

Tibial Tubercle Fractures in Children and Adolescents

Daniel B. Haber, MD¹ Frances A. Tepolt, MD² Michael P. McClincy, MD² Leslie A. Kalish, ScD^{2,3} Mininder S. Kocher, MD MPH^{2,3}

¹Harvard Combined Orthopaedic Surgery Residency Program; ²Boston Children's Hospital; ³Harvard Medical School, Boston, MA

Background & Purpose

Tibial tubercle fractures are uncommon sports-related injuries. Only small series are reported in the literature.

Purpose: To report patient characteristics, fracture types, treatment methods, and clinical outcomes of children and adolescents treated for tibial tubercle fractures.

Methods

Single-site Retrospective Case Series

INCLUSION CRITERIA

Age 18 and younger
Operative or Non-operative treatment of tibial tubercle fracture

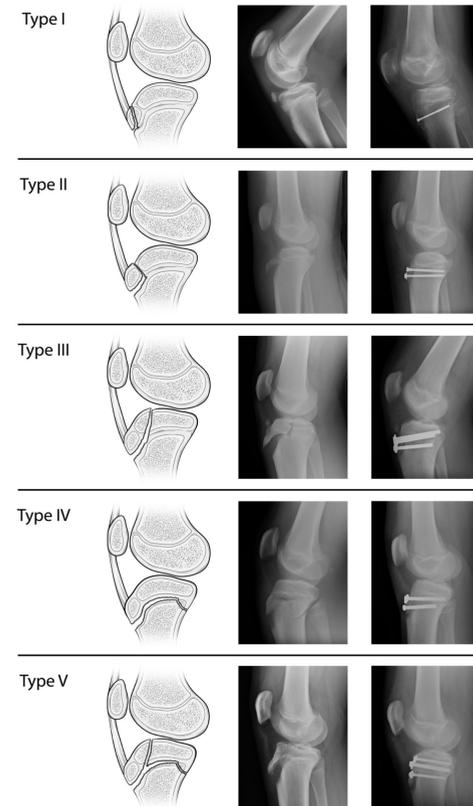
EXCLUSION CRITERIA

Tibial eminence or tibial plateau fracture
Isolated physeal injury without avulsion of the tibial tuberosity

Cohort Characteristics

236 fractures (228 patients) treated 2000-2015

Characteristic	N (%)
Male	198 (86%)
Age years; mean (range)	14.3 (7.7-17.6)
BMI kg/m ² ; mean (range)	25.0 (16.1-38.9)
Osgood-Schlatter disease	72 (31%)
Sports-related injury (most common mechanism: jumping/landing, most common sport: basketball)	203 (86%)
Ogden Class	
Type I	67 (29%)
Type II	43 (18%)
Type III	96 (41%)
Type IV	26 (11%)
Type V	3 (1%)
Displaced fracture	167 (71%)
Displacement mm; median (range)	19 (2-97)
Patellar tendon rupture	21 (9%)
Compartment syndrome	4 (2%)



Surgically Treated Fractures (N=157)

- Initial operative treatment was positively associated (p<0.001) with: male sex, older age, jumping/landing/running mechanism, higher Ogden class, fracture displacement > 5mm
- Patients with Osgood-Schlatter disease were less likely to undergo initial operative treatment (p=0.004)
- Surgical technique: ORIF with screw fixation (90%), closed reduction with screw fixation (7%), other (K-wire/plate/tension band) (3%)
- 37 surgically treated fractures (24%) underwent concurrent fasciotomies, nearly all single-compartment and prophylactic; 4/37 were therapeutic fasciotomies for acute compartment syndrome
- Acute surgical complications: 1 iatrogenic surgical injury to the popliteal artery, 6 cases post-op infection (1/6 requiring return to OR)

Results

- Females most commonly sustained less complex (lower Ogden class) fractures (p=0.004), with 56% having type I fractures (compared to 24% of males)
- Osgood-Schlatter disease was associated with less complex (lower Ogden class) fractures (p<0.0001)
- Type II and III fractures were both associated with elevated BMI Z-scores (p=0.003)
- 3 of the 26 type IV fractures (11.5%) had compartment syndrome, significantly higher than all other fracture types (p<0.05)

Clinical Outcomes at minimum 6 months (N=124)

➤ Median follow-up duration 13.7 months (IQR 9.9 – 23.1)

Surgical outcomes (N=88):

- 50 patients (57%) underwent reoperation: 48 HWR, 1 I&D, 1 revision fixation
- 2 patients (2%) with nonunion on final radiograph
- 2 patients developed leg length discrepancy (1-2 cm), 1 patient developed tibial recurvatum; all 3 patients were asymptomatic

➤ 86% returned to sport

Non-operative outcomes (N=36):

- 2 patients (6%) refractured and went on to surgical treatment
- 1 malunion (3%), 1 physeal bar (3%)
- 94% returned to sport
- 17 non-surgical patients (47%) reported pain with squatting at last follow-up, compared to 23 surgical patients (26%) (p=0.03)
 - Note Osgood-Schlatter disease was more common in non-surgical patients

Conclusions

- Tibial tubercle fractures are sports-related injuries and occur most commonly in adolescent males
- Tibial tubercle fractures are associated with Osgood-Schlatter disease, a higher than average BMI, and a small but relevant risk of compartment syndrome, particularly in type IV fractures
- Whether treated surgically or non-surgically, most patients return to sports despite a high incidence of post-treatment pain at the tibial tubercle