

INTRODUCTION

- Tibial shaft fractures account for 15% of all pediatric long bone fractures¹
- Complications in closed pediatric tibial shaft fractures differ based on treatment method²
 - 24% in operative fractures
 - 9% in fractures treated conservatively
- Open tibial shaft fracture in adults have many complications³
 - Infection between 5% and 50%
 - Nonunion between 7% and 60%
- While prior pediatric studies⁴ have shown lower rates of infection and better prognoses than adults, these complication rates vary widely
- Understanding these complications can inform patients of prognosis, possible need for additional procedure, and outcomes



- Given the variability in treatment approach and reported complications, we identified a matched cohort of open and closed pediatric tibia fractures to investigate differences in complications
- Hypothesis:** In a matched cohort of open tibial shaft fractures and closed tibial shaft fractures, there will not be a difference in complication rates

PURPOSE

To determine if open tibial shaft fractures have higher complication rates than closed tibial shaft fractures in a matched cohort of pediatric patients

REFERENCES

- Mashru RP, Herman MJ, Pizzutillo PD. Tibial shaft fractures in children and adolescents. *J Am Acad Orthop Surg.* 2005;13(5):345-352.
- Stenroos A, Puhakka J, Nietosvaara Y, Kosola J. Treatment of Closed Tibia Shaft Fractures in Children: A Systematic Review and Meta-Analysis. *Eur J Pediatr Surg.* 2020;30(6):483-489.
- Duyos OA, Beaton-Comulada D, Davila-Parrilla A, et al. Management of Open Tibial Shaft Fractures: Does the Timing of Surgery Affect Outcomes?. *J Am Acad Orthop Surg.* 2017;25(3):230-238.
- Chen H, Chen S, Shi Y, Lu Y, Yu B. Children with open tibial fractures show significantly lower infection rates than adults: clinical comparative study. *Int Orthop.* 2019;43(3):713-718.

METHODS

- IRB approved retrospective review (COMIRB Protocol #: 22-0241)
- Inclusion Criteria**
 - Males or females ages 0 to 18 years at time of injury
 - Diagnosis of open or closed tibia fracture
- Exclusion Criteria**
 - Insufficient data (Surgical, radiographic, or less than 5-week clinical follow)
- Matching:**
 - 30 open tibial shaft fractures identified over 5-year period at a tertiary care referral center
 - 30 closed tibial shaft fractures matched by **age, sex and injury pattern**
- Demographic data included:
 - Age, admission dates, injury mechanism, injury films, fracture characteristics, concomitant injuries, initial treatment method, immobilization, and weightbearing
- Outcomes data collected:
 - Leg length discrepancy, non-union, loss of reduction, venous thromboembolism (VTE), neurovascular injury, compartment syndrome, infection, and angular deformity.
 - Defined as: angular deformity >5 degrees of varus or valgus, >10 degrees of procurvatum or recurvatum, or deformity requiring intervention

RESULTS

Table 1. Demographics and clinical characteristics in the two groups

	Open Fracture	Closed Fracture	p-value
Number of patients	30	30	
Age (years)	11.3+/-3.8	11.2+/-3.8	0.8919
Male:Female	24:6	24:6	>0.999
Proximal/middle tibia fracture	21 (70%)	21 (70%)	>0.999
Distal tibia fracture	9 (30%)	9 (30%)	>0.999
Concomitant injuries	24 (80%)	6 (20%)	<.0001
Transferred from OSH	25 (83%)	13 (43%)	0.0013
Time from injury to treatment	0 days (range: 0-1)	0 days (range:0-5)	
Follow-up duration (months)	7.7 (range: 1.2-67.8)	9.3 (range: 1.4-62.9)	

Open Group Gustilo Anderson Fracture Classification Percentages

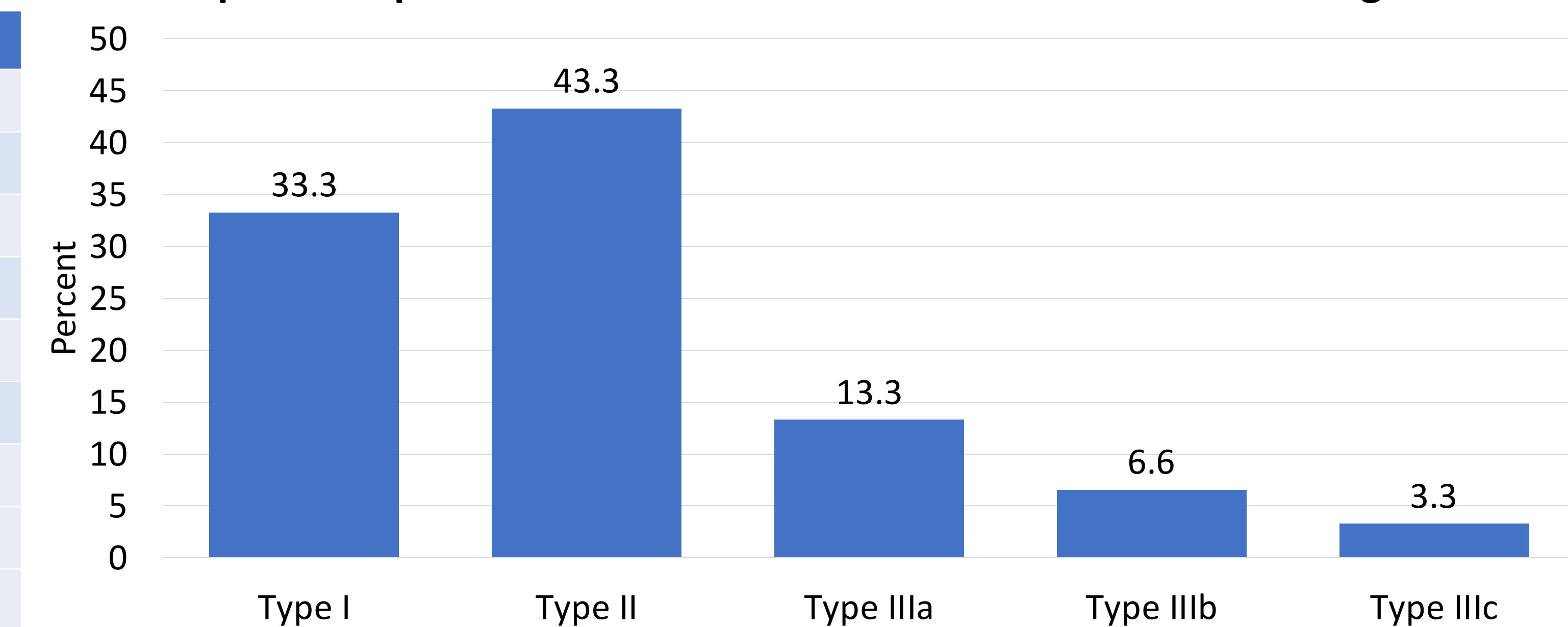


Table 2. Treatment strategies in the two groups

Procedure	Open Fracture	Closed Fracture
Closed Reduction, Casting/Splinting	5 (16.7%)	15 (50.0%)
Elastic Intramedullary Nail	3 (10.0%)	3 (10.0%)
External Fixator	1 (3.3%)	0 (0.0%)
External Fixator, then Elastic Nail	1 (3.3%)	0 (0.0%)
External Fixator, then Rigid Nail	4 (13.3%)	0 (0.0%)
Percutaneous Pin Fixation	3 (10.0%)	1 (3.3%)
Plate and Screw	9 (30.0%)	1 (3.3%)
Rigid Nail	4 (13.3%)	10 (33.3%)

Table 3. Complications between the open and closed groups

Complication	Open Fracture	Closed Fracture
Leg length Discrepancy	2 (6.7%)	1 (3.3%)
Non-Union	2 (6.7%)	1 (3.3%)
Loss of Reduction	1 (3.3%)	2 (6.7%)
Neurovascular	1 (3.3%)	2 (6.7%)
Compartment Syndrome	3 (10.0%)	3 (10.0%)
VTE	0 (0.0%)	0 (0.0%)
Infection	3 (10%)	0 (0.0%)
Angular Deformity	2 (6.7%)	3 (10%)

- No significant difference in complication rates in the open fracture group (20%) compared to the closed fracture group (17%) [OR: 1.20, 95% CI: 0.37 -3.93, p=0.76]

CONCLUSIONS

- This study is limited by retrospective design, small numbers, differences in concomitant injuries, and lack of long-term follow up
- Complications are common in both open (20%) and closed (17%) tibial shaft fractures in pediatric patients
 - Compartment syndrome is always a concern
 - Open fractures -> Angular deformity and infection
 - Closed fractures -> Angular deformity
- Additional studies are needed to delineate differences in outcomes between the various types of treatment approaches within the open and closed tibia fracture groups