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Modern Surgery - Chapter 19. Diseases and Injuries of the Bones and Joints - Operations upon Bones

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Symptoms.—In subastragaloid dislocation the astragalus projects on the dorsum; the foot is everted in outward dislocation and inverted in inward dislocation; the relation of the malleoli to the astragalus is unaltered; the ankle-joint is not absolutely rigid; the foot “is shortened in front and is elongated behind” (Pich).

Treatment.—To treat subastragaloid dislocation make extension in the direction opposite to that of the displacement. In dislocation of the tarsus backward fix a bandage around the foot, on a level with the heads of the metatarsal bones, which bandage the surgeon ties around his shoulders. The surgeon puts one knee in front of the ankle and thus fixes the leg, raises himself up to make extension upon the tarsus, and moulds the bone into position. Tenotomy may be necessary. After reduction apply a plaster-of-Paris dressing and have it worn for three weeks. The ankle-joint, fortunately, is not involved, and stiffness of this articulation need not be apprehended. If reduction is impossible, take the same course as in luxations of the astragalus.

Dislocations of the other tarsal bones are very rare. Single bones may be dislocated, or the luxation may occur at the mediotarsal articulation.

Symptoms and Treatment.—Projection is an obvious symptom in dislocation of the other tarsal bones. The treatment is to reduce by extension and moulding, the part being put up in plaster-of-Paris dressing for two weeks.

Dislocations of the metatarsal bones are rare.

Symptoms and Treatment.—Shortening of the toes and projection of the dislocated bone are symptoms of dislocation of the metatarsal bones. To treat these dislocations reduce by extension under ether and put up in a plaster-of-Paris dressing for two weeks. If reduction fails, the functions of the foot will not be much impaired.

Dislocations of the phalanges are very rare. The first phalanx of the big toe is the one most liable to dislocation.

Symptoms and Treatment.—Dislocations of the phalanges are obvious. The treatment is by reduction as in dislocations of the thumb. Immobilize for two weeks.

5. Operations upon Bones and Joints.

Osteotomy.—By the term osteotomy the modern surgeon means literally the sectioning of a bone for the purpose of straightening a limb ankylosed

in a bad position, correcting a bony deformity, or amending a vicious union of a fracture. In a linear osteotomy the bone is transversely or obliquely divided at one spot; in a cuneiform osteotomy a wedge-shaped portion of

Fig. 253.—Adams's large saw.
Osteotomy for Genu Valgum, or Knock-knee

bone is removed. The operation of osteotomy may be performed with a saw (Fig. 253) or with an osteotome. The saw creates dust, draws much air into the wound, and lacerates the tissues to a considerable degree. Most surgeons prefer the chisel or the osteotome. The osteotome slopes down to a point from each side (Fig. 254); the chisel is straight on one side and on the other is bevelled to a point.

**Osteotomy for Genu Valgum, or Knock-knee** (Macewen’s Operation, Fig. 256).—In this operation the instruments required are the scalpel, hemostatic forceps, osteotomes of several sizes, a mallet (Fig. 255), and a sandbag wrapped in an aseptic towel.

*Operation.*—The patient lies upon his back, being rolled a little toward the diseased side. The leg of the diseased side is partly flexed upon the thigh and the thigh upon the pelvis, and the extremity is laid upon its outer surface, the sand-bag being pushed between the extremity and the bed, opposite to the site of section. The flexion of the knee relaxes the popliteal vessels and saves them from injury. The surgeon, if operating on the right leg, stands outside of that extremity; if operating on the left leg, he stands opposite the left hip (Barker). The knife is inserted into the tissues and carried to the bone at the inner side of the knee, just in front of the adductor tubercle of the inner condyle and on a level with the upper border of “the patellar articular surface of the femur” (Barker). An incision is made upward one inch in length, in the direction of the axis of the femur. At the lower angle of this wound an osteotome is inserted and the blade after
insertion is turned to a right angle with the shaft of the femur, half an inch above the epiphysis (Fig. 256). The osteotome is struck several times with a mallet; the handle is moved several times toward and from the body, so as to widen the cut in the bone (Fig. 257); the osteotome is again struck with the mallet several times; it is again moved toward and from the body, and this process is continued until the bone is cut one-third through. If the osteotome becomes tightly fixed, it should be withdrawn and a smaller one introduced. In the soft bone of a young child this to-and-fro movement of the chisel, if carefully executed, is not liable to break the instrument. In dense bone it may break the instrument; hence, when doing an osteotomy in dense bone, the osteotome is moved to and fro across the limb and slight downward pressure upon the handle will to a great extent prevent binding. When the bone is cut two-thirds through, the osteotome is withdrawn, a piece of wet antiseptic gauze is held over the wound, and the surgeon fractures the femur by strong adduction. The wound is neither sutured nor drained, but is dressed antiseptically, the entire extremity is wrapped in cotton, and a plaster-of-Paris dressing is applied and carried up to the groin. The dressing may be removed in two weeks, and the patient may subsequently be treated with sand-bags, as for an ordinary fracture of the thigh, but without extension. This operation is scarcely ever fatal.

Ogston's Operation (Fig. 256).—In this operation the internal condyle is sawed off obliquely with an Adams saw—a proceeding which permits the straightening of the knee. The objection to the procedure is that it opens the knee-joint, and that this cavity fills up more or less with a mixture of blood and bone-dust. Macewen's operation is decidedly the safer.

Osteotomy for a Bent Tibia.—In this operation the instruments required are the same as those used in the above operation. The tibia is divided transversely or obliquely (linear osteotomy), or a wedge-shaped piece is removed (cuneiform osteotomy). The oblique incision is the best. If the convexity of the tibial curve is inward, cut the bone from above downward and from in front backward; if the curve is forward, section the bone from above downward and from within outward. The fibula need rarely be interfered with. After the osteotomy the limb is treated just as it would be for a fracture.

Osteotomy for Faulty Ankylosis of the Hip-joint.—This operation is performed in order to allow straightening of a limb that has undergone bony ankylosis in a faulty or an inconvenient position. In some cases an attempt is made to obtain a movable joint, but in most cases the surgeon must be satisfied with an ankylosis in extension. Osteotomy may be performed through the neck of the femur or through the shaft of the femur below the trochanters.

Osteotomy through the neck of the femur is performed (1) with a saw (Adams's operation) or (2) with an osteotome.

1. Adams's Operation (Fig. 258).—In this operation the instruments required are a scalpel, hemostatic forceps, a long, blunt-pointed tenotome, and an Adams saw.

Operation.—The patient lies upon his sound hip; the surgeon stands upon the side to be operated upon, and back of the patient. The knife is entered a finger's breadth above the great trochanter, is pushed in until it strikes
the neck of the bone, is then carried across the front of and at a right angle with the neck, and is withdrawn, enlarging the wound, in the soft parts as it emerges, to the extent of an inch. The saw is then introduced and the neck of the femur is entirely divided. After the osteotomy dress the wound antiseptically and place the extremity straight. To straighten the limb it may be found necessary to cut contracted tendons and fascial bands. After securing extension and applying dressings use the weight-extension apparatus and the sand-bags. Begin passive movements from the start if a movable joint is desired; few patients can tolerate the pain necessary to bring this about. If it is determined to aim for a stiff joint, treat the case as an intracapsular fracture would be treated.

2. With an Osteotome.—The instruments required in this operation are the same as those used for genu valgum. A sand-bag is not needed. The position of the patient is the same as that in Adams's operation. An incision one inch long is made, starting just above the great trochanter, ascending in the axis of the femoral neck, and reaching to the bone. An osteotome is introduced, is turned to a right angle with the neck of the bone, and is struck with a mallet until the bone is completely divided. (It is not to be divided partially and then broken.) The after-treatment is the same as that for Adams's operation. The operation with the osteotome is to be preferred to that by the saw.

Osteotomy of the Shaft of the Femur below the Trochanters (Gant's Operation).—In this operation (Fig. 258) the saw may be used, but the osteotome is to be preferred. The instruments employed are the same as those used for Adams's operation, plus an osteotome.

Operation.—The position in Gant's is like that in Adams's operation. A longitudinal incision one inch long is made upon the outer aspect of the femur and on a level with the lesser trochanter. The osteotome is inserted and the bone is completely divided below the lesser trochanter. The after-treatment is the same as that for Adams's operation. Gant's operation is the best method for correcting faulty position in bony ankylosis, and Adams's operation can only be employed in those cases where the femur still has a neck which is practically unchangcd.

Osteotomy for Faulty Ankylosis of the Knee-joint.—This operation is performed for bony ankylosis of a knee in a position of flexion. The instruments employed are the same as those used for genu valgum.

Operation.—The patient lies upon his back with his thighs flat upon the bed, the legs hanging over the end of the bed. The surgeon stands on the patient's right side. Just above the patellar articular surface upon the femur a transverse incision is made, one inch in length and reaching to the bone. The osteotome is introduced and the bone is cut nearly through. The leg is then forcibly extended. It must not be extended too violently, or the popliteal vessels may be injured. In cases where the structures of the popliteal space are tense, the leg must not be brought at once into extension, but this position should be attained gradually by means of weights. The
wound is dressed aseptically, and the extremity is placed upon a double inclined plane and is treated as for fracture near the knee-joint.

**Osteotomy for vicious union of a fracture** is performed in case of angular deformity, and is carried out in the same manner as are the above procedures. It is best, when possible, to enter the osteotome upon the concavity of the bent bone, so that the periosteum will not rupture when extension is made, and the patient will in consequence gain a longer limb.

**Osteotomy for Hallux Valgus.**—In this operation a linear osteotomy is made through the neck of the metatarsal bone of the great toe, the toe is forcibly adducted, and a splint is applied to the inside of the foot and the toe.

**Osteotomy for Talipes Equinovarus.**—The instruments required in this operation are a scalpel, hemostatic forceps, a narrow, blunt-pointed saw, special directors, bone-cutting forceps, sequestrum forceps, and scissors.

*Operation* (after Barker).—The patient lies upon his back, the thigh is semiflexed, the knee is bent, and the sole of the foot rests upon the table. The surgeon stands to the right side if it is the right limb which is to be operated upon, or to the left side if it is the left limb. The surgeon feels for the outer surface of the cuboid bone, and cuts away from over the latter a piece of skin corresponding in size with the bone-wedge intended to be removed (this piece of skin must include the bursa which forms in these cases). The foot is then turned outward, the astragaloscaphoid articulation is located, and over this an incision is made “from the lower to the upper dorsal border of the scaphoid bone” (Barker), reaching through the skin only; the foot is placed again in the first position, all the soft parts are raised from off the superior surface of the tarsus, and a triangular surface corresponding with the base of the wedge to be removed is cleared; a “kite-shaped” director (Fig. 259) is passed into the external wound and projected from the internal wound; the saw is pushed through the groove of the director nearest the toes, and is made to cut through the tarsus, from the dorsum to the sole, at right angles to the metatarsal bones; the saw is pushed through the groove of the director nearest the ankle, and is made to cut from the dorsum to the sole, at right angles to the long axis of the calcaneum; the wedge-shaped piece of bone is grasped with sequestrum forceps and cut out with scissors, with bone forceps, or with a blunt bistoury. The wound is well irrigated, the foot is straightened, the internal wound is sewed up, the external wound is sutured except at its lowest portion, where a drainage-tube is to be retained for twenty-four hours, and the wound is dressed antiseptically. The foot is put up in plaster or upon a Davy splint.

**Osteotomy for Talipes Equinus.**—This operation is described by Mr. Davy, who devised it, as follows:* “Taking the line of the transverse tarsal joint as a guide, on the outer and inner sides of the foot, and immediately over the joint, two wedge-shaped pieces of skin are removed, equal in extent to the amount of bone demanded. The soft structures are freed on the dorsum of the foot in the way previously described; but, as the base of the

* Barker's "Manual of Surgical Operations."
Osseous wedge for equinus cases is at the dorsum and its apex at the sole, the parallel wire director, instead of the kite-shaped varus one, is used. The saw is successively inserted in its grooves, and by keeping in mind the idea of a keystone a clean wedge of bone is cut out from the dorsum to the sole of the foot. The wedge is extracted, and the foot is straightened and is put up in plaster-of-Paris or is placed on a Davy splint.

**Operative Treatment of Recent Fractures.**—In recent fractures where reduction is impossible or where displacement recurs in spite of splints, it may be advisable to operate. In doubtful cases a skiagraph should always be taken, and it will often decide whether operation is or is not indicated. In most instances of irreducible fracture reduction of the fragments is impossible because muscle or fascia is caught between them or because the periosteal soft parts have hardened and shortened as a result of hemorrhage and inflammation. In such cases it may be necessary to make a tolerably long incision; loosen the ends of the fragments from their anchorage, cut the inflammatory ties, remove tissue from between the fragments, and, if the ends are very irregular, saw them off evenly.

The fragments are bored and brought together, and are held by silver wire or kangaroo-tendon, or both fragments are surrounded by Senn’s bone ferrule or bone ring, and fixation is thus secured (Figs. 260, 261). Drainage...
is unnecessary, the soft parts are sutured and dressed with sterile gauze, and
the extremity is put up in plaster-of-Paris. If the clavicle is operated upon,
after sterile dressings are applied a Velpeau bandage is put on, and the
turns of this bandage are overlaid with plaster-of-Paris, a trap-door being
cut over the seat of operation. In an operation for recent fracture the
author does not use an Esmarch bandage, as he believes it best to see what
is cut and thoroughly arrest bleeding at the time, rather than run the danger
of oozing and infection.

The author has wired recent fractures of the humerus, tibia, femur, and
clavicle. Arbuthnot Lane believes that every very oblique fracture of the
tibia and fibula low down should be treated by incision and fixation.* It
is necessary to bear in mind that if one of two parallel bones is broken (as
the radius alone or tibia alone), and it is found necessary to resect a con-
siderable portion, a like amount should be resected from the companion bone
in order to prevent great deformity.

**Recent Transverse Fracture of the Patella.**—(See page 458.)

**Bone-grafting, or Transplantation.**—(See page 371.)

**Operative Treatment of Ununited Fracture.**—The instruments
required in this operation are a scalpel, hemostatic forceps, dissecting forceps,
retractors, Allis's dissector, an awl or special drill (Figs. 262, 263), chisels,
a mallet, a fine saw, lion-jaw forceps, and silver wire.

In operating, incise longitudinally down to the seat of fracture, retract
the periosteum from the bone, drill the bones before cutting them, chisel
away the material of imperfect union, saw through each bone end far enough
from the seat of fracture to reach sound tissue, pass large silver wires through
the holes (this wire should be one-tenth inch in diameter for the femur, one-
sixteenth inch for the patella, etc.) (Fig. 264), twist the wires a fixed number
of times (two complete turns) in the direction that the hands of a watch
move (this is Keen's direction. In case removal of the wires should be
demanded later we know how to untwist them), sever the ends of the
wires, and hammer their stems against the bones. The wires may never
require removal. Dress the part as a recent fracture. Various plans
besides wiring have been employed in ununited fracture. Gussenbauer's

Fig. 265. --Wiring of the patella:
1. Fragments cut and cleaned and the wires passed; 2, wires twisted and hammered down upon the bone (after Barker).

Treves's Operation for Vertebral Caries

Clayton Parkhill's bone-clamp is a very useful appliance, and holds the fragments firmly in contact (Fig. 396). Menard and Lannelongue inject a 1:10 solution of chlorid of zinc between the fragments and around their ends, and then immobilize the parts. Some surgeons unite the fragments with kangaroo-tendon instead of wire (suturing of bone); others use nails of bone or ivory; others use screws. Senn asserts that the above methods will not hold fragments in contact if these fragments have a tendency to become displaced. Senn fastens the bones together by hollow cylinders of decalcified bone or ivory, the cylinders being perforated in many places (bone ferrules) (Fig. 260). The soft parts are sutured, no drain is used, and the limb is encased in plaster-of-Paris.

Ununited Fracture of Patella.—
An incision is made in the long axis of the limb, over the middle of the space between the fragments, from well above the upper fragment to well below the lower piece; this incision divides all the soft parts. The soft parts are retracted, but the periosteum is undisturbed; each fragment is bored (Fig. 265, 1) in one or two places; the surfaces of the fragments are cut square through sound bone with a saw; all old reparative material is cut away; the wires are passed through the perforations, twisted, cut off, and hammered down (Fig. 265, 2). If the bone fragments cannot be approximated, it may become necessary to incise the muscle around and above the patella or to partially separate the tuberosity of the tibia and bend this process upward. A small drain is inserted above the bone, the wound is sutured, aseptic dressings are applied, and the limb is put upon a Macewen splint.

Treves's Operation for Caries of the Lumbar and Last Dorsal Vertebrae.—In this operation the right loin is chosen for incision, as a rule. The instruments required are a scalpel, hemostatic forceps, grooved director, an Allis dissector, sequestrum forceps, curet spoons, and a sand-bag.

Operation.—The patient lies upon his left side, with the knees drawn up and a sand-bag under him. The surgeon stands behind the patient (Barker). An incision is made at the outer border of the erector spinæ mass, reaching from the last rib to the iliac crest and going down at once to the lumbar fascia. The lumbar aponeurosis is opened, the erector spinæ muscle is retracted inward, and the anterior portion of the erector spinæ sheath is incised. The quadratus lumborum muscle is next cut, and then
the anterior leaflet of the lumbar aponeurosis is slit. Loose pieces of bone are removed with forceps, and cavities are thoroughly curetted. The wound is irrigated with corrosive sublimate and is dusted with iodoform; a large tube is inserted; the wound is packed with iodoform gauze, is partly closed by sutures of silkworm-gut, and is dressed antiseptically.

**Aspiration of Joints.**—In certain cases of joint-effusion from inflammation, tuberculous or otherwise, and sometimes in hemorrhage into a joint, it is desirable to remove the fluid by aspiration. The pneumatic aspirator is used (Fig. 266). The trocar and cannula are thoroughly asepticized and the joint is prepared as for a set operation. The needle is entered at a surface free from vessels. The directions for using an aspirator are as follows: insert the stopper firmly into a strong bottle (preferably a clear glass one), then attach the short elastic hose to the stopcock $B$ of the tube projecting from the stopper, and attach the other end of the same elastic hose to the exhausting or inward-flowing chamber of the pump. Next attach one end of the longer elastic hose to the stopcock $A$ projecting from the stopper, and the other end to the needle. Care should be taken that all the fittings or attachments are placed firmly into their respective places. Now close the stopcock $A$ and open the stopcock $B$. By giving from thirty-five to fifty strokes of the pump a sufficient vacuum can be produced to fill with the fluid from the joint a bottle holding from a pint to a quart. After having formed the vacuum, close the stopcock $B$, and insert the needle in the joint. When the stopcock $A$ is opened, suction through the needle draws the fluid from the joint. The trocar may also be used to inject antiseptic agents. After the completion of aspiration the part is dressed antiseptically and the extremity is put at rest upon a splint.

**Excisions of Bones and Joints.**—Excision or resection of a joint is the removal of the articular portions of the bones of the joint, and also the cartilage and synovial membrane. In the hip-joint and shoulder-joint the head of the long bone only may be removed, and not the articular surfaces of both bones. In excision enough bone is known to have been removed only when the remaining bone bleeds. Excision of a bone is the
Erasion, or Arthrectomy

removal of an entire bone or of a portion of it. Excision is a conservative operation which often averts amputation.

Excision may be performed by the *open* method, in which the periosteum is not preserved, or it may be performed by the *subperiosteal* method, in which the periosteum is carefully separated by a rongeur and the capsular ligament is preserved. *Arthrectomy, or erosion,* is the excision of the diseased synovial membrane and ligament, and also small foci of disease of bone and cartilage.

Excision may be employed for compound dislocation, and in compound dislocations of the elbow and the shoulder it is usually performed. Excisions for compound dislocations in other large joints are very dangerous; they are rarely attempted in battle-field practice, and are to be avoided even in civil practice unless the patient is young and vigorous and every advantage can be given him during the operation and convalescence. Excision for deformity is rarely performed except upon the hip, the knee, and the shoulder, and these excisions must not be employed if the patient's condition leads one to fear the result of a protracted convalescence. Excision of the elbow, however, is usually a safe operation. In excising for deformity always consider the patient's trade and the demands of habitual position which it makes upon him.*

Excision is largely employed for joint-disease, especially for tuberculous joints. Bell states that attempts to preserve the limb without excision are more justifiable in the lower than in the upper limbs, because operation in the lower extremity is more dangerous than in the upper, and because a cure without operation in the lower limbs, if this cure can be brought about, gives as good a result as a cure by excision. In the upper extremities the danger from operation is less than is the danger from waiting. In a young subject an excision may remove the epiphysis, and thus lead to permanent shortening, which is productive of less inconvenience and deformity in the arm than in the leg. The great danger of excision operations is that the section may be made through cancellous bony tissue; hence disastrous suppuration, phlebitis, myelitis, septicemia, or pyemia may follow; further, in excision the cut is often made through diseased tissue, and a protracted convalescence is often inevitable. Amputation is effected through healthy tissue, and the convalescence is short. Excision, however, when successful, gives the patient a very useful limb.

**Erasion, or Arthrectomy.**—Erasion is the complete removal of diseased synovial membrane, ligaments, etc. This operation seeks to remove a depot of infection in an early stage of tuberculous synovitis, and it possesses the conspicuous merit of not interfering with the epiphysis. The term erasion is also used to designate the operation of removing healthy synovial membrane, ligaments, etc., for the purpose of producing fixation of a flail joint due to infantile paralysis. Erasion is oftenest practised upon the knee-joint. The instruments required are a scalpel, hemostatic forceps, dissecting forceps, toothed forceps, volsellum, scissors, bone-gouges, curets, and an Esmarch apparatus.

**Erasion of the Knee-joint.**—The patient lies upon his back; the leg is flexed with the sole of the foot planted upon the table, and an Esmarch ban-

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* Joseph Bell, in his "Manual of Surgical Operations."
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dage is applied at a point well up on the thigh. The surgeon stands to the right of the patient. The incision is begun in the mid-line of the thigh (on the side opposite to that occupied by the surgeon), about three inches above the patella; it is carried down across the ligament of the patella and up to a corresponding point on the opposite side of the thigh. This incision goes down to the bone; the flap is turned up and the joint exposed; the knee-joint is strongly flexed, and the synovial membrane and diseased ligaments are dissected away with scissors and forceps, great care being taken that the posterior ligaments (which, fortunately, are rarely implicated early in the case) are not divided and that the contents of the popliteal space remain intact. After removing the diseased ligaments and synovial membrane the cartilage is examined and any diseased portion is removed. The bone is then examined and any tuberculous foci are gouged away. Any exposed vessels are ligated. The wound is irrigated with salt solution, the extremity is straightened, and the ends of the ligamentum patellae are sutured, a drainage-tube is inserted at each angle of the wound, the skin is sutured, and antiseptic or sterile dressings are applied. The limb is placed upon a posterior splint for a few days, then the drainage-tubes are removed, the dressings are changed, and a plaster-of-Paris cast is applied, trap-doors being cut on
Excision of the Shoulder-joint

each side, and the joint is kept immobile for two or three weeks. This operation is only suited to early cases in which the lesion involves chiefly or purely the synovial membrane and ligaments, and in these cases it frequently gives a good result, some capacity for motion being not unusually preserved.

**Excision of the Shoulder-joint.**—In the shoulder-joint partial excision is often performed, the head of the humerus being removed and the glenoid being undisturbed; but some patients require complete excision, the entire glenoid depression, as well as the head of the humerus, being removed by the surgeon. Excision of the shoulder-joint is made, if possible, an intra-

**Fig. 269.**

Fig. 269.—1-9, Amputations (Joseph Bell) : 1, of arm by double flaps; 2, at shoulder-joint; 3, at ankle-joint by internal flap (Mackenzie's); 4, 5, of leg just above the ankle-joint (Syme's); 6, 7, below the knee (modified circular); 8, through condyles of femur (Syme's); 9, at lower third of thigh (Syme's). A, excision of head of humerus; B, of knee-joint (semilunar incision).

Fig. 270.—1-8, Amputations (Joseph Bell) : 1, at elbow-joint (posterior flap); 2, at shoulder-joint, posterior incision (first method); 3, at ankle-joint (Mackenzie's); 4, through condyles of femur (Syme's); 5, at lower third of thigh (Syme's); 6, at knee (posterior incision); 7, of thigh (Spence's); 8, at hip-joint. A-C, Excisions: A, excision of shoulder-joint (deltoid flap); B, of shoulder-joint (posterior incision); C, of elbow-joint (H-shaped incision); D, of elbow-joint (linear incision); E, of hip-joint (Gross's); F, of os calcis; G, of scapula.

capsular operation, the capsule being opened, but the capsular attachment to the anatomical neck of the humerus not being interfered with. In advanced cases, however, the capsular attachment must be destroyed. Excision of the shoulder-joint is seldom performed in civil, but is a common operation in military practice; it is performed for gunshot-wounds, compound dislocations, tuberculous disease, and tumors of the head and upper portion of the humerus. The instruments required are a scalpel, an Adams saw and a metacarpal saw, an osteotome or chisel, a mallet, an Allis dissector, a periosteum-elevator, hemostatic forceps, dissecting forceps, toothed forceps, lion-jawed forceps, sequestrum forceps, metal retractors, curets, and cutting bone forceps.
Operation by Anterior Incision.—The patient lies supine; a pillow is placed beneath the shoulders, and a sand pillow is put beneath the shoulder to be operated upon. The arm is held to the side with the outer condyle forward and the bicipital groove inward (Barker's directions). The surgeon stands by the affected side. An incision three or four inches in length is made from just external to the coracoid process of the scapula, running straight down the humerus (Fig. 269, A). This incision divides the border of the deltoid muscle and brings into sight the long head of the biceps. The tendon of the biceps is retracted inward, unless it is diseased, in which case it is resected. The knife is carried up the groove and opens the capsule of the joint. The periosteum is lifted from the neck of the bone while an assistant rotates the elbow to make the muscles tense. In some places, if the periosteum tears, muscular insertions must be cut with a knife. The head of the bone is sawn off while the bone is in place, or the elbow is strongly pulled back, and the head of the bone is forced out of the wound, and is then sawn off at the point required. In ordinary cases only the articular head is removed; in other cases the section is made just above the surgical neck; in yet others a portion of the shaft must also be cut away. If the glenoid cavity is found slightly diseased, the dead bone must be removed by the chisel and mallet or by the cutting forceps. If the cavity is seriously diseased, the entire glenoid should be removed. Scrape away all damaged tissue; ligate bleeding points; irrigate the wound with corrosive sublimate solution; swab it out with a solution of chlorid of zinc (gr. XX to 3j); dust with iodoform; close the upper portion of the wound and insert a drainage-tube in the lower angle; dress the wound antiseptically; place a small pad in the axilla; apply the second roller of Desault; and put the patient in bed with a pillow under the affected shoulder. In seven days the hand-sling is substituted for the bandage, and with the elbow hanging free the patient is permitted to get up and is advised to move his arm frequently. Drainage is maintained until the wound is well healed from the bottom. Great limitation of movement inevitably follows a shoulder-joint resection.

Excision by the deltoid flap is performed when the head of the bone is much enlarged (as by a tumor) or when the tissues are thick and indurated. The deltoid flap is in the shape of a U or is semilunar (Fig. 270, A). Raising this flap exposes the head of the bone most satisfactorily. Bell states that when the glenoid cavity is chiefly involved the incision should be posterior (Fig. 270, B).

Senn's Method.—Senn has recently described an incision which does not damage any important vessels, muscles, tendons, or nerves, and which is followed by good functional results. A semilunar skin-flap is formed, the incision running from the coracoid process to the posterior border of the axillary space. The flap is turned up, exposing the upper half of the deltoid muscle. The acromion is sawn off and turned down with the attached deltoid. The capsule is now freely exposed; it is opened, and either arthrectomy or excision is performed, according to conditions. In closing the wound it is not necessary to bore the acromion and pass silver wires to join the fragments; it is enough to suture the periosteum with catgut.

Excision of the Elbow-joint.—This operation is performed for wounds,
Excision of the Wrist-joint

faulty ankylosis, and chronic articular disease. Excision must be complete. Endeavor to make a subperiosteal resection; this maintains the shape of the articulation and gives the best chance for a movable joint. The instruments used are the same as those for the shoulder, plus a Butcher saw.

Operation.—The patient is “supine, but inclining to the sound side, the affected arm being held almost vertical, with the forearm flexed and nearly horizontal” (Barker). The incision is made on the posterior surface of the joint. A single posterior incision is usually employed (Fig. 270, d). An incision is made a little internal to the long axis of the olecranon, beginning two inches above and terminating two inches below the tip of the olecranon. This incision goes down to the bone, and throughout the entire operation the surgeon must guard and shield the ulnar nerve. The periosteum and soft parts are well separated; the olecranon is sawn off; forced flexion exposes the joint-cavity freely, and enables the surgeon to lift the periosteum and soft parts from the humerus; the humerus is sawn through at the beginning of its condyloid processes; the radius and ulna are cleared and are sawn at a level below that of the base of the coronoid process of the ulna. Diseased tissues are cut and scraped away; the wound is irrigated, sutured, drained, and dressed. In some cases an H-shaped incision is employed (Fig. 270, c), but the cicatrix of a transverse cut will limit flexion of the limb.

After excision of the elbow the patient is put to bed and the arm is laid upon a pillow, the elbow being placed midway between a right angle and complete extension, the forearm being placed midway between pronation and supination. No splint is used, as a rule. Esmarch used the splint shown in Fig. 271. The aim in treatment is to obtain a freely movable joint. Passive motion is begun in one week, at which time the patient gets up. The hand is carried in a sling for a time after healing of the wound is complete.

Excision of the Wrist-joint.—Bell states that, whatever method of excision is chosen, three cardinal rules must be borne in mind: (1) remove all the diseased bone, including the portions of the radius, ulna, carpus, and metacarpus which are covered with cartilage; (2) interfere with the tendons to the least possible degree; and (3) begin passive motion of the fingers very early. Many surgeons prefer the simple gouging away of diseased foci and the scraping of sinuses instead of a formal resection of the wrist, amputation being employed in severe cases or when scraping fails.

Fig. 271.—Esmarch's splint for the treatment of a limb after excision of the elbow-joint.
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after several trials. Formal excision is not frequently performed, and the results cannot be regarded as very favorable.

Lister's Open Method of Excision.—The instruments required in this operation are the same as those used for any resection. Break up adhesions as completely as possible by forcible movements. Apply a tourniquet or an Esmarch apparatus. The patient lies upon his back, the arm and the forearm being brought, from stage to stage, into the most desirable positions. Begin an incision over the middle of the dorsum of the radius, on a level with the styloid process; carry it downward in the direction of the inner edge of the articulation of the thumb with its metacarpal bone, and when the knife reaches the radial side of the second metacarpal bone alter the direction of the incision and carry it downward in the long axis of the metacarpal bone to about its middle (Fig. 268, A). This is known as the radial incision, and the only tendon divided is that of the extensor carpi radialis brevior muscle. The tissues upon the radial aspect of the incision are dissected up, the tendon of the extensor carpi radialis longior muscle is divided at its point of insertion (Bell), and all the soft structures are retracted outward, exposing the trapezium, which is cut off from the rest of the carpus, but which is left in place, as its removal at this stage endangers the radial artery (Barker). By extending the hand the tendons are loosened and the carpus is cleared in the direction of the ulnar border of the hand.

Another incision is made, starting upon the inner surface of the wrist, two inches above the articular surface of the ulna, and midway between the ulna and the flexor carpi ulnaris tendon. This incision, which is known as the ulnar incision, is carried down until it is opposite the middle of the fifth metacarpal bone in the palm (Fig. 268, B). "The dorsal lip of this incision is raised" (Bell), and the extensor carpi ulnaris tendon is divided and dissected from its depression, but is not separated from the integument. The extensor tendons are lifted; the ligaments upon the dorsum and sides of the wrist-joint are cut; the flexor tendons are raised from the carpal bones; the pisiform bone is cut from the carpus, but is not yet removed; and the unciform process of the unciform bone is cut with forceps. The anterior radiocarpal ligament is divided, the carpometacarpal articulations are cut through, and the carpus is pulled out with bone-forceps. The ends of the radius and ulna are forced out of the ulnar incision. All that portion of the ulna which is crusted with cartilage is to be removed, the saw-cut is to be oblique, and the base of the styloid process is to be left behind. A thin section is to be sawn from the radius, and the tendon-grooves are not to be impinged upon. The articular surface of the ulna is cut away with pliers (Bell). If foci of disease are discovered beyond these points, they are to be gouged out. The articular facets of the metacarpal bones are sawn off, and their articular facets are cut away by means of pliers. The trapezium is dissected out, the end of the first metacarpal bone is sawn off and its facet is cut away with pliers, and a portion of the pisiform bone is removed (the entire bone being removed if it be diseased). The wound is irrigated, vessels are tied, the radial incision is closed, the ulnar incision is partly closed, a drainage-tube is inserted by way of the ulnar incision, the wounds are dressed antisepically, and the Esmarch apparatus is taken off. The forearm and hand are placed upon a splint which immobilizes the wrist and leaves the fingers...
Excision of the Hip-joint

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semiflexed. Passive motion of the fingers is begun after thirty-six hours. The splint is worn for many months, until the wrist-joint is immobile and solid. Esmarch uses the splint shown in Fig. 272.

Excision of Metacarpal Bones and of Phalanges.—Excision of a metacarpal bone, except in cases of necrosis with the formation of large quantities of new bone, usually leaves a useless finger; hence amputation is preferred usually to excision. This rule does not apply to the metacarpal bone of the thumb, which is occasionally resected. The incision for this operation is made upon the dorsum, and is straight. Excision of the proximal phalanx of the thumb is sometimes performed. Excision for disease is rarely performed upon the finger-joints, amputation being preferred, though the operation is sometimes undertaken for compound dislocation. In the metacarpophalangeal joint of the thumb excision, if it can be performed, is preferred to amputation. The incision for resection of this joint is placed upon the radial aspect.

Excision of the Hip-joint.—Some surgeons advocate this operation; others, notably Marsh, are emphatically opposed to it. Excision should be performed in the early stage of tuberculous disease if less radical treatment has failed. In this stage the usual position of the limb is one of flexion, abduction, and eversion. In cases of long duration, especially where dislocation exists, excision is an easy and a comparatively safe operation; in recent cases it is difficult and carries with it decided dangers, but the peril of delay may be greater than the peril of an early resection. In cases of hip disease with involvement of the acetabulum the mortality is 50 per cent., whether operation is or is not attempted. Excision is performed especially for tuberculous disease and for gunshot-injuries. The instruments required are those used for other excisions.

Operation by Anterior Incision (Fig. 273) (Barker’s Operation).—In this operation the patient is supine, with the thighs extended as thoroughly as circumstances permit. The surgeon stands to the right of the patient. An
incision is begun half an inch below and half an inch external to the anterior superior iliac spine, and it is carried downward and a little inward for about three inches (Fig. 273, D). If dislocation exists, the incision must not be so long. This incision is carried at once deeply between the muscles, and the capsule of the joint is opened. The head of the bone is removed. All tuberculous foci must be scraped away, and the flushing gouge is used upon tuberculous areas of the acetabulum. All sinuses should be thoroughly scraped. Bleeding is arrested, the wound is irrigated with normal salt solution, mopped out with chlorid of zinc solution, and dusted with iodoform. A drainage-tube is inserted at the lower angle of the incision, and the upper portion of the cut is closed. The wound is dressed antiseptically. Extension is made with the extension apparatus until healing has obtained good headway, when a double Thomas’s splint is applied, so that the patient can be taken out daily in the air and sunlight. As a rule, rigid ankylosis results from resection of the hip, but occasionally a joint results with a small range of movement.

Operation by Lateral Incision (Langenbeck’s Operation).—In this operation a straight incision two inches long is made in the direction of the axis of the femur, and passing downward from the apex of the great trochanter. From the beginning of this incision a curved incision is carried toward the head of the bone, the convexity of the curve being backward (Fig. 267, A). Bell advises the use of the saw after bringing the head of the bone into the wound by abduction and eversion of the thigh. Barker applies the saw with the bone in situ, and strongly opposes wrenching the bone out of the incision, because of the danger of peeling off the periosteum, which peeling, if it takes place, favors necrosis.

Incision of Gross.—In Gross’s operation a semilunar flap is made with the convexity backward (Fig. 270, E).

Excision of the Knee-joint.—In this operation a complete excision should be performed, and the patella ought to be removed. This operation is performed for tuberculous disease, some compound fractures and compound dislocations, and some cases of angular ankylosis, but it is rarely employed for gunshot-injuries, amputation being usually preferable. The instruments required are the same as those for the shoulder, plus Butcher’s saw.

Operation by Anterior Semilunar Flap.—The patient lies upon his back, and the joint, if not ankylosed in extension, should be semiflexed. The surgeon stands to the right side. An incision is made which at once opens the joint. The incision begins at one condyle and reaches the other condyle by a curve which passes through the ligamentum patellæ midway between the tuberosity of the tibia and the inferior margin of the patella (Fig. 269, B). The flap is dissected up, the knee is thrown into forced flexion, the lateral ligaments and crucial ligaments are cut, and the end of the femur is well cleared. The blade of Butcher’s saw is passed beneath the bone, which is sawn from below upward (Ashhurst). The end of the tibia is cleared and a portion is sawn off. If, after sawing, diseased foci are discovered, another section can be sawn off or
the foci can be gouged away. Ashhurst, who has had a vast experience with this operation, insists that in sawing through the femur the natural obliquity of the bone must be borne in mind and the section must be made in "a line parallel to that of the free surface of the condyles." If the section is made transverse to the axis of the femur, "the limb, after adjustment, will be found to be markedly bowed outward." The same surgeon says that the epiphyseal line is somewhat higher on the front than it is on the back of the femur, and in consequence the following rule is formulated for section of the condyles: the section of the condyles should be "in a plane which, as regards the axis of the femur, is oblique from behind forward, from below upward, and from within outward." Ashhurst advocates section of the tibia "in a plane transverse to the long axis of the bone, with a slight anteroposterior obliquity, so as to correspond with that of the section of the condyles," and he further says that the patella must be removed, whether it is diseased or not, and quotes Périère's observations to the effect that excision of the patella diminishes the risk of death one-third, and its retention doubles the probability of an amputation becoming necessary in the future.

Fig. 274.—Watson’s plaster-of-Paris swing-splint.

After removing the patella the diseased synovial membrane is clipped away with scissors and all sinuses and diseased territories are well curetted. The posterior ligament of the joint is not removed unless it is diseased; its retention prevents displacement and guards the popliteal space. In children the fragments should be wired together; in adults this need not be done. After hemostasis, irrigate, dust with iodoform, insert a drainage-tube, suture, dress antiseptically, and adjust the limb upon Price's splint or Ashhurst's bracketed wire splint. In some cases tenotomy is required to permit extension. Instead of the bracketed splint, a long fracture-box may be used. If the femur tends to project anteriorly, use an anterior splint. If there be a tendency to outward bowing, adopt Ashhurst's expedient of carrying a strip of adhesive plaster around the outside of the limb and fastening it to the inner side of the splint. The splint is kept on until bony union is complete, as in this operation a movable joint is never sought. Many surgeons use a plaster-of-Paris splint, which is employed until the parts have become firm and solid (Fig. 274).

Excision of the Ankle-joint.—This operation is performed chiefly for gunshot-wounds, compound dislocations, and in some cases of tuberculous
Excision of the ankle is an operation which is seldom performed. The instruments used are the same as those employed for any resection.

Operation (Hancock's Method).—In this operation the patient lies upon his back, the foot rests upon its inner side, and the surgeon stands to the outer side of the damaged limb. Begin an incision just behind and two inches above the external malleolus, and carry it across the front of the joint to a corresponding point above and behind the internal malleolus (Fig. 267, b); this incision goes only through the skin, and the flap thus marked out is reflected. "Cut down upon the external malleolus, carrying the knife close to the edge of the bone both behind and below the process, dislodge the peronei tendons, and divide the external lateral ligaments" (Joseph Bell). Cut the fibula one inch above the malleolus by means of pliers; divide the tibiofibular ligament; turn the foot upon its outer side; dissect from their habitat back of the inner malleolus the tendons of the posterior tibial and the common flexor of the toes; carry the knife around the inner malleolus, close to the bony edge; separate the internal lateral ligament, and dislocate the lower end of the tibia through the wound by turning the sole of the foot downward; saw off the lower end of the tibia and the articular process of the astragalus, sawing away from the tendo Achillis, and remove the fragments with bone forceps. Cut away diseased synovial membrane, and curet all sinuses and tuberculous areas. Arrest bleeding, irrigate, and drain. Sew up the wound, insert a tube at the outer angle, and cause it to emerge at the inner angle. Apply antiseptic dressings, and put up the foot in fixed dressing or in splints at a right angle to the leg (Fig. 275). In Langenbeck's operation the excision is subperiosteal. If, in an excision of the ankle-joint, the astragalus is found extensively diseased, remove the entire bone.

Excision of the Os Calcis.—In caries limited to the os calcis most surgeons prefer to gouge away the dead bone, leaving the periosteum and, if possible, a shell of healthy bone, and draining thoroughly. Others advocate excision in some cases. Extensive disease limited purely to the os calcis is rare, and most surgeons advise gouging for limited caries, and Syme's amputation in the event of the disease extending beyond the periosteum or reaching adjacent bones.

Operation by Subperiosteal Method.—In this operation the position as-
Assumed by the patient is supine with the leg extended and the foot resting on its inner side. The incision, which cuts the tendo Achillis and reaches the bone at once, is begun at the upper border of the os calcis and the inner margin of the tendo Achillis, and is taken outward and horizontally forward to a point in front of the calcaneocuboid articulation (Fig. 270, r). A vertical incision is begun near the forward termination of the initial incision, is carried across the outer edge and plantar surface of the foot, and terminates at the external margin of the inner surface of the os calcis. Some surgeons carry the vertical incision a little upward, toward the dorsum. The periosteum is entirely stripped with an elevator, the os calcis is removed, the cavity is packed with iodoform gauze, the wound is stitched, a drain is inserted posteriorly, and the foot is dressed antiseptically, is placed at a right angle to the leg, and plaster-of-Paris is applied, trap-doors being cut for drainage.

Astragalectomy, or excision of the astragalus, is seldom performed. Astragalectomy is employed occasionally for relapsed and inveterate cases of club-foot. The indications are pointed out by Willard ("International Clinics," vol. iii, 12th series): "(1) Adults with great bony deformity; (2) neglected children of five to fifteen years, who have markedly distorted their tarsi by locomotion; (3) relapsed cases which have resisted the milder forms of operation, or which have been neglected by parents after previous operation; (4) only occasionally, young children in whom from infancy the bones of the foot have been exceedingly rigid and unyielding, and where there is practically but little motion either at the ankle-joint or in the tarsus."

Operation by the Subperiosteal Plan.—Barker advises an incision going at once to the bone, from the “tip of the external malleolus forward and a little inward, curving toward the dorsum of the foot.” The foot is extended and turned inward, the periosteum is lifted, the astragalus is removed, and the wound is treated and the foot is dressed as is done in excision of the os calcis.

Excision of the Metatarsophalangeal Articulation of the Great Toe.—In this operation make a lateral incision and cut off or saw off the proximal end of the first phalanx and the distal third of the first metatarsal bone.

Excision of the Metatarsal Bone of the Great Toe (Butcher’s Method).—In this operation a lateral straight incision is made, the periosteum is elevated, and the shaft is swn from each extremity and removed.

Excision of the clavicle may be required for dislocation, caries, necrosis, gunshot-wound, tumor of this bone, as a preliminary to ligation of the artery and vein in certain cases of amputation at the shoulder-joint, or in cases of removal of the entire upper extremity. In excision of the clavicle the position of the patient is the same as that for ligation of the third part of the subclavian artery (page 343). An incision is made down to the bone, from the sternoclavicular joint to the acromioclavicular articulation. If the case is suitable, the periosteum is stripped and the bone is swn and removed; if not, the bone is swn and each half is separately disarticulated. The wound is sutured and dressed, and the limb is put up in a Velpeau bandage.

Excision of the Scapula.—Complete excision of the scapula is usually performed for tumors. Partial excision requires no detailed description.
In excision of the scapula the patient lies upon his sound side. Treves suggests the following incisions: one outside the vertebral border of the scapula, from its superior to its inferior angle; another from over the acromioclavicular joint, along the acromion process and spine of the scapula, to meet the first incision. Syme used an incision carried transversely inward from the acromion process to the vertebral border of the scapula, and another cut directly downward from the center of the first incision (Fig. 270, c). In the method of Treves the upper flap is reflected and the trapezius muscle is divided; the lower flap is reflected and the deltoid muscle is divided. The patient’s hand is placed on the sound shoulder; the muscles of the vertebral border are divided, the posterior scapular artery is tied, and while the vertebral border of the scapula is pulled toward the surgeon the serratus magnus muscle is cut, the upper border of the shoulder-blade is cleared, and the suprascapular artery is tied. The hand is now brought down to the side; the acromioclavicular joint is disarticulated; the conoid and trapezoid ligaments are divided; the muscles of the coracoid process are cut; the capsule is incised, with the supraspinatus and infraspinatus, the subscapularis, and the scapular origins of the biceps and triceps muscles; and finally the teres major and minor muscles are divided, the subscapular artery is tied, and the bone is removed. The wound is stitched, a drain is introduced, and antiseptic dressings are applied. The patient lies upon his back until healing is well under way, when the arm is placed in a sling. The drainage-tube may be removed in twenty-four hours.

Excision of a Rib.—In caries the gouge and rongeur may remove the disease. In other cases excision is performed. In this operation the patient lies upon his sound side unless the operation is performed for empyema, in which case he lies on his back or only partly on the sound side. (See Emphyema, Operation for.) The surgeon faces the patient. Make an incision down to the bone, in the long axis of the rib. The periosteum, if not diseased, is lifted from the bone, and the intercostal artery is lifted out of the way with the periosteum and is thus saved from being cut. After dividing the bone beyond the limits of disease, remove it. During the sawing a metal retractor is held beneath the rib, between the rib and the periosteum. It is better to saw it than cut it with ordinary biting forceps, because the latter splinter the bone. The author usually uses a forceps known as a costotome, which cuts the rib without splintering. If the periosteum is diseased, remove it after tying the intercostal artery. It should be removed in a case of empyema, otherwise bone-formation may interfere with drainage. In empyema, after removing the periosteum, open into the pleura cavity, allow pus to flow out slowly, remove fibrinous masses, employ a finger to feel if there are adhesions and if the lung will probably expand, and insert a drainage-tube. In resection for rib disease curet sinuses and pack with iodoform gauze for some days. Sew up the wound except at one end. Dress antiseptically and apply a binder. (See Operations upon the Chest and Estlander’s Operation.)

Complete Excision of One-half of the Upper Jaw.—The whole upper jaw has been removed, but in what follows only resection of one-half the jaw will be described. This operation is performed for malignant tumors of the superior maxillary bone or its antrum. Up to 1826, at which time

* Treves’s "Manual of Operative Surgery."
Lizars, of Edinburgh, suggested the operation, tumors of the antrum were treated by scraping them away with a sharp spoon. Gensoul, of Lyons, in 1827 performed the first operation for resection of the upper jaw. This operation is not justifiable, except as a palliative measure, if the orbit is invaded, if the skin and subcutaneous tissues are infiltrated, or if the disease extends widely beyond the superior maxillary and palate bones. The instruments required are a mouth-gag; scalpels; strong scissors; tracheotomy tubes; dissecting, toothed, and hemostatic forceps; bone-cutting, lion-jaw, sequestrum and tooth-extracting forceps; a volsella; a narrow-bladed saw; a chisel and mallet; a periosteum-elevator; a spatula or metal retractor; Paquelin's cautery; sponges which are tied to sticks; needles, curved and straight; silk and catgut ligatures; silkworm sutures; large curved needles; and Horsley's antiseptic bone-wax.

**Preliminary Closure of the External Carotid Artery.** Some surgeons ligate the external carotid artery or compress it temporarily. In a number of excisions of the upper jaw I have always found the hemorrhage readily controllable as soon as the bone is removed, and have never felt it necessary to resort to preliminary ligation or compression. A number of surgeons have set forth contrary views (Pirogoff, Madelung, Schlatter). Crile is a warm advocate of temporary closure, and employs a clamp for this purpose.

**Operation by Median Incision.**—The patient, whose face has been shaved, is placed in the Trendelenburg position, thus avoiding the possible need of instant tracheotomy. The surgeon stands to the right side of, and faces, the patient. The incisor tooth on the diseased side is pulled out. The incision, which is known as Weber's incision (Fig. 276, line A B), is begun half an inch below the inner canthus of the eye, and is carried along the side of the nose, around the ala of the nose, by the margin of the nostril, and through the middle of the lip. While the lip is being incised the assistant arrests hemorrhage by grasping the corners of the mouth, and after the lip is divided the coronary arteries are at once ligated. Some operators approach the mucous membrane cautiously and ligate the vessels before opening the cavity of the mouth. The upper portion of the wound having been compressed by another assistant during these manipulations, pressure is now removed and bleeding points are ligated. Another incision is now carried outward from the beginning of the first incision, along
the orbital margin to well over the malar bone. The flap is lifted from the periosteum, and the bleeding from the infraorbital artery and the small vessels is restrained by pressure. The nasal cartilage is separated from the bone, and the nasal process of the superior maxillary is sawn (line A B, Fig. 277). The orbital periosteum is lifted up, and the orbital plate is cut with forceps from the saw-cut in the superior maxillary bone to the sphenomaxillary fissure (line B C, Fig. 277). The malar bone is sawn or is bitten through about its center, the cut running into the sphenomaxillary fissure and taking a downward and outward direction (line C D, Fig. 277). The soft parts covering the hard palate are incised in the median line, a corresponding incision is made along the floor of the nose near the septum, and the soft palate is separated from the hard palate by a transverse cut. The saw is introduced through the nose, and the palate is sawn (line E, Fig. 277). The upper jaw-bone is grasped with Fergusson's lion-jaw forceps and removed, the removal being aided by the use of the scissors and bone-cutters; the latter are used to separate the upper jaw from the pterygoid process (Treves). Every vessel that can be seen is tied, and severe bleeding from bone is arrested by antiseptic wax. Oozing is controlled by hot water and pressure or by Paquelin's cautery. Examine carefully to see if all the diseased area is removed; if it is not, use the gouge, scissors, chisel, and saw until healthy tissue is reached. The wound is packed with iodoform gauze, and the end of the strip is so placed as to be accessible through the mouth. The wound is sutured (the mucous membrane of the lip must be stitched, as well as the skin) and is dressed antiseptically (the eye being protected by aseptic gauze), and a crossed bandage of the angle of the jaw is applied.

Excision of One-half of the Lower Jaw.—In some rare instances the entire inferior maxillary bone is removed. The lesions necessitating removal of the lower jaw are of the same nature as cause us to remove the upper jaw. The instruments required for removal of the lower jaw are those used for excision of the upper jaw, plus a metacarpal saw (having a movable back).

In this operation the patient is placed in the same position as for excision of the upper jaw, the chin having been previously shaved. A vertical cut is made through the chin-tissue, starting below the margin of the lip and reaching to below the border of the jaw (c d, Fig. 276). From the point d an incision is carried outward below the border of the jaw and then back of the ramus, as shown in the line d e (Fig. 276). Treves's advice is to carry this incision down to the bone, except at the line of the facial artery, at which point it must go through the skin only. The facial artery is now to be sought for, tied in two places, and divided. The periosteum is lifted from the external surface of the bone, from the symphysis outward. Hemorrhage is arrested. The buccal mucous membrane is cut from the alveolus. A lateral incisor tooth is pulled, and the bone is sown in the line e (Fig. 277). The bone is grasped in a lion-jaw forceps and is drawn outward. The mylohyoid insertion is cut; the internal pterygoid muscle is cut or the periosteum at this spot is lifted; the inferior dental artery is cut and tied; the jaw is pulled down; the insertion of the temporal muscle upon the coronoid process is cut away; and the external pterygoid muscle is divided. The capsule of the joint is opened, and the bone is separated from the ligaments which still
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hold it in place. Bleeding is arrested, the wound is sutured, a tube is introduced in the posterior portion of the wound and retained for twenty-four hours, and antiseptic dressings and a Gibson or a Barton bandage are applied. Partial excisions of the alveolus may be performed through the mouth by means of chisels and rongeur forceps, and Wyeth has thus removed half of the jaw; but if any considerable part of the body of the jaw is to be removed, it is usually best to make an incision below the inferior maxillary.

Barker's Operation for Dislocation of the Semilunar Cartilages of the Knee-joint.*—Begin the incision over the ligament of the patella, half an inch above the articular surface of the tibia, and carry it in a curve downward and outward to the anterior edge of the internal lateral ligament. The periosteum should be divided by the cut. This incision forms a flap the lower edge of which is half an inch below the border of the articular surface of the tibia. The flap is lifted until the cartilage is seen “under the attachment of the meniscus, which if partially attached will rise with the flap until its under surface is seen.” If partially torn anteriorly it is stitched to periosteum by a few silk sutures. The periosteum is then stitched in place, no drain is used, the joint is immobilized, and for one week ice is kept upon the part. If the meniscus is found completely separated and curled up, it may, if the injury was recent, be reduced. If the injury was old and if the cartilage is shrunken, it should be completely cut away (Barker).

Operation for Congenital Dislocation of Hip.—Lorenz's Bloodless Method of Reduction.—The method of reducing by manipulation a congenital dislocation of the hip was devised by Paci and modified and improved by Lorenz. It has long been known that reduction is easy at birth, because an acetabulum, though probably a shallow one, exists and the head of the bone is not firmly held in its new situation. In an older child the problem is far more difficult, because, even if reduction is effected, the acetabulum may be extremely shallow or absent, and redislocation may readily occur. Lorenz aims to effect thorough reduction and then fixes the limb in abduction for months, so that the acetabulum will deepen and the bone will become firm in its proper socket. This operation is rarely successful in children over six years of age. The child is anesthetized and an attempt is made to draw the femoral head on to a line with the acetabulum. If the child has never walked, this is readily accomplished. If it has walked, the procedure may be very difficult, and it may be necessary to make extension with a fillet fastened above the knee, and counter-extension with a screw and a perineal band. The drawing down of the head is made easier by stretching and massaging the adductor muscles. The next step is to strongly flex the thigh, rotate it a trifle internally, and then abduct it while flexion is maintained. This causes the head of the femur to pass around the posterior margin of the acetabulum and frequently produces reduction. “Full abduction being kept up, the thigh is rotated out, thus forcing the head of the femur more firmly into the socket” (see the description of the Lorenz method in J. Jackson Clarke's “Orthopaedic Surgery”). The strongly abducted limb is put up in plaster-of-Paris. In about three months the plaster is removed, the abduction is diminished, the plaster is reapplied and is retained for another three months. During the continuance of immobilization of the hip, the child

walks about, with the knees bent. When the plaster is finally removed, manipulation, massage, and exercise strengthen the muscles and give freedom to the joint. In a double dislocation one joint can be cured before the other is operated upon, or both may be operated upon at the same séance. In double dislocation plaster must be worn more than six months. The Lorenz operation is safe when applied to very young children, but has elements of danger which increase with the years of the subject. A patient may suffer grave lacerations of muscles and ligaments, and even vessels and nerves. Death may result from shock, and extensive deep-seated hemorrhage may occur. In fact, it is a mistake to call it a bloodless method. The blood flows, though we do not see it. An untrained man may do fearful mischief by this operation, and it should only be attempted by a very skilful manipulator and upon properly selected cases, when it is a very successful procedure. I am satisfied that, except in the case of a very young child, in whom reduction is easy, one who performs the Lorenz operation should be something more than skilful and experienced. He should be physically strong, so that traction and abduction will be powerful and steady. A weak man will jerk, will throw his weight upon the part, and will be apt to tear structures instead of stretching them. Sudden forcible movements are apt to break the bone.

Hoffa's Operation.—The instruments used are the same as for a resection. Make the external incision of Langenbeck to open the joint (page 544). The capsule is incised at its insertion into the neck, and the periosteum and muscles are lifted from the great trochanter. Hoffa claims that in children less than five years of age the head of the bone can be readily replaced into the acetabulum by flexing the thigh and making direct pressure upon the head of the bone. After replacing the femoral head it is held in place while an assistant extends the leg in order to stretch the muscles. In children over five years of age cut the muscles which spring from the ischial tuberosity and also the adductors with a tenotome; cut the fascia lata and muscles which arise from the anterior superior iliac spine by incision; open the joint and liberate the head of the bone; remove the ligamentum teres; scrape out the acetabulum, removing “cartilage, fat, and considerable spongy tissue” (Tubby); and replace the head of the bone in the acetabulum. The limb is maintained in inversion, abduction, and extension for several weeks, when it is straightened. Massage and passive motion are begun in the fifth week. The patient now gets about, wearing an apparatus for many weeks. This apparatus permits the head of the bone to move in the socket, but prevents redislocation.

Lorenz's Operation.—This is a modification of Hoffa's. The muscles inserted into the greater and the lesser trochanter are not cut; the sartorius, the hamstrings, and the external portion of the fascia lata are cut (Tubby). The incision of Lorenz is longitudinally from the anterior superior spine. Another incision is carried inward from this at the level of the lesser trochanter. The capsule is opened by a crucial cut; the acetabulum is enlarged; the head of the bone, if it remains, is inserted into the acetabulum; if there is no true head, a new one is formed and inserted into the cavity. The limb is immobilized in a position of moderate abduction. Massage and passive motion are begun in the fifth week, and are continued for months.*

*I have drawn upon the very lucid description of these operations in A. H. Tubby's treatise upon "Deformities."