

Operative Management of Stress-Positive Minimally Displaced Lateral Compression Type 1 (LC1) Pelvic Ring Injuries: Analysis of Outcomes Before and After Implementation of a Departmental Stress Protocol

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INTRODUCTION:

Lateral compression type 1 (LC1) injuries are the most prevalent of all pelvic ring injuries, but with a wide variety of injury patterns and severities, their management remains controversial. With the reported advantages of reduced resource utilization, normalized force application, and standardized measurements, lateral stress radiographs (LSR) have been routinely applied to the evaluation of minimally displaced LC1 injuries at our level one trauma center to guide management recommendations. Utilizing the threshold first proposed by Sagi et al., patients with dynamic displacement ≥ 1 cm are counseled on the potential risks and benefits of operative versus nonoperative management, while patients with dynamic displacement <1 cm are managed nonoperatively. The purpose of this study was to compare the hospital course of patients with minimally displaced (<1 cm) lateral compression type 1 (LC1) injuries treated before and after implementation of a departmental protocol utilizing lateral stress radiographs (LSR) to determine management.

METHODS: Retrospective review of a prospectively collected database identified patients with *isolated* LC1 injuries that were managed before (n=33) and after implementation of LSR (n=40) to determine treatment. All patients in the pre-stress cohort were managed nonoperatively, while patients in the LSR cohort were managed operatively if stress-positive (≥ 1 cm displacement on LSR) and nonoperatively if stress-negative. Primary outcomes were ability to clear physical therapy (PT) for discharge, discharge location, and hospital length of stay (LOS).

RESULTS: The pre-stress and LSR protocol groups were similar in demographic/injury characteristics (age, sex, mechanism, ASA score, Nakatani classification, bilateral/unilateral injury, Denis zone, sacral fracture completeness, sacral comminution). The LSR protocol group was more likely to clear PT by discharge (97.5% vs. 75.8%, proportional difference (PD): 21.7%, 95% confidence interval (CI): 5.1% to 36.8%, $p=0.009$), less likely to discharge to a rehabilitation facility (2.5% vs. 18.2%, PD: -15.7%, CI: -30.0% to -0.5%, $p=0.04$), and had no difference in LOS (median difference (MD): 0, CI: -1 to 1, $p=0.57$). 55.0% of LSR protocol patients (n=22) were stress-negative and managed nonoperatively. In total, 100% of stress-negative patients were able to clear PT by the third day of admission. When compared to patients in the pre-stress group that were able to clear PT by the third day of admission, stress-negative patients did not differ in patient/injury characteristics or primary outcomes. Some 45.0% of LSR protocol patients were stress-positive (n=18) and managed operatively. When compared to patients in the pre-stress group that were not able to clear PT by the third day of admission, the operative LSR group was more likely to clear PT (94.4% vs. 50.0%, PD: 44.4%, CI: 13.4% to 66.6%, $p=0.006$), less likely to discharge to a rehabilitation facility (5.6% vs. 37.5%, PD: -31.9%, -55.0% to -2.8%, $p=0.03$), and had a trend of a shorter LOS (MD: 1, CI: 0 to 2, $p=0.13$).

DISCUSSION AND CONCLUSION: Implementation of a LSR protocol to determine management of minimally displaced stress-positive LC1 injuries was associated with increased rates of operative management, PT clearance by discharge, and a reduction in the number of patients discharging to rehabilitation facilities. Further research is required to determine the implication of the LSR protocol in post-hospital outcomes.



Figure 1
Figure 1 shows a minimally displaced lateral compression type 1 (LC1) fracture of the right hemipelvis on an anteroposterior (AP) pelvic radiograph. The fracture line is visible in the lateral aspect of the ilium, extending from the greater sciatic foramen towards the lesser sciatic foramen. The patient was managed nonoperatively.

Table 1: Patient Characteristics

Characteristic	Pre-Stress (n=33)	LSR Protocol (n=40)
Age (mean)	45.2	46.1
Sex (Male/Female)	28/5	31/9
ASA Score (I-IV)	12/14/7/0	15/18/7/0
Mechanism (Fall/Trauma)	18/15	22/18
Nakatani Classification (I-IV)	15/15/3/0	18/18/4/0
Bilateral/Unilateral	10/23	12/28
Denis Zone (I-IV)	15/15/3/0	18/18/4/0
Sacral Fracture Completeness	10/23	12/28
Sacral Comminution	10/23	12/28

Table 2: Management Outcomes

Outcome	Pre-Stress (n=33)	LSR Protocol (n=40)
Operative Management (%)	0	45.0
Nonoperative Management (%)	100	55.0
PT Clearance by Discharge (%)	75.8	97.5
Discharge to Rehab (%)	18.2	2.5
LOS (Median)	0	0

Table 3: Stress Test Results

Result	Pre-Stress (n=33)	LSR Protocol (n=40)
Stress-Positive (≥ 1 cm)	0	45.0
Stress-Negative (<1 cm)	0	55.0