What Factors Reduce the Incidence of Early Dislocations in Aseptic Total Hip Revisions with Stem Retention?

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Abstract

It is unclear which factors are the most important protectors for early postoperative dislocation in aseptic total hip arthroplasty (THA) revisions with stem retention. Therefore, we sought to determine what factors reduce the incidence of dislocations among these patients. Single institution retrospective review was made of 83 consecutive aseptic THA revisions of the head/liner and/or cup performed by five surgeons between 2017 and 2020. Periprosthetic infections and femoral component revisions were excluded. Demographics, preoperative diagnosis, revision type, surgical approach, use of dual mobility systems, length of stay, skin-to-skin time, transfusions, complications, and dislocations were assessed. Pearson correlation/logistic regression analyses were used to determine association/independent predictors of dislocation; α was set at 0.05. The overall dislocation rate was 12%. In Pearson correlation, only preoperative diagnosis (instability vs. other, −0.241, $p = 0.028$) and revision type (only liner vs. cup, −0.304, $p = 0.005$) were significantly associated with dislocations. In logistic regression, only preoperative diagnosis other than instability (odds ratio [OR] = 0.235, $p = 0.038$) and cup revision (OR = 0.130, $p = 0.014$) were found significant protectors against dislocation. Surgical approach and dual mobility systems were not independent predictors of dislocations ($p = 0.184$ and $p = 0.083$, respectively). Dislocation rates were significantly different between those cases that had the cup revised (4.0%) and those that did not (24.2%; $p = 0.012$). Preoperative diagnosis other than instability and cup revision seemed to be protective against early dislocation. Revision of the cup, in particular, seemed to be the most important factor to avoid dislocations while use of dual mobility liners per se did not significantly reduce that risk. The role of isolated liner exchanges in revision THA continues to evolve and should be reserved for appropriately selected patients.

Keywords
- aseptic revision
- dislocation
- total hip arthroplasty
- liner exchange
- acetabular cup

It is unclear which factors are the most important protectors against early postoperative dislocation in aseptic total hip revisions with stem retention. In general, various risks factors for dislocation after THA revision have been reported. Faldini et al[1] showed that patient-related factors such as the number of previous surgeries, abductor muscles deficiency/trochanteric nonunion, history of instability, osteonecrosis of the femoral head, and age as well as procedure-related factors such as small

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femoral head diameter, single component revision, and the use of standard rim liner were risk factors related to dislocation. Herman et al[2] in regard to revision hip arthroplasties exclusively performed due to dislocation found that the use of augmented liners, presence of periprosthetic femur fracture, and/or pelvic discontinuity were risk factors for failure, while the use of femur head sizes 36 to 40 mm was protective. In similar cases, Yoshimoto et al[3] showed that osteonecrosis of the femoral head and a femoral head size smaller than 32 mm were independent risk factors for redislocation.

In regard to the direct anterior approach, low dislocation rates have been reported in the setting of revision hip arthroplasty.[4,5] Revision of only the head/liner/acetabular component can be performed with this approach through an internervous plane with preservation of gluteal muscles while allowing access to the entire femoral diaphysis if needed.[6] This approach has been shown to be a replicable procedure in the setting of revision THA, with good clinical results.[7]

The use of dual mobility components have also been reported as a viable alternative in primary and revision THA, with good survivorship and low rates of dislocation being reported.[8,9] The use of such constructs have been shown to lower the risk of dislocation, reoperation, and re-revision even among those patients at the highest risk for dislocation.[10,11] In contrast, the influence of cup positioning in postoperative dislocations remains uncertain with some articles showing that it influences dislocations whereas others not showing that particular association. It is important to note that even the validity of the Lewinnek "safe zone," widely used to ascertain cup position, remains unproven.[12] Indeed, multiple factors play a role in dislocations after primary and revision THA.[12,13]

In patients who undergo aseptic total hip revisions with stem retention, the literature is scarce and it remains unclear which are the most important factors protecting against dislocations. Therefore, the main objectives of the current investigation were to determine in these patients: (1) the most important protectors for postoperative dislocations and (2) discharge disposition, hospital length of stay (LOS), surgical skin-to-skin time, transfusions, and complications with particular attention to dislocations. We hypothesized that use of the direct anterior approach and dual mobility constructs would be the most important protectors against postoperative dislocations in this type of aseptic revisions.

Materials and Methods

After the institutional review board's approval, we performed a retrospective review of our medical records at a single hospital and a total of 83 consecutive aseptic THA revisions (81 patients) of the head, liner, and/or acetabular component with stem retention performed by five surgeons (August 7, 2017–January 27, 2020) were identified. We excluded those revisions that had a preoperative diagnosis of infection.

Baseline demographics including age, gender (male/female), race (white/black/other), ethnicity (non-Hispanic/Hispanic), body mass index (BMI), American Society of Anesthesiologists (ASA) physical status classification, and preoperative diagnosis (instability vs. other) were assessed in all cases. Perioperative variables evaluated included type of surgical approach (anterior vs. other), use of dual mobility systems (yes or no), type of revision (only head/liner vs. cup revision), hospital discharge disposition (home vs. other), hospital length of stay (LOS), surgical skin-to-skin time, hospital transfusions (yes or no), complications within 90 days after surgery (yes or no), and dislocations up to the latest follow-up (yes or no). The mean follow-up in the entire series was 10 months.

Statistical Analysis

Categorical variables such as gender, race, ethnicity, ASA status, preoperative diagnosis, discharge disposition, transfusions, complications, and dislocations were described with numbers and percentages and compared between head/liner revisions and those cases that instead also had the cup revised making use of Pearson's chi-square and/or two-tailed Fisher's exact tests as appropriate. Continuous variables (age, BMI, LOS, and surgical skin-to-skin time) were compared between both groups using two-tailed independent *t*-tests. Pearson correlation and logistic regression analyses were used to determine association and independent predictors of dislocation which included the analysis of the following variables: preoperative diagnosis (instability vs. other), surgical approach (anterior vs. other), revision type (only head/liner vs. cup revision), and the use or not of dual mobility constructs. Statistical analyses were performed by using Statistical Package for Social Sciences (SPSS) version 24 (IBM Corporation, Armonk, New York). Statistical significance was set at $p < 0.05$.

Results

The overall dislocation rate in the entire series was 12% (10/83). In Pearson correlation, only preoperative diagnosis (instability/other, −0.241, $p = 0.028$) and type of procedure (only-liner-revised/cup-revised, −0.304, $p = 0.005$) were significantly associated with dislocations. In logistic regression analyses, preoperative diagnosis other than instability (OR = 0.235, 95% confidence interval [CI]: 0.060–0.922; $p = 0.038$) and cup revision (OR = 0.130, 95% CI: 0.026–0.660; $p = 0.014$) were found to be statistically significant protectors against dislocation. Surgical approach and the use or not of dual mobility systems were not found to be significant predictors of dislocations ($p = 0.184$ and $p = 0.083$, respectively). ►**Table 1** shows the logistic regression analyses performed to determine independent predictors of dislocation.

In the whole series, 56% (47/83) of cases had a dual mobility construct implanted while 44% (36/83) did not. Out of the 36 cases that did not have a dual mobility liner implanted, seven (19%) underwent revision of the acetabular component. Among these seven cases who underwent cup revision without dual mobility liners, only one (14%) dislocated at the latest follow-up. On the other hand, out of the 47 cases that had a dual mobility construct implanted, only four (9%) did not underwent a concomitant revision of the acetabular component. In these four cases which had dual mobility

Table 1 Logistic regression analyses performed to identify independent predictors of dislocation (dependent variable, yes/no)

Independent variable	Odds ratio	95% confidence interval		*p*-Value
		Lower	Upper	
Preoperative diagnosis (instability/others)	0.235	0.060	0.922	0.038[a]
Surgical approach (anterior/other)	0.404	0.106	1.541	0.184
Type of revision (head-liner/cup revised)	0.130	0.026	0.660	0.014[a]
Use of dual mobility system (no/yes)	0.282	0.067	1.182	0.083

[a]Statistically significant at $p < 0.05$

constructs implanted and did not have revision of the cup, 50% (2/4) of them dislocated at the latest follow-up.

When cases were set apart between those that had the cup revised (50/83) and those that did not (33/83), the dislocation rates were significantly different between both groups (4.0% cup-revised vs. 24.2% no-cup revised, $p = 0.012$). It is important to note, however, that the surgical skin-to-skin time and the hospital LOS were significantly higher in the group that underwent cup revision. ►**Tables 2** and **3** show the demographics and the outcomes of these particular cases, respectively.

Discussion

It is unclear which factors are the most important protectors against early postoperative dislocation in aseptic THA revisions with stem retention, the literature is scarce. As a result, the main objectives of the current investigation were to determine in these patients: (1) what factors are the most important protectors for postoperative dislocations and (2) discharge disposition, hospital LOS, surgical skin-to-skin time, transfusions, and complications (with particular attention to dislocations).

This investigation should be viewed in light of certain limitations. It is a retrospective study with the inherit limitations commonly associated with this type of investigation. However, our cohort is a consecutive series of aseptic partial revisions which is truly representative of our current clinical practice. Consequently, we consider that our findings can be extrapolated to patients treated in other institutions. Another limitation is the relatively short period of follow-up (mean 10 months) of our patients. Nevertheless, most dislocations occur early and within the first postoperative year,[14,15] we consider that this is a mitigating factor. Finally, the relatively small number of cases in our series should be mentioned. Due to it, we were unable to perform meaningful statistical analyses in certain subgroups of cases. However, we were able to perform an in-depth chart review in all cases, which allowed a descriptive granularity not shown in studies with larger samples that relied exclusively on data from administrative, national, electronic, or registry databases.

Table 2 Demographics and preoperative characteristics of cases where head/liner exchange without acetabular component revision was performed and where, in addition to liner/head exchange, the cup was also revised

	Head/liner revised ($n = 33$)	Cup revised ($n = 50$)	*p*-Value
Age (mean, y)	66.6 ± 10.0	64.4 ± 9.8	0.318
Gender			
Female	16/33 (48.5%)	25/50 (50%)	1.0
Male	17/33 (51.5%)	25/50 (50%)	
Race			
White	30/33 (90.9%)	45/50 (90%)	0.908
Black	2/33 (6.1%)	4/50 (8%)	
Other	1/33 (3%)	1/50 (2%)	
Ethnicity			
Non-Hispanic	30/33 (90.9%)	47/50 (94%)	0.678
Hispanic	3/33 (9.1%)	3/50 (6%)	
BMI (kg/m^2)	28.2 ± 5.3	29.0 ± 6.0	0.540
ASA			
2	14/33 (42.4%)	27/50 (54%)	0.372
3	19/33 (57.6%)	23/50 (46%)	
Preoperative diagnosis			
Instability	13/33 (39.4%)	12/50 (24%)	0.150
Other	20/33 (60.6%)	38/50 (76%)	

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index.

Table 3 Early perioperative outcomes and dislocation rates of liner-only versus acetabular component revisions

	Head/liner revised ($n = 33$)	Cup revised ($n = 50$)	*p*-Value
Discharge disposition			
Home	31/33 (93.9%)	44/50 (88%)	0.468
Other	2/33 (6.1%)	6/50 (12%)	
Length of stay (mean, d)	1.61 ± 0.7	2.46 ± 1.7	0.002[a]
Surgical skin-to-skin time (mean, min)	97.9 ± 39.97	142.0 ± 43.49	< 0.001[a]
Hospital transfusions	0/33 (0%)	6/50 (12%)	0.076
Complications within 90 d	10/33 (30.3%)	9/50 (18%)	0.285
Dislocations up to the latest follow-up	8/33 (24.2%)	2/50 (4%)	0.012[a]

[a]Statistically significant at $p < 0.05$.

Even so, our sample size is similar to the ones of most relevant studies on the subject, some of which, were cited in this paper.

In logistic regression analyses, we found that a preoperative diagnosis other than instability was a significant protector against dislocations. Our results are in agreement with the ones of Faldini et al[1] who found that history of instability was a risk factor for dislocation after hip revision. We also independently analyzed the use of dual mobility constructs (yes/no) as well as whether the acetabular component was revised (yes/no) and found that the use of dual mobility systems per se was not an independent predictor of dislocation. This somewhat contradicts previous publications that have demonstrated significant reductions in the rates of dislocations with the use of such systems in the setting of hip revisions.[9–11] Instead, in our logistic regression analyses, we found that revision of the cup per se was a significant independent protector against dislocation. Additionally, the postoperative dislocation rates were found drastically different when we set apart those cases that had the acetabular cup revised (4%), and those that did not undergo revision of this component (24.2%; $p = 0.012$). We speculate that an improvement in cup positioning could have been responsible for this finding, but as previously noted, the association between acetabular cup position and the risk of dislocation remains controversial. Seagrave et al[12] (2017) performed a systematic review of the literature on this specific question and found 28 articles relevant to it. The authors showed that some publications supported this association while others did not. They also reported that most papers could not find a statistically significant difference between dislocated and nondislocated THA regarding mean angles of cup anteversion and inclination.

When we analyzed the use of the direct anterior approach as an independent factor of dislocation in the setting of aseptic hip revision with stem retention, we found that it was not a statistically significant predictor. This finding is in disagreement with previous investigations that have reported low dislocation rates using this approach in the setting of revision hip arthroplasty.[4,5]

We wondered what could be the main message in our series; probably, not to expect that the use of dual mobility liners alone could reliably prevent postoperative dislocations, especially true among patients with history of instability. It was also notable that the use of the anterior approach made no difference in our series regarding dislocations while the revision of the cup (regardless of cause) significantly protected against them. We cannot pinpoint to a particular reason of why that was the case because of the diversity of our patients, and the fact that a multitude of concomitant factors were into play and/or run together in many of the cases (factors such as preoperative diagnosis, neuromuscular status, type of previous implants, type of revision, type of components used, and previous history of instability, just to name a few). Our relatively small sample size did not help; that is why this was noted as one of our limitations. A final take home message could be that the nature of dislocation is multifactorial and that each patient is unique; hence, an exhaustive preoperative evaluation should always be performed, especially in the setting of history of instability and/or when in presence of a well-fixed acetabular component.

In conclusion, the revision of the acetabular component seemed to be the most important factor to avoid postoperative dislocations in aseptic partial total hip revisions with stem retention. A preoperative diagnosis other than instability was also found protective. The use of dual mobility constructs and the anterior approach per se did not significantly reduced the risk of dislocations in our series. The role of isolated liner exchanges in revision THA continues to evolve and should be reserved for appropriately selected patients.

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Conflict of Interest
None declared.

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