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Prevention of Dislocation After Total Hip Arthroplasty

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ABSTRACT

Background: Prevention of dislocation after primary total hip arthroplasty (THA) begins with patient preoperative assessment and planning.
Methods: We performed a literature search to assess historical perspectives and current strategies to prevent dislocation after primary THA. The search yielded 3458 articles, and 154 articles are presented.
Results: Extremes of age, body mass index >30 kg/m^2, lumbosacral pathology, surgeon experience, and femoral head size influence dislocation rates after THA. There is mixed evidence regarding the effect of neuromuscular disease, sequelae of pediatric hip conditions, and surgical approach on THA instability. Sex, simultaneous bilateral THA, and restrictive postoperative precautions do not influence the dislocation rates of THA. Navigation, robotics, lipped liners, and dual-mobility acetabular components may improve dislocation rates.
Conclusions: Risks for dislocation should be identified, and measures should be taken to mitigate the risk. Reliance on safe zones of acetabular component positioning is historical. We are in an era of bespoke THA surgery.

Dislocation after total hip arthroplasty (THA) is the most common cause for revision hip surgery in the United States [1]. Although incidence of dislocation has decreased, the volume of primary THAs is set to increase and may account for a net increase in unstable THAs [2–4]. Over 60% of patients that sustain a dislocation have multiple occurrences and over half require revision surgery [5]. Unstable THAs increase hospital costs by up to 300% of the cost of a primary hip arthroplasty [6,7]. The economic and human implication of this complication is important, and strategies to reduce the risk of dislocation should be adopted by surgeons and health care providers. Prevention against dislocation requires thorough preoperative planning and assessment, attention to surgical detail, and good postoperative care [8]. By identifying the patient at risk for instability, greater attention can be paid to factors that the surgeon can control. Dislocations that occur within 2 years of surgery are "early" dislocations and "late" dislocations occur beyond the second postoperative year [2]. A traditional method to determine etiology of THA instability has been to consider patient factors, surgeon factors, and implant factors [9]. Others have described a classification of instability that seeks to identify the pathology involved: Dorr et al [10] described instability because of hip position, soft tissue imbalance, and component malposition. Wera et al [11] devised another method for understanding instability by classifying the unstable THA according to 6 etiologies ranging from acetabular component malpositioning to unexplained instability and provide a management algorithm. In this article, we present a stepwise strategy to reduce the incidence of THA dislocation by identifying risks and offering intervention from patient presentation to postoperative follow-up.

Methods

We performed a literature search to assess historical perspectives and current strategies to prevent dislocation after primary THA using the PubMed platform. The search terms were "Instability" OR "Dislocation" OR "Subluxation" OR "Sex" OR "Age" OR "weight" OR "Neuromuscular" OR "Spine" OR "Mobility" OR "Surgeon" OR "Approach" OR "Inclination" OR

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"Anteversion" OR "Offset" OR "Impingement" OR "Flouroscopy" OR "Robot" OR "Navigation" OR "Precautions" OR "Retrictions" AND "Total hip arthroplasty" OR "Total Hip Replacement." The search yielded 3458 articles and English-language publications were considered for inclusion in the review. Article titles, abstracts, and full texts were read and included if deemed appropriate to discussion of prevention of dislocation after primary THA. Relevant articles that did not appear in the original search but were in bibliographies were included. Results of the search are presented according to the patient and surgeon journey from preoperative assessment and intraoperative events to postoperative care such that the reader can recognize points of intervention to reduce the risk of postoperative THA instability. A summary table is provided (Table 1).

Preoperative Assessment and Planning

Patient history, physical examination, and radiological studies provide the surgeon with almost all the data required to stratify a patient according to risk for postoperative THA instability.

Sex

Despite conventional belief, patient sex is not a risk factor for dislocation in modern single institution and registry studies, and the rate of revision for instability is not different between men and women [13–16].

Age

Older age has consistently shown to be an independent risk factor for dislocation after THA although there is no consistent cutoff age for increased instability, which ranged from 70 to 85 years of age [2,17,18]. There is a bimodal distribution of age vs dislocation of THA according to a retrospective analysis of 22,079 THAs that showed patients aged <50 and ≥70 years had a higher risk of dislocation compared to patients aged 50-69 years [18].

Table 1
Factors Influencing Instability and Interventions to Reduce Dislocation.

Factor	Intervention
Low-volume surgeon	Refer high-risk patients
Age <50 and >70	Elevated liner
	Dual-mobility liner[a]
Obesity	Dual-mobility liner
	Constrained liner
Neurological conditions	Dual-mobility liner
	Constrained liner
Spinopelvic pathology	Spinal surgery before THA
	Navigation or robotic-assisted implant positioning
	Increase acetabular anteversion
	Dual mobility
Posterior approach	Capsular repair
Increased native offset	Lateralized liners and stems
	Resurfacing arthroplasty
Increased native	Femur-first preparation and trial
	Femoral anteversion
Intraoperative impingement	Excise hypertrophied capsule
	Remove osteophytes
	Osteotomize AIIS
Intraoperative instability	Change to elevated liner
	Change to dual-mobility liner

AIIS, anterior inferior iliac spine; THA, total hip arthroplasty.
[a] Concern exists regarding taper junctions between cobalt-chromium liners and titanium acetabular shells with modular dual-mobility designs in young people [12].

Body Mass Index

A meta-analysis has shown that dislocation after THA occurs more often in patients with a body mass index (BMI) of >30 (odds ratio = 0.5, confidence interval: 0.38–0.75) [19]. In a single institution study of 21, 361 primary THAs performed over a 27-year period, early dislocation rates were higher for patients with a BMI of 35 kg/m^2, with a 5% increase for each BMI unit >35 kg/m2 (hazard ratio [HR], 1.05; $P = .02$) [20]. Another study showed that dislocation rates were increased for overweight patients (BMI >25.1 kg/m^2) [21]. Patients with increased BMI may have comparable pain and functional outcomes to nonobese patients, and there is no benefit to weight loss before THA; therefore, overweight and obese patients will continue to be offered THA [22,23]. It remains unclear what predisposes patients with increased BMI to dislocation. Deep operative fields may compromise implant positioning, but this has not been convincingly shown in the literature [24,25]. It is possible that large limbs act as larger levers with more periarticular tissue for impingement, but this is difficult to scientifically prove. A French study showed that obese patients had lower dislocation rates if they received a dual-mobility or constrained liner (2%) compared with obese patients who underwent preoperative bariatric surgery (13%) or obese control subjects with standard liners that did not have bariatric surgery (6-9%) [26].

Mobility and Neuromuscular Pathology

Loss of agonistic and antagonistic balance or general loss of muscle tone around a THA may predispose to instability. Cerebral, spinal, neuromuscular junction, and muscle-tendon-bone integrity is required for normal hip function and stability. Common neurological conditions that may present in patients with intractable pain requiring THA are post-stroke, Parkinson's disease (PD), acquired brain injury, cerebral palsy, and acquired spinal cord injury. A review by Queally et al [27] recommended using constrained devices for patients who are at risk for instability such as those with spinal injury, poliomyelitis, and cerebral palsy. The authors found that other neurological conditions such as PD did not increase the risk for instability. Subsequent articles have shown both a higher rate of dislocation for 297 patients with PD in the first year after THA (HR, 2.33, 95% confidence interval 1.02 to 5.32) compared to control subjects and no dislocations in a case series of 11 patients with PD undergoing THA [28,29]. A recent comparative study of patients with cerebral palsy showed no increased risk for dislocation after THA when judicious use of muscle releases, lipped and dual-mobility liners are used by experienced hip reconstruction surgeons [30]. A registry study of patients with Alzheimer's disease showed that they do not dislocate THAs more than matched control subjects although the authors do not detail whether constrained implants were used [31]. Failure of abductor dysfunction is a risk factor for postoperative THA instability, and muscle transfers have been described [32,33]. Arthrodesis take-down was traditionally considered a risk factor for dislocation due to abductor atrophy, yet a number of series have shown good stability after THA [34–36].

Lumbosacral Pathology

Sagittal balance and lumbosacral mobility influences the functional position of the native acetabulum and femoral neck during deep hip flexion [37–42]. The surgeon should recognize the patient with poor spinopelvic mobility as these patients demonstrate more femoroacetabular flexion putting the patient at risk of impingement and posterior dislocation [39]. Patients who may need lumbosacral fusion before or after THA are at risk for instability. Buckland et al [37] showed that the dislocation rate for 14,747