Management of the Pulseless Pediatric Supracondylar Humerus Fracture

Joshua S. Murphy, MD

Atlanta Trauma Symposium
April 20th, 2017
The Westin Buckhead Atlanta
Atlanta, GA

Disclosures

• Depuy-Synthes Spine

Background

• Supracondylar humerus fractures
  – 60-70% pediatric elbow fractures
  – 3% all pediatric fractures
• Most common pediatric elbow injury requiring reduction and fixation
• Neurologic Injury
  – 10-20%
• Vascular Injury
  – 2-20%

Badkoobehi et al, 2015
Vascular Injury

Pulseless Extremity

- Well Perfused, Pulseless
  - Pink
  - Warm
  - Brisk Cap Refill
- Poorly Perfused, Pulseless
  - White
  - Cool
  - Sluggish Cap Refill

Vascular Injury

- Brachial Artery
  - Stretched/Kinked
  - Soft tissue compression
  - Arteriospasm
  - Intimal Injury
  - Laceration
  - Complete Transection
  - Fracture Entrapment

Badicobehi 2015

Neurovascular Injury

- Elevated suspicion in pulseless extremity
  - Median NN
- Significant association between brachial artery and median nerve injury

Luria, 2007; Mangat, 2009; Lyons, 2000
Examination

- **Initial Exam**
  - Pulse, Color, Temperature, Capillary Refill
  - Severe Swelling, Ecchymosis, Skin Puckering
  - Compare to contralateral extremity if uncertain

- **Continued Serial Exams**
  - Evolving Ischemia or Compartment Syndrome
  - Increasing anxiety, agitation, increased need for pain medication
  - Neurologic injury may mask compartment syndrome
    - Median N.N.

Diagnostic Studies

- **Angiography**
  - Not Recommended Pre-op
  - Post-reduction data is limited
  - AAOS AUC: Post-op angiogram if pre-op pulseless extremity
    - Shaw, 1990; Griffin, 2008; Copley, 1996; Sanders, 2016

- **Post-reduction Pulse Oximetry**
  - Soh et al, 2013

Diagnostic Studies

- **Doppler Ultrasound**
  - AAOS AUC Post-op Vascularity Restored
    - (+) Dopplerable Pulse
      - Observation
      - Vascular Consult
      - Angiogram
    - (-) Dopplerable Pulse
      - Observation
      - Angiogram
      - Vascular Consult
      - Pharmacologic Anticoagulation

Poorly Perfused (White), Pulseless Extremity

- **Emergent** reduction and stabilization
  - Often leads to perfusion restoration

- If no improvement, immediate exploration
  - Brachial AA injury up to 82%
  - Vascular, Microsurgery, or general surgery service

Well Perfused (Pink), Pulseless Extremity

- AAOS Appropriate Use Criteria (2016)
  - Paucity of high level evidence
  - Expert Opinion

- Two schools of thought
  - Immediate Open Exploration
  - Close Observation

- Both proponents agree with **Urgent Reduction**

Well Perfused (Pink), Pulseless Extremity

- **Immediate Open Exploration**
  - **Urgent** Reduction and Fixation

  - Immediate Exploration and/or Vascular Reconstruction
    - High incidence of vascular injury with favorable clinical outcomes
    - Possible ischemic fibrosis, growth disturbance, cold intolerance, exercise-induced ischemia, late compartment syndrome, LLD, or contracture

  - Long term patency rates following brachial artery reconstruction are largely unknown

White, 2010; Blakely, 2009; Sabharwal, 1997; Konstantiniuk, 2011
Well Perfused (Pink), Pulseless Extremity

- **Conservative Approach**
  - **Urgent** Operative Reduction and Fixation
  - +/- Doppler Ultrasound Intra-op
  - Inpatient Serial Exams 24–48 hours
    - Analgesics
    - Anxiety
    - Agitation
  - Low Threshold to return to the OR
    - Compartment release, exploration, possible reconstruction

Weller, 2013; Scannell, 2013; Badkoobehi, 2015

---

Conclusion

- Management is based on perfusion
- **Median NN Injury**
  - Compartment Syndrome Risk
  - May predict brachial artery injury
- **AAOS Appropriate Use Criteria**
  - Pediatric Supracondylar Humerus Fractures Treatment
  - Pediatric Supracondylar Humerus Fractures with Vascular Injury
  - www.AAOS.com/AUC

---

THANK YOU

- JSMurph@Gmail.com
- JMurphy@childrensortho.com