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Oxford Textbook of Orthopedics & Trauma, 1st Edition

Anatomy

Part of "3.53 - Dislocations of the hip and femoral head fractures"

The hip joint is a ball-and-socket joint that is extraordinarily stable. This stability is primarily due to the adaptation of the articular surfaces of the femoral head and acetabulum to each other and is secondarily due to the associated capsuloligamentous attachments and local muscular anatomy.

The articular surface of the acetabulum is lined with hyaline cartilage. The articular surface forms a C-shaped concavity that is deficient medially and inferiorly around the cotyloid fossa (acetabular notch). The fossa is spanned inferiorly by the transverse ligament which gives origin to the ligamentum teres. The bony acetabulum forms approximately 40 per cent of a spherical socket. The peripheral edge of the acetabular articular cartilage is appreciably deepened by the labrum acetabulare, a rim of dense fibrous tissue which encloses the femoral head beyond its equator. The extent of this fibro-osseous concavity is primarily responsible for the unique combination of stability and mobility in the hip joint.

Box 1 General features of hip dislocations

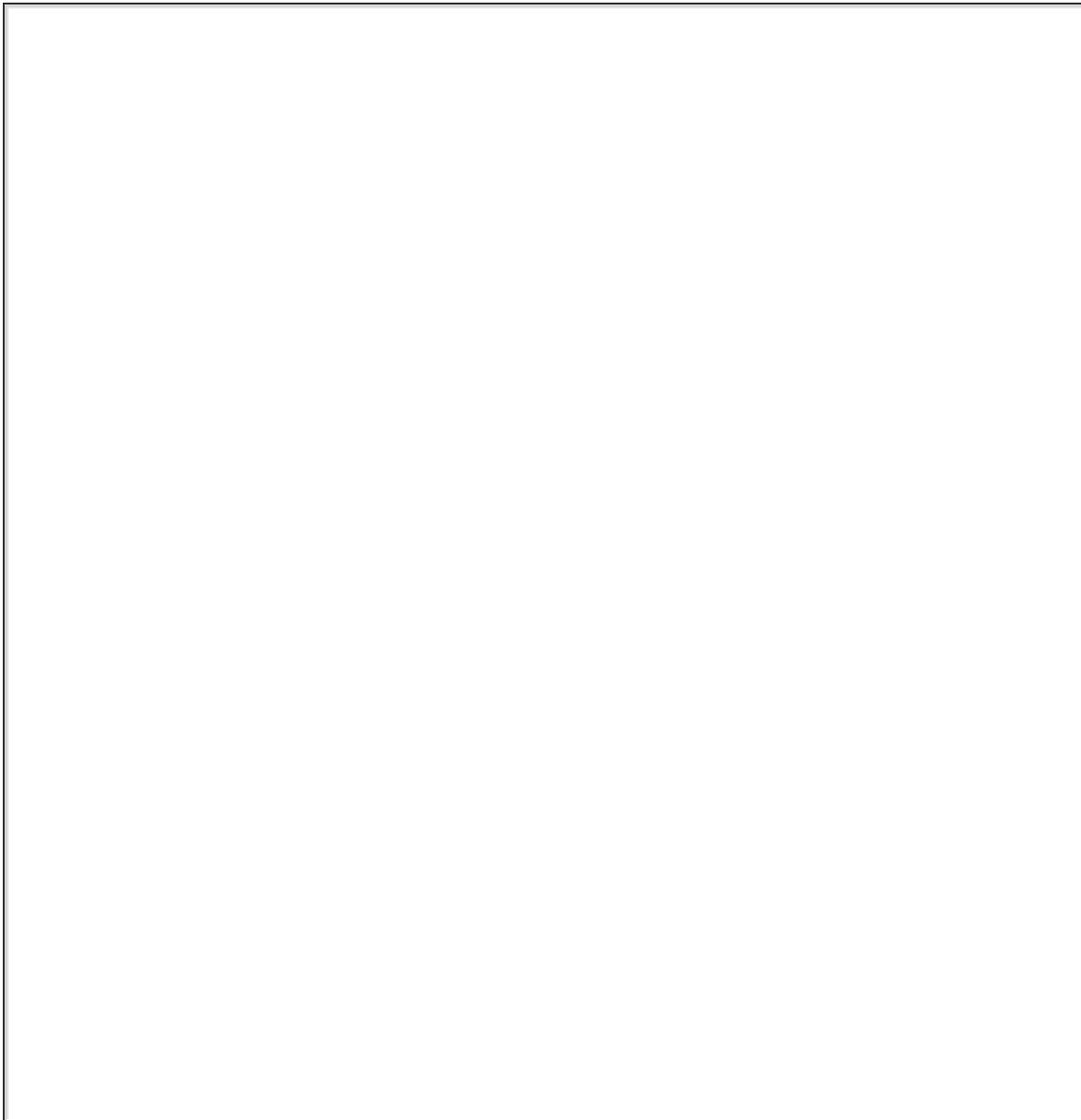
- High-energy injury
- Force vector determines pattern of injury
- Associated injuries common
- Injury sometimes missed
- Early treatment essential

The femoral head is lined by hyaline cartilage except for a small nonarticular pit, or fovea, to which the other end of the ligamentum teres is attached. The femoral head forms approximately two-thirds of a sphere. The femoral neck has a diameter that is three-quarters of the equatorial diameter of the femoral head. The smaller diameter of the neck allows a considerable range of motion without impingement on the acetabular labrum. It is this mechanical feature that provides such a wide range of hip motion without compromising stability. Normal hip motion includes flexion of 120° to 135°, extension of 20° to 30° in a prone position, abduction of 45° to 50°, adduction of 20° to 30°, external rotation of 45°, and internal rotation of 30° (Hoppenfeld 1976).

The hip joint is surrounded by a capsule that is attached proximally to the acetabular brim where it is blended with the labrum and transverse ligament. Distally the capsule is

attached to the femoral neck along the intertrochanteric ridge anteriorly and to the mid-portion of the femoral neck posteriorly, at the level of the obturator externus tendon. From these distal attachments the capsular fibers are reflected back proximally, along the femoral neck, as retinacular fibers, blended with the periosteum and extending to the articular margin of the femoral head. The fibrous capsule is strengthened by strong fibrous condensations that form three named ligaments extending from each of the constituent bones of the acetabulum. Hence, iliofemoral, iliopubic, and ilio-ischial ligaments are described.

The iliofemoral ligament (Y-shaped ligament of Bigelow) attaches proximally to the lower half of the anterior inferior iliac spine, where it fuses with the reflected head of rectus femoris and extends distally as two distinct bands (Fig. 1(a)). The diverging bands each attach to a tubercle at either end of the intertrochanteric line. This ligament, which is the strongest of the three, limits extension at the hip joint. Bigelow described the ligament forming the fulcrum about which the femoral neck rotates in dislocation of the hip joint.



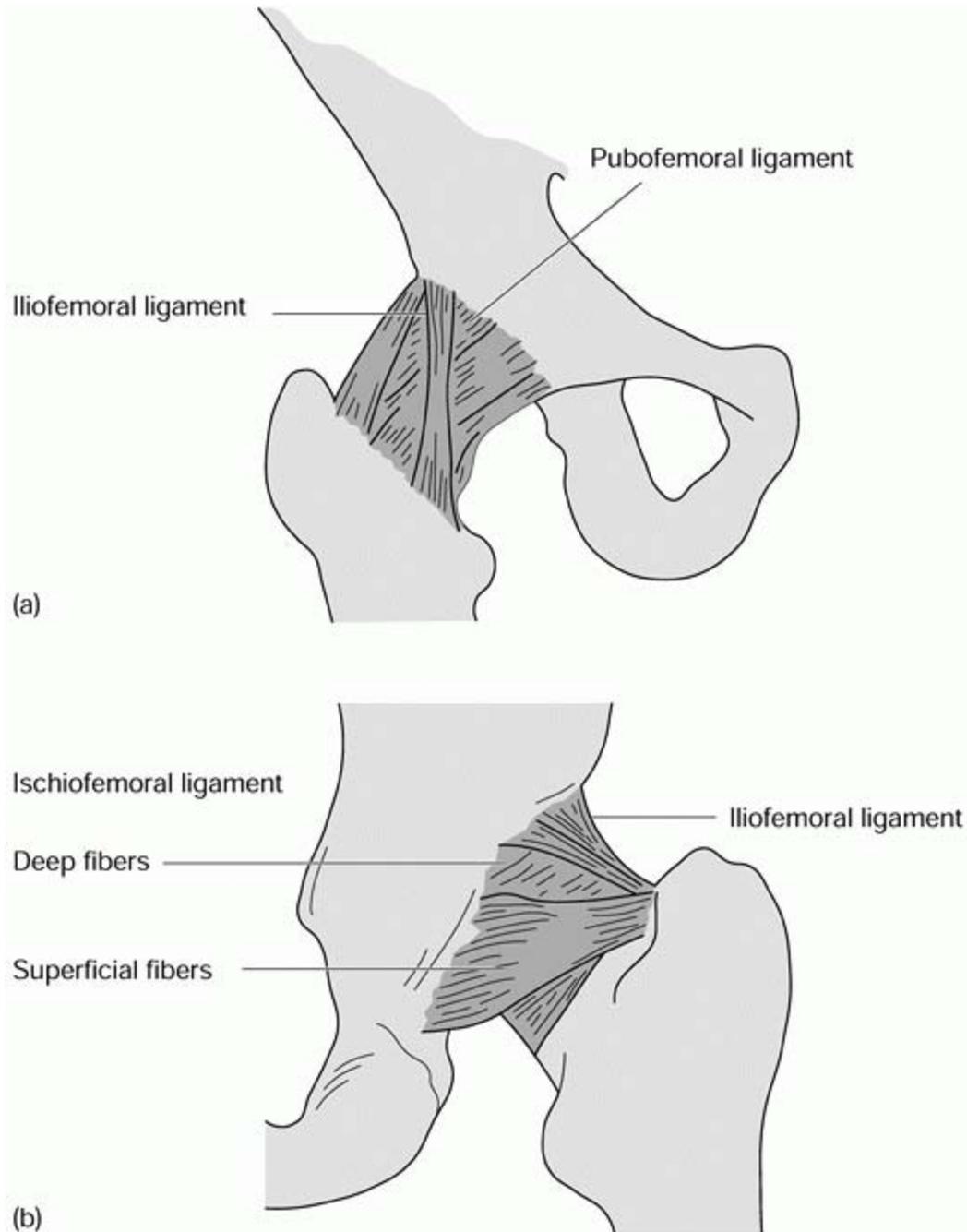


Fig. 1. Condensations of the hip capsule form named ligaments which supplement hip joint stability. (a) The iliofemoral ligament (Y-shaped ligament of Bigelow) and pubofemoral ligament. The iliofemoral ligament extends from the anterior inferior iliac spine as two distinct bands which attach to a tubercle at each end of the intertrochanteric line. The pubofemoral ligament extends from the pubic eminence and obturator crest to the intertrochanteric line. (b) The ischiofemoral ligament. Superficial fibers of the ischiofemoral ligament extend horizontally from the ischial border of the acetabulum to the greater trochanter where they blend with the iliofemoral ligament. Deep fibers of the iliofemoral ligament run around the femoral neck in the capsule of the hip joint where they form the zona orbicularis.

The pubofemoral ligament extends from the pubic eminence and obturator crest to the intertrochanteric line (Fig. 1(a)). When taut, the ligament limits extension combined with abduction of the hip.

The ischiofemoral ligament extends posteriorly from the ischial border of the acetabulum as the weakest of the three ligaments (Fig. 1(b)). Some fibers pass horizontally to blend with the iliofemoral ligament at the greater trochanter. The more deeply placed fibers run in the capsule around the femoral neck to form the zona orbicularis. Therefore the term ischiocapsular ligament would be more accurate.

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The main source of blood supply of the femoral head is the medial and lateral circumflex femoral arteries which arise from the femoral or profunda femoris arteries (Crock 1980). The base of the femoral neck is surrounded by an extracapsular arterial ring. The posterior portion of this arterial ring is formed by a large branch of the medial circumflex femoral artery. Anteriorly the anastomosis is completed by branches of the lateral circumflex femoral artery. Multiple ascending cervical branches pass from the extracapsular arterial ring along the femoral neck to supply most of the femoral head. These nutrient vessels enter the hip joint at the capsular insertion and are bound down by the retinacular fibers until the vessels enter the bone just below the articular surface of the femoral head. A subsynovial intra-articular arterial ring is formed around the edge of the articular cartilage. Epiphyseal branches pass from the intra-articular arterial ring to supply the femoral head. The most lateral epiphyseal branches supply the majority of the superior weight-bearing portion of the femoral head (Claffey 1960). A portion of the femoral head around the attachment of the ligamentum teres is supplied by a branch of the acetabular branch of the obturator artery in the young.

The sciatic nerve is formed by nerve roots from L4 to S3. The common peroneal and posterior tibial components of the sciatic nerve are bound in a common sheath as they exit the pelvis at the greater sciatic notch, deep (anterior) to the piriformis muscle. The nerve lies in contact with bone over the posterior acetabulum where it is vulnerable in posterior fracture dislocations of the hip joint. The common peroneal and posterior tibial components usually separate above the popliteal fossa. When a higher division occurs, the two components may leave the pelvis separately. Occasionally the common peroneal component may then pierce the piriformis muscle or, rarely, it may emerge superficial (posterior) to the piriformis.