LECTURES ON INJURIES TO THE EPIPHYSES AND THEIR RESULTS.

Delivered at the Royal College of Surgeons.

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LECTURE III.

THE EPIPHYSES OF THE ULNA.

MOST of the olecranon process is developed from the shaft the true upper epiphysis including only about one-third of this process, ossifying from the tenth year, and uniting at 17. There is frequently more than one nucleus for this small epiphysis. It is only during the first few years that much of the triceps muscle is attached to the cartilaginous upper end of the ulna, and hence probably the rarity of its detachment. The experiments of Schüller and my own proved that it was quite possible to separate this part on the cadaver in young children, and there is reason to think that this occurs occasionally in the living subject. Eames¹ records one case at the age of 4, occurring from direct violence. Hamilton had the misfortune to produce this separation in attempting to reduce an old dislocation of the elbow in a child aged 7. In Eames's case there was no marked displacement; in Hamilton's the olecranon was drawn up for at least half an inch. There are a few other more doubtful cases on record, and with the note that "fractures of the olecranon" were observed fourteen times at the Middlesex Hospital in patients under 15 during a term of twenty years, we will pass to the lower epiphysis of the ulna. The latter includes the styloid process, the whole of the head and articular surface for the radius; the epiphysal line is decidedly convex downwards, and is situated on a higher plane than that of the radius. The shaft of the ulna narrows so rapidly above the epiphysis that we may say the weakest part of the bone here is not the epiphysal junction but the shaft at a point within $1\frac{1}{2}$ inch of the lower end. In a fall upon the hand so much of the force is transmitted through the radius that in a young subject complete displacement of the lower radial epiphysis may be unaccompanied by any lesion whatever of the ulna. However, occasionally we find the styloid process of the ulna dragged off, more frequently a fracture of the shaft at the point just mentioned, and very rarely the epiphyses of both bones simultaneously detached. I have observed one case of the latter condition, and M. Ozenne obtained a specimen of it.

A third example of this accident I placed in the College of Surgeons' Museum; it was obtained from a boy, aged 14, who sustained a compound fracture of the forearm high up, which necessitated amputation. The lower ulnar epiphysis was found, on dissection, to be cleanly detached, and to be wedged in between the shaft and the lower end of the radius, so that it was hardly possible to disengage it—a most remarkable displacement. The wrist-joint and the membrana saciformis were intact. We have said that the lower ulnar epiphysis is detached very rarely compared with that of the radius, and, corresponding with this, we should expect cases of arrest of growth in the ulna from traumatism to be very infrequent. I know of three cases—the first reported and figured by my father,² in which, after a severe blow on the wrist at the age of 5, the ulna did not grow like the radius, being ultimately nearly 2 inches shorter than the bone of the opposite side. The radius became markedly curved, and the hand was pushed over to the ulnar side.

The second case was reported by Mr. Edmund Owen.³ In this the lower ulnar epiphysis was cut off in a machinery accident at the age of 2 years. The ultimate result was exactly similar to the preceding case. At 18 years Mr. Owen excised 1 inch of the radial shaft with the result that the hand and forearm became much straighter, and their usefulness increased.

The third case was a student, aged 24, who came under my own observation. When 5 years old he had been kicked by a horse on the right wrist. There was no wound and no subsequent suppuration. The radius gradually became curved, and the ulna was ultimately nearly 2 inches shorter than on the other side. The forearm muscles were not so well developed as on the left side, but he had very good use of the hand.

THE EPIPHYSES OF THE RADIUS.

The upper epiphysis may be described as a biconcave meniscus, having at most a depth of 1 cm. in its centre. It ossifies first about the fifth year, and unites from the sixteenth to the nineteenth year. It is remarkable amongst the epiphyses from being always entirely within the joint and from having no muscular or ligamentous attachments. Hence it is practically never separated except from direct violence. I know of only two undoubted cases of its detachment, one (the specimen is in the London Hospital Museum) having occurred at the age of 16, in a lad under the care of Mr. Mansell Moullin, the other (also from severe crushing force) was under my father at the same hospital. In both the epiphyses lay loose in the elbow-joint. Hamilton has recorded three cases, all seen at a considerable interval from the accident, about which we can only say that they may possibly have been examples of epiphysal detachment, and many other supposed cases have been recorded, especially in children under the age of 5. In August, 1885, I published a short paper pointing out that these were in all probability examples of subluxation of the radial head (that is, its slipping from out of the grasp of the orbicular ligament). The mistake in diagnosis is readily explained, for when by appropriate manipulation (flexion and full pronation of the forearm) the subluxation is reduced, a sound is heard which might easily be mistaken for the cartilaginous crepitus of the epiphyses upon the shaft. I have since seen no reason to alter this opinion or to believe that true separation of this epiphysis is other than an extraordinarily rare accident and probably always due to direct violence.

We will now consider the very important epiphysis of the lower end of the radius, which includes the articular surfaces both for the carpus and the head of the ulna. The epiphysal disc, which is comparatively straight, corresponds to the insertion of the supinator longus, the lower edge of the pronator quadratus, and the so-called extensor protuberance (the small, but easily felt ridge on the back of the bone forming part of the groove for the extensor secundi internodii). The latter point has been described as the best landmark to the epiphysal line, but since in cases of displacement the epiphysis is nearly always driven backwards, it would be difficult to detect, and, further, the line of separation often encroaches on the diaphysis posteriorly. The greatest size the epiphysis attains is about 3 cm. across, 2 cm. from before backwards, the same in vertical depth on the outer side, but only 7 mm. on the inner side. Among the 51 cases of separation of this epiphysis I have collected, 17 of which were under my own observation, the age of the patient ranged from 3 years to 20, the majority being over 10 years, and quite a number of them 17 or 18 years. As in the case of other epiphyses, the central part of the epiphysal disc is the first to disappear, complete fusion occurring from the 20th to the 22nd year.

Looking at the great strength of the ligaments connecting the epiphyses with the carpus, we should expect to find that separation of the former takes the place under 20 years of true dislocation of the wrist. But this is not altogether accurate. Thus Haydon⁴ recorded a case of double dislocation at the age of 13, and we could quote others. Nor can we exclude a true Colles's fracture in early life, as convincingly shown by an impacted specimen in the museum of St. Bartholomew's Hospital. Still we can safely assert that three out of four of the cases diagnosed as either dislocation of the wrist-joint or as Colles's fracture, in patients under the age of 20 years, are really examples of epiphysal separation. In a considerable proportion of 21 cases in which the specimen was subsequently obtained, one or other mistake in diagnosis had been made by the surgeon. Theoretically we should not expect much difficulty in diagnosis, the following rules being almost without exception:

1. In complete separation and displacement of the lower

radial epiphysis the styloid process can be felt to have its normal relation to the hand, unlike a dislocation.

2. In such a case the abrupt end of the diaphysis projects in front, forming an angle of usually 90° to 103° , and contrasting well with the gentler slope of a Colles's fracture, which is, as a rule, at least 140° .

Fig. 7.—The deformity present in a recent case of backward displacement of the lower radial epiphysis. The other figure is from a specimen in the Royal College of Surgeons Museum (case under Mr. Bryant).

Sometimes the protruding diaphysial end has been mistaken in compound cases for the articular surface of the bone. It need only be pointed out that the latter is concave in both dimensions, the end of the diaphysis slightly convex.

The causation of this lesion, like the backward displacement, is remarkably constant. A fall on to the hyper-extended hand, with more or less adduction combined, is the usual mechanism of such cases. In only one case was the epiphysis displaced forwards; in this the diaphysis protruded through a wound on the back of the wrist, and was resected.⁵ In one curious case a lad was incautiously lying on the ground, resting his head upon his hand, underneath a lift. He happened to raise his head, and at that minute the lift descended, striking the front of his hand and forcing backwards his radial epiphysis. The chief complications we have to note are (1) dragging off the ulnar styloid process, as so commonly occurs in Colles's fracture; (2) detachment of the lower epiphysis of the ulna; or more often (3) a fracture of the ulnar shaft 1" up; (4) a vertical split in the radial epiphysis (rare); (5) extensive detachment and tearing of periosteum in front of the radial shaft, that on the back being rarely torn; (6) obstruction of radial and ulnar arteries by the pressure of the diaphysial end; (7) interposition of tendons or periosteum, etc., between the latter and the epiphysis; (8) extensive extravasations of blood in front of the wrist, especially in and about the pronator quadratus.

Provided the accident is diagnosed and treated early, and muscular spasm overcome by an anæsthetic, there is often but little difficulty in reduction. Thus, out of 14 cases⁶ of simple detachment of the epiphysis, most of them with very marked displacement, reduction was effected, and a very good result obtained by treatment in every case. Of course splints are required for a time to prevent recurrence of the deformity, but I feel convinced that in most cases where the tendency to this recurrence is marked a complete replacement has not been effected, and that some periosteal band is probably intervening. The danger of tight apparatus in this situation is unfortunately only too well established.

In estimating the prognosis in compound cases of detachment, we will exclude every one in which another injury has been present to complicate the case. We have, then, 10 cases to consider; in 4 it was found necessary to resect the end of the protruding diaphysis before it could be reduced. In all these good recovery ensued; in the other 6 this course was not followed, but more or less imperfect reduction obtained. Two died, both with suppuration, tetanus being responsible in 1 case, pyæmia in the other; 1 case recovered with a crippled wrist-joint after tedious suppuration, 3 underwent amputation on account of gangrene. It must not be thought that this list of "surgical calamities"—2 deaths and 3 cases of loss of the limb out of 6—all occurred long ago; they are nearly all comparatively recent ones.

We have already discussed the cases of arrest of growth from old injury to this epiphysial disc, and the remarkable deformity of the hand to which it may give rise, we have

seen that probably the best operation in such cases, if any be called for, is to excise the lower epiphysial disc of the ulna with a certain amount of the shaft. There is very good reason for believing that these cases form only a small minority of the total number. As already mentioned, out of 6 cases of detachment of the lower radial epiphysis followed up by myself and 3 by M. Goyrand, shortening from arrest of growth followed in only 1.

Before leaving the upper limb, we must recall the fact that each of the phalanges and the four inner metacarpals have one epiphysis, the thumb metacarpal frequently two; and that during early life separation exactly at the epiphysial disc may occur. I have collected notes of about ten cases in all; but they are not of sufficient interest to warrant analysis. In one case the proximal epiphysis of the first metacarpal was separated during an attempt (fortunately successful) to reduce a dislocation of that bone. In another I removed by incision the dead epiphysis of the middle phalanx of a finger after acute inflammation of the disc, etc., following injury.

THE EPIPHYSIS OF THE HEAD OF THE FEMUR.

Up to the age of 12 or eighteen months it is possible that the mainly cartilaginous upper end of the femur, including the head and great trochanter, might be separated from the rest of the bone: but it has never been proved by dissection to have occurred from traumatism during life, and experimental attempts on the cadaver have generally failed. In children and young adults, however, the clinical evidence (which has been lately dwelt on by my father in the *Archives of Surgery*) points very strongly to the possibility of detachment occurring exactly at the epiphysial line between the head and neck of the bone. The accompanying woodcut illustrates roughly such a case, which was under the care of M

Fig. 8.—Specimens from M. Bousseau's case.

Bousseau in Paris.⁷ The patient, aged 15, had been run over by a cart, and after his death from shock it was found that the capsule of the left hip-joint was torn, and that the epiphysis for the head was detached exactly at the epiphysial line. To this solitary case we may add several others derived from the lower animals. In the museum of the Veterinary College there are two examples obtained from horses, in the London Hospital Museum one from a rabbit, in my father's possession one from a sow, etc. All these were cases of traumatic detachment of the epiphysis.

That intracapsular fracture of the femoral neck occurs in young subjects has been proved by specimens described by Coulon, Stanley, and others, and by two in the museums of the Middlesex and Guy's Hospitals. The woodcut represents the latter specimen.

I have collected records of upwards of 20 cases in which the symptoms (shortening from $\frac{1}{2}$ to $1\frac{1}{2}$ inch, eversion of the limb, more or less crepitus, alteration of Bryant's

measurement, etc.) indicated either a fracture of the neck or separation of the epiphysis, in patients under 20 years of age. Dr. Whitman has lately recorded six other examples, and he holds the view that in the majority the lesion is a fracture. Fig. 10 shows a vertical section of the femur, the dotted line indicating the narrowest and probably the weakest part of the neck.

Fig. 9.—Example of fracture of neck of femur in a child (Guy's Hospital Museum).

It is only necessary here to allude to the numerous cases in which, after a wrench of the hip, acute epiphysitis has occurred, and the head become thus detached from the neck. Such separation of the epiphysis is, of course, secondary to the inflammatory process. In case of detachment or of fracture of the neck in young subjects which are primarily due to the accident, bony union appears to follow treatment in nearly all cases. In one, however (recorded by Mayo Robson), a false joint seems to have been formed.

Fig. 10.

SEPARATION OF THE GREAT TROCHANTER EPIPHYSIS.

Looking at the enormous strength of the muscles attached to this process, one would be prepared to find that muscular action alone might produce its separation, and there are one or two cases confirming this view; however, severe direct violence is the usual cause. Out of eleven cases, no fewer than six were followed by suppuration (five of these ending fatally). When the trochanter is detached, but still held in place by the periosteum, etc., the diagnosis must be difficult, the only positive sign being the hinge movement obtained on direct pressure.

THE LESSER TROCHANTER.

I believe only one undoubted example of separation of this process has been recorded, by Dr. Fenwick, of Montreal. His own son, aged 17, in leaping on to a fence, fell backwards on to his feet. The violent strain of the psoas and iliacus tore away the lesser trochanter. This was verified by incision. The boy died of septicæmia on the seventeenth day after the accident. The specimen is in the McGill College Museum at Montreal.

THE LOWER EPIPHYSIS OF THE FEMUR.

There is no epiphysis of so much importance in practical surgery as the lower epiphysis of the femur. The grave

results that have often followed its detachment, including injury to the popliteal vessels, suppuration involving the knee-joint, and arrest of growth have led surgeons from the time of Sir Charles Bell to devote special attention to it; and I have collected records of no fewer than 75 cases, of which 10 have not previously been published. The anatomy of the epiphysis is so well known that it need hardly detain us. We may only recall the facts that the epiphysis includes the whole articular surface, and that its separation must inevitably imply injury to the synovial membrane, that the adductor tubercle is placed exactly at the upper limit of the epiphysis, and that both heads of the strongest muscle in the leg—the gastrocnemius—are attached to the latter in great part. Hence the marked tendency to backward rotation of the epiphysis in cases of complete separation, and the necessity for the use of an anæsthetic before attempting reduction. Theoretically we might expect separation to occur even beyond the 20th year; out of 50 cases three of the patients had attained that age, the average being 10 years. The remarkable breadth of the femur at the epiphysial level and the great strength of the periosteum are circumstances which lessen the frequency of this accident. On the other hand, the attachment of the gastrocnemius, the popliteus, and the exceedingly strong ligaments of the knee almost entirely to the epiphysis favour its occurrence when a sudden wrenching force is brought to bear upon the leg. And it is nearly always a complicated and very violent force that has caused the separation of this epiphysis, such as hyper-extension with twisting or traction. Direct violence may suffice when the knee is run over, and it is remarkable how many cases have been due to the leg getting caught in the spokes of a wheel.

When experimenting on the bodies of young children (chiefly by abduction or adduction of the extended knee), I found—

1. That if the thigh were held high up, the femur usually broke at its narrow central part.

2. That if the lower third were firmly grasped the epiphysis was usually separated.

3. When separation occurred the epiphysial disc almost always remained with the epiphysis, both heads of the gastrocnemius also remaining attached to it, and that the periosteum was extensively stripped from the lower third of the femur.

4. It was far easier to separate this epiphysis than to rupture the ligaments of the knee, or to break the shaft in its lower third.

The latter deduction has an important bearing upon the expediency of performing osteoclasis for genu valgum—an operation largely advocated in France, and advised in certain cases by such authorities as Macewen and Ogston (who has performed it over thirty times).

Now no surgeon would endorse this proposal if there were decided risk of detaching the epiphysis with possible or probable arrest of growth. The dangers attending an aseptic division of the femoral shaft are as nothing compared with ultimate shortening of the limb to the extent of four, three, or even two inches. Putting aside the experiments on the dead subject, the following case sufficiently proves the truth of my contention: A distinguished French surgeon, M. Delore, a great advocate of osteoclasis, and who denied the risk of separation of the epiphysis in this operation, performed it on both sides on a child, aged 7. The patient died of measles three weeks later, and M. Barbarin had the curiosity to dissect the limbs. On both sides the femur had given exactly at the epiphysial disc. Chauvel records an example of separation of the epiphysis in the attempt to straighten an ankylosed knee; Callender in flexing a stiff knee; Volkmann knew it occur three times during the surgeon's manipulation of children affected with old hip-disease. As is the case with the lower epiphysis of the radius and the upper one of the humerus, separation is remarkably clean, occurring exactly at the epiphysial disc, and a division of the condyles by a vertical split is a rare complication. The epiphysis may be completely separated, and yet retained in place by the periosteum, as shown in one of my own specimens; how often this happens without being diagnosed we can only surmise.

When the diaphysis is forced through its sheath the

varieties of displacement are many, though in the great majority of cases the epiphysis is carried forwards, and the danger of stretching the popliteal vessels over the broad diaphysal end is only too obvious. It is probable that in many of these cases the periosteum in front is not torn. Next in frequency to the displacement forwards of the epiphysis comes a lateral one, especially in the outward direction, sometimes so extreme that the leg and thigh form a right angle when seen from in front,* or the deformity may resemble that of severe genu valgum. The epiphysis may be rotated on itself as well as laterally displaced, and in one remarkable case operated on by Mr. Atkinson, of Leeds, it was displaced right in front of the diaphysis, and so twisted that one condyle lay vertically above the other. In one reported by M. Trélat union occurred with the epiphysis rotated through 90° on a vertical axis.

In order to explain the frequency with which displacement has been allowed to remain, or with which a wholly wrong diagnosis has been made, we must remember that the knee-joint may be distended with blood and synovial fluid, and there may be much swelling of the soft parts at the time the patient is seen by the surgeon. Not infrequently the diaphysal end has been mistaken for the condyles and a dislocation diagnosed, even in compound cases. One thing is, however, certain, that a correct knowledge of the pathology of separation of this epiphysis would have saved the patient and surgeon from many a disastrous mistake. The gravity of the lesion is best shown in an analysis of recorded cases. Taking first those uncomplicated by wound, out of 28 cases, 16 were got into good position and recovered with very useful or perfect limbs (the possibility of ultimate shortening is not now considered), whilst of the remaining 12 in which perfect replacement was not obtained, 6 were followed by sloughing or suppuration. In 4 of these amputation had to be performed, 1 recovered after excision of the knee, and 1 after resection of the diaphysal end. In one case a popliteal aneurysm formed twenty years after, and led to amputation.⁹ The remaining cases recovered with more or less useful limbs, the displacement persisting. The cases complicated from the first with wound and more or less protrusion of the diaphysis gave still less favourable results. Out of 30 cases, 4 died from shock, etc., in 8 reduction was more or less effected, with 4 subsequent amputations and 3 deaths from pyæmia. The remaining case recovered after suppuration and some necrosis—a truly dismal record. In 13 cases amputation was performed soon after the injury, with at least 3 deaths (in one the limb was removed at the hip-joint).

In favourable contrast to this list, which is anything but creditable to surgery, are the cases in which the protruding end of the diaphysis was cut off and replacement effected, five in number, all of which recovered with useful limbs. It may be said that after resection of the protruding diaphysis all growth at the affected part will cease. This is by no means certain, and the following case, proving the contrary, is of such interest that a brief quotation will be excused.

1. A boy, aged 8, in climbing behind a carriage, had his right leg caught in the wheel. When examined by M. Delens¹⁰ the diaphysis protruded through a wound on the outside of the popliteal space. Prolonged efforts at reduction under chloroform failed on two occasions, but after the end of the bone had been sawn off replacement was easily effected. At the end of a fortnight the splint had to be removed on account of an abscess forming; this was drained and slowly healed. At the end of fourteen weeks good union had occurred, but with some stiffness of the knee and 4 centimetres shortening. He was repeatedly examined during the next ten years, and at the age of 19 the joint was freely movable, and the shortening amounted only to 9 centimetres. This proves that a considerable amount of growth had occurred at the lower epiphysal disc, since the failure amounted only to 5 centimetres in the ten years.

Unfortunately, we have but few records of cases, whether single or compound, which were followed up a sufficient number of years after the accident to enable us to estimate the risk as to arrest of growth. I can only adduce five:

1. A girl, aged 14. Severe injury to knee, treated for twelve months in the Sainte Eugénie Hospital by Marjolin.¹¹ Nature of the accident apparently never diagnosed. Recovered with stiff knee, displacement of epiphysis inwards and forwards, and shortening at the age of 18 of 4½ centimetres.

2. A case of Mr. Chauncey Puzey's.¹² Injury at 16; outward displacement of the epiphysis—reduced. Perfect recovery. At age of 19 there was 1 inch shortening.

3. A lad, aged 12, under my own care, with very marked

forward and lateral displacement of the epiphysis, the diaphysis pressing on the popliteal artery so as to almost stop the pulse. Reduction under anæsthetic. M'Intyre's splint. Perfect recovery. When seen last, one year after the accident, there was no shortening whatever.

4. A medical student whose knee was severely injured at football when aged 15. When I examined him at the age of 23 there was fibrous ankylosis of the knee with 1½ inch shortening.

5. Delens's case, already quoted.

My impression is—but, unfortunately, it is only an impression—that most cases of separation of this epiphysis, if properly reduced with as gentle manipulation as possible, recover without any ultimate arrest of growth. Before attempting to reduce the displacement it is absolutely essential that muscular spasm should be prevented by thorough anæsthesia, the knee should be flexed and then traction and direct pressure brought to bear on the epiphysis. If the case be compound the wound should be enlarged if necessary and the surgeon's finger should ascertain what is the exact cause of the difficulty. If, as is most probable, this lies in interposed muscles or in the periosteal sheath it may be necessary to hook the former aside or to enlarge the aperture in the latter vertically. The end of the diaphysis should be carefully cleaned, but no strong and irritating antiseptic solution used, for in at least one case they seem to have been responsible for subsequent sloughing. Tenotomy of the tendo Achillis should be performed if the main obstacle is the backward tilting of the epiphyses, and certainly when reduction has been effected the best splint to use is a carefully padded M'Intyre's one, flexed to an angle of 135°. Inflammatory reaction should be combated by iced compresses to the knee. Good union is to be expected in from four to six weeks. Finally if displacement recurs directly the surgeon relaxes his pressure I believe that it is quite justifiable to fix the ends with a steel peg traversing the diaphysis from one side, being careful not to pass it through the epiphysis into the knee-joint. Rather than employ violent efforts at reduction protracted through one, two, or more hours (as has been done with bad results) it is better surgery to resect the expanded diaphysal end. Is it ever justifiable to excise the knee-joint? The results in the cases thus treated are a sufficient answer to this question. Out of 4 cases only 1 recovered with a firm and useful limb, all growth, however, being completely arrested at the knee.

As regards injury to the popliteal vessels the circulation may be arrested and the leg cold from pressure on the artery and yet recovery take place when the diaphysis is got into place, as happened in a case under my own care. But if the artery or vein be torn or completely thrombosed, gangrene is almost certain to follow, and primary amputation is probably the wisest course.

THE UPPER EPIPHYSIS OF THE TIBIA.

Although in its large size and the long period of years which elapses before this epiphysis fuses with the shaft, a strong resemblance exists between it and the lower epiphysis of the femur, yet as regards injury the former is comparatively rarely detached. This is probably due to the fact that the ligamentum patellæ, the internal lateral ligament, and the semimembranosus tendon are inserted partly into the epiphysis and partly into the diaphysis, thus strengthening the connection between the two. It will be remembered that the upper epiphysis includes in front a downward projecting portion of bone, the tubercle of the tibia, which is not infrequently developed from a separate centre. This portion of bone may be torn off by a violent pull of the quadriceps extensor.

Dr. Müller¹³ has collected five cases of this detachment of the tubercle, and Dr. Ogilvie Will¹⁴ has added a sixth, in which the nature of the lesion was made out by operation. All the cases were young male adults between the age of 16 and 20, and in every one the accident occurring in vaulting over "the horse" or in springing from the ground. In Dr. Will's case the surgeon cut down, believing he had to deal with a fractured patella; finding the supposed lower fragment was the tubercle of the tibia he fixed it with a steel needle in place. A quantity of blood clot was evacuated

from the knee-joint. Ultimately good union and power of motion were obtained.

Returning to the subject of the complete upper epiphysis of the tibia, we have records of ten cases of its detachment (including three unpublished ones), mostly happening from violent wrenches of the leg. The youngest patient was 12 months, the oldest 16 years. The great strength of the periosteum, reinforced by the semimembranosus tendon, the internal lateral ligament, and other structures which help to bind the epiphysis and diaphysis together, as a rule prevent much displacement occurring. If any exists, it is usually a forward over-riding of the epiphysis. This is best overcome when the knee is flexed, and probably the best form of splint to use in these cases is a M'Intyre's one. It must be remembered that effusion is almost certain to occur in the knee-joint after this accident.

The displacement just mentioned is well illustrated in a case recorded by Fischer and Hirschfeld,¹⁵ which is of sufficient interest to be quoted here.

A weakly lad sustained a severe machinery accident, and in the left lower limb, this caused separation of the upper tibial epiphysis with forward displacement, and detachment of both fibular epiphyses (not compound). On the right leg the lower femoral epiphysis was detached and twisted round. Both displacements were corrected, but six weeks after the injury suppuration developed in connection with the left fibula at either end (traumatic epiphysitis). This led to amputation, and the specimen showed that union had occurred with the tibial epiphysis tilted forwards, or over-riding. The patient recovered after the amputation, with a very useful right lower limb; although here, also, the displacement had not been fully corrected. Parallel cases of multiple detachment of epiphyses on the same subject are illustrated in the St. George's and London Hospital museums. There is a beautiful specimen of simple detachment of this epiphysis placed by my father in the London Hospital museum; in this case the foot had been run over, and the leg forcibly bent inwards.

I do not think there is anything special to be said about the prognosis and treatment. In the 3 cases of my own, and in one published by Dr. Heuston¹⁶, good union without any noteworthy displacement followed. Should suppuration occur at this epiphysal disc the knee-joint is, of course, in grave danger, as instanced by a case quoted by Gurlt, in which, on the sixth day after the accident, the presence of emphysema and pus in the joint was the precursor of rapid death.

I know of only one example of premature arrest of growth at this epiphysis from traumatism; this was recorded by Volkmann. A boy aged 3 had been severely knocked about by his drunken father. At the age of 4 he began to limp, and after this the tibia grew no more at the upper end, so that the ultimate shortening in this bone amounted to 3". A ridge could be felt as though the diaphysis had been displaced somewhat inwards and forwards. But curiously the femur of that side, the foot, and indeed the whole lower limb partook to a less extent in the want of development.

THE LOWER EPIPHYSIS OF THE TIBIA.

Many points of resemblance exist between this and the corresponding epiphysis of the radius: the epiphysal line is almost straight, situated above the synovial cavity of the neighbouring joint, and separation of this epiphysis (wide as it is) seems to be much more common than that of the lower epiphysis of the fibula. It is, however, often complicated with a fracture of the latter bone, as in the case of the radius and ulna. It may be said practically to take the place of Pott's fracture in young subjects, and may occur either from extreme inversion or eversion. The midwife's efforts may be successful in detaching the lower epiphysis; and in one example of this accident the foot had come to form a straight line with the leg, and the presentation was mistaken for that of a hand. Carus gives a case in which compound separation of this epiphysis occurred *in utero* from a fall, the child being born with a wound through which the diaphysis protruded. Reduction was not effected, and the child died.

Turning to the examples of detachment of this epiphysis in older subjects, we have records of seventeen recent cases, two others of suppurative epiphysitis following a wrench or

sprain, and eight cases of arrest of growth at this part after injury, with overgrowth of fibula and inversion of the foot, making a total of twenty-seven in all. It would have been easy to increase this list by including those cases of severe crush of the leg in which detachment of the lower tibial epiphysis is an unimportant item. The displacement met with has usually been that of the foot and epiphysis backwards or backwards and outwards, so that the sharp ridge of the diaphysal end has projected under the skin. Reduction even in compound cases has been effected without much difficulty as a rule, though Mr. Jacobson once found it necessary to remove the end of the diaphysis, and in two or three cases some necrosis has followed its reduction without resection. So favourable are the chances of conservative surgery in dealing with this injury, that some of the recorded cases would seem to have undergone a needless primary amputation, which in one was certainly owing to an erroneous diagnosis having been made.

Amongst the twenty-seven cases mentioned above are included two reported by Mr. Bryant, three by my father (in one of which the accident occurred in both legs), and three under my own observation.

The only complications we have to note are some splintering of the diaphysis (probably common), fracture of the fibula, and more occasionally separation of its lower epiphysis. There is no doubt that a certain proportion of the cases of so-called sprained ankle involve loosening without displacement of this epiphysis. The epiphyses of the fibula are so unimportant from the surgical point of view, that a few words must suffice to deal with both. The lower one is probably the most important with regard to growth in the bone; the occurrence of its separation is proved by two specimens obtained by Mr. Bland Sutton¹⁷ and M. Anger¹⁸.

Examples of detachment of the epiphysis for the fibular head have been obtained by Stimson, Targett, Delore, and myself.

The only point of interest lies in the possibility of curvature of the tibia following arrest of growth at either end of the fibula.

REFERENCES, ETC.

- ¹ BRITISH MEDICAL JOURNAL, July 16th, 1887. ² *Illustrated Medical News*, November 17th, 1888, and *Path. Trans.*, 1886. ³ *Lancet*, 1891, vol. 2, p. 767.
- ⁴ Astley Cooper's *Fractures and Dislocations*. ⁵ Case occurring at the St. Louis Hospital in Paris. ⁶ Nine of these were under my own observation.
- ⁷ *Bulletins de la Société Anatomique*, 1887, p. 283. ⁸ Case reported by Richet, *L'Union Médicale*, 1876, p. 426. ⁹ Sir Charles Bell's case. ¹⁰ Delens, *Archives Gén. de Médecine*, 1884, p. 272. ¹¹ Case reported by Trélat, *Progrès Méd.*, 1875, p. 470. ¹² *Liverpool Med.-Chir. Journal*, 1885, January. ¹³ Die Riss-fractur der Spina Tibiæ, *Brun's Beiträge*, 1837. ¹⁴ BRITISH MEDICAL JOURNAL, 1887, i, p. 15. ¹⁵ *Berliner klinische Wochenschrift*, 1865, p. 93. ¹⁶ BRITISH MEDICAL JOURNAL, July 21st, 1888. ¹⁷ Middlesex Hospital Museum. ¹⁸ *Atlas of Fractures and Dislocations*.

ABSTRACTS FROM

THE INGLEBY LECTURES ON THE COMMON FORMS OF DYSPEPSIA IN WOMEN.

Delivered at Mason College, 1894.

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LECTURE II.—REST.

EXHAUSTION from over-taxing the physical and mental powers, or from other causes, being the basis of these troubles, we have no difficulty in naming the essential remedy, which is rest—rest in bed.

The duration of the period of rest must necessarily depend upon the intensity and duration of the symptoms. Such virtue is there in prolonged sleep and rest that even thirty-six hours in bed will do much in the early stage of this neurosis; but when our advice is sought it is usually for a condition of things which demands at least a week, and commonly two or three weeks' rest. The rule is to keep the patient in bed until she has eaten ordinary diet without any discomfort for at least three or four days.

When the patient is first put to bed only milk and bread should be allowed. If there is vomiting, only milk, 1 ounce every hour. Then, as this simple food is tolerated, additions are made to the diet, such as minced chicken, cold baked