ELKOPLASTY,

OR ANAPLASTY APPLIED TO THE

TREATMENT OF OLD ULCERS.

ALSO,

A NEW MODE OF TREATMENT

FOR

DELAYED OR NON-UNION

OF A

FRACTURED HUMERUS.

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TO

MY FATHER

AND

MY MOTHER.

ELKOPLASTY,

OR ANAPLASTY APPLIED TO THE

TREATMENT OF OLD ULCERS.

Some writer has said, "old ulcers in 1830 will be old ulcers in 1860," which, not to be understood always in a literal sense, was intended only to express, in a brief and pertinent form, the proverbial obstinacy of this class of sores.

In most cases, the integument has been broken and destroyed by ulceration, and then, usually, bad health, or, perhaps, enlarged veins, have helped to perpetuate the lesion. In other cases, however, the ulcers are directly in consequence of severe lacerating injuries, which have at once torn away the skin beyond the power of nature to repair; and that although the health of the body and of the limb may be perfect. In such cases, the refusal of the ulcers to heal is entirely owing to the extensive loss of integument.

Actual loss of skin is repaired by one or both of two processes. By the development of new, from or upon the free margin of the old skin, or by the contraction of the granulations and of the cicatrix, in consequence of which, the adjacent skin is drawn towards the chasm, and made, as it were, to slide over and cover it in.

This rule admits of but few exceptions. Occasionally, after a very long delay, the granulations acquire the power of forming new skin at various and isolated points of the sore. This process may now and then be observed in the healing of extensive burns, or, perhaps, in the closing up of

an ulcer whose surface is excluded from the air. New skin may even find a matrix in the periosteum, as I have witnessed, and maintained several years since. (*Buffalo Medical Journal*, vol. vii. p. 205.) But the conditions are very rare under which these exceptions can occur. The rule remains as we have stated, and if ulcers are not closed by either the projection of new skin from the margins of the old, or by the contraction of the granulations and cicatrix, then, usually, they must remain open. To the action of both of these processes there is, however, a limit. The formative power of the old skin does not extend beyond a few lines. The new vessels, becoming more and more attenuated as they stretch inward from the periphery, lose, at length, the power of generating epithelial cells, or, if formed, they are too imperfectly organized to sustain an existence, and they crumble away from the slightest provocation. Slowly, but perceptibly, the opaque diaphragm proceeds to shut in the granulations, and for a long time encourages a hope that a cure is to be accomplished. But just when the work is almost consummated, a rapid disintegration sweeps away in a few hours the patient labor of many months. Again and again the reluctant labor is renewed, and as often suddenly, and without provocation, is it arrested and broken up. At the same time the granulations have ceased to condense, and the cicatrix to contract, either because these actions have attained their natural limits, or because the adjacent skin has reached its utmost tension, and affords effectual resistance to further stretching. Here the process of closure forever ends, and the "old ulcers of 1830 will be old ulcers in 1860."

Nature has done its utmost, and hitherto art has failed to complete the work.

I beg to suggest a procedure, which, hereafter, in some unfortunate cases of this class, may deserve a trial.

I propose to close the ulcer by an operation of anaplasty. In short, to imitate one of the processes of nature, by sliding in old skin to repair a waste, where the process of forming new skin has ceased, and been finally given up.

If we seek to obtain this supply from the neighborhood of the ulcer, around which the skin has already reached its utmost tension, we shall only substitute one ulcer for another. We must, therefore, generally look to the opposite limb, or to the limb of some other person, for the material with which the transplantation or engrafting is to be made.

The mode of accomplishing this, will not differ materially from that which has been generally adopted in anaplasty from remote parts, except that the ulcerated surface ought to be excised freely before the new skin is laid upon it.

By this means, I hope, gentlemen, not only to supply an amount of skin equal to the size of the piece transferred, but to furnish, also, a nucleus from which additional skin shall be formed. I hope to establish a new centre of life—an oasis—from whose outer verge a true and healthy vegetation shall advance in every direction over the exhausted soil.

It is not improbable, also, that the graft will itself expand, or be drawn centrifugally by the contraction of the surrounding granulations and cicatrix, conversely, as the skin about the ulcer had before been stretched and drawn centripetally, by a similar action of the granulations and cicatrix situated within its free margin, so that, after a time, it will cover more space, independent of any actual growth, than it did originally. The opposite of this happens usually in anaplasty, and would occur here, did the flap equal or exceed in size the wants of the parts to be supplied. The flap would contract, thicken, and project itself above the surface. But in old ulcers, it will generally be found impossible to furnish a direct supply of integument equal to the loss. A deficiency must probably still exist, and sufficient, it is believed, to determine in the transplanted skin a necessity of expansion.

The value and practicability of these views are, I trust, in a measure established by the results, in the case which I shall now take the liberty of bringing before you.

You will excuse me, however, if I detain you a moment

longer to explain to you that, so long as eight years since, I proposed the same operation, and had anticipated most of the results which I have now actually obtained.

In the report of my surgical clinic, for 1846, at Geneva Medical College, published in the *Buffalo Medical Journal*, vol. ii, p. 508, occurs the following passage :—

"*Indolent ulcer.* M—— of Geneva.—This lad, now about fifteen years old, had the right leg and part of the thigh terribly lacerated, and almost deprived of its integument, by a threshing-machine, eight years ago. The wound has never closed entirely, but an indolent ulcer of great extent exists, surrounded by a broad margin of hard integument, from which sometimes new skin will form, and then it will rapidly crumble away, and the ulceration will extend, perhaps, beyond its original bounds. Thus it has continued to partially close and again open, during all this time ; meanwhile, the health and strength of the lad have remained excellent, but the leg has become bent at the knee, and he walks with a halt. Two years ago Dr. Hamilton took a cast of the ulcer, which is now seen to correspond almost precisely with its present extent.

"Dr. Hamilton and others having tried almost every plan of treatment which would offer a prospect of success, and having so completely failed, as Dr. Hamilton believes, because the indurated margin, near two inches in breadth—all around the sore, is incapable of projecting from itself sound skin, the Dr. has proposed to the boy a plastic operation, with the view of planting upon the centre of the ulcer a piece of new and perfectly healthy skin. He proposes to take this from the calf of the other leg (having secured the two together), not intending to cover the whole sore, but perhaps two or three square inches, which he believes will be enough to secure the closure of the whole wound in a short time."

Two years before the date of this clinic, when I took the cast alluded to in the above report, I had made the same proposition to the lad, and when he declined submitting to

it, I appealed to his father, who was a worthless inebriate, to allow me to secure one of his legs to his son's, that I might make the transplantation from him. In no other way, I assured him, could he so much benefit his family.

I need scarcely say that permission was never obtained, and that I have never found an opportunity of determining the practicability of my suggestions until during the last year, and in the person of the man who is now before you.

The following is the report of the case, copied, in part, from the Hospital Records:

Horace Driscoll, aged 30 years; Irish laborer; had the skin and flesh extensively torn from the right leg by a dirt car, on the 3rd of November, 1852. He has been in the hospital most of the time since then until now. The wound has nearly healed several times, but never entirely; after exercise the whole would give way, and the ulcer again extend itself completely around the leg.

Jan. 21, 1854. I made the following operation:

The patient was laid upon his belly, upon the operating table before the class. A flap of skin measuring seven inches by four was then raised carefully from the calf of the opposite leg, extending in depth through the cutaneous and cellulo-adipose textures, until the fascia was in sight. Its remaining attachment to the body was by a broad and thick base. The hæmorrhage was slight; no vessels were tied. Lint, spread on both surfaces with simple cerate, was laid between the flap and the surface from which it had been detached, other pledgets of lint similarly covered were placed on the outer surface, while over all and around the entire limb was wrapt a large mass of cotton batting, secured in place by a lightly turned roller.

He was then laid in bed and perfect quietude enjoined.

Jan. 22.—During the night the wound has bled until the patient looks pale from the loss. The bleeding has now ceased.

Feb. 4th.—Two weeks since the flap was raised. The patient has had to be sustained with beer, his appetite hav-

ing failed very much since the operation. The flap has been dressed in the same manner as at first, nearly every day. It looks healthy. No part of it has sloughed.

To-day the operation was recommenced before the class, by dissecting out the granulations and part of the cicatrix from the diseased leg, and thus forming a deep bed of the size and shape of the flap as it now appeared, both contracted and thickened. The flap was then made raw again on its margins, and its lower surface was shaved off, with the double purpose of removing the granulations, and of diminishing its excessive thickness. When the bleeding had ceased, the left leg was carried across the right, so that the tendo-Achilles and heel of the left leg rested upon the instep and ankle of the right—a thick cotton pad being interposed to prevent painful pressure. The flap was now brought snugly into its new bed, on the right leg, and well secured with interrupted sutures, a moderate compress, and roller. The two limbs were further secured immovably to each other by bands, and protected at various points by well made compresses, and the wounds carefully covered with lint spread with cerate.

Feb. 5th.—The wound has bled again, as after the first operation, although ice was applied diligently from the moment the dressings were completed. Much pressure was regarded as inadmissible. Bleeding ceased when he became faint, about three hours after the operation.

Feb. 18th.—Two weeks since the last operation, and four weeks from the first. Patient has required to be sustained constantly with beer and nourishing diet. His appetite still remains bad. Bowels have not been moved in two weeks. He has not suffered much pain, only fatigue. To-day the base was separated from the left leg, the flap having united through most of its edges and under surface, to the opposite leg. No bleeding of consequence followed. The parts were thoroughly washed and dressed with ung. basil. and a snug roller applied. Ordered sulph. mag. ℥j.

Feb. 19th.—No movement of bowels. Repeat sulph. mag.

Feb. 20th.—One corner of the extreme end of the flap is beginning to slough.

Feb. 21st.—Bowels have moved. Sloughing of flap continues. Ordered yeast poultice.

Feb. 25th.—Line of demarcation formed, insulating about one inch and a half of the flap, at the corner where the sloughing commenced.

Beyond this the sloughing never extended. The surfaces continued to close, and about one hundred days after the flap was laid down the healing was finally consummated, and now after a lapse of nearly three months, during which he has been acting as a subordinate dresser at the hospital, the ulcer has not re-opened or shown any tendency that way.

The wound made by the removal of skin from the left leg was completely healed over in about the same length of time as the ulcer on the right, and the whole left limb is now as sound and as perfect as before the operation.

Driscoll is, however, at present, by no means a well man. His health has suffered considerably from his long illness, and from his prolonged confinement in bed, which dates from the time of the accident, through most of the period, up to the time of the closing of the wounds since the operation. The cicatrix around the new skin is tender, and especially at one point where several pieces of bone exfoliated soon after the accident, and precisely over which, unfortunately, the sloughing of the flap took place. The ankle is also somewhat stiffened by the contraction of the skin, and of the gastrocnemii and tendo-Achilles, which latter were seriously involved in the original injury. These, however, are conditions which the operation did not propose to remedy, at least only in a small degree, or they are temporary accidents, and will certainly yield to time and careful use. If they were to continue, however, it will not be denied that, in the permanent sealing up of a sore, which, but for this operation, must probably have remained open during life, he is amply repaid for all that he

has suffered at my hands. I venture to predict that, within one year from this time, he will be able to labor nearly or quite as well as before the accident.

On the 12th of March, five weeks after the flap had been transplanted, it had united by adhesion to the adjacent skin, through about one half of its circumference. The other half was surrounded by a border of granulations and of new skin, varying in breadth from one to ten or fifteen lines; but only at a few points was the bridge of new skin complete. It was especially noticed that nearly all, probably nine-tenths, of this new skin had sprung from the margins of the flap, and only the remaining fraction from the adjacent cicatrix; demonstrating that after transplantation and complete separation from the parent limb, its vitality was unimpaired, and that its re-productive power, if I may so speak, was vastly superior to the re-productive power of the old cicatrix.

You may notice to-day also, that since the cicatrization was completed, the cicatrix formed by growth from the flap, has contracted; and, that, in consequence of this contraction, the flap has become expanded, or been stretched outward, and its surface has become flattened and firm, whereas, it was, at first, and for a long time, elevated above the surrounding skin, and flabby.

Summary:—

1st.—Ulcers, accompanied with extensive loss of integument, do generally refuse to heal, whatever may be the health of the body or of the limb.

2d.—Anaplasty will sometimes succeed in accomplishing a permanent cure, and especially where the health of the body and of the limb are perfect, and where, by inference, the refusal to heal is alone attributable to the extent of the tegumentary loss.

3d.—The graft must be brought from a part quite remote; generally from an opposite limb, or from another person.

4th.—If smaller than the chasm which it is intended to fill, the graft will grow, or project from itself new skin to supply the deficiency.

5th.—It is not improbable that the graft will expand during the process of cicatrization at its margins, but especially for a time after the cicatrization is consummated.

6th.—In consequence of one or of both of these two latter circumstances, it will not be necessary to make the graft so large as the deficiency it is intended to supply.

NEW MODE OF TREATMENT

FOR

DELAYED OR NON-UNION

OF A

FRACTURED HUMERUS,

READ BEFORE THE

MEDICAL SOCIETY OF THE COUNTY OF ERIE, JUNE, 1854.

BY FRANK H. HAMILTON, M. D.

It has been observed by surgeons that non-union results more frequently after fractures of the shaft of the humerus, than after fractures of the shaft of any other bone. This observation is confirmed by my own researches.

Comparing the humerus with the femur, between which, above all others, the circumstances of form, situation, &c., are most nearly parallel, and in both of which non-union is said to be relatively frequent, I find that of forty-nine fractures of the humerus, four occurred through the surgical neck, twelve through the condyles and twenty-nine through the shaft. In one of the twenty-nine, the patient survived the accident only a few days. In four of the remaining twenty-eight, union had not occurred after the lapse of six months, and in many more was it delayed considerably beyond the usual time. Two of the four were simple fractures, and occurred near the middle of the humerus; the third was compound, and occurred near the middle also; the fourth was compound, and occurred near the condyles.

This analysis supplies us, therefore, with four cases of non-union, from a table of twenty-eight cases of fractures through the shaft.

Of eighty-seven fractures of the femur, twenty occurred through the neck, one through the trocanter major, and one through the condyles. The remaining sixty-five occurred through the shaft and generally near the middle, and in not one case was the union delayed beyond six months.

To make the comparison more complete, I must add that of the twenty-eight fractures of the shaft of the humerus, six were compound; and of the sixty-five fractures of the shaft of the femur, six were either compound, comminuted, or both compound and comminuted. The six compound fractures of the shaft of the humerus, furnished two cases of non-union. The six cases of either compound or comminuted, or comopund and comminuted fractures of the femur, furnished no case of non-union.

I beg to suggest to the Society what seems to me to be the true explanation of these facts.

It is the universal practice, so far as I know, in dressing fractures of the humerus, to place the forearm at right angles with the arm. Within a few days, and generally, I think, within a few hours, after the arm and forearm are placed in this position, a rigidity of the muscles and other structures has ensued, and to such a degree, that if the splints and sling are completely removed, the elbow will remain flexed and firm; nor will it be easy to straighten it. A temporary false anchylosis has occurred, and instead of motion at the elbow joint, when the forearm is attempted to be straightened upon the arm, there is only motion at the seat of fracture. It will thus happen that every upward and downward movement of the forearm will inflict motion upon the fracture, and inasmuch as the elbow has become the pivot, the motion at the upper end of the lower fragment will be the greater in proportion to the distance of the fracture from the elbow joint.

No doubt it is intended that the dressings shall prevent all motion of the forearm upon the arm; but I fear that they cannot always be made to do this. I believe it is never done when the dressing is made without angular splints, nor is it by any means certain that it will be accomplished when such splints are used. The weight of the forearm is such when placed at right angles with the arm and encumbered with splints and bandages, that even when supported by a sling, it settles heavily forwards, and compels the arm dressings to loosen themselves from the arm in front of the point of fracture, and to indent themselves in the skin and flesh behind. By these means the upper end of the lower fragment is tilted forward. If the forearm should continue to drag upon the sling, nothing but a permanent forward displacement would probably result. The bones might unite, yet with a deformity.

But the weight of the forearm under these circumstances is not uniform, nor do I see how it can be made so. It is to the sling that we must trust mainly to accomplish this important indication. But you have all noticed that the tension or relaxation of the sling depends upon the attitude of the body, whether standing or sitting—upon the erection or inclination of the

head—upon the motions of the shoulders, and in no inconsiderable degree upon the actions of respiration. Nor does the patient himself cease to add to these conditions by lifting the forearm with his opposite hand whenever provoked to it by a sense of fatigue.

This difficulty of maintaining quiet apposition of the fragments while the arm is in this position, at whatever point the arm may be broken, becomes more and more serious as we depart from the elbow joint, and would be at its maximum at the extreme upper end of the humerus, were it not that here a mass of muscles, investing and adhering to the bone, in some measure obviates the difficulty. Its true maximum is therefore near the middle, where there is less muscular investment, and where, on the one hand, the fracture is sufficiently remote from the pivot or fulcrum to have the motion of the upper end of the lower fragment multiplied through a long arm, while on the other hand it is sufficiently near to the armpit and shoulder to prevent the upper portion of the splint and arm dressings from obtaining a secure grasp upon the lower end of the upper fragment.

It must not be overlooked that the motion of which we speak belongs exclusively to the lower fragment, and that it is always in the same plane, forwards and backwards; but especially that it is not a motion upon the fracture as upon a pivot, but a motion of one fragment to and from its fellow. This circumstance I regard as important to a right appreciation of the difficulty. Motion, alone, I am fully convinced, does not so often prevent union as surgeons have generally believed. It is exceedingly rare to see a case of non-union of the clavicle. Of forty-seven cases of fracture of the clavicle which have come under my observation, and in by far the greater majority of which considerable overlapping and consequent deformity has resulted—of this number only one has resulted in non-union, and in this instance no treatment whatever was practiced, but from the time of the accident the patient continued to labor in the fields and hold the plow as if nothing had occurred. I have, therefore, seen no case of non-union of the clavicle where a surgeon has treated the accident. Indeed, what is most remarkable, its union is more speedy, usually, than that of any other bone in the body, of the same size. Yet to prevent motion of the fragments in a case of fractured clavicle with complete separation and displacement, except where the fracture is near one of the extremities of the bone, I have always found wholly impracticable. Whatever bandages or apparatus I have applied, I have still seen always that the fragments would move freely upon each other at each act of inspiration and expiration, and at almost every motion of the

head, body or upper extremities. It is probable, gentlemen, that you have made the same observation.

From this and many similar facts I have been led to suspect, for a long time, that motion has had less to do with non-union than was generally believed.

I find, however, no difficulty in reconciling this suspicion with my doctrine in reference to the case in question; and it is precisely because, as I have already explained, the motion, in case of a fractured humerus, dressed in the usual manner, is peculiar. In a fracture of the clavicle through its middle third, (its usual situation,) the motion is upon the point of fracture as upon a pivot; although, therefore, the motion is almost incessant, it does not essentially, if at all, disturb the adhesive process. The same is true in nearly all other fractures. The fragments move only upon themselves, and not to and from each other. I know of no complete exception but in the case now under consideration.

Aside of any speculation, the facts are easily verified by a personal examination of the patients during the first or second week of treatment, or at any time before union has occurred, both in fractures of the humerus and clavicle. The latter is always sufficiently exposed to permit you to see what occurs, and as soon as the swelling has a little subsided in the former case, you will have no difficulty in feeling the motion outside of the dressings, or perhaps in introducing the finger under the dressings sufficiently far to reach the point of fracture. I believe you will not fail to recognize the difference in the motion between the two cases.

Such, gentlemen, is the explanation which I wish to offer for the relative frequency of this very serious accident—non-union of the humerus.

I know of no other circumstance or condition in which this bone is peculiar, and which, therefore, might be invoked as an explanation. Overlapping of the bones, the reason assigned by some writers, is not sufficient, since it is not peculiar. The same occurs much oftener, and to a much greater extent, in fractures of the femur, and equally as often in fractures of the clavicle; yet in neither case are these results so frequent. Nor can it be due to the action of the deltoid or of any other particular muscles about the arm, whether the fracture be below or above their insertions, since similar muscles, with similar attachments on the femur and on the clavicle, tending always powerfully to the separation of the fragments, occasion only deformity, but not non-union.

If I am correct in my views, we shall be able sometimes to consummate

union of a fractured humerus where it is delayed, by straightening the forearm upon the arm, and confining them to this position. A straight splint, extending from the top of the shoulder to the hand, made of some firm but moulding material, and made fast with rollers, will secure the requisite immobility to the fracture. The weight of the forearm and hand will only tend to keep the fragments in place, and if the splint and bandages are sufficiently tight, the motion occasioned by swinging the hand and forearm will be conveyed almost entirely to the shoulder joint. Very little motion, indeed, can in this posture be communicated to the fragments, and what little is thus communicated, is a motion which experience has elsewhere shown not disturbing or pernicious, but a motion only upon the ends of the fragments as upon a pivot.

I do not fail to notice that this position has serious objections, and that it is liable to inconveniences which must always, probably, prevent its being adopted as the usual plan of treatment for fractured arms. It is more inconvenient to get up and lie down, or even to sit down, in this position of the arm; and the hand is liable to swell. But I shall not be surprised to learn that experience will prove these objections to have less weight than we are now disposed to give them. Remember, the practice is yet untried—if I except the case which I am about to relate, and in which case, I am frank to say, these objections scarcely existed. The swelling of the hand was trivial, and only continued through the first fortnight, and the patient never spoke of the inconvenience of getting up or sitting down, or even of lying down.

The following is the case to which I have just referred.

Michael Mahar, laborer, æt. 35, broke his left humerus just below its middle, Dec. 14, 1853. The arm was dressed by a skillful surgeon in Canada West, and who is well known to me as exceedingly "clever." After a few days from the time of the accident, "the starch bandage was put on as tight as it could be borne, and brought down on the forearm so as to confine the motions of the elbow joint."

Six weeks after the injury, Jan. 29, 1854, Mahar applied to me at the hospital. No union had occurred. The motion between the fragments was very free, so that they passed each other with an audible click. There was little or no swelling or soreness. In short, every thing indicated that union was not likely to occur without operative interference. The elbow was completely anchylosed. His health was unimpaired.

I explained to my students what seemed to me to be the cause of the

delayed union, and declared to them that I did not intend to attempt to re-establish adhesive action until I had straightened the arm. They had just witnessed the failure of a precisely similar case in which I had made the attempt without straightening the arm and without success.

Feb. 6, 1854. I had succeeded in making the arm nearly straight. I now punctured the upper end of the lower fragment with a small steel instrument, and as well as I was able, thrust it between the fragments. Assisted by Dr. Boardman, I then applied a gutta percha splint from the top of the shoulder to the fingers, moulding it carefully to the whole of the back and sides of the limb, and securing it firmly with a paste roller.

March 4th. (Not quite four weeks after the application of the splint,) I opened the dressings for the second time, and carefully renewed them. A slight motion was yet perceptible between the fragments.

March 18th. I opened the dressings for the third time, and found the union complete. This was within less than forty days.

The patient was now dismissed. On the 29th of April following the bone was refractured. Mahar had been assisting to load the "tender" to a locomotive. While the train was just getting in motion he was hanging to the tender by his sound arm when another laborer seized upon his broken arm to keep himself upon the car, and with a violent and sudden pull wrenched him from the tender and reproduced the fracture.

The next morning I applied the dressings as before, and did not remove it during three weeks, at the end of this time the union was again complete. The splint was, however, reapplied and has been continued to this time—a period of about six weeks.