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Treatment of Firearm-Induced Neurovascular Injuries in Children Needs to be Standardized

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UC DAVIS HEALTH | Department of Orthopaedic Surgery

Introduction

- Firearm injuries (FI) are the leading cause of death among children in the United States[1]
- FI are commonly associated with neurovascular injuries (NVI), but no standardized protocol exists for managing pediatric patients with firearm-induced NVI
- Recent systematic review recommended early exploration and intervention of injured peripheral nerves due to higher rate of transection in children and poor follow up rates[4]

Objective

- Our study aimed to characterize presentations and assess the treatment of firearm-induced NVI in pediatric patients at a level-1 pediatric trauma center

Methods

- Following IRB exemption, a retrospective chart review was conducted on patients <18-years-old at the time of injury who presented to UC Davis Medical Center from October 2005 to January 2023
- Following exclusion criteria were applied
  - Patients with only non-extremity FI
  - Patients who initially presented to an outpatient clinic
- Patient demographics, injury characteristics, procedures, and long-term complications were recorded
- Descriptive statistics were employed to characterize FI, NVI, and their managements

Results

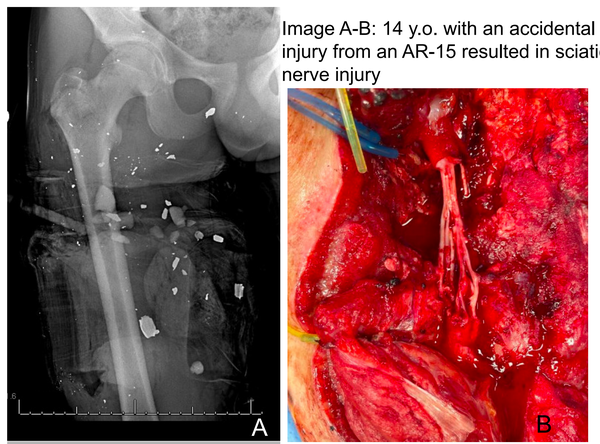

Image A-B: 14 y.o. with an accidental injury from an AR-15 resulted in sciatic nerve injury

Results

Table 1: Patient demographics and injury characteristics

Overall Patients (n = 90)	
Male	73 (81.1%)
Female	17 (18.9%)
Average Age	12.2
Overall Injuries (n = 131)	
Location of Injuries	
Upper Extremity	62 (47.3%)
Lower Extremity	69 (52.7%)
Types of Injuries	
Soft Tissue Only	63 (48.1%)
Fractures	63 (48.1%)
Traumatic Amputations	1 (0.8%)
Types of Firearm	
Low Velocity Firearms	20 (15.3%)
Rifle	9 (6.9%)
Shotgun	4 (3.1%)
BB Gun/Airsoft Gun	4 (3.1%)

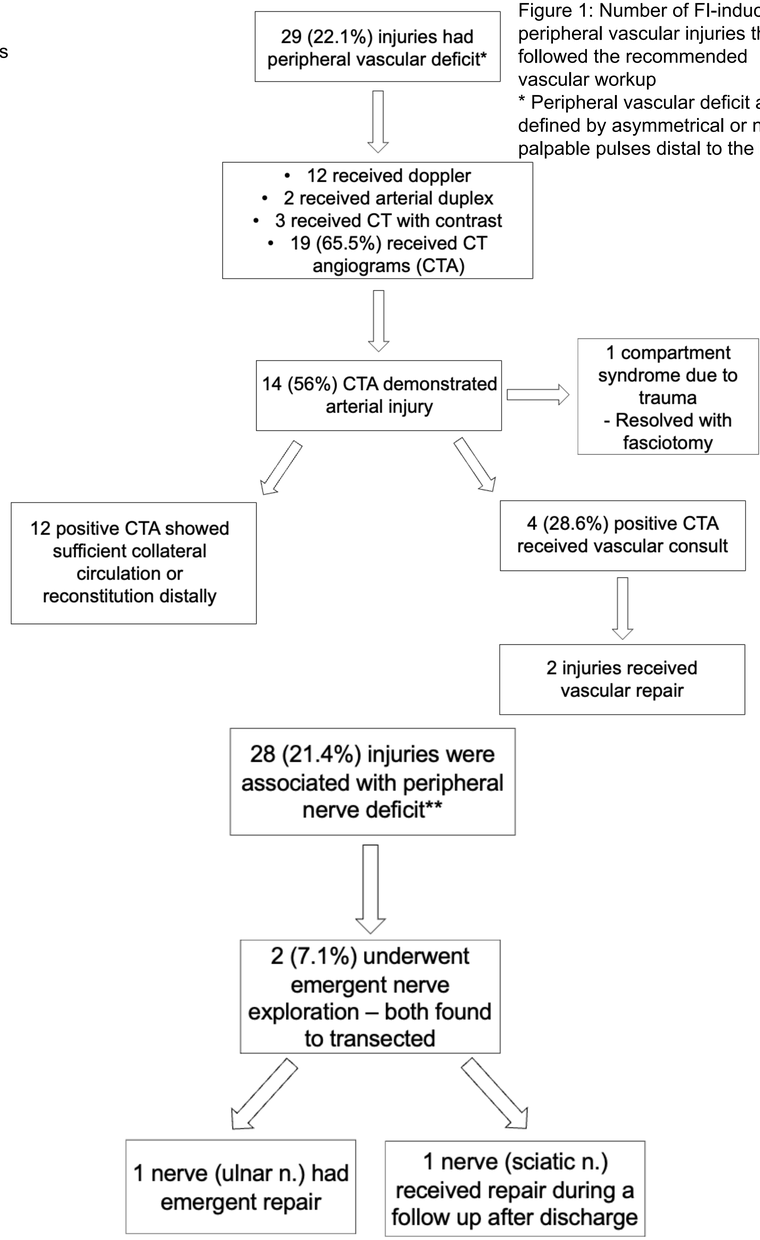

Figure 1: Number of FI-induced peripheral vascular injuries that followed the recommended vascular workup
* Peripheral vascular deficit as defined by asymmetrical or non-palpable pulses distal to the injury

Figure 2: Number of FI-induced peripheral nerve injuries that followed the recommended nerve exploration and repair
** peripheral nerve deficit as defined by abnormal or absent of sensation distal to the injury

Results

- 51 (38.9%) injuries received CTA, despite only 29 (22.1%) injuries had peripheral vascular deficit
- 25/29 (86.2%) injuries with peripheral vascular deficit had symmetrical palpable pulses at discharge or last follow up
- 12/28 (42.9%) injuries with peripheral nerve deficit did not fully regain normal sensation in the injured limb at discharge or last follow up
- 32 (35.6%) patients did not follow up after discharge

Conclusions/Further Study

- Our study describes the presentations, interventions, and complications of FI-induced NVI in pediatric patients, which lack a standardized protocol for treatment
- CTA has been overutilized in peripheral FI without vascular deficits, which exposes children to unnecessary radiation
- Since CTA is the gold standard for confirming vascular injuries, misuse of other imaging modalities can potentially lead to delayed or missed vascular interventions
- Due to high rates of neurovascular complications and loss-to-follow-up, we advocate for a standardized treatment protocol for pediatric FI-induced NVI, including important considerations for CTA, vascular consult, and emergent nerve exploration to improve outcomes in these vulnerable pediatric patients
- A limitation of this retrospective study is that we have not been able to use motor strength grading as a marker for nerve injury due to the lack of proper documentation in chart notes

Acknowledgement

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