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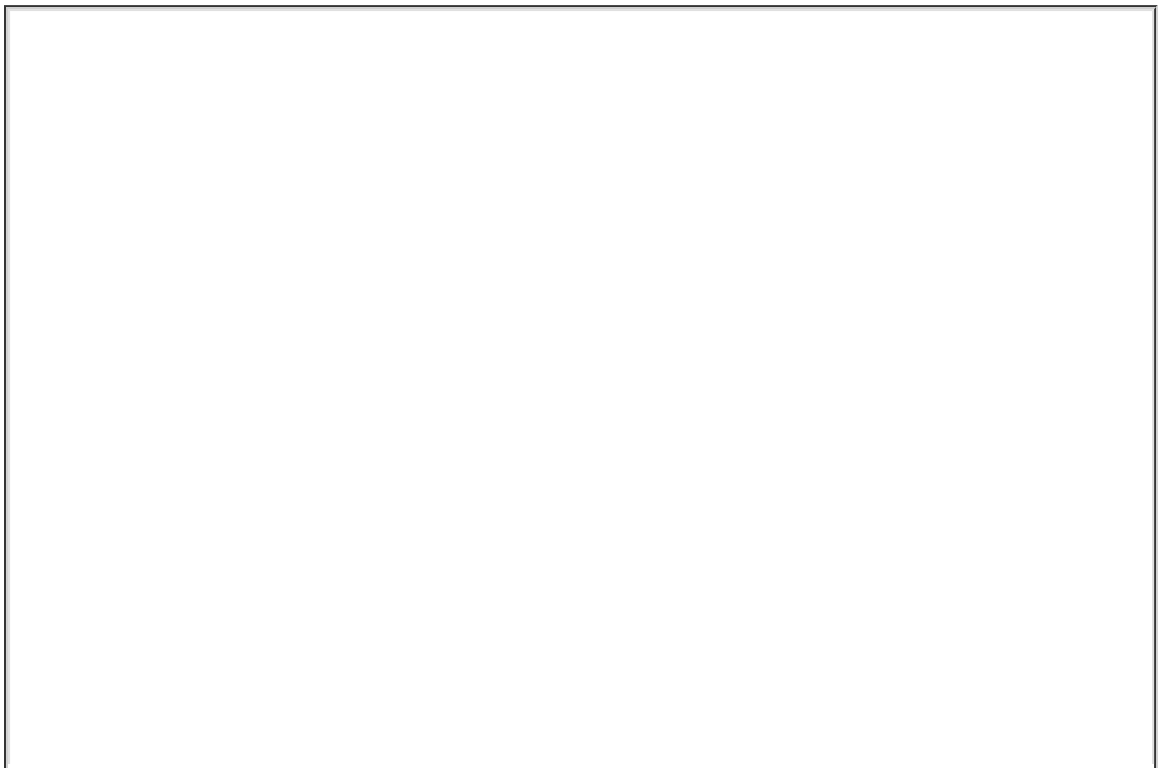
SURGICAL AND APPLIED ANATOMY

Part of "37 - HIP DISLOCATIONS AND FRACTURES OF THE FEMORAL HEAD"

P.1556

Ligamentous Anatomy

The hip joint is a constrained ball-and-socket joint. The head rotates within the acetabulum and is incompletely covered. The depth of the acetabulum is supplemented by the fibrous labrum, which makes the joint functionally deeper and more stable (Fig. 37-9). The labrum adds more than 10% to the coverage of the femoral head, creating a situation that keeps the head more than 50% covered during motion (7,49,50,84,99). It takes more than 400 N of force just to distract the hip joint (37). The capsule of the hip is strong and extends from the rim of the acetabulum to the intertrochanteric line anteriorly and the femoral neck posteriorly. The longitudinal fibers are supported by spiral capsular thickenings called ligaments. Anteriorly, the iliofemoral or **Y** ligament originates from the superior aspect of the joint at the ilium and anterior inferior iliac spine. It runs in two bands inserting along the intertrochanteric line superiorly and just superior to the lesser trochanter inferiorly. The inferior capsule is further supported by the pubofemoral ligament, which takes its origin from the superolateral superior ramus and inserts on the intertrochanteric line deep to the **Y** ligament (49,80) (Fig. 37-10A).



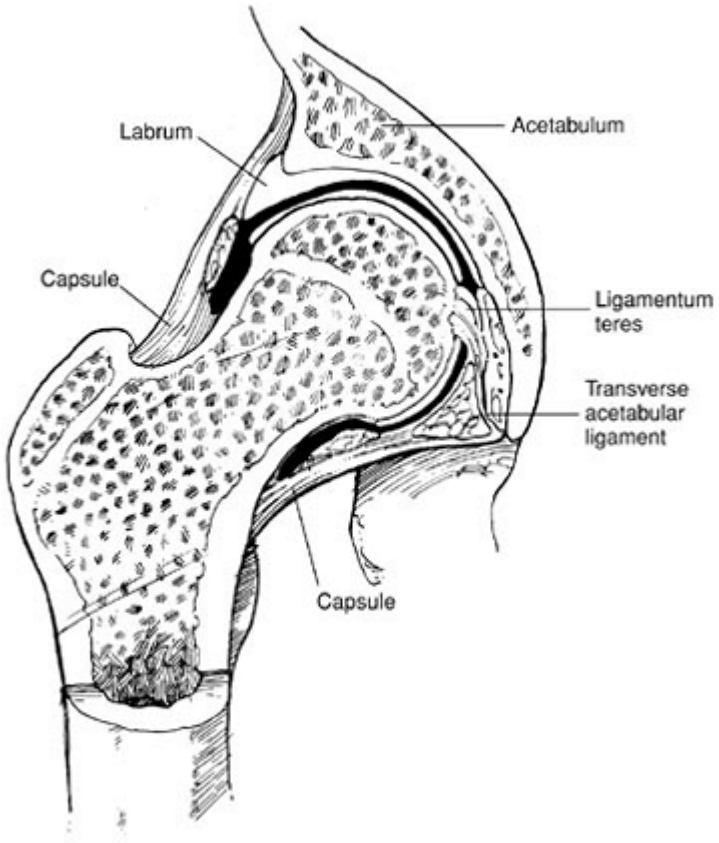


FIGURE 37-9. Coronal section of the hip of a child demonstrates the added depth that the labrum provides over the femoral head.

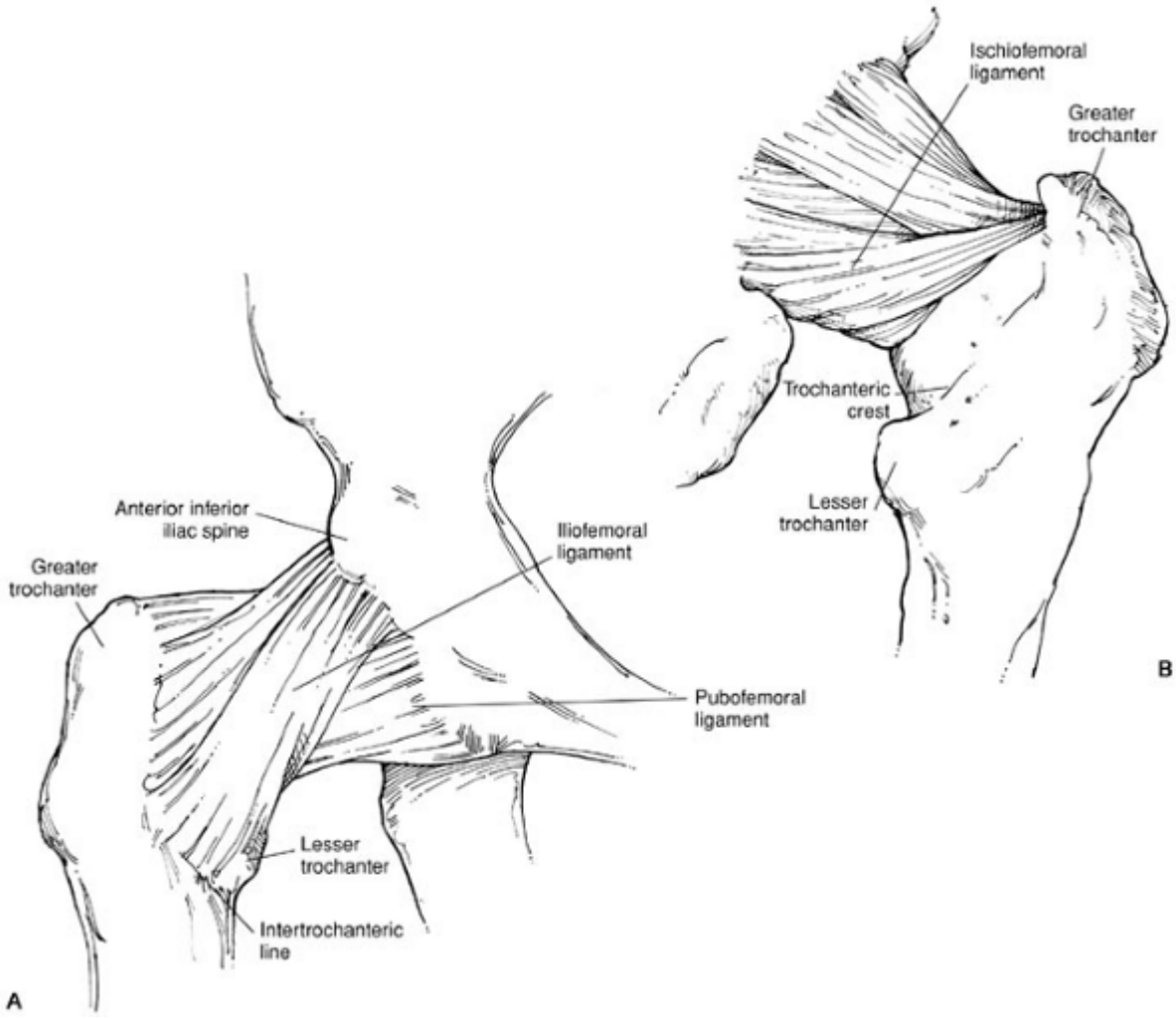


FIGURE 37-10. The hip capsule and its thickenings (ligaments) as visualized from anteriorly **(A)** and posteriorly **(B)**.

Posteriorly, the capsule inserts on the femoral neck just inferior to the head medially and extends to the base of the greater trochanter laterally. The ischiofemoral ligament within the capsule posteriorly originates at the junction of the inferior posterior wall with the ischium. It runs obliquely lateral and superior to insert on the femoral neck with the capsule (49,80) (Fig. 37-10B). In addition to these ligaments, the short external rotators lie on the posterior capsule, providing additional support.

Neurovascular Anatomy

All the nerves to the lower extremity pass close to the hip joint. The sciatic nerve warrants the most attention as it is most at risk. This nerve runs posteriorly to the joint, emerging from the greater sciatic notch deep to the piriformis and superficial to the obturator internis

and gemelli muscles. In 85% of people the nerve is a singular structure located in the normal position. In 12% it divides prior to exiting the greater sciatic notch, and the peroneal division passes through, rather than deep to, the piriformis muscle (5). In 3% the nerve divisions surround the piriformis and in 1% the entire nerve passes through the piriformis. With posterior dislocation, the nerve may be stretched or directly compressed.

The obturator nerve passes through the superolateral obturator foramen with the obturator artery. The femoral nerve lies medial to the psoas in the same sheath and can be injured with anterior dislocation.

Injury to the vascular supply of the femoral head is an important factor in hip dislocations. In adults, the primary blood supply to the head derives from the cervical arteries. These arteries originate from the extracapsular ring at the base of the femoral neck (Fig. 37-11). This ring is formed by contributions from the medial femoral circumflex artery posteriorly and the lateral femoral circumflex anteriorly (55). The capital vessels traverse the capsule close to its insertion on the neck and the trochanteric

ridge, and ascend parallel to the neck, entering the head adjacent to the inferior articular surface (19,45,49). The superior and posterior vessels, which are derived primarily from the medial femoral circumflex artery, are larger and outnumber the anterior vessels. In addition to the cervical vessels, a minor contribution to the head arises from the foveal artery, a branch of the obturator artery that lies within the ligamentum teres. This artery makes a significant contribution to the epiphyseal portion of the femoral head vasculature in approximately 75% of hips (22).

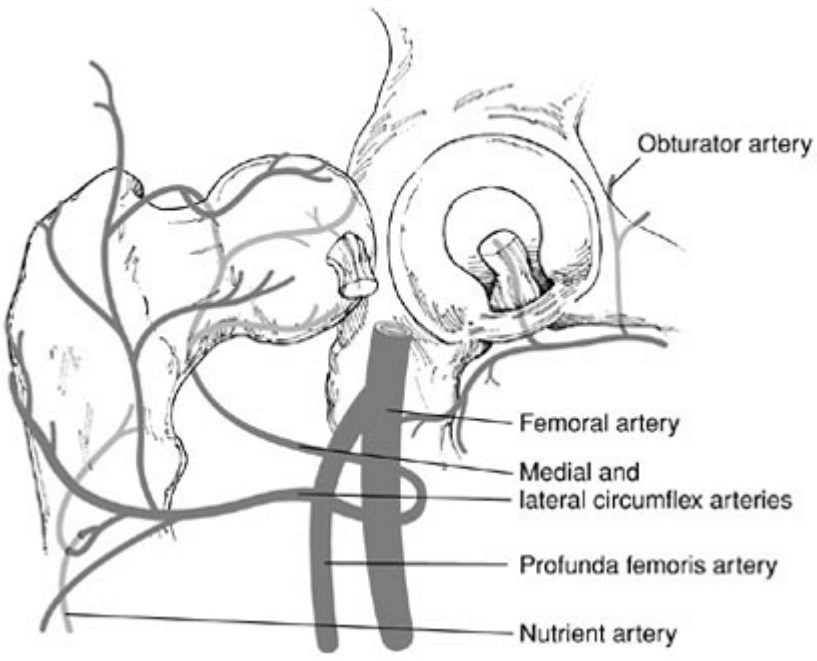


FIGURE 37-11. The vascular supply to the femoral head arises from the medial and lateral circumflex vessels, which create a ring giving rise to the cervical vessels. A minor contribution comes from the

obturator artery via the ligamentum teres.

Pathoanatomy

For the hip to dislocate, the ligamentum teres and at least a portion of the capsule must be disrupted. Labral tears or avulsions and muscular injury are common (67). Pringle and Edwards (95) examined the soft tissue injuries in cadavers in which they induced hip dislocations. They found that the capsule may be stripped as a cuff from either the acetabulum or femur by a rotational force or be split by direct pressure. A combination of these capsular injuries may take place resulting in an **L**-shaped lesion.

In posterior dislocations, the capsule is torn either directly posteriorly or inferoposteriorly depending on the amount of flexion at the time of the injury. The **Y** ligament is generally intact with the capsule stripped from its acetabular attachment posterior to it. However, in some cases, the **Y** ligament may be avulsed with a fragment of bone (12).

In anterior dislocations the psoas acts as the fulcrum of the hip, and the capsule is disrupted anteriorly and inferiorly. Although rare, in extremely high-energy injuries the femoral vessels can be injured or an open dislocation can occur.

Femoral head injury is common and may be the result of a

shearing injury, impaction, or avulsion (23). Avulsions are most common. When the hip dislocates, a small fragment remains attached to the ligamentum teres, avulsing from the head. These fragments, if small and within the fovea, are of minimal concern. More severe injuries to the head involve a shearing mechanism or impaction injury. Impaction is more common after anterior dislocation and may be quite large (Fig. 37-5) (23). Shear injuries are usually the result of a posterior dislocation that occurs with less adduction and internal rotation, forcing the head against the rim of the posterior wall. In these cases, the head fails in shear rather than the posterior wall fracturing. Because of the mechanism, the fracture fragment is sheared from the anteromedial head, with the fracture line running from anterolateral to posteromedial (Fig. 37-12). These head fragments may be attached to the ligamentum teres and remain in a relatively normal position or can be free of soft tissue attachments within the joint.

FIGURE 37-12. The fracture line of the femoral head runs 25 to 45 degrees off the coronal axis with the free fragment located anteromedially.

Free intraarticular fragments can also be generated from comminution of associated fractures, shearing of cartilage, and extraarticular fragments being pulled into the joint during the reduction.