though it would almost seem as if all the Winged Blessings of our art had vanished beyond the cloud that overhangs it, as we pass from the old century to the new, yet Hope comes with us, and even as we look at the shadow it seems to lighten, and the Winged Blessings are seen hovering not far away, for we take with us this assurance, from the old century to the new, that the former has shown us the means by which, if faithfully used, we may dissipate the clouds and render our art worthy of its high and beneficent purpose.

ON THE OPERATIVE PROCEDURES FOR SIMPLE FRACTURES WHICH HAVE BEEN UNSCIENTIFICALLY TREATED.

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(Plates I.–V.)

When I commenced to operate on cases of simple fractures in 1893, the radiograph was unknown, and I did so in the belief that, owing to a shortening of the ties in the length of the limb by haemorrhage and subsequent inflammation in fractures of the long bones, and especially in those of the leg, it is impossible by manipulation, except under special and rare conditions, when the factors resisting replacement were in abeyance, to restore to their normal relationship fragments which have been displaced off one another, whether the direction of the fracture is transverse or otherwise. My views on this subject are described in detail elsewhere, and are summed up briefly in a recent lecture.

The radiograph, which came into use in 1896, verified in every detail, in the most complete manner possible, the conclusions I had arrived at, and no one has, to my knowledge, brought forward any evidence to rebut them. Many vague general statements of an antagonistic character have been made, but any trustworthy facts, as, for example, radiographs of cases treated successfully by manipulation and splints, have not been forthcoming. I have not the slightest doubt that if it were possible to produce the results that surgeons taught ought to be obtained, and which they stated they were in the habit of obtaining, they would have been brought forward long ago.

Now that the principles upon which are based such operative treatment of simple fractures as is necessary to restore accurately

1 “Operative Treatment of Simple Fractures, Cleft Palate, etc.”
2 “On the Operative Treatment of Simple Fractures,” Lancet, London, May 26, 1900.
to their normal position the fragments of long bones, and especially those of the leg, which have been displaced by violence, and which cannot be restored by manipulation, are more or less generally accepted, and the surgical measures which I advised are widely adopted, I think it may be of interest if I describe the condition of some cases of unsatisfactory union, resulting from the imperfect and unscientific treatment previously employed, in which I was asked to operate in order to restore the patient from a crippled state to one of active usefulness.

I wish to call attention to two classes of cases. The first is the condition of mechanical disability which so often results from imperfect restoration of the broken bone to its normal form. The patient may require to be treated either for a more or less complete inability to perform his functions normally, or for pain, or for both conditions. The degree in which the above are present varies considerably with the displacement of the fragments and with the age and habits of the patient. They are generally very marked when they oblige the sufferer to submit to a serious operation which is surrounded with many risks and difficulties. The next class is that of non-union between the displaced fragments, a so-called false joint being developed at the seat of fracture.

The first group is very rarely alluded to, and surgeons will always insist and affect to believe that such cases do not exist in their practice.

A very large number of these cases have come under my care, and have derived a varying amount of benefit from operative procedures, undertaken with the object of restoring the deformed bones as completely as possible to their original form. In the case of the upper extremity, the patient usually suffered from such a limitation of the movements of the bones on one another as altogether incapacitated him from following his employment. Occasionally the radius and ulna had united to one another. Sometimes also, in the case of female patients, the very obvious deformity of the part, rather than the disability, induced them to undergo an operation. In the lower extremity, pain, associated with a corresponding amount of mechanical disability, forces the sufferer to submit to any operation, however serious.

The number of cases operated on form a very small proportion of those which have applied to me for relief, and for many obvious reasons. For instance, to most of them I could promise but a slight prospect of improvement in their condition as the result of operative interference, because the displacement was of long standing, and such definite mechanical changes had taken place in the joints influenced by the deformity, as rendered it unlikely that the patient would lose pain and disability when the fragments had been restored as nearly as possible to their normal relationship to one another. The operative measures necessary
to dissociate fragments which have become firmly ankylosed together, and perhaps to adjacent bones as well, and to saw off sufficient bone from each fragment in such planes as will restore the outline of the necessarily shortened bone, is often very difficult, and may be fraught with damage to important adjacent vessels and nerves. Such operations must not be undertaken lightly, and unless the patient is likely to derive a freedom from pain and disability sufficient to compensate for the risk run. Sometimes it is absolutely impossible to restore the axes of fragments, however extensive the operation and however skilful the operator. It not uncommonly happens that in old-standing fracture of the ulna the head of the radius has been displaced from its normal relationship with the humerus for too long a period to allow of its being replaced in its original position and restored to its previous functional activity. I need not allude to the very frequent separation of the epiphyses, as, for instance, those of the head of the femur, or of the lower end of the humerus, in which, if even only very few weeks have elapsed since the injury, all hope of restoring the fragment to its normal position must be given up, and the surgeon is driven to make some more or less unsatisfactory compromise. The frequent occurrence of these cases must be well known to surgeons of any experience, though I can readily understand any individual observer deluding himself with the idea that he has managed to avoid them in his practice.

When I consider the unfortunate physical condition of the patients whom I have had under my care, and the misery, distress, and financial loss they and those dependent on them have experienced through the gross inefficiency of the so-called science of which they are the victims, it seems little short of ridiculous to read the statements of surgeons, that such mechanical disability is a rare sequence of fracture, and that it can usually be obviated by the use of massage and passive movements at an early date. That massage and passive movements serve to diminish the disability and pain which would otherwise ensue if these fractures are left for an indefinite period in rigid casings, is quite familiar to me, but to suggest such measures alone as being scientific treatment, and not merely adjuvant, suggests a want of perception of the mechanics of the skeleton.

The second group of cases, namely, those of ununited or imperfectly united fractures, are due also to the same unscientific treatment of fractures. Looking through the text-books, I find any number of reasons given for non-union of broken bones, the vast majority of which appear to be utterly without foundation in my experience. The surgeon is only too anxious to lay what blame he can upon his patient or his tissues, and seems inclined to regard as possible any factor other than the inefficiency of his treatment. It may be that in some few cases of simple
fracture, non-union results from some cause which could not be obviated by proper treatment, but I have never come across one instance in which union would not have resulted if efficient operative measures had been adopted, though a very large number have come under my observation. I would also like to express an opinion on the frequency of ununited fractures, since my observations on the subject differ completely from that of those who have written about them. My experience and their statements are not to be reconciled, since I believe that ununited fracture is of comparatively common occurrence. I am not surprised at this divergence, as I frequently hear surgeons make assertions as to the results of their treatment of fractures which they believe to be accurate, and which I have reason to regard with suspicion. As to the published statistics of the frequency of non-union, Lonsdale 1 found that out of 4000 fractures treated at the Middlesex Hospital, only four or five refused to unite; Norris 2 did not meet with one case out of 946 fractures; Liston met with only one in his practice. Hamilton says they do not exceed one in 500 cases, and thinks that this is a high estimate. I do not like to think that surgeons of the present day are less successful than their predecessors in obtaining union, as precisely the same rude methods were employed by both. The probability is that earlier observers were less careful in the examination of the results obtained, and this habit of regarding them through rose-coloured glasses still clings to the profession, particularly as regards the consequences of fractures.

If there was any truth in these published statistics, it would certainly be difficult to account for the number of cases which I alone have treated. I find that other surgeons also seem to operate on a fair number of them. On these grounds I have no hesitation in assuming that the accepted statistics on this subject are, as usual, utterly false and misleading.

As I have no confidence in statements of others when unsupported by facts, I will proceed to give a brief account of a few cases from each group which have come under my care, commencing with those comprised under Group I., between which and Group II. there can be no sharp definition, as they merge into one another.

Case 1.—Plate I. represents the result of an operation performed in January 1899 upon a patient, at. 34, who was the matron of a hospital. She eight months before sustained a Pott's fracture. At the time of the injury she was placed under the care of surgeons of very high repute. Still the displacement of the fibular fragments remained, and, in spite of massage and the means usually adopted in these cases, she was unable to do more than hobble about. Even this caused her great

1 "Practical Treatise on Fractures," London, 1838.
2 "On the Occurrence of Non-union after Fracture," Am. Journ. Med. Sc., Phila., Jan. 1842.
pain. If she continued as she was she must have given up her only means of livelihood, and settled down to the life of a cripple. As will be readily recognised by the number of screws and wires, shown very clearly in the radiograph, which I found it necessary to introduce, the difficulty experienced in levering out the lower fragment after the lapse of many months was great, but, by carefully gauging the displacement, I was enabled, by means of two sections crossing the seat of fracture obliquely, to restore the fibula almost completely to its normal form, and the foot to its original mechanical relationship with the leg. The result has proved most satisfactory. The patient is now able to walk for miles without pain, and has resumed her usual occupation. This shows clearly how entirely the incapacity of the patient, in a Pott's fracture, results simply and solely from the alteration in the mechanical relationship of the bony framework of the ankle-joint, consequent on the displacement of the fragments of the fibula.

Case 2.—Plate II. represents the result of an operation which was performed to restore to the patient the use of her limb. Before she sustained the fracture she occupied an active and important post in the nursing world. She fell down a gangway and broke her tibia and fibula across at the same level, and the fibula a second time near its upper extremity. She received every possible care and attention at the time, being treated in the usual manner. Months and months passed, and she found herself unable to bear her weight upon the limb. She spent a month in a London hospital, but she derived no benefit from the treatment employed. She then came under my care. The radiograph showed very considerable overlapping of the tibial fragments. The material uniting them was dense and strong, but, owing to the alteration in the axes of the fragments, she was only able to transmit a mechanical disadvantage her weight, which was considerable, and which had increased during the long period in which she was unable to move about. As the fibular fractures were at a considerable distance from the ankle-joint, there seemed but little, if anything, to be gained by attacking them. I therefore exposed the tibial junction, and, gauging the displacement as accurately as possible, sawed off the ends of the bones obliquely, so as to bring the axes of the upper and lower fragments into the same line. The double fracture of the fibula had rendered it unnecessary, as is usually the case, to divide this bone also, to effect with complete accuracy the apposition of the tibial fragments.

Firm union took place, and the patient resumed her usual occupation, suffering only a moderate amount of discomfort from the shortening, and from the slight displacement of the fibular fragments.

Case 3.—Plate III. represents the femur of A. B., a governess, at 41, on whom I operated on 20th April 1898. She sustained a fracture of this bone in June 1897, more than a year before she came under my observation. Though she had been under skilful treatment during the whole of this time, she was, when I saw her, quite unable to walk, because of great insecurity, and of the pain she experienced in her hip- and knee-joints, as well as in the seat of the fracture. The upper fragment ran outwards, forwards, and downwards, while the upper
extremity of the lower fragment was united to its inner aspect. This is the most common arrangement of the fragments when the femur is broken in this situation. Besides, the deformity and the shortening of the limb were very considerable. The seat of fracture and the relative position of the fragments having been carefully defined by means of the radiograph, it was freely exposed by means of a long vertical incision on the outer side of the thigh. The callus which connected the fragments was divided with the chisel, and the extremities of the fragments were sawn through in planes which permitted of their approximation. The fragments were approximated by means of lion forceps, very great traction being exerted at the same time upon them. They were fixed immovably in accurate apposition by means of screws. Her recovery was rapid and uneventful. The result was most satisfactory, the deformity being reduced to a minimum; indeed, it was no longer appreciable, while the shortening was considerably lessened, and the patient was able to walk with security and without anything more than discomfort in the joints, which was increased by much exercise. This was due to the fact that it was impossible to establish the fragments in the normal axial rotation.

Case 4.—Plate IV. represents the result of an operation for a fracture of the tibia and fibula, the result of direct violence. In January 1893, the patient, S. B., at 27, was treated in a large London hospital for simple fracture of the tibia and fibula. He had every advantage that science and skill could offer; indeed the surgeon under whose care he was placed is an acknowledged authority on fractures and their treatment. Manipulation and a plaster-case were the treatment adopted. He came into my hands many months after the injury, with the fragments overlapping considerably, the union between them being such as not to enable him to bear his weight upon the limb because of pain in the fracture and in the ankle-joint. The foot was forced inwards in such a manner that the ball of the great toe, centre of the patella, and the anterior-superior spine, occupied the same straight line. This adhesion to an antiquated teaching had, combined with a want of recognition of the factors that resist the replacement of the fragments, brought about a result that was completely disastrous to the patient.

In October 1893, both the seats of the fracture of the tibia and fibula were freely exposed, and the displacement of the fragments and the alteration in their axes were carefully gauged. Then the bones were sawn through in four separate planes, so as to permit of the fragments being brought together in such a manner that their axes retained a normal relationship to one another. The tibial surfaces were then held immovably and accurately together by means of three screws, and a loop of silver wire connected those of the fibula. The progress made by the patient and the result of the operation were excellent. The only mechanical disability which he experienced was the shortening of the limb, which was unavoidable because of the prolonged overlapping of the fragments, since the axes of the component parts of the shortened tibia and fibula were rendered normal.

As the result of the imperfect apposition of the broken surfaces in the first instance, the man and those dependent on him were deprived
of the benefit of his services for nearly a year longer than was necessary, and at the end of that time he was incapacitated to the extent of the shortening of the leg, and will probably suffer later in life from changes in the joints, whose mechanics must be altered by the fact that the restoration of the shaft of the tibia to its original form was not perfect. I would point out that the patient, when he sustained the fracture, was a young and vigorous man in excellent health, and one in whom repair proceeded actively.

The next case I will call your attention to is also a young man.

Case 5.—M. S., at. 23, was admitted under my care in March 1899. While serving as a gunner in India, he sustained a Pott’s fracture. As far as I could gather from him, he received every possible care, being treated by means of splints, and later by massage and manipulation. He was encouraged to use his leg as much and as early as possible.

In spite of all treatment, he was unable to bear his weight on that foot, and was obliged to support his weight on a crutch. As he made no progress, he was invalided from the service in January 1899, without any means of obtaining a livelihood.

I operated on him in March 2, 1899, and found that the fibula had been fractured about 1½ in. above the tibio-fibular articulation, and that the inner malleolus had been broken transversely at the level of the tibial facet, and had been displaced outwards and backwards upon the under surface of the tibia, to whose articular surface it had to some extent become united by bone. In consequence of these fractures and the displacement of the fragments, the astragalus had been forced outwards, and rotated around a vertical axis. The displaced inner malleolus was cut away from its abnormal connection with the tibia, leaving, however, a portion of the facet on the under surface of the tibia bare and uncovered by articular cartilage. The fibula was sawn through in two planes, and the bone was restored to its normal position by means of a single loop of silver wire. After dividing some soft parts about the astragalus, the latter was forced into its normal position between the malleoli. Although I had succeeded in restoring the parts to their normal relationship to one another, yet the fact that the articular surface of the tibia had been so altered by its connection with the displaced malleolus made me hesitate in giving a favourable prognosis. This was fully borne out by subsequent events, since the present condition of the foot, though vastly better than it was, is far from perfect.

This case showed very well indeed the mode of causation of this fracture, which is altogether wrongly described and illustrated.

The general teaching seems to be that the foot is rotated outwards around an antero-posterior axis, and the fibula is broken transversely above or about the tibio-fibular articulation, the upper end of the lower fragment being driven inwards, this displacement being accentuated by rupture of the internal lateral ligament, or by fracture of the inner malleolus.
Accepting this explanation as true, and surgeons have frequently depicted this supposed condition diagrammatically in order to illustrate these views more clearly, the natural conclusion is, that by forcing the foot into a position of adduction, that traction is exerted upon the lower extremity of the fibula by means of the external lateral ligament, that the upper end of the lower fragment is drawn out from its position of displacement, and is brought into apposition with the lower end of the upper fragment. As a matter of fact, I have never come across a true transverse fracture of the fibula among the several examples of Pott's fracture on which I have operated. The fracture of the fibula is not produced in the manner supposed, but is brought about by a twist of this bone upon its long axis; consequently, the fracture is spiral in character, the length of the spiral varying within wide limits. When the foot is abducted, force is exerted upon the anterior part of the fibular facet by the astragalus, in a direction which is outwards and backwards. Upon the bone immediately behind the facet there is a very great strain exerted, in a direction from without inwards and forwards. Again, upon the lower end of the tibial facet the astragalus presses directly outwards and upwards. As the result of these several forces, the fibula sustains an oblique or spiral fracture, the form of the fracture varying with its position. For instance, if the bone yields above the tibio-fibular articulation, the fracture is more or less spiral in character, while if it traverses the tibio-fibular it is oblique. The upper end of the lower fragment when the bone is broken above the articulation with the tibia, is driven inwards and forwards. In order that the lower fragment be brought into accurate apposition with the upper, it is necessary that force be exerted in directions the reverse of those by which the fracture and the displacement of the lower fragment is produced.

There is no mechanism by means of which such force can be applied, and a surgeon who has ever operated upon this form of fracture has been able to satisfy himself that the manipulations and splints usually made use of are quite inefficient to restore the bone to its normal form.

I presume that no rational surgeon can suppose that any form of massage, however efficient or however early performed, can have any influence in producing accurate apposition of fragments not effected in the first instance.

Case 6.—B. M., a woman, æt. 38, was admitted under my care in October 1900. She sustained a Pott's fracture sixteen months before, for which she received skilful treatment at the time of the accident, the displacement of the foot and lower fragment having been rectified to the satisfaction of the surgeon. Her splints were removed as soon as it was thought safe, and manipulation and massage employed. In spite of all this, she was unable to bear her weight upon the damaged limb. In order to improve this condition, she was admitted into a large general
hospital, where massage and manipulation were again resorted to, with no benefit being obtained from it. She was then advised to submit to amputation, which she declined temporarily, in order that she might have an opportunity of trying some less radical measures. She then came under my care. The foot presented the deformity that is so common in this fracture, the outer surface of the astragalus articulating with the displaced fragment of the fibula. As in the preceding cases, the fracture was exposed, the bone was sawn through; the astragalus was restored to its normal relationship to the tibia, when the fibular fragments were fixed together securely with silver wire.

The foot is at the present time in very good position, and I trust that she will suffer only a moderate amount of discomfort from it in future.

Case 7.—W. S., aged 61, was one very similar to that illustrated by Plate II. except that this patient was much older. He was admitted under my care in April 1900. He was treated in an hospital for eight months, when he was discharged in a hopeless condition. Besides the deformity and shortening, which were very considerable, the man was quite unable to bear his weight on the limb. The displacement in this case was practically identical in character with that present in the governess. A similar operation was performed, but in this case I exerted an enormous strain upon the fragments, both by traction in the limb and trunk, and by forcible leverage by a stout steel elevator placed between the fragments. In this manner I found I was able to stretch the soft parts in a very definite manner, but when the strain was removed they returned to their original condition. Taking advantage of this, I sawed the ends obliquely, then, having stretched the parts, the surfaces were retained in accurate apposition by means of lion forceps, when they were fixed immovably in position by screws. This patient derived very great benefit from the operation, since he was able to bear his weight securely and comfortably upon a strong femur. The shortening was reduced very considerably by the enormous force I exerted on the fragments.

Case 8.—L. E. C., aged 18, a painter up to the time of the accident, sustained a fracture of the tibia and fibula in the early part of 1896. The fracture was produced by indirect violence, that of the tibia being in its lower third, while that of the fibula was in its upper third. The displacement of the lower fragment of the tibia was the usual one under these conditions, namely, backwards outwards, and upwards. He had been treated by a Croft, and the bones had united firmly and securely. The lower fragments had been rotated through an angle of 45° upon the upper, the foot on the damaged side being so placed that its inner margin was vertical, while its fellow occupied the normal relationship to this plane. The great toe, inner margin of the patella, and anterior superior spine, were in the same straight line. The surgeon under whose care the patient had been was a well-known surgeon. When I saw him he was quite unable to walk or to follow any useful occupation, and this has been the case during the three years that have elapsed since he sustained the injury. His inability to walk is due to pain in and about the ankle-joint, consequent on the alteration of his mechanics.
I would point out that he is quite young. I have not yet been able to make arrangements to operate on him.

**Case 9.**—W. C., aged 18, sustained a transverse fracture of the os calcis in November 1893, when he was admitted into Guy’s, under my care. Although the foot was very much swollen, it was possible to make out that the anterior fragment was considerably displaced upon the posterior, but it was found impossible to restore the fragments accurately to their normal relationship. The boy was urged to submit to some cutting operation by means of which the bone could be restored to its original form, but he would not agree to this. Consequently we did the best we could under the circumstances, with manipulation and plaster of Paris. The boy recovered, and left the hospital. He returned at intervals, saying that he could not bear his weight on the foot, because of pain in the seat of the fracture, where some irregularity could be felt very clearly. After nine months had elapsed since the receipt of the injury, and as there was no improvement in his condition, I cut down upon the seat of fracture. It was then apparent that in order to restore the anterior fragment to its normal relationship to the rest of the bone, it was necessary to excise a wedge-shaped piece. This was done, and the sawn surfaces were retained in accurate apposition by a long screw. The boy recovered rapidly, and made no further complaint of pain, but set to work very soon after.

**Case 10.**—P. D., aged 43, was admitted under my care in July 1900. He had been a miner, and while fixing a log in a mine ten months previously, he sustained a fracture of the leg from a fall of earth. He had not been able to do any work since the accident, because of great pain in, and about, the ankle-joint when he put his weight upon the limb. Both bones were broken at about the same level, at the junction of the middle and lower thirds. The lower fragment of the tibia was displaced backwards and outwards upon the upper, which it overlapped to the extent of an inch. The fibular fragments were similarly displaced. The bones seemed to have united firmly. The seats of fracture were exposed, and the bones were sawn through in such planes as permitted of their being brought accurately together, with the axis of the fragments in almost perfect continuity. The tibial connection was effected by screws, and that of the fibula by wire. The patient was discharged on the 7th August, having made an uninterrupted recovery.

I think I have described a sufficient number of these cases of badly united fractures, accompanied by symptoms sufficiently severe to make some sort of operation necessary, and also to show that very bad results occur not unfrequently in the practice of surgeons of the greatest eminence. I will now relate briefly the notes of a few cases of ununited fractures, which cases come about, in my opinion, simply and solely from no other cause than improper or inefficient treatment, whichever you like to call it; and I would point out that in none of these cases was failure to establish bony union due to any other cause than the inefficacy of the treatment employed.
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I have carefully avoided referring to the very common ununited fractures of the olecranon, acromion, and patella, but have restricted myself solely to such fractures as surgeons pretend to cure successfully.

Case 11.—G. G., æt. 29, was admitted under my care in November 1890, suffering from an ununited fracture of the ulna, just above its centre. There was apparently much displacement of the fragments, for, besides the loss of power due to the non-union, there was very limited pronation and supination. The fracture had been sustained three months before, and the physical depreciation was such that the patient was quite unable to follow his employment. I operated on the part and fastened the fragments together with wire. This, unfortunately, failed in effecting bony union, consequently I made another attempt with complete success in December.

Case 12.—C. B., æt. 48, a labouring man, was admitted under my care in November 1892. He was suffering from an ununited fracture of the tibia and fibula. When he sustained the fracture he was treated with a back splint and the usual vertical footpiece with side splints. The bones did not unite. Efforts were made to obtain union by means of plaster cases, etc., but without avail. Finally, he came under my care. The foot of the injured side was so placed that its inner margin was vertical, while between the vertical and the inner margin of its fellow existed the normal angle of 45° to 50°. The seats of fracture were exposed, and the ends were so shaped as to restore the axes of the fragments to their normal relationship. They were fixed immovably together. Firm bony union ensued, and the patient obtained a serviceable limb, in which the rotation of the lower fragments of the tibia and of the foot were restored to the normal. This case showed very well the utter absurdity of using the vertical footpiece.

Case 13.—C. S., æt. 45, was admitted under my care in April 1899, suffering from non-union of fractures of the tibia, which traversed the tibia and fibula in their middle third. The injury had been sustained in March 1898, when he was thrown out of a cart, the wheel passing over his left leg. The tibial fragments were exposed, when the fracture was found to be very oblique, their ends overlapping for 1½ in. The ends were made to fit, and were connected with wire. In May, though the tibial junction was secure, that of the fibula was still ununited. This was therefore exposed and its sawn surfaces were retained in accurate apposition by means of wire. This bone also united perfectly, and the patient obtained a very useful limb.

Case 14.—G. N., æt. 27, was admitted under my care in July 1898, suffering from a condition of non-union of the tibia and fibula in their upper thirds. There was much displacement of the fragments, and though an interval of four months had elapsed since the receipt of the injury, the bones moved very freely on one another. The fractures were exposed, when the difficulty of fixing them accurately together by means of the screw was found to be very great. Indeed, it seemed almost if not quite impossible; as I feared, the operation was a failure,
and as there seemed to be no hope of success, I amputated the leg in September.

Case 15.—G. C., æt. 41, sustained a compound fracture of the left humerus about its centre in November 1895, when he was treated by splints. An ununited fracture resulted. In February 1896 he was admitted into an infirmary, where he was operated on for this condition, but without success. Wire was used as the uniting medium. As a result of this operation, paralysis of the musculo-spiral ensued. In June 1896 he was admitted to a London hospital, and underwent another operation with the same result. The old loop of wire was removed, and the same material was again employed as a uniting medium. In August of the same year he was admitted under my care. The bone was then restored as perfectly as possible to its original form, being divided in two oblique planes, and I fixed the fragments accurately and immovably together by means of a screw. Firm bony union resulted, though the paralysis remained as before.

Case 16.—E. J., æt. 39, in May 1897 sustained a fracture of the radius at the junction of the upper three-fourths with the lower fourth, as the result of a direct injury. He was treated by means of splints for seven weeks, at the end of which time it was found that the fragments had not united by bone. He was admitted into Guy’s under my care in October of the same year. He had then an ununited fracture, the lower fragment being displaced backwards and upwards upon the upper, not only producing insecurity of the part, but also limiting very considerably any pronation or supination of the forearm. The seat of fracture was freely exposed, and the ends of the fragments were sawn through in planes such as allowed of their being brought into accurate apposition. They were retained immovably in this position by a screw. There was some slight suppuration in the superficial parts, but the fragments united firmly by bone, and a useful arm with a good range of movement was obtained.

Case 17.—W. K., a seaman, æt. 41, sustained a fracture of the left humerus in January 1895. He was put up in splints. When these were removed, it was found that the fragments were not united by bone. From that time he underwent nine different operations, with the object of establishing bony union. Some of these operations had been performed abroad, and some in London hospitals. The range of movement in the elbow-joint was limited, the patient being unable to extend the arm beyond an angle of 140°. In November 1899 I exposed the seat of the fracture, and found the ends of the bone were connected by thin silver wire, which could have served no useful purpose whatever. The ends of the fragments were sawn through, so as to afford suitable apposing surfaces. These were fixed firmly together with a screw. When the dressing was changed, the limitation in the range of movement of the elbow-joint was forgotten, and in consequence of this enough force was used to separate the fragments from one another. Again, in February 1900, the fragments were freed, and oblique surfaces of bone were obtained. These were united as before. This time bony union ensued, and the patient has now got
a humerus which is strong, but much shorter than its fellow, since each fragment had been curtailed in its length on no less than eleven different occasions. A sinus remained, leading down to the screw, which was subsequently removed.

Case 18.—T. W., æt. 43. He had been a sailor, and about eighteen months before his admission had sustained a fracture of the tibia and fibula about the middle third of the leg. The leg was retained in splints for six weeks. At the end of this time it was found that the fragments showed no signs of union. He was then placed in a hospital, where he was treated for some time, but without success. An operation was then performed, and the fragments were connected by silver wire. After a sufficient time had elapsed, the leg was examined, when it was found to be in the same unsatisfactory condition as before. He was informed that the condition of non-union was due to some defect in his system, and he was discharged. He was admitted under my care in February 1898. He was unable to bear his weight upon the limb, because of very imperfect fibrous union between the fragments. The seats of fracture were exposed, and suitable bony surfaces were obtained by the use of the saw. These were held in accurate apposition, and were retained immovably together by means of screws. During the course of the operation, loops of wire were found embedded in the bone. The wire was too thin to serve any useful purpose. The patient made an uninterrupted recovery, and obtained a sound and useful limb.

Case 19.—J. H., æt. 42, sustained a fracture of the tibia and fibula in their lower thirds in the commencement of 1897. He was admitted into a London hospital, where he was under the care of a very accomplished surgeon. He left the hospital with an ununited fracture of the tibia. He went about on crutches for eight months, at the end of which time he was readmitted, and an operation was performed with the object of effecting union between the fragments. This operation was unfortunately unsuccessful. He was admitted under my care in May 1898, having been unable to use his leg for nearly seventeen months, during which time he had been obliged to depend on his friends for subsistence. The fractures were exposed, and the fragments sawn through in oblique planes. These surfaces were fastened immovably together with screws. He recovered with a useful though a shortened limb.

Case 20.—L. W., a girl, æt. 14, was admitted under my care in March 1899. She had sustained a fracture of the right ulna, just above its centre, in June 1898. Since the time of the injury she had had but very limited use in that arm and hand since the forearm was fixed in the semiprone position. This was apparently due partly to varying rotation of the fragments, and partly to some overlapping of the fragments which had forced the head of the radius somewhat forwards out of its place. The seat of fracture was freely exposed, and the extent of the abnormal rotation was carefully gauged. The bone was then sawn through in two planes, in such directions as to effect a normal continuity of the shaft. Traction was made upon the
fragments, in order to restore the head of the radius as far as possible to its normal position, when the fragments were bound securely together by silver wire. The patient recovered with an arm that allowed an almost complete range of movement.

As a marked contrast with the often very unsatisfactory results obtained by the usual treatment of fractures, I have added a radiograph of a case operated on by the house surgeon under my supervision. It was a spiral fracture of the tibia and fibula, accompanied with the usual amount of displacement of the fragments. The fragments were intact, and were retained in perfect apposition by means of a single screw. I need hardly say that the mechanics of the patient were unaffected by the injury. Plate V. represents the condition of the bones when two years had elapsed since the operation.