NYU Langone Health

NYU Langone Orthopedics

Compartment Syndrome in Association with Tibial Plateau Fracture: Standardized Protocols Ensure Optimal Outcomes

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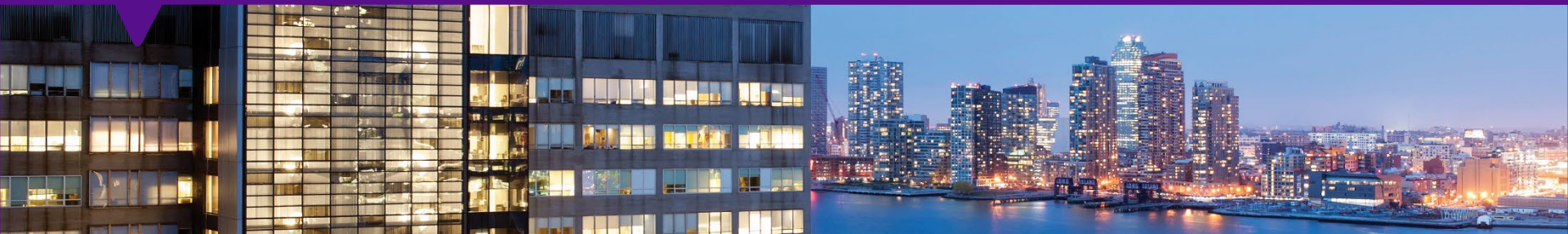
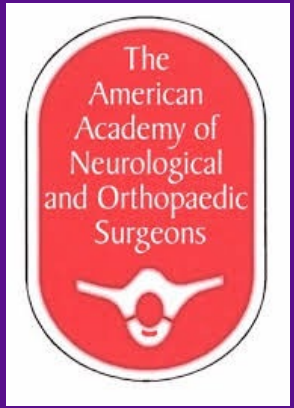
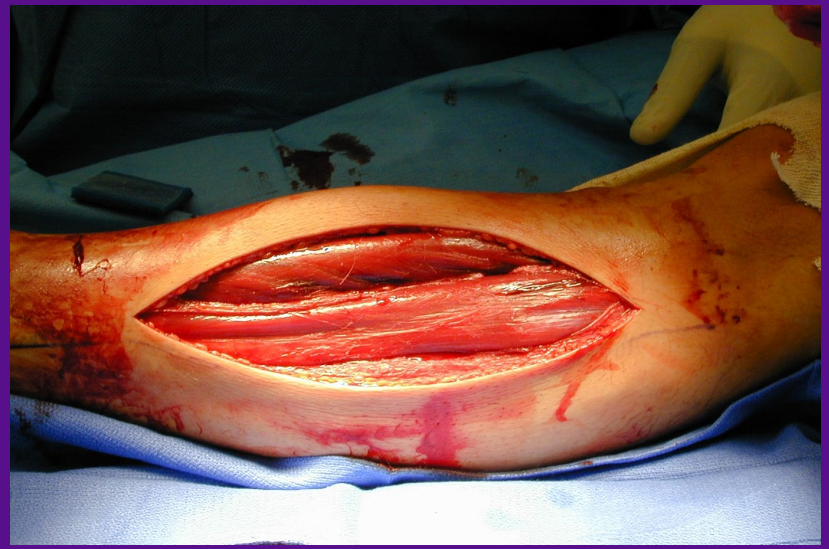


I (and/or my co-authors) have nothing to disclose.



Introduction

- Acute Compartment Syndrome (CS)
  - Condition caused by elevated pressure within a muscle compartment, leading to vascular compromise and ischemia.
  - If left untreated, it results in permanent neuromuscular damage, limb dysfunction, or even amputation



Purpose

- Importance of this study
  - Tibial plateau fractures are associated with Compartment Syndrome (CS in 10.4% of cases).
  - Limited research on long-term outcomes.

Methods – Patient Selection

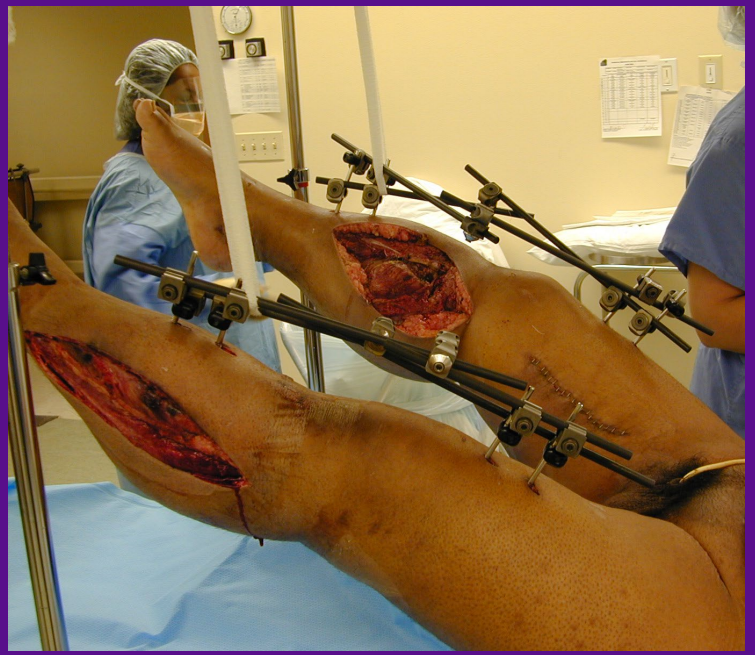
- Study Design:
  - Retrospective cohort study (2006-2023)
  - Data from 766 tibial plateau fractures at a single urban academic trauma center
- Inclusion Criteria:
  - Age > 18 years
  - Schatzker Type 41-B and 41-C fractures
  - Minimum 6-month radiographic and clinical follow-up
- Exclusion Criteria:
  - Bilateral tibial plateau fractures
  - Nonoperative cases

Methods – Patient Cohorts

- CS Cohort (n=14, 1.8%)
  - Diagnosed using clinical signs (pain out of proportion, pulselessness, paresthesia, paralysis, pallor)
  - Confirmed via intra-compartmental pressure monitoring (>30 mmHg ΔP)
  - Treatment: Urgent fasciotomy + external fixation
- Control Cohort (n=608)
  - Operatively treated tibial plateau fractures without CS
- Propensity-Matched Cohort (n=42 vs. n=14)
  - Matched for age, BMI, sex, comorbidities, Schatzker classification

Treatment Protocol

- Step 1: Urgent fasciotomy + external fixation
- Step 2: Serial irrigation & debridement (I&D) until wound stabilization
- Step 3: Final Fixation with delayed primary closure or skin grafting if needed



Demographics

- CS patients significantly younger (39.9 vs. 49.3 years, p=0.035).
- CS was more common in males, although this was not significant (71.4% vs. 52.5%, p=0.16).

	No compartment syndrome (*N* = 752)	Compartment syndrome (*N* = 14)	Total (*N* = 766)	*p*-Value
Age, mean (SD), y[a]	49.3 (16.4)	39.9 (14.6)	49.1 (16.5)	0.035
Male sex, (%)	395 (52.5%)	10 (71.4%)	405 (52.9%)	0.160
Race (white/nonwhite, %)	322 (45.2%/54.8%)	7 (50.0%/50.0%)	329 (45.3%/54.7%)	0.816
BMI (SD)	27.3 (6.2)	29.5 (7.6)	27.3 (6.2)	0.362
Baseline total SMFA, mean (SD)	49.6 (13.0)	46.4 (1.6)	49.5 (12.9)	0.148
Charleson comorbidity index	0.4 (0.8)	0.1 (0.3)	0.4 (0.8)	0.136
Injury mechanism				
High energy	475 (63.2%)	11 (78.6%)	486 (63.4%)	0.236
Low energy	277 (36.8%)	3 (21.4%)	280 (36.6%)	

Abbreviations: BMI, body mass index; SD, standard deviation; SMFA, Short Musculoskeletal Function Assessment.
[a]Statistically significant.

Results

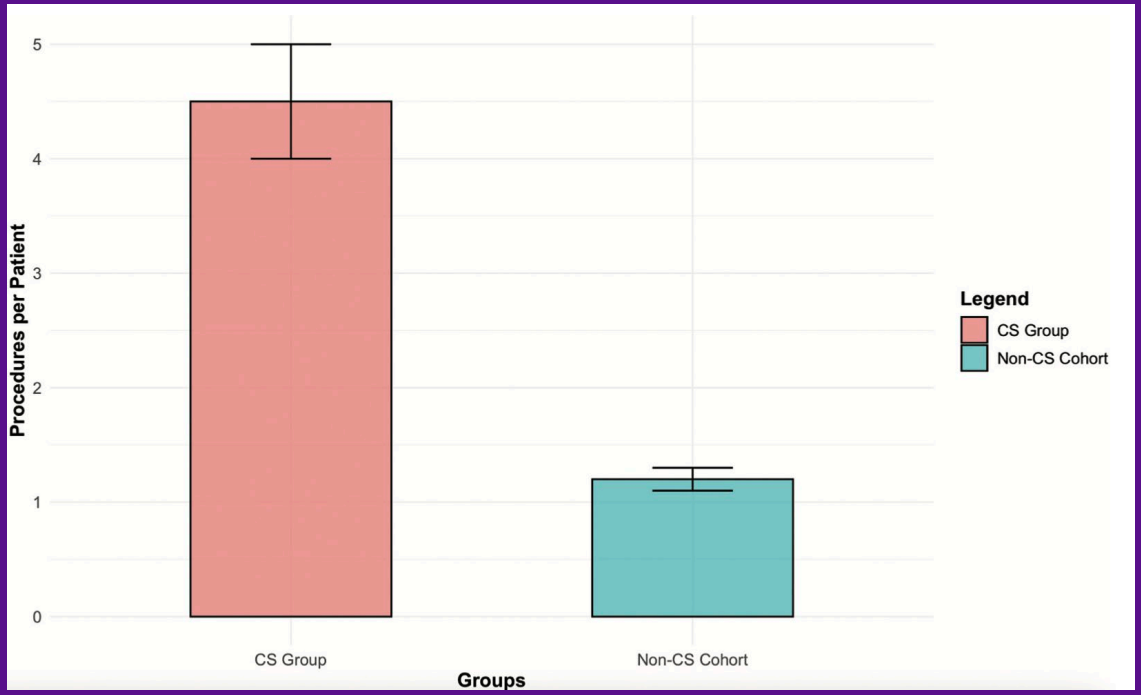
- Functional Outcomes do not differ between CS and Non-CS patients at 12 months
- Higher infection rate in CS: 20% vs. 3.3% (p=0.005)

	No compartment syndrome ($N=42$)	Compartment syndrome ($N=14$)	Total ($N=56$)	*p*-Value
Total SMFA, mean (SD)	79.4 (36.0)	59.4 (16.6)	75.5 (34.0)	0.163
Healed, *n* (%)	41 (97.6%)	10 (100.0%)	51 (98.1%)	0.622
Visual analog pain scale, mean (SD)	3.0 (2.7)	2.4 (2.1)	2.8 (2.6)	0.763
Reported improvement, *n* (%)	38 (95.0%)	10 (100.0%)	49 (96.0%)	0.470
Maximum flexion, mean (SD), deg	130.7 (10.6)	126.0 (15.1)	129.7 (11.7)	0.548
Maximum extension, mean (SD), deg	0.4 (1.8)	0.0 (0.0)	0.3 (1.6)	0.457
Arc of motion, mean (SD), deg	130.3 (11.2)	126.0 (15.1)	129.4 (12.1)	0.585
Residual depression, mean (SD)	0.5 (0.8)	0.2 (0.5)	0.4 (0.8)	0.365
Alignment, mean (SD)	87.7 (1.7)	88.3 (1.8)	87.9 (1.7)	0.470
Postoperative complication, *n* (%)	4 (9.5%)	2 (20%)	6 (11.5%)	0.351
Superficial infection[a]	0 (0.0%)	1 (10.0%)	1 (10.0%)	0.039
Deep infection	3 (7.1%)	1 (10.0%)	4 (7.7%)	0.761
Reoperation, *n* (%)	6 (14.3%)	2 (20.0%)	9 (15.4%)	0.653
Debridement	2 (4.8%)	1 (10.0%)	3 (5.8%)	0.522
ROH/MUA	4 (9.5%)	1 (10.0%)	5 (9.6%)	0.960
Arthroscopy[a]	0 (0.0%)	1 (10.0%)	1 (1.9%)	0.038

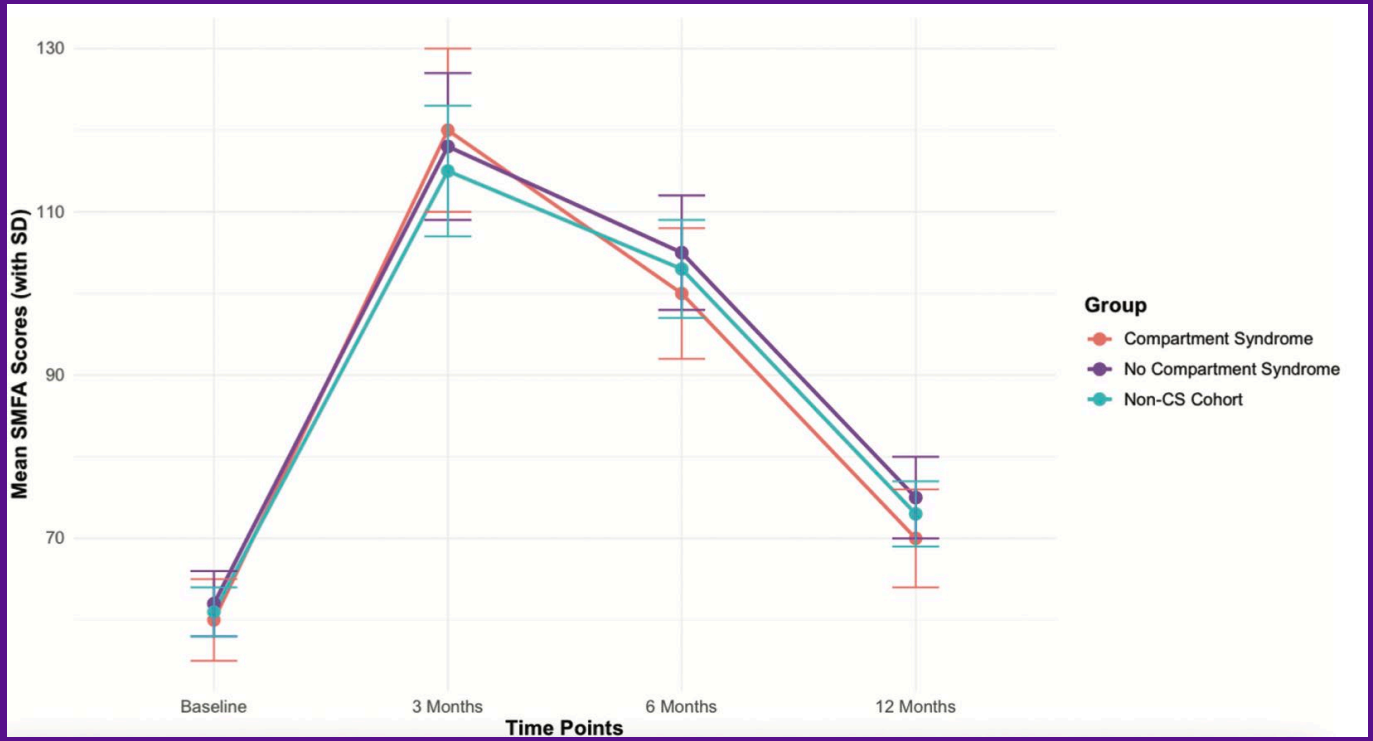
Abbreviations: MUA, manipulation under anesthesia; ROH, removal of hardware[Q7]; SD, standard deviation; SMFA, Short Musculoskeletal Function Assessment.
[a]Statistically significant.

Results

- CS Patients' Underwent More Surgeries: 4.4 vs. 1.2 ($p<0.05$).
- Higher Rate of Fasciotomy, Debridement, & Closure.



Results


130
110
90
70
Mean SMFA Scores (with SD)
Baseline
3 Months
6 Months
12 Months
Time Points
Group
Compartment Syndrome
No Compartment Syndrome
Non-CS Cohort

Discussion

- Younger males were at higher risk for CS
- Higher-energy injuries (Schatzker Types 4-6) were more common in CS cases
- Standardized protocols resulted in no amputations or deaths
- Higher infection rates necessitate strict post-op wound care

Clinical Implications

- Early recognition and intervention improve outcomes
- Fasciotomy should be performed as soon as possible to prevent neuromuscular damage
- Standardized protocols ensure optimal limb salvage rates
- Long-term surveillance is necessary to monitor for post-traumatic arthritis

Conclusion

- Compartment syndrome following tibial plateau fractures is rare but serious.
- Functional outcomes at 1 year were comparable to non-CS patients.
- Higher infection rates highlight the need for improved wound management.

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By the Numbers

EDUCATION

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