Effects of Delayed versus Immediate Surgical Treatment of Thoracolumbar Vertebral Fractures in Geriatric Patients with Ankylosing Spinal Disorders

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INTRODUCTION: Ankylosing Spinal Disorders (ASD's) include Ankylosing Spondylitis (AS) and Diffuse Idiopathic Skeletal Hyperostosis (DISH). Surgical treatment of fractures in these patients is complex and is associated with multiple complications given patients' rigid biomechanics, chronic inflammation, and low bone quality. There is a general recommendation for early surgical intervention in patients with neurological deficits and unstable fractures, however, there is a paucity of research investigating the differences in outcomes of patients who undergo early versus delayed surgical treatment. Therefore, the objective of this study is to determine the effect of a 48-hour operative cut-off on medical complications, hardware failure, revision surgery, and survival in geriatric patients (>65 years).

METHODS: A retrospective cohort study was performed within the TriNetX Research Network, which aggregates de-identified electronic records from 100 U.S health systems between 2008-2025. Patients aged ≥ 65 with AS or DISH, and thoracic or lumbar vertebral fractures treated with posterior lumbar fusion and instrumentation were identified. Patients with cervical fractures or malignancy of the vertebral column were excluded. Cohorts were defined by early (≤ 48 hours) or delayed (> 48 hours) surgical timing relative to the first fracture diagnosis. Patients were then 1:1 propensity-score matching based on demographics and the Charlson Comorbidity Index (CCI). Primary outcomes were determined by 90-day medical complications, and 1-year, 3-year, and 5-year surgical complications. Mortality was assessed at all time points. Risk difference and risk ratios (RR) with 95 % confidence intervals were calculated within the TriNetX system, and $p < 0.05$ was used to determine statistical significance.

RESULTS:

A total of 340 patients were included in each cohort for analysis after 1:1 propensity score matching. There were no statistically significant differences in 90-day risk of readmission, emergency department (ED) utilization, deep vein thrombosis (DVT), pulmonary embolism (PE), pneumonia, infection, wound disruption, sepsis, mechanical failure, pseudoarthrosis, revision surgery, and mortality between patients who underwent fusion surgery within 2 days and after 2 days following vertebral fractures (Table 1). Similarly, there were no statistically significant differences of 1-year, 3-year, or 5-year risk of mechanical failure, pseudoarthrosis, revision surgery, mortality (Tables 2-4) between the two groups.

DISCUSSION AND CONCLUSION: In this large, multicenter analysis of AS and DISH geriatric patients with thoracolumbar vertebral fractures, early surgical intervention within 48 hours of diagnosis did not significantly reduce the risk of perioperative medical complications, long-term mechanical complications, revision surgery, or mortality when compared to delayed intervention. These findings suggest that early surgery may not provide a clear short- and long-term benefit in this population. However, future studies controlling for potential confounders like fracture morphology, neurologic status, and surgeon experience are needed to elucidate these findings and clarify optimal timing for surgical intervention.

Table 1. 90-Day Postoperative Outcomes Following Surgical Management of Ankylosing Spondylitis or DISH-Related Spinal Injuries in Geriatric Patients Comparison of Surgery Within vs After 48 Hours of Injury

90-Day Outcomes	Lumbar Fusion Within 2 Days (%) n=340	Lumbar Fusion After 2 Days (%) n=340	RR (95% CI)	P-value
Readmission	7.1%	5.3%	1.33 (0.74–2.41)	0.339
Emergency Department (ED) Utilization	15.0%	18.8%	0.80 (0.57–1.12)	0.184
Deep Vein Thrombosis (DVT)	7.6%	7.4%	1.04 (0.61–1.76)	0.884
Pulmonary Embolism (PE)	4.1%	5.3%	0.78 (0.39–1.54)	0.469
Pneumonia	8.5%	8.8%	0.97 (0.60–1.57)	0.892
Infection	5.9%	7.6%	0.77 (0.44–1.35)	0.360
Wound Disruption	3.8%	5.3%	0.72 (0.36–1.45)	0.358
Sepsis	7.6%	7.4%	1.04 (0.61–1.76)	0.884
Mechanical Failure	2.9%	3.0%	0.98 (0.41–2.32)	0.962
Pseudoarthrosis	8.0%	4.8%	1.67 (0.91–3.08)	0.095
Revision Surgery	3.0%	3.1%	0.96 (0.41–2.29)	0.935
Mortality	12.7%	10.1%	1.26 (0.83–1.93)	0.282

Table 2. 1-year Postoperative Outcomes Following Surgical Management of Ankylosing Spondylitis or DISH-Related Spinal Injuries in Geriatric Patients: Comparison of Surgery Within vs After 48 Hours of Injury

1-Year Outcomes	Lumbar Fusion Within 2 Days (%) n=340	Lumbar Fusion After 2 Days (%) n=340	RR (95% CI)	P-value
Mechanical Failure	2.9%	3.0%	0.98 (0.41–2.32)	0.962
Pseudoarthrosis	8.3%	6.4%	1.30 (0.75–2.26)	0.350
Revision Surgery	3.0%	3.1%	0.96 (0.41–2.29)	0.935
Mortality	18.0%	16.9%	1.07 (0.77–1.48)	0.698

Table 3. 3-Year Postoperative Outcomes Following Surgical Management of Ankylosing Spondylitis or DISH-Related Spinal Injuries in Geriatric Patients: Comparison of Surgery Within vs After 48 Hours of Injury

3-Year Outcomes	Lumbar Fusion Within 2 Days (%) n=340	Lumbar Fusion After 2 Days (%) n=340	RR (95% CI)	P-value
Mechanical Failure	2.9%	3.0%	0.98 (0.41–2.32)	0.962
Pseudoarthrosis	8.6%	7.0%	1.23 (0.72–2.09)	0.455
Revision Surgery	3.0%	4.0%	0.74 (0.33–1.67)	0.468
Mortality	21.9%	20.8%	1.05 (0.79–1.41)	0.722

Table 4. 5-Year Postoperative Outcomes Following Surgical Management of Ankylosing Spondylitis or DISH-Related Spinal Injuries in Patients Aged 65+: Comparison of Surgery Within vs After 48 Hours of Injury

5-Year Outcomes	Lumbar Fusion Within 2 Days (%) n=340	Lumbar Fusion After 2 Days (%) n=340	RR (95% CI)	P-value
Mechanical Failure	2.9%	3.0%	0.98 (0.41–2.32)	0.962
Pseudoarthrosis	8.6%	7.0%	1.23 (0.72–2.09)	0.455
Revision Surgery	3.0%	4.3%	0.69 (0.31–1.53)	0.357
Mortality	24.9%	23.4%	1.06 (0.81–1.39)	0.669