



# Do All *Rigid and Unbalanced* Spines Present the Same Risk of Dislocation Following Total Hip Arthroplasty?

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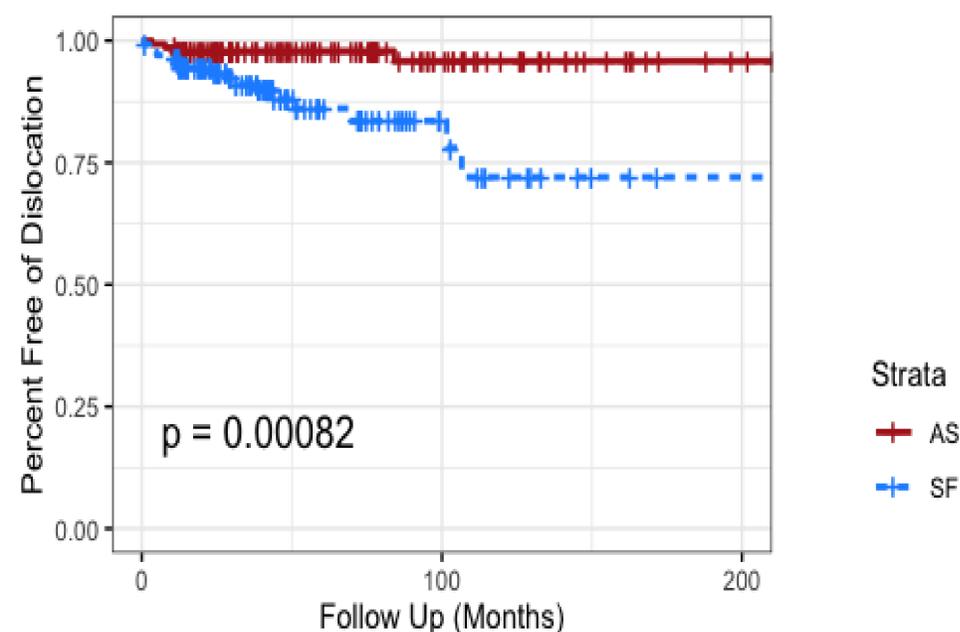
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## BACKGROUND

- Spines with ankylosis or with history of lumbosacral fusions have been collectively classified as *rigid and unbalanced*, meaning that due to spinal rigidity, the pelvis does not adequately tilt posteriorly when sitting and vice versa; this immobility is associated with increased rate of dislocation following total hip arthroplasty (THA)<sup>1</sup>
- Patients with an ankylosing spondylitis (AS) diagnosis or history of spinal fusion (SF) are two patient cohorts that have been identified to experience higher risk of dislocation following THA compared to the general population<sup>2-3</sup>
- AS patients lose lumbar lordosis and thoracic kyphosis due to inflammation<sup>4</sup>
- Lumbar fusion alters spinopelvic biomechanics and jeopardizes stability of THA<sup>2</sup>
- While AS and SF represent different etiologies of *rigid and unbalanced* spines that result in similar pelvic mobility restrictions, it is unclear as to whether the rate of observed THA dislocations differ between these patient cohorts; we hypothesized that there would be no significant difference in dislocation rate.

Figure 1: Kaplan-Meier Survival Curve



## METHODS

- A retrospective cohort study was conducted at a single healthcare system from January 2000 to December 2017
- Inclusion criteria for the AS cohort were: (1) medical record diagnosis of AS affecting lumbar spine or sacral spine, (2) operative indication of primary elective THA, and (3) at least 2 years of clinical follow-up.
- Inclusion criteria for the SF cohort were: (1) operative indication of primary elective THA following the spinal fusion procedure and (2) at least 2 years of clinical follow-up.
- Demographic and surgical variables, and dates of hip dislocation, SF, and THA were collected
- Radiological measurements collected included lumbar lordosis angle (LLA), acetabular anteversion (AA), and inclination angle
- Categorical variables were compared with chi-squared test and continuous variables were compared with student t-test
- Kaplan-Meier survival curve analysis was performed, cumulative survival rates of AS and SF cohorts were reported, and comparisons between cohorts were made with log-rank test
- Cox regression analyses were performed to assess the risk of clinically pertinent potential variables on risk of dislocation

## RESULTS

- 142 patients with AS diagnosis who had THA were identified
- 135 patients who had SF prior to THA were identified
- SF group had a greater mean LLA ( $34.18^{\circ} \pm 14.2^{\circ}$ ) compared to the AS group ( $21.00^{\circ} \pm 9.3^{\circ}$ ; p-value < 0.01)
- In the SF group, 16 patients (11.85%) suffered dislocation following THA, compared to 4 patients (2.82%) in the AS group (p-value < 0.01) (Figure 1)
- Kaplan-Meier dislocation-free survivorship estimates at five and ten years are shown in Table 1
- 64 patients lacked lateral radiographs for determination of LLA and were therefore excluded from Cox regression analysis
- History of SF, increasing LLA, and hip measurements outside the Lewinnek safe zone ( $5^{\circ}$ - $25^{\circ}$  for AA and  $30^{\circ}$ - $50^{\circ}$  for inclination angle), increasing age, and lack of dual mobility construct were associated with higher hazard of postoperative dislocation and were progressed to multivariable analysis
- In multivariable Cox regression analysis, history of SF was no longer a significant predictor of dislocation; only hips outside of Lewinnek safe zone and increasing LLA were significantly associated with higher hazard of dislocation following THA (Table 2)

## RESULTS

Table 1: 5 and 10 Year Survival Estimates for Ankylosing Spondylitis and Spinal Fusion Cohorts

	5 Years		10 Years	
	Number at Risk	Survival Estimate (%)	Number at Risk	Survival Estimate (%)
Dislocation				
Ankylosing Spondylitis	66	98±0.0	27	96±0.0
Spinal Fusion	36	86±0.0	9	72±0.1
P-value	<0.001			

Table 2: Multivariable Cox Regression Analysis of Candidate Risk Factors

Variable	Hazard Ratio (Coefficient and 95% Confidence Interval)	P-value
History of Spinal Fusion vs. Ankylosing Spondylitis Diagnosis	1.43 (0.25-8.09)	0.685
Age	1.01 (0.97-1.05)	0.683
Lumbar Lordosis Angle	1.08 (1.05-1.11)	<0.001
Outside Lewinnek Safe Zone	6.81 (1.95-23.78)	0.003
Dual Mobility Construct	0.68 (0.16-2.88)	0.599

## DISCUSSION

- Our data suggests that increased lordosis of the lumbar spine could help explain the increased dislocation rate of SF patients versus AS patients
- Degree of lumbar spine curvature was more associated with dislocation than history of SF itself when accounting for confounders.
- An increase in LLA of  $1^{\circ}$  increases the probability of dislocation by 7% among AS and SF patients
- Further prospective studies need to be conducted to investigate the underlying biomechanical reasoning for discrepancy between dislocation rate in the AS and SF populations

## REFERENCES

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