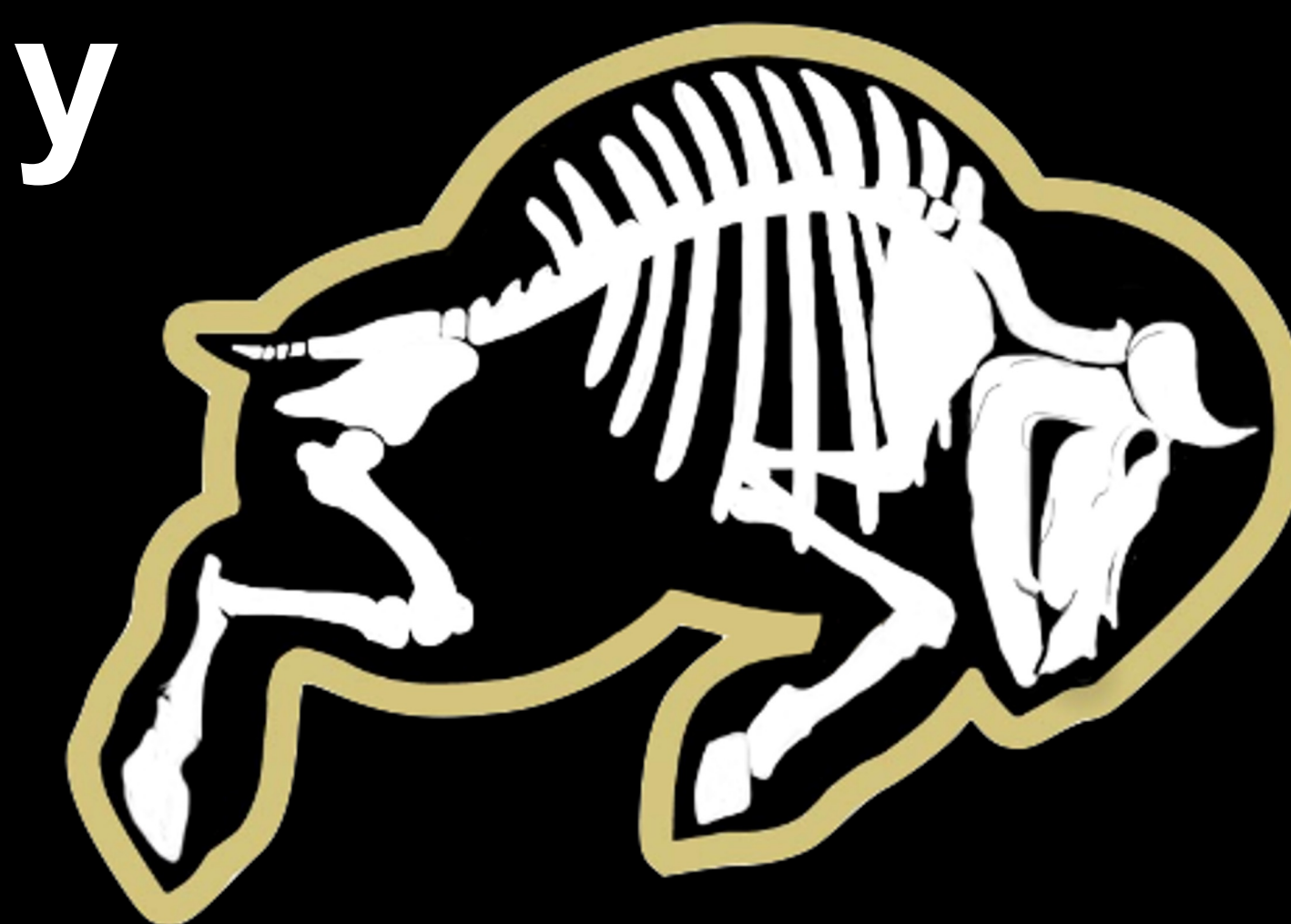
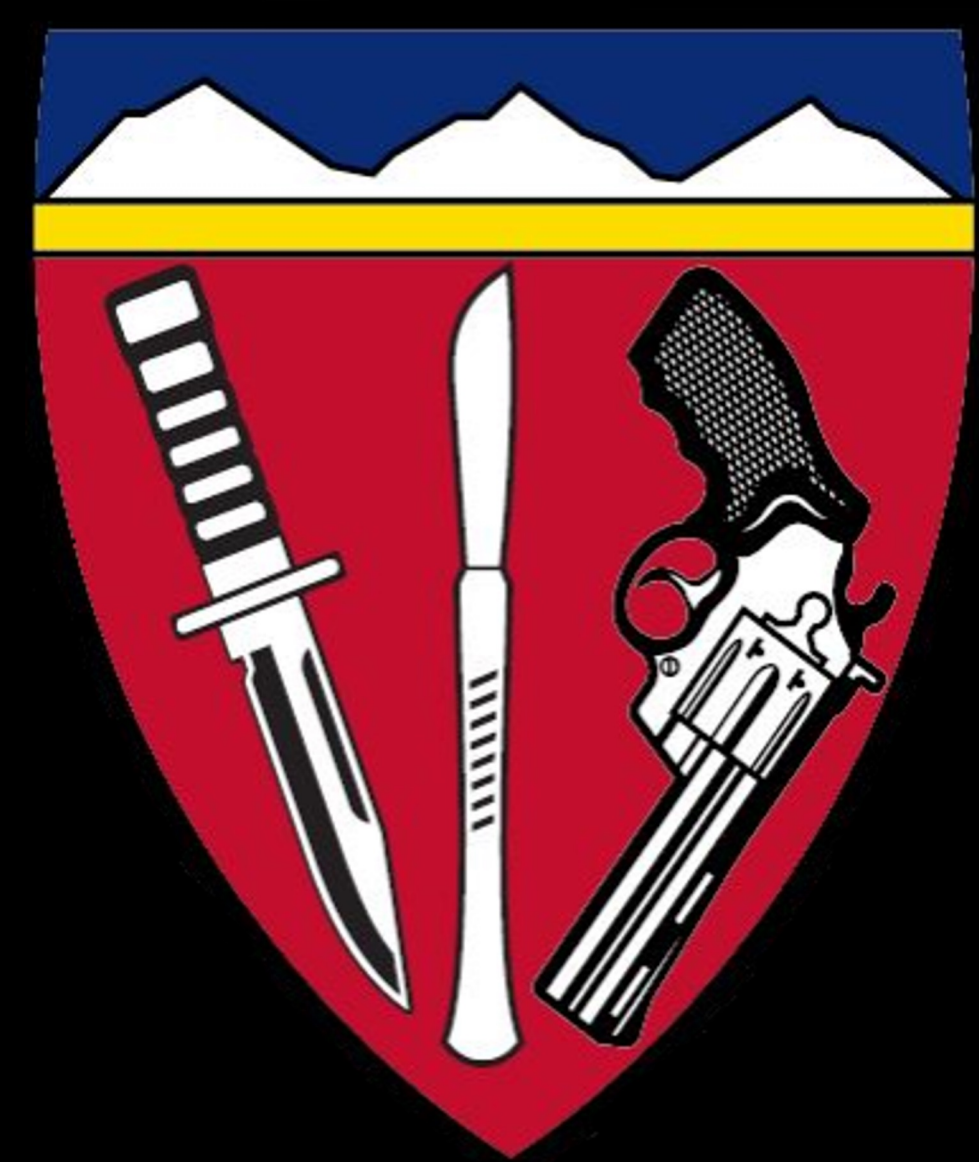


Operative management of stress-positive minimally displaced LC1 pelvic ring injuries: analysis of outcomes before and after implementation of a departmental stress protocol



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Background

Operative management of minimally displaced (<1 cm) LC1 pelvic ring injuries is controversial.

The purpose of this study was to compare the hospital course of patients with minimally displaced LC1 injuries treated before and after implementation of a departmental protocol utilizing lateral stress radiographs (LSR) to determine management (**Figure 1**)

Methods

Design: Retrospective comparative study

Setting: Level-one trauma center

Patients: Orthopaedic trauma patients with acute, isolated LC1 pelvic ring injuries with <1 cm displacement on a static anteroposterior (AP) radiograph

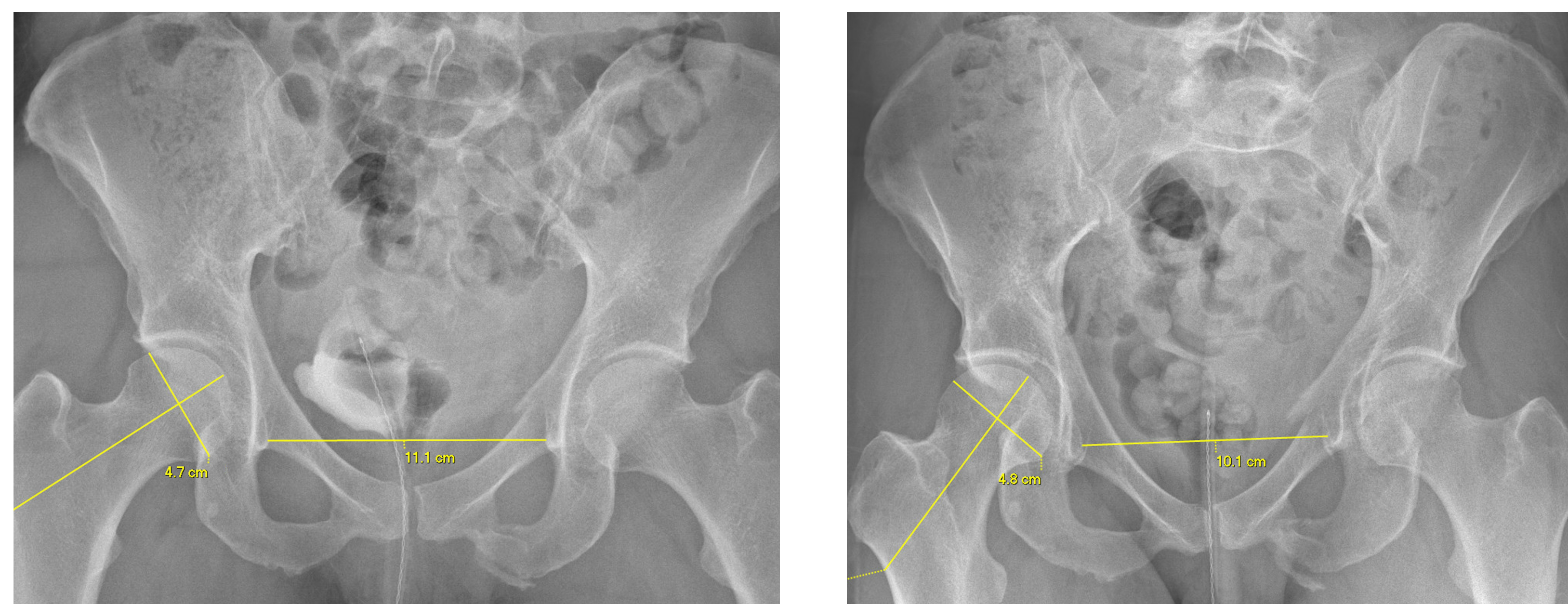
Intervention: Patients before (n=33) and after (n=40) implementation of stress protocol. Historical cohort managed nonoperatively. Contemporary group managed operatively for ≥1 cm dynamic displacement on LSR.

Main outcome measurements:

- Physical therapy (PT) clearance before discharge
- Discharge location
- Hospital length of stay (LOS)
- Morphine milligram equivalents (MME)

Tables/Figures

Figure 1



(A) Anteroposterior (AP) supine pelvis and (B) lateral stress radiographs (LSR) of a 40-year-old woman who sustained a minimally displaced lateral compression type 1 pelvic ring injury from collision with a tree while alpine skiing. Comparison of radiographs demonstrate 12 mm of dynamic displacement after correcting for differences in magnification. The patient elected for nonoperative management and was unable to clear physical therapy and discharge until hospital day 8. At two weeks, the patient was still requiring opioid medications three times a day, was unable to put weight on the injured extremity, and required a walker for mobilization. At three weeks, the patient elected to undergo operative fixation at an outside hospital.

Table 1. Comparison before and after institution of departmental protocol: historical cohort managed nonoperatively and contemporary group managed operatively for ≥1 cm displacement on lateral stress radiograph

	Before Stress Protocol (n=33)	Stress Protocol (n=40)	Difference (95% CI)	P-value
Age	56.0 (28.5 to 70.5)	47.0 (27.3 to 63.8)	5.0 (-5.0 to 14.0)	0.33
Female	23 (69.7%)	27 (67.5%)	2.2% (-19.1% to 22.9%)	0.84
Body Mass Index [†]	24.3 (22.6 to 26.0)	23.6 (22.4 to 24.7)	0.7 (-1.3 to 2.8)	0.50
High Energy Mechanism	14 (42.4%)	19 (47.5%)	-5.1% (-27.1% to 17.5%)	0.66
ASA >2	10 (30.3%)	10 (25.0%)	5.3% (-15.1% to 25.6%)	0.61
Smoking	8 (24.2%)	10 (25.0%)	-0.8% (-20.1% to 19.2%)	0.94
Diabetes	3 (9.1%)	1 (2.5%)	6.6% (-5.7% to 19.0%)	0.32
Nakatani Classification				0.81
I	18 (54.6%)	19 (47.5%)		
II	7 (21.2%)	9 (22.5%)		
III	8 (24.2%)	12 (30.0%)		
Bilateral Rami	3 (9.1%)	5 (12.5%)	-3.4% (-17.8% to 12.1%)	0.72
Rami Communion	25 (75.8%)	26 (65.0%)	10.8% (-10.5% to 30.5%)	0.32
Denis Zone				0.96
I	20 (60.6%)	24 (60.0%)	-0.6% (-22.5% to 21.5%)	
II	13 (39.4%)	16 (40.0%)		
Complete Sacral Fracture	11 (33.3%)	19 (47.5%)	-14.2% (-35.1% to 8.5%)	0.22
Sacral Communion	11 (33.3%)	14 (35.0%)	-1.7% (-22.8% to 20.0%)	0.88
Pelvic Ring Fixation	0 (0%)	18 (45.0%)	-45.0% (-58.4% to -26.3%)	<0.0001
Inpatient Opioid MME	140.5 (25.0 to 349.5)	150.5 (28.7 to 278.3)	9.0 (-60.0 to 101.0)	0.71
Inpatient Opioid MME/day	58.6 (15.3 to 150.0)	67.2 (19.5 to 135.9)	-3.4 (-32.1 to 27.1)	0.78
Able to Clear PT by Discharge	25 (75.8%)	39 (97.5%)	-21.7% (-36.8% to -5.1%)	0.009
Length of Stay	2 (1 to 4)	2 (1 to 3)	0 (-1 to 1)	0.57
Discharge to Rehabilitation Facility	6 (18.2%)	1 (2.5%)	15.7% (0.5% to 30.0%)	0.04
Fracture Displacement at Last Follow-Up* (mm)	2.9 (1.5 to 6.8)	2.0 (0.4 to 3.0)	1.6 (0.0 to 4.1)	0.04
Fracture Displacement ≥5 mm at Last Follow-Up*	5 (31.3%)	2 (8.7%)	22.6% (-3.9% to 46.6%)	0.10

(ASA: American Society of Anesthesiologists score, CI: confidence interval, MME: morphine milligram equivalents, PT: physical therapy)

- [†]All parametric continuous variables are presented as mean (95% CI)

- All remaining continuous data is nonparametric and presented as median (interquartile range)

- Mean difference for parametric continuous data, median difference for nonparametric continuous data, and proportional difference for nominal data

- All 2-way testing

- P-values less than 0.05 were considered statistically significant

- *For patients with minimum follow-up radiographs at 0.5 months

Results

- The LSR protocol group was more likely to clear PT by discharge (97.5% vs. 75.8%, p=0.009), less likely to discharge to rehabilitation facilities (2.5% vs. 18.2%, p=0.04), and had no difference in length of stay (2 vs. 2, p=0.57) (**Table 1**)
- 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, groups did not differ in patient/injury characteristics or primary outcomes.
- When compared to patients in the pre-stress group unable to clear PT by the third day of admission, the operative LSR group was more likely to clear PT (94.4% vs. 50.0%, p=0.006), less likely to discharge to rehabilitation facilities (5.6% vs. 37.5%, p=0.03), and had no difference in LOS (3 vs. 4, p=0.13).

Conclusions

Adoption of LSRs to determine management of minimally displaced LC1 injuries was associated with increased rates of operative management, higher rates of PT clearance by discharge, and a reduction in the number of patients discharging to rehabilitation facilities.

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