

to be the result of the lateral stretching of the labia as of the entrance of air.

I shall be excused if I institute a brief examination of the merits of this method as compared with the merits of the method of horizontal extension recommended and adopted by myself.

Dr. Kümmel has very frankly stated one objection which does not apply to horizontal extension, namely, a severe vaginal catarrh; and this alone would be sufficient objection, in my opinion, to its employment in the case of females. Admitting that it will prove, in most cases, to be only temporary, yet it may not in certain constitutions or habits of body cease with the removal of the cause; and no assurance can be given that the inflammation may not be propagated upwards, and thus lay the foundation of serious future uterine trouble. The mere possibility of such a result is sufficient to condemn the practice, as applied to this class of cases.

A second objection I find in the fact that by Schede's method the patient is during the entire period of treatment confined to the bed, while in horizontal extension he is not.

Singularly enough, almost this same argument is employed by Kümmel in favor of Schede's method. "It does not necessitate constant and complete rest on the back." In other words, the patient may turn over more or less upon his side without disturbing the fracture. This statement, it is evident, must be received with some reserve. In a large proportion of cases where the children are under two years the fracture is a green-stick fracture, and often it may be termed a mere bending of the bone; and in all such cases a certain freedom of motion may be permitted without causing either lateral or rotary displacement; but there must be a limit to the freedom of motion of the body even in these cases.

The case is very different, however, when, as occasionally happens—pretty often, indeed—the fracture is complete, and the fragments have been once permitted to overlap or slide upon each other in the direction of the axis of the bone. In such cases there could be no assurance given, where the patient was subjected to no restraints whatever, that union might not be delayed; and, in some cases, that the fragments might not unite with some degree of rotary displacement. No doubt the close apposition of the muscles will tend to prevent this unfortunate occurrence to a great extent; but then, it seems unnecessary to say, the danger of its occurrence is greater where such perfect freedom of motion is permitted.

If, however, it were to be conceded that some motion of the body is admissible, and that Schede's method permits the patient to relieve the back by turning occasionally upon the side, still it must be observed that the extension apparatus, upon which Schede alone relies to adjust and retain the fragments, does not permit the patient for one moment to leave the bed. In Schede's method the extension apparatus is a fixture, and its position cannot be changed, nor can it ever be relaxed.

On the other hand, in horizontal extension the body is not indeed permitted to roll from side to side, but the patient, inclosed in the splint, and including even the extension apparatus, may be taken from one bed to

another, or taken out of doors, as often as we choose. The patient may be put temporarily into almost any position which necessity or comfort may require.

Further than this, in horizontal extension the surgeon does not rely solely upon the extension made by weight and pulley, to keep the fragments in line, so that these may at any time be temporarily removed without affecting the result. Indeed, in many cases this portion of the apparatus is not employed by myself; and I sometimes omit also the lateral splints.

Nor is it so irksome for infants to lie on their backs three or four weeks if only they be permitted to use their hands, as some would suppose. In fact, after the first day they seem perfectly reconciled to it; while, if permitted to move, they are for a time constantly causing themselves pain by some sudden twist of the limb.

I have not spoken of the inconvenience which must be experienced in the vertical extension in the adjustment of the coverings, and especially in cold weather, which inconvenience is avoided in horizontal extension.

It must be added, also, that although in children of this age the fragments are usually firm in three or four weeks, it has not been found safe, in my experience, to remove wholly restraints until a week or two later. The contrary practice has every now and then resulted in a bending at the seat of fracture, which had subsequently to be remedied. My double splint, with only moderate confinement of the body and limbs, without extension or short splints, prevents this unfortunate accident in the later days of the treatment, while in Schede's method the limb must be left, after the extension is removed, wholly without support. In one of Kümmel's patients the extension had to be continued 104 days, and in another 111.

Finally, if we are to compare results, no evidence is presented by Kümmel that his results are any better than my own, by which latter method rotary displacement is impossible; lateral displacement or bending, improbable; and there is no shortening, of course, unless it is a complete fracture, and if it occurs then it is trivial.

The treatment of compound fractures of the thigh, caused by gunshot injuries, will be considered in the chapter devoted to Gunshot Fractures. Other badly comminuted and compound fractures of this bone are to be managed upon the same general principles as gunshot fractures.

Those compound fractures of the femur which have been caused by the thrusting of the sharp fragments through the flesh, and in which reduction has been easily effected, have in most cases done as well as simple fractures, except that the limb is generally a little more shortened. The wound usually soon heals, and the future progress of the case is the same as that of a simple fracture. They may be treated, therefore, in the same manner as those which have just been described.

§ 5. Fractures of the Shaft, at or near the Base of the Condyles.

These fractures are not so common as fractures of the shaft elsewhere. Only twenty examples are contained in my records as having come under my personal observation. Malgaigne thinks they are caused generally by direct blows, but this was not Sir Astley Cooper's opinion, and ac-

According to my own experience they are caused generally by a fall upon the knees or feet. In at least nine of the cases seen by me the fracture was caused in this manner, and in seven it is known that the fracture was caused by a direct blow.

The direction of the line of fracture is generally from behind forwards and downwards, the upper fragment being driven downwards toward the patella; in other cases the line of fracture preserves the same general direction, but inclines inwards or outwards; and in these cases the upper fragment is found lying more or less on the inner or outer margins of the knee, probably most often on the inner side.

In one instance I have found both femurs broken at the same point and in the same manner. Mr. L. Brittin, aged about forty-five years, while employed upon a building, fell from a fourth-story window upon the stone pavement below, striking upon his feet. In addition to several other fractures, I found both femurs broken obliquely downwards and forwards, just above the condyles. Very little inflammation ensued, and although it was found impossible to employ extension, union occurred readily, and with only a moderate overlapping.

In the left limb, however, the upper fragment pressed down sufficiently to interfere somewhat with the patella, and the patient was unable, after several months, to straighten the knee completely. The motions of the right knee were unimpaired.

I have only once met with a fracture at this point in which the line of separation was downwards and backwards. As the case presents several points of interest, it will be proper to narrate the facts somewhat at length.

George Taylor Aiken, of Lockport, N. Y., æt. 7, on May 18, 1854, in jumping down a bank of about three feet in height, broke the right thigh obliquely, just above the knee-joint. Direction of the fracture obliquely downwards and backwards.



FIG. 202.
Fracture at base of condyles.

Dr. G., an accomplished surgeon, residing in Lockport, was called. The limb was not then much swollen. He applied side-splints, rollers, etc., carefully, and then laid the limb over a double-inclined plane. The knee was elevated about six or eight inches. Before applying the splints, suitable extension had been made, and after completing the dressings, the two limbs seemed to be of the same length.

On the second or third day, Dr. G. noticed that the toes looked unnaturally white, and were cold.

Counsel was now called at the request of Dr. G., when it was determined to abandon all dressings, and direct their efforts solely to saving the limb.

The result was that slowly a considerable portion of his foot died and sloughed away, leaving only the tarsal bones. The fracture united, but with considerable overlapping and deformity.

Feb. 26, 1856, the boy was brought to me by his father. On examining the fracture, I noticed that the anterior line of the femur seemed nearly straight, and this appearance was owing in some degree to the muscles which covered and concealed the bone, and in some degree, also, to the manner in which the fragments rested upon each other; the pointed superior end of the lower fragment resting snugly upon the front of the upper fragment, so that no abrupt angle existed in front. On the back of the limb, however, the lower end of the upper fragment, quite sharp, projected freely downwards and backwards into the popliteal space, so that its extreme point was only about half an inch above the line of the articulation. The limb had shortened one inch, and this enabled us to determine accurately that the lower point, or the commencement of the fracture, was one inch and a half above the articulation, while the point where the line of fracture terminated in front was probably quite three inches and a half above the joint.

The motions of the knee-joint were pretty free. The leg was extremely wasted, and the anterior half of the foot having sloughed off, the sores had now completely healed over. He was able to walk tolerably well without either crutch or cane.

Subsequently, Dr. G. found it necessary to sue the father of the child for the amount of his services, when Mr. Aiken put in a plea of malpractice, and that consequently the services were without value.

The case was tried in the March term of the Niagara circuit of 1856, at Lockport, N. Y., the Hon. Benjamin F. Greene presiding.

On the part of the defence, it was claimed that the death of the foot was in consequence of the bandages being too tight. They failed, however, to show that they were extraordinarily or unduly tight. While on the part of Dr. G., the prosecutor, it was shown that the death of the toes was preceded by a total loss of color, and that it was not accompanied with either venous or arterial congestion. The medical gentlemen examined as witnesses declared that this circumstance furnished the most positive evidence which could be desired that the death of the toes was not due to the tightness of the bandages, but that its cause must be looked for in an arrest of the arterial or nervous currents supplying the limb, or in both. They believed, also, that the projection of the superior fragment into the popliteal space was sufficient to cause this arrest. They also believed that overlapping and consequent projection could not have been prevented in this case, and that therefore the treatment was not responsible for this unfortunate result; indeed, they regarded the treatment as correct, and the result as a triumph of skill, in that any portion of the limb was saved; the leg and foot now remaining being far more useful than any artificial leg and foot could be.

The Hon. Judge, in a speech remarkable for its clearness and liberality, sought to impress upon the jury the value of the medical testimony. The jury returned a verdict for Dr. G., allowing the amount of his claim for services, with the cost of suit.

Specimen 121, in Dr. Marsh's collection at Albany, presents a similar disposition of the fragments. The fracture is oblique, from above downwards and backwards, and the upper portion lies behind the lower. It is firmly united by bone, but with an overlapping of from two and a half

to three inches. The young gentleman who showed me the specimen remarked that it had been found impossible, owing to an ulcer upon the heel, and to other causes, to employ in the treatment any degree of extension.

These two are the only examples which have come under my observation in which a fracture at this point has taken this direction.

Sir Astley Cooper does not seem to have recognized this form of fracture and displacement. Amesbury has, however, recorded one case, which came under his own observation, where, although the bloodvessels and nerves escaped, the bone projected through the skin in the ham, and finally exfoliated.¹ And he thinks the point of bone may sometimes so penetrate the artery and injure the nerves as to render amputation necessary, in order to save the life of the patient.

M. Coural also has related a case in which an epiphysary disjunction, occurring in a child twelve years old, was attended with a displacement of the upper fragment backwards, and amputation became necessary.²

I know of no other cases of this rare accident which have been reported. Lonsdale refers to it as "the rarest direction for a fracture to take;" and thinks that in case of its occurrence, the vessels in the popliteal space will stand a chance of being wounded; but he mentions no example. The popliteal artery hugs the bone so closely at this point, that a displacement of the upper fragment in a direction downwards and backwards must always greatly endanger its integrity. Indeed, it is here that the artery and vein are in the closest contact with each other, and with the bone; an anatomical fact which has been used by Richerand and others to explain the greater frequency of aneurisms in the ham.

The *prognosis* in this fracture has, according to my own experience, a wider range than in the case of other fractures of the shaft. In a proportion of cases the union has been effected with little or no shortening; a result which is not surprising when we consider that at this point the muscular resistance which has to be overcome is less than at any other point of the shaft of the femur; and that occasionally the line of fracture is so little oblique that the fragments being once adjusted support themselves completely. Malgaigne says that here "oblique fractures are more rare" than those which are nearly transverse; but Sir Astley Cooper had never met with a transverse fracture at this point, nor have I; yet no doubt they do occur here more often than in other portions of the shaft. Malgaigne says that M. Denonvilliers thought he had found in the Dupuytren Museum four or five examples of exactly transverse fractures at this point, but he had not found one higher up.

Malgaigne, who I infer has examined these specimens, does not seem to be satisfied that they represent really transverse fractures, but he does not speak positively upon this point.

James A. Manly had his right thigh broken at this point when he was four years old, and when he was thirty years old I found it shortened half an inch, but the point of fracture could be distinctly felt. That it

¹ Remarks on Fractures, etc., by Joseph Amesbury, vol. i. p. 293. London, 1831.

² Archiv. Gén. de Méd., tom. ix. p. 267.

was not an epiphysal fracture I was assured by the fact that the bone had not ceased to grow in this direction, and by observing that the fracture was too high to warrant such a supposition.

Andrew Carr, æt. 25, treated at the New York Hospital, had a shortening of three-quarters of an inch.

Mrs. Jackson, aged about thirty, had a shortening of one inch. Both of these latter patients were treated in the straight position, but without permanent extension, and therefore did not represent the best results which might be obtained.

John Van Pelt, æt. 51, treated by me at Bellevue Hospital in 1873, with plaster of Paris, and, therefore, without permanent extension, had a straight limb, and the shortening was half an inch. This fracture was caused by a fall upon his foot, and the lower end of the upper fragment was thrust through the flesh and skin, making a small hole in the latter; but this soon closed, and the case proceeded as if it had been a simple fracture.

In the following case there was no shortening, but the limb was, after the union, longer than the other: Michael Halloran, æt. 40, had his left femur broken by a direct blow, three inches above the joint, October 6, 1874. Having been received into my wards at Bellevue, my own extension apparatus was applied by my house surgeon, Dr. Lewis, with weight and pulley, and continued seven weeks, when the fragments were found united; the limb being half an inch longer than the other. This measurement has been repeated several times by myself and others with the same result.

I have mentioned the very satisfactory result in the case of Brittin, with a double fracture.

Of the following case it seems proper to say, whether the shortening is no greater than I have been informed or not, that the result is certainly very favorable considering the character of the accident:

Col. A. Alden, of Troy, was blown up in the explosion of the magazine at Fort Fisher, Jan. 19, 1863. I saw him in consultation with Dr. Simmons, U. S. A., at Bedloes Island, on the eighth day after the accident. The right thigh was broken above the condyles, the upper fragment being thrust down in front, and to the inner side. Both limbs were greatly bruised, swollen, and discolored. His right thigh was at this time shortened four inches. At my suggestion, Buck's extension was applied. He was never seen by me again, but his brother wrote me April 28, 1865, that the Colonel (then General) had returned to his command with the limb shortened only half an inch. As I do not understand this measurement to have been made by a surgeon, it cannot be regarded as authoritative.

The following two examples do not present results equal to the average of fractures of the shaft of the femur in other portions:

W. C. Latham, æt. 35, treated chiefly by plaster of Paris; when he consulted me after five months the limb was shortened one inch, and the knee-joint almost completely ankylosed.

Samuel Wilson, æt. 47, fell from a car, striking upon his knee. He was placed under my care at Bellevue, and at first laid upon a double-inclined plane; but this being found very uncomfortable, and not im-

proving the position of the fragments, extension, with weight and pulley, was substituted. The union was effected with a shortening of one inch, but with very little ankylosis of the knee.

Henry Hoff, *æt.* 40, received a comminuted fracture of his left thigh four inches above the knee, from a direct blow, Dec. 2, 1879; fracture oblique. He was treated in my wards at Bellevue by extension and weights. It united in a straight position, but shortened one inch.

Anna Simpson, *æt.* 16, broke her right femur Dec. 12, 1879, by a fall from a rope thirty feet. Shortening at time of admission to Bellevue one inch and a half, showing that it was probably from a fall on the foot or knee. She was treated in my wards by my mode of extension. There is now union with less than half an inch shortening. The motions of the knee-joint are free.

I have taken the pains to mention these fortunate cases more in detail than their simple character would seem to justify, because I wish to place them in contrast with the less fortunate cases.

Mrs. Catharine Sullivan, *æt.* 55, a large, fat woman, fell from a height, striking probably the right knee. The fracture was compound; and when admitted to my service at Bellevue, October 9, 1866, the limb was greatly swollen. Immediate amputation was urged, but she refused to have it done. Moderate permanent extension was then employed, and suitable dressings applied; suppuration occurred in the knee-joint, and she died in about two weeks.

Michael O'Shea, *æt.* 40, had his right thigh broken at the same point by the fall of a piece of timber upon it, and was admitted to my service, in the Buffalo Hospital of the Sisters of Charity, on the same day. He refused to submit to amputation, and he died on the tenth day, after gangrene had ensued.

I was called to see a gentleman in Waverly, Tioga County, who was thrown from his carriage February 20, 1864, striking on both knees, causing a fracture of the right thigh above the condyles. On the sixth day, in order to establish the diagnosis, his surgeon administered chloroform, and examined the knee thoroughly; but he was seized with a tetanic convulsion while they were manipulating; subsequently he had other similar convulsions. I saw him on the ninth day, when the limb was greatly swollen, and his general condition seemed to indicate speedy death. The convulsions still continued. The limb was shortened one and a half inches as it lay reposing upon a double-inclined plane—Daniels's fracture-bed. A few days later he died.

The case of Aiken, in which the line of fracture was from above, down and back, already described at length, was followed by gangrene, and resulted in amputation. This was treated on a double-inclined plane.

Daniel Welsh had his thigh broken by a direct blow just above the knee, when he was twenty years old, in Ireland. The fracture was compound and comminuted, and some fragments of bone subsequently escaped. He was examined by me five years later, when I found the limb shortened seven inches. My notes do not refer to the method of treatment.

Wm. Hennen consulted me in February, 1854, complaining that his leg had been treated badly, and that he was in consequence very much

maimed. His leg had been broken by being caught between a carriage and a tree. His surgeon had extension made by four strong men, and three long side-splints were bound to the limb; but there was no permanent extension. I found the limb shortened more than one inch and a half. (Both of the preceding cases were reported in the *Trans. of the Amer. Med. Assoc.* for 1857, in my paper on Deformities, etc.)

John Bohan, *æt.* 37, was admitted to my service, May 11, 1878, having fallen down an elevator and striking upon his right knee. When admitted the limb was greatly swollen, and the existence of a fracture was not recognized. Subsequently I discovered that the right thigh was broken just above the condyles, and the line of fracture was from below upwards, backwards, and slightly outwards. His legs were covered with open ulcers, and extension by adhesive strips was impossible. After several attempts to adjust the fragments by extension, flexion, etc., his limb was placed in a Hodgen's suspension splint; but this was removed five days later, as it was found not to diminish the shortening, and it failed equally to prevent eversion of the foot. Having decided that it was impracticable to maintain extension, it was determined to do what lay in our power to prevent eversion, to which the foot and leg were greatly inclined on account of the riding of the upper fragment upon the inner side of the lower. This was accomplished very satisfactorily by a long side-splint, well cushioned, and bound to leg, thigh, and body. Union was effected with a shortening of two inches and three-quarters.

Mary Tobin, *æt.* 50, fell seven feet, November 6, 1867, and on the same day was admitted to Bellevue with a fracture at the base of the condyles of the right femur, in the usual direction. We found her thin, pale, and covered with syphilitic eruptions.

Buck's extension was applied with eight pounds. On the 10th this was increased to twelve pounds. December 1st, twenty-four days after the injury was received, the fragments not having then united, my successor, Dr. Wood, took charge of the case. She was at once placed upon a double-inclined plane. This was continued a few days, when the fragments being in a worse position than before, the straight position was resumed. About seven weeks after the injury the fragments were not united, and Dr. Wood cut the quadriceps.

February 2d, nearly three months after the accident, it was not united. On the 25th it was thought to be united, with a shortening of one and a half inches. I did not examine her at this time.

Joshua Marquand, *æt.* 70, fell down a flight of stairs and received a fracture of the left femur, near the condyles, November, 29, 1879. On the same day he was admitted to Bellevue. We found the limb shortened two inches; and the lower end of the upper fragment had penetrated the quadriceps, and lay directly under the skin. An attempt was at once made to reduce the fracture by extension of the leg in the extruded and flexed position, but without any effect, until the patient was placed under the influence of ether; when, under flexion and extension, the sharp end of the bone was seen to recede a little, but it still remained entangled in the tendon of the quadriceps. An extension apparatus was now applied with twenty pounds, by which the length of the limb was

much increased. On the tenth day Hodgen's suspension apparatus was substituted.

Dec. 19, twenty days after the accident, finding no improvement in the condition of the fragments, and feeling assured that union would not take place, after consultation held with my colleagues it was decided to resect the projecting point of bone, and reduce the fracture. This was accordingly done by myself on the same day; one inch and a half of the pointed extremity of the upper fragment being removed. Even then it was with some difficulty released from its entanglement, and restored to its proper position. The limb was dressed with a plaster-of-Paris splint, with a fenestra opposite the wound. On the following day the plaster splint was opened on account of the occurrence of swelling, and three days later the symptoms assumed a grave aspect, gangrene having occurred over his sacrum and several other parts of his body. He died Dec. 25.

It will appear, then, that while a considerable number of these fractures may be reasonably expected to reach a favorable termination, a much larger proportion than usual of fractures of the shaft at other points are to be considered as very grave accidents, and in some cases as demanding immediate amputation. This increased gravity is due, in certain examples, to the greater violence required to cause the fracture; in others, to the penetration of the joint by the upper fragment, and in all cases the hazard may be considered increased by the proximity of the fracture to the joint; the thinness of the soft coverings renders them more liable to be made compound by the penetration of the skin by the upper fragment; and, finally, there exists the danger that this fragment will penetrate the tendon of the quadriceps, or its tendinous expansions on either side, and become button-holed, thus interposing a portion of this dense fibrous tissue between the fragments, and preventing bony union, as happened in two of the cases already recorded.

If the direction of the fracture is from before upwards and backwards, as happens only very rarely, there is danger of the fragments pressing upon the popliteal artery, vein, and nerves, and causing a secondary hæmorrhage, or gangrene of the leg, as happened with the boy Aiken.

The treatment of the accident has already been discussed in connection with fractures of the shaft in general; and the conclusion would seem to be that, except in the last-named and exceptional fracture, as a rule, the straight position with moderate extension affords the most comfort to the patient, and insures the best results. No doubt there will be cases in which Hodgen's swing, or some other forms of the flexed position, will be found the most comfortable, and give equally good results; especially when the parts about the knee are much swollen, or the knee-joint itself has been penetrated. It will be noticed, however, that in the few cases in which this position was adopted by myself and others, a change had to be soon made.

The most serious question is, perhaps, What shall be the course to be pursued when the bone becomes button-holed in the tendon, without penetrating the skin? In neither of the two cases seen by me could the fragment be withdrawn from the tendon by flexion or extension, even when the patient was under the influence of the anæsthetic. Will it be

proper, then, to cut through the skin, expose and remove the projecting bone, and then reduce it? In one of my cases this was not done, and although the union was very long delayed, it is reported to have been finally accomplished; but of the correctness of this report I do not feel assured. In the other case I resected the bone, and my patient died. I confess that I do not think I would be inclined to repeat the operation, but that I would prefer to submit my patient to the risks of non-union, or of a fibrous union. Upon this subject, so far as I know, surgeons have furnished hitherto no experience, and have given no opinions; nor indeed am I aware that they have made any allusion to this class of cases. It is a matter, therefore, for future study.

Bryant says that he has once cut the tendo Achillis in a case of fracture at the base of the condyles, and he recommends it in all cases.¹ I cannot agree with Mr. Bryant as to its necessity or utility ordinarily, since I do not think that the lower fragment has that tendency to tilt backwards, which, in Mr. Bryant's opinion, renders a paralysis of the gastrocnemius necessary. This point has been discussed elsewhere in this chapter.

It has been already mentioned that Dr. M. A. Morris, of Harvard, Charlestown, Mass., has repeated Mr. Bryant's operation in a case in which the fracture was through the base and between the condyles at the same time. In this case the operation proved very serviceable.²

§ 6. Fractures of the Condyles.

(a) *Fractures of the External Condyle.*

Dr. Alph. B. Crosby,³ of New Hampshire, has published an account of a case of simple fracture of the external condyle, in a young man twenty-one years of age, and which happened from a sudden twist of the limb, while he was undressing himself to bathe. He was "standing on a shelving bank, with the right leg flexed over the left in order to remove his pantaloons; he lost his balance, partially twisted the leg, and fell to the ground." Six months after, the fragment was removed by Dr. Crosby, through an incision below the condyle. The recovery of the young man has been complete.

The accompanying drawing represents the specimen as seen from its lower or cartilaginous surface, and of its actual size. (Fig. 203.)

John O'Neill, æt. 40, fell down stairs in Dec. 1873, bending his left leg under his body, and fracturing the external condyle. About three months later the patient was brought under my notice by Dr. Stanley. The patient was able to walk with a slight halt; the fragment, apparently about one inch in diameter, moving upwards about half an inch when the leg was flexed, with a distinct and painful crepitus. When at rest, the fragment formed a marked projection. It is not certain whether the line of fracture entered the joint.

I examined the limb several times during the succeeding two years,

¹ Bryant, Lond. ed., 1872, p. 936.

² Morris, Med. Rec., March, 1878, from Bost. Med. and Surg. Journ., Nov. 1877.

³ Crosby, New Hampshire Journ. of Med., 1857.

and found the condition of matters unchanged, except that the usefulness of the limb has steadily improved. Bandages and knee-supports have served no useful purpose, and have been laid aside.

Dr. T. S. Kirkbride has also reported an example of simple fracture of this condyle, which was produced by the kick of a horse, the blow having been received upon the inside of the knee. When this patient entered the Pennsylvania Hospital, Dec. 1834, the knee was much swollen, and crepitus was plainly felt, but the fragment was not displaced; the muscles upon the outer side, however, were so strongly contracted as to abduct the leg, and produce considerable angular deformity.

FIG. 203.



Dr. Crosby's specimen of fracture of the external condyle.

FIG. 204.



Sir Astley Cooper's case of fracture of the external condyle.

The limb could be easily made straight, but it returned to its former position of abduction as soon as it was released. When fully extended, slight bending of the joint did not give severe pain; but when in any degree flexed, all motion was very painful.

The limb was placed in a long straight fracture-box, and cold applications were made; great swelling followed. It was kept extended in this manner, or in the long splint of Desault, twenty-eight days; at which time union seemed to have taken place, but the motions at the joint were very limited, and productive of great pain. From this period the limb was laid in a splint, so constructed as that the angle of the knee could be changed daily. At the end of about six weeks he began to walk on crutches, and he could then flex the leg to a right angle.¹

Sir Astley Cooper has related a case of compound fracture of the same condyle, produced by falling from a curbstone upon the knees. The man died on the twenty-fourth day. On examination after death, the external condyle was found to be broken off, and also a considerable fragment was detached from the shaft higher up.² (Fig. 204.)

¹ Kirkbride, Amer. Journ. Med. Sci., May, 1835, vol. xvi. p. 32.

² Sir Astley Cooper, on Disloc., op. cit., p. 239.

(b) *Fractures of the Internal Condyle.*

Dr. Thomas Wells, of Columbia, S. C., has reported an example of fracture of the internal condyle, accompanied with a dislocation of the head of the tibia outwards and backwards. The man was about forty years old, and intemperate. Dr. Wells was not called until two days after the injury was received, when he found the limb greatly swollen and gangrenous. The man's account of himself was that while walking in the back yard he fell, and thus dislocated his knee, and that he was then brought into the house, being unable to stand upon his feet. It does not appear that any attempt was made to reduce the limb, probably because his general condition indicated that speedy death was inevitable. On the fourth day he died. The autopsy disclosed, in addition to the dislocation of the tibia, that a thick scale of bone was broken from the inner part of the inner condyle, but it remained attached to the ligaments.¹

A case reported to me by Dr. Lewis Riggs, a very intelligent surgeon, practising in Homer, Oneida Co., N. Y., was more successful:

A lad, æt. 15, was kicked by a horse, the blow being received upon the right knee. Dr. Riggs saw him within three hours after the accident, and found the internal condyle of the right femur broken off, carrying away more than half the articulating surface of the joint; the tibia and fibula were at the same time dislocated inwards and upwards, carrying with them the broken condyle and the patella. The displacement upwards was about two inches, and the sharp point of the inner fragment had nearly penetrated the skin. There was no external wound. The knee presented a very extraordinary appearance, and the lad was suffering greatly. Being at a distance from town, and the Doctor having no chloroform or pulleys with him, he was obliged to depend solely upon the aid of five men who were present. The first attempt at reduction was unsuccessful; but in the second attempt, when the men were nearly exhausted in their efforts at extension and counter-extension, and while the Doctor was pressing forcibly with both hands upon the two condyles, the bones suddenly came into position, except that the breadth of the knee seemed to be slightly greater than the other, a circumstance which was probably due to the irregularities of the broken surfaces, which prevented perfect coaptation.

Neither splints nor bandages were required to maintain the bones in place; but anticipating the probable occurrence of ankylosis, and with a view to making "the limb as useful as possible in this condition," he was placed upon "a double-inclined plane," which, being supplied with lateral supports, would also prevent any deflection in either direction, in case the limb was disposed to such displacement.

The subsequent treatment consisted in the use of cold water-dressings. Very little inflammation followed. A portion of the integument sloughed, but the bone was not exposed, and it healed rapidly. On the twenty-fourth day Dr. Riggs gave to the joint passive motion, and this was

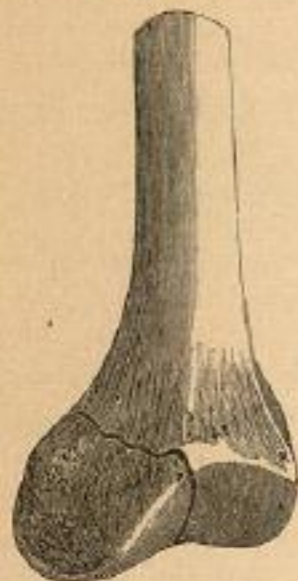
¹ Wells, Amer. Journ. Med. Sci., May, 1832, vol. x. p. 25.

repeated at intervals until, at the end of three months, he was able to walk with a cane. At the end of a year Dr. Riggs examined the leg, and found the knee a very little larger than the other, and he could not flex it quite as completely. In all other respects it was perfect, and the boy himself declared it was as good as the other.

The Dupuytren museum contains a specimen illustrating this fracture, which was presented to the museum by Verneuil, and is referred to by Trélat.¹ The fragment was not displaced.

Treatment of Fractures of either Condyle.—The few cases of these accidents which I have seen reported have been, with one or two excep-

FIG. 205.



Fracture of the internal condyle. (Verneuil's case.)

tions, treated in the straight position. In Kirkbride's case any degree of flexion was painful, although there was little or no displacement of the fragment; and we think we can see, in the relative position of the articular surfaces of the tibia and femur, a sufficient reason why the straight or nearly straight position must generally be preferred. Whichever condyle is broken, the remaining condyle will be sufficient to prevent a dislocation and consequent shortening of the limb, unless, indeed, the dislocation has already occurred as an immediate consequence of the injury. It is very certain that it would not take place from the action of the muscles when the limb was straight. In the flexed position I can conceive that it might take place, but yet not easily. It is not a dislocation of the limb, then, that we seek chiefly to avoid, but a deflection of the leg to the right or to the left, according as one or the other of the condyles has been broken. It will be readily seen that, in order to resist this tendency, nothing but the straight position will answer, and that for this purpose it will be necessary to lay a long splint upon one or both sides of the limb, and to secure the whole length of both thigh and leg to this splint. The long fracture-box used by Kirkbride, if well cushioned on all sides, seems to me at once to answer most completely this important indication, rendering it even unnecessary to employ a bandage, since the opposite sides of the box will compel the limb to adopt the proper position.

As to the remainder of the treatment, it must consist essentially in the employment of such means as are calculated to prevent and allay inflammation.

As soon as the union is consummated the joint surfaces should be submitted cautiously to passive motion, in order to prevent ankylosis; and it would be better to commence this so early as to hazard somewhat a displacement of the fragment, rather than to wait too long. It may not, in some cases, be improper as early as the fourteenth day, and in nearly all cases it should be practised as early as the twenty-eighth. Of course,

¹ Verneuil, Trélat, Arch. Gén. de Méd., 1854, t. 2, p. 78.

the presence of active inflammation in the joint would render motion improper.

(c) *Fractures between the Condyles and across the Base.*

Etiology.—A fracture of this character may be produced by a blow received directly upon any point of the lower extremity of the femur; sometimes the blow has been received upon the patella when the knee was bent, and Bichat mentions a case in which it was produced by a fall upon the feet.

Symptoms.—This fracture is easily distinguished from the preceding by the much greater mobility of the fragments and by the palpable shortening of the limb, since an overlapping of the broken end is here almost inevitable. Each fragment may be felt to move separately, and the motion will be accompanied with crepitus.

Prognosis.—The danger of violent inflammation in the joint is imminent, and ankylosis of the knee is to be anticipated as the most favorable result, since the joint surfaces are likely to be rendered immovable by fibrinous deposits in their immediate vicinity, and also by the adhesion of the muscles to one another and to the bone higher up, at the point where the fracture of the shaft has occurred. More fortunate results than these may, indeed, be hoped for, inasmuch as they have occasionally been noticed, but they cannot fairly be expected.

In a majority of cases such accidents have demanded, either immediately or at a later period, amputation. If recovery takes place, a shortening of the thigh is inevitable. Mr. Canton, of London, has twice performed successfully resection of the joint end of the bone in such accidents.¹

Treatment.—Malgaigne saw a patient who had been treated by Guérbois, with the aid of extension and counter-extension, who was confined to his bed five months, and who had at the end of eight years very little motion in the joint, and he seems disposed to charge in some measure these unfortunate consequences to the position in which the limb was placed, namely, the straight position. But, in my opinion, it is much more reasonable to suppose that, if the treatment was at all responsible for the results, the error consisted in too long and unnecessary confinement, and in too much extension. I suspect that the mere matter of position had nothing to do with the ankylosis. Malgaigne does not, however, himself recommend anything more than a very slight amount of flexion at the knee; and to this practice I am prepared to give my assent; since it will give to the limb a useful position in case ankylosis does occur, and it is not inconsistent with the employment of the moderate amount of extension which alone is justifiable after this accident. If the young surgeon should differ with me in opinion as to the necessity or propriety of using great force to retain the fragments in place and prevent overlapping, I beg him to consider that this fracture probably never happens except from the application of an extraordinary force, and that consequently intense inflammation and swelling are almost

¹ Canton, Lancet, Aug. 28, 1858. Trans. London Path. Soc., 1860.

certain to ensue; and that in some cases, the very fact that immediately after the accident, or for some hours succeeding, no swelling occurs, or muscular contraction, and that replacement of the fragments is easily accomplished, is evidence only of the great severity of the injury, and that the whole system is prostrated by the shock; to which, if the patient does not succumb, sooner or later reaction will ensue, and the fragments will be gradually drawn up with a resistless power. The surgeon ought to remember also that to make extension in this case, he is obliged to pull upon those very ligaments and tendons about the joint which, having been torn or bruised, must soon become exquisitely sensitive.

The long straight box, already recommended when speaking of fracture of one condyle, is equally applicable here; only that it needs a foot-board, or some sort of foot-piece to which an extending apparatus may be secured, and that a pillow should be placed under the knee to give the limb the proper flexion.

Case.—A man was admitted into St. Thomas's Hospital, London, Sept. 17, 1816, with a fracture between the condyles, accompanied also with a fracture through the shaft higher up, occasioned by being caught in the wheels of a carriage while in motion. There was a small wound opposite the point of fracture, and the external condyle was displaced outwards.

The limb was laid in a fracture-box, and in a position of semiflexion.

On the 18th of November, the external condyle, having protruded through the skin, and being dead, was removed with the forceps, bringing with it a portion of the articular surface.

On the 6th of December he was discharged from the hospital, and in February following he was walking without any support, and with the free use of the joint.¹

Case.—A gentleman living about eighty miles from town was thrown from his carriage, breaking the left femur just above the condyles into many fragments, so that when I saw him on the following day the attending physician showed me about four or five inches of the entire thickness of the shaft which he had removed. The external condyle was completely separated from the internal, and was quite movable.

In this case the attempt to save the limb resulted in the loss of the patient's life on the sixth or seventh day.

In a case of this kind, Dr. Morris, of Charlestown, cut the tendo Achillis with an excellent result.²

(d) *Separation of the Lower Epiphysis.*

M. Coural³ relates the case of a boy eleven years old, who, while his leg was buried in a hole up to his knee, fell forwards, separating the lower epiphysis from the shaft, and at the same time driving the shaft behind the condyles into the popliteal space. The epiphysis also became tilted in such a manner that its lower extremity was directed forwards. The limb was amputated.

¹ Sir A. Cooper on Disloc., etc., op. cit., p. 239.

² Morris, Boston Med. and Surg. Journ., Nov. 1877.

³ Coural, Arch. Gén. de Méd., vol. 9, 1825, p. 337.

Madame Lachapelle mentions a case in which traction at the foot of a child in the act of birth, caused at the same time a separation of the lower epiphysis of the femur and the upper epiphysis of the tibia. The child was born dead.¹

Dr. Davis Halderman,² of Columbus, Ohio, Professor of Surgery in the Starling Medical College, reports a case in a boy, 18 years old, caused by a violent blow upon the front and lower part of the thigh. The limb was shortened two inches. It was found impossible to reduce the fracture, even under the influence of ether. Gangrene ensued, and on the fifth day the limb was amputated. On examination it was ascertained that the epiphysis was separated completely, and carried backwards by the action of the popliteus and gastrocnemius; the popliteal artery and vein, and the internal popliteal nerve were displaced forwards, lying between the upper and lower fragments, and were much contused. The epiphysis was lodged above the internal condyle in such a way that it would have been impossible to displace it by traction.

Dr. Little presented to the New York Pathological Society, May 24, 1865, a specimen obtained from his own practice. A boy, æt. 11, while hanging on the back of a wagon, had his right leg caught between the spokes of the wheel which was in rapid motion. A few hours after the accident, Dr. Little found the upper fragment of the femur projecting through an opening in the upper and outer part of the popliteal space. On examination, the wound did not appear to communicate with the knee-joint. Under the influence of an anæsthetic the fragments were reduced; the reduction occasioning a dull cartilaginous crepitus. There was at the time no pulsation in the posterior tibial artery, and the limb was cold. The limb was laid over a double-inclined plane. The following day the upper fragment was again displaced, and it was found that it could only be kept in place by extreme flexion of the leg. This position was therefore adopted and maintained; considerable traumatic fever followed, with swelling, and on the thirteenth day a secondary hæmorrhage occurred from the anterior tibial artery near its origin, and it became necessary to amputate. The boy made a good recovery. The specimen showed that the line of separation had not followed the cartilage throughout, but had at one point traversed the bony structure.

Dr. Voss, at the same meeting, remarked that he had met with the same accident. There was no protrusion of bone, but an abscess formed, and it became necessary to amputate.

Dr. Buck saw a case which occurred in the practice of Dr. Hugh Walsh, of Fordham. The subject was a boy 14 years old, and it happened in the same manner as with Dr. Little's patient.³

Tapret and Chenet⁴ have reported a similar example caused in the same manner, in a boy 9 years old. The integuments were lacerated and there was considerable hæmorrhage. The limb was dressed with plaster of Paris, but after a few days gangrene ensued in the region of the parts wounded, and it became necessary to amputate. On examination

¹ Mad. Lachapelle, Prat. des Accouch., t. 2, p. 225, and t. 3, p. 180.

² Halderman, Med. Rec., July 3, 1882, p. 600.

³ Little, Voss, Buck, N. Y. Journ. Med., Nov. 1865.

⁴ Tapret and Chenet, Bull. Soc. Anat. de Paris, 1875, p. 25.

it was found that the fracture, commencing externally, followed the line of union between the epiphyseal cartilage and the shaft, but toward the inner side it deviated a little, so as to include a small portion of the diaphysis.

The same accident has been frequently caused by attempts to straighten the limb in cases of ankylosis in children. Chauvel¹ saw a case in which, the separation having been produced in this manner, suppuration ensued, and the patient died of pyæmia. Volkmann² says that he has three times detached the epiphysis by rotating the thigh while seeking for crepitus in patients suffering with hip-joint disease, or by the traction made while applying a plaster-of-Paris dressing.

Wm. Smallwood, æt. 12, Aug. 11, 1877, had his right leg caught in the spokes of a wagon-wheel, breaking his thigh at the junction of the lower epiphysis with the diaphysis, the lower end of the upper fragment protruding five inches through the flesh. The end was nearly square. His father, Dr. S. B. Smallwood, of Astoria, N. Y., the lad being under the influence of ether, reduced it within one hour by violent extension and flexion of the leg over his knee, one finger being in the wound, and adjusting the fragments. Lateral splints were employed. The wound closed in about nine months, and in the meanwhile two small fragments of bone escaped. He had also a sharp attack of synovitis.

I examined him April 18, 1880, and found the leg straight, but shortened three-quarters of an inch. There is complete ankylosis of the knee-joint, but the muscles of the leg are well developed, and he walks with very little limp.

§ 7. Non-union and Delayed Union of Fractures of the Shaft of the Femur.

Examples of delayed and of non-union of the shaft of the femur are not very infrequent, yet I must be permitted to say that complete failure to unite by bone has never occurred in my practice when I have had charge of the patient throughout; and I cannot but think that in some of the cases which have come under my notice the mode of treatment was responsible for this unfortunate result. The fragments have not been properly supported, or there has been allowed too much freedom of motion. In other cases, no doubt, the cause of delay was some of those conditions of the patient or of the fracture which have been explained in the general chapter on delayed and non-union.

The treatment of these cases demands a brief consideration, and especially does it seem necessary to call attention to the danger of resorting to some of those surgical expedients which may be employed with much hope of success, and without any danger to the life of the patient in the case of other long bones.

A strong conviction has forced itself upon me that it is never proper, in the case of this bone, to resort to either resection and the wiring of the bones together, or to a seton, or to other means of establishing any considerable continuous or permanent irritation, with the view of exciting

¹ Chauvel, *Dict. Encyc.*, Art. Cuisse, p. 233.

² Volkmann, *Virchow's Jahresb.*, 1866, 2, p. 337.

the tissues to the deposit of bony callus. The femur lies too deeply imbedded in a mass of muscular and tendinous tissue to make it safe or prudent to excite suppurative action in the neighborhood of the bone, even if the drainage were the most perfect; and both of these methods, thoroughly carried out, insure suppuration. To this danger these methods have to add the necessity, during a long period of time, of confining the patient in splints and in bed; while in the case of all the other long bones—even in the case of the leg, but especially of the upper extremities—it is possible to permit the patient to go about, and thus to retain his general health—a condition most essential to the process of repair.

In the very complete and valuable tables constructed by Dr. Frank Muhlenberg, compiled from various medical journals, of ununited fractures—published by Dr. Agnew in his *Principles and Practice of Surgery*—of 155 cases of ununited fracture of the femur there were 92 cures, 3 partial cures, 47 failures, 12 deaths, and 1 of which the result is unknown. Of this number resection was practised in 32 cases; and while 19 were said to have been cured, 8 died.¹ This is certainly an alarming mortality, but the presumption is that the proportion of fatal cases is actually very much larger than these tables would indicate, since fatal cases are much less likely to find their way into the journals than successful cases: and I will add that Dr. Agnew himself, a surgeon of large experience and acute observation, has declared without reserve that both resection and the seton ought to be condemned in the treatment of ununited fracture of the thigh.

It has happened to me to hear of two cases of resection made by excellent surgeons of my acquaintance. In one case the patient died, and in the other, although he escaped death, there was no union of the fragments.

I have never used a seton, nor has any other surgeon within my personal acquaintance, but its dangers are easily understood by the practical surgeon; and one or two cases in which other modes of operating have within my knowledge accidentally resulted in suppuration, will sufficiently illustrate the danger of inducing suppurative action in these tissues.

Within a year one of the surgeons of a New York city hospital, I am informed, in attempting to perforate the fragments with a Brainard's perforator, broke the instrument. Suppuration ensued, and the patient died. For the following fatal result I am myself responsible:

Frank Pavesco, an Italian rag-picker, aged about forty years, was admitted to Bellevue, March 18, 1877, with a fracture of the left femur in the middle third, caused by a fall upon the sidewalk. I found him in my wards nearly six weeks later, when I went on duty. There was at that time no union of the fragments. At the end of eight weeks (May 17) I perforated the fragments, and twisted the limb forcibly, and then secured the leg and thigh in plaster. On the 19th two shawl-pins were introduced to the bone, and left in place twenty-four hours. This was repeated on alternate days; but on the 23d, finding that very little or no

¹ *Principles and Practice of Surgery*, by D. Hayes Agnew, M.D., LL.D., vol. i. p. 806.

inflammatory action had been awakened, I penetrated the fragments with a gimlet, and thus fastened them together, intending to remove it in time to avoid all danger of suppuration. This was not done, the gimlet remaining in place several days, and until pus had formed. A counter-opening was made, and means employed to secure complete drainage. It being apparent that the danger would not now be diminished by removing the gimlet, it was permitted to remain four weeks, during which time it held the fragments firmly together; but my patient gradually sank, and died on the 25th of August.

The strictly surgical expedients which are most likely to prove successful in cases of simply delayed union, and which sometimes have proved successful in cases of non-union, after the lapse of months or years, are violent twisting of the limb and perforation; the perforation being made thoroughly through the ends of the fragments, at several points, and repeated from time to time, while the limb is at rest and inclosed in splints.

In Muhlenberg's table of cases published by Agnew, already referred to, there are 17 cases treated by "manual friction," of which 7 were cured, 10 failed, and none died. Of 18 cases treated by "drilling with its modification," 9 were cured, 8 failed, and 1 died.

In the following case I succeeded by manual frictions, drilling, perforation, and mechanical apparatus combined, or successively employed:

Wm. F. J., æt. 35, of Jetersville, Amelia Co., Va., broke his left thigh a little above its middle, Aug. 9, 1876, by a fall from a ladder. Mr. J. was a lawyer by profession, but accustomed to exercise, and in perfect health. He was treated with a straight splint and perineal band, which latter, he thinks, drew the upper fragment out of line.

About nine months after the accident he came to New York and consulted me. I found the fragments united only by ligament; the femur bent outwards at the point of fracture, and shortened two and a half inches.

May 1, 1877, my patient being anesthetized, I perforated the fragments in various directions with Brainard's instrument, then bent the limb violently, and applied splints. On the 7th I opened and tightened the dressings. The following day I pushed an ordinary shawl-pin down to and between the fragments, leaving it in place twenty-four hours. On the 10th of May I again introduced a shawl-pin and left it in seven days, causing a slight suppuration near the skin. This was repeated on the 23d, and it was allowed to remain again seven days. I think this was repeated once or twice more. July 12th, bored through both fragments with a gimlet, and left it in forty-eight hours. Aug. 7th, I again used the perforator very thoroughly, and left it in forty-eight hours.

Under my instructions, Mr. Stollman then constructed for him an artificial support for his thigh and leg. On the 17th of August the motion between the fragments was so slight that Mr. J. thought bony union had occurred, but it had not; the fibrous union, however, was very close and firm. Having returned to his home in Virginia on the 25th of August, and continuing for some time to wear the apparatus, he wrote me, under date of November 1, 1878, that the fragments were now firmly united by bone—a period of six months since the treatment was com-

menced. Several letters received since inform me that he walks long distances without a cane or other means of support, and that the consolidation is complete.

In another similar case, that of Charles C. Campbell, of Alta, Ill., I have not thus far been equally successful. Campbell, 22 years old, was crushed under a log, and held in this position for some time, Jan. 27, 1879, fracturing the right thigh in the upper part of the lower third. The fracture was treated with Buck's extension, but without the long side-splint to secure quietude of the body. Extension was continued eight weeks, when, as no union had taken place, a starch bandage was applied, and he was permitted to go about on crutches. About the 15th of October the fragments were perforated, and on the 1st of November this was repeated, with twisting of the limb; splints were applied, and he remained in bed ten weeks.

When he consulted me in February, 1880, the limb was shortened two inches and one-quarter, and was not united. On the 15th I placed him under the influence of ether, perforated the fragments very thoroughly in various directions, and then wrenched the limb forcibly. Splints and extension were applied. The perforation was repeated often, as in the case of Mr. Jackson, but, at the end of eight weeks, there was not the slightest attempt at union. A thigh and leg support was made and applied by Messrs. Tiemann and Stollman, and he went home.

After the first operation was made I discovered that his gums were spongy and ulcerated, presenting the appearance usually seen in scorbutus. He informed me that this condition existed before the first fracture occurred.

I have twice seen the same measures fail in the hands of other surgeons.

As to the value of mechanical supports, which permit the patient to go about with or without crutches, there can be no doubt; yet the reported successes of this method are not very numerous, at least in the case of *old* ununited fractures of the femur.

Muhlenberg, in his tables, reports 29 cases treated by mechanical appliances alone, of which 22 were cured, 2 were relieved, 4 failed, and 1 died. Probably some of these were recent cases.

I have mentioned the case of Mr. Jackson, in whom I succeeded by mechanical appliances after operative procedures.

Miles Farr, æt. 45, had his right thigh broken by a direct blow near its middle, Feb. 7, 1866. It was treated in the extended position with Desault's apparatus, and did not unite. Dr. Thaddeus P. Seelye, of Chicago, operated by perforation, Sept. 29, 1867, but with no success. I visited him at his home in St. Lawrence Co., N. Y., Sept. 3, 1868, and repeated the operation by perforation, twisting and friction of the fragments, applying splints, etc. I left the patient in charge of a physician living near, and do not consider myself responsible for the subsequent management. Bony union did not occur, and some time later he came to the city, and Dr. Hudson made for him an artificial support at my request. After several months there was no bony union, and I presume none has occurred since, but I am not able to learn the facts.

O. S. Budlong, æt. 55, of Utica, had a fracture of the left femur four inches above the knee, caused by a direct blow, Nov. 10, 1875. His surgeon is confident the bone was comminuted. Splints were applied after extension had been made under ether.

I found the limb, Sept. 18, 1876, shortened two and a half inches, and not united. At my request, an artificial support was applied by Dr. Hudson, and he returned home. A letter received Oct. 3, 1877, says "the bone has not united, but the apparatus has been of the greatest comfort to him, as it enables him to walk." May 15, 1878, it had not yet united.

CHAPTER XXX.

FRACTURES OF THE PATELLA.

IN 1880, I made a careful study of 127 cases of fracture of the patella. Of these, 71 were either treated by me, or they were seen by me in consultation in the course of the treatment, or came subsequently under my notice. Of nearly all of these I made careful notes at the time. The remainder of the 127 cases (56) are copied from the Bellevue Hospital records, including all that had been recorded up to the date of the completion of the study; excluding only those which had been treated by myself, and were included, therefore, in the class of cases first mentioned. The cases, reported at length, as copied from the records, have been published, with the conclusions drawn from them, and are now embodied in a single volume for the instruction of the profession.¹

In this chapter I shall make free use of the observations and statements contained in that volume, without, however, attempting to describe in detail the cases, but presenting here only a summary of them.

Total number of cases.—127.

Sex.—Males, 99; females, 28.

Age.—Ten years and under, one case. This is the case (52) of a lad five years old, in whom, from a direct blow, a small piece of the margin of the patella was broken off.

From ten years, including twenty, six cases; of which 1 (113) was 16 years old—a boy—the fracture being oblique and caused by a direct blow; 1 (case 19) was 19 years old—the fracture was transverse, and was caused apparently by a direct blow. In this case the ligament subsequently gave way completely on the outside, and a new patella formed in the very much elongated ligament on the inner side. The remaining four cases were at the age of 20 years: all were transverse; two are known to have been caused by muscular action—one by direct force, and in one the cause is not stated.

Before the twentieth year of life, then, there were only three fractures, and these were all supposed to be caused by direct blows. Up to this

¹ Fracture of the Patella. A Study of 127 Cases, by Frank H. Hamilton, M.D. New York, Chas. L. Birmingham & Co., Med. Publishers, 1880.

period, muscular action seems to take little or no part in the production of these fractures.

From twenty years, including thirty, 48 cases. From thirty years, including forty, 33 cases. From forty years, including fifty, 22 cases. From fifty years, including sixty, 8 cases. From sixty years, including seventy, 4 cases. From seventy years, including eighty, 1 case. In this one case, the patient, a woman, was 80 years old.

In all the six cases included in the last two decades—that is, from sixty years, including eighty, four are known to have been caused by direct blows, and the remaining case, Bridget Callaghan, 80 years old, fell fifteen feet, and it is fair to presume that the fracture was caused by a direct blow.

It would seem, then, that after the sixtieth year, muscular action alone seldom causes these fractures, the largest number of cases having occurred between the twentieth and fortieth years of life; the total in these periods being 103, out of 122 whose ages are known, or, if we include the three at the twentieth year, 106 out of 122 cases.

Right or Left Limb.—Of 134 in which this fact is recorded, ninety-three were in the left limb, and forty-one in the right.

Character of the Fracture.—Of the whole number, all were simple, except eleven; and of these, nine were comminuted, and two were both compound and comminuted. Of the comminuted fractures, cases 61 and 94 were accompanied with fractures of the thigh also—one died of shock on the fourth day, and one died after amputation, rendered necessary by gangrene.

Direction of the Fracture.—The fractures were transverse in 106 cases—not including two which were transverse and vertical (comminuted)—of these 106 cases, twenty-two are recorded as below the middle of the patella, sixteen at the middle, and seven above the middle.

Cause of the Fracture.—Twenty-five are known to have been the result of muscular force alone; and fifty-eight are recorded as having received blows upon, or as having fallen upon the patella, and have been placed in the list of those caused by direct blows. In forty-three cases nothing is said as to the cause.

Of the transverse fractures, it will be noticed that a majority of those occurring below the middle are ascribed to muscular action—that is, twelve out of twenty in which the cause is given. Of four oblique fractures, three are known to have been from direct force; and all of the comminuted fractures, except case 127, were from direct blows, as were also the two compound fractures.

Active Synovitis and Bursitis.—I infer that active synovitis ensued in at least thirty-four cases, and probably in many others. Inflammation of the bursa of the patella is mentioned once. Probably in most cases the bursa is torn open as the patella ascends, and communicates freely with the joint, so that bursitis could not be recognized as a distinct phenomenon.

Blood in the Joint, etc.—In case 90, a compound fracture, the presence of blood in the joint was actually demonstrated. Probably it was present in many other cases, but the fact could not be proven. Pretty