is difficult to determine with any considerable degree of accuracy the frequency of reamputation in any given class of cases. We are able, however, to arrive at approximative results, which indicate very clearly how in general the question is to be decided. In 31 cases of ankle-joint amputation, 4 required reamputation, or about 12.9 per cent.; in 65 amputations of the lower third of the leg, reamputation was required 6 times, or in about 9.2 per cent. of the cases.

Comparative  
frequency of  
reamputa-  
tion.

It is evident from these facts that reamputation after ankle-joint amputations was more frequent than after amputations in the leg. In examining as to the causes which led to reamputation we find that in ankle-joint amputations it was performed once on account of retraction of the flaps, and three times on account of sloughing and necrosis. In amputations in the lower third of the leg reamputation was practiced five times on account of sloughing and necrosis; one case cause unknown.

(c.) *Comparative Frequency of Sloughing and Necrosis.* — Sloughing of the flap after Syme's amputation, and necrosis of the adapted portion of the calcaneum after Pirogoff's amputation, are alleged to be the chief sources of failure after ankle-joint amputations. The following collection of cases gives a total of 23 ankle-joint amputations by Syme's method, and

Frequency  
of sloughing  
and necro-  
sis.

<sup>1</sup> *A Manual of Military Surgery, etc.*, by J. Julian Chisholm, M. D., third edition, Columbia, S. C., 1864.

10 by Pirogoff's method. Of the 23 cases of Syme's amputation, 4 are reported to have been followed by sloughing of the flaps, and 3 by necrosis. In other words, 7 in 23 cases were followed by sloughing and necrosis, or 30.4 per cent. Of the 10 cases of Pirogoff's amputation, 2 are reported to have been followed by necrosis, in one case the os calcis necrosed, and in one the posterior part of the lower extremity of the tibia was involved. It is noticeable that in two cases of sloughing after Syme's operation the stumps healed and ultimately became serviceable.

It cannot be alleged, however, that the comparative difference between these two operations is sufficient to decide the question as to the point of election. If ankle-joint amputations present any very considerable advantages in other respects over leg amputations, no prudent surgeon would regard this slightly greater liability to sloughing and necrosis as a sufficient reason why he should be deterred from selecting the former.

Before determining the question, we must consider the comparative value of the stumps resulting from these different operations:—

## II.

### COMPARATIVE SERVICEABLENESS OF THE RESULTING STUMP.

(a.) *As regards Locomotion.*—Ankle-joint amputations differ from amputations in the leg in this essential particular, Serviceable-  
ness of  
stump. namely: in the former the support is taken directly upon the extremity of the stump, and in the latter upon the sides of the limb. In model stumps of each class it will be found that the one which takes direct support upon the extremity is not only capable of enduring a much larger degree of service, but the person suffers far less inconvenience. Direct pressure upon the heel flap may be endured as long in Syme's stump as similar pressure upon the natural heel. And the same is true of stumps following Pirogoff's method. Patients with these stumps have frequently been known to walk successive days twenty and thirty miles with only the simple covering or protection of the heel of a common shoe or boot. Mr. Syme stated in a clinical lecture that "Patients who had suffered the operation, were able to stand, walk, and even run, without any covering or protection of the stump; and a gentleman present, having had his attention accidentally directed, a few days before, to some boys who were amusing themselves on a slide in the street, discovered that one of them had undergone amputation at the ankle joint." Professor Van Buren, of New York,

recently met at his clinic the third person on whom Mr. Syme performed this operation, sixteen years before, who stated that he had walked thirty miles in a day without inconvenience from his stump. These are by no means exceptional cases. Surgeons who have been accustomed to meet with the results of this operation most frequently, uniformly testify to the ease with which patients betake themselves to the stump with only such covering as they can rudely adjust. Of the stumps left by Syme's and Pirogoff's operation, the latter has the greater length, and thus requires less compensation.

Amputations through the leg, at whatever point, and however skillfully performed, never furnish stumps which take direct support. The limb is useless for locomotion by any simple means of compensation; it is only when an artificial limb is accurately and skillfully adjusted that it serves the purpose of even simple progression.

Amputation of leg does not give direct support.

Again, in amputation at the ankle joint the patient retains power over the muscles of the calf which are essential to the act of running. It is extremely rare that a patient who has suffered amputation of the leg can make even the pretense of running upon his artificial limb. The muscles, especially of the calf, have shrunk from disuse, and progressive, permanent atrophy of the parts below the knee ensues. In ankle-joint amputations, however, the tendons of all the muscles employed in locomotion retain their former, or acquire new attachments, and are immediately and constantly exercised in the movements of the limb. It is true this movement of the muscles is more limited than in the normal limb, but it is nevertheless sufficiently great to preserve much of their activity, and consequently their nutrition is but partially impaired. The importance of preserving the functions of the muscles of the leg is seen in the perfection of gait which persons with ankle-joint amputations soon acquire. They can not only run, often with great ease and facility, but they acquire the power of leaping, dancing, etc., to such perfection that their disability frequently passes unrecognized.

Patient has power over muscles of calf in ankle-joint amputations.

(b.) *As regards the Adaptation of the Stump for an Artificial Limb.* — As previously stated, the stump after ankle-joint amputation takes direct support upon the extremity. Mr. Quain thus speaks of the advantages of direct support, in referring to Syme's amputation: "It is free from any valid objection, and, what is more important, the result in practice has been found to be good. A person who has undergone this opera-

Adaptation of stump for an artificial limb.

tion is enabled to bear his whole weight upon the end of the stump without inconvenience ; and on this account the facility of progression is, with a proper apparatus, decidedly greater than when the amputation is performed at any higher part of the limb.”

The advantages of the ankle-joint stump over those of the leg for the adaptation of an artificial limb, are admitted by the most competent mechanical surgeons to be of the most undoubted character. In Syme's amputation the patient walks upon the end of the stump with ease and grace, can run, leap, and dance, and is capable of enduring fatigue little short of that of the sound limb. We speak now of successful cases. No results at all comparable with this are attainable with any form of stump above the ankle.

This review of the comparative merits of ankle-joint and leg amputations as exhibited by statistical evidence authorizes the following conclusions : —

1. Ankle-joint amputations are fifty per cent. less fatal than leg amputations.
2. Ankle-joint amputations are three per cent. more liable to be followed by reamputation than leg amputations.
3. The stumps left after ankle-joint amputations are far more serviceable than those resulting from leg amputation for unassisted locomotion.
4. An artificial limb can be far more usefully applied to an ankle-joint than to a leg stump.

It may be stated in general terms that the experience of the late war has established the fact that ankle-joint amputations are less fatal than leg amputations, but that sloughing and necrosis are more likely to occur in the former than in the latter ; that the resulting stump in ankle-joint amputations is much more favorable for unaided or aided progression than in leg amputations. The correct inference from these conclusions is that ankle-joint amputations should be recognized as occupying an important place among the legitimate operations of military surgery.

It remains to consider the causes of failure in ankle-joint amputations as illustrated in this collection of cases, the remedial measures adapted to prevent or mitigate such causes, and, finally, the comparative value of the methods of operation proposed by Syme and Pirogoff.

## CAUSES OF FAILURE IN ANKLE-JOINT AMPUTATIONS.

The striking difference in the success of ankle-joint amputations in civil practice from that in military practice, depends upon causes not difficult to determine and appreciate.

Surgeon David P. Smith, United States Vols., who has had a large experience, and is a warm advocate of the operation, says : —

“When done in our army for gunshot wound, the results have not, by any means, been uniformly successful. It appears, however, that the failures can hardly with justice be attributed to the form of operation. From much conversation with army surgeons upon this topic, and from no inconsiderable personal experience, it is believed, first, that the operations have been generally too long delayed, and at last done when, from the undermining of tissues by the burrowing of pus, there could be no reasonable hope of success; and, secondly, that the manual performance was faulty in the extreme.”

Surgeon  
David P.  
Smith on  
causes of  
failure.

He illustrates the failure of the operation from the first cause by his own experience : —

“The four cases of ankle-joint amputation occurring at Fairfax Seminary General Hospital, were performed upon wounded removed at a late date from the disastrous field of the second Bull Run battle, where they had undergone much privation and hardship. The tissues were undermined with pus. Had I not witnessed Mr. Syme’s own practice, and heard him detail his experience of constant success under the most adverse circumstances, I should have preferred amputation in the continuity of the leg in these cases, so great was the suppuration about the ankle above the point of section. Mr. Syme’s procedure was strictly followed in all four cases.

“One recovered, and left the hospital with a good firm stump.

“One, apparently the most suitable of all for this operative procedure, succumbed to pyæmia. In this case no section of bone was made, even the malleoli being suffered to remain.

“Two, on account of sloughing of flap and protrusion of bone, were obliged to submit to amputation of the leg.”

The various causes of failure of this operation may be considered under the following heads : —

I. SLOUGHING OF THE FLAPS. — In the early history of ankle-joint amputations, especially by the method of Syme, sloughing of the flaps was a frequent accident. Many surgeons were led to discard the operation altogether after repeated failures from this complication. Experience proves, however, that

sloughing of  
flaps.

sloughing cannot be regarded as a necessary or even a frequent result of this operation. It occurred but four times in twenty-three cases as we have already shown.

There are apparently two principal causes of sloughing of the flaps, namely: (a.) *Contusion of the soft parts entering into the flaps*; (b.) *Destruction of the nutritious arteries of the flap in the operation.*

(a.) *Contusion of the Soft Parts.* — It not unfrequently happens that in the accident that caused the injury for which amputation is performed, there is a much larger destruction of the soft parts than at first appears. Especially is this true of railroad injuries, gunshot wounds, etc. The sudden and terrible violence of the impinging body not only destroys the vitality of the part which it encounters by direct contact, but the same destructive effects are manifested in contiguous tissues after several days over a surface often surprisingly extensive. And this deception is rendered the more complete by the apparent accuracy with which we may at first limit the destroyed parts. The line of demarcation seems well defined by the discoloration which borders the upper limit of the lesion of tissues. But within a day or two the fallacy of this observation becomes unpleasantly apparent. Parts that at first were believed to be uninjured become cold, the purple discoloration of incipient gangrene extends, and the slough that forms proves that the skin and subjacent tissues were devitalized by the shock far beyond the bounds that had been set.

Hence, it not unfrequently happens that the surgeon called to perform an immediate amputation after railroad and gunshot injuries, of the severe class, is deceived as to the extent of the actual destruction of the vitality of the soft parts, and, in his anxiety to save as much of the limb as possible, makes the whole or considerable portions of the flaps of tissues which are already destroyed and must slough. This result is often seen in civil practice after severe railroad injuries, and the same is true of military practice, especially where the injury has been inflicted by a missile of large size, as a cannon-ball, grape-shot, etc.

In no part of the lower extremity are we as liable to meet with this accident as at the heel. The crushing of the foot by railroad cars, or by missiles used in war, not unfrequently impairs the vitality of the soft parts about the heel and ankle to such a degree, that when they are subjected to the necessary bruising of an amputation, sloughing to a given extent ensues.

It is evidently no fault of the operation that in such a case sloughing of the flap occurs. Sloughing doubtless to the same extent would follow any form of amputation which involved tissues similarly injured. The error is in the judgment of the surgeon; amputation should have been originally performed where it was subsequently. But this error is not always reprehensible, for the most experienced and judicious surgeon cannot foresee always the extent of the injury. Where there is a rational doubt, the facts embodied in this paper will, we think, authorize the operator to decide in favor of ankle-joint amputation, as in general preferable to leg amputation, and holding the latter in reserve.

There is a practical point, illustrated by this collection of cases, bearing upon the question of amputation when the soft parts about the heel have suffered severe contusion and laceration, which deserves the most serious consideration. If the tissues of the heel have been destroyed, the surgeon should not at once decide that this precludes amputation at the ankle joint, Possibility of saving flaps. as might be inferred from the preceding remarks. Important as are the tissues of the heel for the covering of the stump where it is to take direct pressure, it is nevertheless true that the tissues of the sides of the ankle and the dorsum of the foot will soon become sufficiently dense to bear readily the weight of the body. If therefore the operator is convinced that on general principles an ankle-joint amputation is preferable to a leg amputation, he should consider well before he rejects the former, if it is not possible to secure sufficient flap tissue around the ankle.

The following case illustrates this point: —

CASE I. *Wound of the Ankle by the Fragment of a Shell; Extensive Destruction of the Soft Parts; Amputation by Lateral Flaps; Sloughing; Final Cicatrization and a Useful Stump.* — C. D. was wounded June 24, 1864, by the fragment of a shell, which struck the sole of the foot just anterior to the heel, lacerating the soft parts extensively, and injuring the tarsal and metatarsal bones. He was removed to the Mower U. S. General Hospital, where amputation was performed on the third day by Acting Assistant-Surgeon W. P. Moon. Owing to the laceration of the soft parts, a complete posterior flap could not be made from the heel. Flaps were, therefore, dissected from the sides of the ankle and foot, and particularly from the sole on the external part. Extensive destruction of soft parts; lateral flaps.

For a few days the case progressed favorably; sloughing then occurred to a small extent, and finally a small fragment of bone separated; abscesses also formed, one being of considerable size. The

wound at length completely cicatrized, and the stump assumed a good shape, though it was somewhat tender.

CASE II. *Wound of the Ankle Joint by a Spiral Case-shot; Destruction of the Heel; Formation of Lateral Flaps; Recovery with a Useful Limb.* — A. L. T., private, 20th Regiment Massachusetts Vols., was wounded at Fredericksburg, Va., May 2, 1863, by a spiral <sup>Lateral flaps.</sup> case-shot which passed through the ankle joint, destroying the articulation and the soft parts about the heel. Amputation was performed about four hours after the receipt of the injury. Notwithstanding the destruction of the heel, it was decided to amputate at the ankle joint, and make the flaps from such uninjured tissues in the neighborhood as could be brought to cover the stump. A sufficient amount of tissue was accordingly dissected from the lateral parts of the ankle to cover the stump, and disarticulation was performed. With the exception of several abscesses which formed from time to time, the wound progressed favorably, and at the end of three months cicatrization was complete, and he could bear his weight upon the stump. The only unpleasant sensation experienced was a prickling. At the end of five months an artificial limb was applied by Hudson, of New York, which enabled him to walk "with ease and comfort."

CASE III. *Extensive Laceration of the Tissues of Foot and Heel by Fragment of a Shell; Amputation at Ankle Joint with Lateral Flaps; Recovery with a Useful Limb.* — H. H. C., private, 100th Regiment New York Vols., was wounded at Drury's Bluff, Va., in May, <sup>Lateral flaps</sup> 1864, by the fragment of a shell striking the left foot. The soft parts of the foot and heel were so extensively lacerated as to preclude the formation of a flap from the heel, if amputation were performed at the ankle joint. It was, therefore, determined to amputate at the ankle joint, with flaps formed from the sides of the ankle.

The operation was performed by Surgeon Kettinger, United States Army, and flaps were made from the lateral aspects of the ankle. The case progressed favorably, although the patient suffered at the same time an amputation of the other foot by Chopart's method. The cicatrix became firm and healthy, and the patient could bear his weight upon it with comparative ease. An artificial limb was subsequently applied by Hudson, of New York, with the most satisfactory results.

Equally good results may be obtained by taking the principal flap from the dorsum of the foot, as is seen in the following case: —

CASE IV. *Amputation of the Ankle Joint for an Old Railroad Injury; Principal Flap taken from the Dorsum of the Foot on Account of Ulceration of the Tissues of the Heel; Sloughing of the Extremity of the Flap; Final Cicatrization of Wound; Useful Stump.* — This case was

treated in Bellevue Hospital, and the history is taken from its records: "B. T. K. — Regiment New York Vols., was admitted to Bellevue Hospital in March, 1864. About two years before, his left foot was caught under a rail-car wheel and severely crushed. He had on the foot a very stout boot, with an unusually thick and firm sole, which saved it from being entirely destroyed. The wheel traversed the foot from the heel to the toes, passing diagonally along the dorsum from the external malleolus to the great toe, fracturing the tarsal, metatarsal, and phalangeal bones in its course. An attempt was made to save the foot. Suppuration was established throughout the foot, with sloughing of the contused integument. Fragments of bone were removed, involving the tarsal and metatarsal bones, but the wound both on the dorsum and palmar surfaces finally completely cicatrized, and he was discharged.

Flap from  
dorsum of  
foot.

"On entering Bellevue Hospital, about two years from the time of the injury, the foot was so completely crippled that he was unable to walk except with crutches. It was so twisted upon itself by the cicatrix on the sole as to assume the position of a talipes varus. An ulcer existed upon the heel, and the tissues of this region were for the most part cicatricial. The cicatrix upon the dorsum was not very firm or adherent, except over the metacarpal bone of the great toe.

"Amputation at the ankle joint by any of the ordinary methods was impossible; but it was determined to make the flap from the dorsum, and take the risk of sloughing in the line of the cicatrix. The operation was performed by Dr. Stephen Smith. A sufficient flap was readily secured, which, turned backward, effectually covered the whole surface of the stump. As was feared, the extremity of the flap where the cicatrix was most dense, sloughed off, but the remainder rapidly united. The stump was moulded by adhesive strips, and assumed a very fine appearance. The patient left the hospital able to walk with comparative ease."

The following case illustrates still more strikingly the value of an ankle-joint amputation:—

CASE V. *Bony Anchylosis of Tarsal and Ankle Joints; Extreme Thickening and Degeneration of Soft Parts; Sloughing of a Portion of Anterior Flap; Successful Moulding of the Stump by Adhesive Strips; Recovery with a Well-formed and Useful Stump.* — The following history is taken from the records of Bellevue Hospital, where the case was treated: Patrick Connelly, corporal, 70th Regiment New York Vols., was wounded at Bristow's Station, Va., August 29th, 1862, by a minie-ball. The point of entrance was the posterior part of the left heel, and it was removed from beneath the integument on the dorsal face of the tarsus, having completely traversed the tarsal bones. The limb was at first condemned to immediate amputation, but subse-

Moulding of  
stumps by  
adhesive  
strips.

quently efforts were made to save it. Suppuration soon became established throughout the tarsus, the foot, and ankle; sinuses formed in various directions, and portions of bones from time to time escaped from the various sinuses.

At the end of a year the inflammation had so far subsided that he was able to walk about on crutches. He obtained his discharge from the army, and returned to his business of a mechanic. He was able at length to bear considerable weight upon the foot, but he was finally obliged to seek more permanent relief.

On entering the hospital his foot was a large, shapeless mass, the swelling and puriform appearance extending from above the ankle to the toes. On the posterior part of the heel was the depressed cicatrix of entrance, and upon the centre of the tarsal region in front was the open extremity of a sinus which corresponded with the point of exit. There was no apparent motion at the ankle or tarsal joints. A probe passed into the sinus came in contact with uncovered bone. His general health was good.

A consultation decided in favor of amputation of the leg. The question of amputation at the ankle joint was discussed, but the soft parts were so thickened and unhealthy, that it was believed that an operation which involved such tissues would necessarily prove a failure.

Subsequently Dr. Stephen Smith amputated at the ankle joint. On incising the soft parts, they were found of the consistence and appearance of fat pork, and so thick and dense that it was impossible to turn the flaps back for the purposes of dissection. The ankle joint being fixed by bony ankylosis, it was sawn through. So thick and unyielding were the flaps, that it was found impossible to unite them, and they were left unadjusted. On the following day a slough began to form around the old sinus, which finally involved two square inches of surface. It was very soon noticeable that the infiltrated tissue began to soften and disappear, melt down apparently, and the flaps became more thin and pliable. Adhesive strips, cut very narrow, were now applied very accurately to the flaps, and the stump rapidly took a round and symmetrical form. Owing to the sloughing, a large cicatrix remained drawn somewhat across the face of the stump. This cicatrix was slow in healing, scabs forming of large size. He experienced considerable inconvenience for a time from this unhealed junction of flaps, but at length the cicatrix was perfectly formed, and he walked with ease with the heel of a boot for his support.

Dr. E. D. Hudson, of New York, applied an artificial limb to the stump, which eventually served him perfectly. He continued under observation for several months, as gate keeper at the hospital, and always expressed himself as able to do his duties with little or no inconvenience from the stump.

(b.) *Destruction of the Nutritious Artery of the Flap during the Operation.* — Mr. Syme remarks upon this cause of failure: “That the flap may and probably will still occasionally slough, is unhappily too true; but that this result is always owing to an error in the mode of performance, I think does not admit of any question. For as the integument, being detached from its subjacent connections, can derive nourishment only from the anastomosing vessels, it is evident that if scored crossways, instead of being separated by cutting parallel to the surface, the flap must lose its vitality.” In his early practice of Syme’s operation, Mr. Ferguson, of London, committed the error above alluded to, and so frequently did he meet with sloughing of the flaps that he rejected the operation altogether. Subsequently, however, he became one of its strongest advocates, stating: “In so far as I can judge, it is one of the greatest improvements in modern surgery as regards the subject of amputations.”

Destruction of nutritious arteries in operation.

That there is great danger of wounding the posterior tibial artery in making the principal dissection from above downward, and from before backwards, is a demonstrable fact, and there is no doubt that it is one source of failure of this operation. While we are not able to determine how frequently this accident happens, we know that among army surgeons the erroneous method of operation alluded to by Mr. Syme was occasionally practiced. We feel authorized, therefore, to attribute to this cause a certain percentage of the failures of ankle-joint amputations from sloughing of the flaps.

II. NECROSIS. — It cannot be seriously alleged against Syme’s amputation that the small amount of necrosis which occasionally results to the extremity of the tibia or fibula is a valid objection to its performance. It is stated to have occurred four times in twenty-three cases, and in three of these the necrosis does not seem to have interfered with the final success of the case; one was still under observation. It is extremely rare that the necrosis is of any considerable extent, or so complicates the recovery as to necessitate reamputation.

Necrosis in Syme’s amputation.

The opponents of Pirogoff’s amputation urge the dangers of necrosis with great pertinacity, although experience decidedly disproves the correctness of their logic. Theoretically the argument is strong and almost conclusive against the operation. It is essentially a resection of bones with an attempt to obtain union by placing the fragments in simple contact. It

Necrosis after Pirogoff’s amputation.

cannot be denied that the section of the calcaneum does occasionally undergo necrosis, and finally separates from the flap, but it must now be considered a rare accident, and dependent rather upon the imprudence of the operator in his effort to excise the bone, than upon any intrinsic fault of the method itself. Pirogoff remarks : —

“ Notwithstanding the suppuration and considerable gravitation of pus into the flap in the third case ; notwithstanding the softness and fatty degeneration of the os calcis, which could be cut with the knife, in the second case ; and lastly, notwithstanding the bleeding fungous excrescences which formed on the bones, also in the second case ; still the remains of the os calcis united firmly with the tibia and fibula. Lastly, one of the cases, the third, proves that the exarticulation at the ankle joint after my method — at least in children and young people — may be undertaken even in cases of diseased ankle joint, provided disorganization has not extended too far over the soft parts about the articulation. In the boy in the second case, I found pus in the capsule during the operation, the cartilages softened and decayed, the ends of the bones also softened and in a state of fatty degeneration, yet the result was most successful.”

Mr. Busk, of London, says : —

“ Some have feared that the section left of the calcaneum would not readily unite with the extremity of the tibia ; but this fear is groundless. In the last operation performed by Mr. Tudor, union was found to be quite firm on the twelfth day. . . . In my first case the man could support his whole weight on the stump within a fortnight.”

Mr. Croft, of the *Dreadnought* hospital ship, London, gives the experience of the surgeons of that ship in six cases, as follows : —

“ Six times the operation has been performed, and in four instances with most perfect success ; but in the two remaining death removed the subjects of operation before cure was completed — in the first instance by granular disease of the kidneys, and in the second instance by secondary deposits of pus in various joints. In two of the six cases in which cure was completed, the operation was performed for the removal of scrofulous disease of the articulation between the tarsal bones, and in the two others the operation was for frost-bite of the anterior part of the foot. Progress towards health was marked by suppuration along the tendons of the tibialis anticus and posticus, and the peroneal tendons in each of the cases, but not by exfoliation of bone. The posterior part of the os calcis was united firmly with the

tibia, generally in about three weeks ; but in one instance — the last in which the operation was performed — union was good at the end of twelve days.”

He thus expresses his confidence in the union of the bones under the most unfavorable conditions : —

“ Although the os calcis may be diseased at and about its articulation in instances of scrofulous disease of the joints of the tarsus, it is rarely that the posterior part is rendered too unhealthy to be made use of in the formation of a stump.”

Hewson, of Philadelphia,<sup>1</sup> has operated five times, and makes the following comments, bearing upon the question of necrosis of the os calcis : —

“ In all a cure followed rapidly. In two especially, the result was least to be expected. These were the adults, one of whom was a seaman advanced in years, and who had been leading an exceedingly intemperate life ; and the other a soldier, who had been wounded in a battle after long and tedious marching in pursuit of the enemy, and who was operated on four weeks after receiving his wound, in a military hospital where gangrene was prevailing to a very great extent at the time. How much the firm and speedy union of the bones in all these cases was the result of the expedient resorted to, namely, the strip of adhesive plaster and the weight, to prevent the contraction of the muscles attached to the tendo Achillis, is a question which we are not prepared to answer. The possibility of such a union not taking place, has been the only theoretical objection apparently of any importance advanced against the operation. But how far such an objection has been realized in the experience of others we have not been able to ascertain. Our own experience certainly points to its being of little, if any, value. For surely there could not be found two more unpromising cases for any operation than those of the adults here reported, and it is against the operation in adults especially that this objection would seem to have greatest force. The very perfect character of the union which took place between the bones in Bowers' case, as is to be seen in the specimen which we had the good fortune to obtain after his death, furnishes as strong a refutation as a single instance could of this theoretical objection.”

Of the ten cases of amputation at the ankle joint by Pirogoff's method, reported in the following tables, but one was attended with necrosis of sufficient amount to necessitate reamputation.

<sup>1</sup> The *American Journal of Medical Sciences*, July, 1864.

The patient was a Confederate soldier, and the case is reported by James M. Holloway, M. D., Professor of Anatomy, Louisville, Ky.<sup>1</sup>

CASE VI. *Pirogoff's Amputation at the Ankle Joint; Necrosis of the Section of the Os Calcis and of the Tibia; Reamputation of Leg.*—

Reamputation for necrosis in Pirogoff's amputation. A. B., soldier, was wounded at Chattanooga, Tenn., in 1863. Amputation at the ankle joint by Pirogoff's method was performed a few days after the injury. The reporter first saw the case in January, 1864. The flaps had united, but a number of sinuses communicated with the coaptated surfaces of the os calcis and tibia, at the bottom of which denuded bone could be felt upon the introduction of the probe. In addition to these, other sinuses situated on the lateral aspects of the lower third of the leg, communicated with the sheaths of the tendons. These latter, so far as could be learned from the patient, appeared subsequently to those leading to the carious bones. The integuments overlying and adjacent to the diseased bone and inflamed sheaths of tendons, presented a remarkably healthy appearance; so much so that the true condition of the stump did not transpire until a more thorough examination was made, while the patient was under the influence of chloroform. Such was the complete disintegration of the os calcis and the end of the tibia that amputation of the leg was found to be necessary.

The following cases illustrate most forcibly the fact that the segment of the os calcis will become united to the tibia under the most unfavorable circumstances:—

CASE VII. *Wound of the Ankle Joint; Pirogoff's Amputation; Feeble Condition of Patient; Attack of Erysipelas; Symptoms of Pyæmia; Convalescence; Recovery with a Useful Limb.*<sup>2</sup>—Lieutenant W. C. W.,

The bone will unite under most unfavorable conditions. Co. I, 5th Michigan Cav., was wounded April 1st, 1865, at the battle of Five Forks, by a conoidal musket-ball, which passed through his left ankle joint. He was immediately carried to the hospital at City Point, and amputation at the ankle was performed on the same day by Surgeon St. Clair, 5th Michigan Cavalry; the articulating surfaces of the tibia and calcaneum were removed, and the cut surfaces were brought into apposition. On April 16th, 1865, the patient was transferred to Armory Square Hospital, at Washington. On admission he was in a feeble condition. An erysipelatous blush extended above the knee on the injured side, an abscess had formed in the lower part of the leg, and no union of the flap had taken place. With the employment of stimulants and nutritious diet, with emollient applica-

<sup>1</sup> *Am. Journal Medical Sciences*, January, 1866.

<sup>2</sup> Circular No. 6, Surgeon-General's office.

tions to the limb, there was a gradual improvement, until April 28th, 1865, when symptoms of pyæmic infection supervened. Rapidly recurring chills, an icteroid coloration of the skin and conjunctiva, anorexia, and a frequent feeble pulse, suggested the gravest prognosis. Energetic treatment was adopted. An ounce of brandy was given every two hours, and quinia, sesquichloride of iron, and beef tea were freely administered. On May 6th, the grave symptoms began to subside, and, by the end of the month, the patient was fairly convalescent. On June 26th, he was pronounced well. The os calcis had firmly united to the tibia, and there was a good solid stump.

CASE VIII. *Amputation at the Ankle Joint by Pirogoff's Method on the Battle-field at Malvern Hill; Patient taken Prisoner, and conveyed in an Army Wagon to Richmond; neglected and exposed to Great Hardships for Several Days; exchanged, and conveyed to City Point without Care or Support in extremely Hot Weather; transported to Fortress Monroe before Proper Dressings were applied; Perfect Union of Hard and Soft Parts without the Slightest Necrosis or Sloughing; Useful Limb.* — H. B., private, 5th New York Art., was wounded by a shell at the battle of Malvern Hill, July 1, 1862. The injury was inflicted principally in the metatarsal and tarsal regions, producing a compound comminuted fracture of the bones of the foot, with the exception of the astragalus and calcaneum. Chloroform was administered, and amputation by Pirogoff's method performed. He was immediately after taken prisoner, and placed in an army wagon and conveyed to Richmond. The weather was extremely hot, and he had no means of supporting or protecting the stump. He remained at Richmond several days, during which he was crowded together with other prisoners, without care, his limb remaining undressed. He was finally exchanged and conveyed to City Point, a distance of twenty-six miles, most of the distance on the railroad, the remainder in an ambulance, but the entire distance he was compelled to take his chances with the crowd. From City Point he was conveyed to Fortress Monroe, where he had the first proper dressings applied. No sloughing or necrosis occurred; the bone united promptly, and the flaps adhered as if union had taken place by first intention. He came under observation at Central Park Hospital several months after, when the stump was in the most perfect condition. It had the appearance of having healed by first intention, throughout. He bore his weight upon it, walked easily with a cane, but complained of slight tenderness. An artificial limb was applied by Hudson, of New York, and he was discharged in a condition to be able to follow almost any ordinary employment.

A second unfavorable case terminating in a good recovery.

The two following cases were reported by Adinell Hewson, M. D., surgeon to the Pennsylvania Hospital: <sup>1</sup>—

<sup>1</sup> *Am. Jour. Med. Sci.*, July, 1864.

CASE IX. *Foot crushed by the Recoil of a Gun-carriage; Attempt to save the Foot; Great Distortion of Foot; Amputation at the Ankle Joint by Pirogoff's Method; Prompt Union of Bone; Recovery with a Useful Limb.*—Tom Bowers, a tall, thin, but well-formed seaman, aged

forty-eight years, applied for admission to the Pennsylvania Hospital, on the 3d of March, 1863, on account of distortion

of his right foot, the result of an injury received on board of one of the Mississippi gunboats in the attack on Vicksburg, in the month of June previous. The foot had then been crushed by the recoil of a gun-carriage, and the bones of the metatarsus had evidently—according to the patient's account—been much comminuted, with great contusion of soft parts, but no great amount of laceration of integument. Attempts had, therefore, been made to save the foot. Extensive phlegmonous inflammation ensued, and extended up the leg, which bore the marks of the free incisions which had been made for the escape of the pus.

The foot itself was distorted by the conglomeration of the bones, through the callus thrown out for their repair, and by a large mass of cicatricial tissue on the plantar surface, all of which combined to draw the toes down and prevent the patient walking on the sole. It was thus only by a very forced elevation of the forepart of the foot, and throwing the whole weight on the back of the heel, that he could get along on the limb. For this deformity he applied at the hospital, desiring to have the leg amputated. It was evident that a partial amputation of the foot was the only remedy for him. The cicatricial mass on the sole would not allow of a Lisfranc tarso-metatarsal disarticulation, or of a Chopart inter-tarsal. It was, therefore, determined to make a Pirogoff amputation. . . . Some symptoms of delirium tremens manifested themselves on the following day, and these were soon developed into a well-defined attack of that disease. The operation was consequently delayed until the 28th of the month (March), when it was performed. . . . Owing to the rigidity of all the tissues of the foot, considerable difficulty was experienced in effecting sufficient dislocation at the ankle to saw off the os calcis at the proper angle. Indeed, this was found impossible without injuring the soft parts. The bone had consequently to be broken after it was partly sawn through. No dressing was applied over the wound. The stump was put in a fracture-box, and the weight of a brick, about four and one half pounds, was applied by means of a long and broad strip of adhesive plaster on the back of the leg to overcome all tendency to displacement of the os calcis, by contractions of the muscles attached to the tendo Achillis. The healing took place very slowly. Still the patient was well enough to be discharged on the 25th of May, eleven weeks after the operation. The os calcis was noted to be firm to the tibia on the twenty-sixth day.

CASE X. *Wound of the Ankle Joint; Suppuration in the Joint;*

*Amputation by Pirogoff's Method on the Twenty-eighth Day; Subsequent Necrosis of Fibula; Rapid Union of Os Calcis and Tibia; Recovery with a Useful Limb.* — O. C., aged twenty, private, 7th Wisconsin Regiment, was wounded on the first day of the battle of Gettysburg (July 1, 1863), by a bullet in the right foot. From the battle-field he was sent to the United States Military Hospital, Philadelphia, where he arrived on the 6th. The wound did not appear at first to be a serious one, and our attention was not called to it until some time after his admission, when the foot and ankle had become very much swollen and inflamed. On probing the wound it was found that the ball had passed through the astragalus, and must have consequently implicated the ankle joint. It was, therefore, determined to amputate the foot, and, as the tissues of the heel appeared sound, it was decided to attempt a Pirogoff, which was done on the 28th of the month (July). On opening the joint it was ascertained that the malleoli had both become considerably denuded by the suppuration which had been going on in the joint, so that it became necessary to remove the ends of both the tibia and fibula an inch above the joint. The denudation of the bones led us to form a rather unfavorable prognosis for the operation. The inflamed condition of the tissues, especially of those composing the anterior flap, caused delay in the process of union, which took place, however, throughout by granulations, and the portion of os calcis was found to be firmly adherent to the tibia on the twenty-eighth day after the operation. When the cicatrization of a greater part of the flaps had been accomplished, it was discovered that two suppurating points, one quite on the front of the leg, and the other behind the line of the fibula, communicated by sinuses with a large piece of necrosed bone evidently belonging to the fibula, and which had pushed the os calcis somewhat to the inside before it had become firm to the tibia. These sinuses were dilated by sponge tent, and this portion of bone detached without even disturbing in the least the union between the tibia and os calcis. The patient is now just beginning to throw his weight on the stump, which has been entirely healed for about a month. He ran with ease on the end of the stump before the members of the college at the meeting at which this communication was made."

III. SENSITIVENESS OF STUMP. — But it is frequently alleged that the stump after ankle joint amputations is very liable to be tender, and will not tolerate direct pressure. Sensitiveness of stump.

In this case we not only lose all the advantages claimed for direct support, but from the shape of the stump it is difficult to obtain sufficient lateral support of the limb to render the artificial appliance useful. This objection cannot, however, be founded on a very large experience. In the thirty-one cases in the accompanying tables, tenderness of the stump of a degree sufficient to interfere with the application of an artificial limb is not once men-

tioned. Hewson, of Philadelphia, speaking of the ease with which patients walk who have Pirogoff's stump, says: —

“No such results as these have ever been obtained from the Syme operation — for not more than one half of the cases which have applied to Mr. Palmer for artificial limbs have been able to bear any pressure whatever on the end of the stump, and that a long time after they were entirely healed. The only case of a Syme amputation of which we have had the opportunity of seeing the results was unable to bear his weight on it a year after it was made.”

This statement is in direct opposition to the experience of surgeons of large experience. Fergusson, of London, who has repeatedly operated by this method, says: —

“In so far as I can judge, it is one of the greatest improvements in modern surgery as regards the subject of amputation.”

Quain, of London, says it is —

“Free from any valid objection, and what is more important, the result in practice has been found to be good. A person who has undergone this operation is enabled to bear his whole weight upon the end of the stump without inconvenience; and, on this account, the facility of progression is, with a proper apparatus, decidedly greater than when the amputation is performed at any higher part of the limb.”

Erichsen, of London, confirms the above estimate of Syme's amputation. He says it —

“Constitutes one of the greatest improvements of recent date in operative surgery, as by its performance amputation of the leg may often be avoided, and the patient being left with an exceedingly useful stump, the covering of which being ingeniously taken from the heel, constitutes an excellent basis of support.”

But the strongest and most important testimony as to the entire serviceableness of Syme's stump is given by Hudson, of New York, who states that in fifty cases to which he has applied artificial limbs he has not met with a single instance where the stump did not, after proper preparatory treatment, take the direct pressure without inconvenience, and invariably give a most happy result. This treatment consisted in removing scabs from the cicatrix, healing superficial indolent ulcers, etc. We need only add that in a large collection of cases from civil practice

but one Syme's stump was found sensitive. It is very important that the surgeon should examine the cicatrix occasionally after the cure seems to be complete, to insure a firm closure of the wound. If a small space is left over which scabs form, these incrustations become so thick before the patient removes them that they take the whole pressure when the stump is placed upon the floor, and the violence is expended upon the small ulcerated surface on which they rest. I have frequently seen stumps which have been pronounced tender, found capable of sustaining the weight of the body, and enduring great fatigue when these incrustations were removed. It is the duty of the surgeon not only to remove these constantly recurring scabs, but to heal by appropriate treatment the chronic, indolent ulcer from which they spring.

Bad effects  
of scabs on  
cicatrix.

Surgeons have mistaken the early sensitiveness of the wound for a permanent disability. A certain degree of tenderness must necessarily exist for a time as the result of so considerable a wound, but as cicatrization progresses the sensitiveness generally gradually subsides, and ultimately ceases to give the patient any trouble

Sensitiveness  
not a sign of  
permanent  
disability.

IV. TENDENCY TO DISPLACEMENT OF THE HEEL FLAP BACKWARD BY THE ACTION OF THE MUSCLES OF THE CALF. — A final cause of failure is alleged to be due to the action of the muscles of the calf, which so act upon the heel, or posterior flap, as to bring the cicatrix upon the most dependent part of the stump, and expose it to injury in walking. The objection is based upon clinical experience, and this result has led to reamputation in some cases.

Displacement of heel  
flap backward.

We have reason to believe, however, that this posterior displacement of the flap is due to circumstances entirely within the control of the surgeon. The remedy is found in the after treatment. Displacement will never take place to an extent sufficient to interfere with complete usefulness of the stump, either in Syme's or Pirogoff's stump, when the posterior flap is well supported and proper traction is made upon the calf. Surgeons too frequently leave the flap entirely unsupported, so that even its weight displaces it. The natural tonicity of the muscles of the calf under such circumstances leads to their abnormal contraction, and hence to the permanent displacement of the flap. The following case illustrates this displacement from want of support: —

Within the  
control of  
the surgeon.

CASE XI. *Amputation at Ankle Joint by Syme's Method; no Support given to the Posterior Flap; Great Displacement backward.*—  
Case where there was no support. I. M., 46th Georgia Vols., was wounded March 25, 1865, by a rifle-ball which passed through the ankle joint. Amputation by Syme's method was performed twenty-four hours after the injury. When examined forty days after the operation the wound was healed, but two or three sinuses discharging gave indications of the presence of dead bone. The stump was placed on a pillow, with the extremity projecting over it, without the slightest support to the flaps. The large posterior flap hung pendulous from the end of the stump, its own weight being sufficient to displace it completely from the face of the tibia. No effort had been made to adjust and retain it with adhesive strips."

This case had been pronounced a failure by those who had it in charge, and reamputation was recommended with great unanimity. But no one who has witnessed the benefits of the proper application of adhesive strips in moulding a stump can doubt that the displacement was entirely due to the lack of proper dressings. In Cases IV. and V., the flaps were of the most unpromising character, being large, thick, and infiltrated, but they were moulded to the stump with great ease, and formed a conical extremity of great perfection. In no form of amputation do we regard the kind of dressings and their method of application of so great importance as in amputation at the ankle joint. From the very first there should be proper support given to the posterior flap, and the best form of support is by means of narrow adhesive strips. In the later stages of the treatment, this dressing is of great value in giving proper shape to the stump. When early and thoroughly applied, the strips fix the posterior flap upon the extremity of the limb, and retain it there so firmly that the flexor tendons form attachments to its anterior part, and effectually counteract the contractions of the muscles of the calf. In a well-formed Syme's stump the patient has power to move the heel flap anteriorly as well as posteriorly, showing that the flexors of the foot have become attached to it.

In regard to the displacement of the flap in Pirogoff's stump, it is still more evident that the fault is in the after treatment. That serious results follow its displacement is proved by those cases in which reamputation was the only remedy by which the defect was overcome. But it is evident that in these cases little effort could have been made to counteract the contraction of the muscles of the calf, during the period of ossific union of the extremity of the os calcis and the tibia, for when that union was once complete, all farther tendency to dis-

Value of dressing.

Displacement of flap in Pirogoff's stumps.

placement ceases. This fact is proved by Hewson's cases, IX., X., in which this contraction was immediately counteracted by proper dressings, and the bones united symmetrically, giving a very useful stump.

We must attribute, therefore, the failure to secure a good apposition of the heel flap in either Syme's or Pirogoff's amputation at the ankle to the neglect of proper after treatment. Failure due to after treatment.

V. NOT ADAPTED TO TRANSPORTATION. — It is very generally alleged against ankle-joint amputations, that owing to the large size of the posterior flap and its imperfect nourishment, the stump will not endure transportation. We have not a sufficient amount of accurate and reliable information on this subject to determine how far this objection is worthy of serious consideration. The accompanying collection of cases contains several instances of patients who had undergone ankle-joint amputations, and were subsequently subjected to transportation long distances without inconvenience. Case IX. proves that Pirogoff's stump, the most liable to be seriously affected by transportation of the two, may not only be transported, but even subjected to much rough handling, without interrupting the process of ossific union. This must undoubtedly be considered an exceptional, perhaps an extraordinary case, but still it must be accepted as proving that the character of the operation does not preclude transportation, even under the most unfavorable circumstances. Not adapted to transportation.

Without sufficient facts to decide this question as to the power of ankle-joint stumps to endure transportation, we would suggest that much must depend upon the manner in which dressings are applied. If they are carefully adapted so as to thoroughly support the parts, we doubt if the inconvenience will be greater than in an ordinary flap stump. Necessity of proper dressings.

We may in this place notice a so-called modification of Syme's amputation, performed by Surgeon David Prince, United States Vols., who reports the following case: —

Corporal W. P. Everett, Co. H., 9th Alabama Vols., received a musket-shot on the inner side of the tarsus, in the battle of Williamsburg, May 5, 1862. There was no counter opening, and it seemed probable that the ball had lodged among the tarsal bones. No ball, however, was found, from which it follows that it must have come out at the same opening at which it went in, or that the injury had been occasioned by some other substance. Prince's modification.

The operation was commenced by making an exploratory incision in

the course of the tendon of the tibialis anticus, discovering numerous fragments which were successively removed, when it was found that all the bones of the tarsus were fractured; and on this account it was resolved to amputate the metatarsus, and exsect the tarsus.

A transverse incision was made over the scaphoid and cuboid bones. The separation of the bones was prosecuted by Liston's large cutting forceps, and the soft parts on the plantar surfaces cut in the manner of a flap. The exsection of the tarsus was prosecuted with Fergusson's large gouging forceps, removing the whole of the astragalus and nearly the whole of the calcaneum. As the fragments of bone were pulled away from their attachments, a considerable amount of periosteum and some shells of bone were left for the formation of new bone. The malleoli were cut off by the bites of the forceps, so as to present a tolerably smooth surface to receive subsequently the plantar integument. No other opening was made in the integument than that in front. The parts were kept somewhat in position by a roller bandage, without sutures or any close approximation. The wound must heal and contract by granulation.

The theory of this operation is to preserve the circulation in the plantar integument, without cutting off its supply by dividing the tissues, as is necessary in the manner of cutting the lateral ligaments of the ankle joints. These ligaments are left in connection with the surrounding parts, unless accidentally pulled away by the traction upon the bones to which they are attached. The bones should not be cut away from their attachments, but pulled away, in order to leave as much as possible of the periosteum.

The patient went from under my observation, and I have not since heard from him.

#### AN APPRECIATION OF THE COMPARATIVE VALUE OF THE METHODS OF AMPUTATION AT THE ANKLE JOINT BY SYME AND PIROGOFF.

Although an important feature of Syme's original operation was the formation of the principal flap from the heel, we shall, in this comparison, include as Syme's amputations all cases in which the os calcis was completely removed with the other tarsal bones. Pirogoff's method is distinguished by an excision of the posterior portion of the os calcis, and the union of the retained fragment with the tibia. A comparison of these two methods involve for the most part a consideration of the same points as in the comparison of leg and ankle-joint amputations.

1. *Comparative Mortality.* — It is difficult to determine with any degree of certainty the mortality from these operations. That patients died after amputations at the ankle joint is

Comparative  
mortality.

evident; but it does not appear to what extent this mortality is attributable to the operation. Taking these collected cases as the only basis of comparison, we have the following comparative results: In thirty-seven cases of Syme's amputation, there were four deaths, or a mortality of 10.8 per cent. In ten cases of Pirogoff's amputation, there was one death, or 10 per cent. This difference in mortality is so slight that it is safe to conclude that there is no appreciable difference in the mortality of the two methods.

2. *Comparative Frequency of Reamputation.* — Of thirty-seven cases of Syme's amputation, six were subjected to reamputation, or 16.6 per cent. Of ten cases of Pirogoff's amputation, one case submitted to reamputation, or 10 per cent. of the cases operated upon. In this comparison Pirogoff's amputation would seem to be the more successful. In examining the causes of reamputation it appears that the most frequent cause in Syme's amputation is sloughing of the flaps; retraction of the flaps is given in one case, and necrosis of the tibia in one case. In the single case of reamputation of a Pirogoff's stump, necrosis of the os calcis and tibia had occurred.

Comparative  
frequency of  
reamputa-  
tion.

We cannot consider these figures as conclusive. We need a detailed history of the individual cases, the circumstances attending the first operations and the subsequent history, before the question can be satisfactorily settled. Too frequently, as we have elsewhere stated, the flap sloughs, and the bone undergoes necrosis, or caries, as the result of an unscientific and unskillful operation, or insufficient after-treatment. Still we give them a certain weight of evidence, and as such consider them an approximation to the truth. In any case they prove that there is but little difference in these amputations as regards primary results, and, therefore, that it is in the final serviceableness of the stumps we are to find points of contrast, if any exist.

3. *As regards the Operative Procedure.* — Pirogoff claims for his operation the following advantages: (1.) The tendo Achillis is not divided, and we avoid all the disadvantages connected with its injury. (2.) It also follows that the base of the posterior flap is not thinner than its apex, while the skin on the base of the flap remains ununited with the fibrous sheath of the tendo Achillis. (3.) The posterior flap is not cup-like, as in Syme's method, and its form is therefore less favorable to a collection of pus. (4.) The leg is longer.

Advantages  
of method of  
operation.

Mr. Croft also says: "The advantages of this operation over 'Syme's' (the only operation with which it can be compared) are, that it may be performed more rapidly as to time, leaves a more vascular flap, forms a larger stump, and produces a firmer pad for the subject to walk upon. Less time is occupied in the operation, for the somewhat troublesome dissection of the skin of the heel from the os calcis is avoided, and the os calcis sawn through instead. Greater vascularity of the flap is secured, for the plantar arteries are divided in the hollow of the foot." Mr. Rusk, of the same hospital, confirms these statements, and claims "greater facility and rapidity of execution; less disturbance of the natural relations of the parts which are to form the cushion of support; a solid instead of a hollow flap," in Pirogoff's method.

Syme denies the correctness of these assertions. He states that his operation can be performed in less than a minute. The cup-shaped form of flap which is liable to collect pus is remedied by perforating it, and thus allowing the free and direct escape of its contents. That the vitality of the flap is not materially affected by a proper dissection is proved by the promptness with which union of the flap generally takes place. Professor Van Buren, of New York, reports a case occurring in his own practice in which there was union by first intention. These objections to Syme's amputation cannot, therefore, be regarded as well founded.

On the contrary, Mr. Syme charges that Pirogoff's amputation "deprives his of all its advantages, by rendering it complicated instead of extremely simple; by impairing its constitution; by retaining a portion of the osseous tissue justly liable to the suspicion of relapse; and finally by not being applicable to all cases requiring amputation at the ankle."

The objections of Mr. Syme are refuted by the experience of competent surgeons whose opinions we have already quoted. Like the objections of Pirogoff, above given, they are entirely theoretical, and ample experience has decided them unworthy of credibility.

In regard to the operative procedure, we may conclude that these two methods have equal advantages, and one cannot justly claim superiority over the other.

Mr. Hancock publishes the following table, showing the comparative results of Syme's and Pirogoff's operation in British civil practice: <sup>1</sup>—

Hancock's  
statistics of  
British sur-  
gery.

<sup>1</sup> *Lancet*, August 11, 1866, p. 144.

<i>Of 219 of Syme.</i>	<i>Of 58 of Pirogoff.</i>
Suppuration specially mentioned in 4.	Suppuration specially mentioned in 11.
Sloughing of flap, 16.	Sloughing of the flap, 1.
Died, 16 (or $7\frac{1}{8}$ per cent.).	Died, 5 (or $9\frac{9}{16}$ per cent.).
Secondary amputation, 13 (or 6 per cent.).	Secondary amputation, 5 (or $9\frac{9}{16}$ per cent.).
Recovered, 185 (or 84 per cent.).	Recovered, 45 (or rather more than 75 per cent.).
Results not stated, 5.	
Period of recovery in 40 cases varied from 3 to 52 weeks.	Period of recovery in 13 cases varied from 6 to 69 weeks.
29 were cured within 12 weeks.	11 were cured within 12 weeks.
34 were cured within 16 weeks.	1 was cured within 24 weeks.
37 were cured within 24 weeks.	1 was cured within 40 weeks.
The remaining 3 between 33 and 52 weeks.	1 was cured within 61 weeks.
	1 was cured within 69 weeks.

COMPARATIVE SERVICEABLENESS OF THE STUMP.

(a.) *As regards Unaided Locomotion.* — In comparing leg and ankle-joint stumps, we stated that the latter had far greater advantages than the former, because the stump resulting from an ankle-joint amputation was longer and took direct support on its face. In comparing now two ankle-joint stumps in unaided locomotion, — by which we mean that no artificial limb is applied, and only such covering is employed as a patient applies, — we have to consider, (1) The value of length of limb; and, (2) The power of endurance of the different stumps.

Comparative serviceable-ness of stump.

1. *The Value of Length of Limb in Progression.* — Pirogoff states that in his operation “the leg appears an inch and a half (sometimes even more) longer than in the three other operations (Syme, Baudens, Roux), because the remnant of the os calcis left in the flap, as it unites with the inferior extremities of the tibia and fibula, lengthens them by an inch and a half.”

Value of length of limb.

Mr. Croft remarks: “The length of the stump is a very important point; it (Pirogoff’s stump) is longer than in Syme’s operation, by the portion of the os calcis left on the flap, which should be quite one inch and a quarter. In the four instances mentioned, the difference in length between the foot operated upon and the sound foot, was never more than three eighths of an inch.”

We cannot doubt that the additional length of stump in Pirogoff’s operation gives it some advantage over that of Syme, provided the patient has no artificial aid. It requires less compensative

appliance to make up the deficiency of length between the sound and amputated limb. The almost direct pressure which Pirogoff's stump makes upon the surface over which the patient walks, gives greater steadiness in his gait.

2. *Endurance of the two Stumps.* — It is claimed for Pirogoff's operation, that the stump having the extremity of the os calcis as its base of support, must be capable of greater endurance than the stump in Syme's operation, which is simply a flap resting directly upon the newly cut surface of the tibia. There are no facts, we believe, to sustain this conclusion. The alleged tenderness of Syme's stump, we have already shown, is not based on experience, and hence must be regarded as theoretical. In all the trials that have been made with these stumps in simple unaided locomotion, no marked advantages could be claimed by one over the other. And, again, there is no necessity of cutting off the extremity of the tibia; the articular surface is found to unite firmly to the flap.

(b.) *Adaptation for an Artificial Limb.* — We have already stated that the real test of the usefulness of a stump is its adaptation to an artificial limb. Judged by this standard, we find a marked contrast between the two stumps under examination. The advantages of greater length yielded to Pirogoff's stump when employed in locomotion without aid, prove to be disadvantages when a proper artificial limb is adjusted.

In constructing a useful artificial foot, it is very important that there be space for an ankle joint which shall have full play. In Pirogoff's stump the base of support is so near the floor that the joint must necessarily be on a much lower plane than that of the sound limb, and have but limited movements. This is a practical difficulty which has not been overcome by any mechanical contrivance. In Syme's stump, on the contrary, the base of support is on the same plane as the original ankle joint; and this space enables the mechanical surgeon to construct a joint which acts with as long a leverage and as free motion as the natural joint. In this respect Syme's stump has a real and permanent advantage over that of Pirogoff.

We cannot better conclude this paper than by the insertion of the following recent letter by Pirogoff to Mr. Hancock, of London, in regard to his experience in this method of amputation. It will be seen that, so far from abandoning it, as reported, he is its strongest advocate: —

“As to my osteoplastic operation, I reckon nearly one hundred cases in Russia alone, for accident or disease. My pupil, Dr. <sup>Pirogoff's last state-</sup> Dzemickeritch, was the first who introduced it into the military practice at Odessa, in the case of a soldier wounded at the Alma; and his patient walked, with the assistance of a stick, in about two months. In the Crimea it was practiced principally during the first six months of the siege; and I have registered sixty cases. In December, 1855, when I inspected the military hospitals at Chersow, Eckerterinoslav, and Charkoff, I found fifteen patients who had been transferred from the Crimea since the date of their operation. The condition of the whole fifteen was satisfactory, notwithstanding nearly half of them had received other injuries. Thus two had undergone also amputation of the fore-arm. In one my operation had been performed upon both his feet. One had the metatarsal bones of his other foot removed. In one the opposite leg, and in another the opposite thigh, had been amputated. Two already walked upon crutches, and two even with a stick only.

“A year after the war, I learned that two of the wounded admitted into the hospital at Sympheropol, having submitted to my operation on both feet, still walked on crutches. I ordered them shoes and steel supports. I only know with certainty of seven deaths; and also of one case wherein the flap sloughed, which necessitated amputation of the leg. Secondary hemorrhage occurred in several.

“These are the results of this operation in my military practice; and, judging from the number of patients so operated upon whom I saw subsequently, the mortality could not have been great. The best proof of this is, that among those who have survived, some had the operation performed on both feet; some had at the same time undergone amputation of the other leg and of the other thigh. To be impartial, I will not speak myself of all the advantages offered by this operation with respect to the functions of the limb; but I will repeat what has been communicated to me by surgeons who have adopted it.

“During the year 1863, I visited nearly twenty hospitals and various universities of Germany; and in five of these I was shown patients operated upon according to my method. The whole walked, even without sticks. But the most remarkable case was in the hospital at Heidelberg, under the care of Professor Chelius. A young woman, aged twenty-five, had club-feet from birth. She had tried all sorts of orthopedic treatment without benefit; and Chelius performed my operation upon both feet. When this patient returned from the city to the hospital, I could not discover what she wanted. She walked without a stick, and wore shoes with lateral steel supports.

“Upon subsequently examining the feet operated upon, I have invariably found the portion of the os calcis grown together with the epiphysis of the tibia. In two cases only have I detected a little move-

ment, which, however, did not prevent the use of the limb. Nevertheless, many French and English surgeons doubt even the possibility of such an operation, and find faults discovered by themselves only. This, doubtless, arises from the fact that this 'osteoplastique' operation did not originate with themselves. Thus, Syme pronounces it as an indication of reckless surgical principles. Syme would speak more courteously if he only knew how I had supported his operation of disarticulation when the late Dr. Arnold, inspector of hospitals at St. Petersburg, would have forbidden its employment.

"Another celebrated English surgeon asserts that I have myself abandoned my operation. Whence he learned this, God only knows. Could he have arrived at this conclusion from one of my letters to a surgeon in London, who applied to me for the results of this operation? 'I have not made up my mind,' I replied; 'time will show whether it is worth anything or no.' Malgaigne repeats what he has read in Fergusson, and, probably never having tried my operation, frightens the reader of his 'Operative Surgery,' about gangrene of the flap, the impossibility of adhesion or coalescence, fistulæ, and the pain experienced by the patient in walking. Exactly what never takes place. The contemporaneous school, however, of Germany has treated me much more impartially. Langenbeck, Lihault, Neudörfen, Chelius, Busch, Belliott, and others, have frequently performed my operation with success. O. Weber has enumerated forty cases, and has defined the rate of mortality at 15 per cent. (He found the same rate of mortality in one hundred and one cases of Syme's operation.) In seven cases the wound healed completely in one month. Dr. Kestnor, of the penal hospital at Strasburg, presents also sixteen cases. Of these, the results of six as to functions of the foot remain at present doubtful; in the other ten only one failed as to walking, and in four fistulæ remained. We might suppose that Malgaigne could not have ignored these results, described by his countrymen in a dissertation in the French language; but he assumes to himself the credit of being the inventor of the subastragaloid amputation, although it is due entirely to his countryman Legnerolles. Hence the reason why, at all hazards, he vaunts the advantages of his operation at the expense of others. On the other hand, Hyrth, from purely anatomical considerations, rejects Malgaigne's operation altogether. As to myself, I will not treat it unjustly, but will say in its favor that it preserves a little increased length to the foot, but that it is much more difficult to perform.

"I do not fear the result of my operation; its importance does not consist in the method of amputating, but in a novel osteoplastic principle. My whole merit consists in irresistibly demonstrating by my proceeding that a portion of one bone remaining, naturally connected with soft parts, readily unites with another, and at the same time serves to lengthen the limb and increase its utility. But few military surgeons

have tried my operation. Stromeyer, without any reasons, doubts its success; and in Chenu's report we cannot make out whether, during the Crimean campaign, the French and English surgeons made any distinction between my operation and that of Syme. Of forty-eight operations, twenty-one proved fatal, or 44 per cent.; but with the English, of twelve, only two died, or 16 per cent. During the Italian campaign, Denne saw Neudörfer perform my operation at Verona three times; all three patients recovered. According to Stromeyer's report, during the Holstein campaign four patients, who submitted to Syme's amputation, died."

## AMPUTATION AT ANKLE JOINT.

## AMPUTATION AT ANKLE JOINT,

NAME.	Residence.	Occupation.	Regiment.	Date when wounded.	Battle.	Missile.	Injury.	What Primary Operation and Method.	What Subsequent Operation and Method.	Where performed and Surgeon.
N. C. N.	—	Lieutenant	5th Mich. Cavalry	April 1, 1865	Five Forks	Conoidal musket ball	Passing through his left ankle joint	Amputation at the ankle was performed. Pirogoff's method. The articulating surfaces of the tibia and calcaneum removed, and the cut surfaces bro't into apposition	—	Surgeon St. Clair, at City Point Hospital
A. B.	—	Soldier	—	1863	Chattanooga or Missionary Ridge	—	—	Pirogoff's amputation, a few days after injury	Amputation of leg early in month of February	Prof Paul Eve, of Nashville, Tenn. Dr. Richard Taylor, of Memphis, Tenn
O. L.	—	—	2d N. H. Vols.	June 10, 1864	Petersburg, Va.	Shell	Injuring right foot	Amputation at the ankle joint by Pirogoff's method	—	—

PIROGOFF'S METHOD.

Treatment.	Progress of Case.	Necrosis.	Atrophy.	Length of Stump.	General Health.	Shortening of Limb.	Usefulness of Limb.	Result.	RE-MARKS.
<p>Carried to the hospital at City Point, April 16, 1865; the patient was transferred to Army Square Hospital, Washington, D. C. With the employment of stimulants and nutritious diet, with emollient applications to the limb, there was a gradual improvement . . . . .</p>	<p>On admission to Army Square Hospital he was in a feeble condition. An erysipelatous blush extended over the knee on the injured side; an abscess had formed in the lower part of the leg, and no union of the flap had taken place. April 28, 1865, symptoms of pyæmic infection supervened; rapidly recurring chills; an icteroid coloration of the skin and conjunctiva, anorexia, and a frequent feeble pulse suggested the gravest prognosis. On May 6th, the grave symptoms began to disappear, and by the end of the month the patient was fairly convalescent. On June 6th, pronounced well; the os calcis had firmly united to the tibia, and there was a good solid stump . . . . .</p>	-	-	-	Good	-	A good solid stump.	Good	<p>(Spec. 2298, A. M. M. and Photo. 75 in series.) Circular No. 8, Surgeon General's Office, p. 47.</p>
-	<p>Case seen for the first time by the reporter, James M. Holloway, M. D., of Louisville, Ky., in the latter part of January, 1864. The flaps had united, but a number of sinuses communicated with the coapted surfaces of the calcis and tibia, at the bottom of which denuded bone could be felt upon the introduction of the probe. In addition to these, other sinuses situated on the lateral aspects of the lower third of leg communicated with the sheaths of the tendons. These latter, as far as he could judge from the statement of the patient, appeared subsequent to those leading to the carious bones. The integuments overlying and adjacent to the diseased bone, and inflamed condition of sheaths of tendons presented a remarkably healthy appearance, so much so that the true condition of the stump did not transpire until a more thorough examination was made, while the patient was under the influence of chloroform. Such was the complete disintegration of the calcis and the end of the tibia that amputation of the leg was necessary . . . . .</p>	-	-	-	-	-	-	-	<p>Reported by James M. Holloway, M. D. Prof. of Anat., of Louisville, Ky., Amer. Jour. Med. Sci., Jan., 1866, p. 85.</p>
-	<p>The case progressed favorably, and terminated in a very useful stump . . . . .</p>	-	-	-	-	-	A very useful stump	Good	-

## AMPUTATION AT ANKLE JOINT.

## AMPUTATION AT ANKLE JOINT,

NAME.	Residence.	Occupation.	Regiment.	Date when wounded.	Battle.	Missile.	Injury.	What Primary Operation and Method.	What Subsequent Operation and Method.	Where performed, and Surgeon.
-	-	-	-	-	-	-	-	Pirogoff's amputation	-	-
R. W. H.	-	-	44th N. Y. Vols.	May 3, 1863	Chancellorsville, Va.	-	-	Pirogoff's amputation	-	-
P. B. C.	-	-	12th N. Y. Vols.	May 10, 1864	Near Spottsylvania C't House	-	-	Pirogoff's amputation, July 20, 71 days after injury	-	-
P. L.	-	-	48th N. Y. Vols.	July 18, 1863	Ft. Wagner, S. C.	Fragment of shell	Communiting tarso-metatarsus except calcis	Pirogoff's amputation performed	-	U. S. Hospital, Hilton Head, six days after injury, by Surgeon Applegate
H. B.	-	-	5th N. Y. Artillery	-	Malvern Hill	Shell	Compound fracture of tarso-metatarsal bones except astragalus and calcaneum	Pirogoff's amputation	-	-

PIROGOFF'S METHOD. — (Continued.)

Treatment.	Progress of Case.	Necrosis.	Atrophy.	Length of Stump.	General Health.	Shortening of Limb.	Usefulness of Limb.	Result.	RE-MARKS.
—	Patient progressed very unfavorably, and subsequently sank and died. . . . .	—	—	—	—	—	—	Died	Reported by Prof. Jas. M. Holloway, <i>op. cit.</i>
—	Upon examination on the 8th of July, 1864, fourteen months afterwards, found the stump healed, but the parts were still swollen and edematous; unable to walk without two crutches; heel drawn upwards, and cicatrix of flap thrown downwards and forwards, so that during locomotion it came in contact with the floor. No trace of the existence of inflammation of the sheaths of the tendons remained, and the bones seemed to be sound. . . . .	—	—	—	—	—	Walk'd with crutches	Poor	Reported by Jas. M. Holloway, M. D., <i>op. cit.</i>
—	The soldier was able to proceed to his home in Georgia, though the stump had not entirely healed, and considerable tumefaction of the stump and leg still existed. The heel was drawn up and the tender cicatrix constituted a portion of the sole of the stump. . . . .	—	—	—	—	—	—	Poor	Reported by Jas. M. Holloway, M. D., <i>op. cit.</i>
—	Stump much enlarged generally; exfoliation from posterior portion of tibia; prognosis highly favorable; leg tumefied; edematous, cicatrized; almost entire weight borne upon the end.	—	—	—	—	—	—	Fair	—
Lower portion of tibia excised, and anterior portion of calcaneum; integuments and posterior portion of calcis brought up; united to tibia. . . .	Stump compact, finely formed, but the portion of calcaneum useless and embarrassing; artificial appliance ordered; to begin to use a boot as base of support. . . . .	—	1 inch below patella, 1 in.; at calf, 4 in., at end of stump, ½ of in.	—	—	2 in.	—	Good	—

## AMPUTATION AT ANKLE JOINT.

## AMPUTATION AT ANKLE JOINT,

NAME.	Residence.	Occupation.	Regiment.	Date when wounded.	Battle.	Missile.	Injury.	What Primary Operation and Method.	What Subsequent Operation and Method.	Where performed, and Surgeon.
F. R.	—	—	—	Dec. 9, 1864	—	Musket ball	Passing through the tarsus	Amputation at ankle joint (Syme's), Jan. 29, 1865	—	Dr. Buck, at St. Luke's Hospital, N. Y.
J. B.	—	—	—	July, 1861	1st Bull Run	Ball	Passing thro' the right tarsus, fracturing the tarsal bones	Amputation, ankle, Syme's method	—	Assistant Surgeon Gouley, at Wash. Infirmary.
J. M.	—	—	45th Ga. Vols.	M'ch 25, 1865	—	Rifle-ball	Passing thro' the ankle joint	Amputation at ankle joint, Syme's method, 24 hours after injury	—	—
C. O'R.	—	—	164th N. Y. Vols.	May 18, 1863	Spottsylvania, Ct. House	Shell	Striking the right foot	Amputation performed 9 hours after injury, by Syme's method	Feb. 12, 1865, Dr. Mott reamputated 3 inch's above ankle joint, by the circular method	Dr. Briggs, Confed. Surgeon
E. R. C.	—	Soldier	—	—	—	—	—	Amputation of ankle joint, Syme's method	—	—
J. H. R.	Gray, Maine	—	8th Minn. Vols.	Dec. 7, 1864	Murfreesboro, Tenn.	Minié-ball	Passing thro' the tarsus from the dorsum to the heel, making a clean track, and causing a compound fracture of tarsal bones	Amputation at ankle joint, by Syme's method	—	U. S. Gen'l Hospital, at Murfreesboro, Surg. Turner
P. C.	—	Corp'l	70th N. Y. Vols.	Aug. 29, 1862	Bristow's Station, Va.	Minié-ball	Entering the posterior part of left heel, and was remov'd from beneath the integument of the dorsal face of the tarsus; it completely traversed the tarsal bones	Amputation at ankle joint, Syme's method, two years after gunshot wound	—	Bellevue Hospital, N. Y., by Dr. Stephen Smith
A. J.	New Eng.	Lawy'r	5th N. Y. Vols.	June 27	Gaines's Mills	Ball	Passing through the tarsal bones	Aug. 1st, Syme's operation performed	—	Dr. Bartholow

SYME'S METHOD.

Treatment.	Progress of Case.	Necrosis.	Atrophy.	Length of Stump.	General Health.	Shortening of Limb.	Usefulness of Limb.	Result.	RE-MARKS.
-	The case did well with a shortening of limb. . . . .	-	-	-	Good	2½ in.	Firm and useful	Good	-
-	Stump healed kindly, leaving a serviceable extremity; artificial limb applied at the end of one year and two months. . . . .	-	-	-	-	-	An efficient and useful stump	Good	-
Patient taken to Jackson Hospital, Richmond, Va. The limb was placed upon a pillow without the slightest support to the flaps, by means of dressing. The large posterior flap dragged down by its own weight, formed a large, pendulous, suppurating mass . . . .	The case progressed unfavorably, with exfoliation of bone and suppuration. When examined forty days after the amputation, there was still considerable discharge from several points . . . .	-	-	-	-	-	-	D'btful	-
-	The flap sloughed. Patient taken to Richmond on the third day. Has been healed, but now open in consequence of an injury.	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	Walks well	Good	-
Patient removed to the U. S. General Hospital, Murfreesboro', and ten days after injury amputation was performed . . . . .	The posterior flap was short and became subsequently enlarged, but by care, union became firm, and the stump sound and reliable. He walks about with a boot leg, having a thick sole, without inconvenience. . . .	-	-	-	Good	-	Walks well	Good	-
The ankle joint being ankylosed, the tibia was sawn through above the malleoli, and the foot removed; so thick and firm were the flaps that it was quite impossible to place them in immediate apposition. By care in the adjustment of strips the irregular margins of the flaps were moulded into shape . . . . .	The progress of the case to ultimate recovery was most satisfactory. The portion of the flap which contained the opening and track of the sinus sloughed, but left a healthy granulating surface; the thickened and infiltrated tissues were rapidly reduced, and the flaps were brought together. The stump assumed a perfectly rounded and symmetrical form, with the cicatrix on the extremity. Dr. Hudson adapted an artificial foot to the stump, which after a little use enabled him to walk with ease and but a slight limp . . . .	None	Slight	-	Bad	-	Walks well	Good	-
Was moved at once to Savage Station, afterwards to Richmond. Cold-water dressings were kept applied. He was sent with the other paroled prisoners to	The flaps came together perfectly well. The wound began to heal up rapidly; about two weeks after the operation, the wound being healed, erysip-	None	-	-	Pretty fair	-	Walks well	Good	-

## AMPUTATION AT ANKLE JOINT,

## AMPUTATION AT ANKLE JOINT,

NAME.	Residence.	Occupation.	Regiment.	Date when wounded.	Battle.	Missile.	Injury.	What Primary Operation and Method.	What Subsequent Operation and Method.	Where performed and Surgeon.
F. J.	—	Lt. Col.	1st Mich. S. Shooters	May 12, 1864	Spottsylvania Ct. House, Va.	Mini-ball	Compound comminuted wound of left tarsus	Amputation at ankle joint, by Syme's method	—	—
B. L.	—	—	12th Mass. Vols.	Sept. 17, 1863	Antietam, Md.	Solid shot	Carrying away the phalanges and metatarsus, and shattering the tarsus	Amputation at ankle joint, by Syme's method	—	Dr. Howard, on the field immediately after injury
M. K.	—	—	14th U. S. Infantry	Nov. 14, 1864	Snicker's Gap	—	—	Amputation at ankle joint, Syme's method	—	—
T. D.	59 Cameron St.	—	1st Excels'r Brigade N. Y. Vols.	June 1, 1864	Fair Oaks, Va.	Rifle-ball	Causing a compound fracture of the tarsus and metatarsal bones	Amputation at ankle joint performed by Surg. Lewis, Syme's method	Reamputation	Surgeon Lewis, at Savage's Station
J. C.	Altoona, Pa.	Labor'r	76th Penn. Vols.	July 10, 1863	Ft. Wagner, S. C.	Musket ball	Causing compound comminuted fracture of tarsus	Amputation of ankle joint, by Syme's method, 24 hours after injury	Reamputation thro' the leg, Sept. 27, 1863	At Fort Schuyler, N. Y.
J. C.	U. S. N.	Coxswain	U. S. N.	May 31, 1864	Appomattox River, Va.	—	Compound comminuted fracture of the tarsal bones, with laceration of soft parts of left foot.	Amputation at ankle joint performed 1 hour after the injury, Syme's method	—	Ass't Surg. Gregory, U. S. N.
J. E. M.	—	—	8th N. Y. Cavalry	July 10, 1863	Funkstown, Md.	Rifle-ball	Entered the left foot at the junction of the tarso, metatarsal bones, and emerg'd behind the external malleolus	Amputat'n performed by Syme's method, at ankle joint, 9 hrs after the injury was received	—	—
W. S.	Kirkland, N. Y.	Student	59th N. Y. Vols.	May 3, 1863	Chancellorsville, Va.	Unexploded shell	Comminuting the phalanges, metatarsal bones and a portion of tarsus of right foot	Amputation of the ankle joint was performed by Syme's method	—	On the field by Surgeon Wood, 24 hours after injury

SYME'S METHOD. — (Continued.)

Treatment.	Progress of Case.	Necrosis.	Atrophy.	Length of Stump.	General Health.	Shortening of Limb.	Usefulness of Limb.	Result.	RE-MARKS.
Baltimore; admitted into the National Hospital, July 21. The skin was laid open freely, the integument sloughed. Under the use of quinine, whiskey, and iron, the man's general condition improved . . .	las attacked the fibula side of the stump, and extended up the leg, chiefly on that side. Matter form'd, the skin became undermined, and small perforations occurred. The healing of the stump progress'd in spite of the complication. Sept. 4th, both the stump and the wound left after the incision are nearly healed up . . .								
	The patient made a slow recovery, with considerable retraction of flaps; the cicatrix continued tender for a considerable period; at the end of seven months an artificial limb was appli'd, which served a good purpose . . .	—	—	—	—	3½ in.	Useful	Good	—
—	Patient made a good recovery. The stump lacks symmetry, but it is sound and highly serviceable . . . . .		1 inch below patella, ½ inch; at calf, 3½ inches; at end of stump, 1½ inch		Good	3 in.	Useful	Good	—
—	No history of case given. From a photograph of the stump it appears that the amputation was successful in the final results . . . . .	—	—	—	—	—	—	Good	—
Patient removed to the steamer Vanderbilt	Sloughing of the flaps occurred, and on June 7th, reamputation performed; patient recovered. Artificial limb applied . . . . .	—	Proximal portion ¼ inch; distal portion 3½ inch.	6 in.	—	—	Walks with aid of artificial limb	—	—
—	Necrosis of tibia occurred. Stump nearly well . . . . .	Necrosis of tibia	Atrophied	—	—	—	Serviceable	—	—
—	Ten months after the amputation, there was some tenderness of the stump and considerable atrophy of the limb. An artificial limb was appli'd which gave him a useful stump . . . . .	—	Considerable	—	The patient made a good recovery	2 in.	Useful	Good	—
—	The case progressed unfavorably for a time, but finally the wound cicatrized, leaving considerable hypertrophy of tissues and some tenderness. Eventually an artificial limb was applied, the stump became very compact and firm, and the patient was able to walk with comfort . . . . .	—	—	—	Good	—	Able to walk with comfort	Good	—
—	Wound healed rapidly, and the flaps made an excellent covering. The cicatrization was complete; he was able to walk freely with only a felt covering to the stump . . . . .	—	—	—	Good	—	Able to walk freely	Good	—

## AMPUTATION AT ANKLE JOINT,

NAME.	Residence.	Occupation.	Regiment.	Date when wounded.	Battle.	Missile.	Injury.	What Primary Operation and Method.	What Subsequent Operation and Method.	Where performed, and Surgeon.
I. S. M.	Tona-wanda, N. Y.	Farmer	100th N. Y. Vols.	July 18, 1863	Ft. Wagner, S. C.	Musket ball	Causing a compound fracture of tarsus	Amputation by Syme's method at ankle joint	—	Dr. Cutter, 4 months after injury
P. F.	—	—	1st C. S. Battery	June 3, 1864	Coal Harbor, Va.	Mini-ball	Passing through the right ankle joint	Amputation at ankle joint, by Syme's method, 28 hours after injury	Reamputation performed	Dr. Richardson, at Seabrook Hospital Richm'nd, Va.
A. L. S.	—	Boot and shoe maker	20th Mass. Vols.	May 2, 1863	Fred'icksburg, Va.	Spiral case shot	Passing through the ankle joint, destroying the articulation	Amputation performed on the field, owing to destruction of heel, the flaps were formed fr. lateral parts of ankle. Lateral flaps	—	On the field 4 h'rs after injury
C. D.	—	—	—	June 24, 1864	—	Fragment shell	Striking sole of foot just anterior to heel, lacerating soft parts extensively, and injuring the tarsal and metatarsal bones	Amputation at ankle joint was performed on the 3d day. Method lateral flaps	Surg. N. P. Moon, Mower, U. S. A. Hospital removed frag'n'ts	Mower, U. S. A. Hospital. Surg. N. P. Moon
D. G.	—	—	8th Ill. Cavalry	June 29, 1862	White Oak Swamp	Ball	Entering below the malleolus externus of the right foot, and emerging through the second and third cuneiform bones	Amputation at ankle joint, by Syme's method	—	—
G. C.	Penn.	—	1st Penn. Vols.	June 30, 1862	Before Richm'nd	Ball	Taking its direction through the instep of right foot	Amputation at ankle joint, by Syme's method	—	On hospit'l transport
H. H. C.	Genesee, N. Y.	—	100th N. Y. Vols.	May, 1864	Drury's Bluff	Fragment of shell	Left foot extensively lacerated	Amputation at ankle joint, performed with lateral flaps	—	Surgeon Kettinger

SYME'S METHOD. — (Continued.)

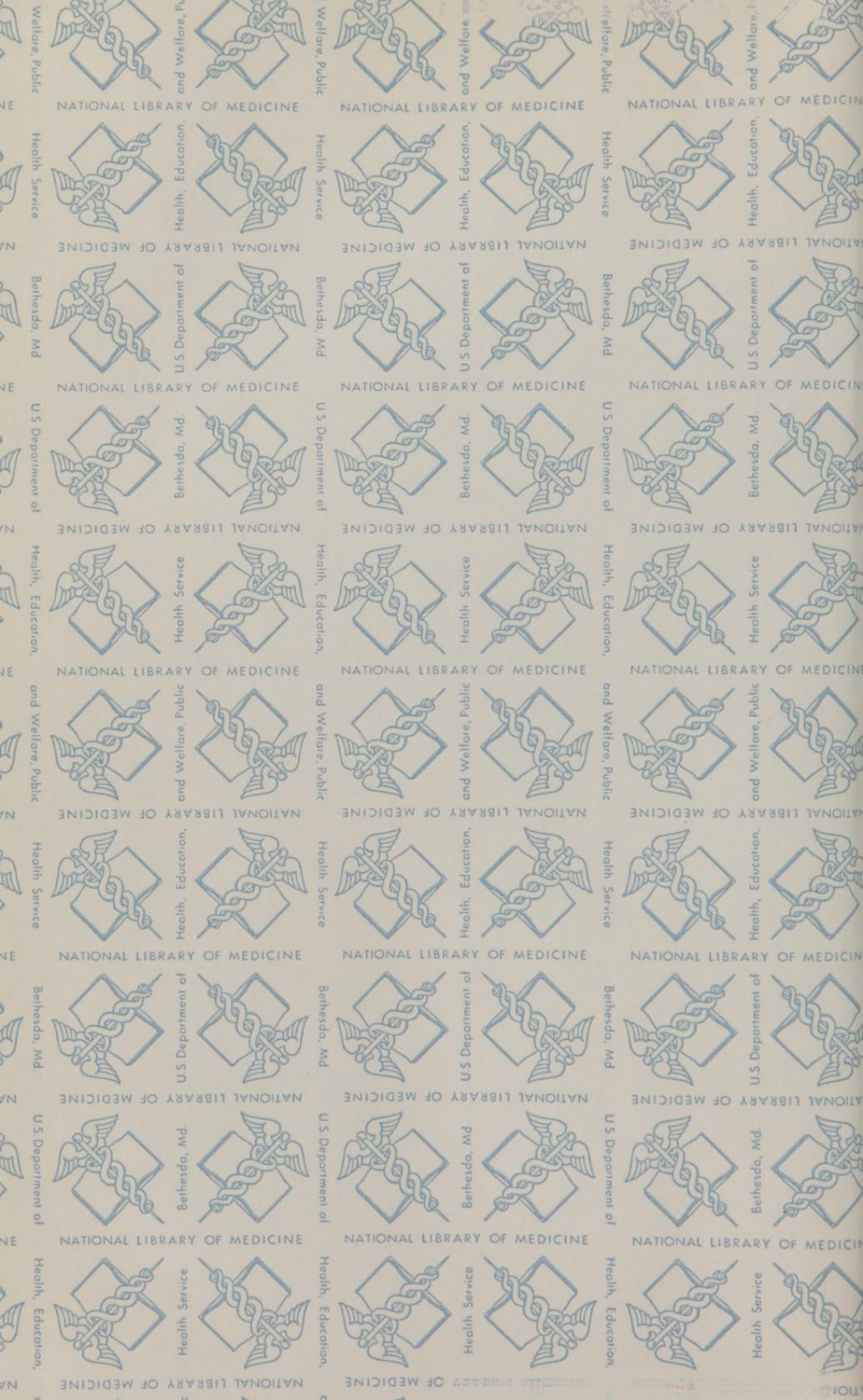
Treatment.	Progress of Case.	Necrosis.	Atrophy.	Length of Stump.	General Health.	Shortening of Limb.	Usefulness of Limb.	Result.	RE-MARKS.
—	The stump healed kindly, but the anterior flap being rather long, and the posterior short, the cicatrix is rather too much on the face of the stump. At the end of nine months an artificial limb was applied, and the stump prov'd very serviceable	—	—	5½ in.	—	—	Stump very serviceable	Good	—
—	The flaps are stated to have retracted so as to necessitate reamputation. Recovered.	—	—	—	Good when wounded	—	—	—	—
—	Abscesses form'd, but with the exception of the cicatrices left by the abscesses the stump was sound and very serviceable. At the end of three months he could bear his weight upon it, experiencing a prickling sensation; at the end of five months an artificial limb applied, and the patient could walk with ease and comfort	—	An in. below the knee, ¾ of an inch; at calf, ¾ inches; at the end of stump, ¾ of an inch	—	—	2½ in.	Walks well with artificial limb	Good	—
Owing to the destruction of the soft tissues about the heel, the flaps were made from the sides of the ankle and foot, and partially from the sole on the external part. Water dressings were applied . . . .	For a few days the case progressed favorably; sloughing then occurred to a small extent. During the following month three abscesses formed in the lower part of the leg, one being quite large. After the removal of the fragments, the case progressed favorably, wound cicatrized, leaving a well-formed but somewhat tender stump	A slight necrosis of the lower end of tibia occurred	—	—	—	—	—	Good	—
—	Patient healthy, sanguine temperament; not in the habit of drinking liquors in excess. The wound (Sept. 1) healing up and doing well, except the part corresponding with the fibula; took a number of detached pieces of bone out .	—	—	—	Aug. 14, general health good	—	—	—	After the necrotic part of the fibula is resected, the wound will undoubtedly heal fast.
Taken prisoner and sent to Richmond; kept there two weeks; exchanged July 22. August 1, flaps shrink somewhat; brought ends together by straps	Aug. 7th, doing well, healing. Aug. 21st, abscess formed on the internal side of foot; opened. Sept. 3d, doing well, and soon in a condition to be dismissed . . . .	—	—	—	—	—	—	—	—
—	Case did well, and the stump was sound and serviceable though the flaps were composed of tissues from the lateral parts of the ankle; the same patient suffer'd a Chopart's amputation of the right foot, which did well.	—	—	—	—	2½ in.	Useful limb	Good	—













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