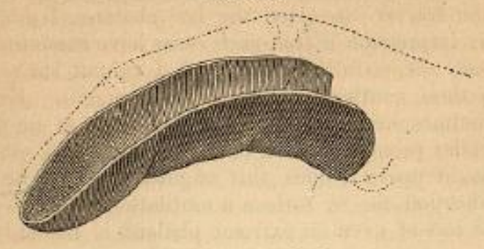
slightly every third or fourth day, until consolidation is nearly or quite completed.

If the fracture is near or extends into a joint, the finger ought to be a little flexed, so as to place it in the most useful position in the event that anchylosis should occur; and as early as the end of the second week the joint surfaces should be slightly moved upon each other, in order to the prevention of fibrous or bony adhesions. Nor is there

Fig. 123.



Gutta-percha splint for finger.

much danger of preventing the union of the bone by moving the joints at this early day. Union occurs between these fragments very speedily, and I have never met with a case of non-union of the phalanges, nor do I remember to have seen a case reported.

It is the lateral inclination of the distal end of the finger which, according to my experience, it will be found most difficult to obviate, and which may, perhaps, in some cases be most successfully combated by laying the two adjoining sound fingers against the broken finger, and then applying a moulded splint to the palmar surface of the whole. In other cases it will be more convenient to apply the splint only to the broken finger.

Rotation of the lower fragment on its own axis is especially to be guarded against, as the deformity which it occasions is more unseemly, and the impairment of utility more decided, than that occasioned by a lateral deviation.

It may be well also to remind the surgeon of the convenience of extending the splint beyond the end of the last phalanx, and moulding it to this extremity, in order that the finger may be protected against injuries, and that when, from time to time, the splint is removed it may be reapplied with accuracy.

In all cases the splint should be lined with cotton cloth, soft flannel, or sheet tint, and secured in place with narrow and neatly cut cotton rollers. Bandages of this width should never be torn, but carefully cut with scissors.

CHAPTER XXVIII.

FRACTURES OF THE PELVIS, AND TRAUMATIC SEPARATIONS OF ITS SYMPHYSES.

Development of the Os Innominatum.—This bone is formed from eight centres, three of which are called primary, and five secondary. The three primary centres belong respectively to the ilium, ischium, and pubes, and by their extension form eventually the greater portion of the innominatum. They have a common point of union in the acetabulum; and the ischium unites with the pubes, also, by the junction of their rami. These conjunctions occur usually between the fifteenth and twentieth years of life. The secondary centres do not begin to ossify until the age of puberty, and may therefore properly be considered as epiphyses. One forms the crest of the ilium; one its anterior inferior spinous process; one forms the symphysis pubis; one the tuberosity of the ischium; while the fifth constitutes the centre of the bottom of the acetabulum. The epiphyses become joined to the primary bones, or the bodies of the innominata, at about the twenty-fifth year.

§ 1. Pubes.

(a) *Separations at the Symphysis Pubis.*

Lente, in his reports from the New York Hospital, mentions the case of a young man, æt. 18, who was crushed between a couple of cars, in consequence of which he died two days after. The autopsy disclosed a separation of the symphysis pubis, unaccompanied with any other fracture. The right side was displaced backwards about half an inch, so that the fingers could be passed between the bones. There was also a wound in the top of the bladder large enough to admit the thumb.[1] Similar accidents have been several times met with by surgeons. Hall reports a case in the *Provincial Medical and Surgical Journal*, May 1, 1844, in which the pubes, thus separated, was actually thrust into the bladder; but in this example the ilium was broken also. I need scarcely add that this patient died;[2] but Sir Astley Cooper has furnished us with an example of a simple fracture or traumatic separation at the symphysis, from which the patient after a long time almost completely recovered. The following is Sir Astley's account of the case:

"Case 79. Richard White, æt. 22, was admitted into Guy's Hospital on the 30th of July, 1832, having sustained a severe injury in consequence of a large quantity of gravel having fallen upon his back while in the act of stooping. It knocked him down; and on rising, which he did with considerable difficulty, he attempted to walk; this produced violent pain in the region of the bladder, extending upwards in the course of the ureters to the kidneys. Upon inquiry, he stated that

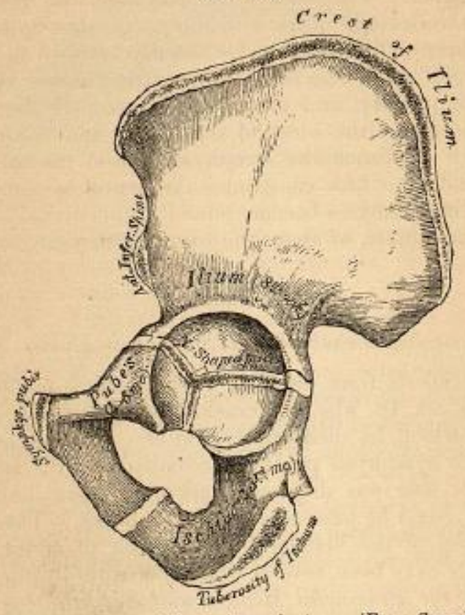
[1] Lente, New York Journ. Med., 2d ser., vol. iv. p. 286.
[2] Hall, Amer. Journ. Med. Sci., vol. xxxiv. p. 248.

the urine he had voided since the accident was bloody and passed with difficulty.

"On examination, a fissure was found at the symphysis pubis, producing a separation of about two fingers' breadth. On pressure being made upon any part of the ilium, he complained of increased pain in the region of the pubes, and of numbness down the left thigh.

"A catheter was immediately passed, and the urine which was drawn off was clear and healthy. Leeches were applied over the pubes, and a broad belt was firmly buckled around the pelvis sufficiently tight to bring the separated pubes nearly in contact, and the patient ordered to be kept perfectly quiet in the recumbent posture, on low diet. The

FIG. 124.



Development of the os innominatum. (From Gray.)

leech-bites ulcerated, and some slight degree of fever resulted, which, however, readily yielded to the usual treatment.

"He remained in the hospital for three months without any check to the progress of his cure; the length of time it required being accounted for by the difficulty of reparation in the amphiarthrodial articulation; and when he left there was some slight separation of the pubes remaining; nor were the two lower extremities, or the anterior and superior spinous processes of the ilia, perfectly symmetrical, although he could walk very well."[1]

Malgaigne has collected four cases of simple separation at the symphysis pubis occasioned by external violence, and in three of the four

[1] Sir Astley Cooper, Frac. and Disloc., Amer. ed., p. 144.

cases it was occasioned by pressing out the thighs with great force; the separation being directly due, therefore, to muscular action.

Two of these patients succumbed to the accidents. The same author has brought together, also, seventeen cases of separations of this symphysis occurring in childbirth, of which only seven survived.

(b) *True Fractures of the Pubes.*

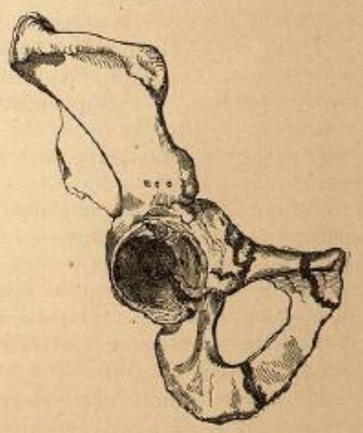
It is much more common, however, to find the pubes broken through its horizontal or ascending ramus; and Clark, of the Massachusetts General Hospital, has described a case of simultaneous fracture of the pubes and ischium in three places. The man, æt. 29, had been caught between two heavy timbers, and on the following day, May 7, 1852, he was brought to the hospital.

No crepitus could be detected, but he was unable to lie upon the right side, and the right limb was nearly paralyzed. It was evident that the bladder or urethra had been ruptured, and on the third day Dr. Clark opened the bladder through the perineum, evacuating a large amount of blood and urine, and affording to the patient very sensible relief. On the first of June, however, he died, having survived the accident twenty-five days.

The autopsy disclosed several fractures, all of which belonged to the right os innominatum. First, a fracture of the pubes near the symphysis; second, a fracture near the junction of the pubes and ilium; third, a fracture through the ramus of the ischium anterior to the tuberosity.[1]

Sir Astley mentions a case (Case 83) of fracture of the "ramus of the pubes," unaccompanied with injury to the bladder or urethra, which resulted in a complete recovery; and in another case (Case 84) the patient recovered in eight weeks, and was able to walk nearly as well as before; but he soon after died of disease of the chest. The os pubis was found, at the autopsy, to have been broken in three places; there was also a fracture extending in two directions through the acetabulum, with an extensive comminuted fracture of the ilium, accompanied with great displacement.

FIG. 125.



Clark's case of fracture of the pelvis.

Marat has even found it necessary, after a fracture, to remove nearly the whole of the body of the pubes by incision, in a girl of 18 years, and who not only recovered completely, but, having subsequently married, she gave birth to two children in easy and natural labors.[2]

[1] Clark, Boston Med. and Surg. Journ., vol. liii. p. 185.
[2] Marat, from Malgaigne, op. cit., p. 646.

Cappelletti relates that a man, æt. 54, jumped from a carriage, the horses having run away, and alighted with his feet to the ground, but with one limb in the greatest possible degree of abduction. A surgeon, who saw him immediately, found an enormous swelling at the superior part of the thigh, accompanied with very acute pain. When seen by Cappelletti, at Trieste, six months after, there still remained a slight swelling near the ramus of the ischium and pubes, under which a careful examination detected a fragment of bone two and a half inches long and of the "size of the finger." The patient was able to walk, but not without pain and limping. Cappelletti soon began to suspect that this fragment of bone consisted of a part of the ramus of the ischium and pubes detached by muscular contraction. On examining it anteriorly, he found this part of the pelvis defective, and the loose portion of the bone had all of the anatomical characters of the defective part. He felt distinctly the circular projection indicating the point where the ascending branch of the ischium unites with the descending branch of the pubes.[1]

Whitaker, of Lewistown, N. Y., saw the body of the left os pubis broken in a female while in the seventh month of pregnancy. She had fallen down a flight of stairs, striking astride the edge of an open, upright barrel. The fracture was oblique, and with but little displacement; yet she complained of excruciating pain in the left pubic region on the least motion. The accident was followed by no positive attempt at miscarriage.[2]

Prognosis.—The danger in these accidents consists not so much in the fracture, as in the injury done to the bladder and other pelvic viscera. If the bladder is opened into the peritoneal cavity, death is almost inevitable; and even when the bladder or urethra has suffered laceration lower down or at any point above the deep perineal fascia, extensive urinary infiltrations, followed by abscesses and gangrene, generally expose these patients to the most imminent hazards.

Treatment.—The practice pursued at Guy's Hospital, in the case of separation at the symphysis pubis, commends itself both by its simplicity and by its success. Antiphlogistic remedies steadily pursued, rest in the recumbent posture, the use of the catheter when necessary, and in certain cases the girding the pelvis with a firm belt or band, are measures which seem to meet all of the important indications.

If the fracture is accompanied with displacement, it will be proper to attempt to restore the fragments; but, except in the case of separation at the symphysis, very little aid can be expected from a band or any similar means in retaining them in place. It will be sufficient, generally, in such examples to place the patient quietly upon his back, with his thighs flexed upon his body, and to treat the accident in all other respects as a case of inflammation.

If the urine has become extravasated underneath the pelvic fascia, no time ought to be lost in opening freely through the perineum, and in extending the incision, if necessary, into the urethra and bladder.

[1] Cappelletti, Ranking's Abstract, No. viii. p. 83; from Giornale per servire al Progressi della Patologie della Terrapeutica, 1847.
[2] Whitaker, Amer. Journ. Med. Sci., July, 1857, p. 283.

§ 2. Ischium.

When speaking of fractures of the pubes, I have already mentioned some examples of fractures of the ischium also; indeed, it is seldom that one of the bones of the innominatum is broken without a coincident fracture of one or both of the others. The records of surgery furnish several other examples, produced generally by a fall upon the tuberosities; but, perhaps, the most remarkable instance is that mentioned by Marat as having occurred in a female during labor.

The following summary of a case of fracture of the ischium, reported by Sir Astley Cooper, will serve to illustrate one of the most fortunate terminations of these accidents when accompanied with a rupture of the urethra:

A young man who was driving a cart was thrown down, and a wheel passed over him. On the following morning he was found to have a fracture of the left leg and a contusion of the inner side of the left thigh. There was also great swelling and ecchymosis of the scrotum, with a slight appearance of injury over the pubes and left hypochondrium. No fracture of the pelvis was at that time discovered. The patient was suffering great pain, and was cold and exhausted. Bloody urine escaped from the bladder. On the eighth day an abscess had pointed on the left side of the perineum, which, being opened, discharged a large quantity of pus having the odor of urine; extensive sloughing occurred, and the patient sank very low. On introducing the finger into the wound, the ascending ramus of the ischium could be distinctly felt, and the fracture traced in an oblique course, the upper fragment being slightly displaced forwards. When the catheter was introduced into the urethra it was found to enter this wound, and could be felt resting against the naked bone. From this time until the twenty-sixth day, the urine continued to escape freely through the wound. In about six weeks more the fistulous opening had entirely closed, and after several months his recovery was complete.[1]

Symptoms.—The signs of this accident are generally even more obscure than those of fractures of the pubes, but in a case of doubt the bones ought not only to be carefully examined from without, but the finger should be introduced freely into the rectum and the anterior surface explored; or the tuber ischii may be grasped between the thumb and finger and moved laterally in order to determine the existence of motion or crepitus. If the patient is a female, this exploration can be best made through the vagina. By flexing and extending the thigh, also, crepitus may sometimes be discovered. The examination will generally be made while the patient lies upon his back; but if turning is not found too painful, it will be well to lay him upon his face, that the tuberosities of the ischium may be more plainly brought into view.

Prognosis.—A considerable proportion of the fractures of both the pubes and the ischium are accompanied with lesions of the bladder or of the urethra, either of which circumstances will render the prognosis very

[1] Sir A. Cooper, by Bransby Cooper, Amer. ed., p. 140.

unfavorable; but in simple fractures recoveries may generally be expected, yet only after a tedious confinement.

Treatment.—It is not usual, except in cases which must almost necessarily prove fatal, to find much displacement of the fragments; nor is it probable that by any manœuvres the slight displacements which are found to exist can be entirely overcome. Instances may occur, however, in which careful pressure from without, or the introduction of a finger into the rectum or vagina, may aid in the restoration.

The posture best suited to these cases will be indicated usually by the sensations of the patient himself. Ordinarily he will prefer to lie upon his back with his thighs flexed and supported by pillows; and his hips slightly elevated by a firm cushion laid under the upper part of the sacrum. His knees ought also to be gently bound together; but if the patient finds this position painful or excessively irksome, as sometimes he will, he may be permitted to occupy any position which he finds most comfortable.

§ 3. Ilium.

Fractures of the ilium are much more common than fractures of either the ischium or pubes, and they assume a great variety of forms, directions, and degrees of complication.

In the two following examples the anterior superior spinous process alone was broken off:

John Kelly, æt. 36, was admitted to the Hospital of the Sisters of Charity, Dec. 28, 1852, having just fallen and broken the anterior superior spinous process of the ilium. The fragment was displaced downwards about one-quarter of an inch. Motion and crepitus distinct. A slight ecchymosis existed over the point of fracture, and other signs of contusion about the hip were present. He was intoxicated at the time of the accident, and could not tell how or where he fell.

He was laid upon his back in bed, with his thighs flexed upon his body; and in this position we attempted to reduce the fragment and retain it in place with a bandage; but finding this impossible, we left him with only instructions to remain quietly in bed. In about two weeks the fragment was firmly fixed in its new position, and he was allowed to get up and walk about, which he was able to do without inconvenience.

July 13, 1853, Matthias Morrison was caught under a bank of falling earth, and on the following day Dr. Mixer, his attending surgeon, requested me to see the case with him. He was unable to stand upon his feet. There was a lacerated wound and an extensive bruise on his left hip; but the thigh was not shortened nor everted, and he could flex it slightly upon his body. Noticing a swelling and discoloration in the region of the anterior superior spinous process of the ilium, I pressed upon it and felt it recede with a distinct crepitus; the fragment, however, immediately resumed its place when the pressure was removed. I was able, also, by a careful manipulation, to trace the line of fracture, and to determine that it included a small portion of the anterior extremity and wing of the pelvis.

We directed the patient to remain quietly upon his bed, with his legs

drawn up. He soon recovered, but I am unable to say what is the present position of the fragment.

In the case of Mooney, æt. 60, admitted to Bellevue, September 10, 1871, the fragment was displaced downwards one inch, and could not, by flexion of the limb, be replaced. It was not united at the end of three weeks. The ability to move his limb was unimpaired.

More frequently, however, the fracture involves a still larger portion of the crest, as in the following examples:

Joseph Joquoy, æt. 40, was caught by the bumpers between two cars, February 10, 1854, breaking obliquely the anterior superior portion of the ilium. I saw him within an hour, and found him greatly prostrated; the fragment of the pelvis broken off was quite movable, and crepitus was easily detected. His abdomen was very tender and slightly bloated.

He was laid upon his back with his legs drawn up, and hot fomentations of hops and vinegar were directed to be applied to his belly. He also took one grain of morphine. The broken ala did not seem disposed to become displaced. With no other treatment, his recovery was rapid; and the bones seemed to have united without displacement.

James Roche, æt. 41, fell March 7, 1854, from a height of fourteen feet, breaking off the anterior superior portion of the right ala of the pelvis. On the following day I found him at the Hospital of the Sisters of Charity. The fragment, which was quite large, was movable, and occasionally a crepitus could be detected. It was displaced downwards and forwards about three-quarters of an inch.

He was laid upon his back, with his thighs and limbs moderately flexed. At the end of two weeks he found himself able to walk without much difficulty, and he immediately left the hospital. At this time the fragment was displaced in the same manner and direction as at first, but I cannot say whether it had united or not.

I have three other similar cases upon my records; but in the last example, the sixth, which has been especially recorded, the fracture was caused by the muscular action. William Alexander, æt. 70, on the 5th of September, 1869, after riding in a railroad car about half an hour, arose to leave his seat, when he felt "something wrong" in his right groin, and found himself unable to walk without great pain. He was admitted to Bellevue Hospital on the same day, and I found a fracture involving about three inches of the ilium, including the anterior superior spinous process. It was inclined to fall outwards, but was easily replaced with a distinct crepitus.

I have once seen a fracture of the posterior superior spinous process, and I do not know of any other example.

Miss B., æt. 19, was thrown from her horse backwards, striking with her back upon the ground. She was first attended by Dr. Conn, of Ovid, N. Y., and she did not come under my care until two weeks after the accident.

I found a small fragment broken from the posterior superior spinous process of the ilium, and displaced backwards in the direction of the spine about half an inch. It was movable, and by pressure it could be partially restored to place, but it would immediately return to its abnor-

mal position when the pressure was removed. The injured hip was painful, and occasionally it felt numb. She had previously suffered from spinal irritation.

I laid a compress behind the fragment, and secured it in place with a roller, enjoining perfect rest. She recovered from her lameness in a few weeks, but I believe the fragment remains displaced

Prognosis.—Extensive comminuted fractures of the ilium are generally accompanied with so much injury of the pelvic viscera as to prove rapidly fatal; but the following example will show that this rule admits of exceptions:

June 5, 1854, Bernard Duffie, æt. 32, was crushed under a very heavy stone which fell upon his back. I found the left ala of the pelvis broken into several fragments, between the different portions of which motion and crepitus were distinct. The fractures were near the superior part of the bone, commencing about two inches back of the anterior superior spinous process, and extending backwards irregularly. There was a narrow wound communicating with the fracture, from which I removed a loose fragment of bone. The right leg was also broken.

Four months after, he was still confined to his bed, and a fistulous opening continued opposite the point of fracture; there existed also a large and irregular mass of ossific matter or callus around the fragments. He soon after left the hospital.

Dr. Sargent, of the Massachusetts General Hospital, has reported a case in which a man received a compound fracture of the left ilium, and several small fragments were removed. He was discharged at the end of three months with a fistulous opening still remaining, but in other respects he was quite well.[1] Dr. Cheever, of the same hospital, reports a case of fracture of the ilium, with fracture of the ascending ramus of the pubes, resulting in complete recovery; but the leg became shortened and the toes inverted. Dr. Cheever believes that the lines of fracture met in the acetabulum.[2]

The following case illustrates the more fatal injuries of this character:

John O'Keaf was crushed under a heavy stone, Oct. 23, 1851, breaking and comminuting the alæ of the pelvis on both sides, and wounding also the iliac vein. He was taken to the Hospital of the Sisters of Charity, and died in a few hours, partly from the shock to his system, and partly from the hæmorrhage.

Lucas[3] has also recorded two cases of lesion of this vein due to the same cause.

Lente, of the New York Hospital, has reported a case of dislocation of the hip, which was accompanied with a fracture also of the ala of the pelvis upon the same side. The dislocation was reduced on the third day, and the patient soon after died. The autopsy disclosed what had not been suspected during life, namely, that the left ilium was broken horizontally about through its middle, and vertically through the crest;

[1] Sargent, Boston Med. and Surg. Journ., vol. liii. p. 121.
[2] Cheever, Boston Med. and Surg. Journ., May 3, 1866.
[3] Lucas, The Lancet, 1878, vol. i. p. 147.

and also that there was a fracture extending through the sacro-iliac synchondrosis, accompanied with considerable comminution of the articular surfaces. It was found that a portion of the small intestine was ruptured, and probably by one of the sharp fragments of the broken pelvis.[1]

It is seldom, I think, that the fragments become much displaced; such, at least, has been my experience; and I have noticed in Dr. Neill's cabinet three specimens of fracture of the crest of the ilium, all of which had united without any appreciable displacement. Dr. Neill also called my attention to the fact that in two of these specimens the ensheathing callus was confined to the outer surface of the bone; an observation which, this gentleman assures me, he has had frequent occasion to make before where the fracture belonged to a flat bone.

If any displacement exists, the upper or loose fragment is generally carried slightly inwards; occasionally, however, it is found displaced upwards, outwards, or downwards.

Treatment.—In a large majority of cases the fragments, if displaced, cannot be completely replaced. Occasionally, however, as where the anterior superior spinous process is broken off with only a small portion of the crest, the fragment may be seized with the fingers and carried outwards or upwards, or in whatever direction may be necessary; but to retain it in this position is generally quite impossible. The bandage or broad belt which we have recommended in certain fractures of the pubes would be in these cases not only useless, but absolutely mischievous, since its effect must be to press inwards the fragments, and thus to create a displacement which might not otherwise exist.

The surgeon ought to determine by a careful examination the extent and direction of the fracture, and, having done what was in his power to replace the fragments, he should lay his patient upon his back with the thighs drawn up and supported. This is the position which will generally be found most comfortable; but, as in other fractures of the pelvis, it may be well always to try the effect of other positions, and especially to determine their influence upon the fragments, and finally to adopt that precise posture which accomplishes the indications best.

If the fracture is compound, and the fragments have penetrated the belly, the wound should be enlarged, and, as far as possible, every piece of bone should be removed; but if the fragments cannot be found, the external opening should be allowed to remain so as to favor their escape when suppuration shall have taken place.

§ 4. Acetabulum.

Although, strictly speaking, fractures of the acetabulum belong always to one or all of those bones of the pelvis whose lesions have already been described, yet the peculiar relations of this cavity to the femur render it necessary that they should be considered as a separate class of accidents.

[1] Lente, New York Journ. of Med., Jan. 1851, p. 29.

Fractures of the acetabulum divide themselves naturally into two varieties:

First. Fractures of the base of the cavity, with or without displacement.

Second. Fractures of the rim, with or without displacement.

(a) *Fractures of the Base.*

Without Displacement.—In fractures of the base of the cavity, not accompanied with displacement, nothing but crepitus can be present as a sign of the accident; and this will scarcely be sufficient, in itself, to enable the surgeon to distinguish it from a fracture of the neck of the femur within the capsule without displacement.

It is probable, therefore, that its existence will only be determined by dissection. Nor is it of much importance that the diagnosis should be made out; since in either case neither splints nor any other surgical appliances could be of service. An injury so severe as to fracture the acetabulum will necessarily so much bruise the body, and concuss the viscera of the pelvis, as to compel the patient to remain quiet for a number of days, and this is all that would be thought necessary if the nature of the accident was exactly determined.

Dr. Neill's cabinet contains a specimen of this kind, in which the fracture, commencing near the centre, extends in three directions across the cotyloid margins, in which perfect bony union has occurred without displacement.

M. Bouvier related to the Academy the case of a man, æt. 71, who, in consequence of a fall from his bed, remained for three weeks unable to walk, and never was able afterwards to walk without crutches. No fracture could be discovered during life, but after his death, which occurred some months subsequent to the accident, a fracture was found extending from the ilio-pectineal eminence to the spine of the ischium, and traversing the centre of the acetabulum. The fragments were not displaced, but remained slightly movable.[1]

With Displacement.—Fractures of the base of the acetabulum, with displacement of the femur into the pelvic cavity, constitute a much more formidable, and unfortunately a more common form of accident.

Like the preceding variety of acetabular fractures, they are produced generally by falls upon the trochanter major, but the force of the concussion has been greater.

Even here, it is not often that the diagnosis has been clearly made out during life; and indeed, generally, the true character of the accident has not even been suspected, the surgeons believing that they had to do with a fracture of the neck of the femur, or with a dislocation. In two examples (Cases 71 and 72) mentioned by Sir Astley Cooper as having been presented at St. Thomas's Hospital, the thigh was thought to be dislocated backwards.

The following case was reported by Mr. Earle, to the London Medico-Chirurgical Society, and will be found in the nineteenth volume of its

[1] Bouvier, Amer. Journ. Med. Sci., vol. xxiii. p. 486; from Bullét. de l'Acad. Roy. de Med., August 15, 1838.

Transactions. It is also referred to by Sir Astley, in his treatise on Fractures and Dislocations:

In the month of October, 1829, a man, æt. 40, was admitted into St. Bartholomew's Hospital, with a severe injury, caused by having fallen from a height of thirty-one feet, and striking upon the left side. The left leg was powerless and shortened. The foot was everted. Any attempt to rotate the limb caused great pain, and was accompanied with a sensible crepitus. The left trochanter was very much depressed, and when it was pressed upon, the patient complained of deep-seated pain in the hip-joint.

He recovered in eight weeks, and was able to walk nearly as well as before: but he soon after died of disease in the chest.

On dissection, a fracture was found extending in two directions through the acetabulum; there was an extensive comminuted fracture of the ilium, with great displacement, and the os pubis was broken in three places.

The repair was very complete, and Mr. Earle remarked how nature had guarded against any considerable deposit of new bone within the articulation, which might have interfered with the functions of the joint, while there was an abundant deposit of callus around the other parts of the fractured bone.

Mr. Travers has reported two similar cases, and in the paper accompanying the report he maintains that very acute pain caused by pressing upon the projecting spine of the os pubis, and the inability of the patient to maintain the erect posture, may be regarded as signs diagnostic of the accident.[1] It is doubtful, however, whether these phenomena, so common to many other accidents, could be relied upon as evidence of this peculiar lesion.

In the following example reported by Lendrick, of Dublin, the patient was supposed to have a fracture of the neck of the femur:

An old man, well known as the "Wandering Piper," was admitted into the Mercer Hospital in January, 1839, suffering from phthisis pulmonalis and acute inflammation of the hip-joint. Some years before, he had received a severe injury by the upsetting of a coach, and was under treatment several months for what was supposed to be a fracture of the neck of the femur. Since that time he had been lame, but still able to take a great deal of exercise on foot both in Great Britain and in America. The acute disease of the joint commenced about two months before his admission, and he was at first under the care of Sir Philip Crampton, who remarked that the thigh was only shortened about half an inch, and expressed his surprise at this fact.

This man died on the 17th of February, and the dissection showed that there had been no fracture of the femur, but its head and neck were affected with "morbus coxæ senilis." The head was also thrust through a rent in the acetabulum into the cavity of the pelvis; but the head had again been covered by a bony case, complete, except in a small portion about the size of a shilling piece, and at this point the covering was ligamentous.

[1] Travers, Holmes's System of Surgery, vol. ii. p. 478.

The os pubis had also been broken at the same time, and it had united so much overlapped that the space between the inferior anterior spinous process and the symphysis pubis was shortened nearly an inch. A portion of intestine was found protruding through an opening in the pelvis and adherent to the bone, in which situation it seemed to have been caught by the broken fragments and retained.'[1]

Morel-Lavallée, in his thesis upon complicated luxations, mentions a case which had come under his observation, and which had been treated as a fracture of the neck of the femur. The patient survived the accident many years; during a part of which time he suffered such pain in the hip-joint as to induce a belief that it was itself diseased. At his death he was found to have had a multiple fracture of the bones of the pelvis, and the head of the femur had penetrated more than an inch into the cavity of the pelvis, pressing upon the obturator nerve to such a degree as to have, no doubt, caused the severe pain from which he had suffered, and which had been ascribed to coxalgia.[2]

Symptoms.—In the two cases mentioned by Sir Astley Cooper as having been received into St. Thomas's Hospital, the toes were turned in. In the example mentioned by the same author as having been presented at St. Bartholomew's Hospital, the toes were everted; the two persons seen by Lendrick and Morel-Lavallée were supposed before death to have had a fracture of the neck; it is probable, therefore, that in both of these cases the toes were also everted; while Moore has dissected a subject whose pelvis was broken into many fragments—the left os innominatum was divided into three portions, corresponding to the three bones of which it was composed in infancy; the head of the femur had completely penetrated the basin; the limb was shortened two inches, and in a position of slight flexion and adduction, but neither rotated outwards nor inwards.[3]

There seems, therefore, to be no certain rule in relation to the position of the limb; but it is found to take the one position or the other, probably according to the direction of the force which has inflicted the injury, and perhaps in obedience to circumstances not always easily explained.

The shortening has been observed to vary from half an inch to two inches or more; the trochanter is also usually driven in toward the pelvis. Pressure upon the trochanter occasions a deep-seated pain. If the limb is drawn down to the same length with the other, it immediately resumes its position when the extension is discontinued. Crepitus is more uniformly present than in fractures of the neck of the femur, and it is especially felt while the limb is being extended or while it is again shortening, and not so much in flexion or rotation.

If, in addition to all of these phenomena, we learn that the accident has occurred from a severe blow, or a fall from a great height upon the trochanter; and that the viscera of the pelvis, and especially the bladder, seem to have suffered considerable injury; or if we detect at the same

[1] Lendrick, Amer. Journ. Med. Sci., vol. xxiv. p. 481; August, 1839; from London Med. Gazette, March, 1839.
[2] Morel-Lavellée, from Malgaigne, op. cit., vol. ii. p. 881.
[3] Moore, Med.-Chir. Trans., vol. xxxiv. p. 107, 1851.

time a fracture of some other portion of the pelvis—we may reasonably conclude that the head of the femur has penetrated the acetabulum. Yet it must be confessed that no one of these symptoms is positively distinctive of this accident, and that they are seldom found sufficiently grouped to render the diagnosis certain. Possibly the displacement may be detected by the finger introduced into the rectum or vagina.

The old "piper" mentioned by Lendrick, and the man dissected by Morel-Lavallée, lived many years, and managed to walk about, but not without considerable pain; the other three, to whom I have alluded, died soon after the injuries were received.

Treatment.—Some have thought of treating these cases by extension and counter-extension; the latter being accomplished through the aid of a perineal band; but it is not probable that after an injury of this character, any patient will be able to endure the requisite pressure about the perineum or groins. It will be better to lay the patient upon Daniel's invalid bed, or some bed similarly constructed, so that it may be converted into a doubled-inclined plane; allowing the knees to be suspended over the angle thus formed, in order that the weight of the body may have some effect to draw away the pelvis from the femur. Or we may adopt extension without the perineal band, as will be described hereafter when treating of fractures of the femur; or we may resort to Hodgen's suspension apparatus.

(b) *Fractures of the Rim.*

Fractures of the rim of the acetabulum have frequently been discovered in dissections; and the records of surgery abound with cases of unreduced dislocations of the femur, in which the failure to reduce or to retain the bone in place has been ascribed, not always with sufficient reason, perhaps, to this fracture.

Dr. McTyer, of the Glasgow Royal Infirmary, published, in the *Glasgow Medical Journal* for February, 1830, four cases of this fracture.

The first was that of a man, æt. 27, on whose back a number of bricks had fallen while he had his right knee placed on the bank of a trench. His right leg was found shortened about one inch and a half, bent, and the toes turned a little outwards. The limb could be moved without much difficulty, but every motion gave him pain; motion was also attended with crepitus. On making extension, the limb was easily brought to the same length with the other, but it became shortened again immediately when the extension was discontinued.

The symptoms, differing but little, if at all, from those which are usually present in a case of fracture of the neck of the femur, led to the supposition that this was actually the nature of the accident. Subsequently, the toes became slightly turned in, but this circumstance was not regarded as sufficiently distinctive to warrant a change in the diagnosis.

Having succumbed to the injuries after a few days, the autopsy revealed a fracture extending through the bottom of the right acetabulum, and about one inch and a half of the rim at its upper and posterior margin completely detached, except as it was held in place by a portion of the capsular ligament. The head of the bone could be easily pushed upwards and backwards upon the dorsum, the fragment of the acetabular

margin being moved aside, and swinging upon its fibrous attachment as upon a hinge, but resuming its place again perfectly when the head of the femur was restored to the socket. The femur was not broken.

In the second case the limb was found shortened, the knee slightly bent, and turned a little forwards and inwards, and the toes pointing to the tarsus of the other foot. It was thought to be a fracture also of the neck of the femur, but the autopsy disclosed only a fracture of the upper margin of the rim of the acetabulum.

In the third case, seen only after death, the limb was not shortened much, but the toes were stretched downwards, and turned slightly inwards. It was supposed at first to be a simple dislocation, but on dissection the posterior and inferior margin of the acetabulum was found to be broken and displaced toward the coccyx, while the head of the femur rested upon the pyriformis muscle, over the ischiatic notch.

The fourth example was found in the dissecting-room, and the history of the case is not known. A fragment of the superior and posterior margin of the acetabulum had been broken off, and had reunited slightly displaced.[1]

Causes and Symptoms.—Several other similar examples have been established by dissection;[2] and Dr. Nicholas Senn, of Milwaukee, Wisconsin, has collected a number of examples more or less satisfactorily demonstrated without the aid of an autopsy.[3]. We are able, therefore, to determine pretty accurately what are the usual causes, phenomena, and terminations of this accident, though we are far from having arrived at a satisfactory means of diagnosis. Its causes are generally the same as those which produce dislocations of the hip, but in most instances the violence has been greater than in the case of dislocations. In a case reported by Miner[4] it was the result of a gunshot; the fragment having escaped through a fistulous opening.

The symptoms are, first, such as indicate a dislocation, to which must be added crepitus and a difficulty, if not impossibility, of retaining the head of the femur in its place when it is reduced. The crepitus is sometimes discovered the moment we begin to move the limb, and this will aid us to distinguish it from a fracture of the neck of the femur accompanied with much displacement, since, in the latter case, crepitus is not felt usually until the extension is complete, and the fragments are again brought into apposition.

Prognosis.—Some of these accidents, either from a failure to recognize them, or from the impossibility of maintaining the head of the femur in place when once it has been reduced, have resulted in a permanent dislocation of the hip and a serious maiming. In nine out of thirteen cases which Senn has found reported, the reduction was maintained, and in four it was not. The following case was recognized and reduced, but it was found impossible to maintain the reduction.

[1] McTyer, Amer. Journ. Med. Sci., vol. viii. p. 517, Aug. 1831.
[2] Maisonneuve, Chirurg. Clin., 1863, p. 168. Sir Astley Cooper on Disloc. and Frac., 1823, second London edition, p. 16. M. Beraud, Bulletin de la Soc. de Chir., 1862, tom. iii. p. 185. Ibid., p. 226. Bigelow on Hip-Joint, 1869, p. 139 et seq. Eve, British Med. Journ., Jan. 24, 1880 (2 cases). Agnew, Treat. on Surgery, vol. i. p. 929.
[3] Senn, Trans. Wisconsin State Med. Soc., 1880.
[4] Miner, Buffalo Med. and Surg. Journ., vol. v. p. 383.

February 3, 1847, a strong German laborer was crushed under a mass of iron weighing several tons. Drs. Sprague and Loomis, of Buffalo, were called, and found the left thigh dislocated upwards and backwards, and by the aid of six men they succeeded in reducing it, the reduction being attended, as the gentlemen informed me, with a slight sensation of crepitus. The legs were then laid beside each other, and the knees tied together, the patient lying on his back; and now the two limbs appeared to be of the same length. On the second and third days the injured limb was examined by the same gentlemen, and there was no displacement. On the fourth day I was invited to meet these gentlemen, the patient having had muscular spasms during the previous night, and the thigh being redislocated. I found the limb shortened one inch and a half, adducted, and the toes turned in. We immediately applied the pulleys, and soon drew the trochanter down to a point apparently opposite the acetabulum, and a careful measurement showed that the two limbs were of the same length. The pulleys being removed, the leg did not draw up again, nor did the foot turn in, yet we had felt no sensation to indicate that the bone had slipped into its socket, nor had we felt crepitus. The legs and thighs were now laid over a double-inclined plane, and well secured. He remained in this condition three days more, during which time Dr. Sprague saw him each day, and found nothing disarranged. On the night of the seventh day the spasms returned, and in the morning the thigh was displaced.

The next day we again applied the pulleys, but soon found that the bone would not remain in place one minute after the pulleys were removed.

At this time, while moderate extension was being made at the foot by rotating the foot inwards, we could distinctly feel a slight crepitus. A straight splint was applied, and as much extension made as he could conveniently bear, and in this condition the limb was kept several weeks. Seven years after, I found the thigh still displaced upon the dorsum ilii. He limped badly, but he could walk fast, and perform as much labor as before the accident.

In one case mentioned by Mr. Keate, the bone had become dislocated downwards, and could be felt lying against the tuber ischii, and the presence of a "distinct grating as of ruptured cartilage" led him to conclude that the cartilaginous labrum of the socket was broken off; but as the fracture was in the lower margin of the socket, no difficulty was experienced in retaining the bone in position.[1]

Dr. Homer O. Hitchcock, of Kalamazoo, Mich., reported to the Michigan Medical Society, June 12, 1879, a case of supposed fracture of the rim of the acetabulum, accompanied with a backward dislocation, which was successfully reduced and retained in place seven or eight weeks after the accident, by Dr. Noyes, of Detroit. The surgeons who had charge of the patient at first were prosecuted, and a judgment was obtained for damages, but this was finally reversed and the surgeons fully exonerated. As to what was the precise nature of the case the surgeons who testified were not agreed, and perhaps nothing but an autopsy could determine.

[1] Keate, Amer. Journ. of Med. Sci., vol. xvi. p. 225.

Dr. O. H. Walker, of Detroit, Michigan, presented to the Detroit Academy of Medicine, May 27, 1879, a specimen of this fracture, the history of which was as follows: A man, æt. 78, falling upon his hands and knees, was struck on the lower portion of his back by a passing street-car. He was taken to a hospital, and was found to have a dislocation upon the dorsum ilii. Reduction was readily accomplished, and crepitus was recognized, but its seat not fully determined. The patient died in a few hours from shock. In the autopsy the head of the femur was found in the socket, but it was easily displaced. The ligamentum teres and a greater part of the posterior half of the capsular ligament were torn away, leaving a part of the anterior portion, together with the ilio-femoral ligament, untorn. Some of the gluteal muscles were torn from their femoral attachments. The greater portion of the posterior lip of the acetabulum was torn away, making an opening through which the head of the femur had escaped, passing between the fasciculi of the ilio-femoral ligament, and resting finally near the crest of the ilium. Less than one-third of the normal depth of the acetabulum remained to support the head of the femur when it was in place.[1] Dr. Walker incidentally mentions that Brodie reported a case which he supposed to be of this nature, in the *London Lancet*, in 1833.

FIG. 126

Walker's case of fracture of the acetabulum.

Treatment.—If the diagnosis is satisfactorily made out, and upon complete reduction the femur will not remain in place, the treatment ought to be nearly the same as for fracture of the thigh, except that no lateral splints or bandages to the thigh will be necessary. If the straight position is chosen, the limb ought to be rotated in a direction opposite to that in which the acetabular margin is supposed to be broken, and kept drawn out to its proper length, as far as this shall be found to be practicable, by extending and counter-extending apparatus. A band around the pelvis, so adjusted as to press the head of the bone into its socket, may also be of service in preventing the tendency to displacement; and in case the bone manifests little or none of this tendency, the hip bandage will probably alone be sufficient, yet even here no harm could come of applying the extending apparatus, secured moderately tight, simply as a measure of precaution. Dr. Bigelow recommends angular extension, effected by means of an angular splint, such, for example, as Nathan R. Smith's, or Hodgen's, suspended from the ceiling, or from some other point above the patient; "or," he adds, "if any manœuvre has reduced the bone, the limb should be retained, if possible, in the attitude which completed the manœuvre."

[1] Walker, Detroit Lancet, July, 1879.

§ 5. Sacrum.

Simple fractures of the sacrum, known to be exceedingly rare,[1] are occasioned either by such injuries as break at the same time the other bones of the pelvis, or by blows or falls received directly upon the sacrum. It may be broken at any point, and in any direction, when the fracture is produced by the first of this class of causes; but if the fracture is the result of a fall upon the sacrum, it will generally be transverse, and below the sacro-iliac symphysis. The displacement in this latter class of cases is almost invariably the same, the coccygeal extremity being simply carried forwards, yet this is seldom sufficient to interfere in any degree with the functions of the rectum and anus; but in one case seen by Bermond it nearly closed the rectum. Sometimes, also, there is a slight lateral deviation. There is also in the Dupuytren museum, at Paris, a specimen in which the whole of the lower fragment is displaced a little forwards.

Symptoms.—The signs of this fracture are pain at the seat of injury, aggravated greatly in the attempts to flex or elevate the body, and especially in the efforts at defecation; swelling and discoloration of the soft parts covering the sacrum; displacement of the coccyx forwards; an angular projection at the point of fracture, with a corresponding retiring angle upon the opposite side; mobility.

Prognosis.—Experience has shown that where the fracture of the sacrum is accompanied with other fractures of the pelvis, the patients seldom recover; and only because so extensive an injury implies usually great force in the cause which produced the fractures, and, of necessity, greater lesions among the pelvic viscera. Simple fractures, from falls upon the sacrum, occurring below the sacro-iliac symphysis, are generally followed by speedy recoveries, although the inward displacement is not often completely overcome.

Treatment.—By introducing a finger into the rectum, the lower fragment can be easily pressed back to its natural position, but the difficulty consists in finding any means of retaining it there until bony union is effected. Judes succeeded to his satisfaction with a wooden cylinder, which he compelled the patient to wear forty-five days; removing it, however, every third day, in order to cleanse the rectum with an enema. Bermond introduced first a linen bag, which he immediately proceeded to fill with lint; but during the night it became necessary to remove it, in order to relieve the bowels of wind and stercoraceous matter. He now substituted a silver canula covered with a shirt, which latter he filled with lint in the same manner as before. This was retained without much inconvenience nineteen days; having only been removed once during this time. The union now seemed to be firm, and the apparatus was removed. Plugging the rectum in this manner may be necessary whenever the inward inclination of the lower fragment is found to be considerable, but not otherwise; ordinarily it will be sufficient to lay the patient upon his back, with a firm cushion above the point of fracture,

[1] Malgaigne has referred to eight cases; and I have not been able to find a record of any others.

so as to prevent the bed from pressing in the lower fragment; and having emptied his rectum thoroughly by an enema of warm water, he should be placed under the influence of an opiate sufficiently to restrain the action of the bowels for several days, or for as long a time as may be consistent with health or comfort. To the same end, also, the diet ought to be light and dry; nothing should be allowed which might prove laxative. By constipating the bowels, two ends may be gained. We shall prevent that frequent action of the sphincters, which might tend to disturb the union; and the hardened fæces, by their accumulation in the rectum, may serve to press back the lower fragment of the sacrum, in a manner much more natural and quite as effective as any apparatus which can be contrived.

Separations at the Sacro-iliac Symphyses.

I have already mentioned a case of separation of the bones at the sacro-iliac symphysis, reported by Lente, but which was accompanied also with a fracture of the ilium and a dislocation of the hip. Several other similar examples have been reported, in some of which both of the sacro-iliac symphyses have been separated, or displaced. Such accidents are the results only of great violence, and the subjects of them seldom recover.

Dr. J. T. Banks, of Griffin, Ga,, has reported one example of complete recovery in an adult male, in which the right sacro-iliac symphysis was separated "by a blow received upon the tuberosity of the ischium, driving the ilium up an inch or more, causing complete paralysis and anæsthesia of the right leg for two or three weeks;" motion of the hip caused also severe pain. No attempt was made to reduce the bones, but union occurred, and he gradually regained the use of his limb.[1] In a few instances this articulation has been known to give way during labor, while the symphysis pubis has suffered little or no diastasis; and in these cases recovery has generally taken place.

In nearly all the traumatic examples reported, the diastasis has been accompanied with a fracture extending parallel with the margins of the synchondrosis; and it is for this reason that I have preferred to consider these accidents as fractures, rather than as dislocations.

§ 6. Coccyx.

The bones which compose the coccyx, four in number, develop slowly, the third not presenting an ossific nucleus until from the tenth to the fifteenth years of life, and the fourth not until between the fifteenth and twentieth year. Subsequently the first and second become united into one, and later the third and fourth are united into one; finally the second and third unite, and the coccyx is complete as a single bone. At a late period of life, later in the female than in the male, the coccyx is united by bone to the sacrum. These facts render it apparent that a true fracture can scarcely occur until late in life; and it seems probable, also, that a diastasis or dislocation will be very unlikely to occur. For myself, I have never met with the accident in any of its forms. Malgaigne says he has seen one example of fracture in an autopsy, in which

[1] Banks, Atlanta Med. and Surg. Journ., May, 1866.

case there was also a fracture of the sacrum; and he adds that Cloquet had seen another in an old man, caused by a kick.

Treatment.—In case a fracture were to occur, the treatment would be the same as that already described for a fracture of the lower portion of the sacrum.

Dr. Geo. A. Mursick, of Nyack, New York, reports[1] two cases of "coccygodynia," in which he practised excision of the last two bones of the coccyx successfully. One of them was a case of fracture, with forward displacement, in a woman twenty-nine years old, and was caused by a fall upon the nates. Fourteen months after the accident she came under Dr. Mursick's observation. She was suffering great pain in the pelvic region, and especially in the region of the rectum, which was aggravated by walking, defecation, and by rising from the sitting position.

June 2, 1873, Dr. Mursick removed the last two bones of the coccyx, the patient being under the influence of ether, by making an incision posteriorly of two inches in length, exposing the bone thoroughly, and then having seized the bone with a pair of forceps, it was drawn out and carefully dissected from its attachments. Severe pains in the pelvic region followed the operation, with retention of urine, and the wound healed slowly.

As a result of his two operations he concludes that the operation is simple and easy of performance, but that the constitutional disturbance which ensues is out of all proportion to its magnitude. The subsequent pain is very severe, and lasts for several days; and the wound heals slowly.

I am also indebted to Dr. Mursick for the statement, that extirpation of the coccyx has been practised occasionally since the first differentiation of coccygodynia by Nott and Simpson, with successful results, but especially in those cases which were of traumatic origin. In other cases, unaccompanied with fracture or dislocation, subcutaneous incision of the attachments of the coccyx has proved sufficient, while in many cases, of purely neurotic origin, the cure has, after a time, been effected without resort to surgical interference. My own experience confirms this latter statement. Nor can I fully appreciate the necessity or advantage of resection in any case of simple fracture or diastasis of this bone. In the case related by Mursick there is no evidence furnished that union had ever taken place between the second and third portions, and the age permits a presumption that it had not, and that it was not therefore in reality a fracture; but even if it had been, what possible harm could come of its being rendered movable by the fracture, since if it were movable it could not interfere with defecation? The coccyx is not without its function, and cannot without injury be lost, inasmuch as it serves for the attachment of muscles and ligaments, most of which are of importance in connection with defecation, and occlusion of the rectum.

[1] Mursick, American Journal of the Medical Sciences, Jan. 1876, p. 122.