Anti-Osteoporotic Treatment Reduces Risk of 10-Year Revision Following Lumbar Fusion in Osteoporosis

John George Parel, Philip M Parel, Theodore Quan, Ami Kapadia, Tushar C Patel[1], Addisu Mesfin
[1]Washington Orthopedics and Sports Medicine

INTRODUCTION: Osteoporosis, a prevalent bone density disorder, introduces a complex dynamic in the context of lumbar fusion (LF) surgery. The incidence of osteoporotic patients undergoing LF has been on the rise, attributable to insufficient screening practices. However, despite the well-established association between osteoporosis and an elevated risk of revision, the existing literature lacks comprehensive insights into the impact of anti-osteoporotic therapy on long-term surgical outcomes in the setting of LF surgery. Thus, the purpose of this study was to investigate whether anti-osteoporotic therapy correlates with improved 10-year surgical outcomes following LF.

METHODS:

A retrospective cohort analysis was performed using a national all payer's claims database. Patients who underwent primary LF were identified using Current Procedural Terminology (CPT) and International Classification of Diseases (ICD) procedure codes. Patients with a preoperative diagnosis of osteoporosis were included, then stratified into two groups: [1] patients who underwent anti-osteoporotic therapy within 6 months prior to surgery (AOP Cohort) and [2] patients who never received anti-osteoporotic treatment (NAOP Cohort). Primary outcomes included the cumulative incidence of 10-year all-cause revision, pseudarthrosis, mechanical failure, hardware removal, drainage and evacuation, and decompressive laminectomy. The AOP cohort was matched by age, gender, and Charlson Comorbidity Index (CCI) to the NAOP cohort in a 1:4 ratio. The 10-year cumulative incidence rates were determined using Kaplan-Meier survival analysis. Multivariable analysis was conducted using Cox Proportional Hazard modeling.

RESULTS: In total, 23,680 LF patients were included in this study, with 4,749 (20.05%) osteoporotic patients stratified into the AOP cohort. Patients who received anti-osteoprototic treatment had significantly lower odds of 10-year all-cause revision (Odds Ratio [OR]: 0.82; P = 0.001) and decompressive laminectomy (OR: 0.81; P < 0.001) following LF when compared to those untreated for osteoporosis. No significant differences were observed in 10-year incidence of pseudarthrosis, mechanical failure, hardware removal, or drainage and evacuation (P > 0.05 for all).

DISCUSSION AND CONCLUSION: This study demonstrates a significant association between anti-osteoporotic therapy and reduced rates of 10-year revision following LF. Spine surgeons should recognize the heightened risk of long-term implant failure in the absence of osteoporosis therapy. This underscores the imperative for increased screening initiatives given the high prevalence of undiagnosed or untreated osteoporosis in the LF population. These results also emphasize the importance of integrating osteoporosis management strategies into the broader context of surgical decision-making as treatment within 6 months of surgery has crucial impacts on long-term survivorship, thus contributing to enhanced patient outcomes and quality of care in spine surgery.

Table 1: Demographics and clinical characteristics of unmatched Anti-Osteoporotic and No Anti-Osteoprootic cohorts

	Anti-Osteoporotic Treatment		No Anti-Osteoporotic Treatment		
	n	%	n	%	P-Value
Total	7,557	-	21,160	-	-
Demographic and Comorbidity Characteristics					
Age (years)	66.7 ± 7.7	-	64.6 ± 9.3	-	**<0.001**
<50	170	2.25%	1,343	6.35%	**<0.001**
50-59	1,289	17.06%	4,650	21.98%	**<0.001**
60-69	3,070	40.62%	9,443	44.63%	**<0.001**
70-74	2,702	35.75%	8,366	39.54%	**<0.001**
75+	1,458	19.29%	5,298	25.04%	**<0.001**
Gender	-	-	-	-	-
Male	666	8.81%	3,777	17.85%	**<0.001**
Female	6,891	91.19%	17,383	82.15%	**<0.001**
Charlson Comorbidity Index	2.02 ± 2.19	-	2.62 ± 2.49	-	**<0.001**
0	2,051	27.14%	3,400	16.07%	**<0.001**
1	1,866	24.69%	5,109	24.14%	0.348
2	1,312	17.36%	4,097	19.36%	**<0.001**
3+	2,328	30.81%	8,554	40.43%	**<0.001**

Table 2: Demographics and clinical characteristics of matched Anti-Osteoporotic and No Anti-Osteoprootic cohorts

	Anti-Osteoporotic Treatment		No Anti-Osteoporotic Treatment		
	n	%	n	%	P-Value
Total	4,749	-	18,931	-	-
Demographic and Comorbidity Characteristics					
Age (years)	65.7 ± 8.1	-	65.6 ± 8.1	-	0.641
<50	159	3.35%	628	3.32%	0.951
50-59	936	19.71%	3,863	20.41%	0.295
60-69	1,988	41.86%	8,825	46.62%	**<0.001**
70-74	1,628	34.28%	7,906	41.76%	**<0.001**
75+	774	16.30%	4,991	26.36%	**<0.001**
Gender	-	-	-	-	-
Male	635	13.37%	2,518	13.30%	0.917
Female	4,114	86.83%	16,413	86.70%	0.917
Charlson Comorbidity Index	2.41 ± 2.25	-	1.75 ± 2.05	-	**<0.001**
0	831	17.50%	6,161	32.54%	**<0.001**
1	1,199	25.25%	4,805	25.38%	0.863
2	937	19.73%	3,053	16.13%	**<0.001**
3+	1,782	37.52%	4,912	25.95%	**<0.001**

Table 3: Cox proportional hazards modeling of 10-year surgical outcomes for matched Anti-Osteoporotic and No Anti-Osteoporotic cohorts

Surgical Outcome	Hazards Ratio*	95% Confidence Interval	P-Value
All-Cause Revision	0.82	0.73-0.92	**0.001**
Pseudarthrosis	0.99	0.89-1.10	0.875
Mechanical Failure	0.94	0.81-1.09	0.431
Hardware Removal	0.91	0.75-1.09	0.314
Drainage and Evacuation	0.87	0.75-1.01	0.075
Decompressive Laminectomy	0.81	0.77-0.86	**<0.001**

*Hazards ratios compare the Anti-Osteoporotic cohort to the No Anti-Osteoporotic cohort