and tenderness, distension, vomiting, constipation, cessation of abdominal respiration, quickened pulse, pyrexia, etc.), the rupture is *intraperitoneal*. If, however, these symptoms do not quickly ensue, and in place of them there be pain limited to the pelvis, with swelling in front of the rectum, or reaching up above the pubes or along the fold of the groin, with fever, quick pulse, and dry tongue, the rupture is *extraperitoneal*, and has led on to *pelvic cellulitis*; this, if unrelieved, may lead to *peritonitis*. The bladder may be ruptured without fracture of the pelvis, by severe contusions of the hypogastrium, or with fracture of the pelvis (wound of the bladder), by muscular violence, during parturition, by over-distension, or as the result of disease.

If there be an induration in any part of the penis immediately following an injury it is produced by *extravasation of blood into the corpus spongiosum* or *corpus cavernosum*; if this be extensive, and involve the whole organ, it may cause "permanent chordee." The diagnosis of *contusion* and *rupture* of the *pregnant uterus* and *rupture of an ovarian cyst* is discussed on page 153.

Wounds of the pelvic viscera.—If from any wound of the penis or perinæum urine flow during the act of micturition, it shows that there is a *wound of the urethra*. Similarly the escape of urine from a wound over or above the pubes independently of micturition along with the signs of laceration of the bladder (*vide antea*) will indicate *wound of the bladder*. If there be an external wound of anus, or vulva, or vagina, or a history of a weapon of any kind having entered either of these canals, the finger must be passed gently into them, and their walls carefully explored; a rent in either of them may in this way be found. The onset of acute peritonitis will point to a *wound of the peritoneum*; if the bladder be found

empty or containing only a little blood and urine, it will indicate *wound of the bladder*. (*Vide antea.*) The small intestines may be found prolapsed into the vagina. The escape of blood and liquor amnii from the wound, or protrusion of part of the fœtus or of the placenta, and hæmorrhage into the vagina, indicate *wound of the pregnant uterus*.

Foreign bodies in the rectum or vagina will be detected on digital examination; when recently introduced, the history of the case will lead to their detection; when long impacted, the fact of a chronic muco-purulent discharge, with pain, and, in the case of the rectum, tenesmus will suggest the necessity of an examination.

For *foreign bodies in the bladder*, *see* page 551.

Foreign bodies in the urethra.—If in the spongy portion, they may be felt by carefully passing the finger along the outside of the urethra, or they may be felt by a bougie, or seen by the endoscope. When deeper in, the finger in the rectum may detect them; or if not, on passing a full-sized silver catheter or bougie obstruction will be met with near the neck of the bladder, and the foreign body may be pressed back into the bladder, and thus detected.

CHAPTER XIII.

THE DIAGNOSIS OF THE SPECIAL INJURIES OF THE UPPER LIMB.

FULL directions for the diagnosis of wounds, sprains, and contusions are given in chapters ii. and iii. Here, therefore, we have to consider only the diagnosis of dislocations and fractures, and of any injuries liable to

be mistaken for them. In approaching this question we would urge upon students not to rely upon any individual "test" symptom, but upon the rational signs of these injuries, and to make a systematic examination of the parts. Different teachers and surgeons recommend various methods of examination, and it matters little which of several the student adopts, provided only that the method be systematic, and that he follow it faithfully. We shall here, of course, mention only one of these methods of procedure.

In the large majority of cases the patient is able to point out the seat of injury; but this is not always the case, and the student must be particularly cautioned against omitting to examine all the parts of an injured limb, and all the limbs of a seriously injured person; for it not uncommonly happens that when one fracture or dislocation has been detected other similar injuries or sprains and contusions are quite overlooked, and the results of such negligence may be very serious.

Mode of examination.—When possible, the patient should be seated in a chair, and the surgeon standing behind him should place the forefinger of each hand on the suprasternal notch of the sternum, and passing outwards he should feel on either side the large inner ends of the clavicles, noting whether they are symmetrical or not; he should then run the ends of his fingers along the upper surface of each clavicle, quite to the point of the shoulder, and along the acromion and spine of the scapula to the posterior border of that bone, all this arch of bone being subcutaneous. Comparing the two sides, he observes particularly any break in the line of the clavicle or scapula, and any tender spot in the bony arch.

He should next proceed to examine the shoulder

joint, to determine whether or not it is dislocated, or if there be a fracture near to it. Placing the hands flat upon the prominence of each shoulder, with the thumb resting on the point of the acromion, he must note whether the thumb or the hand is internal, whether he plainly feels the prominence of the upper end of the humerus beneath the hand, or whether he can press in the deltoid muscle, and feel through it the glenoid fossa of the scapula; these signs prove a dislocation of the shoulder, and search must then be made for the head of the bone below the clavicle, in the axilla, or, failing to find it there, below the spine of the scapula; then, with one hand grasping the head of the bone, let him rotate gently the elbow on the same side, and notice whether the head moves with the rest of the shaft, or not, and if there be crepitus.

By this examination any lesser degree of flattening of the natural prominence of the shoulder will have been noted; let the surgeon now place the points of his fingers in the groove between the pectoralis major and deltoid, and feel for the coracoid process, and press firmly upon that point of bone, and take special notice of acute pain, or crepitus, or mobility of the process so produced; then pass the ends of the fingers out round the shoulder to note any difference in the outline on the two sides. Gently raising the arm, place the fingers in the axilla, and feel the inner surface of the neck of the bone, first on the sound side, then on the injured, and note any projection, or if the head of the bone be too plainly felt. Then place the hand flat and rather firmly on the shoulder, and rotate the elbow, and feel for crepitus, noting as accurately as possible where the crepitus is produced. Finally, the hands should be passed over the back of the scapulæ below the spine, and any irregularity or tender line noticed, and then the angle should be seized in one hand, and an attempt be made to move

it on the rest of the bone. Departures from the normal in these various respects will indicate a fracture about the shoulder.

The surgeon should then stand in front of his patient, and place the sound limb in exactly the same position as the injured one. There may be an obvious deformity, such as angular bend in the arm or fore-arm, or great projection of the point of the elbow, which shall at once declare a fracture or a dislocation; but even in such a case it is best to follow out a systematic examination, for it occupies but a few seconds, and may save from serious blunder. To examine the shaft of the humerus, place the thumbs on the inner side of the surgical neck of each humerus, and the fingers on the outer side, and run them down along the bone to the elbow, noting, of course, any want of symmetry, especially any sharp projection or irregularity, and any local tenderness; where either of these is detected, grasp the arm above it in one hand, and rotate the elbow with the other, and try to move the lower end of the bone laterally, or forwards and backwards, noting mobility in the length of the bone, crepitus, and whether the attempt produces sharp pain at the suspected spot. It may be well here to remark, that if on rotating the elbow distinct mobility or crepitus be obtained, and the place where they occur be detected, it is unnecessary and therefore wrong to repeat the act, or to try the effects of movement of the elbow in other directions.

Coming now to the elbow, the two joints should be taken into the palms of the hands with the fore-finger resting on the tip of the olecranon, the thumb will then be placed on the outer epicondyle of the humerus and the middle digit on the inner epicondyle. The relative distance between and level of the olecranon and these two points of bone is to be noted, also whether

the outline of the sigmoid notch of the ulna can be felt, or a gap in the line of the olecranon, whether the olecranon is more or less prominent on the injured side than the other, and whether flexion and extension of the joint are painless and free. The thumb of the left hand should then be placed on the outer condyle of the humerus, and the hand seized with the surgeon's right hand and gently rotated, when the rounded head of the radius should be felt rotating immediately below the condyle. If this movement be painful, and produces crepitus at the elbow, of course special note is to be made of it. Then each epicondyle is to be separately grasped, and an attempt made to move it on the rest of the humerus, the surgeon observing, so far as he can, the size of the fragment that he is able to move. Lastly, he should run the finger carefully along the olecranon to note any slighter irregularity in it that may have escaped notice before, or any tender spot, and, grasping the tip of the prominence, he should attempt to move it laterally, and should then notice how much of the bone, if any, is detached, and whether there is crepitus between the two fragments or not; the tendon of the triceps muscle should be followed down to its insertion into the ulna, and it will not then be possible to overlook a fracture of the olecranon, with drawing up of the upper detached fragment. It may happen that when the surgeon first sees his patient the part is so swelled that an exact diagnosis is impossible, he should endeavour to assure himself that there is no dislocation; extensive ecchymosis should be taken as strongly indicating a fracture.

Fracture of the shaft of both bones of the fore-arm is usually a very obvious accident, on account of the angular deformity of the limb at the site of the fracture. The whole length of the ulna can be plainly felt through the skin, and the finger should be run along

its posterior border from the olecranon to the styloid process, and the radius should be similarly examined; as already mentioned, the head of the radius should be felt immediately below the outer epicondyle of the humerus at the bottom of a slight dimple in that situation; the shaft of the bone is covered by muscle, but the finger can plainly feel its outer surface the whole way down; its lower end and styloid process are easily felt, and compared with the same parts on the sound side. The hand should then be pronated and supinated, to determine whether the head of the radius moves with the lower end of that bone; by attempts at angular movements in the fore-arm, the solidity of the bones or the reverse may be shown.

The bones of the wrist being so subcutaneous any displacement at the joints or fracture with displacement of the fragments is easily detected by the eye and by the hand. The same is true of the fingers and thumb, the bones are all practically subcutaneous on the dorsum; the surgeon should, therefore, run his fingers along the dorsum of the metacarpal and phalangeal bones, and note any irregularity, and then grasping the extremities of each bone, one in either hand, should see if there be any mobility with crepitus.

Measurement of the limb is sometimes useful in diagnosis, and before going further it will be well to notice the best measurements to take, and the injuries that modify them. First, measure *from the inner end of the clavicle to the tip of the acromion;* this is not increased by any injury; it may be shortened by fracture of the clavicle with over-riding of the fragments, bending of the bone (greenstick fracture), or by dislocation of its outer end. Next, measure *from the tip of the acromion to the outer epicondyle* of the humerus, or *from the tip of the coracoid process to the inner epicondyle.* If lengthened, there is a dislocation

of the shoulder. Shortening of the arm, as shown by this measurement, may be caused by dislocation of the shoulder, by fracture of the humerus, or by fracture with displacement downwards of either the acromion or the coracoid the process. Then measure *from each epicondyle of the humerus to the styloid process* of the same side; shortening of the outer line may be caused by dislocation of the radius at the elbow, or by fracture of the same bone; shortening of the inner line is similarly due either to fracture or dislocation of the ulna. In the wrist and hand measurements may be taken *from the tip of either styloid process to the base of the first and fifth metacarpal bone* respectively, shortening of this measurement indicating a dislocation of the wrist. A useful measurement is the *circumference of the shoulder*, taken by passing the tape under the axilla, and bringing its ends vertically up over the shoulder; dislocation of this joint increases this measurement by from one to two inches. The distance between the tip of the olecranon and either epicondyle of the humerus indicates the relative position of the ulna to these bony points.

Among many other "pathognomonic signs" may be mentioned this: when a flat rule or some similar body is placed with one end resting on the outer epicondyle of the humerus, and the other extremity on the prominence of the shoulder, its point should not touch the acromion, but should be separated from it about an inch; if, however, its upper end rest against the acromion, it shows that the upper end of the humerus is not occupying the socket of the scapula, in other words, that it is dislocated.

By this examination, which, when the surgeon is expert in his movements, can be very quickly conducted, we are able to decide whether there is any serious injury to the bones or joints, any fracture or dislocation;

and are also able to tell where the injury is, and to put it in one or other of these categories :

Fracture and dislocation of clavicle, acromion, or spine of scapula.	Fracture or dislocation of elbow.
Dislocation of the shoulder.	Fracture or dislocation of wrist.
Fracture of the shoulder.	Fracture or dislocation of fingers and thumb.
Fracture of shaft of humerus.	
Fracture of fore-arm.	

We will now discuss the diagnosis of the various lesions in each of these groups.

A. **Fractures and dislocations of the clavicle, acromion, and spine of the scapula.** —(1) If, in commencing the examination, the suprasternal notch be found narrowed, and the sternal end of the clavicle be felt to be on the top of the sternum, projecting strongly under the skin, and allowing its whole articular surface to be felt, it is a *dislocation of the clavicle upwards.* If, however, on passing the finger out from the suprasternal notch the end of the clavicle be not felt in its proper place, feel for it behind the sternum or in front, and, according to its position, it will be recognised as *dislocated backwards or forwards.* In all these cases there is no shortening of the measurement from the inner end of the clavicle to the point of the shoulder, and owing to the large size of the inner end of the bone, and its superficial position, the diagnosis is not difficult. When the bone is dislocated backwards there may be very great distress, owing to the displaced bone pressing upon the trachæa, the œsophagus, or the great vessels and nerves of the neck.

(2) On running the finger along the clavicle a distinct break in the line of the bone may be detected, one part of the bone being obviously separated from the other; this is most often met with a little to the outer side of the middle of the bone, the end of the

inner fragment projecting under the skin, the outer fragment being on a lower level; it may occur close to the inner end of the bone, when the outer fragment will, in most cases, be prominent, riding downwards and forwards over the inner. This sign will of itself suffice to indicate a *fracture of the clavicle*, and to localise it precisely. When the fracture is near the inner end of the bone, the facts that the inner extremity is felt in its right position on the sternum, that movement of the clavicle is attended with crepitus, and that the point of the shoulder is approximated to the inner end of the bone, will at once distinguish the injury from a dislocation of the bone, for which it might possibly be mistaken.

If on running the fingers over the outer flattened end of the bone, it be found that there is an angular projection backwards, that the shoulder has rolled forwards, and is approximated to the inner end of the clavicle, that over the bony projection there is pain and great tenderness, and especially when on rotating the elbow freely crepitus at this spot is detected, a *fracture of the acromial end of the clavicle* is to be diagnosed. Sometimes the angular deformity is upwards instead of backwards. There may, however, be no displacement of the fragments, and no deformity; but if, as the finger passes along the bone, at one spot the patient winces and complains of great tenderness, and when the shoulder joint is freely moved it causes pain at the same point, a *fracture of the clavicle without displacement*, or, as some prefer to call it, a *fracture opposite the coraco-clavicular ligaments*, is to be suspected; if crepitus can be obtained, the diagnosis becomes certain; but without that, or some slight irregularity in the bone, the diagnosis cannot be certain, unless in the course of a week or ten days slight thickening from callus at the spot clears it up. Where there is no displacement there is no shortening. When in an

infant or young child, who has fallen on its shoulder, the middle of the clavicle is found projecting forwards or upwards, but the bone quite continuous, it being simply bent, and the bone is found shorter than the one on the other side, a *greenstick fracture of the clavicle* may be diagnosed. This can only be mistaken for the curve in the bone often seen in rickets. If, however, the bone can be straightened out again with more or less distinct crepitus, or if it become swelled along the curvature in a few days, there can be no difficulty whatever in the diagnosis. In rickets the deformity of the bone is the same on the two sides, and there will be other signs of the disease in the bones, teeth, etc. This fracture may, however, occur in a rickety child, and the surgeon must then be guided by asymmetry (the rickety curve being exaggerated by the fracture), by the marked local tenderness, by the crepitus if present, and by the swelling coming on or increasing for a day or two after the injury.

(3) The articulation of the clavicle with the scapula can always be felt as a slight projecting ridge. If, however, in place of this slight ridge there be, just internal to the point of the shoulder, a marked bony projection, it is a *dislocation of the scapula*. If the projection be continuous with the clavicle, and that bone be found lying upon the acromion, it is a dislocation *downwards*. As a very rare occurrence the acromion may be found lying on the clavicle, and projecting under the skin, dislocated *upwards*. In the latter case try to feel the coracoid process, as that has been described as lying above the clavicle. These injuries are sometimes called dislocations of the acromial end of the clavicle.

(4) When there is bruising, swelling, and pain over the top of the shoulder, examine carefully the line of the acromion to detect an irregularity, or the detachment and displacement downwards of a fragment

in front of the outer end of the clavicle, or crepitus on forcibly raising the elbow; inability to abduct the shoulder owing to a sharp pain referred to the end of the acromion, as well as slight flattening of the shoulder, should make the surgeon strongly suspect a *fracture of the tip of acromion*, but it is only when he detects the fragment displaced and movable that the diagnosis is certain.

If, on running the finger still farther back along the acromion, a gap be found in it behind the point of the shoulder, if the shoulder be flattened and dropped, and if on raising the elbow this latter deformity be corrected, and the acromion be then found to be raised to the level of the spine of the scapula, crepitus thus being obtained, a *fracture of root of acromion* has occurred. Where there is no crepitus, or only soft friction to be obtained, it is to be regarded as *diastasis of the acromion*, or separation of the epiphysis. Care must be taken to ascertain that the mobility of the acromion is not a natural condition, and present on the uninjured side also.

If on running the finger along the spine of the scapula, a depression or sharp projection in it be detected, grasp the bony prominence, and attempt to move it while holding the rest of the scapula firm in the other hand; if this be possible, and especially if crepitus be at the same time noticed, a *fracture of spine of scapula* is to be diagnosed. This injury is a very rare one.

B. **Dislocations of the shoulder.**—The surgeon having found that there is a dislocation of the head of the humerus, the diagnosis will be made complete by his determining where the head of the bone is now lying. While comparing the two shoulders, the possibility of a bilateral dislocation of the shoulder must be borne in mind. The globular head of the humerus should first be felt for in front,

filling out the groove between the deltoid and pectoral muscles, obscuring the coracoid process, and forming a rounded prominence, moving when the arm is rotated; if it be found there, the dislocation is *subcoracoid*. Some would draw a distinction between subcoracoid and intracoracoid; in the former the arm is rotated out, in the latter the arm is rotated in. This form of dislocation is much the most frequent, and the surgeon must remember that in it, when the arm is raised, the head of the bone can be plainly felt in the axilla. The length of the arm may be unaltered, a little shortened, or a little lengthened.

If, on examining the front of the shoulder, the tip of the coracoid process can be plainly felt, but a rounded prominence is seen and felt under the pectoral muscle, one or two fingers' breadth below it (the prominence being shown to be the head of the humerus by its outline, and especially by its rotating with the shaft of the bone), and if the head of the bone be plainly felt in the axilla, bulging down its floor, even without raising the arm, the elbow being directed far away from the side, the dislocation is *subglenoid*. Subcoracoid dislocations are often spoken of as dislocations into the axilla, and are mistaken for subglenoid, owing to the ease with which the misplaced bone can be felt in the axilla, especially when the arm is raised. A subglenoid dislocation is rare, and is only to be diagnosed when there is a distinct interval between the coracoid process and the head of the humerus, and when the whole globe of the head can be readily felt in the axilla. The arm is usually lengthened in this displacement; it has, however, been described as shortened. Mr. Hulke has described two cases of this dislocation, in which the arm was placed vertically up by the ear of the same side, the head of the bone filling out and projecting from the axilla; he has called this particular variety *luxatio erecta*.

If the head of the bone be found lying below the clavicle internal to the coracoid process, and out of reach of the fingers passed into the axilla, the dislocation is *subclavicular*. If the head of the humerus cannot be found in front, feel for it behind, below the acromion and spine of the scapula; if detected there, and it will be easily known by its rounded shape and its moving with the shaft of the bone, it is a *subspinous* dislocation.

Mr. Holmes has drawn attention to cases where the head of the humerus is found forced up under the skin between the deltoid and pectoral muscles, forming a very marked and unmistakable projection at the top of the shoulder; this form is called the *supracoracoid* dislocation, and is always associated with fracture of the acromion or of the coracoid process. It is occasioned by severe violence applied to the elbow forcing the humerus upwards against the scapula.

If, in reduction of the dislocation, crepitus is obtained, and the head of the bone easily slip out of place again, and the surgeon be able to assure himself that there is no fracture of the humerus or of the coracoid or the acromion process, he should diagnose a *fracture of the glenoid cavity*, an injury never met with apart from dislocation of the joint.

C. **Fractures of the shoulder.**—The surgeon having decided that there is no fracture or dislocation of the claviculo-acromial arch, and that the upper end of the humerus still occupies the glenoid cavity of the scapula, finds that there is deformity about the shoulder or crepitus on rotating the arm or on manipulating the scapula; he therefore decides that there is a fracture of the bones entering into the shoulder, either of the upper end of the humerus or of the scapula.

Let him first grasp the rounded head of the humerus immediately below the acromion, and with the other hand