

Outcomes of Percutaneous Lumbopelvic Fixation in Patients with High Energy Sacral Trauma

Jacob Chaisson, BS¹, Jessica Rivera, MD¹, PhD, Daniel Gelvez, MD¹, Amit Bhandutia, MD²

Department of Orthopaedic Surgery, Louisiana State University Health Sciences Center, New Orleans, LA

Introduction

- High energy, complex sacral and pelvic fractures following trauma can result in lumbar spine disassociation from the remainder of the sacrum and pelvis resulting in highly unstable fracture patterns.¹
- Through minimally invasive percutaneous incisions and intra-operative fluoroscopic guidance, lumbopelvic fixation (LPF) entails stabilizing the lumbosacral junction through a surgical construct using pedicle screws, iliac screws, and connecting rods.
- This creates a triangular osteosynthesis construct that is highly stable allowing for fracture healing and early weight bearing in high energy trauma patients.²
- The objective of this study was to review outcomes of patients who had undergone percutaneous lumbopelvic fixation (LPF) following high-energy sacral fractures with or without additional pelvic ring stabilization and compare LPF surgical techniques.

Methods

- This retrospective study included 20 patients who underwent LPF with at least 3 months of follow-up
- Time intervals in count of days was collected between admission and initial pelvic stabilization (if indicated), admission and LPF, pelvic stabilization and LPF (if separate), days to successful immobilization relative to admission and LPF, and length of hospital stay.
- Different operative methods for LPF (L4-Pelvis and L5-Pelvis) were compared and analyzed.

References

[1] Jazini E, Weir T, Nwodim E, Tannous O, Saifi C, Caffes N, Costales T, Koh E, Banagan K, Gelb D, Ludwig SC. Outcomes of lumbopelvic fixation in the treatment of complex sacral fractures using minimally invasive surgical techniques.
[2] Schildhauer TA, Josten C, Muhr G. Triangular osteosynthesis of vertically unstable sacrum fractures: a new concept allowing early weight-bearing.
[3] Kanaan et al. Management of a rare case of isolated U-shaped displaced sacral fracture in a young female high school student.

Analysis

Variable	β coefficient	Δ mobilization time (hr)	p-value
time from Pelvic Stabilization to LPF	0.094	2.25	0.002
two stage procedure vs one stage procedure	-0.987	-24	<0.001

Table 1 illustrates a regression table as a summary of key relationships affecting mobilization time. The β coefficient provides a time relationship between important study variables and time to mobilization. In the top row, a positive β value indicates that for every additional day between initial pelvic stabilization and LPF, there was a 0.094 day (2.25hr) increase in time to mobilization ($p=0.002$). The bottom row provides that two stage procedures offer a reduction in mobilization time compared to one stage procedures (~24 hours less, $p<0.001$).

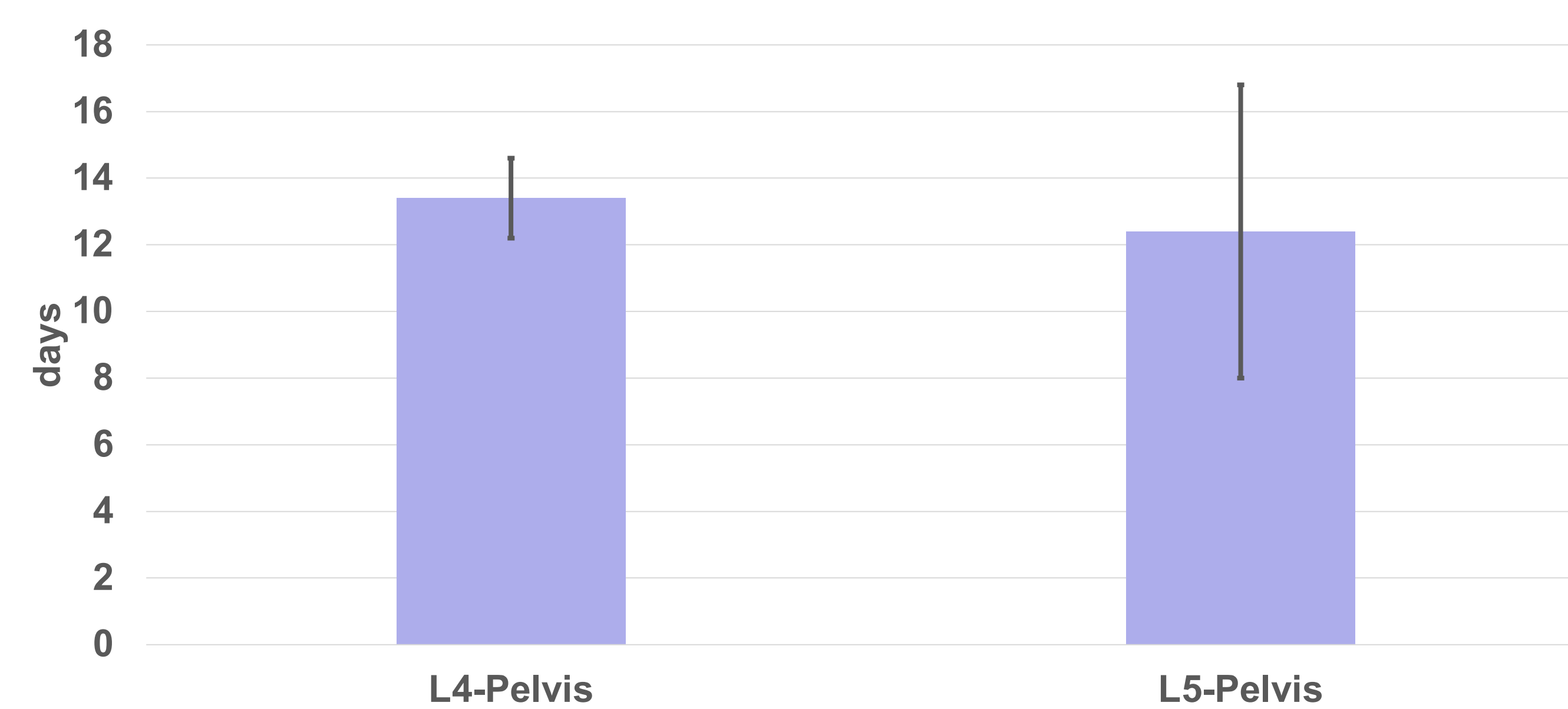


Figure 1 provides total time from admission to mobilization between the 2 different operative spine level groups. The L4 patients had an average time to mobilization from admission of 13.4 ± 1.2 days, and L5 patients had an average time to mobilization from admission of 12.4 ± 4.4 days. Similarly, there was no significant difference between the groups.

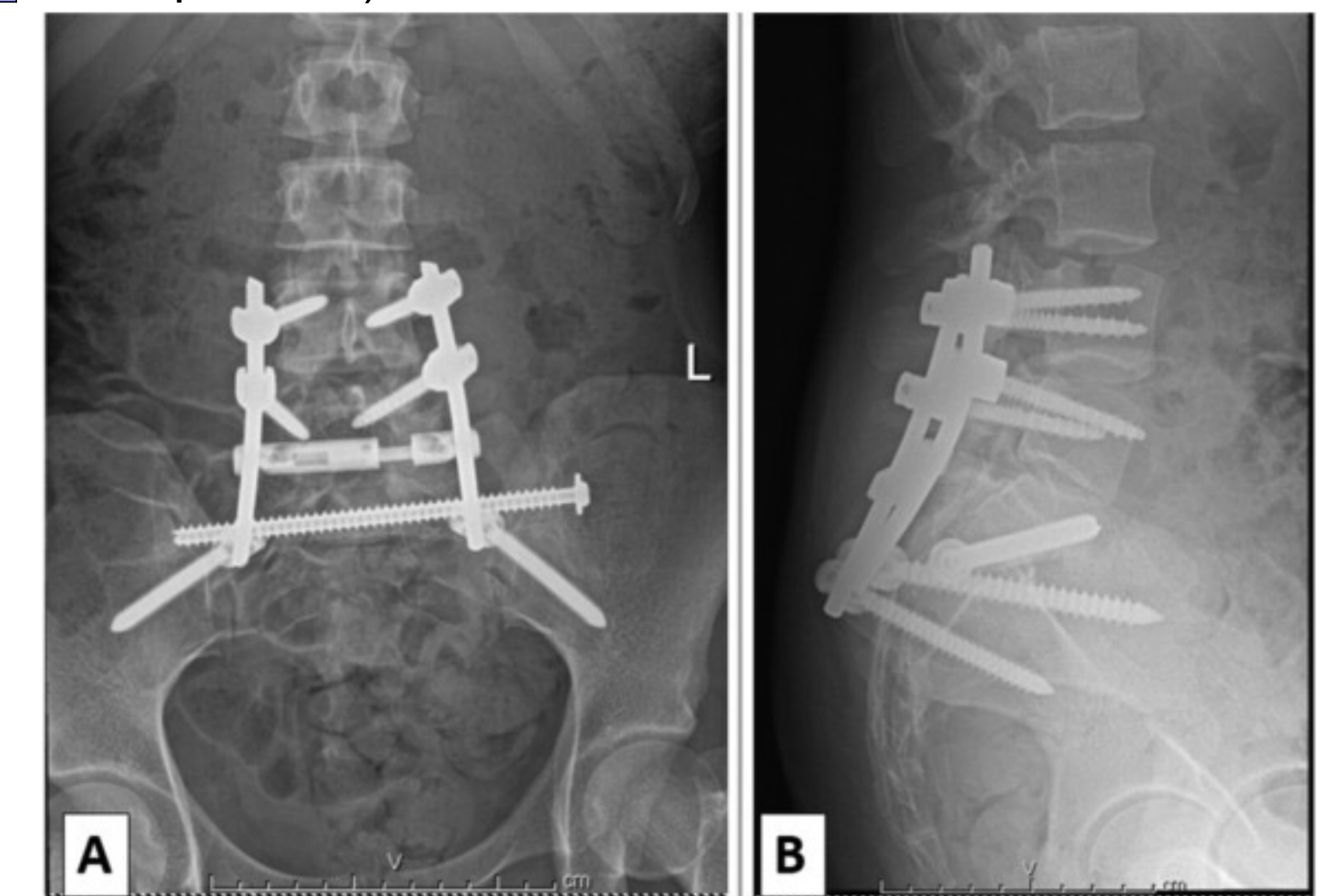


Figure 2 features posterior to anterior (A) and lateral (B) radiographic images of a lumbopelvic fixation osteosynthesis surgical construct. The construct includes L4 screws, L5 screws, and iliac screws, connected by rods bilaterally. An ilio-sacral screw is also included in the construct for pelvic stabilization³.

Results

- Increased time between initial pelvic stabilization and LPF was associated with a longer time from LPF to successful mobilization ($\beta= 0.094$, $p=0.002$).
- Time between LPF and mobilization was not different for patients who underwent instrumentation including L4 (mean 6.9 ± 1.6 days) and patients who underwent instrumentation to L5 (7.7 ± 2.6 days).
- Admission to mobilization was not different between L4 patients (13.4 ± 1.2 days) and L5 patients (12.4 ± 4.4 days).
- Time between admission and mobilization increased with increased time between initial pelvic stabilization and LPF ($\beta=0.103$, $p<0.0001$).
- However, undergoing a two-stage procedure (pelvis fixation first, followed by LPF versus LPF in single stage) was associated with a decreased time from admission to mobilization ($\beta=-0.987$, $p<0.001$) These results likewise affected length of stay.

Conclusion

- This study reports successful outcomes in patients undergoing minimally invasive LPF following high energy sacral fractures.
- First, the importance of total time to LPF as an important time interval in predicting patient recovery was demonstrated.
- Second, when comparing L4-Pelvis and L5-Pelvis operative techniques, results indicated similar successful outcomes. The reduced EBL of the L5-Pelvis group was predicted, as one less level of pedicle screw instrumentation was required.
- Overall, this study adds to the literature of successful outcomes of minimally invasive LPF and demonstrates its importance as a tool in the treatment of high energy sacral fractures.