

Early External Fixation of Tibial Plateau Fractures are Associated with Increased Risk of Compartment Syndrome

Julian Wier¹ MD, Andrew Duong¹ BS, Ian G. Hasegawa¹ MD, Joshua L. Gary¹ MD, Joseph T. Patterson¹ MD

¹Keck School of Medicine of the University of Southern California

jwier@usc.edu

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Introduction: Tibial plateau fractures may require temporary external fixation (ex-fix) when soft tissue or neurovascular injuries preclude immediate definitive fixation. There is evidence that pin placement and fracture distraction with an ex-fix may transiently increase compartment pressures after tibial plateau fracture. We sought to determine if early versus late ex-fix placement is associated with the risk of compartment syndrome after tibial plateau fracture.

Methods: This study was IRB exempt as data was deidentified. The Trauma Quality Improvement Program was retrospectively queried between 2015-2019 for adult patients with a tibial plateau fracture who underwent ex-fix placement. Patients with concomitant tibial shaft and/or distal femur fractures, requiring lower extremity fasciotomy before ex-fix, or ex-fix >7 days after admission were excluded. Bayesian regression with random-walk Metropolis-Hastings sampling was used to identify a cut point value for time from admission to ex-fix and odds of compartment syndrome. This cut point value was used as the reference for a restricted cubic spline (RSC) model to identify a threshold value for time to ex-fix on odds of compartment syndrome. Multivariable regression on odds of compartment syndrome by this threshold (early vs late ex-fix) was conducted using age, sex, lower extremity injury severity score, Gustilo-Anderson classification, Schatzker class, knee dislocation, and fibula fracture as covariates.

Results: 3,192 patients met inclusion criteria. A threshold of 1.4 days was identified on the restricted cubic spline model, corresponding to 475 (14.9%) patients who underwent late ex-fix (Figure 1). The median time to ex-fix was 2.7 days (interquartile range (IQR)=1.8-4.7) and 0.5 days (IQR=0.2-0.8) in the late and early ex-fix cohorts, respectively. Patients undergoing late ex-fix were 1.6 years older than early ex-fix (49.7 vs. 48.1 years, $p=0.038$) and the majority of patients were male for both (68.4% vs. 64.0%, $p=0.18$). Significantly greater aggregate injury severity scores (11.9 vs 8.6, $p<0.001$), lower extremity injury severity scores (2.4 vs 2.3, $p=0.005$), Gustilo-Anderson type III (6.5% vs 4.2%, $p=0.036$), and concomitant fibula fractures (55.6% vs. 50.0%, $p=0.024$) were identified in the late ex-fix group. Schatzker classification types IV-VI were most common for both groups (84.8% vs 86.7%, $p=0.28$), with similar rates of knee dislocation (4.4% vs. 4.7%, $p=0.98$). Significantly higher rates of compartment syndrome were observed in the early ex-fix cohort (3.0% vs 1.1%, $p=0.021$), corresponding to a 3.4-times higher adjusted odds of compartment syndrome when compared to late ex-fix (95% confidence interval=1.3-8.4, $p=0.010$).

Discussion: External fixation of tibial plateau fractures within 1.4 days of admission was associated with greater risk of compartment syndrome. Patients who underwent late external fixation exhibited significantly higher aggregate and lower extremity injury severity scores compared to those who underwent early external fixation.

Clinical Significance: Patients with tibial plateau fractures requiring early external fixation should be monitored closely for compartment syndrome.

