

Etiology of Acute Pediatric Compartment Syndrome: A Retrospective Review

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INTRODUCTION:

Acute compartment syndrome (CS) is an emergent clinical diagnosis that prior systematic reviews have found to be most commonly caused by traumatic fractures (75%), mainly in the lower leg (60%), and often times confirmed with compartment pressures (68%).¹ Many prior articles have investigated traumatic causes and risk factors of traumatic CS.^{2,3} This project aimed to analyze all cause etiologies of acute compartment syndrome diagnosed at a level I pediatric trauma center. The primary outcome was the prevalence of non-traumatic etiologies and the secondary outcome was prevalence of upper versus lower extremity CS per etiology.

METHODS:

Electronic medical records of a level I pediatric trauma center were retrospectively reviewed. Inclusion criteria were age < 19 years, non-abdominal compartment syndrome, and acute diagnosis of CS of an inpatient or emergency department patient. Exclusion criteria included chronic exertional compartment syndrome. Per chart review, each extremity was classified into one of the following etiologies: Vascular, Fracture, Non-Fracture Related Trauma, Iatrogenic, and Other.

RESULTS:

EPIC medical records queried from 1/1/2010-1/9/2023 using ICD codes for compartment syndrome identified 355 patients. Patients were all diagnosed clinically based on attending level examination. A total of 133 patients met the inclusion criteria for a total of 151 extremities with acute CS of which >90% received fasciotomies and >75% underwent compartment checks. Some 30% of CS was diagnosed in the upper extremity (UE) versus 70% in the lower extremity (LE) (p=0.68). Overall, 37% of extremity CS were found to be secondary to vascular etiologies, 34% fractures, 13% non-fracture trauma, 13% iatrogenic, and 3% other (see Figure 1). There was no statistically significant difference among causes for selective UE or LE CS (p=0.27 and p=0.68, respectively). Within vascular etiologies, the most common causes were cardiac arrest or shock (29%, n=16), cardiothoracic or interventional surgery (23%, n=13), and septic shock (20%, n=11). Within fracture etiologies, the most common causes were tibia fractures (46%, n= 24), supracondylar or peri-elbow fractures (19%, n=10), and both bone forearm fractures (13%, n=7). Other fracture patterns included femur, isolated distal radius, metacarpal and metatarsal fractures. Non-fracture trauma causes included sports injuries (n=5), motor vehicle accidents or other non-sport crush injuries (n=4), gunshot wounds (n=4), and snake bites (n=3). Iatrogenic causes included surgical technique (n=5), infiltrated intraosseous lines (n=4), infiltrated peripheral IV (n=4), infiltrated arterial lines (n=3), and surgical positioning (n=2). One case of neonatal compartment syndrome was documented.

DISCUSSION AND CONCLUSION:

Contrary to prior studies, we found that vascular etiologies were the most common cause of acute compartment syndrome in pediatric patients at a level 1 pediatric trauma center. Vascular causes (37%) and fractures (34%) consisted of 71% of the causes of acute pediatric compartment syndrome of the upper and lower extremities. However, non-fracture related trauma and iatrogenic causes are also considerable etiologies. Lower extremity compartment syndrome is more common than upper extremity compartment syndrome across all etiologies, and more than twice as common as upper extremity overall. Fractures were the most common cause of upper extremity CS and vascular insults were the most common cause of lower extremity CS, although this did not show statistical significance. Further research is required to analyze surgical and mortality outcomes across pediatric CS etiologies.

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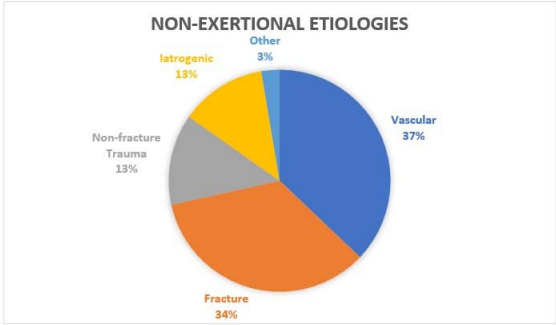


Figure 1. Non-Exertional Etiologies of Acute Pediatric Compartment Syndrome.

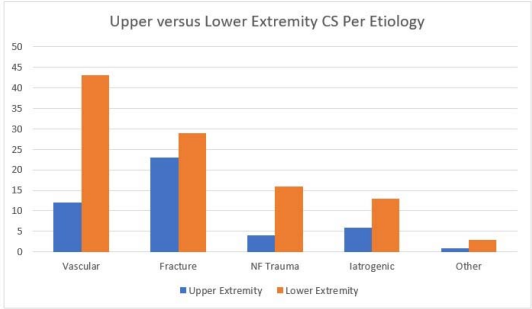


Figure 2. Upper and Lower Extremity Compartment Syndrome by Etiology. Upper and lower extremity prevalence showed no statistical difference based on etiology (Chi-squared = 5.2, p=0.27 and chi-squared 2.3, p=0.68, respectively).
 CS: Compartment Syndrome. NF: Non-fracture Trauma