Avoiding Hip Instability and Limb Length Discrepancy After Total Hip Arthroplasty

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KEYWORDS

• Total hip arthroplasty • Instability • Limb length discrepancy • Preoperative templating
• Component position

KEY POINTS

- Patient risk factors for dislocation include obesity, increasing age, neuromuscular and cognitive disorders, alcoholism, and a previous diagnosis of femoral neck fracture.
- Clinical evaluation includes gait assessment, measurement of true and apparent limb length discrepancies, and identifying a fixed or flexible pelvic obliquity and any periarticular soft tissue contractures.
- Preoperative radiographs help calculate limb length differences and plan intraoperative lengthening, component sizing, and acetabular and femoral component position in relation to radiographic landmarks.
- Larger femoral head sizes ($\geq$32 mm), elevated or lipped liners, high offset stems, and dual mobility devices are implant options that may improve hip stability in higher-risk patients.
- Postoperative hip instability can usually be managed with closed reduction. When this fails, surgical management includes increasing femoral head size, increasing soft tissue tension with higher offset or limb lengthening, and component revision with possible conversion to a dual mobility or constrained liner.

BACKGROUND

Total hip arthroplasty (THA) reduces pain and improves function in patients with end-stage arthritis of the hip[1–3] and is associated with a high satisfaction rate and a low incidence of complications.[4] Two complications after THA are hip instability and limb length discrepancy, and between 2000 and 2007, instability was the most common indication for revision THA.[5] In addition, significant limb length discrepancy after THA is a cause for patient dissatisfaction and possible litigation.[6] The goal of a successful THA is to maximize impingement-free range of motion, recreate appropriate offset, and equalize limb length discrepancies to produce a pain-free and dynamically stable THA. The objective of this article is to review the patient risk factors for dislocation and limb length discrepancy, key elements of the preoperative template, the anatomic landmarks for accurate component placement, the leg positions for soft tissue stability testing, and the management of postoperative instability.

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CLINICAL PATIENT EVALUATION

Patients at risk for postoperative limb length discrepancies include those with previous surgery, trauma, infection, growth plate arrest, and congenital dysplasia. Patients at risk of instability include those with hyperlaxity, connective tissue or neuromuscular disorders, a diagnosis of femoral neck fracture, avascular necrosis, increasing age, alcoholism, obesity, and female sex.[7–9]

PATIENTS AT RISK FOR DISLOCATION

- Female gender
- Obesity
- Diagnosis of femoral neck fracture
- Neuromuscular or cognitive disorders
- Hyperlaxity or connective tissue disorder
- Alcoholism

PATIENTS AT RISK FOR TRUE OR PERCEIVED POSTOPERATIVE LIMB LENGTH DISCREPANCY

- Operative leg longer preoperatively
- Perception of limb length equality when operative leg shorter (block testing)
- Significant (>3 cm) limb length discrepancy
- Fixed pelvic obliquity

Physical examination includes a gait assessment for signs of spasticity or imbalance. The axial skeleton should be assessed for coronal or sagittal plane deformities, such as scoliosis or ankylosing spondylitis. Pelvic obliquity can occur from a spinopelvic deformity or be compensatory and secondary to a limb length discrepancy or soft tissue contracture. If a pelvic obliquity is present, evaluate the patient in both the standing and seated position. A flexible pelvic obliquity corrects in a seated position, whereas a fixed pelvic obliquity does not.

KEY PHYSICAL EXAMINATION FINDINGS

- Gait: spasticity or imbalance
- Fixed or mobile pelvic obliquity
- Soft tissue contractures (flexors, abductors, adductors, external rotators/capsule)
- Abductor strength
- Distal sensation and proprioception
- Actual or perceived limb length discrepancy

Supine range of motion testing should identify any hip or knee contractures that may affect accurate limb length assessment. Abductor strength is tested and should be compared with the contralateral side. A distal sensory examination may identify the presence of a peripheral neuropathy, which may increase the risk of gait imbalance, falls, and subsequent postoperative instability.

LIMB LENGTH ASSESSMENT

True and apparent limb length are the 2 methods used to assess limb length discrepancy. True limb length is measured from the anterior superior iliac spine to the medial malleolus. The apparent limb length is measured from the umbilicus to the medial malleolus. True limb length represents the length of the limb, whereas the apparent limb length takes into account all factors that contribute to differing leg lengths, such as a pelvic obliquity or soft tissue contractures. For this reason, the apparent limb length is a better reflection of the patient's perception because it includes the true limb length difference in addition to any factors that altogether contribute to leg length inequality. Block testing with blocks of different heights placed under the affected extremity helps to quantify the apparent leg length discrepancy (**Fig. 1**).

PREOPERATIVE TEMPLATING AND RADIOGRAPHIC MEASUREMENTS

Standing anteroposterior (AP) pelvic and operative hip radiographs, in addition to a frog-leg or cross-table lateral, are helpful for preoperative planning. A line drawn across 2 fixed reference points on the AP pelvis view and measured from a femoral reference point (lesser trochanter) allows calculation of a radiographic leg length discrepancy. The 3 pelvic reference points include the inferior aspect of the obturator foramen, the ischial tuberosities, and the acetabular teardrop. The teardrop is the most reproducible and accurate when calculating limb length discrepancy[10] but if distorted anatomy makes identification difficult, then another pelvic reference point can be used. **Fig. 2**A shows a pre-operative AP pelvic radiograph and a leg length discrepancy as measured from the teardrop to the midpoint of the lesser trochanter bilaterally.

Fig. 1. A block of known thickness is placed under the shorter extremity until the patient perceives leg lengths to be equal.