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Original Research

Is Timing of Total Hip Arthroplasty and Lumbar Spine Fusion Associated With Risk of Hip Dislocation?

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ABSTRACT

Background: In patients with concomitant hip and lumbar spine disease, the question of which surgery—total hip arthroplasty (THA) or lumbar spine fusion (LSF)—to address first has not been adequately answered. We aimed to evaluate the risk of dislocation after THA in patients with LSF first or after THA.
Methods: Retrospective review utilizing the PearlDiver database querying Current Procedural Terminology codes for LSF in the year prior (LSF first) or in the year after primary or revision THA (THA first). International Classification of Disease codes identified postoperative hip dislocation as our primary outcome variable. Demographic data collected included age, sex, and obesity. Dislocation rates were described as a proportion of the cohort and compared with chi-square tests.
Results: We identified 280,857 primary THA and 42,314 revision THA cases from 2012-2019. Of these, 2090 underwent primary THA and LSF, and 283 underwent revision THA and LSF within a year of each procedure. No differences in age, sex, or obesity between groups were noted. No difference in rate of all-time dislocation for primary THA was noted for the LSF first 51/1429 (3.6%) compared to the THA first 30/661 (4.0%) groups ($P = .34$), or for revision THA with LSF first 48/204 (23.5%) compared to THA first 27/117 (23.1%) groups ($P = 1.0$).
Conclusions: There was no difference in the risk of dislocation after primary or revision THA if LSF occurred prior to or after the THA. These findings can help surgeons as they counsel patients with concomitant lumbar spine and hip degeneration.

Introduction

Hip and spine syndrome was first described by Offierski [1] in 1983 and refers to the concurrent presence of both symptomatic hip and lumbar spine degeneration. Since then, the awareness of this syndrome has grown, and the prevalence may be increasing [2–5]. The condition continues to remain difficult to diagnose and treat, as hip and spine degeneration can cause overlapping symptoms. Further complicating the surgical treatment for these patients are the unclear recommendations regarding surgical timing of lumbar spine fusion (LSF) and total hip arthroplasty (THA).

Patients who suffer from hip and spine syndrome including those who have undergone prior LSF are at higher risk for dislocation after THA [6–10]. When patients with hip and spine syndrome present to clinic prior to undergoing either LSF or THA, it is not clear what surgical procedure should be addressed first or if this will change the risk for dislocation after the THA. Conflicting evidence currently complicates the decision-making process for surgeons and patients. Prior reports of single-center experiences show no difference in risk of dislocation for LSF first or THA first [11,12], but these studies are limited in their generalizability. Conflicting evidence from large database investigations suggests there is decreased risk with LSF after THA [13,14]. Unfortunately, these investigations included patients with remote LSF prior to THA and remote THA prior to LSF and are limited as they potentially fail to capture patients presenting with concomitant hip and spine syndrome. In addition, these previous investigations did not compare revision THA and risk for dislocation with LSF first or revision THA first.

The PearlDiver database is comprised of over 140 million patients, is based on national all-claims data, and provides extensive data from a patient population made up of both private and

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government funded programs. This provides us with the ability to examine patients with hip and spine syndromes to compare orders for surgeries and THA dislocation risk with findings that can be applied to a broad patient population. The primary aim of this investigation is to determine if the rates of dislocation after primary THA are different for patients with hip and spine syndrome who undergo LSF prior to THA compared to patients who undergo THA prior to LSF. Our secondary aim is to determine if rates of dislocation after revision THA are different for patients who undergo LSF prior to revision THA compared to patients who undergo revision THA prior to LSF.

Material and methods

A retrospective review was performed using the all-claims data files from the PearlDiver database (PearlDiver Technologies, Inc., Fort Wayne, IN, USA). This database is comprised of deidentified patients based on national all-claims data including Medicare, Medicaid, government, and private insurance. We queried PearlDiver using Current Procedural Terminology procedure codes for primary THA, revision THA, and LSF. The patients were filtered for ages 50-85 and for years 2012-2019. Patients with conversion of previous surgery to THA were grouped into the revision THA cohort. For primary THA and revision THA, patients were stratified into 2 groups: the LSF first group included patients who underwent LSF in the year prior to THA, and the THA first group included patients who underwent THA with LSF in the following year. We limited our inclusion to 1 year prior to or after THA in an effort to limit selection bias and try to capture only those patients who have concomitant hip and spine syndrome, and eliminate confounding by the inclusion of patients with remote LSF or remote THA.

We identified postoperative hip dislocation using International Classification of Diseases 9 and 10 diagnostic codes as our primary outcome variable. We identified dislocation in the year following THA and all-time after THA. Demographic data collected included age, sex, and diagnosis of obesity. Statistical analysis was performed using the R statistical package provided by PearlDiver. Descriptive statistics were calculated for demographic variables for each group. Rates of post-THA dislocation were described as a proportion of the cohort. Chi-square frequency comparisons were done to compare the dislocation rates between the THA first and LSF first groups. Logistic regression was used to investigate the association between dislocation rates using the other covariables including age, sex, and diagnosis for obesity.

Results

Primary total hip

We identified 280,857 primary THA cases from 2012-2019. Of these, we identified 2090 patients who underwent both THA and LSF within a year of each other. The mean age of these patients was 66.2 ± 7.6 years; 59.5% were female gender, and 48.2% had a diagnosis of obesity. Of patients with both THA and LSF within a year, 1429 had LSF in the year prior to THA and were included in our LSF first group. We identified 661 patients who had THA in the year prior to LSF and were included in THA first group (Fig. 1). There were no noted differences between the LSF first and THA first groups in terms of age, gender, or diagnosis of obesity (Table 1).

There was no difference in the rate of dislocation within a year of THA comparing the LSF first group 40/1429 (2.8%) to the THA first group 14/661 (2.1%) ($P = .45$). There was no difference in rates of dislocation for all-time after THA compared the LSF first group 51/1429 (3.6%) to the THA first group 30/661 (4.0%) ($P = .34$). Logistic regression using demographic variables of age, gender, and obesity did not affect differences between groups.

Revision

We identified 32,627 revision THA cases from 2012-2019. Of these, we identified 283 patients who underwent revision THA and LSF within a year of each other. The mean age of these patients was 66.5 ± 7.6; 50.2% were female gender, and 43.1% carried a diagnosis of obesity. Of patients with both revision THA and LSF within a year, 181 had LSF in the year prior to revision THA and were included as our revision LSF first group. We identified 102 patients who had revision THA in the year prior to LSF and were included as revision THA first group (Fig. 2). There were no noted differences between the revision LSF first and revision THA first groups in terms of age, gender, or diagnosis of obesity (Table 2).

There was also no difference in the rate of dislocation within a year of revision THA, as noted comparing the revision LSF-first group 42/181 (23.2%) to the revision THA-first group 18/102 (17.6%), $P = .32$. There was no difference in the rate of dislocation for all-time after THA, comparing the LSF first 48/181 (26.5%) to the revision THA first 27/102 (26.5%) groups, respectively, $P = 1.0$. Logistic regression using demographic variables of age, gender, and obesity did not affect differences between groups.

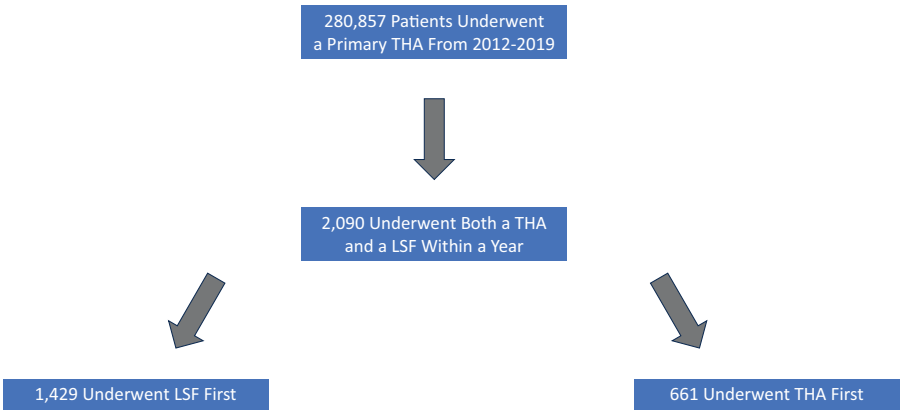

Figure 1. Patient flow chart primary total hip arthroplasty (THA) and lumbar spine fusion (LSF).

Table 1
Demographics of patients undergoing primary THA for lumbar spine fusion (LSF) first and primary total hip arthroplasty (THA) first groups.

Total (N = 2090)	LSF first (N = 1429)	THA first (N = 661)	*P*-value
Sex			
Male	561 (39.3%)	284 (43.0%)	.119
Female	868 (60.7%)	377 (57.0%)	
Age, mean (SD)	65.9 ± 7.5	66.8 ± 7.7	.012
Obesity			
Yes	674 (47.2%)	333 (50.4%)	.187
No	755 (52.8%)	328 (49.6%)	

Discussion

Patients with lumbar spine degeneration and LSF will have elevated rates of dislocation following THA, but complicating the surgical treatment for these patients are the mixed prior evidence regarding surgical timing of LSF and THA. In this investigation, utilizing the PearlDiver database, we found that the timing and specifically, the order of procedure has no association with rate of dislocation after THA for patients with hip and spine syndrome. For patients undergoing revision THA, we found similar findings with no difference in rate of dislocation if the revision THA or LSF is performed first.

Our finding of no difference in the LSF-first compared to the THA-first groups are similar to and supported by prior literature from single institution cohorts and from a meta-analysis on this topic. Parilla et al. evaluated patients at a single practice site who received both THA and LSF between 2005 and 2015 and found no differences in dislocation rates between operative order groups [12]. Grammatopoulos et al. also evaluated their single-center experience and found no differences in rates of dislocation after THA for their THA 1st or THA 2nd groups [11]. While these studies had similar findings, they were limited in generalizability due to being single institutional experiences, whereas our investigation is a broad picture of the US experience and more generalizable. Additionally, further supporting our findings was a meta-analysis and systematic review on this topic that found no difference in rates of hip dislocation with LSF subsequent vs prior to THA [15].

Studies generally agree that there is a higher rate of dislocation in patients undergoing primary THA with lumbar spine pathology [2,6–10,12,13,16,17]. In our study, primary THA dislocation rates in patients who underwent LSF ranged between 2.1% and 2.8% at 1 year, and 3.6%-4.0% for all-time dislocation risk. This is similar to other studies that found primary THA dislocation rates in the context of LSF to be between 2%-4% [18–23]. We were also able to expand on this and evaluate revision THA in patients with hip and spine syndrome. We then explored revision THA dislocation rates in the setting of LSF and noted rates to be between 17.6% and 23.2% at 1 year and 26.5%-26.5% for all-time. This is similar to other studies that found revision THA dislocation rates in the context of LSF to be between 6.6% and 28% [24–28]. To our knowledge, no previous investigations have looked at how the order of performing revision THA and LSF affects THA dislocation rates. Despite the high risk for instability in this cohort, there was no difference if LSF was done prior to or after revision THA.

Multiple studies theorize the increased THA dislocation rate in patients with spine pathology due to altered spinopelvic biomechanics. This is thought to limit pelvic motion during postural changes leading to decreased anterior clearance, acetabular anteversion, and increased rates of prosthesis impingement [2,7,12,16,17]. We found similar dislocation rates for patients with hip and spine syndrome regardless of the timing of the LSF suggesting that those patients with lumbar spine disease who have not yet had LSF will have altered motion due to their lumbar disease and not the fusion. Our findings suggest that this decreased spinopelvic motion is present in patients with degenerative changes to a similar degree as in those who have undergone LSF.

By limiting our selection to THA or revision THA within 1 year of LSF, we attempted to evaluate only patients who may present with concomitant hip and spine disease and who could potentially question what to address first. This is in contrast to other investigations on this subject, which included patients with THA and a remote history of LSF or patients who underwent LSF with a remote history of THA [13]. Bala et al. also reviewed the PearlDiver database and suggested that LSF after THA was associated with a reduced dislocation rate compared with THA after LSF [13]. This investigation included patients with LSF at any point in the study period prior to THA and THA at any point in the study period post-LSF. This created the potential for including bias and limited the ability to identify those patients who present with concomitant hip and spine syndrome. In clinical practice, we can only affect future decisions; a strength of our study is narrowing inclusion of patients who underwent both THA and LSF within 1 year of either procedure to capture the individuals with hip and spine syndrome and not a remote history of prior surgery. Supporting this are the findings of Malkani et al., who evaluated the Medicare inpatient claims data and found that the dislocation risk is time-dependent for the interval between LSF and THA and increases comparing patients with longer times between index THA and LSF [14].

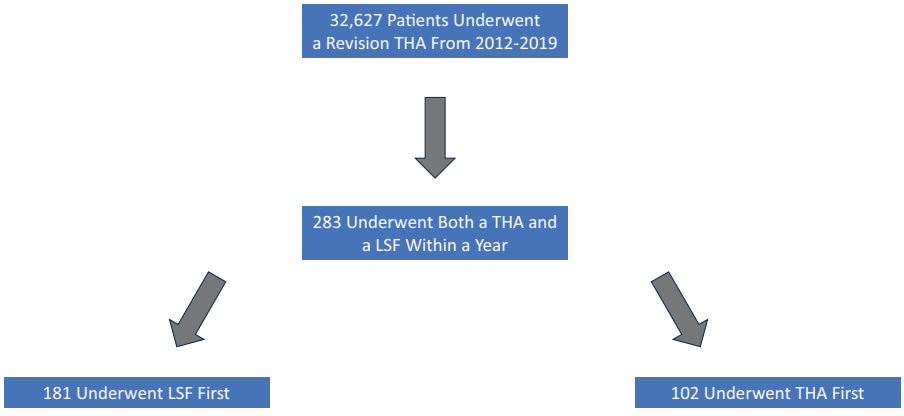

Figure 2. Patient flow chart primary total hip arthroplasty (THA) and lumbar spine fusion (LSF).

Table 2
Demographics of revision THA patients for lumbar spine fusion (LSF) first and revision total hip arthroplasty (THA) first groups.

Total (N = 283)	LSF first (N = 181)	THA first (N = 102)	*P*-value
Sex			
Man	94 (51.9%)	47 (46.1%)	.411
Woman	87 (48.1%)	55 (54.9%)	
Age, mean (SD)	66.7 ± 7.9	67.8 ± 6.9	.202
Obesity			
Yes	79 (43.6%)	43 (42.2%)	.906
No	102 (56.4%)	59 (57.8%)	

There are several limitations to this study. Most prominent among these is the retrospective nature of database, which has a potential for selection bias. To limit this, as mentioned above, we only included those who had both LSF and THA within a year of either procedure. While this study was able to encompass a large national dataset to identify our THA first and LSF first groups, the data was recorded for payment purposes and not specifically for documenting medical diagnosis and treatment and relies on proper coding. Therefore, an element of coding bias is possible due to the entry of diagnosis and procedural codes. We attempted to minimize confounding effect of contributing variables, specifically our demographic factors by also doing logistical regression. However, it is possible that all relevant variables were not identified or controlled for in our models. Furthermore, we were unable to perform subgroup analysis of the number of levels fused given the limited coding capabilities within the dataset, thus we were not able to stratify groups into multilevel spine fusion or single-level fusion as a marker of severity of spine disease.

Conclusions

We found no difference in the risk of dislocation after primary or revision THA if LSF was performed before or after THA. This suggests that decreased spine mobility leading to an increased risk of dislocation after THA is present in both patients with lumbar degeneration and those who undergo LSF. We hope surgeons use the findings of this investigation to counsel patients who present with hip and spine syndrome that severity of symptoms, length of recovery, and work or life situation should guide their surgical decisions. Patients with hip and spine syndromes will be at higher risk for dislocation after THA, and we hope that this investigation helps them simplify their decision on what to address first. Future investigations should focus on other ways surgeons can mitigate the increased risk of dislocation in this population.

Conflicts of interest

J. Yoo receives payments from Osiris Therapeutics. R. Kagan receives research support as a primary investigator from Ortho-Development, Smith and Nephew, and 3M. R. Kagan is a pain consultant for OrthAlign Corporation and Smith and Nephew. R. Kagan is on the American Association of Hip and Knee Surgeons Evidence-Based Medicine committee and is an elite reviewer for The Journal of Arthroplasty; all other authors declare no potential conflicts of interest.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2023.101202.

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