Modern Surgery - Chapter 19. Diseases and Injuries of the Bones and Joints - Luxations or Dislocations

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and they result from enlargement and chondrification of the villi of the synovial membrane. Some loose bodies are broken-off osteophytes; some arise from blood-clots; some by projection or herniation of the synovial membrane, which protrusion is broken off; others are detached fringes of tuberculous synovial membrane. Traumatism is the usual exciting cause. Loose cartilages are commonest in adult men.

**Symptoms.**—Many small bodies give rise to no symptoms other than those of synovitis. A large body produces pain and interferes with joint-function. The joint is weak and a little swollen, and the patient can feel the body and often can push it into a superficial area of the joint, where it may be felt by the surgeon. From time to time the body may get caught, thus suddenly locking the joint and producing intense and sickening pain, extension and flexion being impossible until the body slips out. This accident is followed by inflammation and effusion.

**Treatment.**—To relieve locking, employ forced flexion and sudden extension. Cure can be obtained only by operation. Asepticize with the utmost care. Let the patient bring the foreign body to a point where it can be felt; the surgeon then fixes it with a pin or holds it with the fingers, ether being given or cocain being used. The joint is now opened, the foreign body extracted, and an exploration made to see that no other bodies are present. The wound is sutured and the leg is placed upon a splint. Asepsis must be most rigid. The operation does not cure the causative lesion, and these bodies are apt to form again.

4. **Luxations or Dislocations.**

A dislocation is the persistent separation from each other, partially or completely, of two articular surfaces. A self-reduced dislocation is called a sprain (Douglas Graham). There are three forms of dislocations: (1) traumatic; (2) spontaneous or pathological; (3) congenital.

1. **Traumatic dislocations** are due to injury. They are divided into—complete dislocation, in which the two articular surfaces are entirely separated and the ligaments are torn; incomplete or partial dislocation, in which the two articular surfaces are not completely separated and the ligaments are rarely lacerated; simple dislocation, in which there is no wound leading from the surface to the articulation; compound dislocation, in which a wound leads from the surface to the joint; complicated dislocation, in which, besides the dislocation, there is a fracture, extensive damage of the soft parts, an opening which makes the case compound, or damage of a nerve or blood-vessel; primitive or primary dislocation, in which the bones remain as originally displaced; secondary dislocation, in which the dislocated bone assumes a new position; for instance, a subglenoid luxation of the humerus is primary, and it may become secondarily a subcoracoid luxation because of muscular contraction or attempts at reduction; recent dislocation, in which the displaced bone is not firmly fastened by tissue-changes in its new situation, and its old socket is not obliterated; old dislocation, in which the displaced bone is firmly fastened by tissue-changes in its new habitat, and the old socket is to a great extent obliterated (whether a dislocation is old or new depends on the state of the parts rather than on the time which has elapsed since the accident); double dislocation, in which corresponding bones on each side are dislocated; single dislocation, in which only one
joint is dislocated; *unilateral* dislocation, in which one articulation of one bone is out of place; *bilateral* dislocation, in which symmetrical articulations are dislocated; and *relapsing* or *habitual* dislocation, which recurs constantly from slight force because of relaxed ligaments or lack of complete repair after the ligamentous rupture of a first dislocation.

2. Spontaneous, Pathological, or Consecutive Dislocations.—Spontaneous dislocation arises from such very slight force that the cause may not be identified, and it acts on a joint rendered lax by disease. It may arise in the course of chronic synovitis, tuberculous joint-disease, or rheumatoid arthritis. In typhoid fever spontaneous dislocation is not uncommon. The hip-joint is most often the one attacked. *Dislocation in typhoid fever* generally occurs at the hip-joint, follows a severe joint-inflammation, is usually upon the dorsum of the ilium, and is frequently not noticed until convalescence. If a typhoid dislocation is seen early, reduction is easily effected, but if seen late is impossible. The treatment for irreducible typhoid dislocation is the same as for any other irreducible dislocation. In Charcot’s joint a spontaneous dislocation will occur sooner or later.

3. Congenital Dislocations.—A congenital dislocation is due to a congenital joint-malformation which renders it impossible for the bone to maintain a normal position, or is due to external violence during the period of uterine gestation. Congenital dislocations should not be confounded with dislocations produced during delivery. The hip is the joint most often involved. The shoulder suffers occasionally. Lannelongue maintains that congenital dislocation of the hip is due to atrophy of the muscles and of the acetabulum following spinal-cord disease. Verneuil thinks the dislocation is paralytic. Broca says that in view of the fact that the head of the bone is larger than the cavity in which it belongs, it is useless to attempt reduction by manipulation or extension. Lorenz and Hoffa have each devised an operation for this condition (pages 551, 552). Congenital dislocation of the shoulder requires incision, possibly excision, or the paring down of the head to fit the glenoid cavity (Phelps).

Traumatic Dislocations.—In the succeeding pages the traumatic form of dislocations will be particularly considered.

The *causes* of traumatic dislocations are divided into *predisposing* and *exciting*.

**Predisposing causes** are: (1) *age*; dislocations are commonest in middle life, the usual lesion of the young being green-stick fracture, and that of the old being fracture; dislocations of the radius are not uncommon in youth; (2) *muscular development*; dislocations being commonest in those with powerful muscles; (3) *sex*, males being more predisposed than females, because of their occupations and muscular strength; (4) *occupation* predisposes as a cause according as it demands the employment of muscular force, as in the carrying of burdens; (5) *nature of the joint*, ball-and-socket joints being more liable to luxation than are ginglymoid joints, because of their wide range of motion; (6) *joint-disease* predisposes by relaxing the ligaments; (7) *situation of the joint*, some joints being more exposed to injury than others.

**Exciting causes** are divided into (1) *external violence* and (2) *muscular action*. *External violence* may be *direct*, as when a blow upon one of the bones forces it directly away from the other; or it may be *indirect*, as when a blow at a
diistant part of a bone transmits force to its end and drives the bone out of its
socket. Muscular action is a cause when sudden and violent muscular con-
traction occurs during the maintenance of a position of the joint which gives the
muscles full sway, and throws the head of the bone against the weakest part of
its retaining ligaments.

Pathological Conditions.—In a recent complete traumatic dislocation
the ligaments are damaged, and may perhaps show extensive laceration, or may
show only a buttonhole laceration through which a bone projects. External
force produces much laceration and little stretching of the ligaments; muscular
action produces little laceration and much stretching of the ligaments. In
some cases of dislocation due to external violence the structures about the joint
are bruised or otherwise damaged; the old socket is filled with blood, and the
bone in its new situation lies in a bloody area. Large vessels and nerves are
rarely torn, though they may be compressed.

If a dislocation is not soon reduced, inflammation arises in the old joint and
about the displaced bone, and the whole area is glued together, first by coagu-
lated exudate, and finally by fibrous tissue. After a time, in ball-and-socket
joints, the old socket fills with fibrous tissue, contracts, becomes irregular, and
may even be obliterated; the head of the dislocated bone is altered in shape, its
cartilage is destroyed or converted into fibrous tissue, and the pressure of the
head of the bone forms a hollow in its new situation, which hollow becomes
surrounded by fibrous tissue or even by bone. A new joint may form, the
surrounding tissue becoming a compact capsule, and a bursa forming between
the head of the bone and its new socket. In a dislocated hinge-joint the ends of
the bone alter greatly in shape and their cartilage is converted into fibrous tis-
sue. In an unreduced dislocation the muscles shorten or lengthen or undergo
atrophy or fatty degeneration, as the case may be. An unreduced dislocation
of a ball-and-socket joint may give a fairly movable new joint, but an unre-
duced dislocation of a hinge-joint rarely allows of much motion.

General Symptoms of Traumatic Dislocations.—In general, traumatic
dislocations are indicated (1) by pain of a sickening, nauseating character; (2)
by rigidity, voluntary motion being impossible except to a slight extent in the
direction of the deformity. (For instance, in dislocation of the inferior maxil-
lary the jaw can be opened a little more, but it cannot be closed.) This rigidity
brings about loss of function. When the surgeon attempts to move the joint he
finds it very rigid; (3) by change in the shape of the joint (as flattening of the
shoulder after dislocation of the humerus); (4) by alteration in the mutual re-
lations of bony prominences about a joint (as the alteration of the relation be-
tween the olecranon and humeral condyles in dislocation of the elbow back-
ward); (5) by feeling the displaced bone in its new situation; (6) by missing the
head of the bone from its proper situation; (7) by alteration in the length of the
limb (in dislocation of the femur into the thyroid foramen the limb is length-
ened, but in dislocation onto the dorsum of the ilium it is shortened); and (8) by
alteration in the axis of the bone (in dislocation upon the dorsum of the ilium
the axis of the injured thigh would, if prolonged, pass through the lower third
of the sound thigh); (9) by seeing the dislocation with a fluoroscope or looking
at a skiagraph of it.

Diagnosis of Traumatic Dislocations.—A dislocation may be mistaken
for a fracture. In dislocation there is rigidity, in fracture there is preternatural
mobility; in dislocation there is no true crepitus (may get tendon- or joint-crepitus), in fracture there usually is crepitus; in dislocation the deformity does not tend to recur after reduction, in fracture it does recur after extension is relaxed. In a sprain the movements of the joint are only limited, not abolished, by the almost complete rigidity encountered in dislocation. The change which a sprain may cause in the shape of a joint is due to effusion or to bleeding; there is no alteration in the relation of the bony prominences to one another; there is no notable alteration in the length of the limb (a slight increase in length may arise from joint-effusion, or the head of the bone may subsequently be absorbed, and thus produce shortening after some weeks); there is no alteration in the axis of the bone; the bony head is not felt in a new position, and it is found in its normal place. Always remember that a fracture may exist with a dislocation. In any doubtful case—in fact, in most cases—give ether, for a dislocation should be reduced while the patient is anesthetized (except in dislocation of the jaw, of the fingers, of the carpus, etc.). In some cases swelling renders the diagnosis difficult or impossible. Always compare the injured joint with the corresponding joint of the sound side. The x-rays constitute a valuable aid to diagnosis.

**Treatment of Traumatic Dislocations.**—**Recent Simple Dislocations.**—Reduce simple dislocations under ether, as a rule. Try manipulation, a procedure which seeks to make the bone retrace its own pathway. If this procedure fails, employ extension and counter-extension. If considerable force is needed, an assistant makes counter-extension, and the surgeon fastens to the extremity a clove-hitch, which he ties about his waist, and thus secures powerful extension. Counter-extension may be obtained by bands, or, in some instances, by the foot of the surgeon. The clove-hitch is used because it will not tighten by traction; a tightening band would lacerate the soft parts (Fig. 240). If great power is needed, compound pulleys may be employed, such as the Jarvis adjuster or some similar appliance, but at the present day pulleys are rarely used (see page 504). If these means fail, cut down upon the bone and restore it to position; operation is much safer than is the application of great force. After reducing a dislocation, immobilize the joint for a time, which varies for different joints, and for the first few days combat swelling and inflammation by rest of the part and the use of evaporating lotions or an ice-bag. If there exists a fracture of the dislocated bone, apply splints and then try to reduce by manipulations, grasping the limb and the splints with one hand below and, if possible, with the other hand above the seat of the fracture. Allis believes that a dislocation can be reduced even when a fracture exists. It is possible to pull the dislocated head down to the joint, because a portion of periosteum and possibly tendinous material and muscle still hold the two fragments as a strap might unite two sticks. The head can be forced into place by the fingers while traction is being made. If the fracture is near the joint and the fragments cannot be fixed, try to reduce the dislocation, first striving to press the bone into place. This attempt can be greatly aided by traction upon the lower fragment. In some cases with fracture reduction can be much aided by making a small incision, screwing a gimlet into the head of the bone, and using this tool as a handle. McBurney incises, drills a hole in each bone, inserts hooks into them, and pulls the dislocated bone into position (Figs. 159, 160).

When the dislocation has been reduced, the bone fragments should be wired.
Compound Traumatic Dislocations.—The opening in the soft parts may be due to external violence or to projection of a bone. Compound dislocations are very serious. Hinge-joints are more liable to these injuries than are ball-and-socket joints. Many cases require excision, some amputation; one that does not demand excision or amputation should be treated by sterilizing the parts, restoring the dislocated bone, making a counter-opening, draining, dressing antiseptically, and immobilizing. Considerable ankylosis generally ensues, except sometimes in the small joints. It is scarcely ever necessary to cut away any portion of the protruding bone to effect reduction. If a joint is badly splintered, or if the soft parts are extensively damaged, it may be necessary to excise or amputate; if the main vessels or the nerves are seriously injured, or if the patient is so old or so feeble that it is perilous to force him to combat a long illness, amputate.

Old Traumatic Dislocations.—The problem always presented in an old dislocation is, Shall reduction be tried, or shall the bones be let alone? Sir Astley Cooper laid down this rule: "Do not attempt to reduce a shoulder-dislocation after three months, nor a hip-dislocation after two months"; but this rule was put forth before the days of ether. Do not select any fixed period of time to determine what action is advisable. In dislocation of a ball-and-socket joint considerable motion may become possible and a new joint may form. If movement does not produce pain, a useful new joint may be obtained by the persistent employment of active and passive movements; if movement of the limb does produce pain, enough motion will not be attempted by the patient to produce a useful joint. In the former case try to obtain a useful new joint, and in the latter case try to reduce the old dislocation. Always remember that dislocations of a hinge-joint, if left unreduced, will never eventuate in a useful new joint.

In trying to reduce an old dislocation, give ether, make movement to break up adhesions, and persist in making these motions until the head of the bone is felt to move; then try at once to reduce by manipulation or extension, and counter-extension, not waiting for two days, as some suggest. If the head of the bone cannot be made to move, the Dieffenbach plan may be followed, which is to cut the tense restraining bands with a tenotome. Lord Lister, being much impressed with the danger inevitably linked with forcibly dragging old dislocations into place, prefers to cut down and restore the bone, employing, of course, the strictest asepsis, and surgeons in general have adopted this view. In some old dislocations excision of the head of the bone is the proper operation.

Special Traumatic Dislocations.—Lower Jaw.—A dislocation of the lower jaw, when there is no fracture, is almost invariably forward. Backward dislocation without fracture is extremely rare, and some have maintained that it cannot occur. Croker King reported a case in 1858. Theim has observed it seven times in five women. The condyle passes under the lower surface of the auditory canal.* The common dislocation is forward, and this is the form meant when we simply speak of dislocation of the jaw. There are two forms of forward dislocation—the unilateral, which is rare, and the bilateral, which is common. Dislocations of the jaw are commonest in women and during middle life. When the mouth is open, contraction of the external pterygoid muscle may pull the condyle over the articular eminence; this con-

* Theim, in Rev. de Chir., vol. viii, 1888.
traction may be brought about by yawning, vomiting, scolding, etc. When
the mouth is open, dislocation of the lower jaw may be caused by a blow upon
the chin; it may also be caused by forcing the mouth more widely open by
pushing a bulky body between the teeth.

Symptoms of Lower-jaw Dislocations.—In the bilateral form the mouth is
open and fixed, and it cannot be closed, though it can be opened a little more.
The condyles are in front of the articular eminences, and are fixed by the action
of the masseters and internal pterygoids, the coronoid processes being wedged
against the malar bones. The lower jaw is advanced in front of the upper jaw
and the face looks longer than natural. The lips cannot close, the saliva
dribbles, swallowing and speech are difficult, there is a depression in front of
each ear, the condyles are recognizable in their new abodes, the coronoid pro-
cesses are detected by a finger in the mouth, and the masseters and temporals
stand out in a state of rigidity. Pain may be severe, may be moderate, or
may be absent. In the unilateral form the chin goes toward the sound side,
and the mouth is not so widely open as in the bilateral form, neither is the
jaw so fixed. The symptoms are similar to those of a bilateral luxation, but
are not so pronounced. The hollow in front of the ear and the abnormal
situation of the condyle are detected upon one side only. In an unreduced
dislocation the patient may after a time establish some movement of the jaw,
but the power of mastication will always be seriously impaired.

Treatment of Lower-jaw Dislocations.—In reducing a dislocation of the
lower jaw the patient is placed with his head against the back of a chair or
against the body of an assistant. The surgeon, after wrapping up his thumbs to
protect them from being bitten, stands in front of the patient, puts his thumbs
upon the last molar teeth, and grasps the chin with his free fingers. He now
presses downward and backward on the jaw, and as soon as the condyle is loos-
ened closes the jaw over the thumbs by pushing up the chin, using his thumbs
as levers. If this procedure fails, wedges should be put between the molar teeth
and the chin should be pushed up either by the hands or by a tourniquet whose
band is round the head and chin. In a unilateral dislocation the wedge should
only be used on the injured side. In difficult cases Sir Astley Cooper pushed
a round wooden ruler between the molar teeth, used the upper teeth as a ful-
crum, and raised the end of the ruler as the handle of a lever. The forceps
used by an anesthetizer may depress the condyle from its point of fixation,
whereupon the chin may be pushed up and back. Nélaton’s plan was to put
the thumbs in the mouth and push the coronoid processes backward. After
reduction a Barton bandage is applied and worn for over two weeks. The
dressing is renewed once a day, and passive motion is begun in the second
week. The bandage is discarded in the third week. Liquid diet is advisable
for three weeks after the accident. In an old dislocation reduction is always
attempted, at least up to a period of six or seven months after the accident.
An unreducible dislocation requires osteotomy of the neck of the bone, if the
part cannot be restored after incision.

Dislocation of the Clavicle.—Sternal End.—There are three forms of
dislocation of the sternal end of the clavicle, namely: (1) forward; (2) back-
ward; and (3) upward.

Forward Dislocation of the Sternal End of the Clavicle.—The causes
of forward dislocation of the clavicle are blows, falls, or pulls which drive or
draw the shoulder backward.
Symptoms and Treatment of Forward Dislocation of the Sternal End of the Clavicle.—The symptoms manifest in dislocation of the clavicle are: prominence in front of the sternum; the acromion is nearer to the sternum on the injured than on the sound side; the clavicular origin of the sternocleidomastoid muscle is rigid; movement is difficult and painful. To reduce a dislocation of the clavicle, pull the shoulders back against the knee of the surgeon, which is placed between the scapulae. Dress with a posterior figure-of-eight bandage (Fig. 532), or a Velpeau bandage (Fig. 534), the dressing to be worn for three weeks. After removal of the dressing apply a truss, the pad of which is put over the head of the clavicle, and which instrument is to be worn for a month. Dislocation of the clavicle is difficult to keep reduced, but even if it becomes fixed in deformity the motions of the arm will not be impaired permanently. It can be reduced and fixed by incision and wiring.

Backward dislocation of the sternal end of the clavicle is very rare.

The causes are direct violence and indirect force, such as falls or blows which drive the shoulder forward and inward.

Symptoms and Treatment of Backward Dislocation of the Sternal End of the Clavicle.—The symptoms are: pain; loss of function in the arm; inclination of head toward the injured side; stiffness of the neck; the shoulder passes forward and inward, and often falls downward; a depression exists over the sternoclavicular joint; the head of the clavicle cannot be felt, or is found back of the sternum. The displaced clavicle may press upon the trachea, the esophagus, or the great vessels, inducing dyspnea, dysphagia, obliteration of pulse in the arm of the injured side, or great venous congestion of the head (see Pick). To treat a backward dislocation, pull the shoulders backward and apply a posterior figure-of-eight bandage (Fig. 532), which must be worn for three weeks. If pressure-symptoms are urgent, incise, restore the bone to place and wire it, or resect the displaced head.

Upward dislocation of a clavicle is very rare. The cause is indirect force which carries the shoulder downward, inward, and backward (Smith).
Diseases and Injuries of Bones and Joints

Symptoms and Treatment of Upward Dislocation of the Sternal End of the Clavicle.—The chief symptom is impaired function of the arm; the shoulder passes downward and inward, the clavicular axis is altered, and the displaced head is felt. Dyspnea may or may not exist. To treat this dislocation, put a pad in the axilla and press the elbow to the side in order to throw the bone outward, and try to push the head into place. Apply a Desault bandage (Fig. 536) and place a firm pad over the sternoclavicular joint. The deformity is apt to recur, but a useful limb will nevertheless be obtained. It may be desirable to wire the bones in place.

Dislocation of the acromial end of the clavicle is almost always upward, but it may be below the acromion. The cause is violent force, which, if so applied to the scapula as to drive the shoulder forward, may produce a dislocation upward. A dislocation downward is due to blows upon the upper surface of the outer end of the clavicle.

Symptoms and Treatment.—The symptoms of dislocation of the acromial end of the clavicle are: prominence of the clavicle upon the top of the acromion; impaired function of the arm (it cannot be lifted over the head); the shoulder falls downward and passes inward; there is apparent lengthening of the arm; the head is bent toward the injured side, and the clavicular origin of the trapezius is strongly outlined (Pick). In dislocation downward both the acromion and the coracoid are very prominent, the clavicular axis is altered, and there is depression over the sternoclavicular joint. A dislocation upward is reduced by pulling the shoulder back and pushing the bone into place. The old method was to apply a Desault bandage, which was kept on for three weeks, and more or less deformity was looked for as inevitable. Stimson dresses with adhesive plaster. The author has recently seen a case treated by the apparatus of Thomas Leidy Rhoads. The apparatus completely corrected the deformity, and the patient made a most satisfactory recovery. The essential element of Rhoads's apparatus is a trunk strap applied as is shown in Fig. 236. Dislocation downward is reduced and treated in the same manner as dislocation upward.

Simultaneous dislocation of both ends of the clavicle is a very rare injury. It is treated as is single dislocation.

The so-called dislocation of the lower angle of the scapula is not, as it was long thought to be, a dislocation at all. The lower angle and vertebral border deviate from the chest. This condition was thought to be due to the bone slipping from under the latissimus dorsi muscle, but it is now known to be due to paralysis of the serratus magnus muscle, the bone being acted upon by the trapezius, pectoralis minor, levator anguli scapulae, and rhomboid muscles. Examination shows that the scapula will not rotate normally forward. This is demonstrated by extending the arms in front to a right angle, the gliding forward of the scapula upon the sound side being marked and upon the diseased side being slight or absent.

Treatment of paralysis of the serratus magnus muscle comprises massage, electricity, passive motion, and deep injections of strychnin.

Dislocations of the Humerus (Shoulder-joint).—These injuries are quite frequent because of the free mobility of the shoulder-joint, its anatomical insecurity, and its exposed situation; they rarely occur in the very young and in the aged, and are oftenest encountered in muscular young adults.
Four chief forms of shoulder-joint dislocation exist, namely: (1) forward, inward, and downward, under the coracoid process—subcoracoid; (2) downward, forward, and inward, beneath the glenoid cavity—subglenoid; (3) backward, inward, and downward, under the spine of the scapula—subspinous; and (4) forward, inward, and upward, under the clavicle—subclavicular.

A very rare form of shoulder-joint dislocation has been described, which is known as the *supracoracoid*. Another rare form is the *luxatio erecta*.

*Subcoracoid Luxation.*—The subcoracoid variety of dislocation embraces three-fourths of all the shoulder-joint luxations. It may be caused by direct force driving the head of the humerus forward and inward, or by indirect force, such as falls upon the hand or the elbow. In this dislocation the anatomical neck of the humerus lies upon the anterior margin of the glenoid cavity, just beneath the coracoid process, and is above the tendon of the subscapularis muscle.

*Subclavicular luxation* is very rare. It is caused by the same sort of violence which produces subcoracoid luxation. The head of the bone rests upon the thorax, below the clavicle and underneath the pectoralis major muscle.

*Subglenoid* or *axillary luxation* may be produced by contraction of the great pectoral and latissimus dorsi muscles when the arm is at a right angle to the body, but it is usually due to falls upon the hand or the elbow when the arm is raised and the head of the bone is against the lower portion of

![Fig. 237.—Subcoracoid dislocation of the humerus (St. Joseph's Hospital case; photographed by Dr. Nassau).](image-url)
the capsule. In this dislocation the head of the bone rests upon the border of the scapula, below the tendon of the subscapularis, in front of the long head of the triceps, and above the teres muscles. Some observers hold that most dislocations of the shoulder are primarily subglenoid, the position having been altered by muscular action. *Luxatio erecta* is an unusual form of subglenoid dislocation. The arm is upright and the forearm rests behind the occiput or on the top of the head, and the patient holds it there to avoid pain. Judd, Hulke, and Cleland have related cases.

*Subspinous luxation* is a rare injury. Pick met with this accident in a man who, while having his hands in his pockets, fell upon the front of the point of the shoulder. The head of the bone reposes beneath the scapular spine, between the infraspinatus and teres minor muscles.

*Supracoracoid luxation* is seldom encountered. The head of the humerus rests upon the coraco-acromial ligament or upon the acromion process and the acromion or the coracoid is always fractured.

**Symptoms of Dislocation of the Shoulder-join.**—Dislocation is diagnosed by (1) pain of a sickening character; (2) flattening of the shoulder, the head of the bone having ceased to bulge out the deltoid muscle; (3) apparent projection of the acromion through sinking in of the deltoid; (4) hollow beneath the acromion, over the empty glenoid cavity, and the bone missed from its normal habitat. This hollow may be easily appreciated by the finger, especially when the extremity is somewhat abducted; (5) rigidity (some movement is possible, in the direction especially of an existing deformity, but mobility is strictly limited and attempts at motion produce great pain); (6) Dugas's sign: the elbow cannot touch the side when the hand is placed upon the sound shoulder, and the hand cannot be placed upon the sound shoulder if the elbow is to the side (this is due to the rotundity of the chest). In a dislocation the head of the bone is already touching the chest, and the bone, being approximately straight, cannot touch it in two places at the same time. If the elbow can be placed against the chest with the hand on the sound shoulder, there cannot be dislocation; if it cannot be so placed, there must be dislocation; (7) finding the head of the bone in a new situation; (8) examining by means of the x-rays. Symptoms 1 to 5 inclusive may be grouped as Erichsen's list of signs. The form of dislocation is made out by a study of the direction of the axis of the limb, the existence and extent of lengthening or of shortening, and the situation of the head of the bone.

In a shoulder-joint dislocation the head of the bone may press upon the brachial plexus and produce pain and numbness, and occasionally a traumatic neuritis or paralysis; sometimes pressure upon the axillary vein causes intense edema, and pressure upon the axillary artery diminishes or obliterates the pulse. The axillary vessels may be torn and the muscles may be lacerated badly. The capsule is torn and considerable blood is usually effused. Swelling is due first to hemorrhage, and secondly to inflammation. Partial dislocations sometimes, though rarely, occur. What is usually spoken of as "partial dislocation" or "subluxation" is a condition in which the head of the humerus passes forward under the coracoid because of rupture of the long head of the biceps or because this tendon slips out of its groove, the ligaments of the shoulder-joint being intact.
Dislocations of the Humerus

The following table from T. Pickering Pick's work on "Fractures and Dislocations" makes the above points clear:

<table>
<thead>
<tr>
<th>Direction of the Axis of the Limb</th>
<th>Alteration in the Length of the Limb</th>
<th>Presence of the Head of the Bone in New Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcoracoid.</td>
<td>Very slight lengthening.</td>
<td>The head of the bone cannot easily be felt; it is found at the upper and inner part of the axilla.</td>
</tr>
<tr>
<td>Subglenoid.</td>
<td>Very considerable lengthening.</td>
<td>The head of the bone can easily be felt in the axilla.</td>
</tr>
<tr>
<td>Subspinous.</td>
<td>Lengthening intermediate in degree between the subcoracoid and the subglenoid.</td>
<td>The head of the bone can be felt and be grasped beneath the spine of the scapula.</td>
</tr>
<tr>
<td>Subclavicular.</td>
<td>Shortening.</td>
<td>The head of the bone can readily be seen and be felt beneath the clavicle.</td>
</tr>
</tbody>
</table>

The elbow is carried backward and slightly away from the side.

The elbow is carried away from the trunk and slightly backward.

The elbow is raised from the side and carried forward.

The elbow is carried outward and backward.

**Diagnosis of Shoulder-joint Dislocation.**—In fracture of the neck of the scapula there is prominence of the acromion and a hollow below it, a hard body being felt in the axilla; but the coracoid process descends with the head of the humerus, which it does not do in dislocation. Furthermore, in fracture there is mobility; in dislocation, rigidity. In fracture crepitus is present; in dislocation it is absent. In fracture the deformity is easily reduced, but it at once recurs; in dislocation the deformity is with difficulty reduced, but does not recur. In fracture the elbow can be made to touch the side when the hand is upon the sound shoulder; in dislocation it cannot be so manipulated. In fracture of the anatomical neck of the humerus deformity is slight; the head of the humerus is found in place, does not move when the shaft is rotated, and is not in line with the axis of the bone. Crepitus exists in the fracture if impaction is absent. In paralysis of the deltoid muscle there is distinct flattening, but the bone is felt in place and there is no rigidity. The x-rays are a great aid to diagnosis.

**Treatment of Shoulder-joint Dislocation.**—Reduction by manipulation is usually readily obtained in recent cases of shoulder-joint dislocation. If a simple trial without ether fails, an anesthetic should be administered. Forward dislocations (subcoracoid, subclavicular, and axillary) are reduced by Kocher's method (Fig. 238). Reduction by this method can frequently be effected without the aid of ether. Put the arm against the side, flex the forearm to a right angle with the arm, perform external rotation of the arm until resistance becomes decided, raise the elbow, make internal rotation, bring the arm across the front of the chest and lower the elbow. The formula is, flexion of the forearm, external rotation, lifting the elbow forward, internal rotation of the arm, and lowering the elbow. The motions to unlock the bone and start it to retrace the steps it took when emerging should be gentle, not forcible; slow, not sudden; and rigid muscles should be tired out and made to relax by steady traction upon them. Sudden and violent motions increase rigidity. If in trying Kocher's plan external rotation of the humerus does not take place, abandon the method, as persistence will
fracture the humerus. Another method of manipulation is as follows: if the right shoulder is dislocated, the surgeon stands behind the patient (who is sitting erect); if the left shoulder is dislocated, he stands in front of the patient. The surgeon holds the forearm flexed upon the arm with his right hand and makes external traction and rotation, and with the fingers of his left hand he tries to force the bone into place.

In Henry H. Smith's method for forward dislocations the surgeon stands in front of the patient. If the left shoulder is dislocated, the surgeon grasps it with his left hand; if the right shoulder is dislocated, he grasps it with his right hand, the thumb resting on the head of the bone. With his disengaged hand the surgeon grasps the elbow, abducts it, makes traction and external rotation, and suddenly sweeps the elbow inward, aiming it at the sternum, and tries with his thumb to push the bone into place. In subspinous luxations reduction may be effected if the surgeon stands behind the patient, makes abduction, traction, and internal rotation, sweeps the elbow inward toward the spine, and with the thumb aids the bone in its return into position. Raising the elbow far above the head and sweeping it inward will reduce some dislocations. As the head of the bone slips back a distinct jar is felt and a snap is heard, the motions of the joint are again obtainable, and with the hand on the opposite shoulder the elbow may be made to touch the side.

Reduction by Extension.—Before attempting the reduction of a dislocation of the shoulder-joint by extension, the patient should be anesthetized and placed upon a low bed or upon the floor. The surgeon then places his foot, covered only by a stocking, in the axilla. Place the sole of the foot, not the heel, against the chest high up, the instep being made to touch the humerus and the heel the border of the shoulder-blade, a towel being first put into the axilla to rest the foot against (Fig. 239). If the left arm is dislocated, use the left foot, and vice versa. The elder Gross approved of making extension while sitting between the patient's limbs. Make steady extension, which will in many cases bring about the reduction. If it fails to cause reduction, bring the patient's arm across the chest and use the foot as the fulcrum of a lever. If the humerus is pretty firmly fixed in its abnormal position, make counter-extension with a foot in the axilla and make extension by fixing a clove-hitch (Fig. 240) above the elbow and fastening to it bands which go over one shoulder and under the other shoulder of the surgeon. The back may be used for extension,
Dislocations of the Humerus

the hands being left free for manipulation (Allis’s and Pick’s plan). Lateral extension is used by some surgeons. The patient lies down, a large piece of canvas is split, the arm is passed through the split and the body is thus fixed. The arm is pulled to a right angle with the body and traction is applied.

The late Prof. Joseph Pancoast favored Sir Astley Cooper’s method of placing the unanesthetized patient in a chair and using the knee as a fulcrum, pushing the elbow to the side (Fig. 241). Brunus, in the thirteenth century, devised the method of upward extension. In applying this method the surgeon takes his place behind the patient, steadies the scapula with his hand, and carries the patient’s arm upward and backward above his head, making extension and external rotation (Fig. 242). La Mothe’s method is applied with the patient supine upon the floor. The surgeon places his foot upon the shoulder to make counter-extension, and makes extension as in Brunus’s method. It is a useful expedient, when either of these plans is applied, to have an assistant make the traction while the surgeon manipulates the head of the bone. Cock advises, when reduction fails, that an air-pad be placed in the axilla and the arm be bound to the side—a method by which reduction will often take place after two or three days.

Pulleys should not be used to pull the bone into place, as they develop a dangerous force. In a dislocation irreducible by ordinary force, antiseptic incision is safer and better than the pulleys. After incision try to restore the bone to place. In an old dislocation it may be necessary to resect the head of the bone.
In reducing a dislocation the axillary artery or vein may be ruptured, fracture of the neck of the humerus may take place, injury to the brachial plexus may occur, or the soft parts may be badly damaged. After reducing a dislocation apply a Velpeau bandage, keep the shoulder immobile for one week, then make passive motion daily, reapplying the dressing after each séance. The patient may wear a sling alone during the third week, after which period he may use the arm. (For old dislocations and compound dislocations see page 503.) Reduction of old dislocations may sometimes be effected by manipulation. Extension may have to be used, and ether will be required. In old dislocations try to reduce, after breaking up adhesions, by forced flexion and strong extension. After reduction immobilize for three weeks, and begin passive motion after seven days.

If a dislocation is complicated by a fracture of the humerus, try to pull the head of the bone opposite the joint. This may be possible if the two fragments are held partly together by a fair amount of periosteum and muscle. Traction is exerted upon the arm, and an attempt is made to manipulate the head into the socket (Allis's plan in the hip). McBurney incises, fixes a hook in the scapula and a hook in the head of the humerus, pulls the head into place, and wires the fragments (Figs. 158, 159, 160). In an emergency gimlets may be used instead of the hooks. In some cases it is necessary to excise the head of the bone.

Dislocations of the Elbow-joint.
Dislocations of the elbow-joint are not infrequent, and they are commonest in children. Both bones or only one bone of the forearm may be dislocated, and the dislocation may be partial or complete.

Dislocation of Both Bones Backward.—The causes of backward dislocation of both bones of the forearm are falls upon the extended hand or twists inward of the ulna (Malgaigne). The coronoid process lodges in the olecranon fossa of the humerus.

Symptoms of Backward Dislocation.—In complete dislocation of both bones of the forearm the olecranon is very prominent (Fig. 243). The dis-
Dislocation of Both Bones of the Forearm

Dislocation of Both Bones of the Forearm is a blow on the olecranon when the arm is flexed, fixed, and pronated; the joint is widened; the head of the radius projects externally and has a depression above it; the inner condyle projects internally and has a depression below it; the olecranon is nearer than normal to the external condyle and further than normal from the internal condyle. Reduction is effected by extension of the forearm and pressure inward upon the head of the radius. Apply an ascending spiral reverse bandage of the forearm, a figure-of-eight bandage of the elbow-joint, and a sling. Make passive motion after a few days. The bandages must be worn for two weeks.

Symptoms and Treatment of Inward Dislocation.—In dislocation inward of both bones of the forearm the position of the forearm is the same as that in dislocation outward; the sigmoid cavity of the ulna projects internally, and the external condyle projects externally. Reduction is effected by extension.
of the forearm and pressure outward on the ulna, subsequent treatment being the same as that employed in the preceding form.

Dislocation of the ulna alone is very rare, and can only take place backward.

Symptoms and Treatment.—Dislocation of the ulna alone is indicated by the forearm being flexed and pronated. The head of the radius is found in place, and the olecranon projects posteriorly. The treatment of this injury is the same as that for dislocation of both bones.

Dislocation of the Radius Forward.—Dislocation of the radius forward is the commonest form of dislocation of the elbow. This injury is caused by a fall upon the hand with the forearm in pronation and extension, or is produced by blows on the back of the joint; forced pronation alone will not cause it.

Symptoms and Treatment.—The symptoms in dislocation of the radius forward are—the forearm is midway between pronation and supination, and is semiflexed; attempts to increase flexion cause the radius to strike against the humerus with a distinct blow; the head of the radius is felt in front of the outer condyle and is missed from its proper abode. Reduction is effected by flexion over the knee, extension, and manipulation. The subsequent treatment is Jones's position and passive motion. Deformity is apt to recur after reduction, because of rupture of the orbicular ligament.

Dislocation of the radius backward is caused by falls on the hand or by blows on the front of the joint.

Symptoms and Treatment.—Backward dislocation of the radius is indicated by the forearm being slightly flexed and fixed in pronation, by some impairment of flexion and extension, and by the radius being felt behind the outer condyle. Reduction is effected by flexion over the knee, extension, and manipulation, and the subsequent treatment is the same as that given for the preceding dislocation.

Dislocation of the radius outward is very rare. In this injury the head of the radius is distinctly felt. Reduction is effected by extension and pressure; the subsequent treatment is the same as that for the above-mentioned dislocations.

Subluxation of the Head of the Radius.—This name is given to an injury which is very frequent in children between two and four years of age. It results from traction upon the hand or the forearm, and often arises when the nurse or the mother pulls upon a child's arm to save it from a fall or to lift it over a gutter. Some writers hold that pronation is required, as well as extension, to produce the injury; many surgeons claim that extension and adduction are the causative forces. Hutchinson asserts that supination may cause subluxation. Bardenheuer assigned falls as causes.

The symptoms are very characteristic. The history points to the injury. Pain, and often a click, may be felt in the wrist at the time of the accident. The arm hangs by the side, with the elbow-joint slightly flexed and the forearm midway between pronation and supination. Flexion to a less angle than 60° and complete extension are resisted and are very painful, but movements between 60° and 130° are free and painless.* The movements of the wrist-

* See the instructive article by W. W. Van Arsdale, in the Annals of Surgery, vol. ix, 1889.
Dislocations of the Wrist

joint are free and painless. The elbow-joint presents no deformity. Pressure over the head of the radius causes pain. Strong pronation is painful; strong supination is very painful, and there seems to be a mechanical obstacle to its performance. Forced supination develops a distinct click at the head of the radius, and causes pronation and supination to become natural and free from pain. The condition will be reproduced if a splint is not used. The nature of the lesion is not understood, and various conditions have been thought to exist by different observers. Among them may be mentioned the following: a slight anterior displacement of the head of the radius; a slight posterior displacement; locking of the tuberosity of the radius behind the inner edge of the ulna; dislocation of the triangular cartilage of the wrist; intracapsular fracture of the radial head; painful paralysis from nerve-injury; displacement by elongation, the return of the bone being prevented by collapse of the capsule; and the slipping up of the margin of the orbicular ligament over the rim of the head of the radius.

Treatment.—Place the forearm at a right angle to the arm and make forcible supination; apply an anterior angular splint, and have it worn for four or five days, or put the part in Jones's position for an equal period.

Dislocations of the wrist are very uncommon and are caused by falls upon the hand.

![A](image1.png) ![B](image2.png)

Fig. 245.—Deformity in dislocation of the wrist backward (A) and in Colles's fracture (B) (Stimson).

Backward Dislocation of the Wrist.—Symptoms.—The deformity in backward dislocation of the wrist (Fig. 245, A) resembles that of Colles's fracture (Fig. 245, B). The fingers are flexed, the wrist is bent backward, the radius projects on the front of the wrist, the carpus projects on the dorsal surface of the forearm, the relation of the styloid process of the radius to the styloid process of the ulna is unaltered (it is altered in Colles's fracture), there is rigidity, and crepitus is absent (Fig. 245).

Forward dislocation of the wrist, which is very unusual, is caused by a fall upon the back of the hand.

Symptoms and Treatment.—In forward dislocation of the wrist the radius and ulna project posteriorly and the carpus projects in front. The treatment in both of these dislocations is reduction by extension and manipulation, the use of a Bond splint for ten days, and the employment of passive motion after five or six days.

Dislocation at the inferior radio-ulnar articulation, which is also very uncommon, is caused by twists.

Symptoms and Treatment.—In forward dislocation at the inferior radio-ulnar articulation the forearm is pronated, the space between the styloid processes is diminished, and the ulna forms a projection posteriorly. In backward dislocation the forearm is supinated, the space between the styloid...
processes is diminished, and the ulna projects in front. Reduction is accomplished by extension and manipulation. Two straight splints (as in fracture of both bones) are to be applied for four weeks, and passive motion is to be made in the third week.

**Dislocation of Individual Carpal Bones.**—Pick says there is one weak spot, which is “between the head of the os magnum and the scaphoid and semilunar bones,” and the os magnum may be forced up. The os magnum is the only bone dislocated with any frequency, and the injury is caused by forced flexion of the wrist.

*Symptom and Treatment.*—The symptom of dislocation of the carpal bones is a firm projection which becomes more prominent during flexion of the wrist. The treatment is extension and manipulation, a Bond splint being worn for three weeks.

**Dislocations of metacarpal bones** are uncommon. The first metacarpal bone is most liable to dislocation.

*Symptoms and Treatment.*—Dislocations of the metacarpal bones are obvious because of projection. The dislocations are reduced by extension and manipulation, a straight splint and large pad for the palm are applied (as in fracture of the metacarpus), and the splint is worn for three weeks.

**Dislocations at the metacarpophalangeal articulations** are uncommon. Backward dislocation is the most common. The cause is a fall upon the hand.

*Symptoms and Treatment.*—Dislocated metacarpophalangeal articulations are obvious. Reduction is easily effected by extension and manipulation, except in the case of the thumb. A splint must be worn for three weeks.

**Dislocation of the Metacarpophalangeal Joint of the Thumb.**—In this dislocation the phalanx usually passes backward.

*Symptoms.*—The symptoms of backward dislocation are as follows: The base of the first phalanx rests upon the metacarpal bone; the head of the metacarpal bone projects forward and buttonholes the muscles of the thumb; the first phalanx of the thumb is strongly extended, and the terminal phalanx is semiflexed. The symptoms of forward dislocation are as follows: The
base of the first phalanx is felt in the palm, and the head of the metacarpal bone is felt posteriorly.

**Treatment.**—In treating backward dislocation of the metacarpophalangeal joint of the thumb, reduction is difficult because the head of the bone is caught in the perforation of the flexor muscle. Always give ether. Keetley's directions are to adduct the metacarpal bone into the palm (this relaxes the muscles) and to have an assistant hold it; bend the thumb strongly back, extend, pull the thumb toward the fingers, and suddenly flex. To get a firm enough grasp for these manipulations use the apparatus of Charrière or of Levis (Figs. 246, 247). If the above maneuvers fail, perform tenotomy or incise freely and reduce. After reduction of this dislocation a splint must be worn for three weeks. In forward dislocation reduction is easily effected by strong extension and forced flexion. A splint is to be worn for three weeks.

**Dislocations of the phalanges** may be complete or may be partial. They are commonest between the first and second phalanges.

**Symptoms and Treatment.**—Dislocations of the phalanges are obvious. In reducing such dislocations employ extension and manipulation. Use a splint for one week.

**Dislocations of the Ribs and Costal Cartilages.**—The ribs may be dislocated from the vertebrae. This accident is seldom uncomplicated, and cannot be differentiated from fracture. The diagnosis is rarely made, and the injury is treated as a fracture. The ribs may be dislocated from their cartilages, one or more ribs being displaced. The end of the rib forms an anterior projection, there is a depression over the cartilage, and crepitus is absent. **Treatment** is the same as that employed for fractured ribs. The costal cartilages may be displaced from the sternum, forming an anterior projection upon this bone. Reduction is brought about by placing the patient upon a table, with a sand pillow between the scapula, pushing back the shoulders and chest, and forcing the cartilage into place. The dressings are the same as those used in fractured sternum. The cartilages of the lower ribs (sixth, seventh, eighth, ninth, and tenth) may be separated. The inferior cartilage goes forward and can be felt. Pick states that reduction is brought about by causing the patient to hold the chest full of air while efforts are made to push the cartilage into place. The injury is dressed as are fractured ribs.

**Dislocations of the Sternum.**—In dislocations of the sternum the manubrium may be separated from the gladiolus in young subjects. The **symptoms and treatment** are the same as those in fracture (page 407).

**Pelvic dislocations** are almost always complicated with fracture. A pubic bone can be dislocated by falls from a height or by applying violent force to the acetabula. The dislocation may be up or down, front or back, and it may damage the urethra or the bladder. The patient cannot stand; there are great pain and recognizable deformity. Treat by moulding the bones into place, by applying a pelvic belt, and by rest in bed for four weeks. Dislocations of the sacro-iliac joint are produced by falls. Movement on the part of the patient is difficult or impossible; there is violent pain, and often paralysis (from pressure upon nerves). In dislocation backward there is an apparent shortening of the leg, eversion of the foot exists, and the illum
Diseases and Injuries of Bones and Joints

moves posteriorly and upward. In dislocation forward the anterior superior iliac spine projects and the pelvis is broadened. Sacro-iliac dislocations are reduced by holding the pelvis firm and making extension with a pulley. The patient stays in bed for four weeks and wears a pelvic belt as in fracture.

**Dislocations of the Femur (Hip-joint).—**These injuries are not often encountered, as the hip-joint is very strong. They occur in young adults. In forcible extension the head of the femur presses against the capsule of the joint, but the capsule here is very thick, and certain muscles, the rectus, psoas, and iliacus, are pulled tight and serve to strengthen it. The head of the bone cannot go directly upward, because of the acetabulum (Edmund Owen). The weak point of the acetabular rim is below; the weak part of the capsule is also below; hence forced abduction is apt to push the head of the bone through the lower part of the capsule, a dislocation occurring primarily into the thyroid foramen. The signs of the dislocation depend upon the untorn portion of the capsule. The Y-ligament and more than the Y-ligament usually escape laceration. Vessels are rarely injured. Muscles are often torn. In some cases the sciatic nerve is lacerated, bruised, or caught up on the neck of the bone. Four forms of hip-joint dislocation are usually described: (1) upward and backward, on the dorsum of the ilium; (2) backward, into the sciatic notch; (3) downward, into the obturator foramen; and (4) inward, on the pubes.

All dislocations are primarily inward or outward. From these initial positions the head may be shifted to any region about the socket within reach of the remnant of untorn capsule (Oscar H. Allis). Allis rejects the old classification and suggests the following:

- **Low thyroid:**
  - Mid- "  
  - High "  

Reversed thyroid:
- **Low dorsal:**
  - Mid- "  
  - High "  

- **Dislocations upon the dorsum of the ilium** comprise one-half of all hip-dislocations. They are *caused* by a fall or a blow when the limb is flexed and abducted (as in carrying a weight upon the shoulder), by a fall upon the knees or feet, by a weight striking the back while bending, etc. Allis says rotation inward is the chief element in their production. In these dislocations the head of the femur goes upward and backward, rests upon the ilium, and is always above the tendon of the obturator internus muscle. These dislocations are secondary to thyroid dislocation, muscular action shifting the bone from its initial seat of displacement.

**Signs.**—Dislocation on to the dorsum of the ilium is indicated by the following symptoms: the buttock appears flat and broad; the great trochanter is above Nélaton's line and is deeply placed; the head of the bone can be detected in its new situation; deep pressure in front of the joints finds a hollow; the leg is shortened by about two or three inches, as a rule; the fascia lata is relaxed; in some thin people the socket can be outlined; when the patient is
recumbent the injured extremity can be brought to the perpendicular without flexing the leg (Allis); the knee is somewhat flexed; the thigh is slightly flexed, inwardly rotated, and adducted (Fig. 248) (this is shown by the fact that the axis of the thigh of the injured side, if prolonged, would pass through the lower third of the sound thigh); when the capsule is extensively lacerated there may be no adduction and may be eversion (Allis); the heel is raised, and the great toe of the foot of the injured side rests upon the front of the instep or the ankle of the sound side; rigidity exists; voluntary movement is impossible, though some passive motion is possible in the direction of the deformity (the deformity can be made more marked). If a patient is recumbent and the knees vertical, the foot of the sound extremity is free of the bed, but the foot of the injured extremity touches the bed (Allis's sign).

**Diagnosis.**—Examine first without anesthesia, and then again while the patient is anesthetized. The x-rays are valuable in diagnosis. Dislocation is distinguished from intracapsular fracture by noting the inversion, the great shortening, the absence of crepitus, the age of the subject, and the nature of the force. The nature of the force, the inversion, and the absence of crepitus mark the diagnosis from extracapsular fracture.

**Treatment.**—The chief obstacle to reduction in dislocation on to the dorsum of the ilium, Bigelow states, is the unornament portion of the capsule, especially the Y-ligament. The ilio-femoral, Y, or Bigelow's ligament resembles an inverted Y, arises from the anterior inferior spine of the ilium, is inserted into the anterior intertrochanteric line, and is incorporated into the front of the capsule. To reduce a dislocation this ligament must be relaxed by manipulation or be torn by extension. Manipulation makes the head of the bone retrace its steps over the same route it took in emerging. Give ether; place the patient supine upon a mattress on the floor; flex the leg on the thigh (to relax the hamstrings), flex the thigh on the pelvis; increase the adduction over the middle line; strongly abduct; perform external rotation and extension. This treatment may be summed up as flexion, adduction, external circumduction, and extension; or, as Pick puts it, "bend up, roll out, turn out, and extend." Allis's advice is to fix the pelvis to the floor, lift the head of the bone to the level of the socket, rotate outward by carrying the leg toward the pubis, and extend the femur. If extension and counter-extension are employed, make extension in the axis of the dislocated limb and obtain counter-extension by a perineal band. The extension band is fastened to the thigh by a clove-hitch. After reduction put the patient to bed and use sand-bags (as in fracture of the hip) for four weeks. We may tie the knees together instead of using the sand-bags. Passive motion is made in the third week. The pulleys must not be used in reduction. They may inflect great or even fatal injury. If the surgeon fails to reduce the deformity, there are two courses open to him. He may let it alone. He may operate. If he lets it alone, the limb will become ankylosed, though probably useful. Allis thinks the dorsal region will be the best place to leave it. If he determines to operate, he must recognize that tenotomy is
useless. It is necessary to make a free incision in order to restore the bone.

**Dislocation into the Sciatic Notch.**—In this dislocation the head of the bone passes backward and a little upward, and rests upon the ischium at the margin of the sciatic notch (not in the notch), below the tendon of the obturator internus muscle. The *causes* are the same as those given for the previous dislocation.

*Signs.*—The signs in dislocation into the sciatic notch are like those of dislocation upon the dorsum of the ilium, but they are not so marked. There are flattening and broadening of the hip; ascent of the trochanter above Nélaton's line; shortening to the extent of an inch; relaxation of the fascia lata. If the knee of the injured side is vertical, the sole of the foot touches the bed. Flexion, inward rotation, and adduction exist, but the axis of the femur of the injured side passes through the knee of the sound side, and the ball of the great toe of the injured side rests upon the great toe of the sound side (Fig. 249). Other symptoms are identical with those of dislocation upon the dorsum of the ilium, but are less pronounced.

Allis's signs of this dislocation are of value: if, with the patient recumbent, the thighs are brought to a right angle with the body, shortening on the affected side is materially increased; if the dislocated thigh is extended, the back arches as in hip disease.

**Diagnosis and Treatment.**—The signs of dislocation into the sciatic notch are similar to, but are less marked than, those of dorsal dislocation, and, being a backward dislocation, the reduction and treatment are the same as for dislocation backward upon the dorsum of the ilium.

**Dislocation Downward into the Obturator Foramen.**—Downward dislocation is the primary position of most dislocations of the hip, the bone rarely remaining in the thyroid foramen, but usually mounting up as a result of muscular action or of the initial violence. The *cause* is violent abduction by falls or by stepping from a moving car.

*Signs.*—Dislocation downward into the obturator foramen is indicated by flattening of the hip; the head of the bone is felt in its new position and is missed from the acetabulum; rigidity exists; passive motion is only possible in the direction of deformity, and that to a slight extent; a hollow is noted over the great trochanter, which process is well below Nélaton's line and nearer than normal to the middle line. The gluteal crease is lower than is the crease of the opposite side; there is lengthening to the extent of one to two inches; the body is bent forward by the traction upon the psoas and iliacus muscles, and is also deviated to the side, thus causing great apparent lengthening; the limb is advanced partially flexed and abducted, and the foot is pointed straight ahead or is a little everted (Fig. 250); when the patient is recumbent, extension is impossible, the knees cannot be pushed together without great pain, and the abductor muscles are hard and rigid. Allis's sign is absent. Unreduced dislocations do well, the patient obtaining a very useful hip-joint (Sédillot).
Dislocation with Catching up of Sciatic Nerve

_Treatment._—In treating dislocation downward into the obturator foramen give ether and effect reduction, if possible, by manipulation, and, if this fails, by extension. To reduce by manipulation, flex the leg on the thigh and the thigh on the pelvis, and then perform, in the following order, abduction, internal circumduction, and extension. Allis's rule of reduction is as follows: fix the pelvis to the floor; pull the head of the femur outward and above the socket; fix the head; push the knee toward sound knee and extend the femur. If extension is made, make traction in the axis of the limb by means of muslin fastened around the thigh by a clove-hitch. Do not use pulleys; incise rather than use them.

**Dislocation upon the pubis** is a very uncommon accident. The head of the bone usually rests just internal to the anterior inferior spine of the ilium. The primary position of the bone is in the thyroid foramen; the pubic dislocation, when it occurs, is always secondary, and is due to the initial force and to muscular action.

_Symptoms._—In pubic dislocation the head of the bone can be felt and seen in its new position; the hip is flattened; there is a hollow over the great trochanter, this process being found below the anterior superior spine of the ilium; there is shortening to the extent of an inch; the limb is in abduction with eversion (Fig. 251), and the knees cannot be approximated without great pain.

_Treatment._—In the treatment of pubic dislocation give ether and employ manipulation as for thyroid dislocation. If this fails, employ extension. The limb is well abducted, extension made downward and backward, and the head of the femur pulled outward "by a towel around the thigh, just beneath the groin" (Keetley). The after-treatment is the same as that for the previous forms.

**Anomalous Dislocations of the Hip.**—In _supraspinous dislocation_ the dislocation of the hip is backward, the head of the femur resting upon the ilium above or even anterior to the anterior superior spine. In _ischial dislocation_ the dislocation is downward and backward, the head of the femur resting on the ischial tuberosity or in the lesser sciatic notch. _Monteggia's dislocation_ is a supraspinous dislocation with eversion of the limb. In _perineal dislocation_ the head of the femur is in the perineum. In _suprapubic dislocation_ the head of the femur passes above the pubes. In _subspinous dislocation_ the femoral head rests on the horizontal ramus of the pubes.

_Dislocation with Catching up of the Sciatic Nerve during Reduction._—This accident causes severe pain. The leg is flexed on the thigh and the thigh is flexed on the pelvis. Allis tells us that the task of reduction is very unpromising. We must strive to put the neck of the femur in such a position that the nerve will "drop off," and yet often the nerve cannot drop off because it is held by adhesion to the injured muscles. Allis attempts reduction by the following plan:
1. Place the patient upon his back and redislocate the femur.
2. Extend the thigh.
3. Flex the leg on the thigh.
4. Turn the ankle out until the leg is horizontal (this causes the head of the bone to look downward).
5. “Shake, shock, jar, adduct, and abduct,” to disengage the nerve.
6. Rotate into socket without flexing the leg (without making the nerve tense).
7. If this fails, make an incision above the popliteal space, and draw the nerve out of the wound. Detach the head of the bone from its entanglement and rotate it into the socket.*

Dislocation of the Head of the Femur with Fracture of the Shaft of the Bone.—We may incise and replace and wire the fragments. We may use McBurney’s hooks as in the shoulder. We may be forced to do a resection of the head.

Allis maintains that it is possible to reduce it by manipulation. He states that the upper fragment is the entire lever, and the lower fragment “is only the agent through which we apply our force.” The fragments are not completely separated, but are connected at one side by material which is “partly periosteal, partly tendinous, and partly muscular.” This connecting material enables us to make traction upon the upper fragment, but does not allow “rotation, circumduction, and leverage through the agency of the lower fragment.” Hence “the only agency at our command is traction.” If the dislocation is inward (forward), draw the head outward and have an assistant make direct pressure upon the head of the bone. If this fails, the assistant holds the head of the bone to prevent its slipping into the thyroid depression, and the surgeon makes traction inward or inward and downward. If the dislocation is outward (backward), make traction directly upward to lift the head of the bone to the level of the socket, and try to place the head over the socket by traction obliquely upward and inward. During all these manipulations an assistant presses upon the trochanter to prevent the head of the bone slipping back. Traction is now made downward and inward, and the tightened ligament drags the head of the bone into place.

Dislocations of the Knee.—These dislocations are rare. There are four forms—forward, backward, inward, and outward. They may be complete or incomplete; the commonest dislocations are lateral. The cause is violent force, such as a fall, or in jumping from a moving train, or in being caught by the foot and dragged.

Dislocation Forward of the Knee-joint.—In the complete form of forward dislocation the deformity is obvious. The limb is usually extended, but it may be flexed. Much shortening exists; the condyles are felt posterior and below; the head of the tibia is felt anterior and above; the patella is movable and the quadriceps is lax; pressure of the condyles upon the contents of the popliteal space arrests the tibial pulse and causes edema and

* Allis’s views will be found in “An Inquiry into the Difficulties Encountered in the Reduction of Dislocations of the Hip.” By Oscar H. Allis, M.D. This highly original and valuable treatise received the Samuel D. Gross prize of the Philadelphia Academy of Surgery in 1895.
intense pain. In incomplete dislocation the symptoms are identical in kind, but are less pronounced.

Treatment.—Compound dislocation of the knee-joint often demands excision or amputation. In simple dislocation give ether, have one assistant extend the leg while another makes counter-extension on the thigh, and the surgeon pushes the bone into place. Reduction is easy because of ligamentous laceration. Place the limb on a double inclined plane, and combat inflammation by the usual methods (see Synovitis, page 469). Begin passive motion in the third week. The patient must wear a knee-support for months. If the popliteal vessels are much damaged, gangrene will supervene and amputation will be demanded.

Dislocation Backward of the Knee-joint.—In the complete form of knee-joint dislocation backward, displacement is not so great as in dislocation forward. The head of the tibia projects posteriorly and above, the femoral condyles anteriorly and below; the leg is, as a rule, partly flexed, but it may be extended, and there is moderate shortening. In incomplete dislocation the symptoms are less marked.

Treatment.—The treatment of backward dislocation of the knee-joint is the same as for forward dislocation.

Dislocation Outward of the Knee-joint.—Is usually incomplete. The inner tuberosity of the tibia in outward dislocation lies upon the outer condyle of the femur (Pick); the inner condyle of the femur projects internally; the outer tibial tuberosity and fibular head project externally, the former having a depression below it, and the latter above it; the leg is semiflexed, but shortening is absent.

Dislocation Inward of the Knee-joint.—Is usually incomplete. The outer tuberosity of the tibia in inward dislocation lies upon the inner condyle of the femur; the outer condyle of the femur forms an external prominence, and the inner tuberosity of the tibia forms an internal prominence. Pick cautions us not to mistake a separation of the lower femoral epiphysis for lateral dislocation (the former is reduced easily, the deformity tends to recur, and there is soft crepitus).

Treatment.—In treating lateral dislocation of the knee-joint, effect extension and counter-extension as in anteroposterior dislocations. The leg is moved from side to side and attempts are made at rotation. The after-treatment is the same as that for anteroposterior luxations.

Dislocations of the Patella.—Are usually acquired. There are thirty-five congenital cases on record (Bajardi). There are three forms: outward,
inward, and edgewise. The so-called dislocation upward is in reality rupture of the ligamentum patellae (page 557).

Dislocation outward (Fig. 252) may be due to muscular action or to direct force, and occurs during extension of the leg. It occasionally happens in a person with knock-knees. If dislocation is complete, the bone lies upon the external surface of the external condyle; if incomplete, the patella rests upon the anterior surface of the external condyle. The leg is extended, flexion is impossible, and attempts at flexion produce great agony. In the patient shown in Fig. 252, flexion became possible in an unreduced dislocation, but not until months after the accident. The knee is wider than normal. There is a hollow in front of the joint. The bone is felt in its new position.

Dislocation inward is very rare. The signs are like those of dislocation outward, except that the patella rests upon the inner condyle.

Treatment.—Give ether. Raise the body upon a bed-rest, and flex the thigh. Grasp the patella, depress the margin of the patella which is farthest from the center of the joint (Pick). The muscles pull the bone into place. Immobilize for three weeks, and then begin passive motion. Incision may be necessary in order to effect reduction.

Dislocation of the Patella Edgewise.—The patella rotates vertically, one edge resting between the condyles. As a rule, the outer border is in the intercondylar notch (Pick). This condition is produced by direct force when the extremity is partly flexed. Twisting and muscular action have been assigned as causes. The condition is obvious at a glance.

Treatment.—Give ether. Pick recommends "sudden and forcible bending of the knee." In some cases the bone can be pushed into place, the limb being extended and flexed as in the reduction of a lateral dislocation. In some cases incision will be necessary.

Dislocation of the Semilunar Cartilages of the Knee-joint (the Internal Derangement of Hey; Subluxation of the Knee-joint).—The interarticular cartilages of the knee-joint are attached in front of and behind the tibial spine, and the convexity of each cartilage is attached to the edge of the corresponding tibial tuberosity by means of the coronary ligament. The internal cartilage is fastened to the internal lateral ligament and has a moderate freedom of movement. The outer cartilage is not connected with the internal lateral ligament and is not freely movable. It has been stated that the outer cartilage is more frequently dislocated than the inner, but modern experience indicates that this is not true, and that the internal cartilage is the one most apt to suffer. In 17 cases operated upon by Barker, the internal cartilage was involved in every case ("Lancet," Jan. 4, 1902). Those persons whose occupations force them to pass considerable time upon their knees are predisposed to this accident (Annandale). The derangement of the cartilage is usually caused by a sudden external rotation of the tibia, while the knee-joint is in partial flexion; for instance, when the patient stumbles over an obstacle, the knee-joint being partially flexed, the tibia is twisted outward. When the joint is flexed, a normal cartilage moves backward, and when it is extended, moves forward again. When the cartilage is thrown out by the sudden eversion and flexion of the tibia, it is caught and does not move into place readily when the leg is extended. The tear takes place in the direction of the fibers of the cartilage.
Symptoms.—The indications of interarticular cartilage displacement are a sudden, violent, sickening pain in the knee, which may be so severe as to cause the patient to fall to the ground. The knee is in a position of fixed semiflexion. Further flexion is possible, but extension is impossible. In some cases the patient can voluntarily make further flexion; in others, the pain is so severe that he either cannot or will not do it; but increase of flexion can be obtained by passive motion. The joint is, however, blocked both to passive and to voluntary extension. Attempts at passive motion are productive of fierce pain. If either cartilage is displaced away from the tibial spine, a prominence may be found on one or the other side of the knee-joint. If the displacement takes place toward the tibial spine, a prominence may be found on one side of the ligament of the patella. Subluxation is rapidly followed by inflammation of the synovial membrane of the joint and of the cartilages themselves; and swelling quickly masks the projection of the cartilage. This accident is frequently mistaken for the blocking of the joint by a floating cartilage; but a dislocated cartilage always remains in the same position, and a loose cartilage changes its position from time to time (Turner). Loose bodies in a joint produce pain of a shifting character, and interference with both flexion and extension, or with either flexion or extension in an irregular way (Cotterill). In regard to the diagnosis, Cotterill points out that in a sprain of the joint extension is not painful, but flexion is interfered with; whereas, in the dislocation of a cartilage of the joint, flexion is still possible, but extension cannot be carried out ("Lancet," Feb. 22, 1902).

Treatment.—In treating dislocation of a semilunar cartilage of the knee give ether and reduce by forced flexion and external rotation. Extension becomes possible if the cartilage is freed. During these maneuvers an assistant endeavors to push any projection of cartilage into place. After reduction apply a splint for two weeks and combat inflammation by proper remedies (see Synovitis); then begin passive motion. At the end of two weeks apply a firm knee-cap made of leather and let the patient get about on crutches. After a couple of weeks the crutches can be laid aside. As recurrence of the displacement is usual, the patient should wear a knee-cap during the day for many months. A partial tear may entirely heal when thus treated by rest and support; an extensive tear will not, although even in such cases a useful but somewhat stiff joint may be obtained. If it is found impossible to unlock the blocked joint, or if the tear is extensive and redislocation is prone to occur, an operation is advisable. The joint is opened and the loose cartilage is pushed into place and held by stitches or the loosened portion is excised.

Dislocations of the Fibula: Dislocation at the Superior Tibiofibular Articulation.—This injury is rare. The head of the fibula may go forward or backward. The causes are direct force and violent adduction of the foot with abduction of the knee (Bryant).

Symptoms.—After dislocation of the fibula the position is one of semiflexion of the knee, voluntary extension and flexion being impaired or lost. A distinct movable projection is readily noticed in front or behind, which is found to be continuous with the fibula. There is a depression over the normal position of the head of the fibula.

Treatment.—In treating dislocation of the fibula bend the knee to relax
the biceps, and proceed to push the bone into place. Put a compress over the head of the fibula, apply a bandage, and put the limb on a double inclined plane for three weeks. At the end of this time put a lacing knee-support upon the knee and let the patient up. Displacement being liable to recur, a knee-cap must be worn for a year.

**Dislocations of the Ankle-joint.**—These injuries are not unusual. Fracture is a frequent complication. There are five forms of ankle-joint dislocation—outward, inward, forward, backward, and upward.

**Lateral dislocations of the ankle-joint** are either outward or inward, and may be complete or incomplete. In these dislocations the astragalus rotates. In incomplete dislocations "there is no great separation of the trochlear surface of the astragalus from the under surface of the tibia, but the outer or inner margin of this surface is brought into contact with the articular surface of the tibia, and the whole foot presents a lateral twist" (Pick). The causes of these dislocations are twists of the joint.

**Symptoms.**—Incomplete outward dislocation of the ankle-joint is known as Pott's fracture (see page 465). Complete outward dislocation, in which the articular surface of the astragalus is completely displaced outward from the articular surface of the tibia, and which condition is associated with a fracture of the fibula and separation of the inferior tibiofibular articulation, is known as Dupuytren's fracture. In incomplete dislocation the foot goes outward and upward, the fibula is fractured, and the tibiofibular ligaments are torn off. In Dupuytren's fracture the ankle is broad, the inner malleolus projects and looks lower than natural, the outer malleolus ascends with the foot, the foot rotates outward, and crepitus can be detected. In inward dislocation which is associated with fracture of the inner malleolus there is inversion, the outer malleolus projects, and crepitus can be detected. In incomplete separation the symptoms are similar, but are not so marked.

**Treatment.**—In treating a case of dislocation of the ankle-joint the deformity is reduced by flexing the leg on the thigh and the thigh on the pelvis; an assistant makes counter-extension from the knee; the surgeon makes extension from the foot, and at the same time rocks the astragalus into place. Dupuytren's fracture is treated in the same manner as Pott's fracture (page 466). Dislocation inward is treated in a fracture-box for the same period as Pott's fracture.

**Anteroposterior dislocations of the ankle-joint** are rare. The cause is the catching of the foot in jumping or falling—direct violence. In dislocation forward the foot is lengthened, the heel is not conspicuous, the tibia and fibula project against the tendo Achillis, and the relation of the malleoli to the tarsus is altered. In incomplete dislocation the symptoms are similar, but less pronounced. In dislocation backward the foot is shortened, the tibia and fibula project in front, the heel is prominent, and the relation between the malleoli and the tarsus is altered. In incomplete dislocation the symptoms are similar, but less marked.

**Treatment.**—In anteroposterior dislocation of the ankle-joint, reduce as in lateral dislocations. Sometimes the tendo Achillis must be cut. Apply a plaster-of-Paris dressing, and let it be worn for two weeks; then begin passive motion, and let the patient wear side-splints for a week longer.

**Dislocation upward of the ankle-joint,** or Nélaton's dislocation, is
a very rare injury. The astragalus is wedged between the widely separated tibia and fibula. This dislocation is usually associated with fracture. The cause is a fall upon the feet from a great height.

**Symptoms.**—Upward dislocation of the ankle-joint is indicated by the widening of the ankle and by the flattening of the foot. The malleoli are nearly on a level with the plantar surface of the foot, and there is absolute rigidity.

**Treatment.**—In treating upward dislocation of the ankle-joint give ether, and try to reduce by powerful extension and counter-extension. Treat the injury afterward in the same manner as an anteroposterior luxation.

**Dislocation of the Astragalus.**—The astragalus may be displaced from the bones of the leg and at the same time be separated from the rest of the tarsus. The displacement may be forward, backward, outward, inward, or rotary.

**Dislocation of the astragalus forward or backward** is caused by falls or twists.

**Symptoms.**—In forward dislocation the astragalus projects strongly; there is shortening of the foot, and the malleoli approach the plantar aspect of the foot; the foot is deviated to one side or to the other, and there is absolute rigidity of the ankle-joint. In incomplete luxations the symptoms are similar, but less marked. This dislocation may be obliquely forward. In backward dislocation of the astragalus the foot is not deviated to either side; the astragalus projects between the malleoli and above the os calcis, and the tendo Achillis is stretched over the projection. Rigidity is absolute. This dislocation may be obliquely backward.

**Lateral and Rotary Dislocations of the Astragalus.**—Lateral dislocations of the astragalus are rare, are always compound, and are always associated with fracture. In rotary dislocation the astragalus remains in its normal habitat after rotating on its own axis, either horizontal or vertical. The causes of rotary dislocation are twists of the foot when it is at a right angle to the leg (Barwell). The symptoms of rotary dislocations are obscure. There is rigidity, but sometimes portions of the astragalus may be made out.

**Treatment of Dislocations of the Astragalus.**—In treating astragalus dislocation reduce under ether by flexing the knee to relax the gastrocnemius, extending the foot, and pushing the bone into place. It may be necessary to cut the tendo Achillis. After reduction put up the foot and leg in a plaster-of-Paris dressing for two weeks, and then begin passive motion and apply side-splints, which are to be worn for one week more. If reduction fails, support the limb on splints, combat inflammation, and endeavor to bring about union between the dislocated bone and the tissues. Often, in unreduced dislocation, the skin sloughs over the projecting bone. Excision is demanded the moment sloughing is seen to be inevitable. Cases of compound dislocation of the astragalus require immediate excision.

**Subastragaloid Dislocation.**—This condition is a separation of the astragalus from the os calcis and scaphoid, without separation from the bones of the leg. Pick states that the usual classification for these dislocations is forward, backward, inward, and outward, but that the displacement is, as a rule, oblique, the foot passing backward and outward or backward and inward. The cause is twisting.
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" (Pick).

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