Dislocation After Total Hip Replacement

Essay

Submitted For Partial Fulfillment of Master Degree in Orthopaedic Surgery

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2009

Introduction

Total hip arthroplasty (THA) is a reconstructive procedure that has improved the management of those diseases of the hip joint that have responded poorly to conventional medical therapy[1].

Direction of dislocation of a T.H.A. is usually posterior (77%), anterior dislocation is much less frequent (23%), whereas superior or Lateral dislocation has also been described[2].

A number of implant-related factors affect hip stability; these include femoral component offset, femoral component head to neck diameter ratio, femoral component neck geometry, and acetabular component design[3].

For treatment purposes, dislocation after total hip arthroplasty can be categorized as early or late on the basis of the timing of the onset. Early dislocation usually occurs in the early post- operative period after the arthroplasty and is often successfully treated with nonoperative means. In contrast, late dislocation occurs after five years and generally requires surgical treatment. Dislocations occurring between six months and five years may be categorized as intermediate. This temporal classification is useful because it highlights the differences in the etiology of the dislocation in each category, which in turn determine the type of treatment that is selected[4].

The etiology of hip instability is often multifactorial. Patient demographics, operative technique and implant design variables have been demonstrated to affect the risk of dislocation[5].

Surgeons are well that preventing dislocation is far preferable to having to manage the problem[4]. To prevent early dislocation, it is common practice to impose postoperative restrictions. These restrictions typically include the use of abduction wedges in the early post operative period and strict advice regarding permissible posture while standing, walking, sitting, or sleeping[1].

Immediate management of a dislocation after primary or revision operations is relocation, which in most instances can be affected by closed means. Open reduction of a hip dislocation occasionally is required. During the operation an effort should be made to identify the source of instability and if necessary manage it at the time of the open reduction[4].

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Anatomy of the hip joint

The hip joint:

The hip joint is multi-axial, synovial, and of ball and socket variety [6].

In general, it can be said that; in all joints, stability and range of movement are in inverse proportion to each other; the hip joint provides a remarkable example of a high degree of both. Its stability is largely the result of the adaptation of the articulating surfaces of acetabulum and femoral head to each other and its great range of mobility results from the femur having a neck that is much narrower than the equatorial diameter of the head **(Fig. 1)** [6].

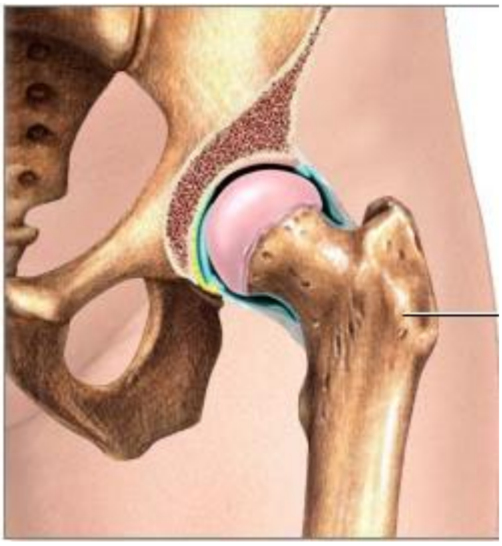

Fig. 1: *The hip joint provides a high degree of Stability and range of motion*[7]

Surface Landmarks:

The bony landmarks provide initial guidance to the incisions and orientation of the pelvis for the various approaches to the hip. Anteriorly, the prominent anterior superior iliac spine (ASIS) marks the anterior limit of the iliac crest and serve as an attachment for the sartorius muscle and the inguinal ligament. Posteriorly, the iliac crest ends at the posterior superior iliac spine (PSIS), which is defined by a superficial skin dimple. Laterally, the greater trochanter is most easily defined at its posterior superior corner or tubercle. Medially, the femoral artery can be palpated below the inguinal ligament in the femoral triangle at a point midway between the ASIS and symphysis pubis [8].

Bony anatomy

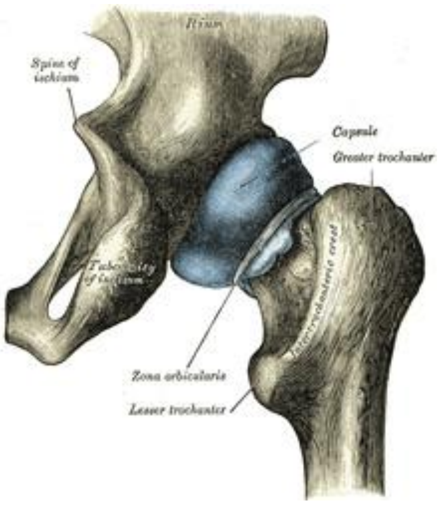

Fig. 2: *Bony anatomy of the hip joint*[9]

The Femur

The femur is the longest and strongest bone in the human body. Its length is necessary to accomplish the biomechanical needs of gait [8].

The neck of the femur is narrower than the equatorial diameter of the head and considerable movement in all directions is possible before the femoral neck impinges upon the acetabular labrum (**Fig. 2**). The presence of a relatively narrow neck is the mechanical factor responsible for the wide range of movement in such a stable joint [6].

The hemispherical femoral head diameter averages 46 mm (range 35 to 58) and joins the femoral neck at the subcapital sulcus. The neck shaft angle averages 135° (range 105 to 155 with wide variability). Femoral version is determined by the angle between the plane of the femoral condyles and axis of the femoral neck (**Fig. 3**). The average adult angle of version is 10–15 degrees of ante-version with wide variations[11].

In most hips, the center of the femoral head is at the level of the tip of the greater trochanter. As the neck shaft angle increases, the center of the head comes to lie above the level of the trochanter (resulting in coxa valga). A decreased neck shaft angle results in coxa vara[11].

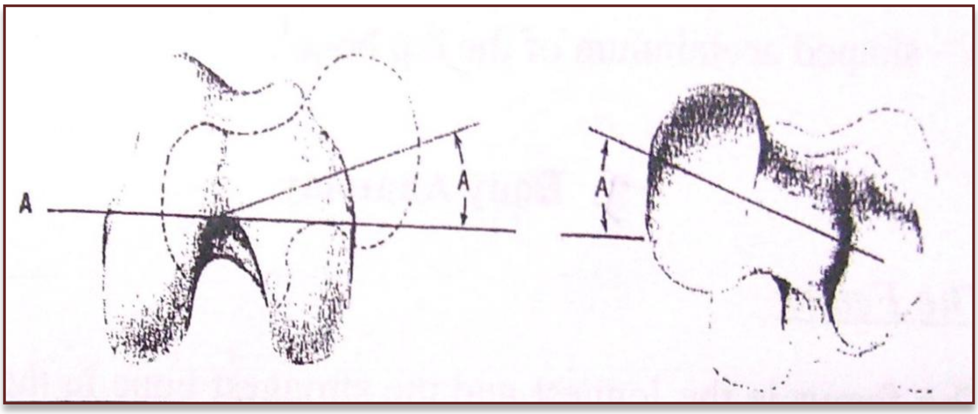

Fig 3: *Anteversion as femur is viewed from femoral condyles (A), and from top of neck of femur (B)*[11].

Also, the distance between the center of the femoral head and the lateral aspect of the trochanter can vary independent of the neck shaft angle (although patients with increased valgus tend to have less offset, while patients with increased varus have more offset). These variants are important because if they are anatomically normal, they need to be reconstructed with the use of femoral components with similar offset and angulation. If the variant is pathological, it is necessary to reestablish normal hip joint kinematics and leg length[11].

The head overhangs the neck in all directions but more soon the posterior aspect. This posterior overhang further emphasized by trochanteric crest posteriorly, produces an apparent curved axis of the femoral neck. The neck is compressed in an anteroposterior direction measuring about 25 mm compared with the vertical diameter, which measures 30 to 35 mm. The neck diameter measures only 65% of the equatorial diameter of the head. This relative neck constriction together with the pliable labrum allows a free range of joint motion without marginal impingement or dislocation[12].

The Acetabulum

Fusion of the ischium, ilium and pubic bones creates the acetabulum that provides functional columns for bony support of the femoral head in the hip joint articulation. The acetabulum is an approximately hemispherical cavity on the lateral aspect of the hip bone about its center, and directed laterally, downwards and forwards[12] (**Fig. 1**).

The acetabular surface is orientated approximately 45° caudally and 15° anteriorly. The normal bony acetabular angle of about 55° is reduced to 45° by the presence of the acetabular labrum (**Fig. 4**)[13].

The acetabulum has prominent reinforced superior and posterior margins to counteract the effect of the pressures exerted by the weight-bearing femoral head both in flexion and extension. The margins of the acetabulum give attachment to a fibro-cartilagenous rim (the labrum acetabuli) which deepens the cavity of the acetabulum and enhances the stability of the joint as it embraces the femoral head beyond its equator, thus completely isolating the intra-articular joint cleft from the intra-capsular cavity. The labrum is continued across the acetabular notch as the transverse ligament, which gives attachment to the ligament of the head of the femur [13].

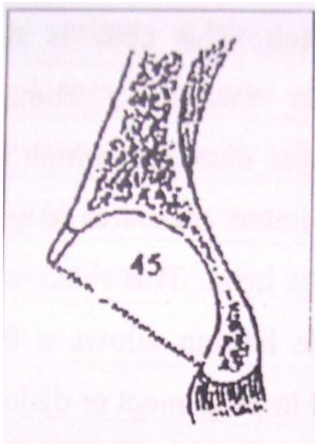

Fig 4: *The normal bony acetabulum is a 55° degree to the horizontal, the acetabular labrum reduces this to 45° degree*[13].

This means that if inserted at 45° the superior lip of the cup tends to hang out or be uncovered, the advent of cementless cups with offset plastic liners suggests that these cups can be inserted for maximum bony coverage, i.e. at 55°, the plastic overhang serving as the labrum [13].

If the cup is anteverted 15° or more, then the chances of posterior dislocation are reduced, and the anterior lip of the cup does not contact the patient's femoral neck in flexion and adduction. The cup anteversion, however must not be so great to allow femoral neck contact with the cup in extension and external rotation without impingement because this can lead to anterior dislocation [13].

Soft tissue anatomy

The capsule

The articular capsule of the hip is strong and dense, contributing substantially to joint stability. The capsule is attached along the anterior and posterior periphery of the acetabulum just outside the acetabular labrum making anterior and posterior incisions between the capsule and labrum allow retractors to be placed safely over the anterior and posterior columns. The anterior portion of the capsule is reinforced by two strong accessory ligaments. The iliofemoral and the pubofemoral ligaments. The posterior capsule is reinforced by the ischiofemoral ligament[14].

The iliofemoral ligament

The iliofemoral ligament (**Fig. 5**) often referred to as the y ligament of the Bigelow is a fan-shaped ligament that resembles an inverted letter y. the apex of the ligament is attached to the lower portion of the AIIS, and the diverging fibers of the y fan out to attach along the intertrochanteric line. The fibers of the iliofemoral ligament become taut in full extension, providing a check to hip extension beyond neutral. The superior portion may resist excessive external rotation. When this ligament is contracted, a flexion internal rotation contracture may result, requiring release at total hip arthroplasty. It is partially important to correct this internal rotation contracture if a posterior approach to the hip is done (otherwise a tendency toward hip internal rotation will result). An anterolateral approach may be preferred as it will perforce release this contracture[14].

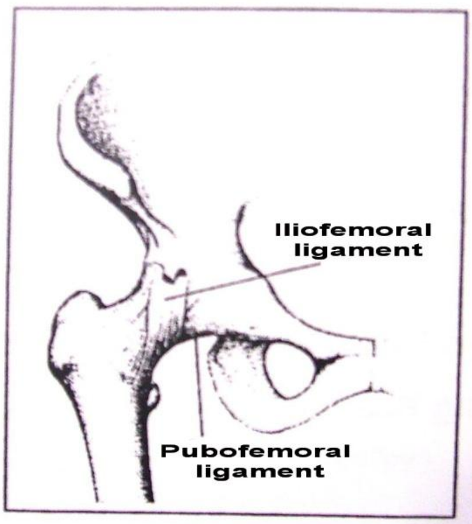

Fig 5: *The Iliofemoral & The Pubofemoral ligaments*[11].

The pubofemoral ligament

The pubofemoral ligament (**Fig. 5**) is applied to the inferior and medial part of the anterior capsule. It arises from the pubic portion of the acetabular rim and the obturator aspect of the superior pubic ramus passing below to the neck of the femur to blend with the inferior-most fibers of the iliofemoral ligament. The fibers of the pubofemoral ligament become taut in hip extension and abduction[14].

The ischiofemoral ligament

The ischiofemoral ligament reinforces the posterior surface of the capsule. It arises from the ischial portion of the acetabular rim. Its fibers spiral laterally and upwards arching across the femoral neck to blend with the fibers of the zona orbicularis. The spiral fibers tighten during extension but loosen or unwind during hip flexion. Other fibers traverse horizontally and attach to the inner surface of the greater trochanter providing a check to internal hip rotation[14].

Muscles

There are a lot of muscles crossing the hip joint. The tensor fascia lata and the gluteus maximus have been described as the doorway to the hip joint[15].

One of these muscles or the iliotibial tract should be split to gain access to the deeper muscles in the hip joint. Beneath this outer layer, the gluteus medius is inserted in the greater trochanter. All surgical approaches to the hip joint are designed to either avoid detachment of the gluteus medius or displace the adductor muscles by mechanisms that facilitate reattachment [16].

Quadrant system of the hip:-

The acetabular anatomy and surrounding nerves and vessels can be easily understood by using the acetabular quadrant system. Use of this system allows the surgeon to know the location of intra-pelvic structures with respect to fixed point of the reference within the acetabulum. For primary or revision acetabular arthroplasty, a line drawn from the anterior superior iliac spine through the center of the acetabulum defines anterior and posterior quadrant locations. If this line is then bisected within a perpendicular at its midpoint, four quadrants are formed. Anatomic quadrant system can be used to locate the safe and dangerous zones for the trans-acetabular placement of screws, but they also can be used as a guide for retractor placement, for drilling acetabular anchoring holes for graft fixation, or to estimate bone depth in a specific acetabular zone[14].

The use of the anterior quadrants for the placement of screws, anchoring holes, or to help secure retractors may endanger the external iliac artery and vein and the obturator nerve, artery and vein. The external iliac vessels lie opposite the anterior superior quadrant and the obturator neural and vascular structures lie opposite the anterior inferior quadrant. The siatic nerve and the superior gluteal nerve and vessels course opposite the posterior superior quadrant, and the inferior gluteal and internal pudendal structures are opposite the posterior inferior quadrant. In contrast to the shallow bone in the anterior quadrants, the bone depth in the posterior quadrants is 25 mm or greater in the central regions. Screws and anchoring holes can be placed relatively safe in these zones. In addition, the siatic nerve can be gently displaced during retractor and screw placement, reducing the likelihood of injury. The sciatic notch is easily palpable and the superior gluteal nerve and vessels can be protected. The inferior gluteal and internal pudendal neural and vascular structures are not palpable at the level of the ischial spine. They are relatively mobile and can be protected if retractors are placed directly against the bone of the posterior column[14].

Motion

As in any ball and socket joint, movement is possible in any direction. Flexion, extension, adduction and abduction are free; a combination of all four produces circumduction. In addition, medial and lateral rotation of the femur occur [6].

Flexion: it is limited by the thigh touching the abdomen, or by tension of the hamstrings if the knee is extended; the normal range is about 120° [6].

Extension: the movement is limited by tension in thr iliofemoral ligament, and amounts to about 20° [6].

Adduction: (about 30°). It is limited by contact with the other leg or, if the latter is abducted out of the way, by the tension of gluteus medius and minimus [6].

Abduction: It is produced by contraction of the gluteus medius and minimus, assisted by piriformis. It is limited by tension in the adductors and in the pubofemoral ligament, and amounts to about 60° [6].

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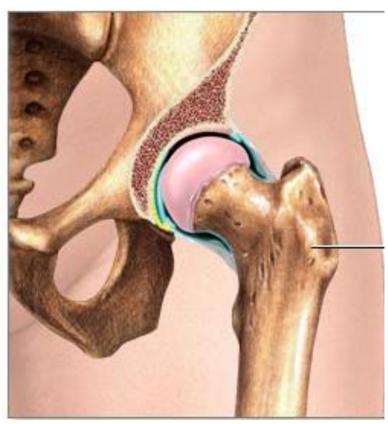

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