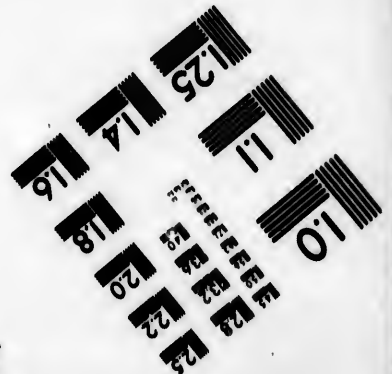
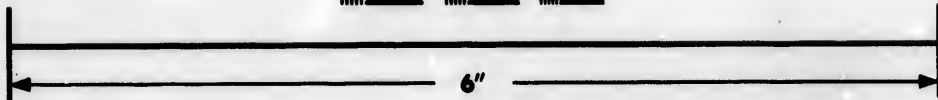
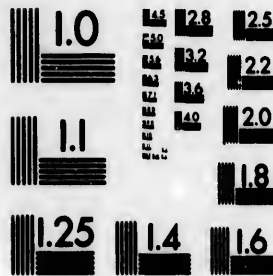


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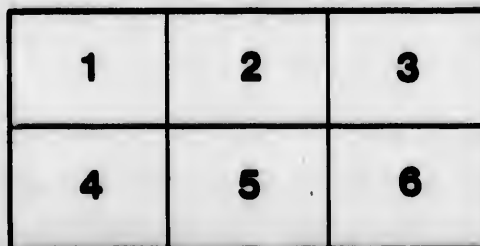
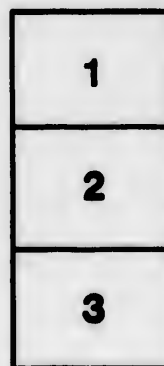
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Reprinted from the Montreal Medical Journal, March, 1892



TRAUMATIC SEPARATION OF THE LOWER EPIPHYSIS OF THE FEMUR.*

By JOHN M. ELDER, B.A., M.D.C.M.,
Assistant Demonstrator of Anatomy, McGill University.

Mr. President and Gentlemen,—The scant attention given to the subject of separation of the condyloid epiphysis of the femur by the standard works on surgery, coupled with a conviction that the accident is not as rare as was at one time supposed, has led me to hope that a short paper on this subject might prove interesting to the members of this Association, and at the same time might add somewhat to our knowledge on this question. In connection with the paper I am fortunately able to show you an example of this surgical accident in the person of this young man; and I think, when you hear the report of his case, you will agree he is fortunate in being able to carry with him this specimen, at one time the lower diaphysis of his femur, even if he has to do so in his pocket.

In a clinical lecture on the surgery of the epiphysis, delivered in 1885,† Wheelhouse drew attention to the important part played by the epiphyses in all dislocations and fractures in the neighbourhood of joints, and hinted that many supposed cases of dislocations in young persons have really been fractures through the epiphyseal line, as shown by the frequency with which de-

* A paper, with illustrative case, read before the Canadian Medical Association, at Montreal, September, 1891.

† British Medical Journal, Vol. I, 1885, p. 475.

formity has followed their reduction, and that this may account for the paucity of literature on this subject *

A glance at these specimens, kindly put at my disposal by Dr. Shepherd, will enable you to see how easily, in the case of young patients, any one might mistake fracture through the lower femoral or humeral epiphyseal line for dislocation of knee or elbow. Moreover, in the case of the femur, the liability to just this kind of accident extends over a goodly period of time, for you will recollect that while this epiphysis is one of the first to be formed (9th month, foetal), it is one of the last to join its corresponding diaphysis (21st year). While I have these specimens in hand, I would ask your attention to the mechanism of this form of injury. When fracture takes place, the epiphysis will be tilted forward by the two heads of the gastrocnemius, thus presenting its articular surface to the patella. At the same time the diaphysis will be thrust backwards and downwards by the pull of the quadriceps extensor muscles in front and the ham-string muscles behind, and will impinge on the vessels and nerves in the popliteal space, or slipping past them, may be forced out through the skin altogether, and thus become compound. One peculiarity of the injury, when compound, is that the protruding diaphysis is always stripped of its periosteum, which is turned back like a stocking on a foot.

I have premised thus far that we may be able to see clearly what has happened in the case of this young fellow whom I accidentally stumbled upon a couple of years ago in my last practice.

When seven years old, he was standing on one foot, with the other resting on the hub of a waggon wheel; a pile of lumber behind him fell forward and struck the standing limb just below the knee, driving the lower part of the leg violently forward, and letting the lower part of the femur impinge on and perforate the popliteal space, through which the bone protruded for about three and a half inches, letting the boy down as it were. The two nearest medical men were at once summoned, and diagnosed compound dislocation backward of the femur, not noticing the absence of the condyloid cartilage on the protruding bone. Two

* of. Erichsen's and Holmes' "System of Surgery."

different attempts, under chloroform, were made at reduction, but neither successful, so amputation above the knee was advised. To this the boy's father strongly objected, and failing this they sawed off what they could not reduce (about an inch and a half), tucked in the remainder, and left the case in disgust at the obduracy of the father. It was hot weather and before the days of modern antisepticism, so that the neglected wound soon became septic. The father (an intelligent French-Canadian blacksmith) then took the case in hand, and henceforward was the only surgeon employed. He killed the maggots by pouring whiskey into the wound, improvised a sole-leather back-splint, and in four weeks the lad was propelling himself around the garden, and in two months was walking, at first stiffly, but as time went on he got the perfectly good knee-joint, which he now presents. The injured limb is shorter than the other by exactly the amount of bone removed thirteen years ago ($1\frac{1}{2}$ inches), but in every other respect is as strong as its fellow, and he is able to do any kind of work. The specimen of bone is not quite perfect, owing to the father having singed it at his forge "to burn off the stink," but anyone can see it is the lower end of a femur.

The above history (which I took pains to verify by the doctors who attended) puzzled me not a little; and I exhibited the case to several of the medical men here a couple of years ago, when Dr. Shepherd suggested the explanation of what had occurred as a compound separation of the lower epiphysis of the femur.

In the *New York Medical Record* for Jan. 3rd last (1891) a case is reported by Dr. John H. Owings almost identical with this one, and the treatment and result tally so well that I will ask your forbearance to quote it in a condensed form.

On Aug. 29th, 1890, was called to see a ten-year-old girl whose left leg had been caught in a waggon wheel and fractured at the knee. A careful examination under an anæsthetic showed that the condyloid epiphysis had been separated from the diaphysis, and that the shaft of the femur had lacerated the soft parts and was protruding through the skin over the popliteal space fully five inches. Amputation was advised, but owing to absence of the father, the strenuous objections of the mother, and

a tendency to collapse on the part of the patient herself, we deemed it best to attempt reduction. We did so, but much to our surprise, we utterly failed to reduce the protruding shaft of the femur. Dr. Minshall and I called Dr. Douglass to our aid, and we made another attempt at reduction, but with no better result. As the patient now began to show signs of suffering from the continued anæsthetic (one hour), I advised amputation of the protruding end of bone to facilitate reduction, and my confrères concurring, I removed three-quarters of an inch, which allowed us easily to reduce the remainder.

Beyond the impossibility of reduction, I had other reasons for the course I pursued, viz. (1), the danger of pinching some important vessel or nerve between the diaphysis and epiphysis; (2) the probability of necrosis following the denudation of periosteum; (3) the greater probability of bony union between the fragments if the smooth end were sawed off.

The wound was then thoroughly douched out with bichloride solution, and the external wound closed by ten silk sutures. Iodoform was dusted over the parts, antiseptic dressings applied; and the limb left in a flexed condition at both hip and knee. The only antipyretic ordered was quin. sulph. gr. i, 4tâ horâ. Next day we put up the leg on Smith's anterior wire splint, and suspended the limb from the ceiling. The temperature was then $101\frac{1}{2}^{\circ}$, but gradually subsided to normal on Sept. 3rd, patient having suffered very little in the meantime. But next day (probably owing to want of drainage) temperature went up a little, and wound showed signs of sloughing. We removed sutures and gave vent to some bloody serum, and by Sept. 8th temperature was normal again, and we removed all sutures and held the edges together by adhesive strips. The wound then healed rapidly, and on Oct. 25th I removed the splint and found no articular effusion and some motion. Put leg up again on anterior copper splint and starch bandage, and left it until Nov. 14th, when I substituted a short knee splint, and found more motion and evidently good bony union. Ordered patient up on crutches, and from that on her improvement was rapid. On Dec. 1st she walked with only a slight limp, had a good moveable knee-joint, with one inch shortening of the affected leg."

An exhaustive article on this same subject, by Dr. Packard of Philadelphia, appeared some time ago in the *Annals of Gynecology and Pædiatrics* (vol. iv, p. 111), and to this I am indebted for many references; though, as Dr. Packard says, many of the cases have been so carelessly reported as to leave room for doubt whether they were not simple supra-condyloid fractures instead of simple diastases: regarding the compound cases there is no room for doubt. Dr. Packard at the same time relates a compound case of his own where amputation was necessary, and figures the specimen removed, with the gastrocnemius, as we have seen, attached to and tilting the epiphysis, and the bare diaphysis sticking out. I mention this particularly, because Mr. Mayo Robson,* in an article on this same subject in which he cites several cases and gives drawings of specimens in Guy's Hospital museum, makes the strange statement that the gastrocnemius is attached to the diaphysis, and that it is the muscles of the calf instead of the muscles of the thigh which prevent reduction. Accordingly, in his remarks on treatment, he logically enough recommends tenotomy of the tendo-Achillis to assist reduction, which he practically regards as impossible in compound cases, and his conclusion is that amputation above the knee is the correct surgical procedure in these cases.

An analysis of the seventy (70) odd cases I have managed to disinter from medical journals, with a view to determining the kind of violence most likely to produce this form of injury, gives the following facts: Entanglement of the limb in a moving wheel (as of a carriage), 33 cases; a fall while running, 3 cases; one case of a fall from eighty feet; body thrown forwards while leg was in a hole up to knee, 2 cases; one case while boy was playing leap-frog, and alighted with feet widely separated; direct blow to lower part of limb (as in this case), 4 cases; run over by vehicles, 4 cases; and finally, as result of surgical procedures for correction of ankylosis or deformities, five cases. In 33 of the cases the compound character of the lesion is mentioned.

* *Annals of Surgery*, Feb. 1880. Quoted by Dr. Shepherd, in *Montreal Medical Journal*, vol. xviii, p. 108.

In conclusion, I think we are justified in drawing the following deductions regarding the proper treatment of this form of injury :

1. In all cases, simple as well as compound, there is danger to the popliteal vessels, and the first thing to be done is to ascertain their condition. If ruptured, or in any way irreparably damaged by pressure of the diaphysis, our plain duty is to amputate, and thus prevent gangrene.

2. But if we have reason to think the popliteal vessels are functionally intact, we should, in simple cases, reduce the injury by traction (and possibly tenotomy of the tendo-Achillis), and then put up the leg in plaster or on a McIntyre splint, with the knee semiflexed.

3. In compound cases, we should first try reduction of the protruding fragment. For my own part, I cannot see why every attempt to do this has hitherto failed. But failing this, I think these cases we have would justify the surgeon in cutting off what he could not reduce, and then put the leg up in plaster, with a window through which to dress the wound. I do not think we can any longer justify the classical treatment of amputation above the knee, at least as a first resort, for I am sure you will agree with me that the result before you to-day, even though not premeditated, is infinitely better for the patient than a wooden leg would be.

Subjoined is a list of references to the literature of this subject, so far as I have been able to investigate it :

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