The Incidence of Compartment Syndrome after Flexible Nailing of Pediatric Tibial Shaft Fractures

INTRODUCTION:
Pediatric tibial shaft fractures are common injuries encountered by the orthopaedic surgeon. Flexible intramedullary nailing has become popular for pediatric patients with tibial shaft fractures that require operative fixation. The purpose of our study was to evaluate the incidence of, and the risk factors for, compartment syndrome (CS) after flexible intramedullary nailing of these injuries.

METHODS:
A retrospective review of tibial shaft fractures, treated consecutively with flexible intramedullary nailing at our institution from 2003 to 2010 was performed. The incidence of CS (confirmed by intra-operative pressure measurements of the anterior, lateral, superficial posterior, and deep posterior compartments of the lower leg) after flexible nailing was recorded. In addition, age, weight, mechanism of injury, polytrauma, presence of an open fracture, presenting neurovascular exam, fracture pattern, delay in treatment (>24 hours from injury), prior closed reduction attempts, and method of reduction (open versus closed) in the operating room were recorded. Comparisons were made between children who developed CS and those who did not.

RESULTS:
Thirty-one children met inclusion criteria with a mean age of 11.2 years (range: 6.3 to 15.3 years); all were boys. Nearly 20% of children developed CS after flexible nailing of their fractures. Those who developed CS after flexible nailing were heavier than the unaffected group (52.6 ±14.5 kg vs. 39.4 ± 15.2 kg, p = 0.05); with a greater percentage of children 50 kg or greater (83.3% vs. 26.1%, p = 0.02) within the CS group. Children who developed CS were also more likely to present with neurovascular deficits prior to surgery (66.7% vs. 9.1%, p = 0.009), and more likely to have comminuted / complex fracture patterns (83.3% vs. 29.1%, p = 0.02). There was no difference between patients who did and did not develop CS in regards to age (p = 0.42), high-energy injury mechanism (p = 0.30), polytrauma (p = 1.0), delay in treatment (p = 0.28), prior closed reduction attempts (p=1.0), or method of reduction (open versus closed; p = 1.0) in the operating room. In addition, there was no difference (p = 0.65) in the rates of CS between children with open and closed fractures.

DISCUSSION:
There is a high-risk of CS after flexible intramedullary nailing of pediatric tibial shaft fractures regardless of whether an injury is open or closed. Variables which would seemingly be associated with the development of CS (high-energy injury mechanisms, polytrauma, treatment delay, prior closed reduction attempts, and closed reduction in the operating room) were not statistically associated to CS in our study. Clinicians should be wary for the development of CS whenever utilizing flexible nails for tibial shaft fractures, especially when the following co-morbidities are present: the child weighs greater than 50 kg, has complex / comminuted fracture patterns, or has a neurovascular deficit prior to operative intervention.

SIGNIFICANCE:
Flexible nailing of tibia fractures is associated with compartment syndrome in a certain subset of pediatric patients. Surgeons must be aware of this complication, and be prepared to perform fasciotomies if necessary.

REFERENCES:

FIGURES

Fig 1. Percentage of patients weighing greater than 50 kg in CS versus non-CS group; p = 0.02

Fig 2. Percentage of patients with pre-operative neurovascular deficits in CS versus non-CS group; p = 0.009

Fig 3. Percentage of patients with comminuted / complex fractures in CS versus non-CS group; p = 0.02