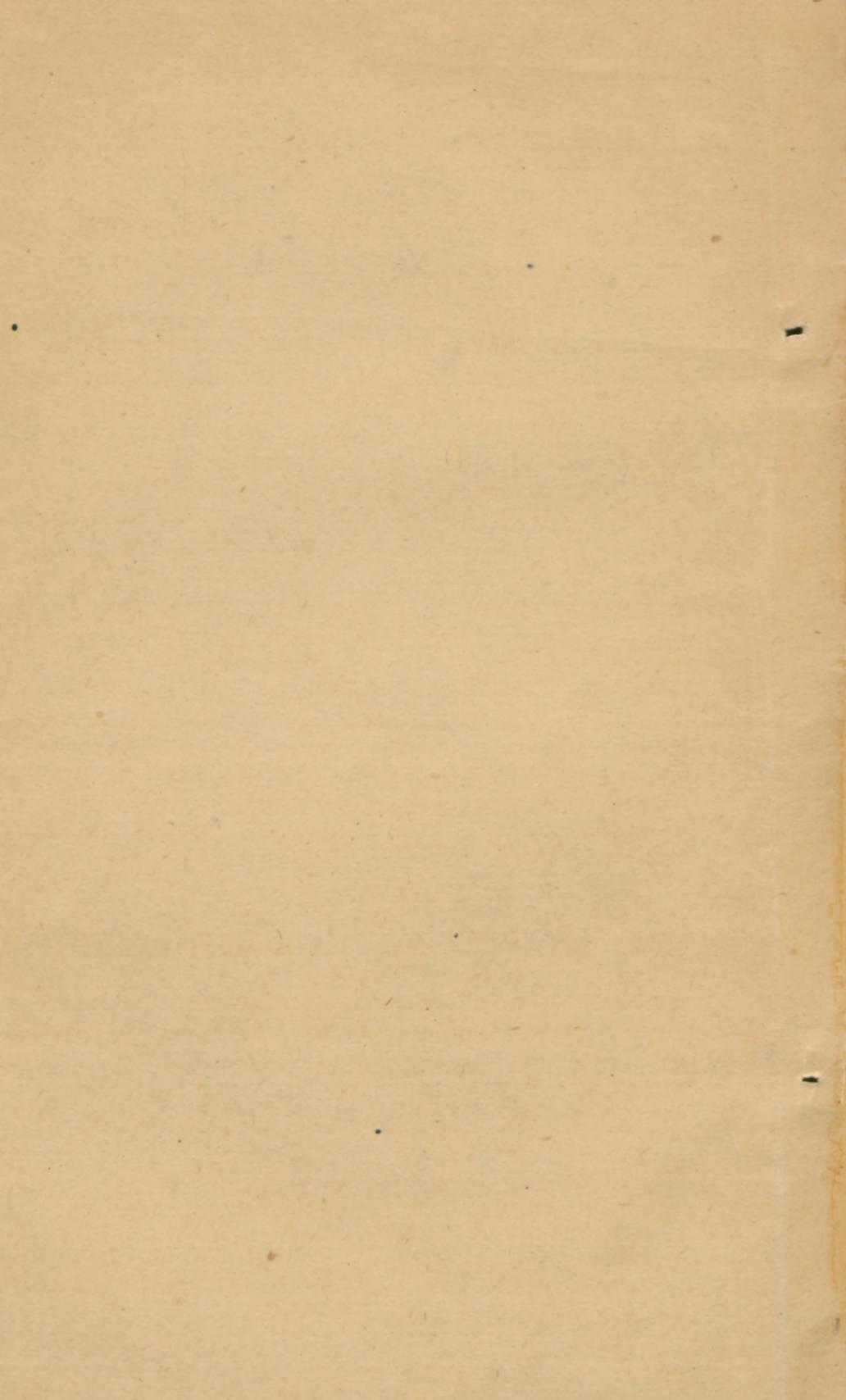


HAMILTON (F. H.)

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L O N G B O N E S ;

CONSIDERED WITH

ESPECIAL REFERENCE TO THE VALUE OF RESECTION.

BY ✓

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COMPOUND DISLOCATION OF THE LONG BONES.

Frequency of Compound as compared with Simple Dislocations.—Compound dislocations, as compared with simple, are of rare occurrence. Of ninety-four dislocations reported by Norris as having been received into the Pennsylvania Hospital for the ten years ending in 1840, only two were compound;¹ and of one hundred and sixty-six dislocations recorded in my observations, only eight were compound.²

Relative Frequency in the Different Joints.—In my own recorded cases, four were dislocations of the tibia inward at the ankle-joint, one was a partial (pathological) luxation forward at the same joint, one was a luxation of the astragalus, one a luxation of the head of the humerus into the axilla, and one a forward luxation of the radius and ulna at the wrist-joint. Both of the cases reported by Norris were dislocations of the thumb.

Sir Astley Cooper, speaking upon this point,³ says that the elbow, wrist, ankle, and finger-joints are most subject to these accidents; and that he has seen but two in the shoulder-joint, and one in the knee-joint. He had never seen a compound dislocation at the hip-joint, and he believed that it was "scarcely ever" so dislocated. On p. 119, however, Mr. Bransby Cooper has reported in detail a very interesting case of this accident, communicated to him by Dr. Walker, of Charlestown, Mass., in which reduction was accomplished by *manipulation* alone, by Dr. Ingalls, on the second day. The patient died at the end of about three weeks. So far as I know, this is the only case upon record. Malgaigne says that a compound dislocation at the hip-joint has probably never occurred.⁴

Among the cases of compound dislocation recorded by Sir Astley and Bransby Cooper, most of which were communicated to these gentlemen by other surgeons, 45 were dislocations of the ankle, 10 of the astragalus, 4 of the ulna at the wrist-joint, 4 of the thumb, 2 of the knee, 1 of the shoulder, 1 of the elbow, 1 of the radius and ulna at the wrist, 1 of the scaphoid bone, and 1 of the metatarsal bone of the great toe. Other writers have occasion-

¹ See this Journal, vol. xxvii. p. 335 (1841).

² For the most of these cases, see Transactions of the New York State Med. Soc. for 1855; article entitled "Report on Dislocations, with Especial Reference to their Results." By Frank H. Hamilton.

³ Treatise on Disloc., &c., Amer. ed., 1851, p. 59.

⁴ Traité des Frac. et des Lux., tom. ii. p. 212.

ally described compound dislocations of the clavicle, but I know of no record of a compound dislocation of the lower jaw.

Prognosis, as determined by the Mode of Treatment adopted by most of the Ancient and many of the Modern Surgeons.—By most of the early writers these accidents, whenever they occurred in the larger joints, were regarded as nearly beyond the reach of art. Says Hippocrates :—

“In cases of complete dislocation at the ankle-joint, complicated with an external wound, whether the displacement be inwards or outwards, you are not to reduce the parts, but let any other physician reduce them if he choose. For this you should know for certain, that the patient will die if the parts are allowed to remain reduced, and that he will not survive more than a few days, for few of them pass the seventh day, being cut off by convulsions, and sometimes the leg and foot are seized with gangrene.”—*Works of Hippocrates, published by the Sydenham Soc., London, vol. ii. p. 634.* Hippocrates adds, “But if not reduced, nor any attempts at first made to reduce them, most of such cases recover.”—*Op. cit., p. 634.*

The same remarks are applied by Hippocrates to compound dislocations of the head of the tibia, of the lower end of the femur, of the wrist, elbow, and shoulder-joints; death occurring in all cases, as he believes, more or less speedily whenever the bones are reduced and retained in place a sufficient length of time, and “were it not that the physician would be exposed to censure” (*op. cit., p. 638*), he would not reduce even the bones of the fingers, since it must be expected, he thinks, that their articular extremities will exfoliate even when the reduction is most successful.

I shall presently show, however, that even Hippocrates advised and probably practised resection in certain cases of these accidents.

Both Celsus and Galen adopt almost without qualification the line of practice laid down by Hippocrates, and affirm equally the danger and almost certain death consequent upon the reduction of compound dislocations in large joints.¹ Celsus recommends resection in some cases.

Paulus Ægineta, however, and after him Albucasis, Haly Abbas and Rhazes, do not regard the rules established by Hippocrates in relation to the non-reduction of the bones as so imperative, nor the results of the opposite practice as so uniformly fatal.

“Hippocrates remarks,” says Paulus Ægineta, “in the case of dislocations with a wound the utmost discretion is required. For these, if reduced, occasion the most imminent danger, and sometimes death, the surrounding nerves and muscles being inflamed by the extension, so that strong pains, spasms, and acute fevers are produced more particularly in the case of the elbows, knees and joints above, for the nearer they are to the vital parts the greater is the danger they induce. Wherefore, Hippocrates, by all means, forbids us to apply reduction and strong bandaging to them, and directs us to use only anti-inflammatory and soothing applications to them at the commencement, for that by this treatment life may sometimes be preserved. But what he recommends for the fingers alone we would attempt to do for all the other joints; at first, and while the parts remain free from inflammation, we would reduce the dislocated joint by moderate extension, and if we succeed in our object we may persist in using the anti-inflammatory treatment only. But if

¹ Paulus Ægineta, vol. ii. p. 510, Syd. ed.

inflammation, spasm, or any of the afore-mentioned symptoms come on, we must dislocate it again if it can be done without violence. If, however, we are apprehensive of this danger (for perhaps if inflammation should come on it will not yield), it will be better to defer the reduction of the greater joints at the commencement; and when the inflammation subsides, which happens about the seventh or ninth day, then, having foretold the danger from reduction, and explained how, if not reduced, they will be mutilated for life, we may try to make the attempt without violence, using also the lever to facilitate the process."¹

In the following quotations from three of the most celebrated writers of the two last centuries we find but little if any evidence that the opinions of the fathers upon this subject were not still held in general respect:—

"If the joint be dislocated, so that it is either uncovered, or a little thrust forth without the skin, the accident is mortal, and of more danger to be reduced than if it be not reduced. For if it be not reduced, inflammation will come upon it, convulsion, and sometimes death. 2. There will be a filthiness of the part itself. 3. An incurable ulcer, and if perhaps it be brought to cicatrize at all, it will easily be dissolved by reason of the softness of it; but if it be reduced, it brings extreme danger of convulsion, gangrene, and death."²

"Si vero in magnis articulis tam valida fuit facta luxatio, ut ligamentis ruptis os articuli multum sit protrusum per integumenta, hæc pars ossis vasis privata moritur, citius autem si reponatur, quam si non reponitur; quare sola amputatio restat ad conservationem vitæ."³

Heister, who makes no allusion to this subject in the first edition of his great work, published at Amsterdam in 1739, adds the following remarks in his last edition, translated and published in London in 1768:—

"Dislocations attended with a wound, especially of the shoulder or thigh bone, are of very bad consequence, and often endanger the life of the patient; in Celsus's opinion (Book VIII. Chap. XXV.), whether the bones be replaced or not, there is generally great danger; and so much the more the nearer the wound is to the joint. Hippocrates has declared that no bones can be reduced with security, beside those of the hands and feet (*Vectiar.* 19, 5). See more on this subject in that passage of Celsus just now quoted, though I by no means recommend the following him implicitly."⁴

Such were the extreme views as to the fatality of these accidents, and of the feebleness of our resources entertained by the ancient, and even by the more modern writers almost down to our own day; with only rare exceptions these limbs were condemned either to great and inevitable deformity, or to amputation. Nor, if we speak only of their fatality, have surgeons ceased to regard these accidents as among the most grave with which they have to deal.

Pathology and Appreciation of the Sources of Danger, as compared especially with Compound Fractures.—The danger, according to Sir Astley

¹ Works of Paulus Ægineta, Sydenham ed., vol. ii. p. 509.

² "Chirurgion's Storehouse." By Johannes Scultetus, of Ulme, in Suevia. London ed., 1674, p. 31.

³ Johannes de Gorter. *Chirurgia repurgata.* Lugduni Batavorum, 1742. p. 86.

⁴ General System of Surgery, by Dr. Laurence Heister. 8th ed. London, 1768. Vol. i. p. 164.

Cooper, consists in the rapid inflammation of the synovial membranes, which is speedily followed by suppuration and ulceration, whereby the ends of the bones become exposed; and for the repair of which lesions great general as well as local efforts are required, and a high degree of constitutional irritation results. In addition to which circumstances, "the violence inflicted on the neighbouring parts, the injury of the muscles and tendons, and the laceration of bloodvessels, necessarily lead to more important and dangerous consequences than those which follow simple dislocations."¹

The sources of danger enumerated by Sir Astley Cooper have been regarded as sufficient to account for their extraordinary fatality by the majority of those modern surgical writers who have alluded to the subject; but I must confess that to me they do not appear so. In compound fractures the mortality is far less; yet one might naturally suppose, that when the sharp and irregular fragments are pressing into the flesh, among nerves and bloodvessels, the irritation and inflammation would be equal, if not more than equal to the irritation and consequent inflammation produced by exposing a joint surface to the air; indeed, modern experience has sufficiently shown that these surfaces are much more tolerant of atmospheric exposure, and of the action of many other irritants, than surgeons formerly supposed. A clean incision into a large joint, which exposes the synovial membranes to the air, and which permits the products of inflammation to escape freely, is attended with much less danger than a small puncture which does not at all permit the air to enter, nor the increased synovia and the pus to escape. Very grave results sometimes follow from large wounds into large joints, but under judicious treatment such results are the exception and not the rule.² But Sir Astley evidently attributes more of the bad consequences to the exhausting effects of the efforts at repair, than to the immediate inflammation resulting from the exposure of the joint. It is pretty certain, however, that a majority of these patients die at a period too early to render this cause in any considerable degree operative.

As to the bruising of the "muscles and tendons, and laceration of bloodvessels," it cannot be denied that it must usually be greater than in "simple dislocations;" and I will not say that it is not in a given number of instances greater than in the same number of instances of compound fractures. The tissues have often been thrust rudely through by a large and smooth bone, and the tendons have been stretched violently or torn completely asunder; while occasionally large arteries, which are prone to hug the bones about the joints, are lacerated and left to bleed. That the importance of these complications, however, may not be over-estimated, we must state that Sir Astley Cooper himself has remarked how seldom, in compound dislocations of the

¹ On Dislocations and Fractures. Amer. ed., 1851, p. 59.

² Upon this point see the very able article entitled "Amputations and Compound Fractures," by John O. Stone, in the New York Journal of Medicine, vol. iii. of 2d series, p. 316. Nov. 1849.

ankle-joint, the large arteries are injured; that a tearing of the ligaments and of the tendons is almost as likely to occur in simple dislocations as in compound; and, indeed, that in neither case are the tendons usually ruptured, but only thrust aside. Moreover, the skin is often made to give way not so much from the pressure of the round head within, as from the equal pressure of some sharp angular body from without. In all of these respects, there are many examples of compound fractures which possess not a whit of advantage; in which cases, nevertheless, the surgeon feels very little doubt as to the ultimate cure.

In short, the causes which, according to Sir Astley Cooper, determine the extraordinary fatality of these accidents, do not sufficiently differ from those which operate in compound fractures to occasion so great a difference in results, and the fatality of compound dislocations remains unexplained; or if surgical writers have here and there intimated the true cause, they have failed to give it its proper place and value.

I think the cause of the greater fatality of compound dislocations over compound fractures is to be found in the simple fact that dislocations are generally reduced, and by splints or other apparatus successfully maintained in place, while compound fractures, as my reports of cases have proven, are not generally reduced completely, nor can they by any means yet devised, except in a few cases, be maintained in place if reduced. Broken limbs, whether simple or compound in their character, will in a great majority of cases shorten upon themselves in spite of the most assiduous and skilful attempts to prevent it.

In adults most bones break obliquely, and cannot be made to support each other, and even in transverse fractures the broken ends are generally small compared with the articular ends of the same bones, and afford a very uncertain and inadequate support for themselves; not to speak of the difficulty of once bringing their ends into exact apposition where the muscles are powerful, or they lie embedded in a large mass of flesh, so that they cannot be felt. While, on the other hand, dislocated bones, whether simple or compound, are capable when restored to place of supporting themselves; or with only slight assistance, their reduction may be maintained: it is also ordinarily a work of no great difficulty to reduce them.

Herein, then, consists the most important difference between these two classes of accidents, which are in other respects so similar. In the one, the very nature of the injury prevents the complete reduction, and the consequent violent strain of the muscles, tendons, and other soft tissues; while in the other, the nature of the accident leaves it in the power of the surgeon to reduce the bones, and modern surgery has in a great measure sanctioned the practice of maintaining them in place, in defiance of the efforts of the muscles to shorten the limb, and probably to the imminent hazard of the life of the patient.

Is it not fair to presume that tissues which have been lacerated and

stretched, require rest in order that they may recover from the effects of their injuries? And if the soft parts are really more injured in dislocations than in fractures, does not the indication for rest become, for this very reason, more imperative?

General Inferences.—We have come, then, to regard the shortening of limbs after fractures, within certain limits and in certain cases, as a conservative circumstance rather than as a circumstance which the surgeon should in all cases seek to prevent.

There is abundant evidence that the ancients had some knowledge of the value of rest to the muscles, tendons, &c., in the prevention of inflammation after compound dislocations, since they constantly urge the greater danger of reducing these dislocations, than of leaving them unreduced; and they do not hesitate to recommend, that in case violent inflammation supervenes upon the reduction, the bone shall immediately be again dislocated. Galen speaks very explicitly on this subject, and says that “the danger in reduction consists partly in the additional violence inflicted on the muscles, and partly in their being then put into a stretched state, whereby spasms or convulsions are brought on, and gangrene as the result of the intense inflammation which ensues;”¹ and Paulus Ægineta remarks: “For these, if reduced, occasion the most imminent danger, and sometimes death; the surrounding nerves and muscles being inflamed by the extension,” &c.²

I have already quoted from Sir Astley Cooper the causes to which he attributes in general the great fatality of compound dislocations; and the same reasons have generally been assigned by those who have written since his day; but he has elsewhere, when speaking of exsection, given place to the very idea for which we claim so much prominence, the danger arising from a stretching of the muscles.³ Mr. Liston,⁴ also, and Mr. Miller,⁵ when speaking especially of dislocations of the tibia at the ankle-joint, refer to the same source of danger.

Treatment.—Let us see now the alternatives which surgery presents for the treatment of these intractable accidents.

1. Reduction of the bone.
2. Non-reduction.
3. Amputation.
4. Tenotomy.
5. Resection and reduction.

The questions for us to consider are, first, by which of these several methods is the life of the patient rendered most secure; and second, where of two or

¹ Works of Hippoc., vol. ii. p. 634. Note by the translator.

² Paulus Ægineta, vol. ii. p. 509.

³ Cooper on Disloc. and Frac., Amer. ed., 1851, p. 270.

⁴ Liston's Practical Surgery, Amer. ed., p. 97.

⁵ Miller's Principles of Surgery, Amer. ed., p. 684.

more methods all are equally safe, by which will be suffered the least maiming or mutilation.

By Reduction.—We have seen already how the old surgeons regarded the practice of reducing compound dislocations of the larger joints. It is not difficult, however, to find in the records of surgery numerous examples of their successful termination under this practice.

In the third vol. of this journal, p. 109, may be found a case of this kind, in which the dislocation was at the ankle-joint, reported by Dr. White, of Hudson, N. Y. Pott says he has seen this practice occasionally succeed,¹ and Mr. Scott communicated to the *Lancet* in March, 1837, a case of compound dislocation of the humerus successfully treated by reduction. Sir Astley Cooper also records several cases of compound dislocations at the lower end of the tibia and fibula, successfully treated by reduction.

A careful examination, however, of those cases reported by Sir Astley as having been reduced without resection, and which resulted in cures, does not, in my opinion, leave much substantial evidence in favour of the practice; or perhaps we ought rather to say that it leaves only a qualified evidence of its propriety in certain cases. He has mentioned about sixteen of these examples, comprising dislocations of the lower end of the tibia, or of the tibia and fibula outwards and inwards and forwards, all of which, save one quoted from Mr. Liston, have been reported to him by other surgeons, and not one of which he had ever seen himself. Many of the cases are reported very loosely, evidently in reply to circular letters, and from memory, without recorded notes, and by unknown, and in some sense irresponsible surgeons. It is not always said whether the wounds in the soft parts were made by the protrusion of the bones, or by some external violence; yet this is certainly a very material point in determining whether reduction is to be followed by inflammation or not. The results, sometimes only accomplished after exposure to great hazards, are, after all, often sufficiently unfavourable.

It will be noticed, also, that in Cases 152 and 153, the astragalus was comminuted and removed, either at first or at a later day; and in Cases 154, 155, 156 and 160, the tibia, and also probably the fibula, was broken, and it does not appear but that in consequence of this complication the limb became shortened, and the muscles were thus put at rest, very much as if the bones had been retracted; and in one of the cases enumerated under 161, the lower end of the tibia spontaneously exfoliated. That a comminution, or that any fracture of the astragalus or of the tibia and fibula, should be regarded in these cases as rendering the accident less grave, can only be comprehended by a full appreciation of the value of relaxation of the muscles.

The few cases which remain after this exclusion do indeed illustrate how nature and skill may triumph over great difficulties, but nothing more.

Non-Reduction.—While, on the other hand, it will be very difficult to find an equal number of cases of compound dislocations unreduced, which have

¹ Chirurg. Works, vol. ii. p. 243.

terminated favourably, surgeons who have themselves left such limbs unreduced, would scarcely be willing to give them the notoriety of a public record. In the *Transactions* of the New York State Medical Society for 1855, I have reported (Case 16 of Tibia and Fibula, p. 87), a compound dislocation at the ankle-joint, which, being unreduced, terminated fatally on the twenty-eighth day. This is the only example of a compound dislocation of a long bone, left unreduced, which has fallen under my observation; excepting, of course, those cases in which amputation was practised.

The united testimony, however, of the old surgeons, who generally neither amputated nor adopted the method of resection, but who recommended and practised non-reduction, is, that it is much more safe to leave these bones unreduced, than to reduce them without resection; and I see no reason to doubt the correctness of their opinions in this matter. But whether it would be more safe to leave such limbs unreduced, or having practised resection to restore them, is another question, in which the advantage and comparative safety of the latter practice is too obvious to require explanation or defence.

Amputation.—"When this accident (dislocation of the ankle) is accompanied, as it sometimes is, with a wound of the integuments of the inner ankle, and that made by the protrusion of the bone, it not unfrequently ends in a fatal gangrene, unless prevented by timely amputation, though I have several times seen it do very well without."¹

Says Sir Astley Cooper: "Thirty years ago it was the practice to amputate limbs for this accident (compound dislocations of the ankle-joint), and the operation was then thought absolutely necessary for the preservation of life, by some of our best surgeons." (*On Disloc., &c.*, p. 256.) Nor is it difficult to see by what reasoning they had fallen back upon this desperate remedy. Both reduction and non-reduction having proven eminently hazardous, in the absence of perhaps both knowledge and experience in resection, they finally adopted the alternative of amputation as that which after all must give to the patient the best chance for life; and were no other alternatives to be presented, this would be our choice in a large proportion of cases.

It must not be understood, however, that amputation is an expedient wholly free from danger; or indeed that the chances of the patient are in the average very greatly increased by this practice. Of thirteen amputations made for compound dislocations at the ankle-joint, in the Royal Infirmary at Edinburgh, only two resulted in the recovery of the patients.² Alluding to which, Mr. Fergusson remarks: "An amount of mortality which may well incline the surgeon to act upon the doctrine inculcated by Sir Astley Cooper." (To attempt to save the limb by reduction.) But Mr. Fergusson has added a sentiment which accords very closely with my own experience and opinions. "I fear, however, that in the attempts which have been made to save the

¹ Potts' *Chirurg. Works*, Philada. ed., 1819, vol. i. p. 248.

² *Edinb. Med. Monthly*, Aug. 1844.

foot (by reduction) the results in all the cases have not met with the same publicity; that the instances where amputation has been afterwards necessary, or where death has been the consequence, have not always been recorded; and from what I have myself seen, I would caution the inexperienced practitioner from being over-sanguine in anticipating a happy result in every example.”—*Fergusson's Surg.*, p. 281.

By Tenotomy.—As a means of overcoming the resistance of the muscles, and for the purpose especially of facilitating the reduction, tenotomy has been proposed. (See p. 250 of vol. xxxiv. of this Journ.)

This method, based in some degree upon a very correct notion of the principal sources of difficulty and of danger in these cases, I regard as totally impracticable, at least to any useful or adequate extent. In order to be efficient all of the tendons passing the articulations must be cut, or nearly all of them; and I doubt whether the judgment of any discreet surgeon will ever sanction such an extreme, I might almost say, such an absurd measure. Nor do I think that in the point of view in which we are now considering this subject, having reference only to the question of danger, if the cutting of the tendons was sufficiently extensive to have any real effect in facilitating the reduction, the practice would be found to have any advantage over other methods known to be eminently dangerous.

By Resection.—Finally resection presents itself for our consideration as the only remaining surgical expedient.

We have seen that most of the early writers understood the effects of a constant strain upon the muscles in increasing the danger of spasms, inflammation and death; but in general they have suggested no remedy but non-reduction or amputation. Hippocrates, however, uses the following language, after speaking of resection of protruding bones in accidental amputations, or in fractures of the fingers: “Complete resections of bones at the joints, whether the foot, the hand, the leg, the ankle, the forearm, the wrist, for the most part, are not attended with danger, unless one be cut off at once by deliquium animi, or if continual fever supervene on the fourth day.” (*Op. cit.*, vol. ii. p. 638.) To which passage the translator adds the following note: “This paragraph on resection of the bones in compound dislocations and fractures contains almost all the information on the subject which is to be found in the works of ancient medicine.” Celsus notices the practice of resection in compound dislocations very briefly, as follows: “Si nudum os eminent, impedimentum semper futurum est; ideo quod excedit, abscindendum est.”

Mr. Hey, of Leeds, was the first of the modern surgeons who called especial attention to the value of resection in compound dislocations.

Subsequently Mr. Parks, of Liverpool, in an “Account of a new method of treating Diseases of the Joints of the Knee and Elbow,” advocates the practice of resection in certain cases of diseases of these joints, but especially in “affections of the joints produced by external violence.”¹

¹ System of Surgery, by Benj. Bell, Edinburgh ed., 1801, vol. vii. p. 360.

Mr. Levéille, in France also, following as he affirms the guidance of Hippocrates, has advocated a similar practice.

Velpeau,¹ Symes,² Fergusson,³ Erichsen,⁴ Miller,⁵ Liston,⁶ Chelius,⁷ Lizars,⁸ Gibson,⁹ Norris,¹⁰ under certain circumstances, and especially where the bones cannot otherwise be reduced, and where the dislocations occur in certain joints, and especially the elbow and ankle-joints, recommend resection. To which names we may add that of Sir Astley Cooper, who has considered the subject, as applied to the ankle-joint, quite at length, and who says: "I have known no case of death when the extremities of the bone" (tibia, at the ankle) "have been sawed off, although I shall have occasion to mention some cases which terminated fatally when this was not done."¹¹

Why resection should diminish the danger to life, by placing at rest the injured muscles, has been already sufficiently considered; but it seems not improbable that, if synovial membranes are indeed more susceptible of violent and dangerous inflammations than the other tissues about the joints, then would this source of danger be removed just in proportion as the synovial membranes themselves are removed. Such indeed was the argument used by Sir Astley; and Mr. South, in a note to Chelius, when referring to this fact, has made the following statement:—

"In compound dislocations of the ankle-joint with protrusion of the shin-bone through the wound, most English surgeons saw off the joint end, not merely to render reduction more easy, but also, according to Sir Astley Cooper's opinions, to lessen the suppurative process, by diminishing the synovial surface. This mode of practice is certainly not commonly followed in reference to other joints, and the younger Cline was always opposed to it being resorted to in dislocated ankle." (*Op. cit.*, vol. ii. p. 251.)

Case of Compound Dislocation of the Tibia inwards, with Fracture of the Fibula. Resection of the lower end of the tibia, and recovery with a very useful limb.—Samuel Adamson, of Buffalo, æt. 24, was caught by the cable of a vessel June 17, 1855, dislocating the left tibia at its lower end inwards, and breaking the fibula two inches above the ankle. I was immediately called and found the tibia protruding through the skin about three inches. The periosteum was torn up, and the cartilaginous surface of the end of the bone was roughened. His thigh was also severely bruised and lacerated, but the bone was not broken.

Dr. Boardman assisting me, we attempted to reduce the bones, but with our hands we found it impossible to do so. I proceeded immediately to remove about one inch and a half of the lower end of the tibia with the saw.

¹ This Journal, vol. xxxiv. p. 250. ² Principles of Surg., Amer. ed., pp. 332-3.

³ Practical Surgery, 4th American ed., pp. 194, 202, 280, 281.

⁴ Surgery, Amer. ed., pp. 239, 263. ⁵ Principles of Surgery, Amer. ed., p. 684.

⁶ Practical Surgery, 1st Amer. ed., pp. 97-8.

⁷ System of Surgery, Phila. ed., 1847, vol. ii. p. 251.

⁸ Practical Surgery, Edinburgh ed., pp. 155, 160.

⁹ Elements of Surgery, 2d ed., vol. i. p. 340. ¹⁰ This Journal, vol. xxxi. p. 15.

¹¹ Treatise on Disloc. and Frac., Amer. ed., 1851, p. 271.

The remaining portion was then brought easily into place, and the wound was dressed with sutures, adhesive straps, bandages, and light splints. On the same day he became an inmate of the marine wards at the Hospital of the Sisters of Charity, and was placed under the care of Dr. Wilcox, but through the politeness of Dr. Wilcox I was permitted to see him frequently.

The wound in the leg healed kindly, and with only a slight amount of inflammation and suppuration. Violent inflammation, however, occurred in the thigh, followed by extensive suppuration and sloughing. This, in fact, proved to be by far the most serious injury, and that which most endangered his life and delayed his recovery.

After about two months, the ankle was in such a condition as to require little or no further attention. The fragments of the fibula had shortened upon each other, and were united so that the tibia rested upon the astragalus. It was nearly two months, however, before he began to walk, owing to the condition of his thigh.

Aug. 24, 1856, fourteen months after the accident, Adamson called at my office. He is now employed again as a sailor on board the schooner Sebastopol, and performs all the duties of an ordinary deck hand. His leg is shortened one inch and a quarter; from which, it seems, that there has been some deposit upon the end of the bone, which has compensated for one-quarter of an inch of that which I removed. The ankle is perfect in its form, being neither turned to the right nor to the left, and he treads square and firm upon the sole of his foot. There is considerable freedom of motion, especially in flexion and extension. Occasionally it becomes a little swollen and painful.

The following case also, although not a dislocation, will serve to illustrate the same principle:—

Compound Comminuted Fracture of the Radius. Resection of a portion of the Ulna. Recovery.—William Croak, of Buffalo, æt. 30. Jan. 29, 1856, a large piece of iron casting fell upon his arm, crushing and lacerating the wrist, and comminuting the lower part of the radius; he was immediately taken to the Hospital of the Sisters of Charity. I found the whole of the soft parts torn away in front of the joint, and the fragments of the radius projected into the flesh in every direction. The hope of saving the hand seemed to be scarcely sufficient to warrant the attempt; at least by the ordinary mode of procedure. I, however, stated to the gentlemen present, among whom were Dr. Rochester, my colleague, and the house surgeon, Dr. Lemon, that I believed it could be saved if, having removed the fragments of the radius, we practised resection of the lower end of the ulna, and allowed the muscles to become completely relaxed. Accordingly, after placing my patient under the influence of chloroform, I enlarged the wounds so as to enable me to remove six or seven fragments of the radius, leaving others which were broken off but not much displaced. I then removed with the saw one inch and a half of the lower end of the ulna. The hand was immediately drawn up by the contraction of the remaining muscles, but their tension was completely relieved.

The wounds were closed and dressed lightly, and the whole limb was placed on a broad and well padded splint covered with oil cloth. The hand, which was very pale and exsanguine, was covered with warm cotton batting.

The subsequent treatment was changed from time to time to suit the indications; but his recovery was rapid and complete, nor was there at any time excessive inflammation in any part of the limb.

I have not seen him within the last two or three months, and I am at pre-

sent unable to say how useful his hand has become. I am satisfied, however, in a knowledge of the fact that it is saved.

In a case of compound dislocation of the upper end of the humerus, occurring also under my own observation, and recorded in the *Transactions of the New York State Medical Society for 1855* (p. 27, Case 14), in which reduction was followed by death, I have now much reason to believe that if I had practised resection before the reduction, my patient's chances for recovery would have been greatly increased; perhaps, also, the case of compound dislocation at the wrist-joint recorded in the same vol. (p. 68), in which, having reduced the bones, I was subsequently compelled to amputate, may equally illustrate the hazard to which the practice of reduction without resection must often expose the patient.

The same remarks I will venture to apply to the case of compound dislocation of the hip, of which I have already spoken as having occurred in the practice of Dr. Walker, of Charlestown, Mass. Had the head of the femur been resected before its reduction, I cannot doubt but that the unfortunate man's chances for recovery would have been very greatly improved.

Thus, if we consider the question of the life of the patient only, the argument and the testimony seem to favour resection in a great majority of cases of compound dislocations occurring in large joints, and in a considerable number of cases of similar accidents in the smaller joints. It is certainly more safe than non-reduction or reduction without resection, and it is probably quite as safe as amputation or tenotomy.

But there is another question, which is, in our estimation, secondary to the one now considered, but which is often, in the estimation of the patient himself, of the first importance—namely, by which method will he suffer the least maiming or mutilation?

This question I do not find it difficult to answer. Certainly it is not by non-reduction or by amputation; and, putting tenotomy aside, it is now a question only between reduction without resection, and reduction with resection. These two methods, one of which experience has shown to be fraught with danger, and the other of which experience has shown to be relatively safe, are now to be compared in a point of view in which their antagonisms are perhaps less conspicuous, yet sufficiently marked.

First. In either case the inflammation consequent upon the injury may be violent, and the recovery slow and tedious. The same arguments, however, which we have applied to the question of the comparative danger of the two modes, must apply with nearly equal force to this question of maiming; since the amount of maiming must often be governed by the intensity and duration of the inflammation, and upon this point the testimony has been shown to be in favour of resection.

It will be observed that not only is the danger of maiming rendered more considerable by reduction without resection, because the inflammation is so

much more likely to extend to the tendons and muscles, causing them to adhere to each other, and to become subsequently atrophied, a condition from which they often never completely recover, but also because the ligaments and capsules of the joints, with the synovial surfaces, are in consequence encroached upon, and the freedom of motion is ever afterwards greatly restricted, if not completely lost. This marked impairment of the functions of the joint does not always happen, but it cannot be denied that it does generally. Indeed it is by no means uncommon for these accidents to be followed, after ulcerations of the cartilage, by copious bony deposits in and around the joints.

How is it, on the other hand, with these joints after resection? I have thus far heard of no cases in which complete ankylosis resulted; but in all considerable freedom of motion has returned, and in some the restoration in this respect has been nearly or quite as complete as before the accident.

Says Dr. Kerr, of Northampton:—

“Several cases of compound dislocation of the ankle have fallen under my care, and it has been uniformly my practice to take off the lower extremity of the tibia, and to lay the limb in a state of semiflexion upon splints; by this means a great deal of painful extension, and the consequent high degree of inflammation, are avoided. The splints I used are excavated wood, and much wider than those in common use, with thick movable pads stuffed with wool. I keep the parts constantly wetted with a solution of liquor ammoniæ acetatis, without removing the bandage. In my very early life, upwards of sixty years ago, I saw many attempts to reduce compound dislocations without removing any part of the tibia; but, to the best of my recollection, they all ended unfavourably, or, at least, in amputation. By the method which I have pursued, as above mentioned, I have generally succeeded in saving the foot, and in preserving a tolerable articulation.”¹

Sir Astley Cooper has made a valuable experiment to determine the condition of the new joint under these circumstances; and the vast number of cases in which resection has now been practised in cases of caries of the articulating surfaces, and their results, add still more substantial proofs as to the usefulness of the joints after such operations.

“I made an incision upon the lower extremity of the tibia, at the inner ankle of a dog, and cutting the inner portion of the ligament of the ankle-joint, I produced a compound dislocation of the bone inwards. I then sawed off the whole cartilaginous extremity of the tibia, returned the bone upon the astragalus, closed the integuments by suture, and bandaged the limb to preserve the bone in this situation. Considerable inflammation and suppuration followed; and in a week the bandage was removed. When the wound had been for several weeks perfectly healed, I dissected the limb. The ligament of the joint was still defective at the part at which it had been cut. From the sawn surface of the tibia there grew a ligamento-cartilaginous substance, which proceeded to the surface of the cartilage of the astragalus, to which it adhered. The cartilage of the astragalus appeared to be absorbed only in one small part; there was no cavity between the end of the tibia and the cartilaginous surface of the astragalus. A free motion existed between the tibia and astragalus which was permitted by the length and flexibility of the ligamentous substance above described, so as to give the advantage of a joint where no

¹ Cooper on Dis. and Frac., p. 275.

synovial articulation or cavity was to be found. This experiment not only shows the manner in which the parts are restored, but also the advantage of passive motion; for if the part be frequently moved, the intervening substance becomes entirely ligamentous; but if it be left perfectly at rest for a length of time, ossific action proceeds from the extremity of the tibia into the ligamentous substance, and thus produces an ossific ankylosis."

Second. Is it not probable, moreover, since the limb can be retained in place so much more easily after resection, that it will actually, in a majority of cases, be found to have been retained in place more perfectly? Even after simple dislocations, especially in those occurring at the ankle-joint, great deformity and much maiming are the not unfrequent results, and that too when all diligence and care have been employed. It has been impossible always to maintain a perfect apposition in the articulating surfaces. How much greater must be this difficulty in cases of compound dislocations!

Third. The only argument which remains in favour of reduction without resection is the necessary shortening of the limb after resection. But this need seldom perhaps to exceed three-quarters of an inch, and often not more than half an inch; an amount of shortening which, as I have had occasion to prove when treating of fractures, does not necessarily produce a halt, and which indeed is often not known to exist by the patient himself.

Finally, it must not be inferred that the writer intends to recommend resection as a universal practice in cases of compound dislocations of the long bones. He has only sought to determine in a general manner its relative value as compared with other modes of procedure; and especially has it been his intention to bring more prominently into view the importance of rest and relaxation to the muscles, as an element in the treatment most essential to success. To declare its special application to cases would demand a treatise more elaborate than it was proposed to write. If, however, one were to speak of the individual bones only, there seems sufficient authority in the facts and arguments already presented to conclude that resection is applicable to certain compound dislocations of the clavicle, humerus, radius and ulna, fingers, femur, tibia and fibula, and toes; in short, to all of these accidents occurring in the long bones of the extremities.

