CORTICES Annual Meeting 2025

Gillete Children's

Hosts: Jennifer Laine, Emmalynn Sigrist, & Walter Truong

September 26-27

CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

gillette CHILDREN'S

Welcome to CORTICES 2025 Annual Meeting: Day 1

Presenter(s): Shore, Laine, Truong, & Sigrist

Thank You

Thank You – Gillette Team

Pam Strandberg
Administrative Assistant

Sarah Norman
CRC Supervisor

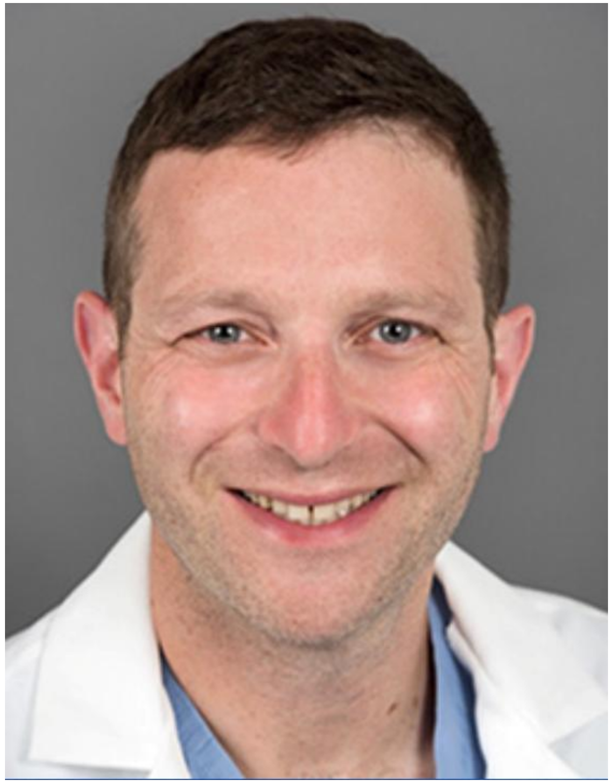
Jamie Price
Ortho CRC

Susan Novotny, PhD
Ortho Clinical Scientist

Thank You – CORTICES Boston Team

Fernanda Canizares

Saurav Pandey



Ben Shore

Gillette Leadership

Barbara Joers, CEO

Micah Niermann

Paula Montgomery

Pat Nolan

Tim Getsay

Stephen Bariteau

Coen Wijdicks

Gillette Children’s

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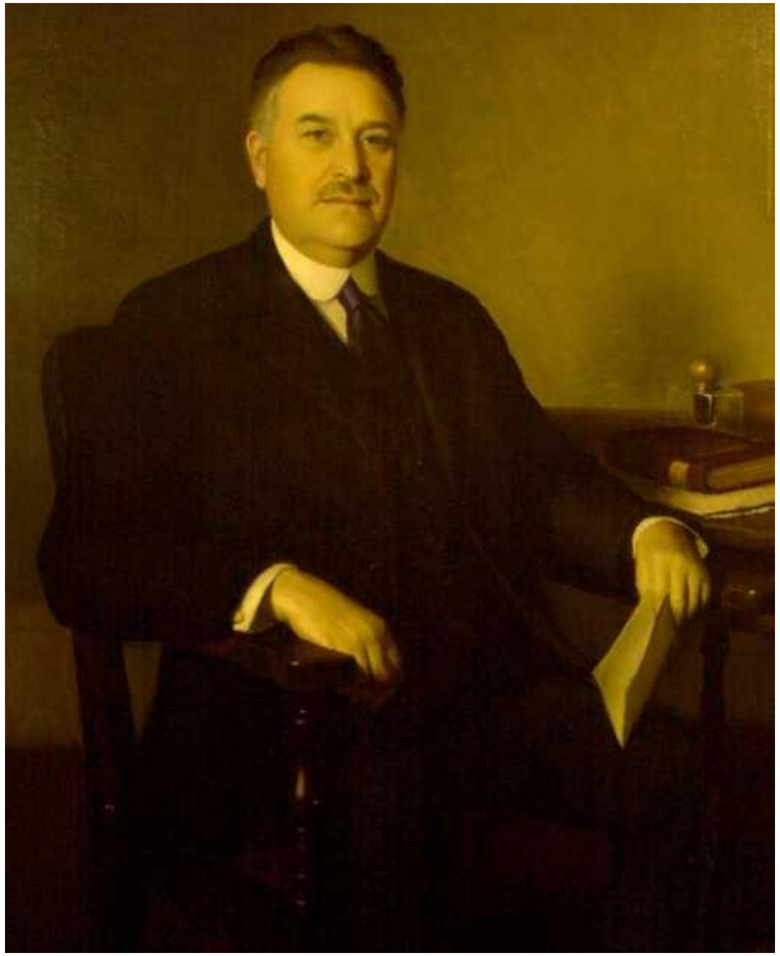
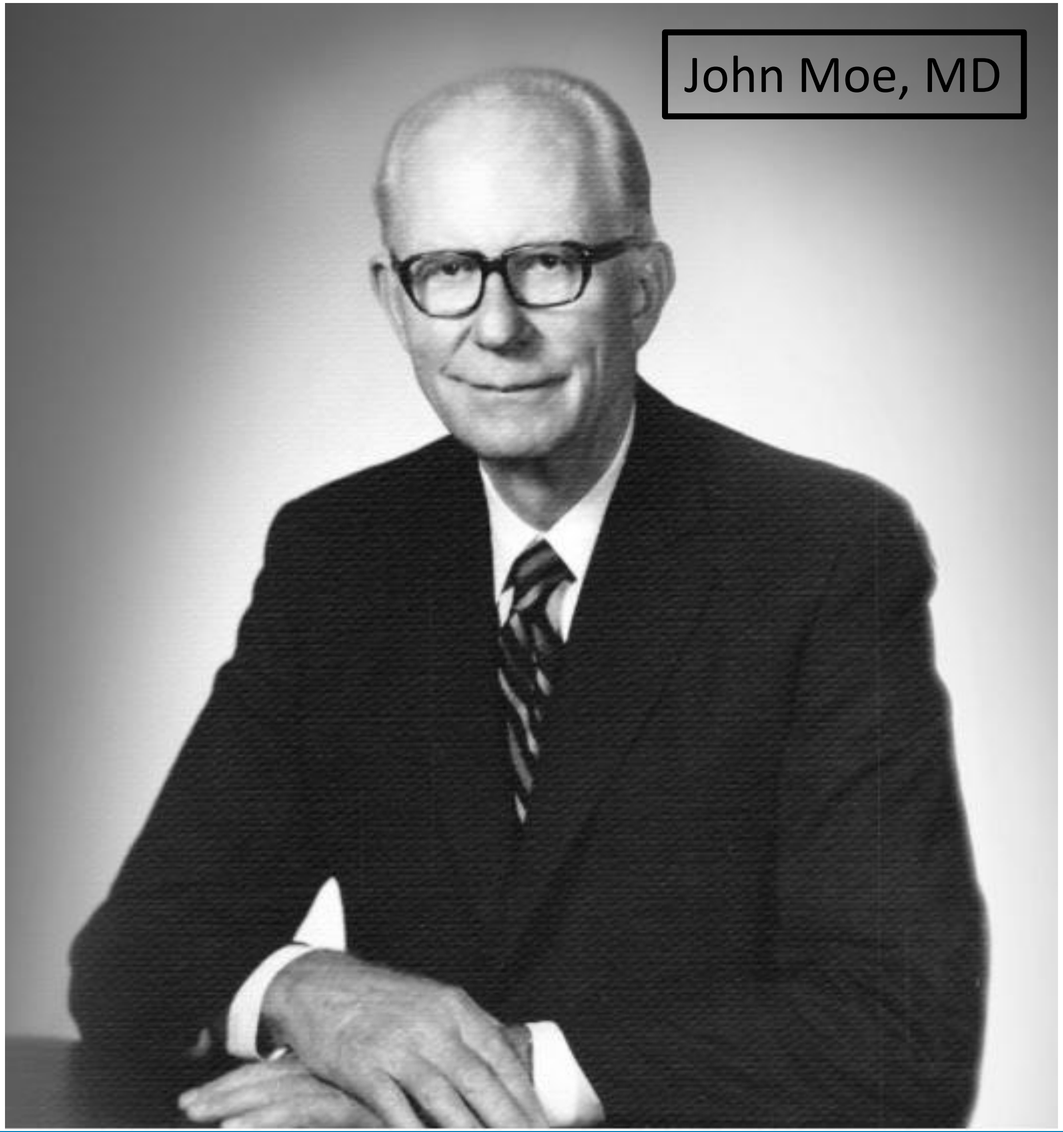
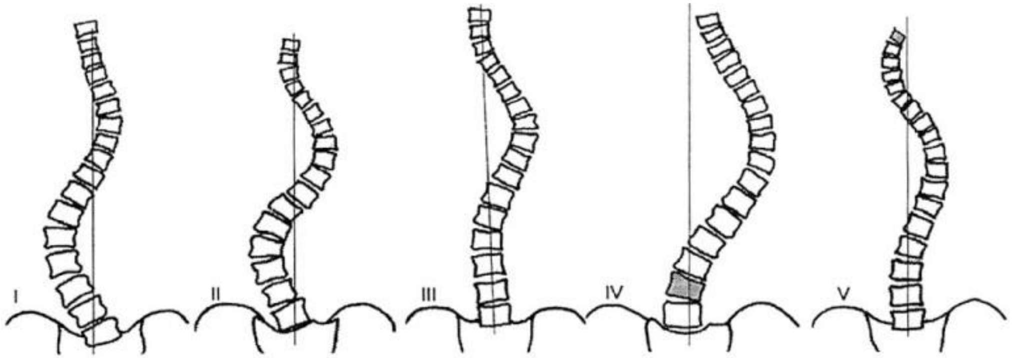
Gillette Children's

- Founded in 1897
- Nation's first hospital for children with disabilities




John Moe, MD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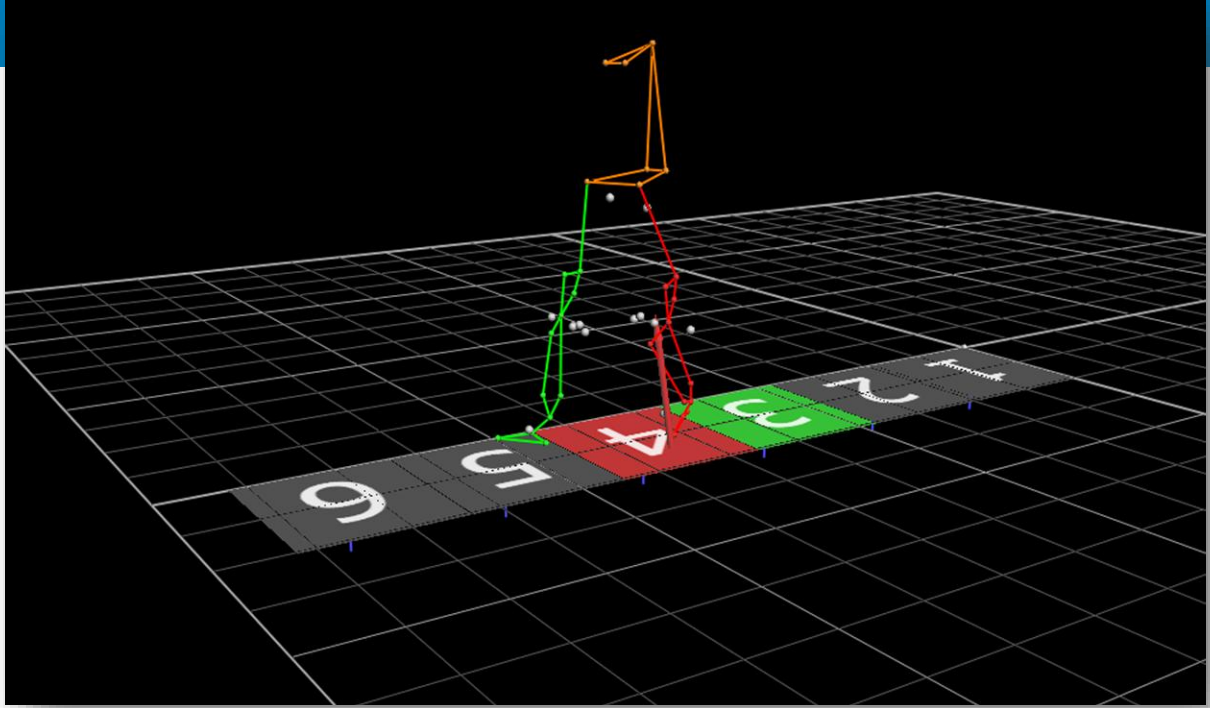
V

Steve Koop, MD

Jim Gage, MD



Tom Novacheck

Andy Georgiadis

We have grown…

- 16 full-time pediatric orthopaedic/spine surgeons
  - Upper extremity, deformity, spine

Deb Bohn and Ann VanHeest

Mark Dahl

We have grown…but the mission stays the same

- 16 full-time pediatric orthopaedic/spine surgeons
  - Upper extremity, deformity, spine
- Neurosurgery
- Physical Medicine and Rehabilitation
- Neurology
- Complex and Developmental Pediatrics
- Craniofacial Surgery
- Sleep

2025 Annual Meeting

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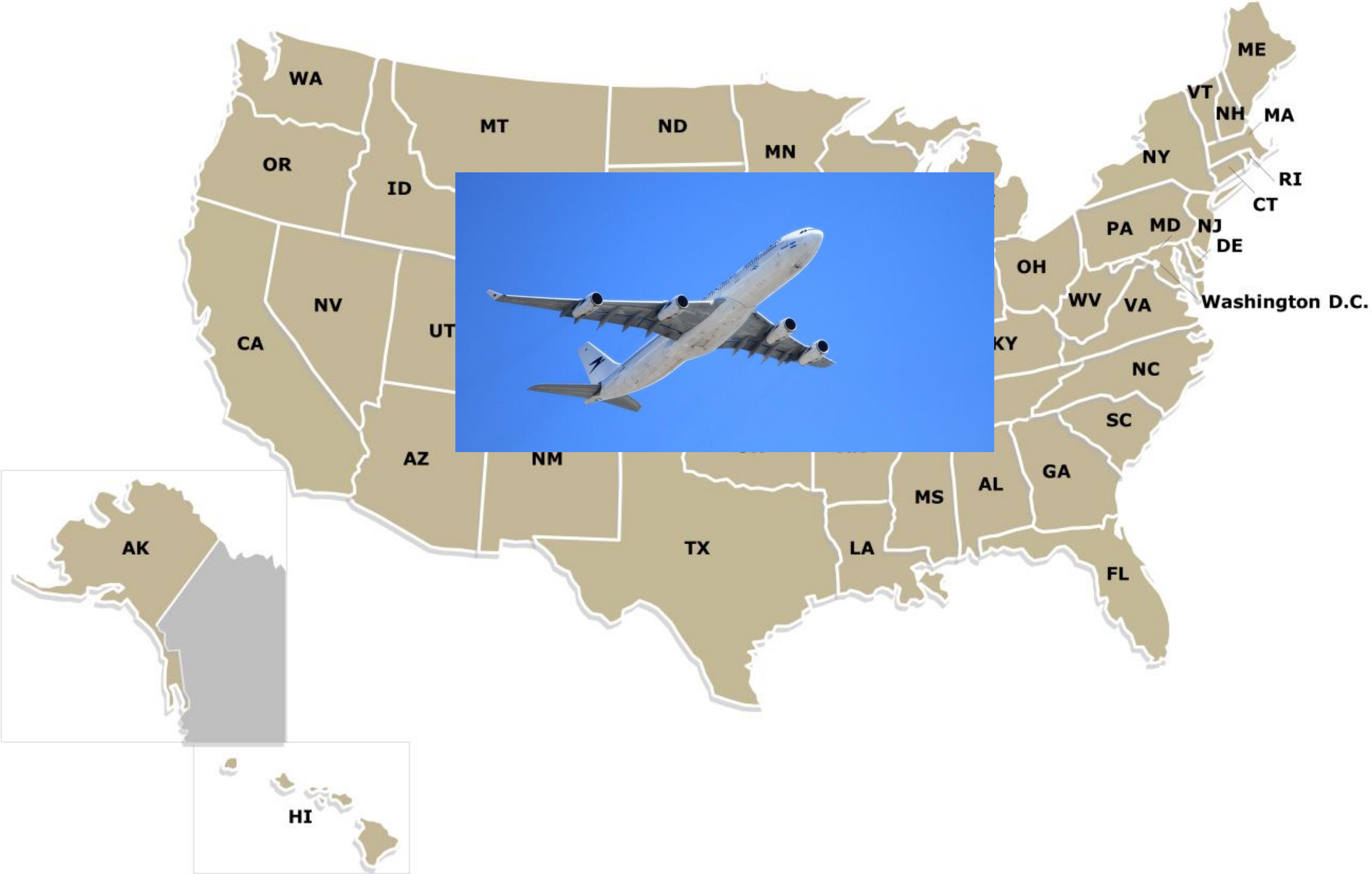
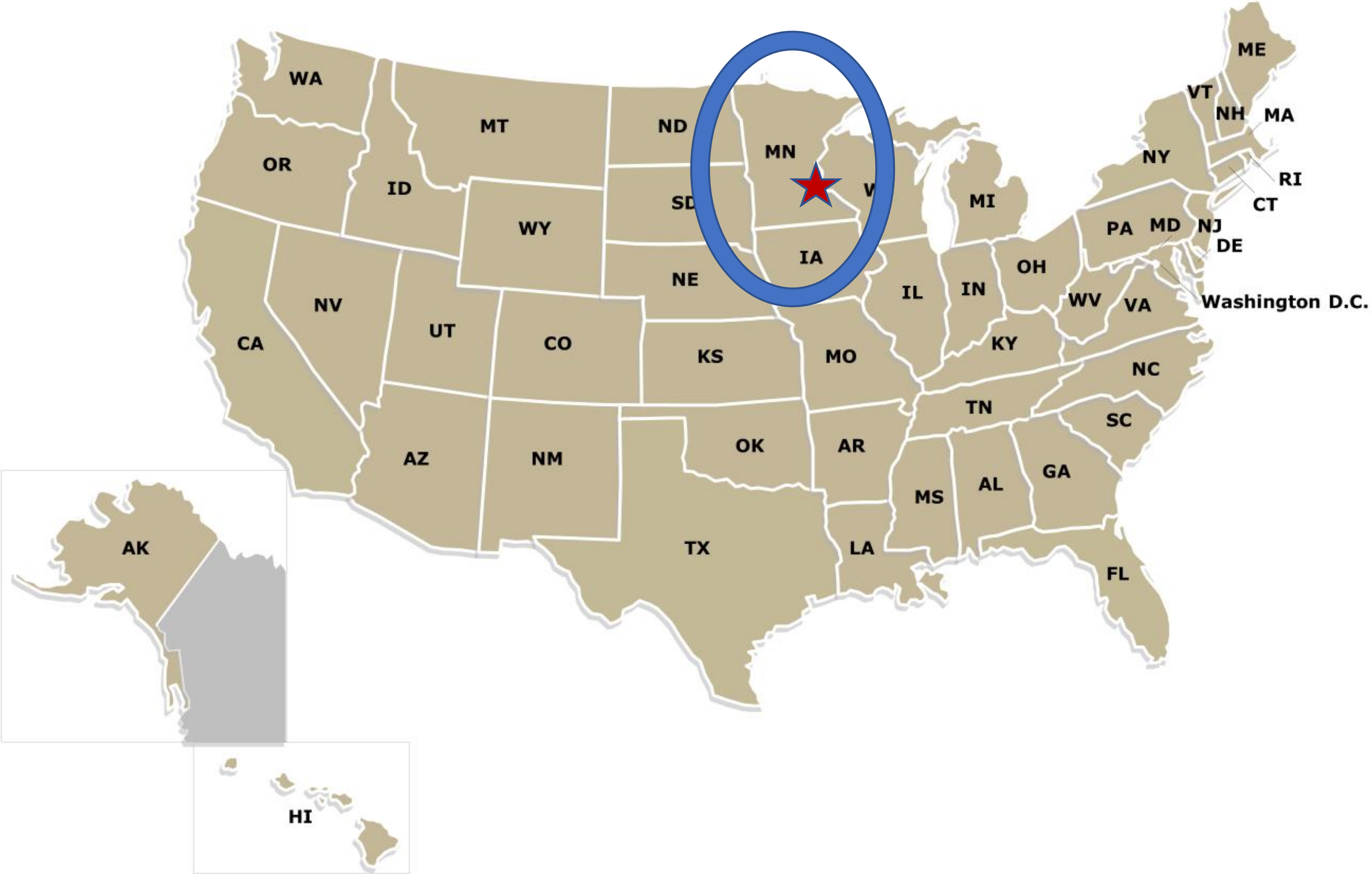
Welcome to Minnesota



Welcome to Minnesota



Twin Cities

- Metro Area: 3.7 million
- Capitol: Saint Paul
- Cities divided by Mississippi
- Chain of Lakes within Minneapolis
- Sports: Vikings, Twins,Wild, Timberwolves, Lynx, Loons…

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3M Science. Applied to Life.™

General Mills

Medtronic

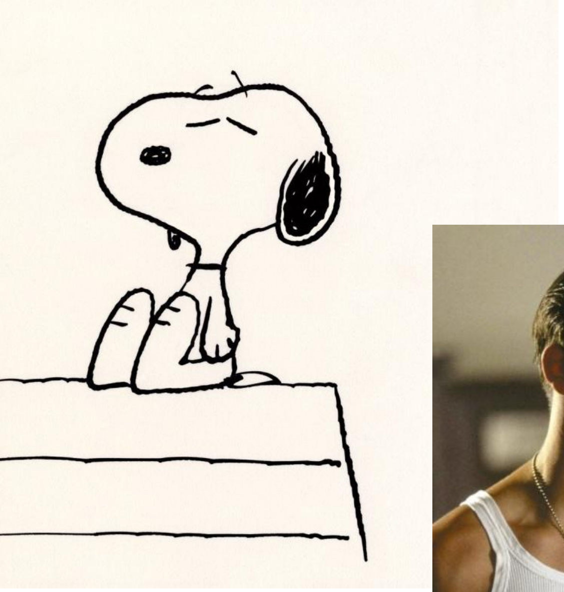
United Healthcare

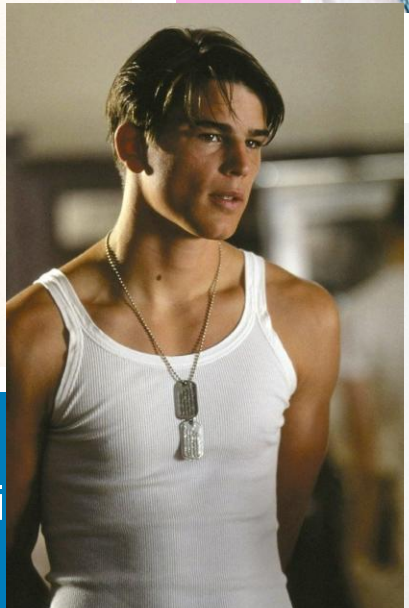
Hormel Foods

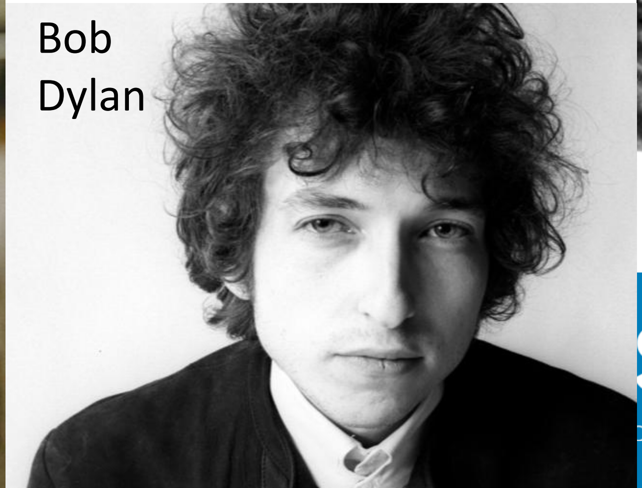
F. Scott Fitzgerald

Lindsay Vonn

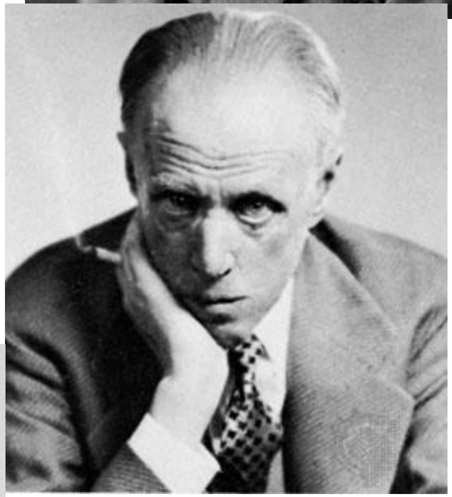
Judy Garland



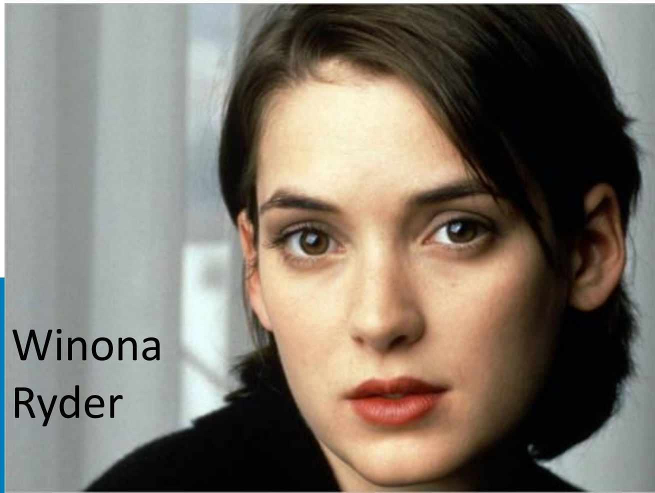




Bob Dylan



Sinclair Lewis



Winona Ryder

2025 Annual Meeti

Josh Hartnett

S

CARE

Housekeeping

Dinner @ Cardamom at 630pm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WELCOME!

Rigid Intramedullary Nailing of Tibial Diaphyseal Fractures: Study Updates

Presenter(s): Miller

Antegrade rigid intramedullary nailing (RIMN) of tibial diaphyseal fractures in adolescents with open proximal tibial physis

September 26, 2025
CORTICES Annual Meeting
Minneapolis, MN

Mark L Miller, MD and Josh Marino BS

Outline:

1. Recap of retrospective adolescent tibia CORTICES study

2. Review results from the beta test and abstract for POSNA

Primary Aim:
Quantify proximal tibial iatrogenic deformity at skeletal maturity in adolescents with diaphyseal tibial shaft fractures treated with antegrade rigid intramedullary nailing through an open proximal tibial physis

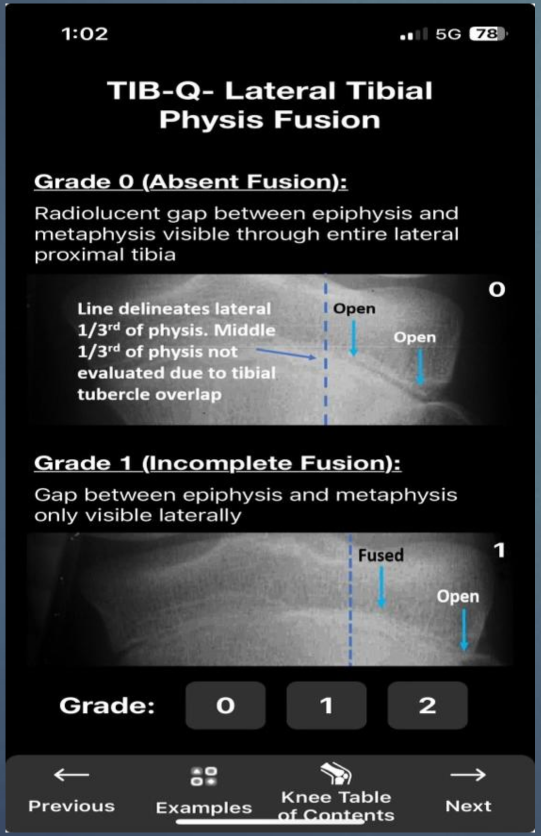
Hypothesis:
Antegrade rigid intramedullary nail fixation through open proximal tibia physis in adolescents nearing skeletal maturity will not cause clinically significant proximal tibial deformity- greater than 5 degree change in MPTA or PPTA (Mechanic axis deviation > 5mm, Leg length difference > 1 cm).

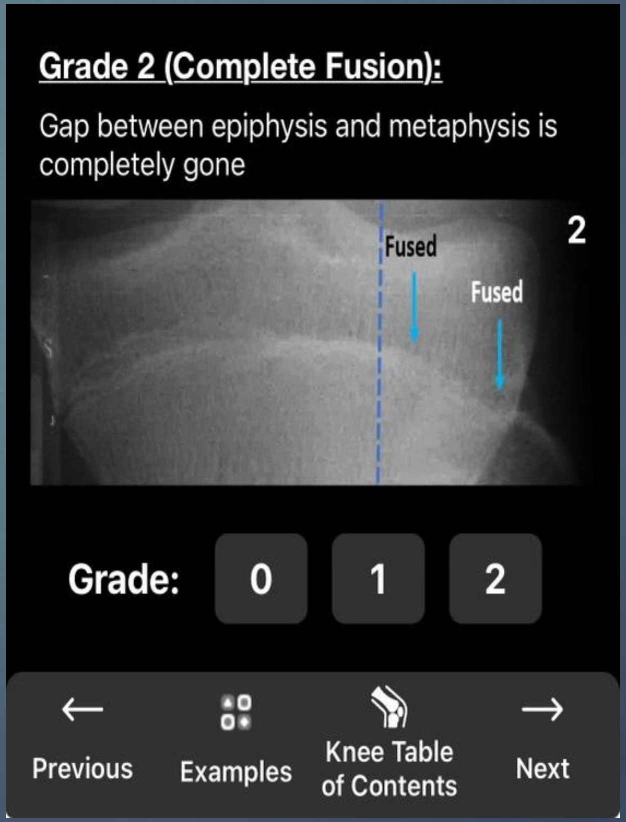
Primary Outcome:
Deformity Parameters at Skeletal maturity: mechanical Medial proximal tibia angle (mMPTA), mechanical posterior proximal tibial angle (mPPTA) (Mechanical Axis devivation and Leg length discrepancy (LLD))

REDCAP is built with BCH as host data site. BCH statistician. HUGE Thanks to BCH team

- Inclusion criteria: Age <18, tibial shaft fracture, open physes (Defined as Skeletal Age App Tib-Q type 0 and 1), treated with rigid tibial IMN, Treated at a CORTICES institution between January 2010 and May 2025
- *no further collection of TibQ-1’s beyond Beta testing*

- Exclusion criteria: skeletally mature (Tib-Q type 2), treatment with other than rigid tibial IMN





- Xray measurements:
- First AP and lateral of tibia obtained post-operatively
    - MPTA
    - PPTA

- AP and lateral of tibia obtained after skeletal maturity (closure of proximal tibial physis).
    - MPTA
    - PPTA

- If patient was skeletally immature at last postop visit but greater than 12 months from injury: latest AP and lateral of tibia
    - MPTA
    - PPTA

- Was a standing AP of both lower extremities obtained within three months of injury?
- Was a standing AP of both lower extremities obtained after skeletal maturity?
- If so, calculate:
  - MTPA, LDTA of both sides
  - AP standing hips to ankles
    - Leg length discrepancy (mm)
    - MAD (mechanical axis deviation) (mm)

- Current results include 137 patients from 6 of our sites: Boston, Colorado, Chop, Rady, Vanderbilt, and STL (For new sites we decided only to have them enter TibQ-0's)

- 42% were classified as TibQ-0

- 30/57 TibQ-0's had >12 months of follow-up (15 reached skeletal maturity by last visit)

- 28/30 had adequate operative details for analysis

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Orthopedics & Sports Medicine

TABLES

Table 1. Demographic characteristics of TibQ-0 cohort

Characteristic	(N=30)[1]
Age (years)	14 (13, 15)
Sex	
Male	22 (73%)
Female	8 (27%)
Height (cm) (n=21)	169 (161, 180)
Weight (kg) (n=27)	61 (49, 71)
BMI (n=21)	21 (19, 23)
Race	
White	16 (53%)
Asian or South Asian	2 (7%)
Black or African	4 (13%)
Native American or Alaskan Native	1 (3%)
Other	3 (10%)
Declined to answer	1 (3%)

[1]Continuous variables presented as median (IQR); categorical variables presented as frequency (%)

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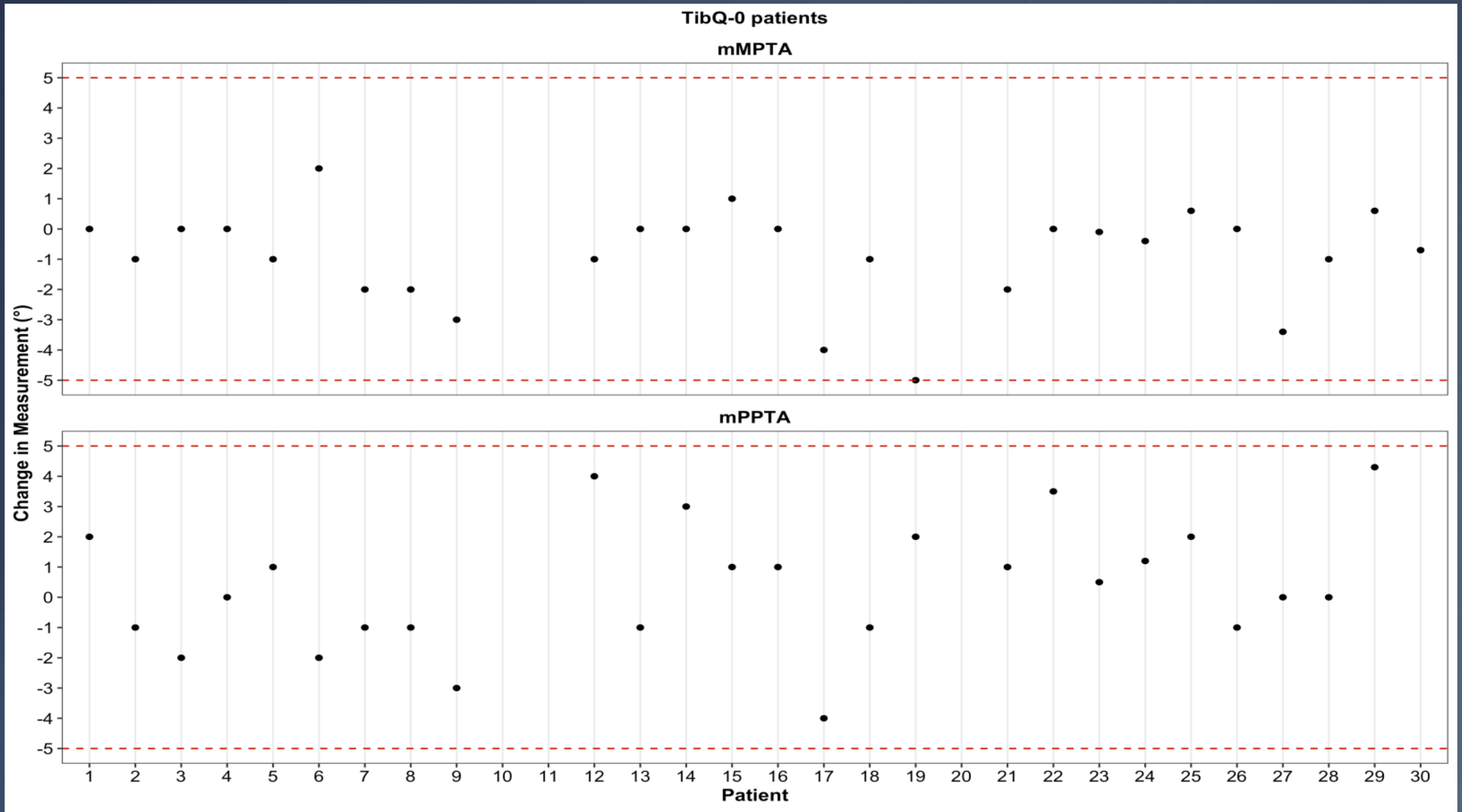
Table 2. Injury and fracture characteristics of TibQ-0 cohort

Characteristic	(N=30)[1]
Mechanism of injury	
MVA/MCA/ATV	3 (10%)
Auto-ped	4 (13%)
Sports	17 (57%)
Fall from height	1 (3%)
Other	5 (17%)
Fracture location	
Distal 1/3 of shaft	10 (33%)
Middle 1/3 of shaft	18 (60%)
Proximal 1/3 of shaft	2 (7%)
Fracture characteristics	
Transverse	6 (20%)
Spiral	3 (10%)
Oblique	16 (53%)
Comminuted	5 (17%)
Open fracture	9 (30%)
OTA classifiction	
Simple	26 (87%)
Wedge	4 (13%)
Fibula fracture	23 (77%)
Fibula fracture location (n=22)	
Distal	8 (36%)
Middle	9 (41%)
Proximal	5 (23%)
Associated injuries	
Ligamentous knee	1 (3%)
Fracture	8 (27%)
Head injury	4 (13%)
Other	4 (13%)

[1]Categorical variables presented as frequency (%)



Only 1 patient 5 degrees or more for mMPTA and 0 for mPPTA

*TibQ-1 had 0 for mMPTA and 2 for mPPTA with greater than 5 degree change 2/80

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Table 4. Equivalence testing of change in radiographic outcomes from immediate postoperative to latest follow-up in TibQ-0 patients

Radiographic outcome	N	Mean Difference (90% CI)[1]	Equivalence bounds	Equivalence (TOST)
mMPTA	27	-0.87 (1.38, -0.35)	±5	Equivalent
mPPTA	26	0.37 (-0.33, 1.06)	±5	Equivalent

[1]Outcome meets equivalence if 90% CI for difference excludes both equivalence bounds

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Table 3. Surgical characteristics of TibQ-0 cohort

Characteristics	(N=30)[1]
Age at surgery (years)	14 (13, 15)
Surgical technique (n=28)	
Open reduction	11 (39%)
Closed reduction	17 (61%)
Nail technique (n=28)	
Suprapatellar	14 (50%)
Infrapatellar	11 (39%)
Extraarticular lateral	1 (4%)
Other	2 (7%)
Nail diameter (mm) (n=29)	8.5 (8.5, 9.0)
Nail length (cm) (n=28)	34.0 (31.9, 36.0)
Nail location	
Above physis	19 (63%)
At physis	4 (13%)
Below physis	7 (23%)
Screws cross physis (n=19)	1 (5%)

[1]Continuous variables presented as median (IQR); categorical variables presented as frequency (%)

Table 5. Outcomes in TibQ-0 cohort

Characteristic	(N=30)[1]
Postoperative immobilization	
Cast/splint	9 (30%)
Boot	15 (50%)
Other	4 (13%)
Complications	3 (10%)
Type of complication	
Infection	1 (3%)
Delayed/nonunion	1 (3%)
UPROR	1 (3%)
Ipsilateral extremity injury	1 (3%)
Other	1 (3%)
Return to OR for hardware removal	9 (30%)
Full return to normal activities and sports (n=29)	22 (76%)
Time to healing (weeks) (n=29)	6 (5, 15)

[1]Continuous variables presented as median (IQR); categorical variables presented as frequency (%)

Draft of abstract for POSNA 2026
Plan to have manuscript ready to submit Q2 2026

Questions for group-
What timeframe to allow for more data collection and REDCAP data input?
What is group appetite for prospective study of tibQ=0 skeletally immature patients?
Funding for prospective study?

HUGE thanks to Josh Marino, BCH team (Fernanda, Shanika De Silva, Saurav, Ben) and all PI research staff at contributing times- large time commitment to do radiographic measurements and analysis

Non-Accidental Trauma Database: Study Updates

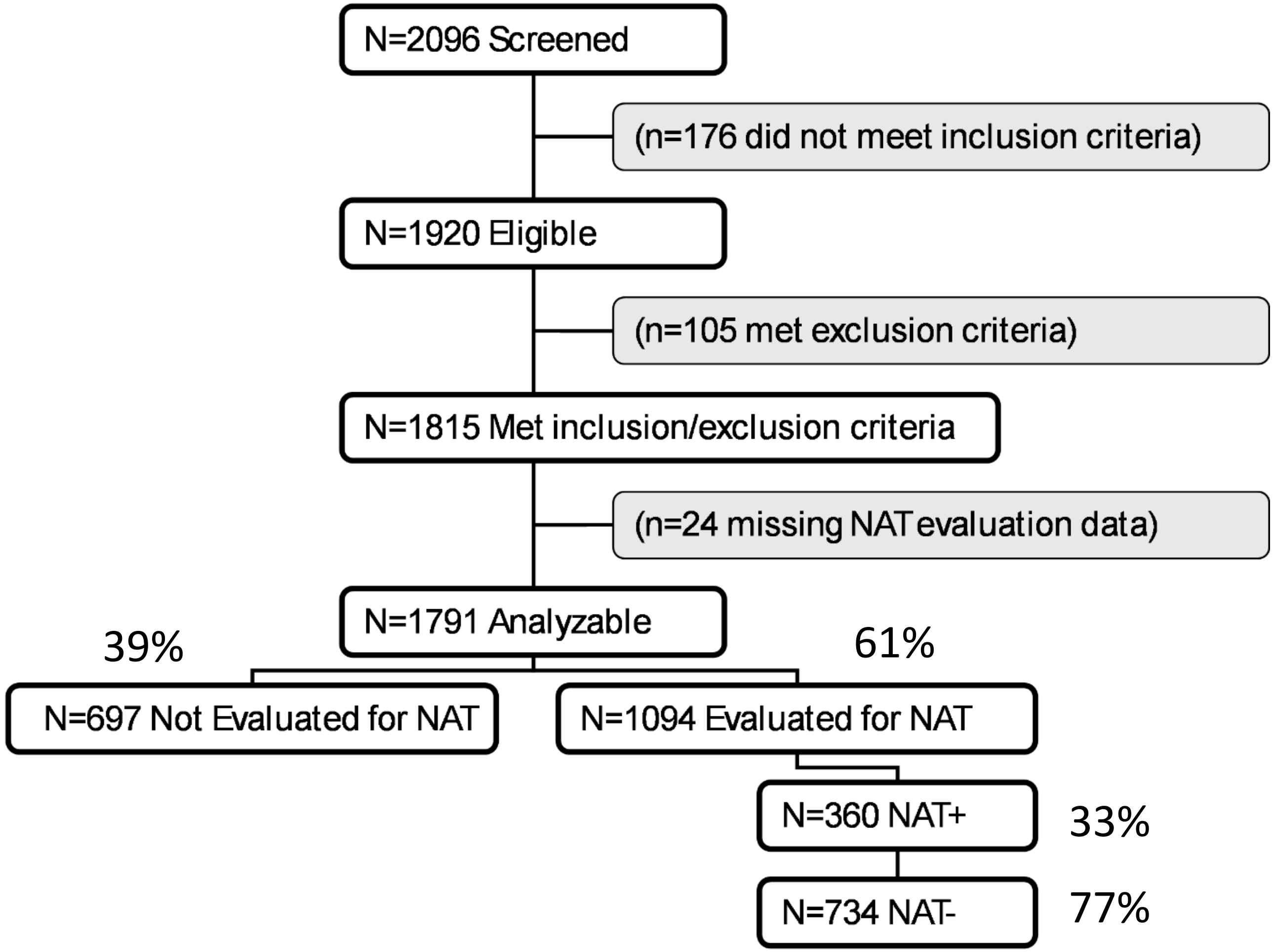
Presenter(s): Canizares, Pandey, & Shore

Additional Collaborator(s): Rosenfeld

NAT Database

- Diaphyseal femur fractures
- ≤36 months old at time of presentation
- Between 1/1/2017 and 6/30/2020

- **Exclusion:**
- Established Dx of OI or skeletal dysplasia
- MOI is MVA or during the delivery/birthing
- Metaphyseal Fx



NAT Database:

- 17 CORTICES institutions
- Screened ~2000 patients with femur fractures
- Led to **1791** analyzable cases
- 61% evaluated for NAT
- 33% NAT +

Variables included in NAT Database

Demographic Characteristics

- **Age (months):** 0–12, 13–18, 19–36
- **Sex:** Male, Female
- **Race/Ethnicity:** Non- Hispanic (W, B, Other), Hispanic, Other/UNK.
- **Pre-injury ambulatory status:** Independent vs. Not independent
- Chronic conditions or Disability

Socioeconomic Factors

- **Insurance:** Private, Government, None
- **Area Deprivation Index (ADI):** Quartiles (national)

Injury Characteristics

- **Time from injury to presentation:** Binned (e.g., <6h, 6–24h, >24h, unknown)
- **Mechanism of injury:**
  - Low-energy fall High-energy fall
  - Conflicting stories / Other
  - Unknown to family
- **Fracture details:** Laterality, Pattern, Displacement
- **Treatment modality**: Spica, Brace, LLC, No treatment.
- **Resources:** ED vs OR treatment
- Provider in the ED
- Abuser

Diagnostic Workup

- **Skeletal Survey (SS):** Obtained vs. not
- **Follow-up Skeletal Survey (FUSS):** Obtained vs. not
- **Other Imaging:** CT, abdominal, spine, ophthalmologic exam
- **Laboratories:** CBC, coagulation panel, chemistry, lipase, amylase.

NAT diagnosis:

- Removed from caregiver
- ICD code (T74.12 XA)
- SW/CAP referral to govt agency (including CPS)
- SW/CAP referral for ongoing SW FU
- SW/CAP supervised or prohibited contact

Papers

Preliminary work not used NAT database

Variation of Work up NAT protocols across CORTICES (published)

Studies using the NAT database:

1. NAT Evaluation rates and site variation (analyzed)
2. Epidemiology of NAT (analyzed)
3. Skeletal Survey and Follow up Skeletal Survey Results (analyzed)
4. Laboratory and work up for NAT (analyzed)
5. Treatment patterns for diaphyseal femur fractures in ≤36 months (analyzed)

What do the guidelines say?

AAOS guidelines Femur Fx → Screen for NAT if younger than 36mo.

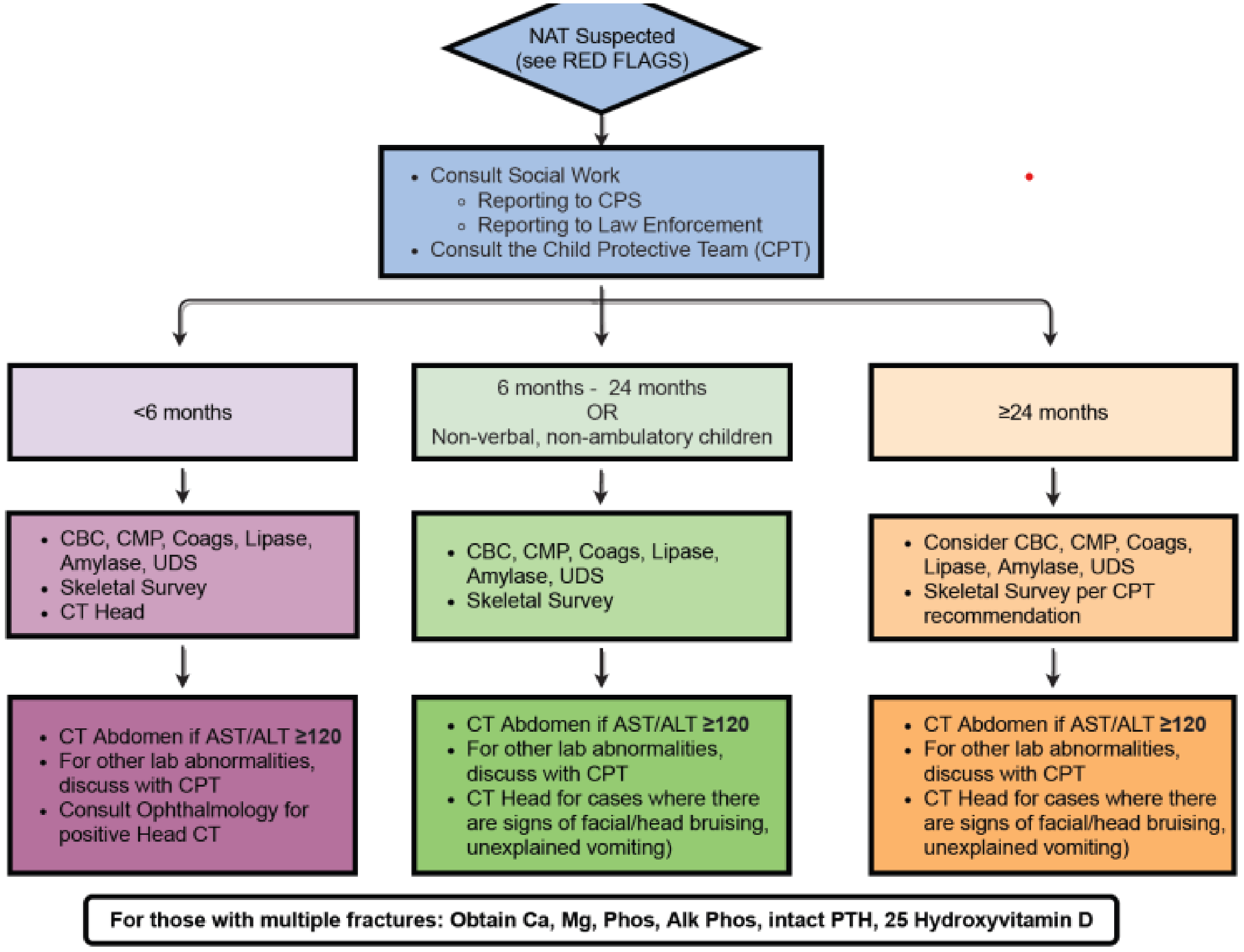
12 mo or younger not walking highly suggestive of abuse.

AAP guidelines

SS→ All patients 24 months or younger w/ obvious abusive injuries, suspicious injury (inconsistent hx, non-ambulatory infants), or unexplained intracranial injury.

Hematologic testing→(CBC, coagulation panel)~ suspicious bruising or head trauma

Liver enzyme testing→ (AST ALT) and **pancreatic enzymes** (amylase and lipase) ~ suspicious abdominal trauma.



NAT Evaluation

Overall NAT evaluation rate: 61%

Who gets a NAT evaluation?

- ***Younger age (0-12mo)***
- Race/ethnicity (more NH-Black & Hispanic)
- High Neighborhood deprivation
- Insurance (government)
- Displaced fracture

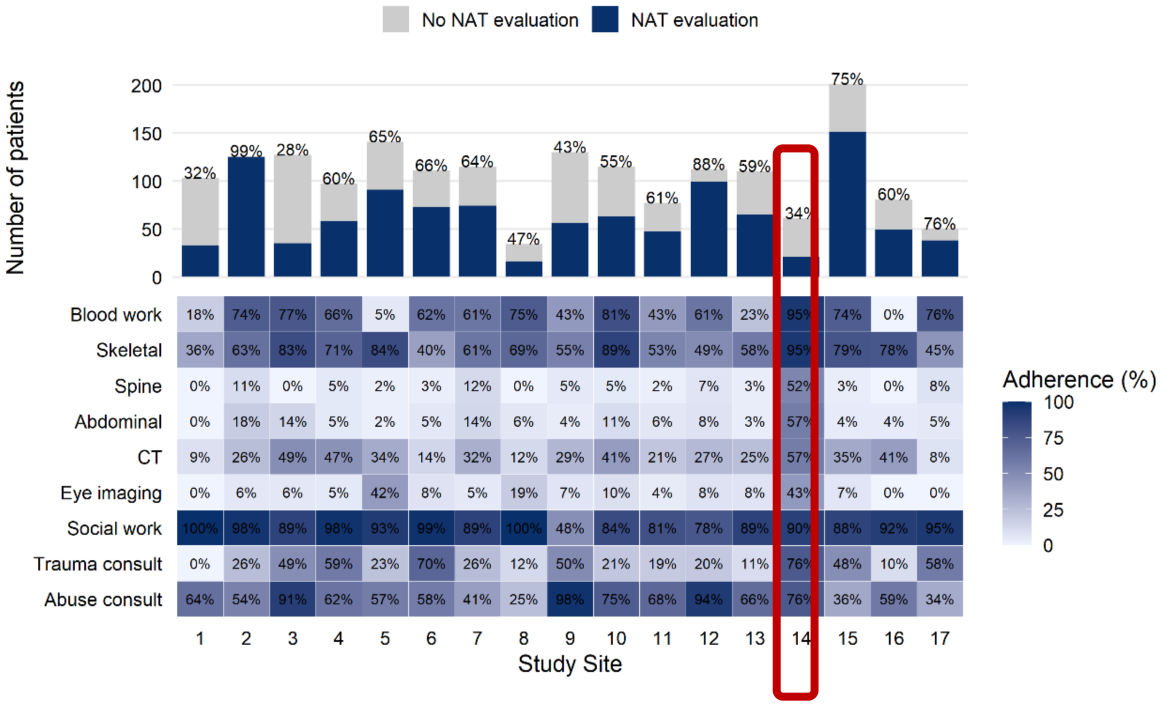
Table 3. Multivariable analysis for the likelihood of NAT evaluation.

Variable	OR	(95% CI)	P
Age Group			
19-36 Months	Referent	--	
13-18 Months	1.83	(1.16-2.87)	0.009
0-12 Months	7.57	(4.96-11.55)	<0.001
Race			
Non-Hispanic White	Referent	--	
Non-Hispanic Black	1.69	(1.15-2.47)	0.007
Hispanic (any race)	1.59	(1.1-2.28)	0.01
Other/unknown race or ethnicity*	1.51	(1.00-2.27)	0.048
ADI			
Below Median	Referent	--	
Above Median	1.42	(1.05-1.92)	0.02
Time from Injury			
0 days	Referent	--	
1+ days	1.09	(0.81-1.48)	0.56
Insurance			
Private	Referent	--	
Government	1.52	(1.15-2.00)	0.003
None	0.84	(0.52-1.35)	0.47
Displaced Fracture	1.36	(1.02-1.81)	0.03

Site variability for NAT Evaluation

Does it vary by site? → 28-99%

Blood work: : 0–95%	Skeletal survey: 36–95%
CT: 8–57%;	Eye exam: 0–43%
Spine imaging (0–12%, max ~52%);	Abdominal imaging (0–14%, max ~57%
Social work: ≥80–100% (one site ~48%)	Abuse consult: ~35–98%



Some sites pair lower screening rates with more intensive workups among those screened

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2. Epidemiology of NAT

Prevalence of NAT among those screened = 32.9%

NAT+ clusters in younger, non-ambulatory infants, with higher Black representation, delays to care (+1day), and non-fall/conflicting histories.

Table 2. Multivariable analysis for the likelihood of NAT+ diagnosis.

Variable	OR	(95% CI)	P
Age Group			
19-36 Months	Referent	--	
13-18 Months	1.98	(1.05-3.727)	0.04
0-12 Months	4.67	(2.88-7.596)	<0.001
Race			
Non-Hispanic White	Referent	--	
Non-Hispanic Black	2.08	(1.26-3.425)	0.004
Hispanic (any race)	0.88	(0.5-1.545)	0.65
Other/unknown race	1.05	(0.53-2.055)	0.89
Time from Injury			
0 days	Referent	--	
1+ days	2.23	(1.49-3.342)	<0.001
Insurance			
Private	Referent	--	
Government	1.82	(1.18-2.804)	0.007
None	1.74	(0.85-3.556)	0.13
Method of Injury			
High energy fall	Referent	--	
Low energy fall	1.38	(0.81-2.345)	0.23
Conflicting stories/Other	2.77	(1.65-4.654)	<0.001
Unknown to family	6.04	(3.1-11.783)	<0.001
Displaced Fracture	2.07	(1.33-3.232)	0.001

Skeletal Survey (SS) and Follow up SS

- 61% were evaluated for NAT (1,094/1791)
- 49% were younger than 12months
- 65% male, 50% White, 27% Black
- Conflicting Stories, Patients <12 mo, Non-Hispanic Black, injury +1day, government insurance higher odds of NAT+ with SS.

Skeletal Survey and Follow Up SS

- 1094 NAT eval, 715 had a SS→65%
- ***715 SS, 119 were positive SS→16%***
- Tibia, ribs, and forearm, other femur fractures, clavicle.
- FUSS indicated in 235 patients (21%)
- FUSS obtained (n=183/235) → 78%
- 15% Positive FUSS (n=28)
- 8% Changes in Mngmt (n=15)

TABLE 2 Indications for Obtaining a Skeletal Survey

All children <2 y with obvious abusive injuries
All children <2 y with any suspicious injury, including
Bruises or other skin injuries in nonambulatory infants;
Oral injuries in nonambulatory infants; and
Injuries not consistent with the history provided
Infants with unexplained, unexpected sudden death (consult with medical examiner/coroner first)
Infants and young toddlers with unexplained intracranial injuries, including hemorrhage and hypoxic-ischemic injury
Infants and siblings <2 y and household contacts of an abused child
Twins of abused infants and toddlers

AAP:The Evaluation of Suspected Child Physical Abuse | Pediatrics | American Academy of Pediatrics

Laboratory and work up for NAT

- AAP guidelines state that laboratory testing and cranial imaging are recommended in ***specific ages and scenarios.***
- Laboratory testing was obtained in 82% of NAT+ vs 42% of NAT− children.
- Abnormal CBC, Coagulation, Chemistry results were similar across NAT+/NAT-.
- Amylase more frequent in NAT+ patients
- Abnormal findings in Diagnostic tests (SS, Eye exams, CT scans, Abdominal imaging, Spine) were more frequently NAT + patients.

Fx Patterns Across Regions

Almost all fractures (n = 1778; **99%**) were **unilateral** – 69% displaced

- Majority fx noted to be of **spiral/oblique pattern**, suggesting **twisting mechanism**
- Observed pattern not inherently concerning for NAT in <3-year-olds: ~30% were NAT-screed regardless of pattern

<u>**Key conclusion:** *Fracture pattern ≠ abuse correlation* in this age group</u>

Unilateral

	Northeast	Midwest	South	West
Spiral	33.2%	43.1%	34.8%	57.6%
Oblique	42.1%	36.9%	43.5%	25.3%
Transverse	19.2%	14.9%	17.7%	11.7%

	Northeast	Midwest	South	West
Buckle/torus/ impact-like	2.3%	2.8%	0.5%	2.6%
Indeterminate/ unspecified	0.9%	0.6%	3.1%	1.4%
Comminuted/ multiple	0.5%	0.6%	0%	0.9%
Greenstick/incomplete/ cortical-irregularity	0.9%	0.6%	0.3%	0.2%
Segmental	0.9%	0%	0%	0%

Treatment	Spica Cast (n=1435)	Pavlik (n=202)	Intramedullary Nail (n=7)	Long Leg Cast / Splint (n=103)	Dressing & Immobilizer (n=18)	Functional Brace (n=10)	P-value
Age (median IQR)	**25.2**(20-30)	**3.5**(2-6)	**24**(21-29)	**9.5**(7-17)	**10.2**(5-22)	**24.5**(23-30)	**<0.001**
Age group	**Freq.(%)**	**Freq.(%)**	**Freq.(%)**	**Freq.(%)**	**Freq.(%)**	**Freq.(%)**	**<0.001**
0-12m	153(11%)	199(99%)	0(0%)	64(62%)	10(56%)	1(10%)	
13-18m	131(9%)	3(2%)	1(14%)	13(13%)	3(17%)	0(0%)	
19-36m	1151(80%)	0(0%)	6(86%)	26(25%)	5(28%)	9(90%)	

1. CORTICES institutions adhere well to AAOS guidelines for pediatric femoral shaft fracture, particularly in relation to age

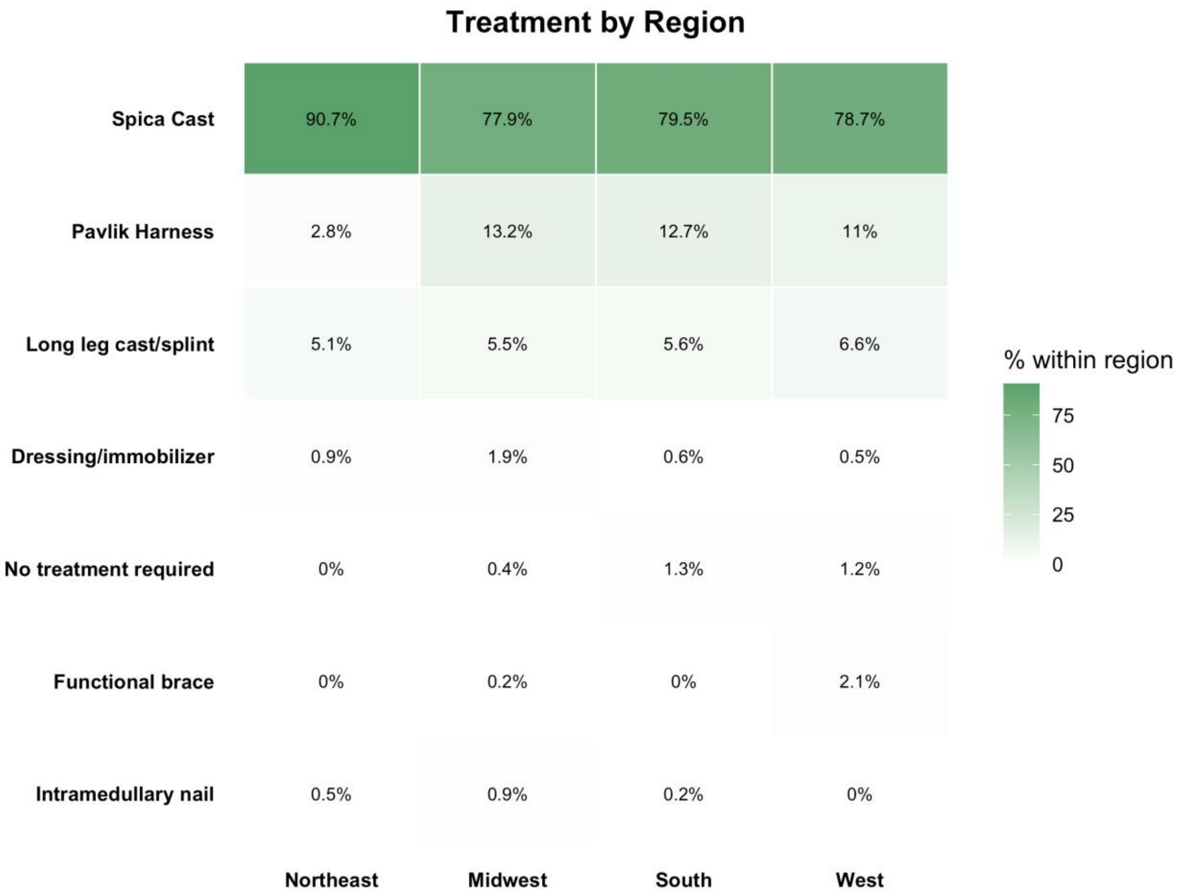
2. Spica casting remains a popular treatment modality for this cohort of patients (~80% treated with spicas)

3. Non-operative and conservative management favored for young infants and babies

4. Emergent treatment modalities such as fractures braces also noted, but only in small numbers

Treatment Patterns:

- Spica cast dominates treatment
  - ~50% single leg & ~50% 1.5 spica
  - No specific preference noted
- Spica Application:
  - Almost all centers apply spicas in OR
  - Two centers apply exclusively in ED
- Regional Trends
  - Fracture bracing used by small portion of West Coast centers
  - Pavlik harness use rare in NE relative to other regions (higher use in ME, S, & West)



Traumatic Hip Dislocation: Study Updates

Presenter(s): Baldwin

Additional Collaborator(s): Arkader

Multicenter Study > Eur J Trauma Emerg Surg. 2023 Aug;49(4):1897-1907.
doi: 10.1007/s00068-023-02280-2. Epub 2023 Jun 1.

Epidemiology and injury morphology of traumatic hip dislocations in children and adolescents in Germany: a multi-centre study

- Systematic review 24 Studies
- 575 patients – Mean age 9.50 years
- AVN rate 15.5%

Associated Pathologies	N (%) out of 414 reported pathology
Sciatic Nerve Injury	9 (2.2%)
Leg Length and or Limp	16 (3.9%)
Hip OA	14 (3.4%)
Femur Fracture	20 (4.8%)
Physeal Injuries	14 (3.4%)

- One multicenter study
- 16 hospitals 42 years 76 patients
- AVN rate 15 %
- Mainly epidemiological

Associated Pathologies	N (%)
Sciatic Nerve Injury	7.8%
Bone	21%
Labrum	23%
Cartilage + Bone	6.5%

Objectives

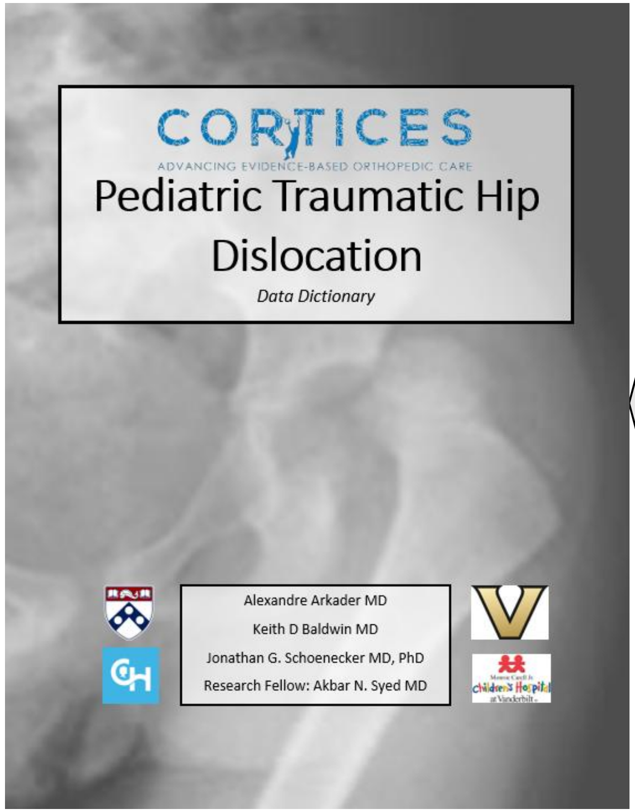
- Establish differences in:
  - reduction protocols/ incidence of fractures and other adverse events of reduction
  - Timing/ location of reduction
  - Imaging protocols
  - Rehabilitation protocols
- To determine:
  - rate and risk factors for AVN
  - factors influencing return to sports
  - risk factors for hip instability/re-dislocation/stiffness
- To develop meaningful CPG for pediatric hip dislocations

Hypotheses/Questions

1. Closed reduction will have similar complications in ED vs OR, and OSH vs CORTICES site, femoral head fracture/ epiphyseal separation rate will be low
2. Open reduction and associated injuries will be associated longer timed to recovery, and higher rates of persistant morbidity
3. Changes in management will be common after obtaining an MRI vs CT or MRI+CT
4. Shorter bracing periods and early weightbearing will show faster recovery of range of motion, return to sports without increased complication rates in simple isolated hip dislocations.
5. AVN will be associated with longer times to reduction, presence of femoral head fractures, open reduction and/or failed closed reduction.
6. Skeletal maturity patterns will be predictive of associated fracture patterns in hip dislocations
7. Injury patterns will be predictable based on MOI and direction of dislocation

- **Inclusion (All Studies):**
    - Presented with injuries between 1/1/2010 and 1/1/2024
    - Age 0 to 18 years at date of injury
    - Diagnosis of hip dislocation or fracture-dislocation (fractures of the proximal femur or acetabulum or pelvis)
    - Minimum 3 months follow-up
- **Exclusion:**
    - Previous history of fracture without dislocation.
    - Inadequate documentation or x-rays.

Data Dictionary



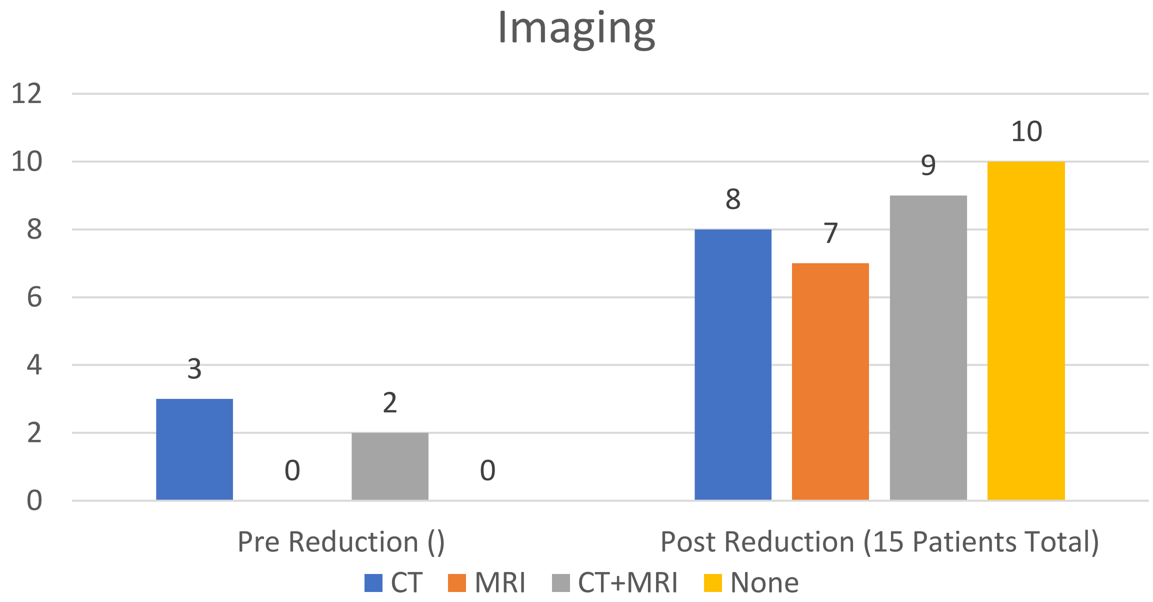
- **Demographics**
- **Presentation, Injury and Clinical Features**
- **Management**
    - Imaging (Pre and Post Reduction)
    - Reduction
    - Post Reduction
- **Post Discharge:**
    - 0-3m, 4-6m, 7-12m, 13-24m year, Additional follow-up 1 (2y – 3.99 years), follow up 2 (4+ year)

Interval progress

1. Refinement of Data Dictionary
2. Exclusion of data points not related to a question
3. Alpha testing and refinement of Redcap based on alpha test
4. Recruitment of Beta sites
5. Training of Beta sites for data collection with a conference call
6. Beta site delivery of data (Pending)

CHOP Data

- 34 patients over 10 years
- **Mean Age:** 11.1 years
- **Mean Follow-Up:** 404 days
- Time to reduction 17 h
- **Mechanism:**
  - **23/34 (67.6%) – Sport 100% Posterior Dislocation**



α – testing complete!

- Reduction:
  - Closed – 29/34 (**5 in OR, 24 in ED**)
- Most were immobilized for ~2-6 wk
- Post Reduction Weightbearing:
  - **NWB – 19 (56%)**
  - **TTWB – 10 (30%)**

β - testing

Beta-Testing Meeting on August 5th

- Covered the Data Dictionary and covered radiographic measurements

C.S. MOTT CHILDREN'S HOSPITAL
MICHIGAN MEDICINE

Boston Children's Hospital
Until every child is well

Children's Hospital Colorado

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

Timeline and Submission Goals

- **Timeline:**
  - **Sept – Dec 2025**
    - Finalize Sites and Redcap (Alpha and Beta Testing)
  - **Dec – Summer 2026-Winter 2026/7**
    - Data Collection for all interested sites
  - **Late Summer/Early Fall 2027**
    - Analysis, Results
  - **Q3 of 2027 – 2028: Manuscript/'s**
- **Submission:**
  - Conference: POSNA 2027, AAOS 2027-8
  - Publication: JBJS, JPO

Provider Survey

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MSKI Registry: Grant Updates

Presenter(s): Schoenecker

PROJECT NARRATIVE

Severe infections and traumatic injuries in children can trigger a catastrophic, dysregulated response in the body's immune and clotting systems, leading to Multiple Organ Dysfunction Syndrome (MODS), the primary cause of death and long-term disability in these patients.

This study will investigate the biological mechanisms that cause the body's protective responses to become uncontrolled, utilizing a novel two-tiered biomarker strategy to track the dynamic trajectory of this response and understand why natural control mechanisms fail.

The successful completion of this research will deliver urgently needed tools to predict which children will deteriorate before organ damage occurs, enabling proactive treatment and identifying new strategies to prevent MODS and save lives.

- **The Clinical Challenge and Critical Gaps.** In pediatric orthopaedics, the initial insult—severe musculoskeletal infection (MSKI) or major trauma—is often survivable. The true driver of mortality and lifelong disability is the subsequent development of Multiple Organ Dysfunction Syndrome (MODS), a catastrophic systemic process resulting from a dysregulated host response.
- Progress in preventing MODS is hampered by critical gaps.
- First, there is an urgent **"screening gap."** Current clinical practice is reactive; while the new Phoenix Sepsis Score provides a standard for *diagnosing* MODS, it cannot predict deterioration *before* irreversible organ damage occurs. Second, there is a **"biomarker gap."** Clinicians rely on static, non-specific markers (e.g., CRP, lactate) that fail to differentiate a transient, appropriate inflammatory response from a sustained, pathological one. Third, there is a **"prediction gap."** Existing models are often trigger-specific (e.g., sepsis only) and lack the prospective validation needed for robust application across heterogeneous populations. There is a pressing need for a proactive, mechanism-aware approach to identify at-risk children early.

Overall Objective and Novel Framework. The long-term goal of this research is to shift the paradigm in pediatric critical care from reactive treatment to proactive, predictive management of MODS.

The **objective of this application** is to define the kinetic determinants of sustained thromboinflammation and develop a robust, trigger-agnostic algorithm for the early prediction of clinical deterioration. We propose a novel, unified mechanistic framework wherein distinct triggers (PAMPs in infection; DAMPs in trauma) converge on a final common pathway.

We posit that an initial state of hyperfibrinolysis activates the neutrophil (acting as a central rheostat), triggering a massive thromboinflammatory response. The transition from a protective to a pathologic state occurs when the endogenous **Protein C buffer system** is consumed and fails, allowing thromboinflammation to become pathologically *sustained*, driving MODS.

Central Hypothesis. Progression to MODS is determined by the *kinetic profile* (magnitude and duration) of a sustained thromboinflammatory response, which is perpetuated by the failure of the Protein C buffer system, regardless of the initiating trigger.

Research Strategy. To test this hypothesis, we will leverage the Children's Orthopaedic Trauma and Infection Consortium for Evidence-Based Study (CORTICES), a mature, multi-center network uniquely capable of enrolling both infection and trauma cohorts. We will conduct a prospective observational study of 1150 children, collecting time-locked biospecimens (0h, 6-12h, 24-36h, 72h).

We will employ a sophisticated and rigorous **two-tiered biomarker strategy** designed to maximize both feasibility and scientific depth. **Tier 1** consists of pragmatic, universally available clinical tests collected on the entire cohort to power the development of a generalizable predictive algorithm. **Tier 2** employs advanced, research-grade assays (e.g., CitH3 for NETosis, sTM/sEPCR for endothelial injury, Thrombin Generation) on a nested case-control subset to provide deep mechanistic validation. The primary outcome is incident MODS (PELOD-2 score ≥ 11 within 7 days).

Aim 1: Define the kinetic determinants of thromboinflammation that predict MODS in pediatric orthopaedic infection (PAMP-dominant).

- We will analyze the Tier 1 kinetic profiles (peak, AUC, time-above-threshold) in a prospective cohort of 500 children with severe MSKI.
- *Hypothesis 1:* Higher magnitude and longer duration of markers reflecting damage matrix formation and fibrinolysis shutdown, coupled with profound depletion of the protein C pathway, will predict the development of MODS.

Aim 2: Define the kinetic determinants and injury-context modifiers of sustained thromboinflammation that predict MODS after pediatric orthopaedic trauma (DAMP-dominant).

- We will analyze the Tier 1 kinetic profiles in a prospective cohort of 650 children with major orthopaedic trauma and examine the influence of injury context (e.g., Injury Severity Score, hemorrhage).
- *Hypothesis 2:* Progression to MODS after trauma is characterized by a sustained thromboinflammatory response driven by the failure of the protein C buffer system, and the risk of this failure is amplified by the severity of tissue injury and hemorrhage.

Aim 3: Develop, validate, and translate an integrated, trigger-agnostic algorithm for the early prediction of clinical deterioration and validate the underlying mechanisms. We will integrate the data from Aims 1 and 2 and leverage both datasets.

- *Aim 3a (Prediction):* Develop and rigorously validate a unified predictive model using advanced machine learning (e.g., XGBoost, multi-task learning) on Tier 1 data.
- *Aim 3b (Mechanism):* Use the Tier 2 nested case-control dataset to perform mediation analysis, validating the causal links in our mechanistic model, and use unsupervised clustering to discover novel patient endotypes.
- *Hypothesis 3:* A mechanism-aware model incorporating the kinetics of the thromboinflammatory cascade will outperform static clinical tools and generalize robustly across CORTICES hospitals

Innovation and Impact. This proposal is **innovative** in its conceptual shift from static risk assessment to the dynamic kinetic profiling of buffer system failure. It is methodologically innovative in its trigger-agnostic design and the rigorous two-tiered strategy that uniquely balances pragmatic prediction (Tier 1) with deep mechanistic interrogation (Tier 2). The successful completion of these aims will be **transformative**, delivering: (1) A validated, EHR-embeddable algorithm for early prediction of MODS, ready for immediate clinical deployment; and (2) Mechanistically defined patient endotypes that will directly guide the development of targeted therapies (e.g., protein C concentrate, anti-fibrinolytics) to prevent MODS and improve outcomes for critically ill children.

AIM 1

- **Target Population:** Children presenting with acute, high-risk musculoskeletal infection (MSKI) requiring hospitalization and/or surgical intervention (e.g., AHO, Septic Arthritis, Pyomyositis, NSTI).
- **Spectrum of Severity Targets:**
- **High-Severity (Target: 30-40% of enrollment)**
  - Necrotizing Soft Tissue Infections (NSTI) / Necrotizing Fasciitis.
  - Septic shock (requiring vasopressors) or meeting Phoenix Sepsis criteria on admission.
  - Disseminated disease (e.g., multifocal osteomyelitis, positive blood cultures, metastatic foci).
- **Medium/Low-Severity (Target: 60-70% of enrollment)**
  - Unifocal AHO or Septic Arthritis requiring surgical decompression.
  - Patients with localized infection but significant systemic inflammatory response (e.g., high fever, markedly elevated CRP) who ultimately recover without ICU care.

AIM 2

- **Target Population:** Children presenting with major orthopaedic trauma requiring hospitalization and surgical intervention.
- **Spectrum of Severity Targets:**
- **High-Severity (Target: 30-40% of enrollment)**
    - Polytrauma (e.g., Injury Severity Score [ISS] > 15).
    - Major pelvic or acetabular trauma.
    - Patients presenting in shock, requiring massive transfusion protocol (MTP) activation, or with elevated lactate.
    - Multiple long bone fractures.
- **Medium/Low-Severity (Target: 60-70% of enrollment)**
    - Isolated high-energy femur or tibia fractures in hemodynamically stable patients.
    - Injuries associated with significant soft tissue damage (e.g., severe open fractures, crush injuries, degloving).
    - Patients requiring Level 1 or Level 2 trauma activation but without initial physiological derangement.

The CORTICES study aims to enroll a total of **1150 patients** over a 3-year enrollment period.

- **Aim 1 (Infection):** N=500
- **Aim 2 (Trauma):** N=650
- **Total Monthly Enrollment (Across Consortium):** ~32 patients/month
- Assuming 15-20 participating centers, the average enrollment target is approximately **2–4 patients per site, per month.** We will work with sites to establish customized targets based on their volume and Trauma Center status (e.g., Level 1 Trauma centers will be expected to contribute more heavily to Aim 2).

Targets

Responsibility	Tier 1 (Clinical Labs)	Tier 2 (Biorepository)	Tier 1.5 (VHA)
Requirement	Mandatory (All Sites)	Mandatory (All Sites)	Opportunistic (Optional)
Patient Identification & Consent	Yes	Yes	Yes
Timing (Windows)	0h, 6-12h, 24-36h, 72h	0h, 6-12h, 24-36h, 72h	0h, 24-36h
Blood Collection	Standard Clinical Tubes	Research Tubes (Citrate, EDTA)	Citrated Tube (Point-of-Care)
Sample Processing	N/A (Clinical Lab handles)	Spin (PPP), Aliquot, Freeze (-80C) per SOP within 60 mins.	Run assay immediately
Assay Execution	Local Clinical Lab	CORTICES Central Lab	Local Site (TEG/ROTEM)
Data Entry (REDCap)	Yes (Results and Timing)	Yes (Tracking/Inventory)	Yes (Results)
Feasibility/Effort	High Feasibility; Requires coordinator vigilance on timing.	Moderate Feasibility; Requires infrastructure and time-sensitive processing.	Resource-Dependent.

Critical Requirement: Ensuring a Spectrum of Severity and Avoiding Selection Bias

- A critical requirement for this study is enrolling a diverse cohort that represents the full spectrum of disease severity. **It is critical that we do not only enroll the sickest patients.** A predictive model requires both "cases" (patients who deteriorate/develop MODS) and "controls" (high-risk patients who do not deteriorate) to be successful.
- **Enroll Early:** Patients must be enrolled upon presentation (ideally in the ED, within 6 hours of arrival) *before* their clinical trajectory is clear. Do not wait for patients to require PICU transfer before enrollment.
- **Broad Inclusion:** The "worrisome" admission to the acute care floor who ultimately recovers is just as important as the patient who deteriorates 24 hours later.

Tier 1 is the backbone of the study and powers the primary objective: developing a generalizable predictive algorithm.

- **The Main Focus:** The successful execution of Tier 1 is the primary responsibility of every participating center and is designed to be highly feasible.
- What Tier 1 Entails:
- Tier 1 consists only of standard clinical laboratory tests that are universally available.
- **The Tier 1 Panel:** CBC with Differential, Comprehensive Metabolic Panel (CMP), C-Reactive Protein (CRP), Coagulation Panel (PT/INR, aPTT, Fibrinogen), D-Dimer, and Lactate.

Tier 2 provides the deep mechanistic insights. The study employs a nested case-control design, which requires prospective sample collection from *all* enrolled patients to allow for the later identification of cases and selection of matched controls. Therefore, **all participating sites must collect Tier 2 samples.**

- **Crucial Clarification on Resources:** The advanced, expensive assays for Tier 2 will be performed at a **CORTICES Central Laboratory**, not at the local sites. The burden of running these complex assays is entirely removed from the local sites.
- **The Main Focus:** The responsibility of the local sites is the rigorous collection, processing, and storage of the biospecimens.
- What Tier 2 Entails for Sites:
- At the same four time windows as Tier 1, sites will collect dedicated research tubes:
- Two 4.5 mL Sodium Citrate tubes (Light Blue top)
- One 4 mL EDTA tube (Lavender top)

Necrotizing Soft Tissue Infections: Study Updates

Presenter(s): Schoenecker

Additional Collaborator(s): Ramalingam

Coffee Break, Tour of Lab, & Group Pictures

Please reconvene back at 10:45 AM for Day 1: Progress Report Block 2

Napkin Idea #1

Hybrid Fixation Outcomes: Both-Bone Forearm Fx

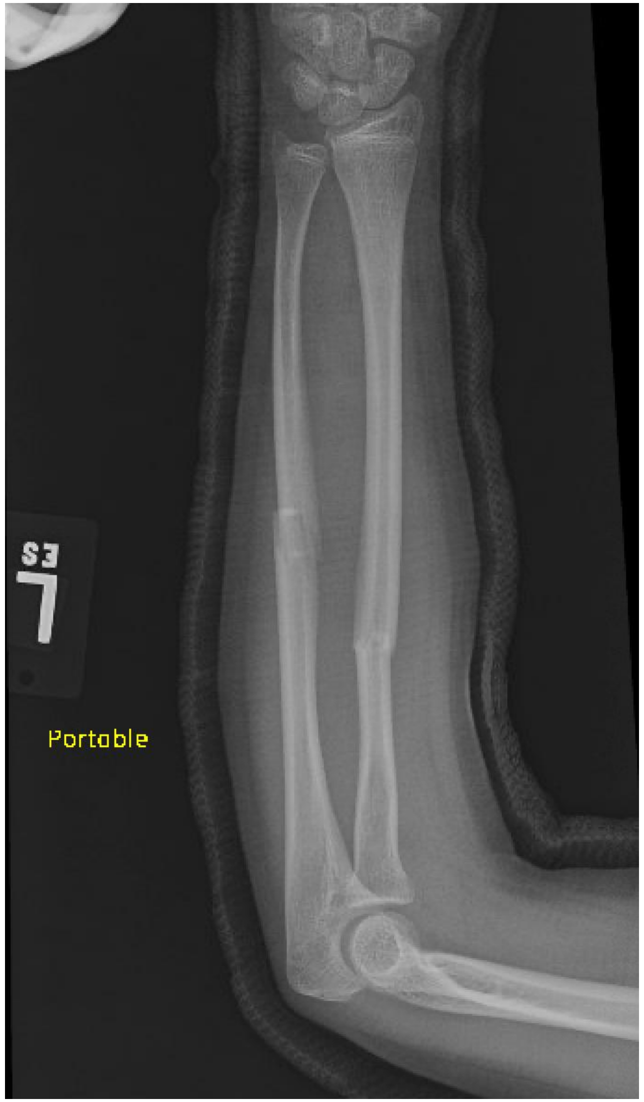
Presenter(s): Larson

Napkin Idea

- Clinical and Radiographic Outcomes of Hybrid Fixation for the Treatment of Adolescent Both-Bone Forearm Fractures
    - Primary Aim – To determine the incidence and risk factors of adverse outcomes in the management of adolescent both bone forearm fractures with a hybrid fixation construct
    - Primary Hypothesis – Hybrid fixation will have similar adverse outcome profile to standard management including flexible nailing or open plating for the treatment of adolescent both bone forearm fractures
- Specific outcomes: Time to Radiographic Union / Time to Return to sport / Rate of hardware removal / Risk of compartment syndrome (Prospective?)
- Inclusion – closed both bone forearm fracture in patients ages 10 to 16 years with open distal radius and ulna physis
- Exclusion – closed growth plates – skeletal maturity

Case

- Hybrid fixation strategies that encompass both flexible intramedullary of the radius/ulna (ESIN) and plate fixation of the raids/ulna have been reported to address the unique complications respective to both surgical techniques. Unfortunately, there are few studies in the literature describing the use of and indications for hybrid fixation in the treatment of adolescent both-bone forearm fractures. Hence, we present a case of a 12-year-old girl whose forearm fractures were successfully treated with hybrid fixation after a failed attempt of dual ESIN.



Case

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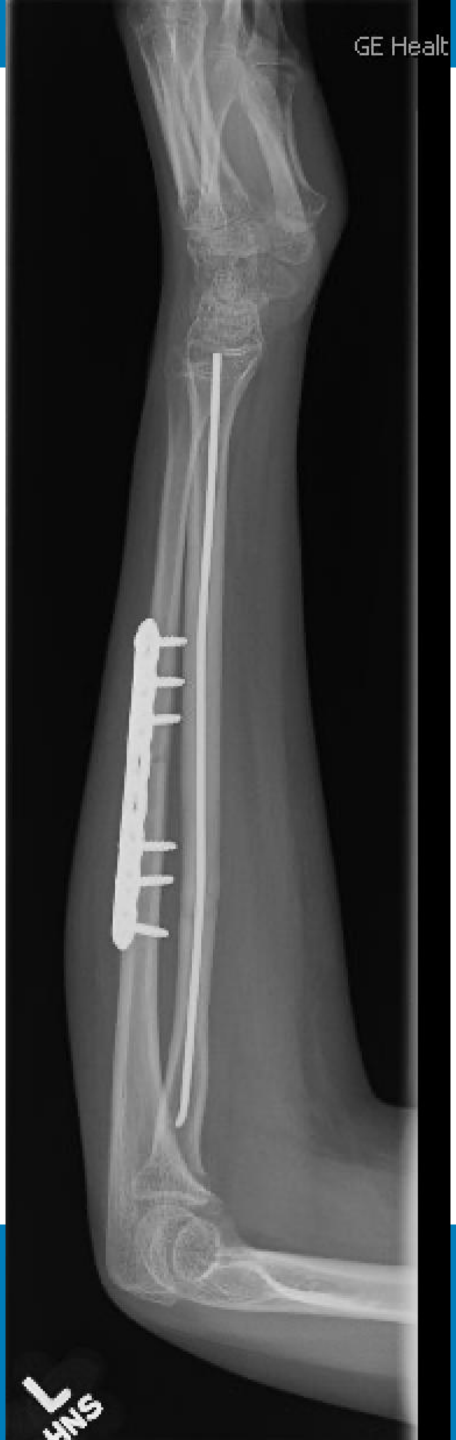

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Literature

2023 systematic review encompassing 6 articles w/ a total of 409 patients analyzed w/ treatment by ESIN, dual plating, hybrid fixation, external fix.

Compared to plating, the nailing group in this review revealed an increase in time to union in all but one study. Although significant, overall this difference is thought not to be clinically relevant and poses no statistical significance when both groups are weighed against each other.

Review > Cureus. 2023 Aug 16;15(8):e43557. doi: 10.7759/cureus.43557. eCollection 2023 Aug.

Clinical and Radiological Outcomes of Paediatric Forearm Fractures of the Radius and Ulna Following Fixation by Intramedullary Nailing or Plating: A Systematic Review

Kingsley Mmerem [1], Mohammad Waseem Beeharry [2]

Affiliations + expand

PMID: 37719570 PMCID: PMC10503882 DOI: 10.7759/cureus.43557

Literature

- Retrospective chart review 137 patients at Yuying Children's Hospital of Wenzhou Medical University age 10-16 comparing outcomes of dual plating, ESIN, and hybrid fixation. Notable delayed union of ulna at 3 mo observed in ESIN group vs. dual plating and hybrid fixation. No significant difference in outcome or complication rates at final endpoint.

International Journal of Surgery 51 (2018) 10–16

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.elsevier.com/locate/ijsu

ELSEVIER

Original Research

Comparison of three surgical fixation methods for dual-bone forearm fractures in older children: A retrospective cohort study

Wenhao Zheng, Zhenyu Tao, Chunhui Chen, Chuanxu Zhang, Hui Zhang, Zhenhua Feng, Hang Li, Liang Cheng, Leyi Cai, Hua Chen*

Department of Orthopaedic Surgery, The Second Affiliated Hospital and Yuying Children's Hospital of Wenzhou Medical University, Wenzhou 325000, China

Femoral Neck Fracture: Protocol & REDCap Updates

Presenter(s): Larson

Ann & Robert H. Lurie Children's Hospital of Chicago

Northwestern Medicine Feinberg School of Medicine

CORTICES

ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

Femoral Neck Fracture Study

CORTICES Annual Meeting

Lance Lew, BA; Soroush Baghdadi, MD; Jill E Larson, MD

September 26, 2025

BEST CHILDREN'S HOSPITALS U.S.News & WORLD REPORT RANKED IN 10 SPECIALTIES 2021-22

MAGNET RECOGNIZED AMERICAN NURSES CREDENTIALING CENTER

Retrospective Study

Primary Aim: To determine the incidence and risk factors of adverse outcomes (AVN, non-union, repeat surgery, etc.) after femoral neck fractures.

Primary Hypothesis: The incidence and risk factors associated with adverse outcomes following femoral neck fractures in children treated at CORTICES institutions will be similar across sites.

Secondary Aims:

1) To identify the demographic and clinical factors associated with a higher incidence of femoral neck fractures in children treated at CORTICES institutions..

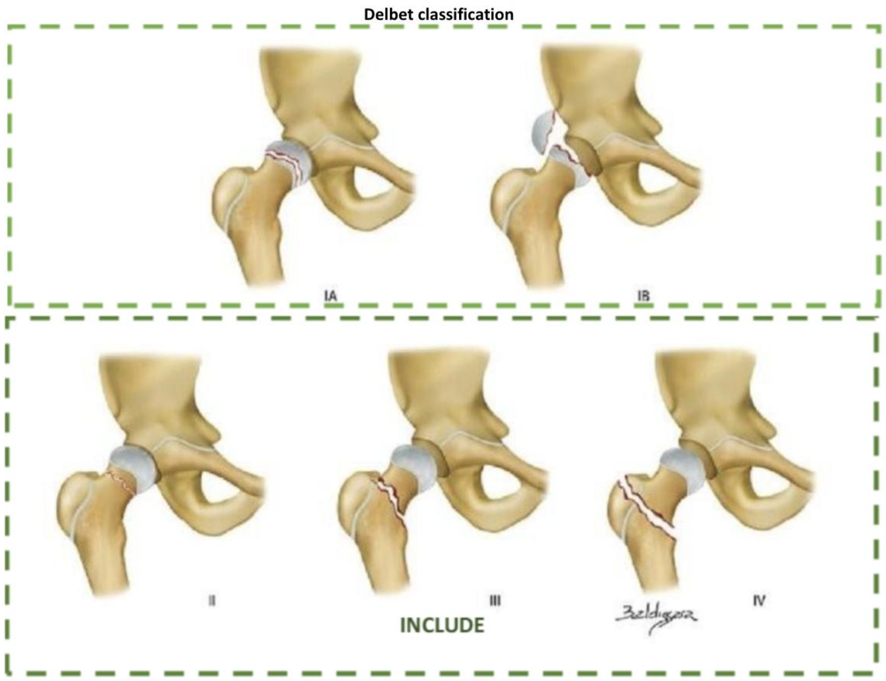
   Hypothesis: Various patient characteristics (i.e older age), treatment factors (delayed surgical intervention), and imaging data (i.e severe displacement) will be significantly associated with higher incidence of adverse outcomes following femoral neck fractures in children treated at CORTICES institutions.

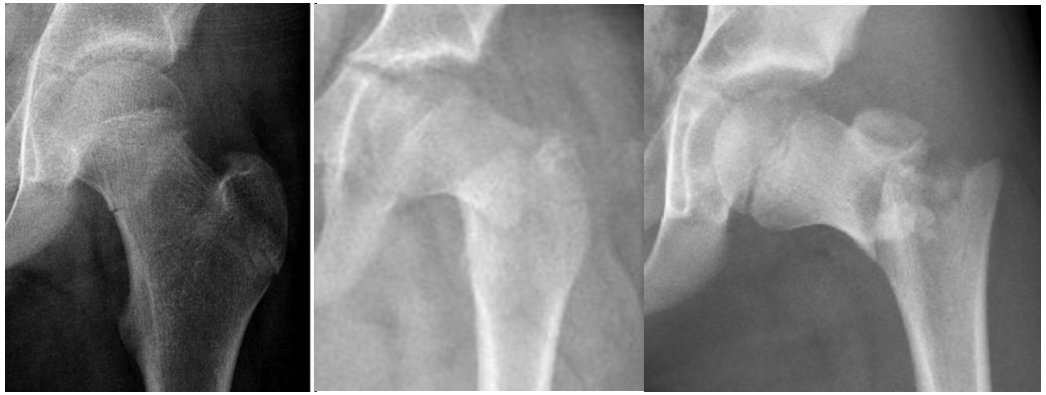
   Outcome: incidence of femoral neck fractures in different groups, prevalence of risk factors for femoral neck fractures in these groups.

2) To develop a multicenter retrospective database of femoral neck fractures treated by CORTICES members

Inclusion Criteria – Research Committee Review

- Patients with femoral neck fracture defined as **Delbet 1, 2, 3, and 4 fractures** distal to the physis and proximal to the lesser trochanter (Salter Harris 2 fractures)
- Between 1/10/2010 and 6/30/2024
- Age **2 to 16 years** at date of injury presentation
- Presented at, transferred to, or followed up at a CORTICES-participating institution. Patients who were not initially treated at a participating center will be included if injury films are available for measurement





Ann & Robert H. Lurie Children's Hospital of Chicago

Adverse Outcomes

Modified Clavien-Dindo-Sink Complication Classification System	
Grade	Definition
I	A complication that does not result in deviation from routine follow-up in the postoperative period and has minimal clinical relevance and requires minimal treatment (e.g., antiemetics, antipyretics, analgesics, diuretics, electrolytes, antibiotics, and physiotherapy) or no treatment
II	A deviation from the normal postoperative course (including unplanned clinic/office visits) that requires outpatient treatment, either pharmacological or close monitoring as an outpatient, or results in prolonged initial inpatient hospital stay.
III a/b	A complication that is treatable but requires an unplanned hospital readmission (**IIIa**); or unplanned surgical, endoscopic, or interventional radiology procedure(s) **(IIIb)**
IV a	A complication that is life or limb-threatening, and/or requires ICU admission, a complication with potential for permanent disability but treatable, a complication that may require organ/joint resection/replacement. No long-term disability
IV b	A complication that is life or limb-threatening, and/or requires ICU admission, a complication that is not treatable, a complication that requires organ/joint resection/replacement or salvage surgery. With long-term disability
V	Death

Injury Imaging



- Fracture Location (Type I, II or III)
- Fracture description
  - incomplete (fracture line in only one cortex)
  - complete (fracture extends to both cortices),
  - Stress (chronic symptoms, often seen on MRI only),
  - impacted (more common in individuals with fragile bone, no visible fracture line but the femoral neck height is diminished, hence "impacted
- Pauwel's type/angle (Type I, II, III)
- Displacement of fracture – Modified Garden Classification
- OTA Classification
- Skeletal Maturity
  - Proximal femur physis (open/closed)
  - Triradiate cartiledge (open/closed)
  - Oxford Score

Intra-operative Imaging

- If intraoperative imaging in the form of fluoroscopy shots, O-arm, etc. is available. Please note that mm measurements can only be measured on calibrated images
- Quality of reduction
  - Excellent: <2mm of displacement and <5 degrees of angulation in any plane on any view
  - Good: 2-5 mm of displacement and/or 5-10 degrees of angulation in any plane on any view
  - Fair: >5-10 mm of displacement and/or >10-20 degrees of angulation in any plane on any view
  - Poor: >10 mm of displacement and/or >20 degrees of angulation or any varus

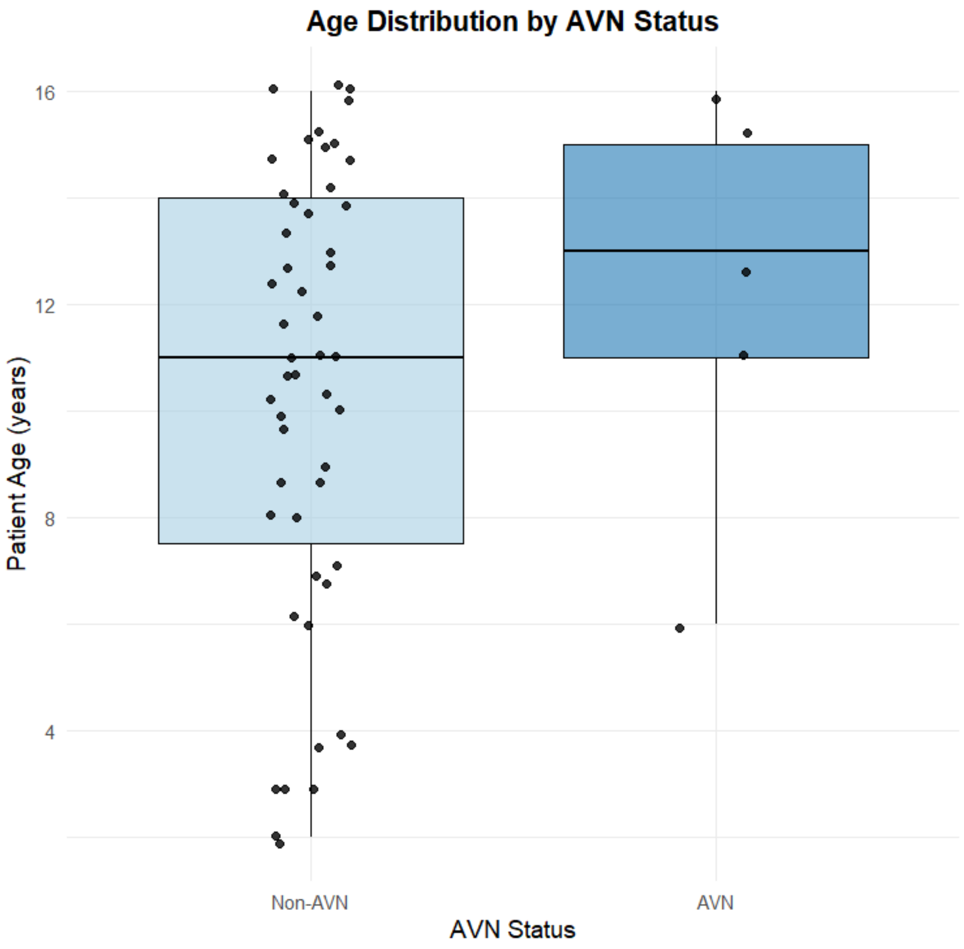
Post-operative Imaging (≤ 3 mo, ≤6 mo, ≤12 mo, ≤18 mo, ≤24 mo)

- Quality of reduction
  - Excellent: <2mm of displacement and <5 degrees of angulation in any plane on any view
  - Good: 2-5 mm of displacement and/or 5-10 degrees of angulation in any plane on any view
  - Fair: >5-10 mm of displacement and/or >10-20 degrees of angulation in any plane on any view
  - Poor: >10 mm of displacement and/or >20 degrees of angulation or any varus
- Femoral Neck Length: measurement of tip of greater trochanter to femoral head center on an AP Pelvis radiograph
  - Affected side:
  - Non-affected side:
- Is hardware in stable position from intra-operative images? OPTIONAL if intraoperative imaging is available

Lurie Data

- 56 patients were identified
  - 38 male (67.9%)
  - age distribution
    - 2 infants (0 to 2 years) - 3.6%
    - 9 young child (2-6 years) - 16.9%
    - 23 older child (7-12 years) - 41.1%
    - 22 adolescent (13-16 years) - 39.3%
- A total of 5 patients had AVN (8.9%), with
  - 1 case identified 6 months after surgery and **3 cases >= 12 months and 1 case >= 19 months**
- Adverse outcome was 46.4% (95% CI 33.0-60.3)
- No significant associations were found between AVN and patient sex, BMI, abnormal bone quality conditions, or delayed surgery => likely underpowered to detect difference (power calculation around 300)

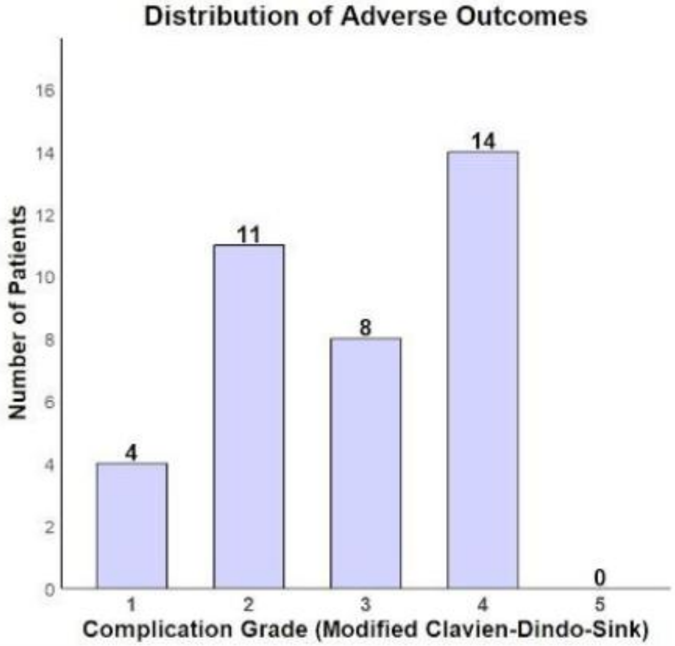
AVN and Adverse Outcomes



2.48 (95% CI 0.26–32.2 p = 0.371) times odds of developing AVN in older patients (age > 13) vs. younger patients.

Incidence of Postoperative Complications

Complication	Events (n/N)	Rate (95% CI)
Superficial infection	1/56	1.79% (0.05–9.55%)
Deep infection	0/56	0% (0–6.38%)
Avascular necrosis	5/56	8.93% (2.96–19.62%)
Nonunion	8/56	14.29% (6.38–26.22%)
Malunion	4/56	7.14% (1.98–17.29%)
Hardware complications	11/56	19.64% (10.23–32.43%)
Other complications	20/56	35.71% (23.36–49.64%)
Overall	26/56	46.43% (32.99–60.26%)



Next Steps

- Final Research Committee Approval on Protocol and Data Entry Guide
- Launch beta testing work-flow with radiographic example/videos

    CHLA – Jonah Owen

    Colorado – Sayan De

    Cincinnati – Wendy Ramalingam

    Michigan – Matt Stepanovich

    Lurie – Jill Larson

- During beta testing, ask: "Are we capturing exactly what we need? Can it be reproduced by another reviewer?"

Membership Committee: Addition of New Sites

Presenter(s): Beebe & Laine

Lunch Break

Please reconvene back at 1:00 PM for Day 1: Progress Report Block 3

Antibiotic Prophylaxis & Open Fracture: Updates & Treatment Proposal

Presenter(s): Livingston

Boston Children's Hospital
Where the world comes for answers

Small Bones, Big Wounds, High Stakes: The Management and Outcomes of Pediatric Grade III Open Fractures

Mackenzie H. Morris, BS[1], Shanika De Silva, PhD[1,2], Kristin S. Livingston, MD[1,2]
[1] Boston Children's Hospital, Department of Orthopaedic Surgery, Boston, MA
[2]Harvard Medical School, Boston, MA

HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

PEDIATRIC GRADE 3 OPEN FRACTURES

KEY FEATURES

- Relatively infrequent injuries
- High energy injuries including pedestrian vs car, lawnmower, mangled limb
- Our understanding of the injury is largely extrapolated from adult studies

TREATMENT & CONCERNS

- Early initiation of antibiotics is important but our (CORTICES) agreement on ideal antibiotics is low
- Unclear what optimal treatment strategy is

RESEARCH GAP

Limited studies on characteristics, management, and outcomes in pediatric population

CORTICES Survey Study:

KEY FINDINGS

- Provisional acceptance by JPO
- We all have 1 hour rules (variable success)
- We have multidisciplinary trauma committees that make our protocols
- Grade 1, 2 treatment is consistent
- We really don’t have any consistency when it comes to grade 3, soil, water contamination injuries
  - → Should we study more severe injuries within CORTICES (rare injuries, little existing research)

Table 3: Consensus-based recommendations for IV antibiotic administration in pediatric long bone open fractures

For hospitals looking to instate a policy for IV antibiotic administration in pediatric open long bone fractures, based on the most common protocols of our surveyed institutions, we suggest the following:	• Engaging a multidisciplinary group, involving some combination of Infectious Disease, Orthopaedic Surgery, Emergency Medicine, Pharmacy, Pediatrics, and General Surgery for widespread buy-in and routine auditing
	• Administration of IV antibiotics to patients with an open long bone fracture within 1 hour of presentation to the ED by the Emergency Medicine team
	• Patients with GA type 1, 2 open long bone fractures receive cefazolin (with allergy alternate clindamycin)
	• Patients with GA type 3 open long bone fractures receive ceftriaxone or [cefazolin + gentamicin] (with allergy alternate clindamycin +/- gentamicin)
	• We are unable to comment on specific antibiotics for soil and water contamination due to lack of general consensus

Grade 3 Open Fracture BCH Retrospective:

KEY FINDINGS

- Interest in abx/infections, but also looked at complications in general
- Abstract being submitted to POSNA
- Manuscript in progress
- 10 years BCH data
- 33 patients
- High level of complications

Table 1. Demographic characteristics

Characteristics	(N=33)[1]
Age (years)	10 (8, 14)
Sex	
Female	10 (30%)
Male	23 (70%)
Race (n=37)	
White or Caucasian	23 (72%)
Black, African American/Canadian or African	6 (19%)
Asian or South Asian	1 (3%)
Hispanic	1 (3%)
American Indian or Alaska Native	1 (3%)
Other	2 (6%)
Height (cm) (n=22)	134 (126, 163)
Weight (kg)	46 (25, 57)
BMI (n=22)	19 (15, 23)

[1]Continuous variables presented as median (interquartile range) and categorical variables presented as frequency (percentage)

Table 2. Clinical and injury characteristics

Characteristics	(N=33)[1]
Mechanism of Injury	
Pedestrian/Biker struck	13 (39%)
Motor vehicle accident passenger	4 (12%)
Lawn mower	2 (6%)
Fall	8 (24%)
Other	6 (18%)
Comorbidities	5 (15%)
Fracture Subtype	
IIIa	18 (56%)
IIIb	6 (19%)
IIIc	8 (25%)
Fracture Location	
Femur	2 (6%)
Tibia	21 (64%)
Fibula	15 (45%)
Humerus	6 (18%)
Radius	3 (9%)
Ulna	3 (9%)
Pelvis	3 (9%)
Patella	2 (6%)
Injury Severity Score	13 (9, 17)
Injury Severity Score Category	
Minor	3 (9%)
Moderate	21 (64%)
Severe	6 (18%)
Profound/Very Severe	3 (9%)
Polytrauma	9 (27%)
Additional Injuries	24 (73%)

[1]Continuous variables presented as median (interquartile range) and categorical variables presented as frequency (percentage)

Table 3. Hospitalization characteristics

Characteristics	(N=33)[1]
ED Admission Quarter	
6am-12pm	2 (6%)
12pm-6pm	12 (36%)
6pm-12am	17 (52%)
12am-6am	2 (6%)
ED Arrival Mode	
Ambulance	15 (45%)
Medical Flight	4 (12%)
Transfer	14 (42%)
Admitting Service	
Orthopaedics	19 (58%)
Trauma	4 (12%)
Medical Intensive Care	8 (24%)
General Surgery	1 (3%)
Plastic Surgery	1 (3%)
ED Admission to IV Antibiotic Administration (mins)	50 (30, 85)
Duration of Inpatient IV Antibiotics (days)	3 (1, 13)
Time to OR (hours)	2.8 (2.3, 7.9)
Number of surgeries	2 (1, 3)
Non-orthopedic procedures	14 (42%)
Type of non-orthopedic procedure	
Plastic Surgery	12 (36%)
Urology	1 (3%)
General Surgery	2 (6%)
Dental	2 (6%)
Length of stay (days)	7 (3, 13)
Discharge PO Antibiotics	12 (36%)
Duration of Prescribed PO Antibiotics Course (days) (n=12)	7 (7, 10)

Table 4. 90-day outcomes

90-day Outcomes	(N=33)[1]	95% CI[2]
Infection (n=31)	7 (23%)	(11%, 40%)
Complication (n=32)	19 (59%)	(42%, 74%)
UPROR (n=32)	11 (34%)	(20%, 52%)
Readmission (n=32)	4 (13%)	(5%, 28%)
Time to union (days) (n=30)	100 (60, 178)	-
Delayed union (>6mos) (n=30)	7 (23%)	(12%, 41%)
Amputation	4 (12%)	(5%, 27%)

[1]Categorical variables presented as frequency (percentage) and continuous variables presented as median (interquartile range)
[2]Estimated using Wilson-score method

Associations with Infection:

- Mechanism of Injury: Ped/Biker struck, lawnmower
- Fracture location: Tibia
- Higher injury severity score (ISS)
- Trend: IIIB, IIIC more likely in the infection group (p=0.1)

Associations with Complication:

- Time of admission (day time admissions had higher rates of complications)
- Trend: complications tended to be in younger patients (10 vs 13yrs)
- Trend: time to abx slightly longer in complication patients but TTOR slightly faster

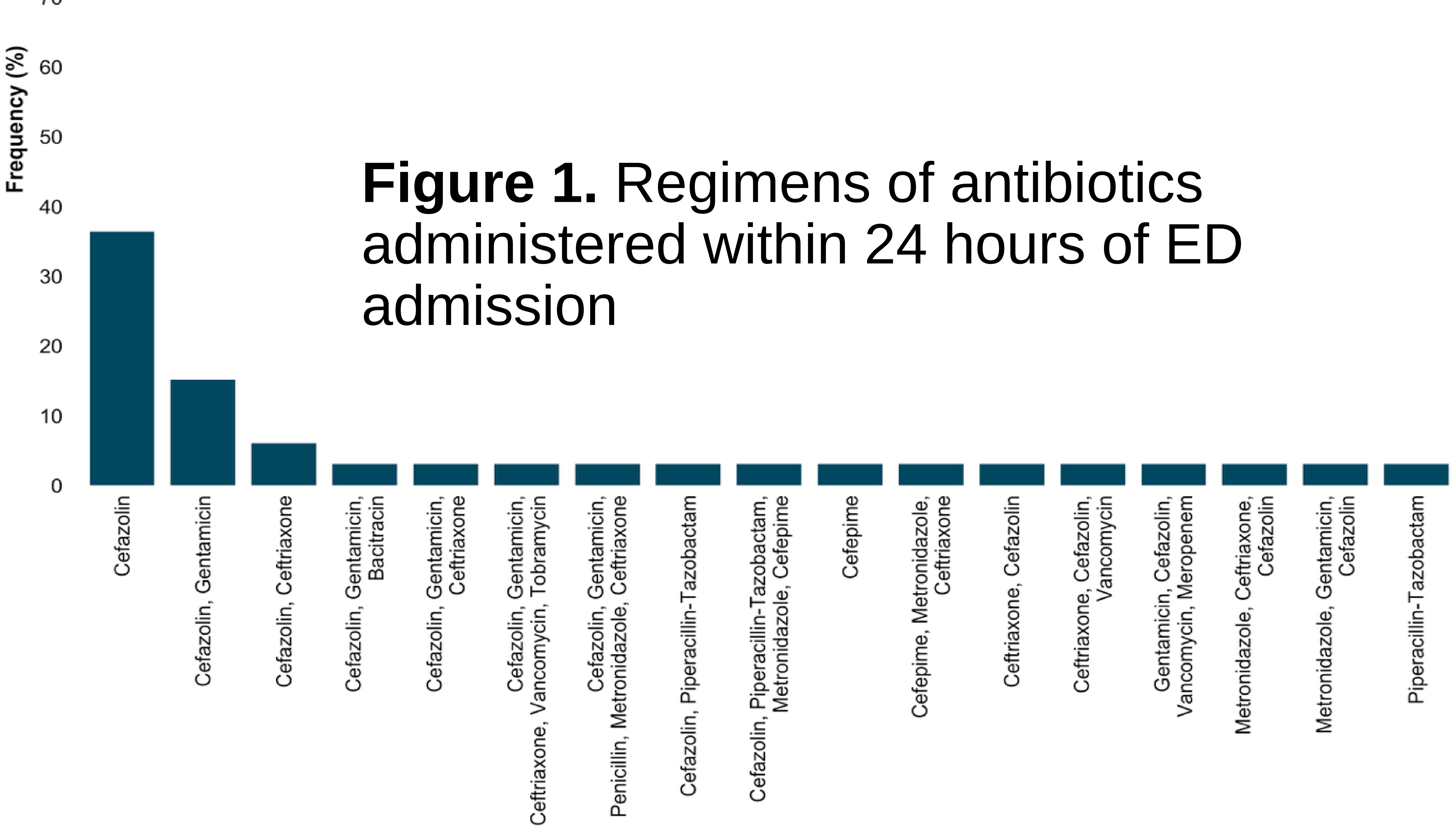


Figure 1. Regimens of antibiotics administered within 24 hours of ED admission

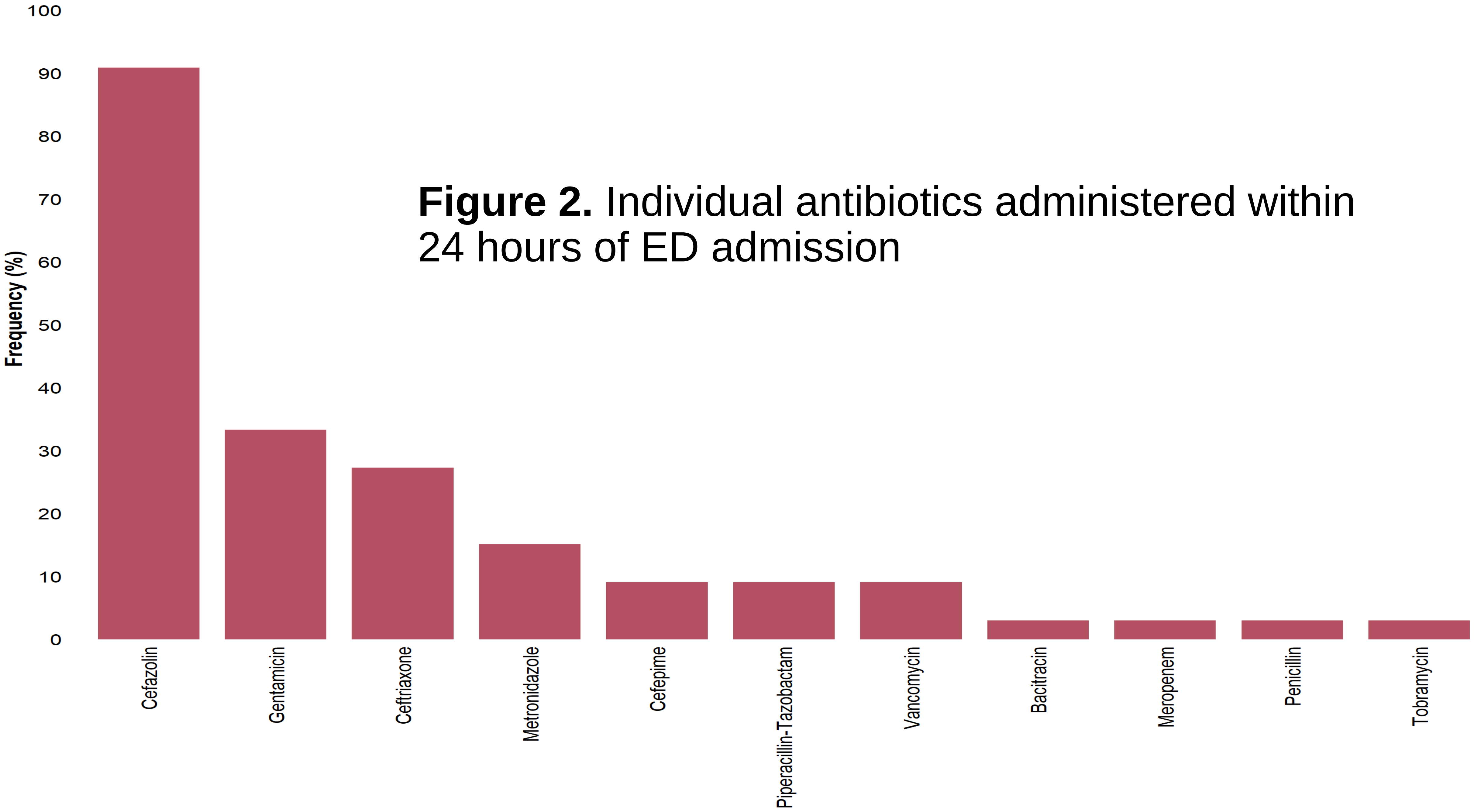


Figure 2. Individual antibiotics administered within 24 hours of ED admission

- Low volume single institution retrospective data
- Survey of practice patterns with wide variation

CORTICES multicenter retrospective outcomes study to describe outcomes/complications/infection rates as a function of injury type/time to antibiotics/time to OR/time to coverage and choice of/duration of antibiotics?

NEXT STEPS: CORTICES Retrospective??

THANK YOU

Pediatric Traumatic Arthrotomy: Survey & Retrospective Study Design

Presenter(s): Livingston

Boston Children's Hospital
Where the world comes for answers

Clinical Characteristics, Management and Outcomes of Pediatric Traumatic Arthrotomies

Kristin Livingston, MD
CORTICES Annual Meeting
9/26/2025

HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

PEDIATRIC TRAUMATIC ARTHROTOMIES

KEY FEATURES

- Relatively infrequent injuries
- Concern for septic arthritis
  - Is this a real concern or historic?
- Our understanding of the injury is almost entirely based on adult studies
- Our treatments are based on “how we trained” and personal preference

TREATMENT QUESTIONS

- How important is early initiation of antibiotics?
- Do all cases need surgery? (
- Do we need to treat with post op abx?

RESEARCH GAP

Limited studies on characteristics, management, and outcomes in pediatric population

Traumatic Arthrotomy BCH Retrospective:

KEY FINDINGS

- Abstract submitted to POSNA
- Manuscript submitted to JPOSNA
- 10 years BCH data
- 36 patients
- No deep infection (2 superficial)
- All treated with surgery
- Full ROM, sports by 6 weeks

Table 3: Surgical and postoperative outcomes description of the entire cohort and stratified by infection

HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Characteristic	Overall[1] (N=36)	No Infection[1] (N=34)	Patient 1	Patient 2
Time to OR (hours)	9 (2, 45)	9 (2, 45)	8 hours	16 hours
Procedure type				
Open	33 (92%)	31 (91%)	Open	Open
Arthroscopic	2 (6%)	2 (6%)		
Both	1 (3%)	1 (3%)		
Drain	8 (22%)	8 (24%)	No	No
Lavage (L) (n=32)	6 (1, 9)	6 (1, 9)	-	3L
Antibiotics	36 (100%)	34 (100%)	Yes	Yes
Time to antibiotics (mins)	4 (0, 16)	4 (0, 16)	2.4 hours	8.9 hours
Antibiotics duration (days)	6 (0, 24)	5 (0, 24)	16 days	7 days
Length of stay (days)	1 (0, 21)	1 (0, 21)	2 days	0.1 day
Return to OR	4 (11%)	4 (12%)	No	No
Complications	3 (8%)	2 (6%)	No	Yes
Time to full ROM (days) (n=23)	45 (6, 93)	47 (9, 93)	6 days	-
Time of immobilization (days) (n=34)	14 (0, 59)	14 (0, 59)	6 days	-
Time to clearance for return to activity (days) (n=31)	40 (12, 153)	41 (12, 153)	31 days	-

[1]Continuous variables presented as median (min, max) and categorical variables presented as frequencies (%)

HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

CORTICES Survey Study:

KEY FINDINGS

- Abstract being submitted to POSNA
- We really don’t have any consistency when it comes to timing/urgency of OR, need for OR in GSW, need for/duration of postop abx

Abstract: Traumatic Arthrotomy Survey Study

Introduction:

Traumatic arthrotomy (TA) is a rare but severe orthopaedic injury that carries risk of septic arthritis. Successful management presumably includes prompt diagnosis, surgical irrigation and debridement(I&D), and antibiotic therapy, but limited research exists on the optimal management strategies in children. This study aims to describe the current practice landscape for TA management among pediatric orthopaedic surgeons across a large group of Level-1 pediatric trauma centers.

Abstract: Traumatic Arthrotomy Survey Study

Methods:

A voluntary, anonymous survey was administered to 39 pediatric orthopaedic surgeons across 18 Level-1 pediatric trauma centers. This survey captured provider perspectives on evaluation, surgical decision-making, antibiotic usage, and follow-up care as determined by contamination level and injury mechanism. Data analysis was conducted using descriptive statistics with survey responses presented as frequencies and percentages.

Abstract: Traumatic Arthrotomy Survey Study

Response rate was 97%(n=38/39). The majority of respondents(74%) utilize CT scan to help diagnose TAs. For TAs with minimal/mild contamination, 97% of providers administer immediate antibiotics upon presentation, 68% continue postop IV antibiotics, while only 26% prescribe postoperative antibiotics, compared with 97%, 94%, and 58%, respectively, for moderate/severe contamination. All surgeons performed surgical I+D in the OR for minimal/mild/moderate/severe contamination TAs, but 42% managed TA due to gunshot wound(GSW) definitively in the ED. Surgeons recommended non-emergent surgical scheduling the next day, either first case (42%) or whenever available (50%) for minimal/mild contamination. More significant contamination triggered more urgency (32% of surgeons preferring 6-8 hours from presentation, and 47% preferring next day first case). Three liters(L) was very commonly preferred to irrigate minimal/mild contamination wounds, while 6L were utilized for moderate/severe contamination. Drains were often utilized for moderate/severe contamination(56%) but few surgeons(23%) utilized them for minimal/mild contamination. Practices of surgical timing, surgical technique, and antibiotic usage varied widely for TAs due to GSW. Postoperative management practices were similar in WB restrictions but varied substantially for duration of immobilization and return to sport.

Abstract: Traumatic Arthrotomy Survey Study

Conclusions:

This study represents the first widespread assessment of current practice patterns in the management of pediatric TAs across multiple U.S. Level-1 trauma centers. We report a lack of consensus among surveyed surgeons regarding the optimal timing of I&D and postoperative IV and oral antibiotics courses.

Significance:

Substantial practice variation exists among like-minded providers regarding the optimal management of pediatric TAs. Future research is needed to establish evidence-based guidelines to standardize and improve the care for children with TA across our society.

- Low volume single institution retrospective data
- Survey of practice patterns with wide variation

CORTICES multicenter retrospective outcomes study to describe outcomes/complications/infection rates as a function of injury type/time to antibiotics/time to OR, and duration of antibiotics?

WHAT MATTERS?

NEXT STEPS: CORTICES Retrospective??

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THANK YOU

Boston Children's Hospital
Where the world comes for answers

Committees Updates & Bylaws Voting

Presenter(s): Shore, Beebe, Laine

Napkin Idea #2

Compartment Syndrome & Regional Anesthesia

Presenter(s): Shore

Regional Anesthesia & Compartment Syndrome

Do You Want A Block for Your Case?

Regional Anesthesia & Compartment Syndrome

Hell No!

Regional Anesthesia & Compartment Syndrome

- Previous study at BCH
- 31,000 regional blocks
- 8 cases of CS
- Time to Dx 21.75 hrs
- Time to Sx 22.62 hrs
- PNB no delay to DX of CS

Acute compartment syndrome in pediatric patients with peripheral nerve blocks

Tricia Vecchione ,[1] Vipin Bansal,[2,3] Benjamin Joel Shore,[4,5] Giorgio Veneziano,[6,7] Rani A Sunder ,[8] Harshad Gurnaney,[9,10] Karen Boretsky [11]

I think this paper doesn't tell the whole story

Regional Anesthesia & Compartment Syndrome

Aim 1: Determine the risk of CS associated with PNB in Orthopedic Trauma and Elective Surgery

Aim 2: Assess risk factors associated with CS in the setting of PNB

Napkin Idea #3

ECMO Limb Monitoring

Presenter(s): Livingston

Compartment Pressure Monitoring in Kids with MY01

- Implanted monitor with 18 hours of continuous data streamed to your phone
- Opportunity to learn more about compartment pressures in kids after tibia fractures
- Opportunity to monitor pressures in kids who are intubated/sedated with limb at risk (ECMO, groin cannulation)
- Open field for research!

Ischemic Compartment Syndrome due to ECMO

HISTORY: 12yo F previously healthy, Influenza B and fulminant viral myocarditis

Admitted to CICU in cardiogenic shock → cardiac arrest. Multiorgan failure/coagulopathic

Emergent venous + arterial ECMO @ right groin

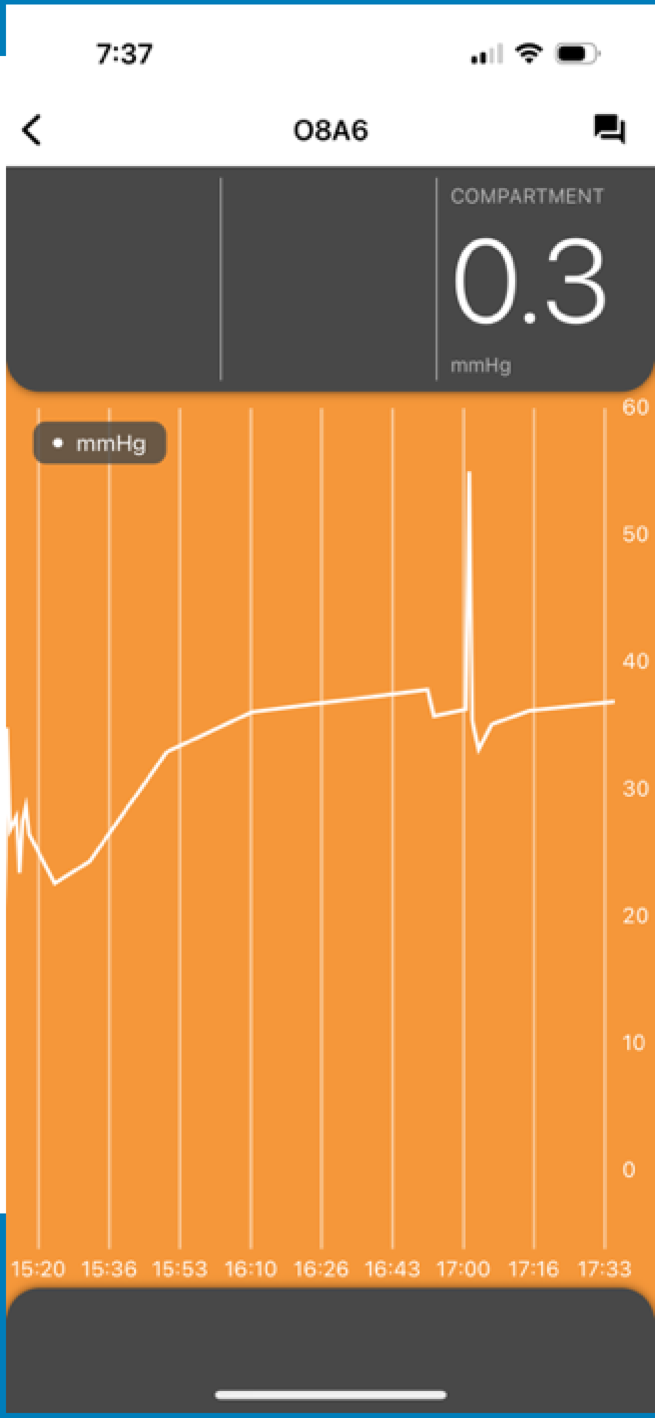
CONSULT ORTHO: Right leg swelling, firmness

EXAM: Patient is intubated, sedated, paralyzed

ECMO access canula in R groin

RLE swollen, firm compared with other side (no motor exam)

- Initial pressures: 20's to about 30 (Diastolic Pressure 60)
- Delta P: ~30, MY01 left in place in anterior compartment
- Pressures steadily increased to 35-37 with diastolic pressures in the 50’s, map of 60.
- → Emergent bedside fasciotomies



Case Outcome & Key Takeaways

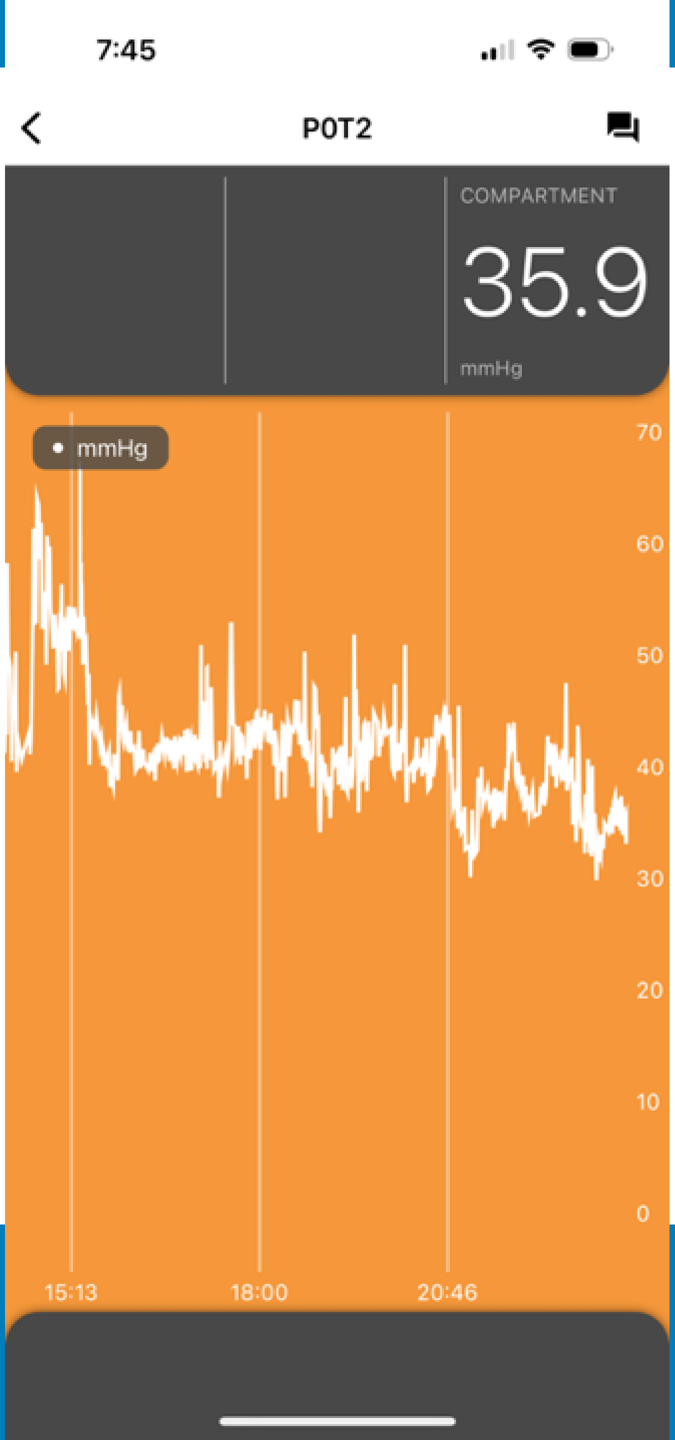
- Saved muscles of the leg, despite ultimate partial foot amputation (some muscle death of anterior compartment at time of fasciotomy)
- Incredibly sick patient with high risk of surgical procedure. More complex decision making
- Steady line indicative of paralyzed patient
- Trend more helpful than initial data points
- Useful adjunct when physical exam is limited

Postop Course ORIF Tibial Tubercle

Significant swelling noted in the OR but preop had been clinically stable. Placed MY01 in anterior compartment in the OR prior to extubation

Initial pressures surprisingly high, but overall trend improved. Clinically remained comfortable and NVI.

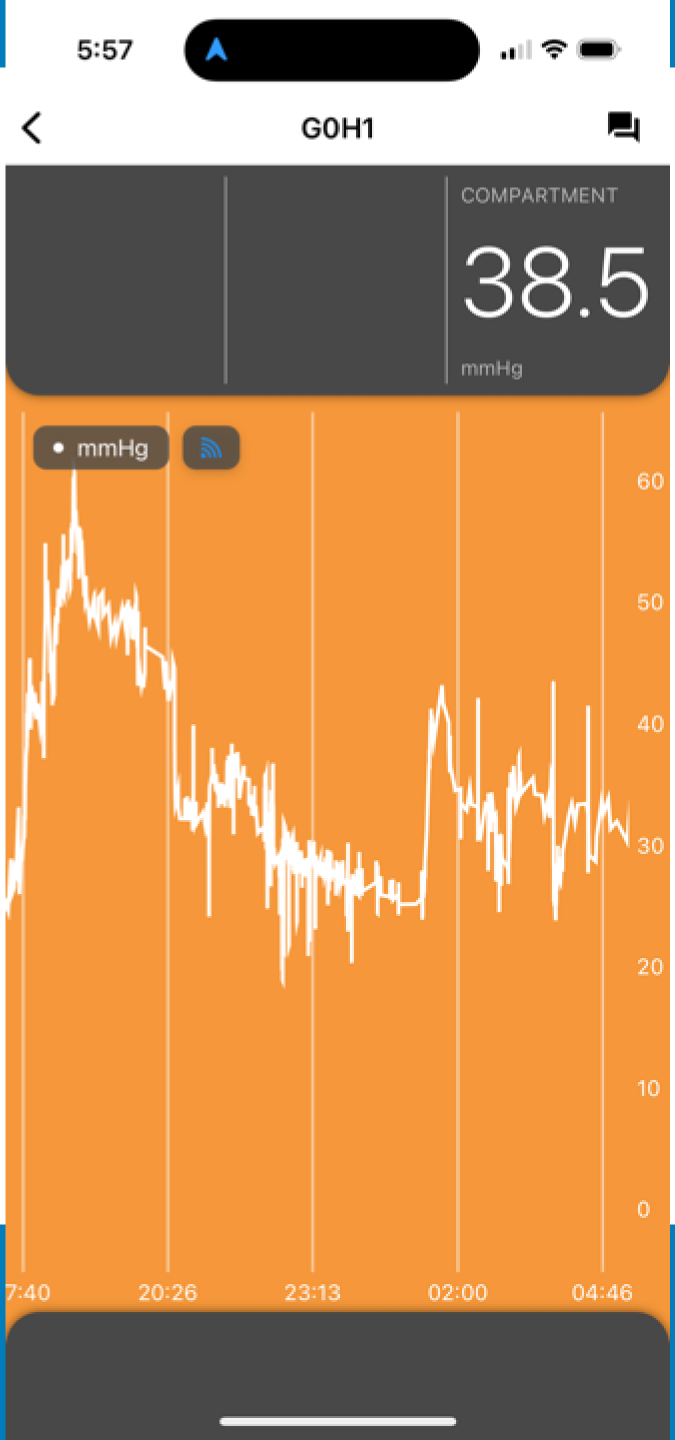
Completely normal postop exam and recovery



Case Outcome & Key Takeaways

- Trend is reliable, matches clinical exam
- Reactive tracing c/w labile postop patient
- Spikes may be related to elevated blood pressure due to postop pain, spasms
- Children can tolerate high pressures – zero clinical signs/symptoms even with pressures >40mmHg
- Good learning case!

- 14 yo boy with midshaft tibia fracture
- Underwent IM nail, uneventful surgery
- MY01 placed at end of case in anterior compartment for monitoring
- NVI and comfortable
- BPs 130/70s
- Nail biter! High pressures but normal exam. Overall downward trajectory



CONSENSUS BUILDING (Or Destroying)

Presenter(s): Schoenecker; Swarup

CORTICES

ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

CONSENSUS BUILDING
(Or Destroying)

Schoenecker Swarup


PGY1

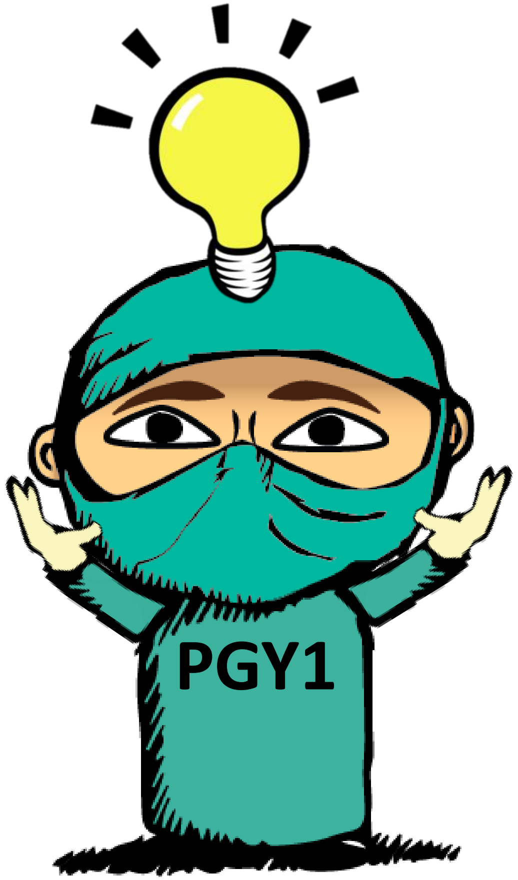
MANAGING JUNIOR CALL

MANAGING JUNIOR CALL

A

MANAGING JUNIOR CALL

A



MANAGING JUNIOR CALL

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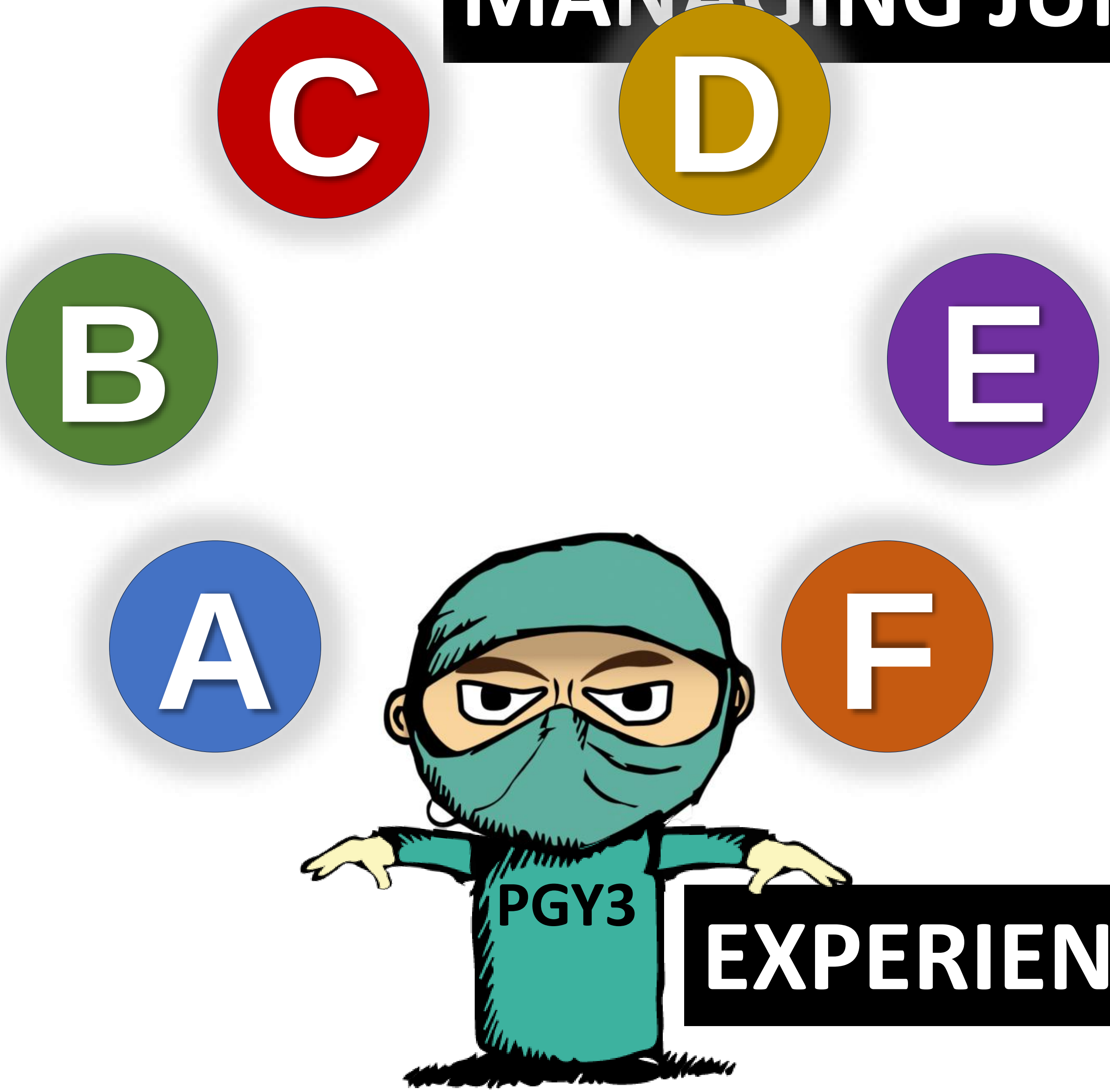
EXPERIENCE

MANAGING JUNIOR CALL



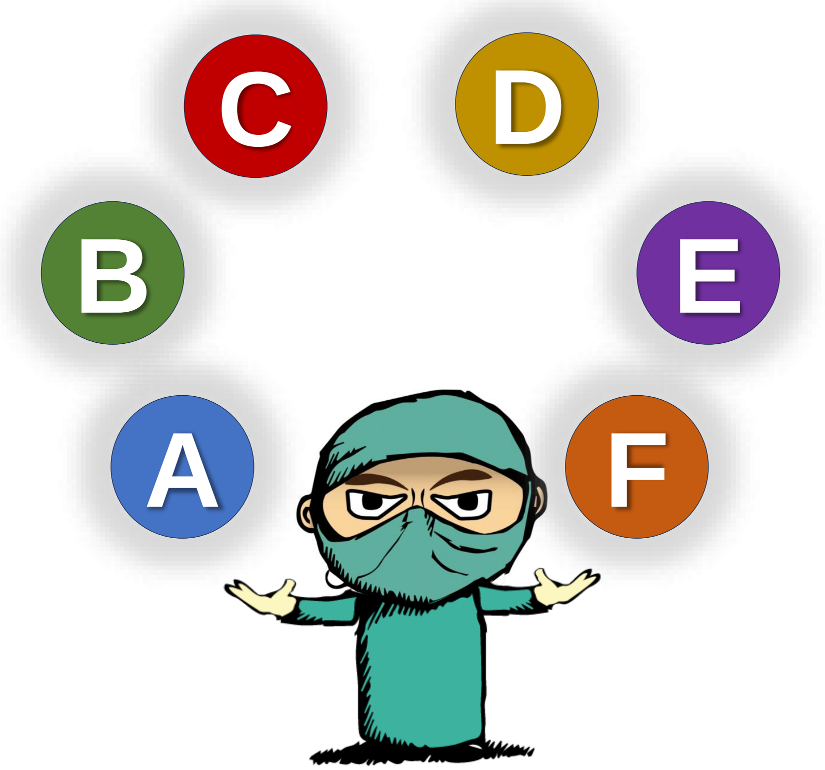
EXPERIENCE

MANAGING JUNIOR CALL

EXPERIENCE

TRAUMA TRIAGE

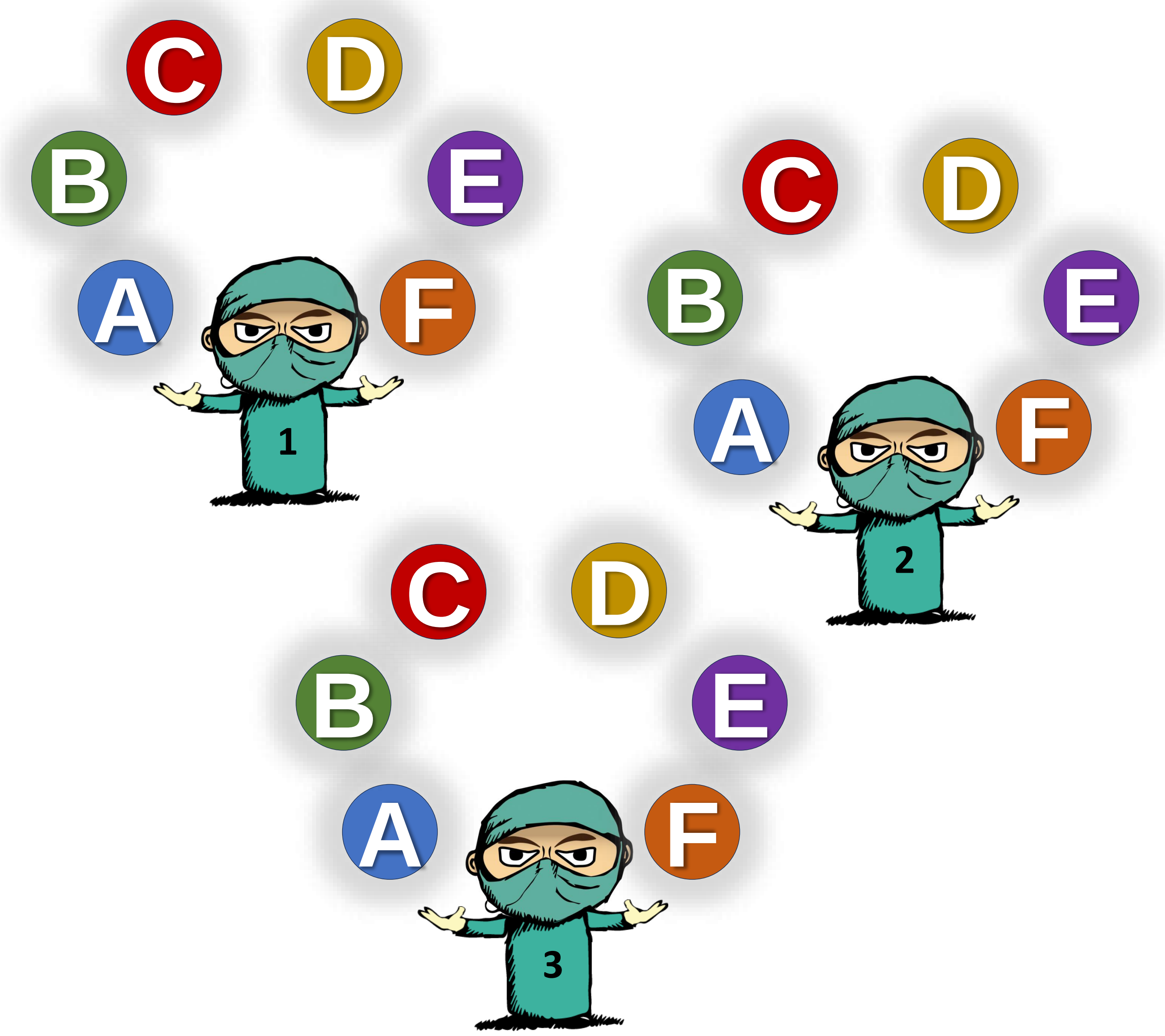
ER TRIAGE



CLINCAL INTUITION

TRAUMA TRIAGE

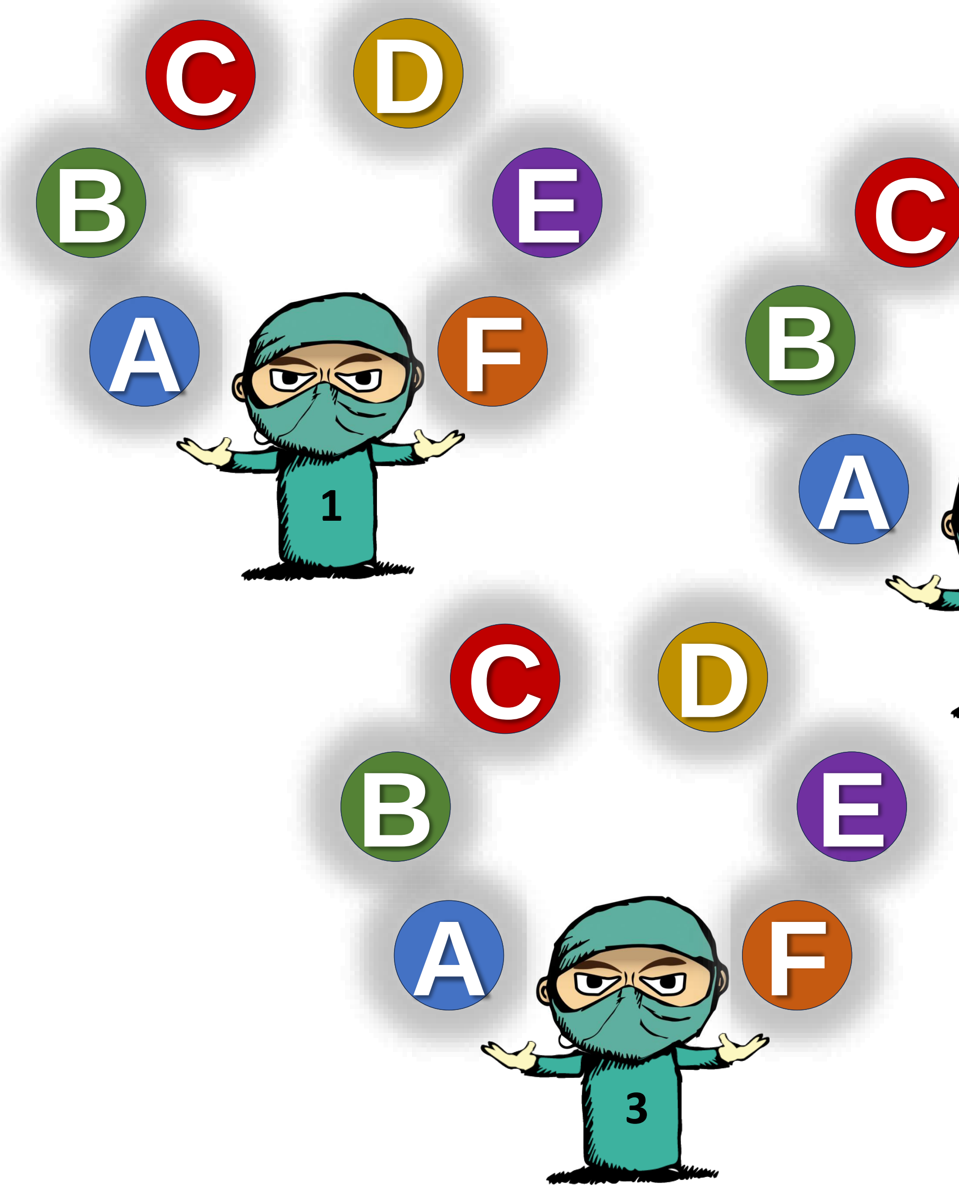
ER TRIAGE



CLINCAL INTUITION

TRAUMA TRIAGE

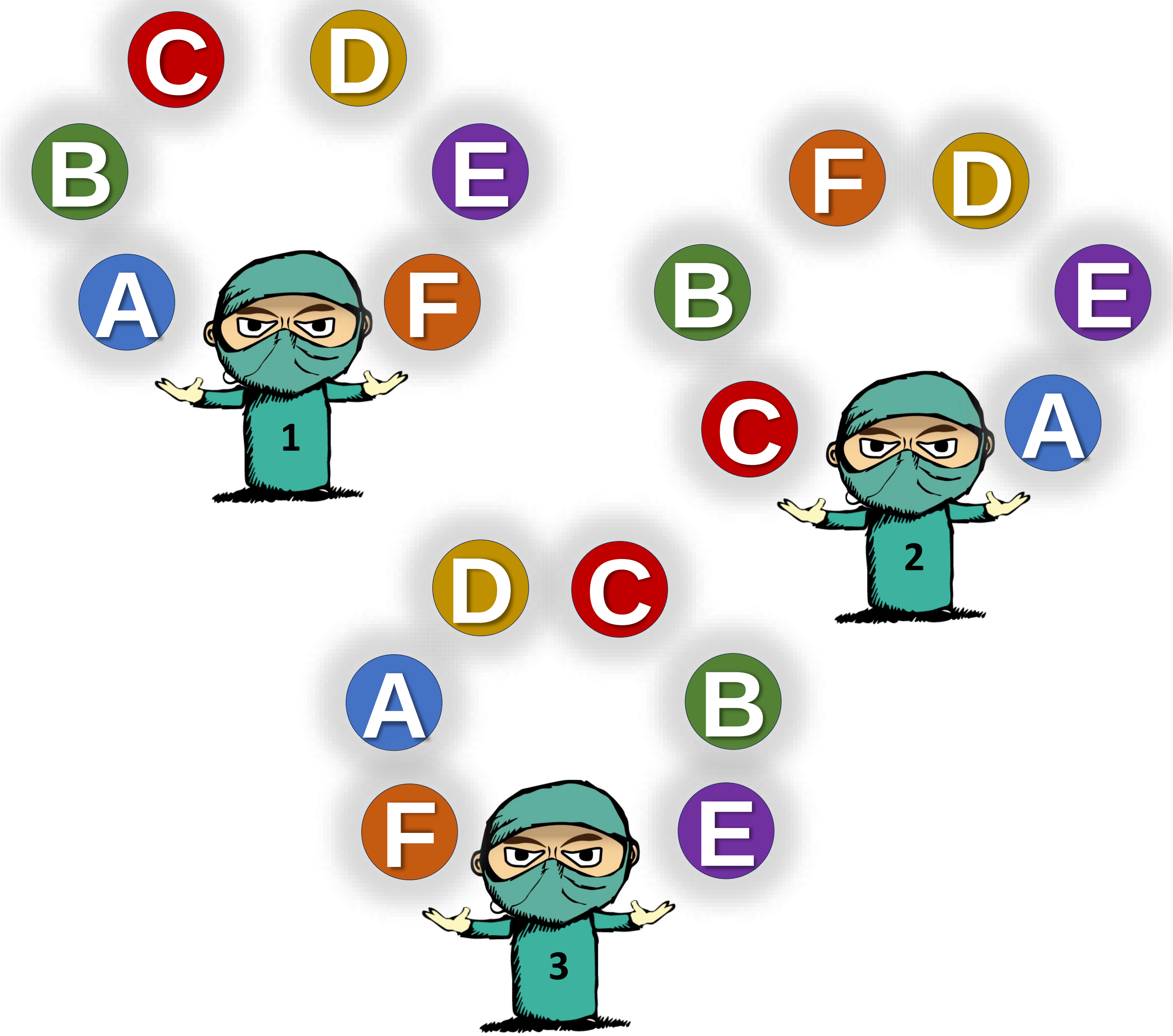
ER TRIAGE



CLINCAL INTUITION

TRAUMA TRIAGE

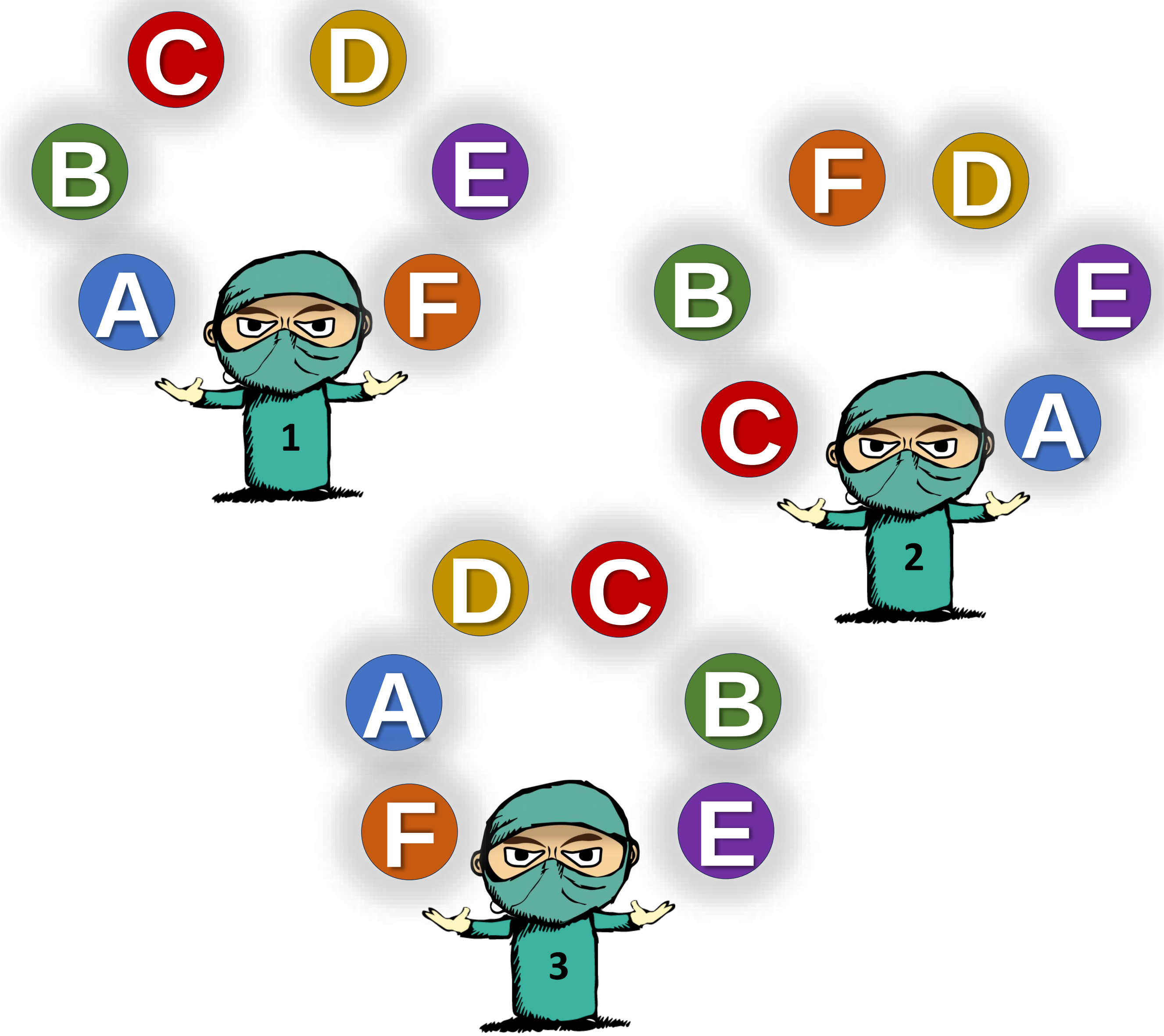
ER TRIAGE



CLINCAL INTUITION

TRAUMA TRIAGE

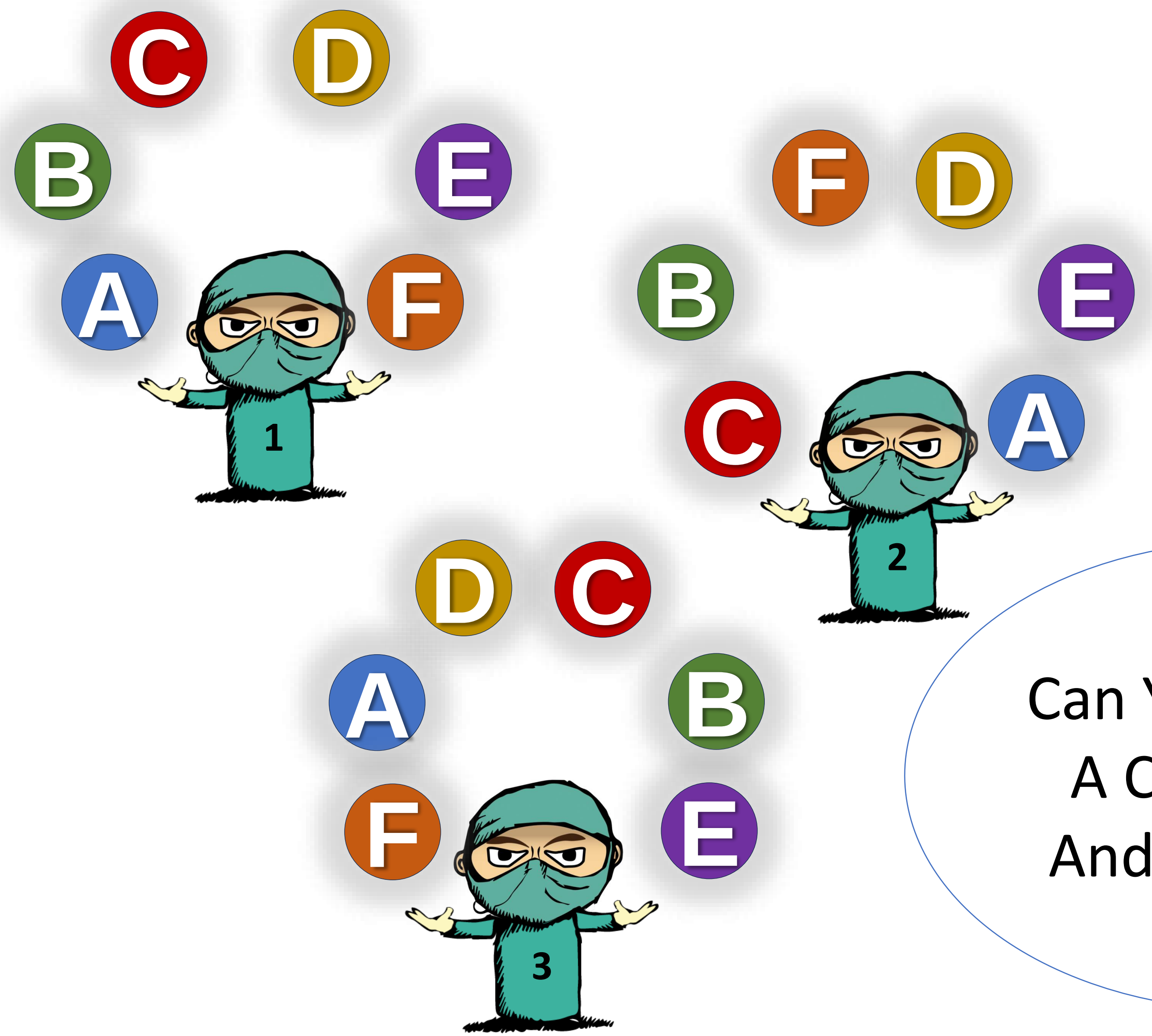
ER TRIAGE



CLINCAL INTUITION

TRAUMA TRIAGE

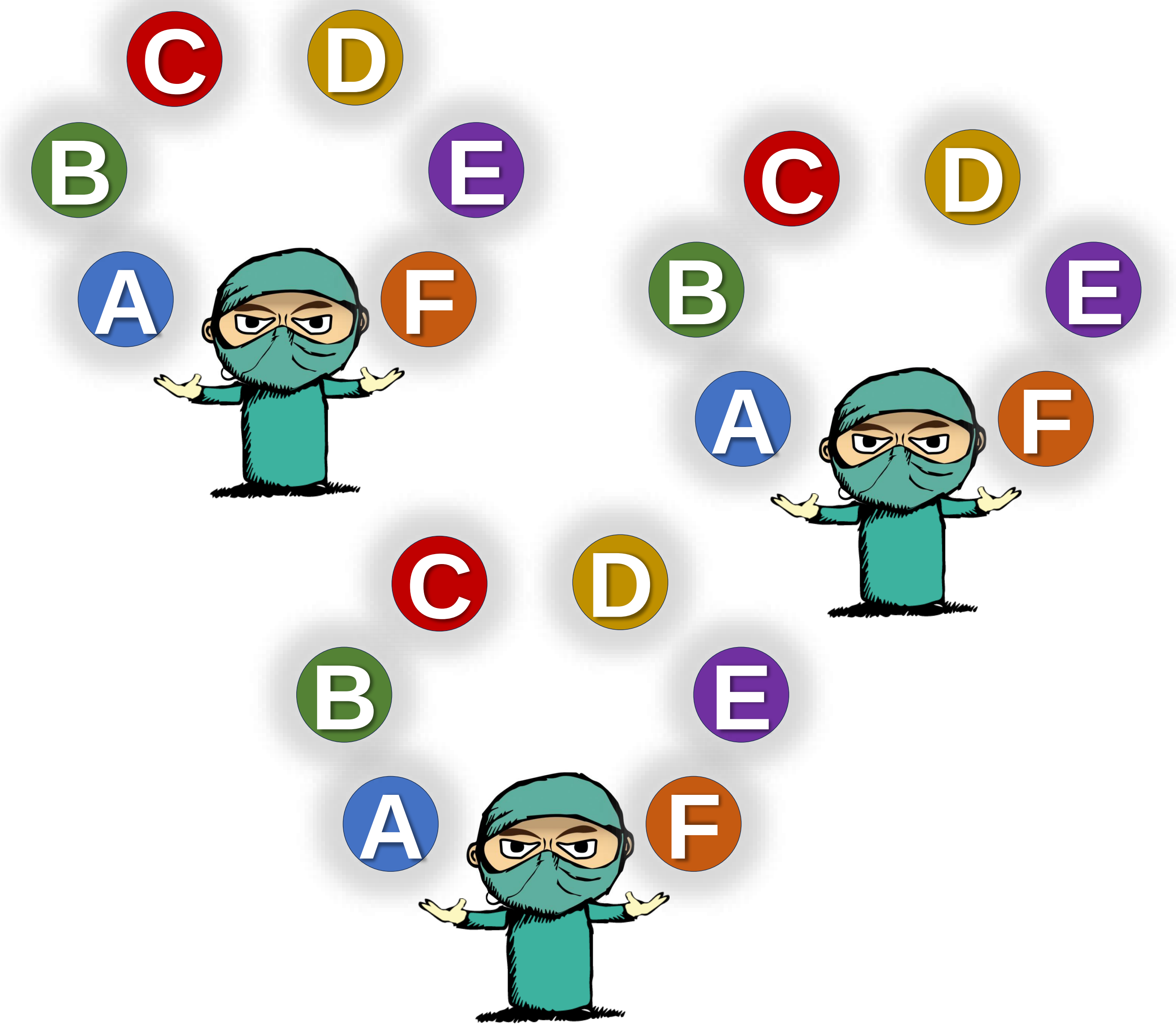
ER TRIAGE

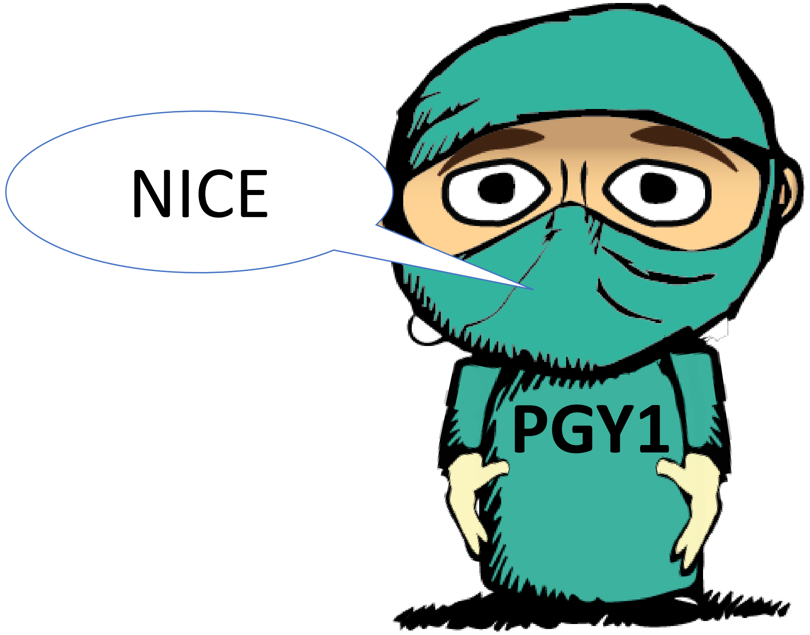


CLINCAL INTUITION

TRAUMA TRIAGE

ER TRIAGE





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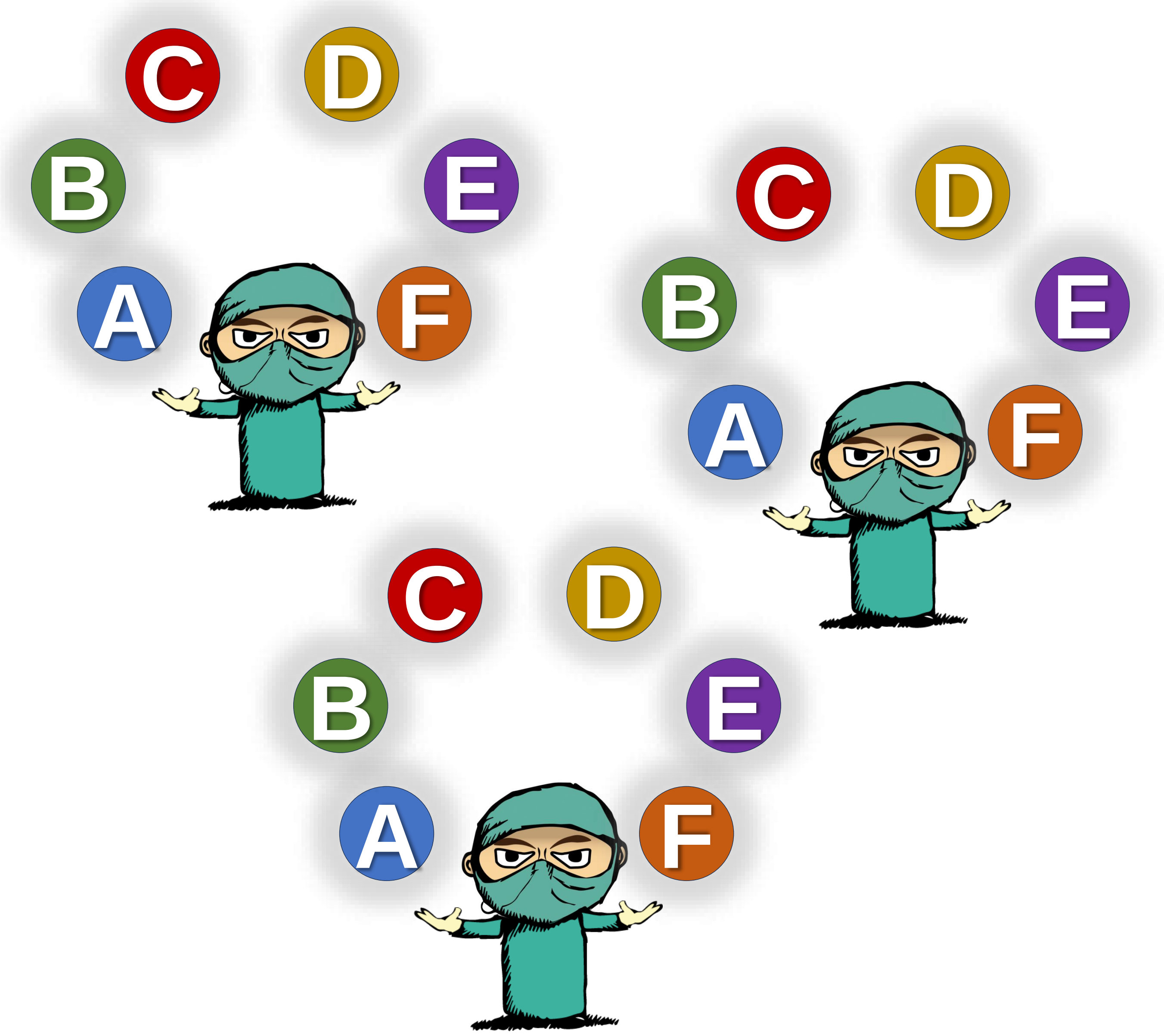
TRAUMA TRIAGE



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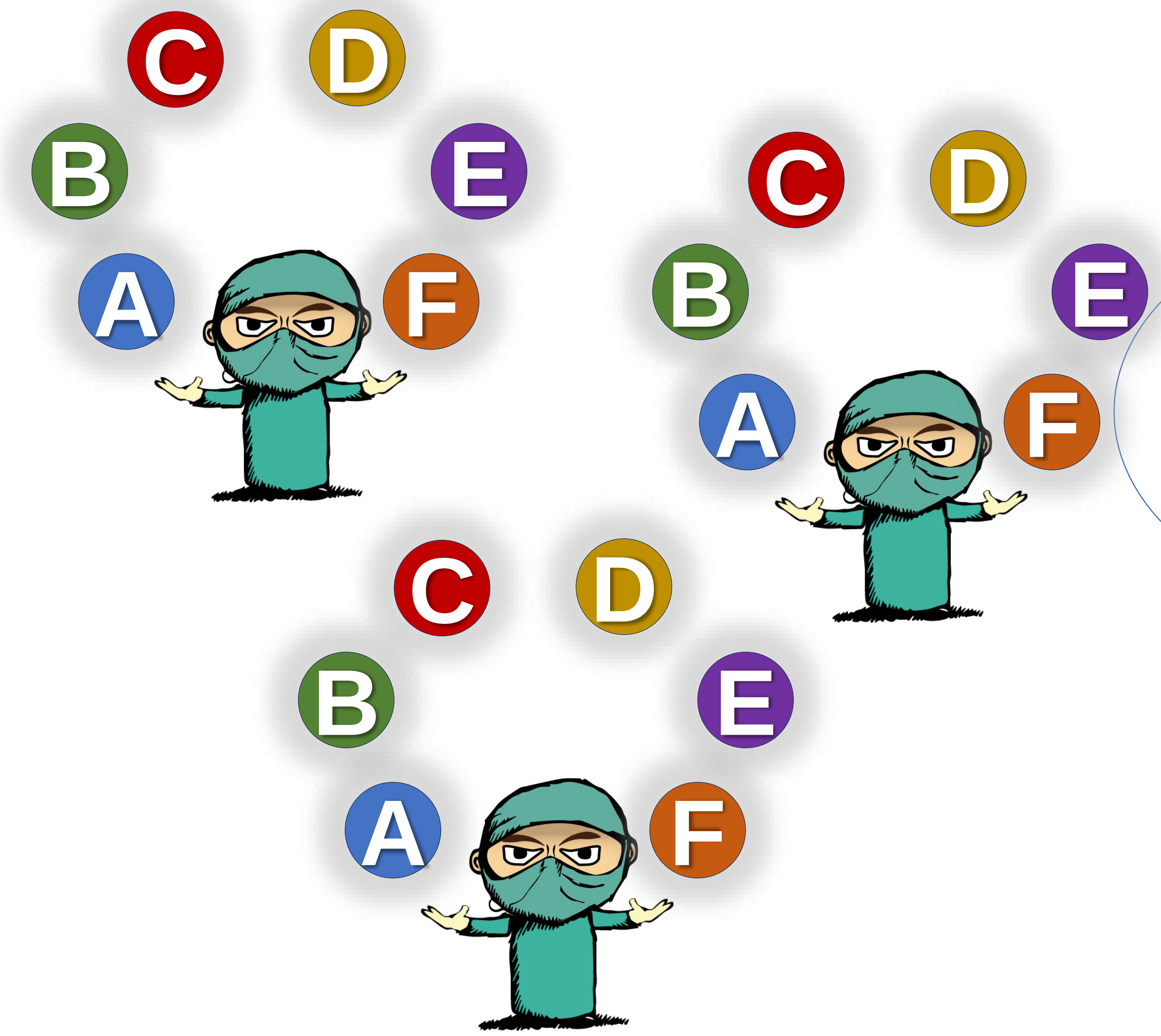


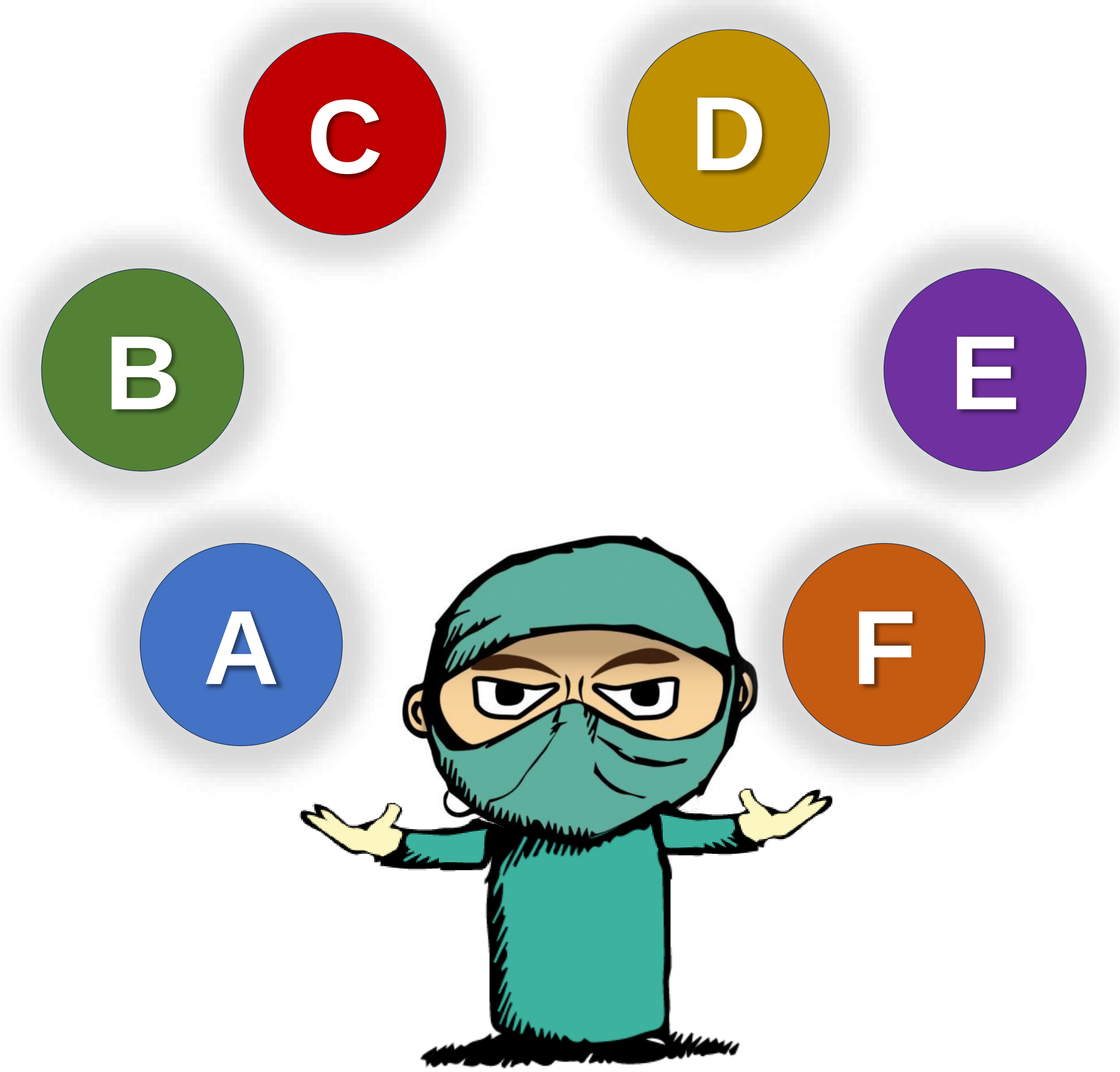
TRAUMA TRIAGE

OR TRIAGE

CLINCAL INTUITION

TRAUMA TRIAGE

OR TRIAGE



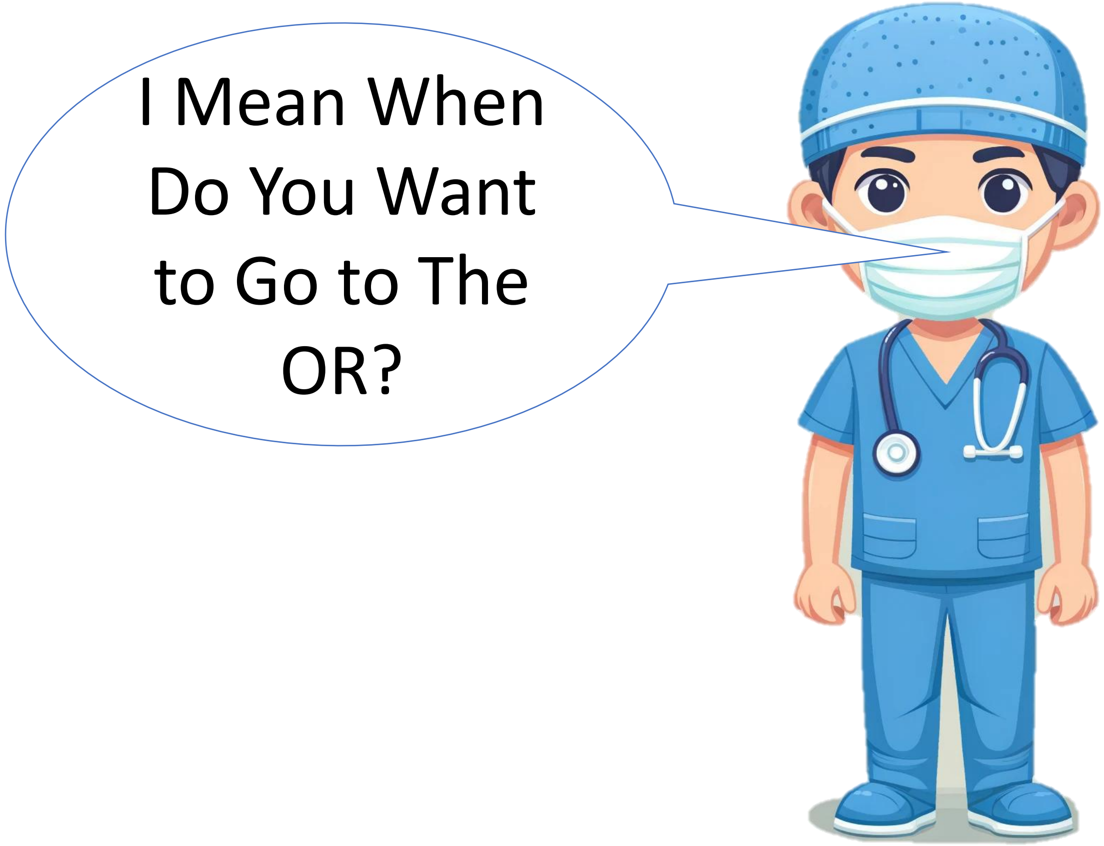
I Mean When Do You Want to Go to The OR?

CLINCAL INTUITION

TRAUMA TRIAGE

OR TRIAGE

- **A** <1 Hour
- **B** <2 Hours
- **C** <6 Hours
- **D** <24 Hours
- **E** <1 Week



CLINCAL INTUITION

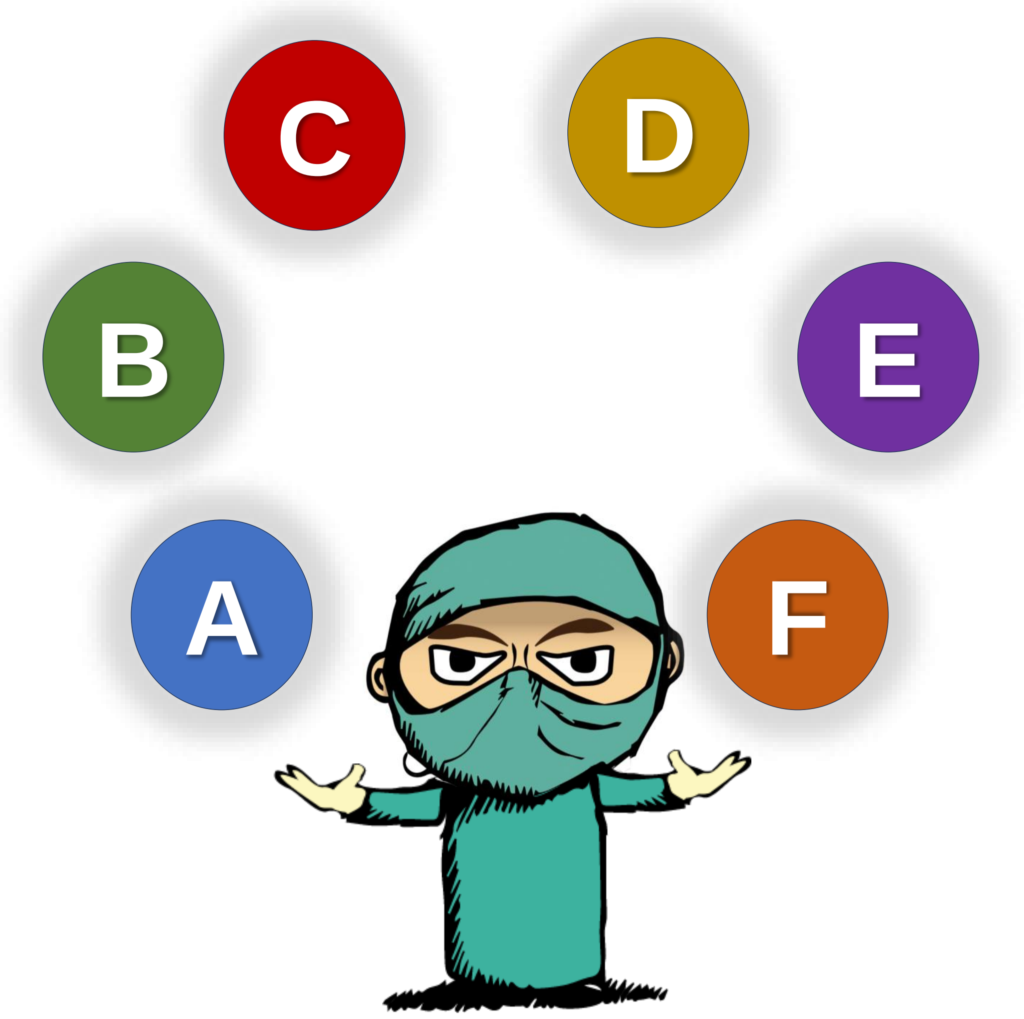
TRAUMA TRIAGE

OR TRIAGE

A < B < C < D < E

What Order Do You Want to Go In?

CLINCAL INTUITION



TRAUMA TRIAGE

OR TRIAGE

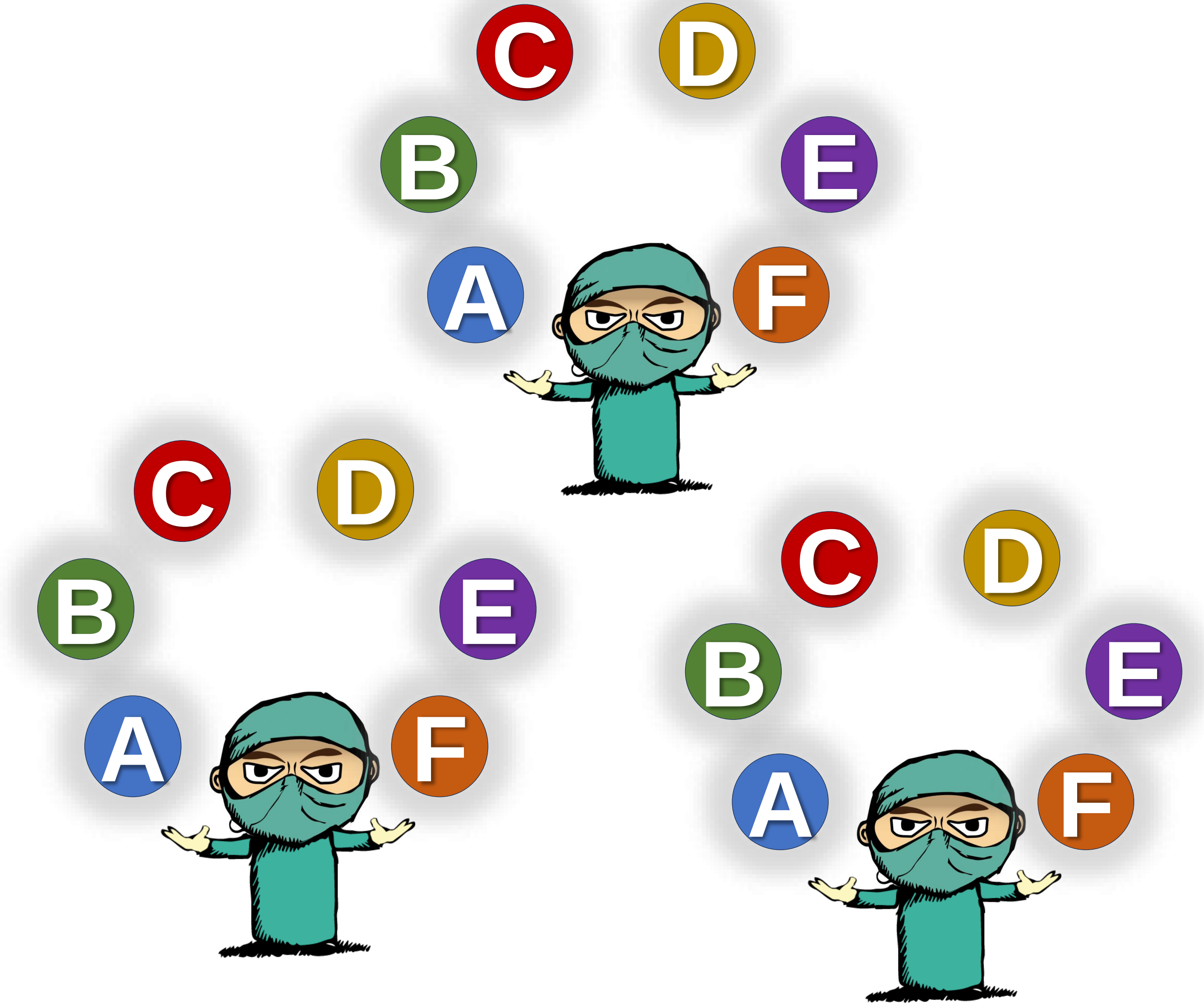
ER TRIAGE

CLINCAL INTUITION

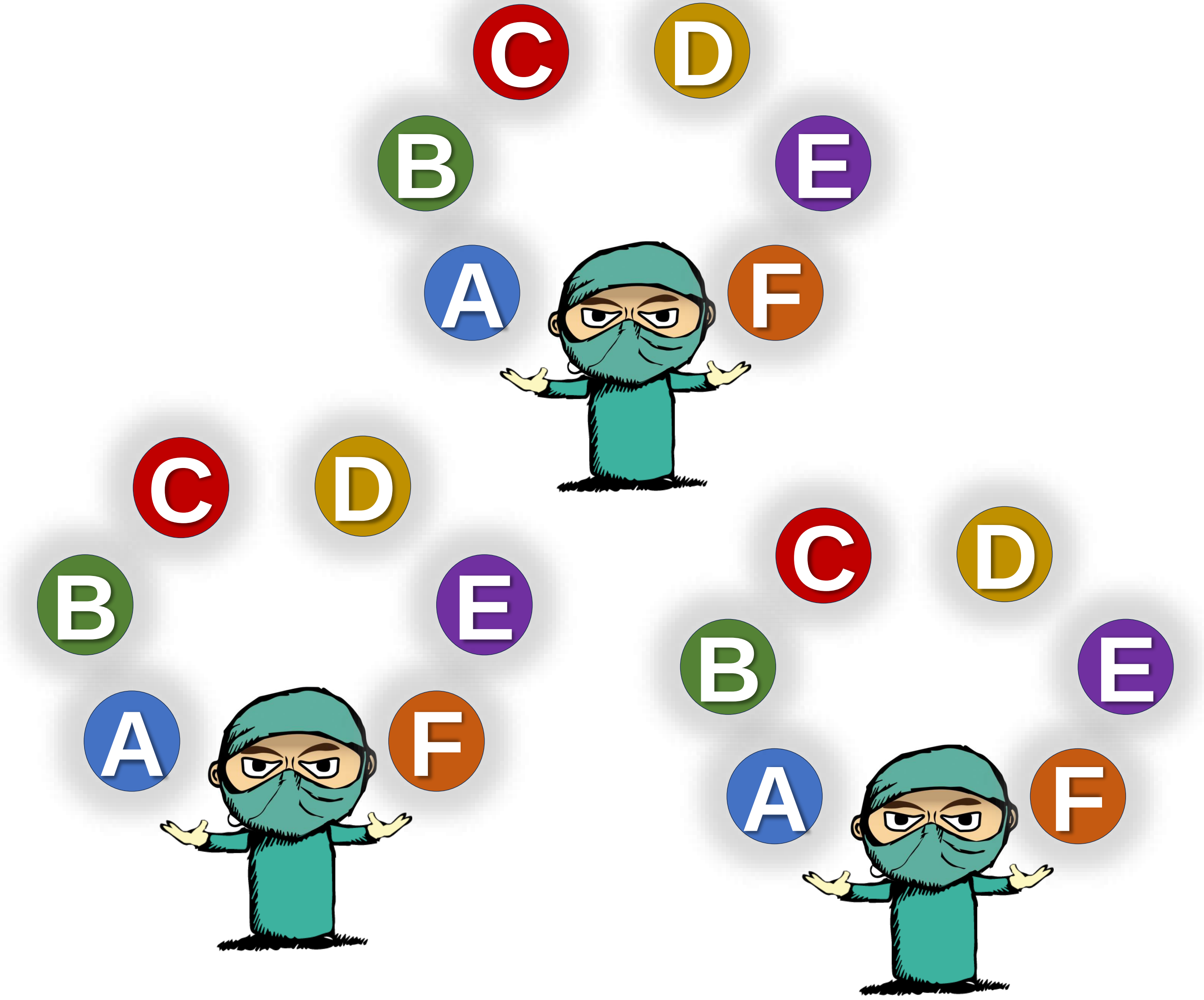
TRAUMA TRIAGE

OR TRIAGE

ER TRIAGE



CLINCAL INTUITION



TRAUMA TRIAGE

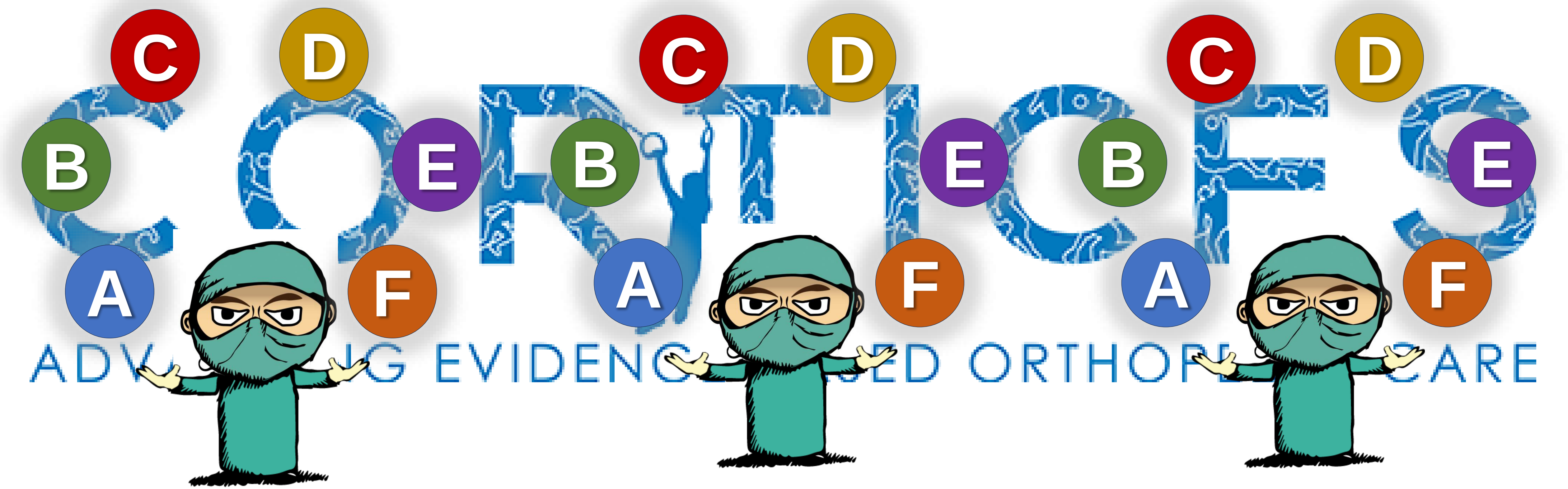
OR TRIAGE

ER TRIAGE

CLINCAL INTUITION ORDICAL HIERARCHY (CLIOH)

MODIFIED DELPHI

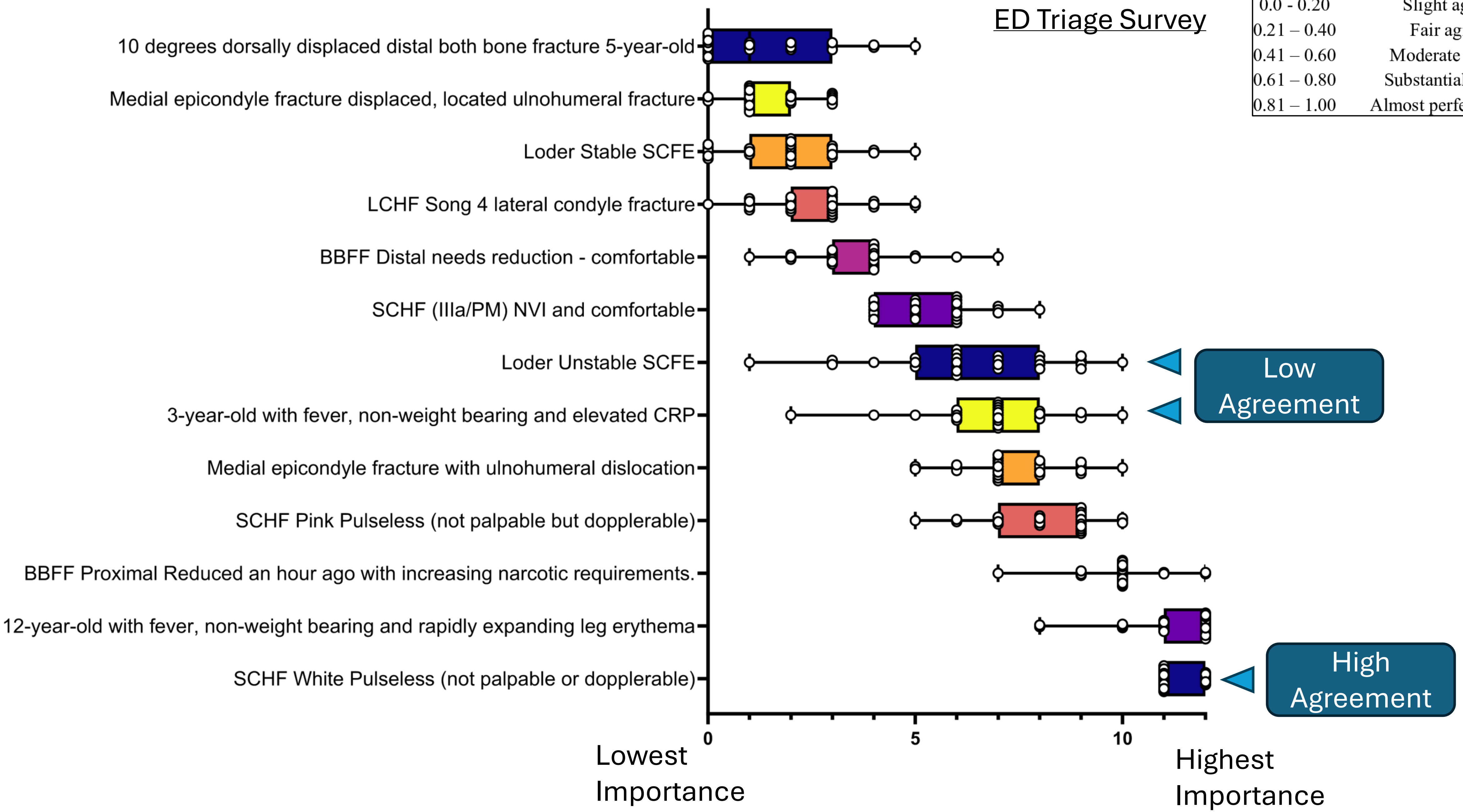
Iterative, anonymous technique
Target: ICC > 0.75 ("Good" to "Excellent" agreement)
Minimizes bias, focuses on clinical merit



CLINCAL INTUITION ORDICAL HIERARCHY (CLIOH)

Question 1) Which of these should you see first on call?

Kappa	Interpretation
< 0	No agreement
0.0 - 0.20	Slight agreement
0.21 – 0.40	Fair agreement
0.41 – 0.60	Moderate agreement
0.61 – 0.80	Substantial agreement
0.81 – 1.00	Almost perfect agreement



Low Importance

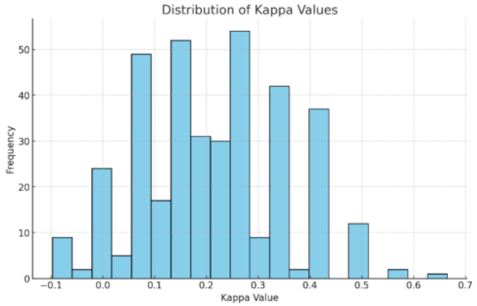
High Importance

Δ Score 2

	Sheffer	Rosenfeld	Heyworth	Kadado	Sanders	Li	Truong	Beebe	Blumberg	Johnson	Owens	Ramalingam	Shore	Baldwin	Copley	Denning	Shen	Sigrist	Spence	Stepanovich	De	Larson	Miller	Lempert	Meyer	Riccio	Dell	Laine
SCHF White Pulseless (not palpable or dopplerable)	11	11	11	11	12	12	11	11	11	11	11	11	11	12	12	12	11	11	12	11	12	11	11	11	12	12	11	11
12-year-old with fever, non-weight bearing and rapidly expanding leg erythema	12	10	12	8	8	11	12	12	11	12	12	12	12	10	10	11	12	12	11	12	11	12	12	12	11	11	12	12
BBFF Proximal Reduced an hour ago with increasing narcotic requirements.	7	12	9	12	11	10	10	10	11	10	10	10	10	10	9	9	10	10	10	10	10	10	10	10	9	10	10	10
SCHF Pink Pulseless (not palpable but dopplerable)	9	9	10	10	9	7	8	5	8	9	9	8	9	7	9	10	9	9	8	9	6	8	9	9	7	7	6	7
Medial epicondyle fracture with ulnohumeral dislocation	6	7	8	9	10	9	7	9	7	7	7	7	8	5	6	7	8	5	7	7	8	9	6	7	9	8	8	9
3-year-old with fever, non-weight bearing and elevated CRP	6	7	6	6	7	8	7	7	9	2	8	9	5	10	8	7	7	6	6	8	7	7	7	7	4	9	7	8
Loder Unstable SCFE	10	1	5	4	5	6	8	7	6	7	6	3	6	8	9	7	6	6	9	6	9	3	8	7	9	5	8	6
SCHF (IIIa/PM) NVI and comfortable	7	7	7	5	6	5	4	4	5	6	4	6	6	6	4	4	5	8	4	5	5	6	4	5	6	6	6	5
BBFF Distal needs reduction - comfortable	3	4	3	6	3	4	3	7	4	4	4	5	4	3	1	4	4	4	4	4	2	5	3	3	2	4	2	4
LCHF Song 4 lateral condyle fracture	4	3	3	2	4	2	3	2	3	5	2	2	3	1	5	1	3	3	3	3	3	1	0	1	1	2	4	2
Loder Stable SCFE	2	0	3	0	2	0	1	1	2	2	3	0	0	3	3	2	2	3	1	2	4	0	2	4	5	2	2	3
Medial epicondyle fracture displaced, located ulnohumeral fracture	1	3	1	1	1	3	3	1	1	0	2	2	3	1	2	1	1	1	2	1	1	3	1	0	3	0	2	1
10 degrees dorsally displaced distal both bone fracture 5-year-old	0	4	0	4	0	1	1	2	0	3	0	3	1	2	0	3	0	0	1	0	0	3	5	2	0	2	0	0

Low Agreement

High Agreement

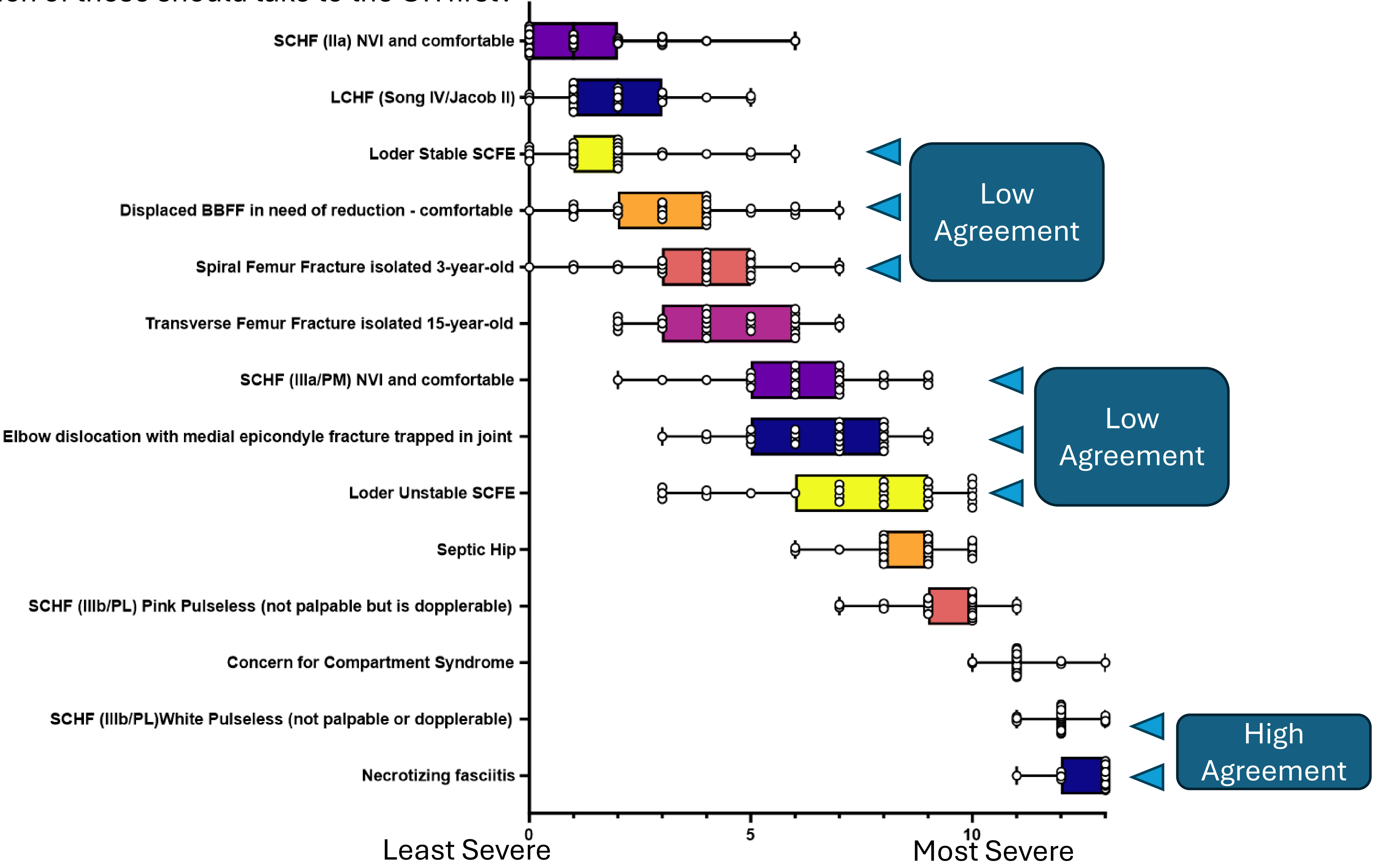


Adv Kappa:
0.213+/- 0.138

"Slight to Fair Agreement"

	Sheffer	Rosenfeld	Heyworth	Kadado	Sanders	Li	Truong	Beebe	Blumberg	Johnson	Owens	Ramalingam	Shore	Baldwin	Copley	Denning	Schoeneck	Sigrist	Spence	Stepanovich	De	Larson	Miller	Lempert	Meyer	Riccio	Dell	Laine
Sheffer	1	0.150327	0.5	0.166667	0.416667	-0.08333	0.166667	0.155844	0.25	0.24026	0.245161	0.083333	0.166667	0.083333	0.171975	0.065359	0.324675	0.18239	0.065359	0.345912	-0.02632	0.18239	0.16129	0.412903	0.071429	0.083333	0.245161	0.24026
Rosenfeld	0.150327	1	0.155844	0.264151	0.083333	0.166667	0.306667	0.059211	0.25	0.24026	0.245161	0.171975	0.420382	0	0.094937	0.121622	0.315789	0.166667	0.311258	0.177215	0.083333	0.100629	0.083333	0.166667	-0.01299	0.025	0.10625	0.083333
Heyworth	0.5	0.155844	1	0.264151	0.25	-0.08333	0.225166	0.18239	0.25	0.089172	0.259494	0.071429	0.235294	0.150327	0.166667	0.171975	0.409091	0.320261	0.089172	0.5	0.083333	0.089172	0.166667	0.416667	0.259494	0.111801	0.10625	0.25
Kadado	0.166667	0.264151	0.264151	1	0.083333	0.25	0.025	0.259494	0.166667	0.006369	0.077419	0.177215	0.077419	0.012658	-0.09032	0.094937	0.177215	0.089172	-0.08333	0.25	-0.01299	0.166667	0.012658	0.012658	-0.08333	0.077419	-0.01299	0.16129
Sanders	0.416667	0.083333	0.25	0.083333	1	-2.22E-16	0.083333	0.083333	0.25	0.166667	0.083333	-2.22E-16	0.083333	0.25	0.166667	0.25	0.083333	0	0.25	0.166667	0.25	0	0.166667	0.25	0.083333	0.25	0.25	0
Li	-0.08333	0.166667	-0.08333	0.25	-2.22E-16	1	0.166667	0.166667	0.25	0.083333	0.333333	0.166667	0.416667	0.166667	0.083333	0.166667	0.166667	0.166667	0.333333	0.25	0.333333	0.25	0.083333	0	0.25	0.5	0.166667	0.416667
Truong	0.166667	0.306667	0.225166	0.025	0.083333	0.166667	1	0.412903	0.25	0.259494	0.33758	0.333333	0.412903	0.139073	0.018868	0.139073	0.329032	0.397351	0.412903	0.245161	0.1875	0.35	0.254777	0.405229	-0.06962	0.111801	0.264151	0.1875
Beebe	0.155844	0.059211	0.18239	0.259494	0.083333	0.166667	0.412903	1	0.083333	0.235294	0.333333	0.254777	0.192547	0.16129	0.012658	0.209459	0.245161	0.259494	0.235294	0.259494	0.18239	0.333333	0.329032	0.24026	-0.0974	0.315789	0.083333	0.259494
Blumberg	0.25	0.25	0.25	0.166667	0.25	0.25	0.25	0.083333	1	0.25	0.333333	0.25	0.25	0.025	0.012658	0.333333	0.416667	0.416667	0.416667	0.503185	0.25	0.25	0.083333	0.166667	0.245161	0.100629	0.320261	0.416667
Johnson	0.24026	0.24026	0.089172	0.006369	0.166667	0.083333	0.259494	0.235294	0.25	1	0.409091	0.409091	0.424051	0.089172	0.089172	0.324675	0.490196	0.26875	0.24026	0.341772	0.155844	0.16129	0.405229	0.245161	-0.00645	0.315789	0.324675	0.324675
Owens	0.245161	0.245161	0.259494	0.077419	0.083333	0.333333	0.33758	0.333333	0.333333	0.409091	1	0.412903	0.420382	0.094937	0.416667	0.16129	0.664516	0.341772	0.577922	0.416667	0.155844	0.16129	0.16129	0.329032	0.077419	0.401316	0.401316	0.580645
Ramalingam	0.083333	0.171975	0.071429	0.177215	0	0.166667	0.333333	0.254777	0.25	0.409091	0.412903	1	0.333333	0.077419	0	0.094937	0.324675	0.33758	0.171975	0.166667	0.077419	0.324675	0.405229	0.24026	0.006369	0.320261	0.324675	0.329032
Shore	0.166667	0.420382	0.235294	0.077419	0.083333	0.416667	0.412903	0.192547	0.25	0.424051	0.420382	0.333333	1	0.077419	-0.00645	0.018868	0.416667	0.409091	0.33758	0.416667	0.24026	0.254777	0.341772	0.259494	0.094937	0.26875	0.177215	0.329032
Baldwin	0.083333	0	0.150327	0.012658	0.25	0.166667	0.139073	0.16129	0.025	0.089172	0.094937	0.077419	0.077419	1	0.171975	0.16129	0.083333	0.24026	0.089172	0.071429	0.177215	0.094937	0.25	0.24026	0.192547	0.333333	0.177215	0.177215
Copley	0.171975	0.094937	0.166667	-0.09032	0.166667	0.083333	0.018868	0.012658	0.012658	0.089172	0.416667	0	-0.00645	0.171975	1	0.177215	0.254777	0.065359	0.33758	0.16129	0.083333	-0.03311	-0.06289	0.100629	0.16129	0.16129	0.18239	0.166667
Denning	0.065359	0.121622	0.171975	0.094937	0.25	0.166667	0.139073	0.209459	0.333333	0.324675	0.16129	0.094937	0.018868	0.16129	0.177215	1	0.155844	0.083333	0.397351	0.259494	0.177215	-0.06962	0.089172	0.16129	0.24026	0.166667	0.177215	0.012658
Schoeneck	0.324675	0.315789	0.409091	0.177215	0.083333	0.166667	0.329032	0.245161	0.416667	0.490196	0.664516	0.324675	0.416667	0.083333	0.254777	0.155844	1	0.424051	0.493506	0.506329	0.155844	0.25	0.155844	0.333333	0	0.25	0.33758	0.493506
Sigrist	0.18239	0.166667	0.320261	0.089172	1.11E-16	0.166667	0.397351	0.259494	0.416667	0.26875	0.341772	0.33758	0.409091	0.24026	0.065359	0.083333	0.424051	1	0.177215	0.490196	0.111801	0.405229	0.192547	0.177215	0.012658	0.1875	0.111801	0.43125
Spence	0.065359	0.311258	0.089172	-0.08333	0.25	0.333333	0.412903	0.235294	0.416667	0.24026	0.577922	0.171975	0.33758	0.089172	0.33758	0.397351	0.493506	0.177215	1	0.259494	0.493506	0.012658	0.083333	0.25	0.24026	0.25	0.333333	0.245161
Stepanovich	0.345912	0.177215	0.5	0.25	0.166667	0.25	0.245161	0.259494	0.503185	0.341772	0.416667	0.166667	0.416667	0.071429	0.16129	0.259494	0.506329	0.490196	0.259494	1	0.18239	0.324675	0.33758	0.416667	0.094937	0.333333	0.333333	0.424051
De	-0.02632	0.083333	0.083333	-0.01299	0.25	0.333333	0.1875	0.18239	0.25	0.155844	0.155844	0.077419	0.24026	0.177215	0.083333	0.177215	0.155844	0.111801	0.493506	0.18239	1	0.18239	0.24026	0.25	0.493506	0.25	0.405229	0.225166
Larson	0.18239	0.100629	0.089172	0.166667	0	0.25	0.35	0.333333	0.25	0.16129	0.16129	0.324675	0.254777	0.094937	-0.03311	-0.06962	0.25	0.405229	0.012658	0.324675	0.18239	1	0.259494	0.18239	0.089172	0.225166	0.254777	0.33758
Miller	0.16129	0.083333	0.166667	0.012658	0.166667	0.083333	0.254777	0.329032	0.083333	0.405229	0.16129	0.405229	0.341772	0.25	-0.06289	0.089172	0.155844	0.192547	0.083333	0.33758	0.24026	0.259494	1	0.401316	0.16129	0.405229	0.230263	0.324675
Lempert	0.412903	0.166667	0.416667	0.012658	0.25	0	0.405229	0.24026	0.166667	0.245161	0.329032	0.24026	0.259494	0.24026	0.100629	0.16129	0.333333	0.177215	0.25	0.416667	0.25	0.18239	0.401316	1	0.245161	0.235294	0.483444	0.254777
Meyer	0.071429	-0.01299	0.259494	-0.08333	0.083333	0.25	-0.06962	-0.0974	0.245161	-0.00645	0.077419	0.006369	0.094937	0.192547	0.16129	0.24026	0	0.012658	0.24026	0.094937	0.493506	0.089172	0.16129	0.245161	1	0.083333	0.16129	0.329032
Riccio	0.083333	0.025	0.111801	0.077419	0.25	0.5	0.111801	0.315789	0.100629	0.315789	0.401316	0.320261	0.26875	0.333333	0.16129	0.166667	0.25	0.1875	0.25	0.333333	0.25	0.225166	0.405229	0.235294	0.083333	1	0.306667	0.333333
Dell	0.245161	0.10625	0.10625	-0.01299	0.25	0.166667	0.264151	0.083333	0.320261	0.324675	0.401316	0.324675	0.177215	0.177215	0.18239	0.177215	0.33758	0.111801	0.333333	0.333333	0.405229	0.254777	0.230263	0.483444	0.16129	0.306667	1	0.16129
Laine	0.24026	0.083333	0.25	0.16129	0	0.416667	0.1875	0.259494	0.416667	0.324675	0.580645	0.329032	0.329032	0.177215	0.166667	0.012658	0.493506	0.43125	0.245161	0.424051	0.225166	0.33758	0.324675	0.254777	0.329032	0.333333	0.16129	1

Question 2) Which of these should take to the OR first?



Low Importance

High Importance

Δ Score 2

	Sheffer	Rosenfel	Heyworth	Kadado	Li	Sanders	Truong	Beebe	Blumberg	Johnson	Owens	Ramaling	Shore	Baldwin	Copley	Denning	Shen	Sigrist	Spence	Stepanov	De	Larson	Miller	Lempert	Meyer	Riccio	Dell	Laine
Necrotizing fasciitis	13	13	13	11	13	13	13	12	13	13	13	12	13	13	13	13	13	13	12	13	13	13	12	12	12	13	13	13
SCHF (IIIb/PL)White Pulseless (not palpable or dopplerable)	12	12	12	13	12	12	12	12	11	12	12	13	12	12	11	12	12	11	13	12	12	12	11	13	13	12	12	12
Concern for Compartment Syndrome	11	11	10	11	11	11	11	11	12	11	11	11	11	11	12	11	11	12	11	11	11	11	13	11	10	11	11	11
SCHF (IIIb/PL) Pink Pulseless (not palpable but is dopplerable)	8	10	11	11	10	9	9	7	9	10	9	10	10	8	10	10	10	8	9	10	9	9	10	10	11	10	7	8
Septic Hip	9	8	9	7	8	10	8	10	10	6	6	9	8	9	8	9	9	10	8	9	10	10	8	8	8	9	9	10
Loder Unstable SCFE	10	3	3	8	7	5	9	10	6	8	10	7	7	10	9	8	8	9	10	4	4	3	9	7	9	8	10	9
Elbow dislocation with medial epicondyle fracture trapped in joint	7	5	7	8	9	8	8	8	8	5	5	3	6	4	7	7	7	6	6	8	7	7	4	9	6	5	8	6
SCHF (IIIa/PM) NVI and comfortable	6	9	8	5	5	6	3	6	5	9	7	6	9	7	2	6	6	7	7	7	8	8	7	5	6	7	4	6
Transverse Femur Fracture isolated 15-year-old	5	6	4	4	3	7	6	2	3	2	7	6	4	6	5	4	3	2	4	6	6	5	5	4	4	2	6	5
Spiral Femur Fracture isolated 3-year-old	1	7	3	3	4	4	5	3	5	5	4	7	4	4	0	5	5	1	5	4	2	4	4	2	6	3	5	4
Displaced BBFF in need of reduction - comfortable	2	3	5	7	6	1	4	5	6	4	4	2	4	3	3	0	4	4	2	3	1	6	4	4	1	3	1	4
LCHF (Song IV/Jacob II)	4	0	1	2	2	3	2	3	1	1	1	1	2	2	6	2	1	5	0	1	5	0	2	0	0	2	2	0
Loder Stable SCFE	3	2	1	1	1	1	1	1	2	5	2	1	1	2	4	1	1	3	2	0	3	2	2	5	3	0	0	2
SCHF (IIa) NVI and comfortable	0	2	4	0	0	1	0	1	0	0	0	3	0	0	1	3	1	0	2	3	0	1	0	1	2	6	3	1

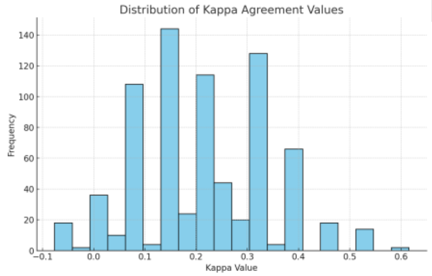
Low Agreement

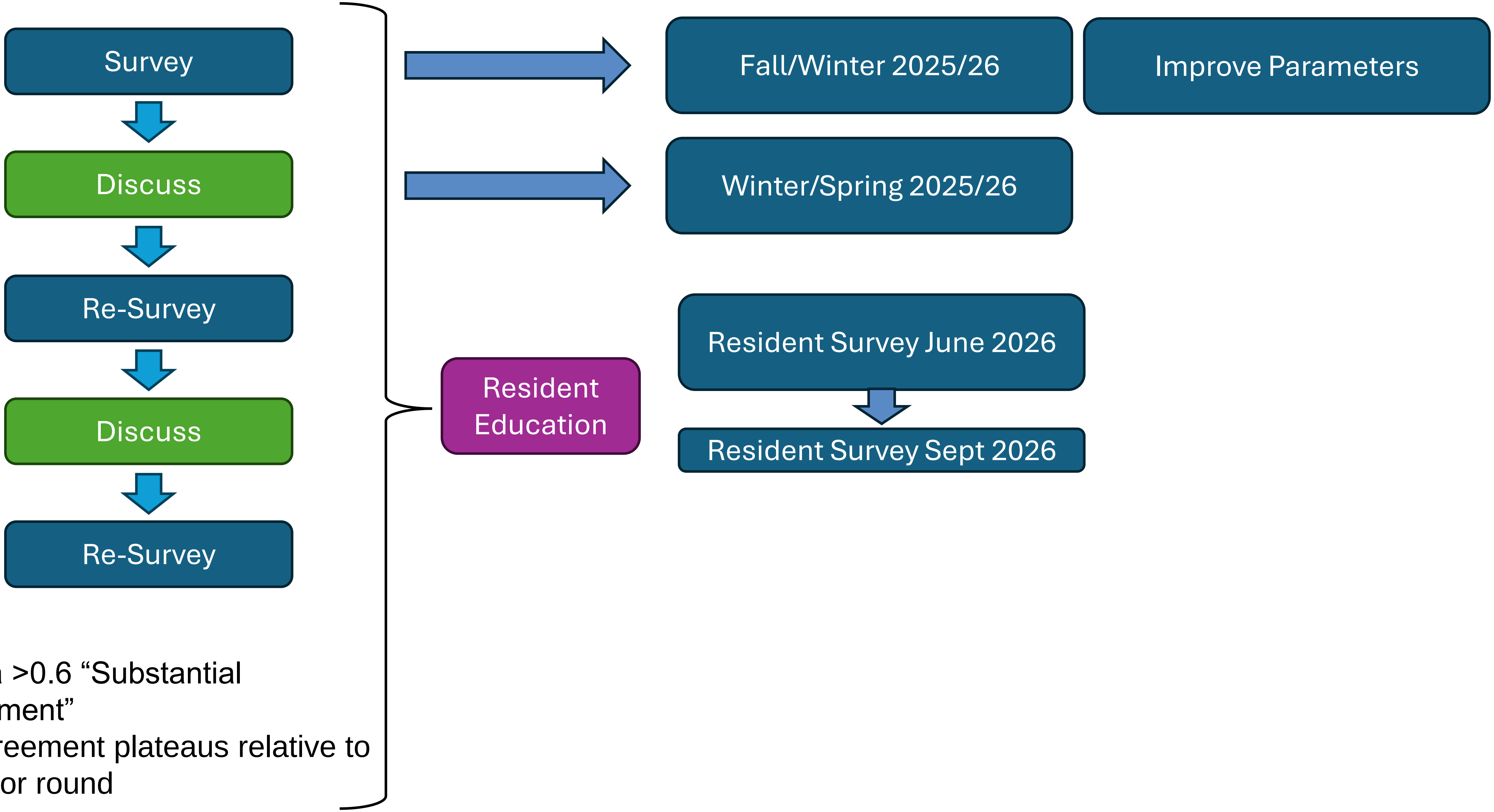
High Agreement

Adv Kappa: 0.211+/- 0.13

"Slight to Fair Agreement"

	Sheffer	Rosenfeld	Heyworth	Kadado	Li	Sanders	Truong	Beebe	Blumberg	Johnson	Owens	Ramalinga	Shore	Baldwin	Copley	Denning	Shen	Sigrist	Spence	Stepanovic	De	Larson	Miller	Lempert	Meyer	Riccio	Dell	Laine
Sheffer	1	0.153846	0.230769	0.076923	0.230769	0.230769	0.230769	0.230769	0.076923	0.230769	0.307692	0.230769	0.230769	0.307692	0.307692	0.384615	0.076923	0.230769	0.230769	0.307692	-2.22E-16	0.384615	0.230769	-2.22E-16	-2.22E-16	0.230769	0.307692	0.384615
Rosenfeld	0.153846	1	0.163043	-2.22E-16	0.307692	0.167568	0.307692	0.071823	0.071823	0.387978	0.315217	0.226519	0.391304	0.163043	0.153846	0.311475	0.163043	-0.07104	0.296089	0.381215	0.086957	0.234973	0.394595	0.15847	0.005464	0.381215	0.144444	0.234973
Heyworth	0.230769	0.163043	1	0.226519	0.153846	0.134831	0.153846	0.222222	0.086957	0.15847	0.153846	0.149171	0.234973	0.144444	0.384615	0.3	0.153846	0.066667	0.031915	0.226519	0.081967	0.15847	0.217877	-0.07692	0.307692	0.01087	0.243243	0.226519
Kadado	0.076923	-2.22E-16	0.226519	1	0.307692	0.153846	0.307692	0.234973	0.163043	0.15847	0.076923	0.15847	0.311475	-0.07692	0.243243	0.076923	0.163043	0.071823	0.071823	0.081967	0.217877	0.086957	0.15847	0.076923	0.243243	0.144444	0.23913	0.226519
Li	0.230769	0.307692	0.153846	0.307692	1	0.307692	0.461538	0.153846	0.307692	0.307692	0.307692	0.230769	0.615385	0.076923	0.307692	0.307692	0.153846	-2.22E-16	0.153846	0.230769	0.076923	0.384615	0.307692	0.307692	-0.07692	0.153846	0.307692	0.307692
Sanders	0.230769	0.167568	0.134831	0.153846	0.307692	1	0.384615	0.530726	0.230769	0.153846	0.384615	0.139665	0.230769	0.144444	0.230769	0.296089	0.144444	0.005464	0.176471	0.226519	0.226519	0.538462	0.394595	0.076923	0.071823	0.307692	0.234973	0.307692
Truong	0.230769	0.307692	0.153846	0.307692	0.461538	0.384615	1	0.23913	0.303867	0.381215	0.391304	0.163043	0.538462	0.081967	0.307692	0.307692	0.230769	0.234973	0.307692	0.387978	0.234973	0.311475	0.384615	0.3	-0.00552	0.377778	0.296089	0.149171
Beebe	0.230769	0.071823	0.222222	0.234973	0.153846	0.530726	0.23913	1	0.071823	0.15847	0.163043	0.213483	0.163043	0.076923	0.149171	0.222222	0.15847	0.076923	0.172043	0.217877	0.230769	0.311475	0.180851	0.234973	0.15847	0.374302	0.311475	0.23913
Blumberg	0.076923	0.071823	0.086957	0.163043	0.307692	0.230769	0.303867	0.071823	1	0.217877	0.315217	-2.22E-16	0.081967	0.163043	0.153846	0.307692	0.153846	0.315217	0.149171	0.226519	0.234973	0.307692	0.326203	-2.22E-16	-0.07692	0.066667	0.061453	0.081967
Johnson	0.230769	0.387978	0.15847	0.15847	0.307692	0.153846	0.381215	0.15847	0.217877	1	0.538462	0.172043	0.464481	0.016216	0.307692	0.538462	0.381215	0.149171	0.226519	0.387978	0.005464	0.149171	0.311475	0.3	-0.07104	0.230769	0.226519	0.230769
Owens	0.307692	0.315217	0.153846	0.076923	0.307692	0.384615	0.391304	0.163043	0.315217	0.538462	1	0.076923	0.3	0.222222	0.076923	0.384615	0.149171	0.144444	0.307692	0.391304	0.071823	0.374302	0.52809	0.071823	-0.07692	0.091892	0.163043	0.226519
Ramalinga	0.230769	0.226519	0.149171	0.15847	0.230769	0.139665	0.163043	0.213483	-2.22E-16	0.172043	0.076923	1	0.230769	0.061453	0.307692	0.3	0.230769	0.016216	0.163043	0.377778	0.153846	0.071823	0.031915	0.163043	0.149171	0.230769	0.071823	0.15847
Shore	0.230769	0.391304	0.234973	0.311475	0.615385	0.230769	0.538462	0.163043	0.081967	0.464481	0.3	0.230769	1	-0.01676	0.384615	0.307692	0.303867	0.15847	0.230769	0.23913	0.066667	0.217877	0.370787	0.377778	0.071823	0.153846	0.307692	0.303867
Baldwin	0.307692	0.163043	0.144444	-0.07692	0.076923	0.144444	0.081967	0.076923	0.163043	0.016216	0.222222	0.061453	-0.01676	1	0.230769	0.226519	0.307692	0.303867	0.172043	0.384615	0.153846	0.222222	0.066667	0.076923	0.081967	-2.22E-16	0.23913	0.226519
Copley	0.307692	0.153846	0.384615	0.243243	0.307692	0.230769	0.307692	0.149171	0.153846	0.307692	0.076923	0.307692	0.384615	0.230769	1	0.538462	0.458564	0.226519	0.081967	0.384615	0.005464	0.307692	0.153846	0.081967	0.076923	0.226519	0.307692	0.307692
Denning	0.384615	0.311475	0.3	0.076923	0.307692	0.296089	0.307692	0.222222	0.307692	0.538462	0.384615	0.3	0.307692	0.226519	0.538462	1	0.458564	0.15847	0.163043	0.461538	-0.07692	0.458564	0.315217	0.226519	0.076923	0.307692	0.307692	0.384615
Shen	0.076923	0.163043	0.153846	0.163043	0.153846	0.144444	0.230769	0.15847	0.153846	0.381215	0.149171	0.230769	0.303867	0.307692	0.458564	0.458564	1	0.23913	0.458564	0.311475	0.149171	0.071823	0.15847	0.234973	0.303867	0.15847	0.307692	0.384615
Sigrist	0.230769	-0.07104	0.066667	0.071823	-2.22E-16	0.005464	0.234973	0.076923	0.315217	0.149171	0.144444	0.016216	0.15847	0.303867	0.226519	0.15847	0.23913	1	0.096774	0.076923	0.315217	0.081967	0.213483	0.230769	0.167568	0.153846	0.096774	0.071823
Spence	0.230769	0.296089	0.031915	0.071823	0.153846	0.176471	0.307692	0.172043	0.149171	0.226519	0.307692	0.163043	0.230769	0.172043	0.081967	0.163043	0.458564	0.096774	1	0.391304	0.071823	0.149171	0.23913	0.153846	0.230769	0.311475	0.217877	0.311475
Stepanovi	0.307692	0.381215	0.226519	0.081967	0.230769	0.226519	0.387978	0.217877	0.226519	0.387978	0.391304	0.377778	0.23913	0.384615	0.384615	0.461538	0.311475	0.076923	0.391304	1	0.15847	0.167568	0.172043	0.091892	0.076923	0.307692	0.234973	0.23913
De	-2.22E-16	0.086957	0.081967	0.217877	0.076923	0.226519	0.234973	0.230769	0.234973	0.005464	0.071823	0.153846	0.066667	0.153846	0.005464	-0.07692	0.149171	0.315217	0.071823	0.15847	1	0.076923	0.149171	0.076923	0.222222	0.303867	-0.07104	-2.22E-16
Larson	0.384615	0.234973	0.15847	0.086957	0.384615	0.538462	0.311475	0.311475	0.307692	0.149171	0.374302	0.071823	0.217877	0.222222	0.307692	0.458564	0.071823	0.081967	0.149171	0.167568	0.076923	1	0.452514	0.134831	-2.22E-16	0.163043	0.303867	0.303867
Miller	0.230769	0.394595	0.217877	0.15847	0.307692	0.394595	0.384615	0.180851	0.326203	0.311475	0.52809	0.031915	0.370787	0.066667	0.153846	0.315217	0.15847	0.213483	0.23913	0.172043	0.149171	0.452514	1	0.134831	0.061453	0.185185	0.172043	0.370787
Lempert	-2.22E-16	0.15847	-0.07692	0.076923	0.307692	0.076923	0.3	0.234973	-2.22E-16	0.3	0.071823	0.163043	0.377778	0.076923	0.081967	0.226519	0.234973	0.230769	0.153846	0.091892	0.076923	0.134831	0.134831	1	0.149171	0.15847	0.3	0.071823
Meyer	-2.22E-16	0.005464	0.307692	0.243243	-0.07692	0.071823	-0.00552	0.15847	-0.07692	-0.07104	-0.07692	0.149171	0.071823	0.081967	0.076923	0.076923	0.303867	0.167568	0.230769	0.076923	0.222222	-2.22E-16	0.061453	0.149171	1	0.167568	0.3	0.307692
Riccio	0.230769	0.381215	0.01087	0.144444	0.153846	0.307692	0.377778	0.374302	0.066667	0.230769	0.091892	0.230769	0.153846	-2.22E-16	0.226519	0.307692	0.15847	0.153846	0.311475	0.307692	0.303867	0.163043	0.185185	0.15847	0.167568	1	0.066667	0.384615
Dell	0.307692	0.144444	0.243243	0.23913	0.307692	0.234973	0.296089	0.311475	0.061453	0.226519	0.163043	0.071823	0.307692	0.23913	0.307692	0.307692	0.307692	0.096774	0.217877	0.234973	-0.07104	0.303867	0.172043	0.3	0.3	0.066667	1	0.461538
Laine	0.384615	0.234973	0.226519	0.226519	0.307692	0.307692	0.149171	0.23913	0.081967	0.230769	0.226519	0.15847	0.303867	0.226519	0.307692	0.384615	0.384615	0.071823	0.311475	0.23913	-2.22E-16	0.303867	0.370787	0.071823	0.307692	0.384615	0.461538	1





Goal:
Kappa >0.6 “Substantial Agreement”
Or Agreement plateaus relative to the prior round

TRAUMA TRIAGE

OR TRIAGE

A < B < C < D < E

CLINCAL INTUITION

TRAUMA TRIAGE

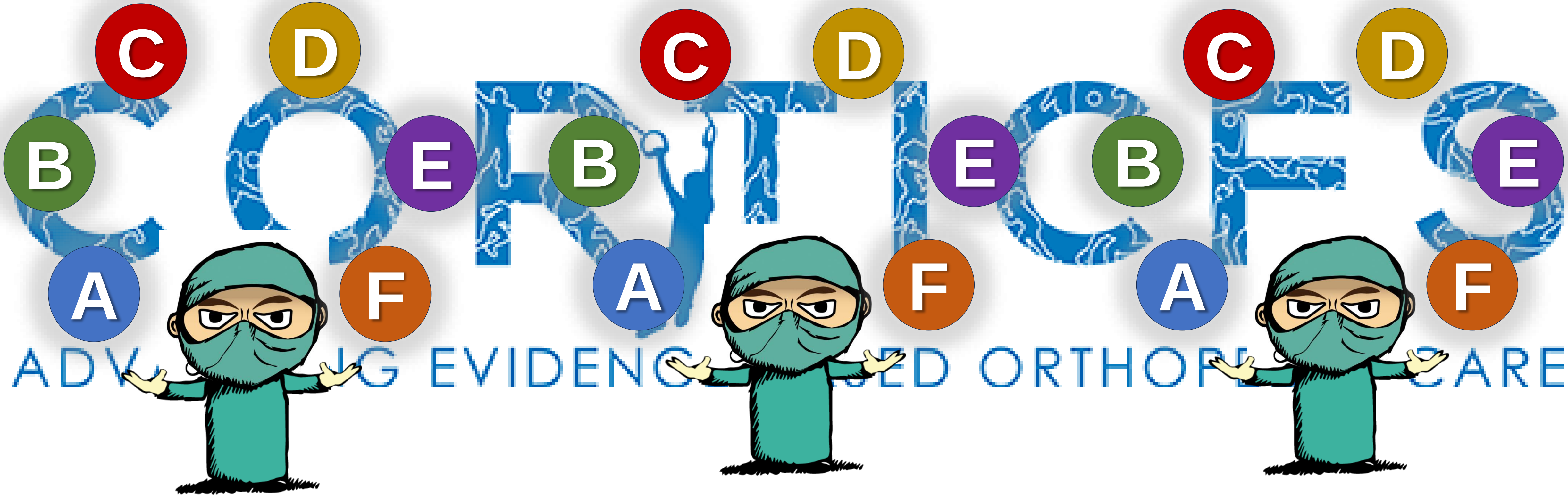
OR TRIAGE

A < B < C < D < E

CLINCAL INTUITION

Bradley-Terry Model

TRAUMA TRIAGE



CLINCAL INTUITION ORDICAL HIERARCHY (CLIOH)

CORTICES Annual Meeting 2025

Gillete Children's

Hosts: Jennifer Laine, Emmalynn Sigrist, & Walter Truong

September 26-27

Welcome to CORTICES 2025 Annual Meeting: Day 2

Presenter(s): Shore, Laine, Truong, & Sigrist

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gillette CHILDREN'S

Day 2 Annual Meeting Agenda

8:15 to 10:30 AM: Progress Report Block 1

- Calcaneus Fractures: Study Updates – *May*
- SH2 Distal Tibia Fractur Consensus – *Swarup*
- Napkin: Timing of Femur Fracture Fixation – *Swarup*
- Lisfranc Fx: Survey Results & Findings – *Rice Denning*
- Lisfranc Fx: Retrospective Protocol Development – *Rice Denning*
- Complication of Septic Arthritis of the Hip – *Sanders & Canizares*
- Napkin: Grade 3BC Open Tibia Shaft Fx – *Sheffer*
- Authorship Guidelines & Suggestions – *Shore*
- Research Idea to Publication *(Time Permitting)* – *Canizares*
- Website & Marketing Updates *(Time Permitting)* – *Pandey*

10:30 to 10:45 AM: 15-Minute Refresh

10:45 to 11:45 PM: Progress Report Block 2

- Thoracolumbar Burst Fx: REDCap Updates – *Shore*

Publications:

- *Characteristics of Septic Arthritis of the Foot and Ankle in Children-Review of a Retrospective Multicenter Database* – *Ying Li*
- *Descriptive Epidemiology of Venous Thromboembolism in Pediatric Orthopedic Patients: A National, Multicenter Study* – *Shore*
- *The Identification and Work-Up of Nonaccidental Trauma: Practice Variation Across US Children's Hospitals* – *Shore*
- *Hold that K Wire! Fixing Nondisplaced Distal Forearm Fractures in Pediatric Floating Elbow Injuries is Unnecessary* – *Baldwin*

- Finances & Company External Funding Updates – *Shore*
- Final Thoughts – *Open Floor*

12:00 PM Meeting Adjourned

New Study Ideas & Updates

Presenter(s): May, Swarup , Canizares/Sanders, Rice-Denning

Calcaneus Fractures in Children: Study Updates

Presenter(s): May

Background

- Rare injury
- Paucity of data looking at fracture patterns, operative indications, operative fixation options, and outcomes
- Are there different indications/outcomes for kids (or adolescents) vs. adults?

Literature

ORIGINAL ARTICLE

Operative Treatment of Intraarticular Calcaneal Fractures in the Pediatric Population

Charles J. Petit, MD, B. Minsuk Lee,† James R. Kasser, MD,‡ and Mininder S. Kocher, MD, MPH‡*

(*J Pediatr Orthop* 2007;27:856–862)

- 14 fractures in 13 patients
- 50:50 tongue type: joint depression
- 13/14 treated with plate/screw via extensile lateral approach
- 4 minor complications, 0 major complications
- All doing well at final follow up

Aims (BCH Data 2003-2024)

- Characterize Pediatric/Adolescent Calcaneus fractures (age, sex mechanism of injury, radiographic patterns, surgery incidence, outcomes)

- Assess differences in fractures treated operatively vs. those treated nonoperatively
  1. Fracture severity/patterns
  2. Outcomes of treatment (return to weight bearing/sports)

Methods

- Retrospective Review 2003-2024
- Inclusion
  - Age 0-17
  - Intra-articular calcaneus fracture
  - Minimum 6 month follow up
- Exclusion
  - Pathologic fracture
  - Isolated anterior process or tuberosity fracture
  - Open

Demographics

38 fractures in 35 patients

Mean Age: 12 years (2-16)

Sex: 74% male

Majority in active or very active kids

16 underwent surgery (42% rate of intervention)

Mechanism Of Injury

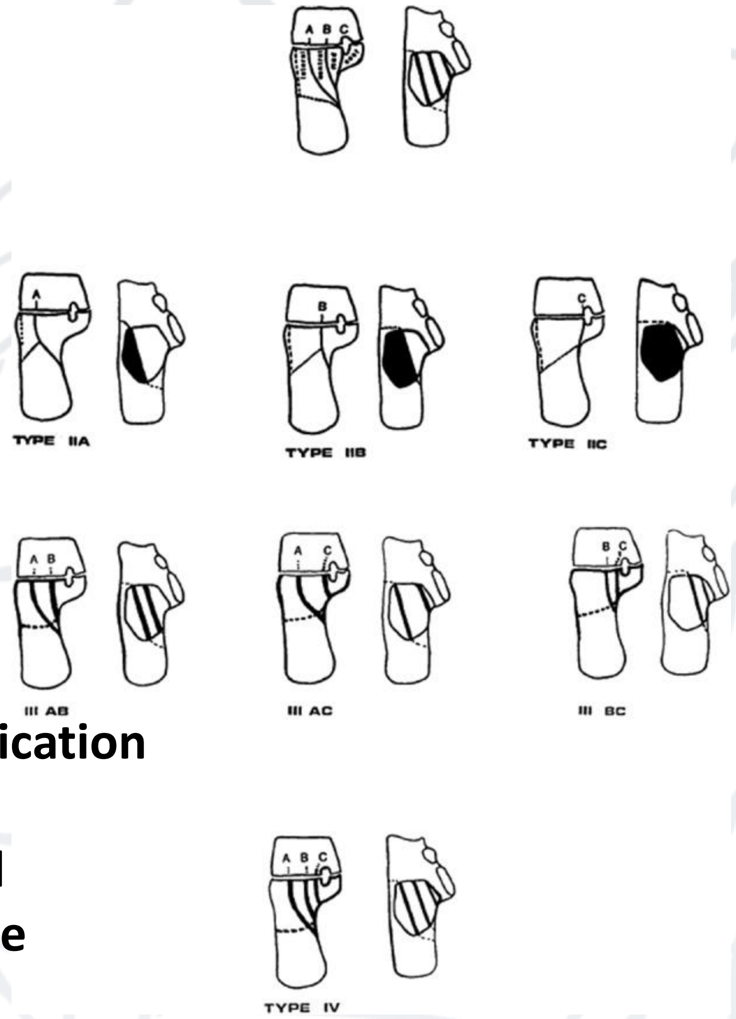
- Fall from < 10 ft 6 (16%)
- Fall from > 10 ft 13 (34%)
- Ski/Snowboard 15 (40%)
- MVC 1 (3%)
- Other 3 (8%)

Fracture Pattern – Sanders Class

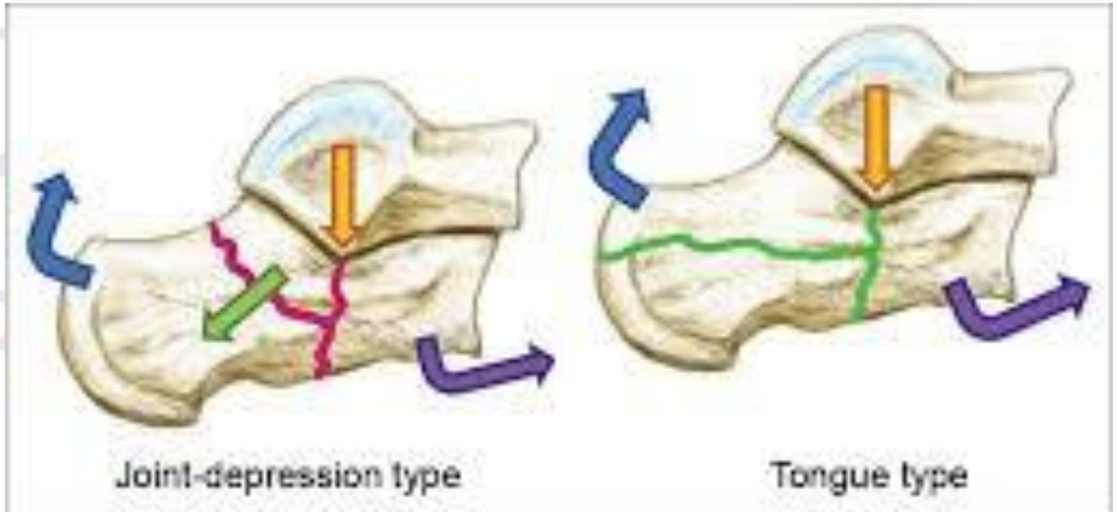
Sanders class	Total		Operative		Non-Operative	
1	10	(26%)	2	(13%)	8	(36%)
2	16	(42%)	5	(31%)	11	(50%)
3	6	(16%)	5	(31%)	1	(5%)
4	5	(13%)	4	(25%)	1	(5%)

***Significant relationship between Sanders classification and operative intervention (p=0.004).**

***Of the type IV fractures, 80% (4/5) were treated surgically, while 20% (2/8) of type I fractures were treated surgically**



Fracture Pattern – Essex-Lopresti



Essex-Lopresti class	Total		Operative		Non-Operative	
Tongue type	8	(21%)	5	(31%)	3	(14%)
Joint Depression	21	(55%)	9	(56%)	12	(55%)
Other/unknown	7	(18%)	1	(6%)	6	(27%)

P= 0.24

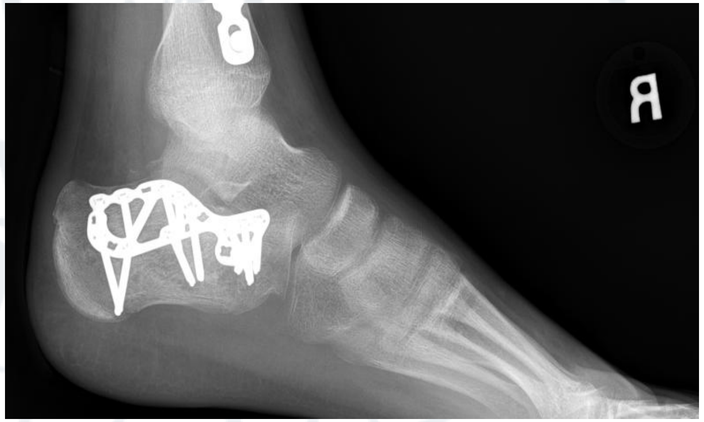
*Not associated with functional outcomes

**Lack data to correlate with surgery type and method

Surgery Characteristics (N=16 pts)

- Surgical Approach
  - Extensile lateral – 9 (56%)
  - Percutaneous – 7 (44%)

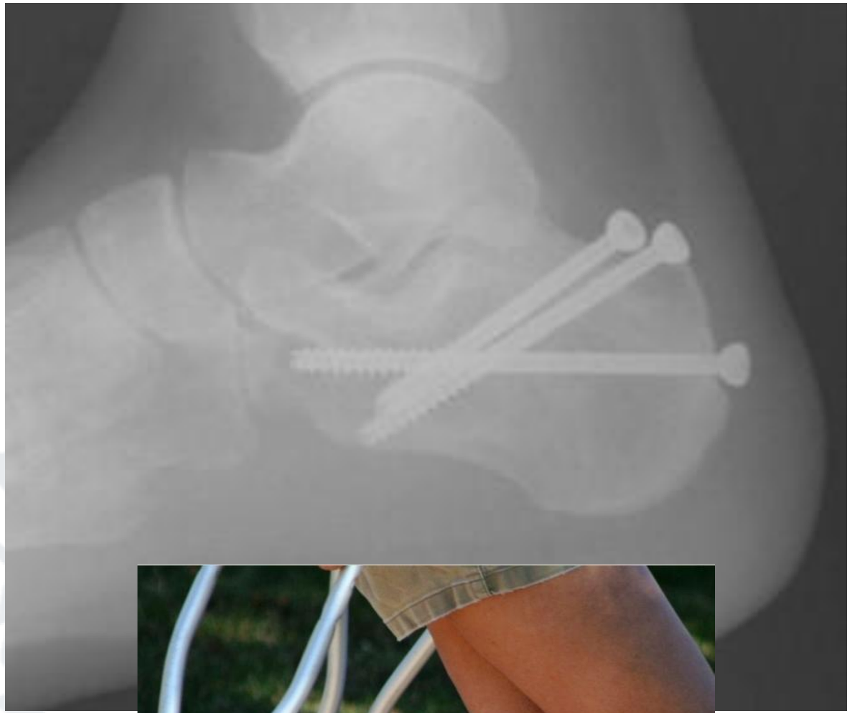
- Implant
  - Anatomic Calcaneus plate – 7 (44%)
  - Cannulated Screw – 7 (44%)
  - Small frag plate - 2 (13%)
  - K-wires - 1 (6%)



Op vs. Nonop

Patients that got surgery were:

- Older (mean 13.7 yrs vs. 10.3 yrs, $p=0.001$)
- Had Ski/SB injuries (69% vs. 18%, $p=0.004$)
- More displacement ($p=0.005$)
- Lower Bohler's angle (14 vs 38, $p<0.0001$)
- Higher Sanders Classification ($p=0.02$)

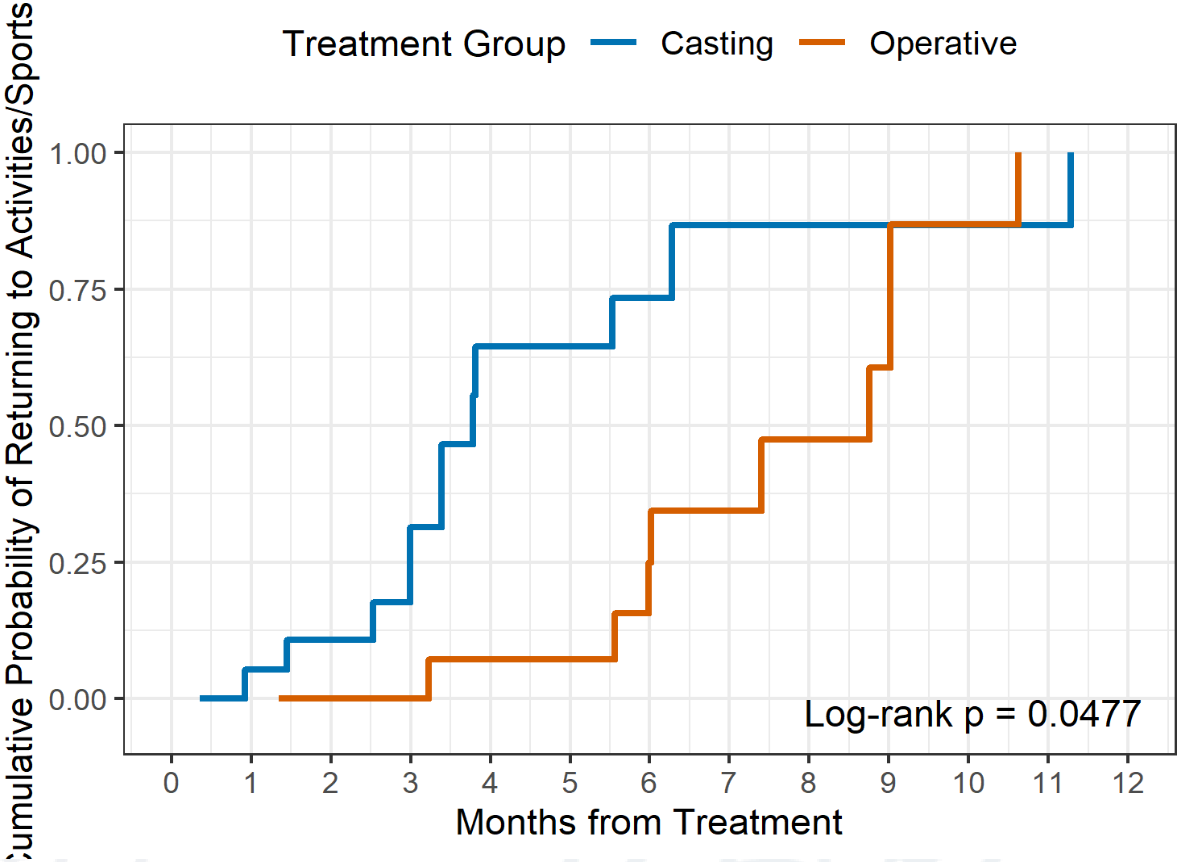


Op vs. Nonop – Return to Activity

Operative injuries median 13 months to return to activities vs. median 8 months in casted fractures

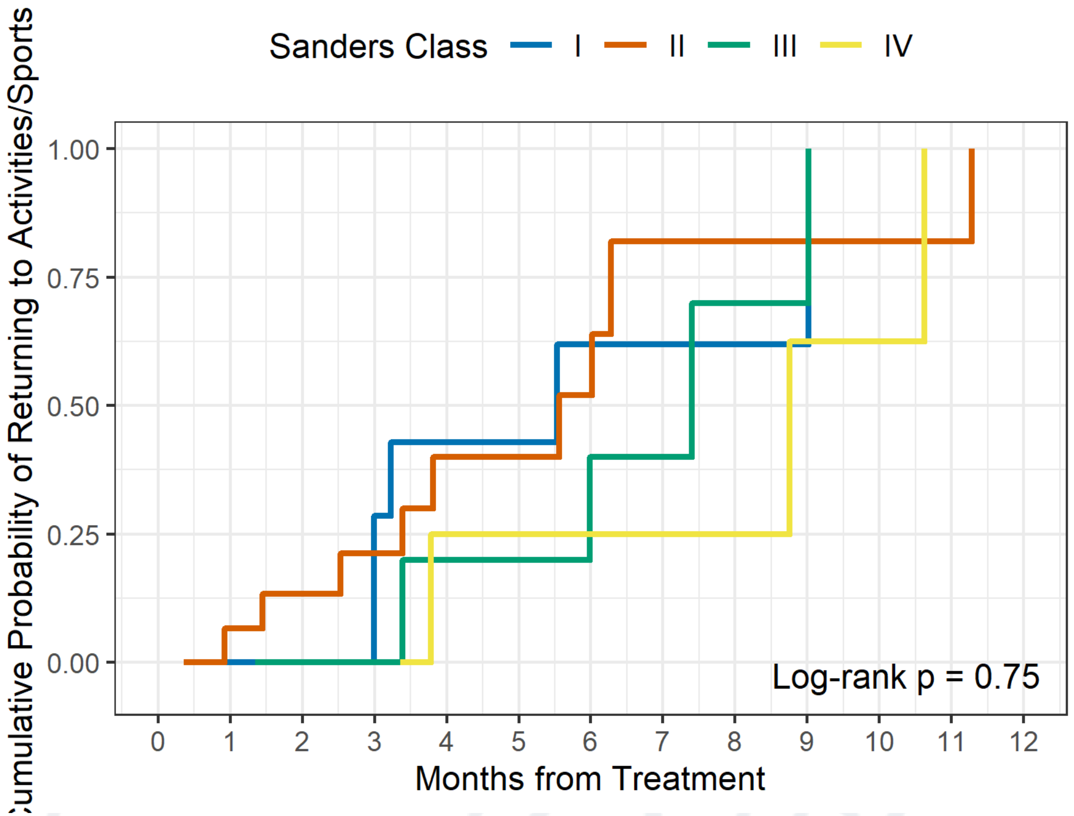
(P=0.04)

Likely reflects fracture severity, indication bias



Injury/Surgery Chars – Return to Activity

NO association between fracture pattern, Sanders class, mechanism of injury, type of surgery and return to activity/sports



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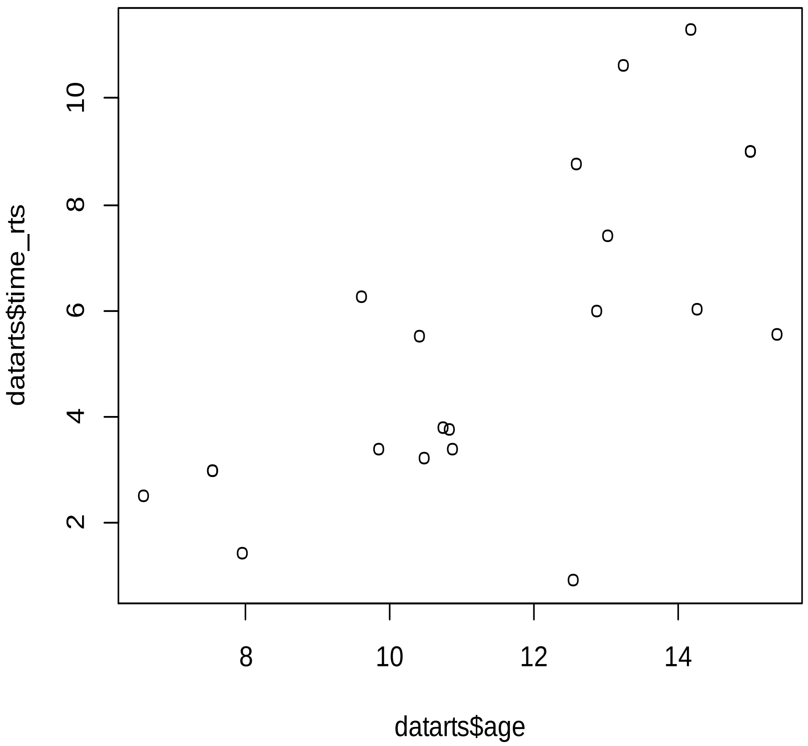
Age a predictor of outcome?

- NO association between **mechanism of injury** (p=0.20), **comminution** (p=0.51), **Sanders class** (p=0.65), or **surgery performed** (p>0.3) and time to weight-bearing.

- **Age** was significantly associated with delayed return to weight-bearing. Specifically, each additional year of age was associated with a 24% reduction in the hazard of return to weight-bearing (HR = 0.76, 95% CI 0.63–0.91, p = 0.003), independent of treatment modality, and E-L & Sanders fracture class.



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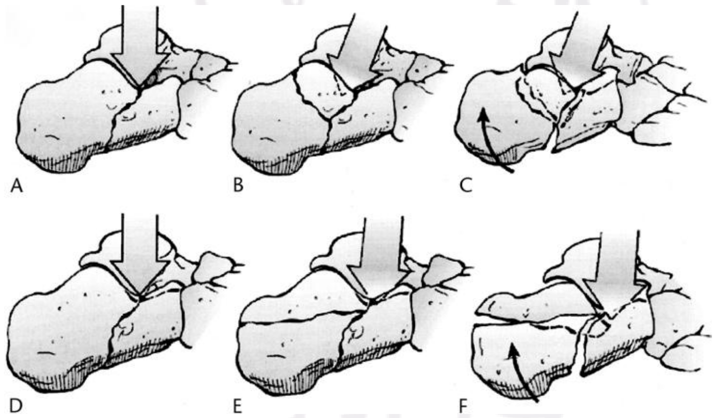
Predictors of Arthritis or other Complications?

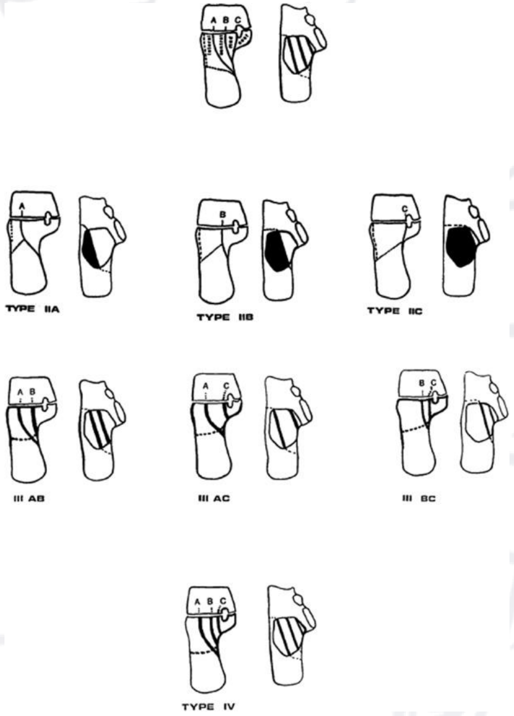
- **Arthritis**: 4 patients had signs of arthritic change (2 in op, 2 in nonop groups) at final follow up
- **Secondary Procedures**: 3 patients had hardware prominence/pain necessitating removal. 1 patient with revision ORIF
- **Other Complications**: No infections or wound complications

LOW EVENT NUMBERS PRECLUDE STATISTICAL ANALYSIS

Potential Questions

- **Fracture classification** – are the patterns different in young people?





Potential Questions

- **Fracture classification** – are the patterns different in young people?

BCH Data suggests more patients with lower Sanders classification than in adults

Potential Questions

- Fracture classification – are the patterns different in young people?
- What is the rate of **associated injuries?**

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Potential Questions

- Fracture classification – are the patterns different in young people?
- What is the rate of **associated injuries?**

BCH data:

17/38 (45%) had at least one other fracture

4/38 (11%) had a spine fracture

Potential Questions

- Fracture classification – are the patterns different in young people?
- What is the rate of associated injuries?
- **Indications for surgery** and decision making – is this different in a young, active population?

Potential Questions

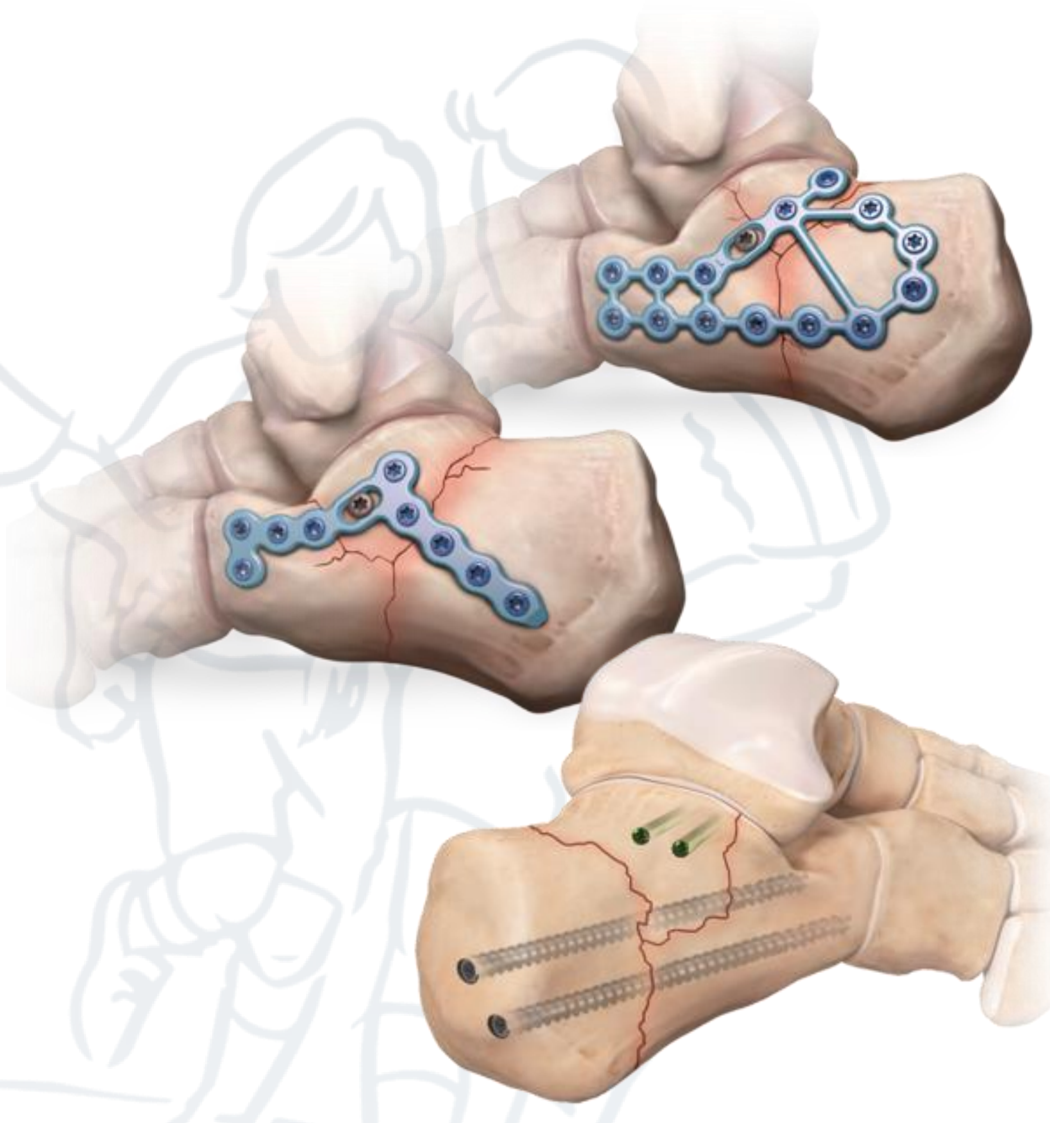
- Fracture classification – are the patterns different in young people?
- What is the rate of associated injuries?
- **Indications for surgery** and decision making – is this different in a young, active population?

BCH data suggests older, more severe fractures get fixed

Potential Questions

- Who does these at your institution?
  - Foot specialist? Traumatologist? Anyone?

- How are we fixing them?
  - Open vs. percutaneous approaches?
  - Sinus tarsi vs. extensile lateral?
  - Plate/screw constructs vs. screw-only?



Potential Questions

- Surgical complication rate and risk factors?
- Subtalar arthrosis risk?
- Secondary surgery rate?

SH2 Distal Tibia Fractures Consensus

Presenter(s): Swarup

Predictors of Premature Physeal Closure

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UCSF Benioff Children's Hospitals

Background

- Distal tibia physeal fractures carry a meaningful risk of premature physeal closure (PPC) with long-term malalignment and deformity
- Reported predictors and PPC management differs across studies → management varies in practice
- There is no consensus ranked set of PPC predictors across Salter-Harris distal tibia fractures
  - Essential for day-to-day care:
    - Consistent decisions across surgeons/centers
    - Patient/parent counseling
    - Operative thresholds
    - Follow-up protocols

Proposal – Modified Delphi

- Can we come to a consensus with the existing literature and combined experience?
- Build expert-derived hierarchy of predictors of premature physeal closure (PPC) for distal tibia fractures
  - Including Salter-Harris II, III, and IV fractures
- Method: modified Delphi using REDCap
  - Identify group of CORTICES members
  - Survey
  - Read existing literature
  - Re-survey → Discuss → Re-survey

Panel & Platform

- 20 CORTICES members agreed to participate as an expert
  - Responsibilities:
    - Completing surveys
    - Reading literature (10-15 articles)
    - Meeting at least twice via zoom
- Survey distributed through REDCap
  - Present two factors in an X vs. Y format → pick the more deterministic factor → hierarchy of factors
- Consensus target: predefined threshold (e.g., 80% agreement)

Where We Are and What is Next

Problem area — Literature Review → 12 factors identified and defined ✓

Panel Members — 20 CORTICES members identified ✓

Delphi rounds
- REDCap survey with clear definitions and visual aids
- Survey distribution → read literature → re-survey → discuss → re-survey

Closing criteria
- Consensus criteria
- Analysis of consensus
- Develop agreement on most important indications for elevated PPC risk

Goal

Convert conflicting literature into a shared, reproducible PPC risk hierarchy for distal tibia fractures

↓

Drive protocol uniformity, decision consistency, and risk-aligned follow-up

Napkin Idea #4

Timing for Femur Fracture Fixations

Presenter(s): Swarup

Predictors and Complications of Delayed Fixation in Pediatric Femoral Shaft Fractures

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UCSF Benioff Children's Hospitals

Background

- Pediatric femoral shaft fractures are largely heterogeneous across age groups, with multiple treatment options
- Early fixation (<24hrs from presentation) has been associated with lower rates of complications, improved outcomes in adults
- However, there is currently no consensus regarding optimal treatment of femoral shaft fractures in the pediatric population

Previous Investigation

- In our recent retrospective cohort study, we employed the TQIP database to investigate 3800 cases of pediatric femoral shaft fractures nationwide in 2017
- Significant predictors of delayed fixation (>24hrs from presentation) included: Patients with ISS scores >15, worse GCS scores, older age, and higher number of days on a ventilator
- Delayed fixation was significantly associated with the development of various complications (e.g., DVT, PE, pressure ulcer injury)

Main Limitations

- Database limitations
  - Clinical data but not very granular
- We were unable to compare between cases of isolated femur fractures versus polytrauma
- More granular outcome measures are needed:
  - Operative time
  - Potential readmission data
  - More robust med/surg complications (e.g., infection)

Proposal for CORTICES

- Does time to fixation affect outcomes after isolated femoral shaft fractures in pediatric patients?
- What are potential delays to fixation for isolated femoral shaft fractures in pediatric patients?
- Patient population: pediatric patients aged 6-16 diagnosed with femoral shaft fractures
- Accounting for GCS, ISS, isolated versus polytrauma, demographics (age, sex, race, payor type), mechanism of injury
- Outcomes of interest: Time to fixation, operative time, method of treatment, intraoperative/post-operative complications, readmission, length of stay

Lisfranc Fracture

Provider Survey Results & Findings

Presenter(s): Denning

Additional Collaborator(s): Johnson, Baldwin, Riccio

Background

- Lack of literature on pediatric Lisfranc injuries
- Little known about mechanism of injury, fracture patterns, threshold for operative vs. nonoperative management, fixation options, subsequent disability/pain
- Not known if the presence of open physes should direct operative vs. nonoperative management, fixation choice, return to activity

Previous Work

- Single institution – 56 peds patients, no PROs (2017)
- Single institution – 30 peds patients, PROs (2021)
- Prelim work by Jaime Denning (unpublished)
- Systematic Review – 114 patients (2022)
- Single institution – 14 peds patients, PROs (2025)

Lisfranc Survey

- Survey on practice variation ✅
  - Lisfranc Case Survey
- Pilot with 10 patients to look at inter-rater reliability
  - Shanika De Silva (statistician) provided data analysis (lumped cases and case-by-case data)
  - Abstract to be submitted to POSNA (based on summary cases) ✅
    - Abstract
  - Any other suggestions for how to use the case-by-case data?

Lisfranc Fractures: CORTICES Survey

PI: Dr. Denning

Summary of Data Analysis

Prepared by Shanika De Silva, September 7th, 2025

DATA ANALYSIS

Responses from **29 providers across 18 CORTICES sites who completed the survey** were collected. Participants reviewed 10 clinical cases, and responses were summarized both across all cases and for each individual case with respect to treatment strategies. Data were visualized using bar plots, heatmaps, and Likert plots.

Agreement on treatment choice (operative vs. non-operative) was assessed using Fleiss' kappa, a statistical measure of **inter-rater reliability** for categorical data when more than two raters are involved. Interpretation of kappa values followed standard cutoffs: values ≤0 indicated poor agreement, 0.01-0.20 slight agreement, 0.21-0.40 fair agreement, 0.41-0.60 moderate agreement, 0.61-0.80 substantial agreement, and 0.81-1.00 almost perfect agreement.

SUMMARY RESULTS

TREATMENT CHOICE ACROSS 10 CASES

Among the 10 Lisfranc fracture cases, treatment preference varied by case (**Figure 1**). Three cases (cases 5, 7, 8) were uniformly managed operatively by all respondents. Cases 1, 3, and 9 showed near consensus for operative management (>90%). Greater variability was observed in cases 10 and 4, where 28-38% of respondents selected non-operative treatment. In contrast, non-operative management was favored in cases 2 and 6, with only 31% and 24% of respondents, respectively, recommending operative intervention.

The overall agreement between the 29 respondents on operative versus non-operative treatment across the 10 cases was moderate (Fleiss' kappa = 0.414, p<0.001).

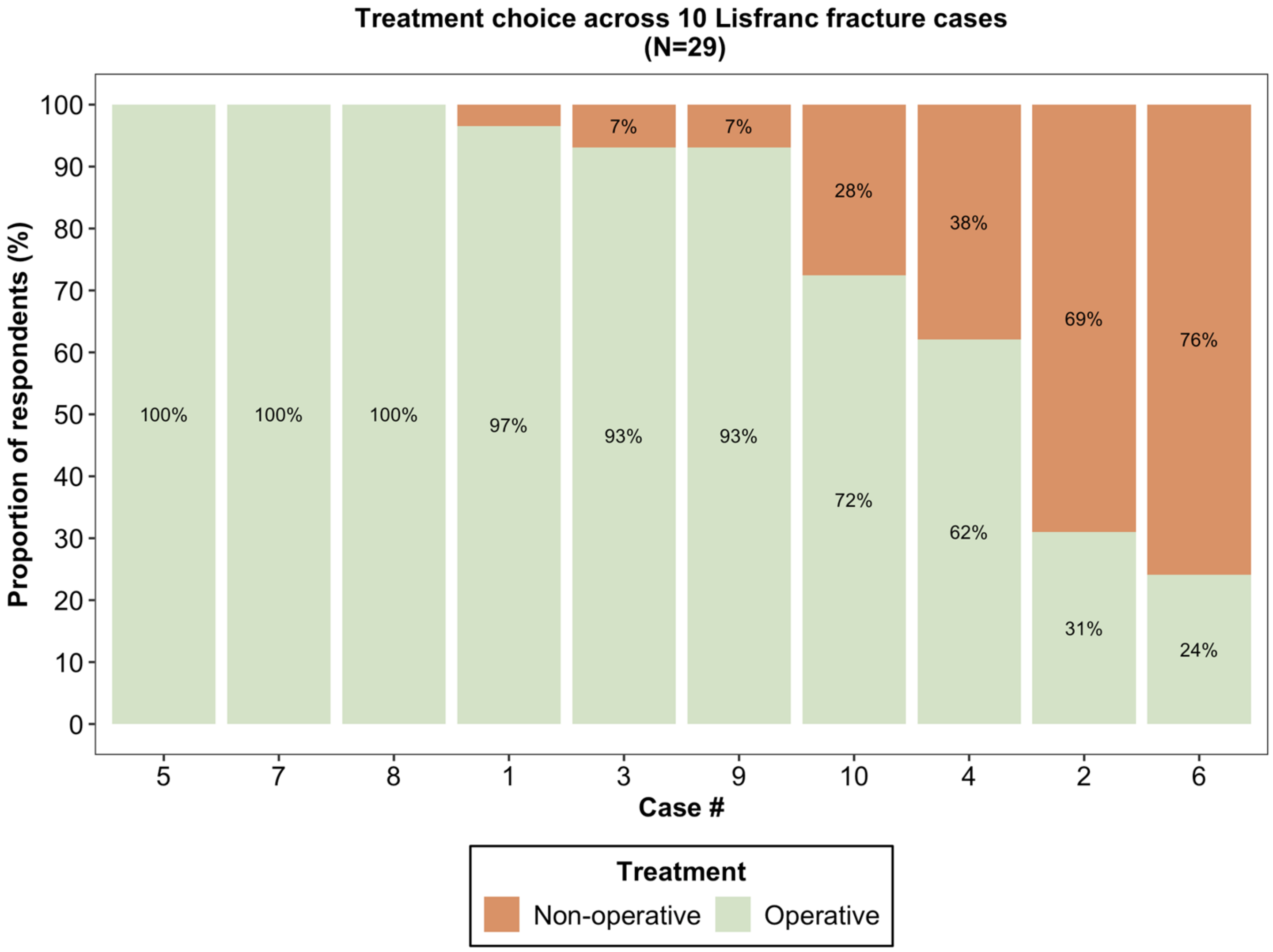


Figure 1. Treatment choice among 29 CORTICES respondents across 10 distinct Lisfranc fracture cases.

IMPLANT USED DURING FIXATION ACROSS 10 CASES

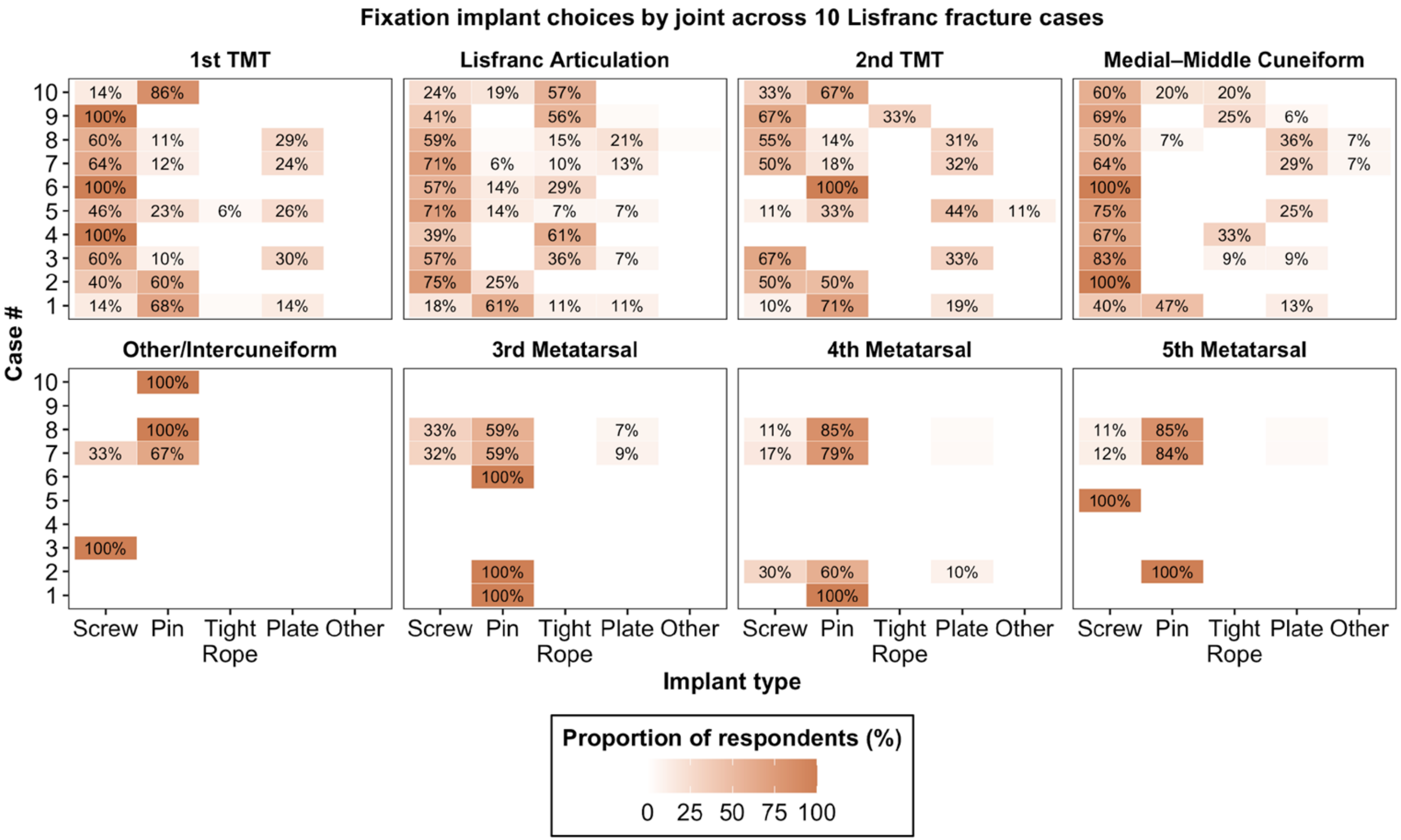


Figure 2. Implants used during fixation across 10 distinct Lisfranc fracture cases and specific joints, among 29 CORTICES respondents

Fixation implant preferences differed by joint and showed variability across the 10 Lisfranc fracture cases (**Figure 2**).

For the 1st TMT joint, screws were most commonly selected (60-100% in 6/10 cases), although pins were occasionally chosen (60-86% in 2/10 cases).

At the Lisfranc articulation, variability was greatest, with respondents selecting screws most often (57-75% in 6/10 cases), but a substantial proportion also choosing plates (56-61% in 3/10 cases) or pins depending on the case.

The 2nd TMT joint was also most frequently stabilized with screws (50-67% in 5/8 cases) or pins (50-100% in 4/8 cases).

Fixation of the medial-middle cuneiform was similarly heterogeneous, with screws most common (50-100% in 9/10 cases).

Fixation of the 3rd, 4th, and 5th metatarsals showed relatively strong consensus, with pins overwhelmingly preferred and screws or other implants rarely selected.

Intercuneiform fixation was infrequent and, when performed, exclusively involved pinning.

RANKING OF MOST IMPORTANT FACTORS ACROSS 10 CASES

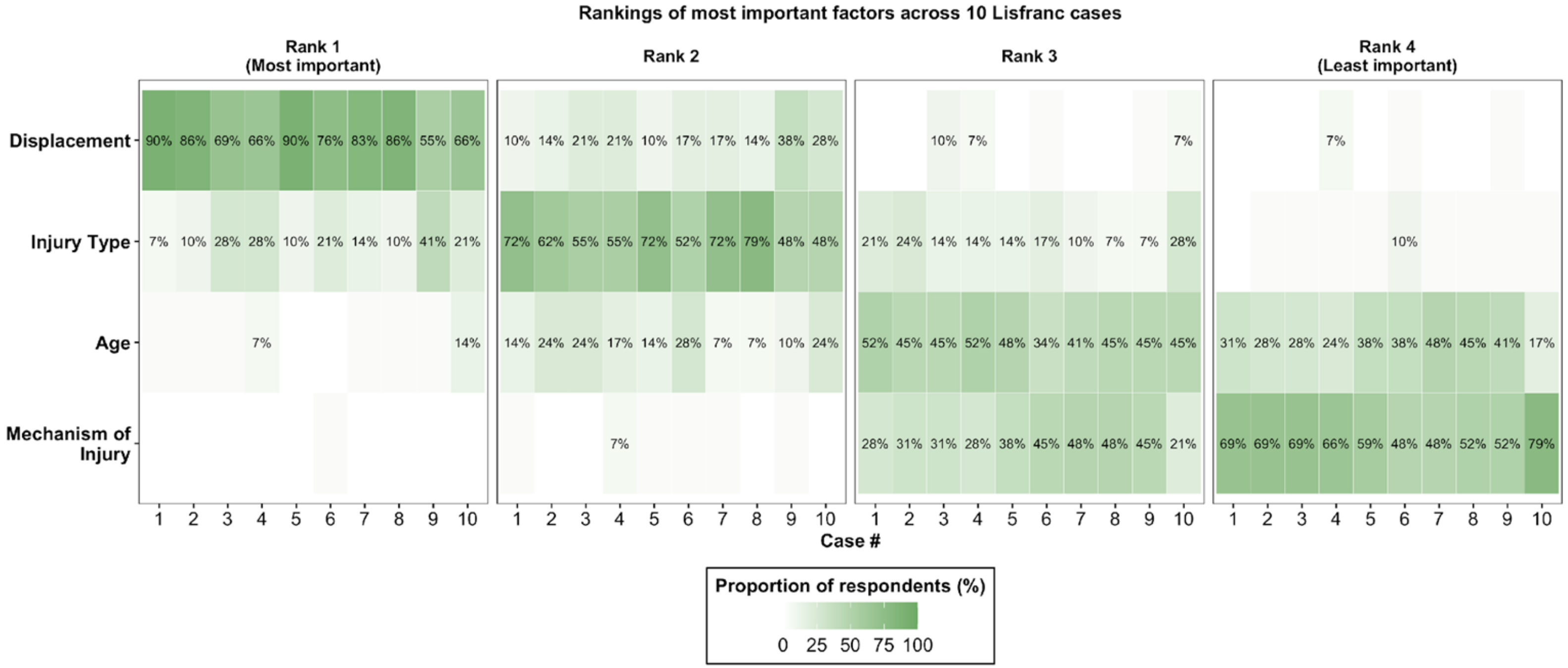


Figure 3. Ranking of most important factors across 10 Lisfranc fracture cases. Each facet shows the % of the respondents assigning that exact rank.

Figure 3 shows the ranking of factors considered most important across 10 Lisfranc fracture cases.

Across all cases, displacement was the dominant factor, ranked most important by the majority of respondents (55-90%). Injury type was most frequently ranked second (48-79%), followed by age, which was generally ranked third (34-52%). Mechanism of injury was consistently considered least important, ranked fourth in most cases (48-79%). The following overall hierarchy was observed: displacement > injury type > age > mechanism of injury.

Despite this overarching trend, some variability was observed across cases. In case 9, injury type was ranked the most important factor by 41% of respondents. Age occasionally shifted from its typical third position to the fourth, while mechanism of injury, though most often ranked least important, was occasionally placed third (45-48% in 4 cases).

RETURN TO ACTIVITIES ACROSS 10 CASES

Recommendations for return to activities varied across the 10 Lisfranc fracture cases, though most respondents favored a 12-week timeline (ranging from 48-76%) (**Figure 4**).

Early return at 6 weeks was rarely recommended. The highest proportion was seen in Cases 2 and 6 (28% each), while most other cases had fewer than 20% of respondents selecting this option.

In contrast, recommendations for return beyond 12 weeks showed greater variability. Only a small minority suggested a delayed return to activities for Cases 10 (7%) and 1 (14%), but almost half of respondents endorsed delayed return for Cases 7 and 8 (48% each).

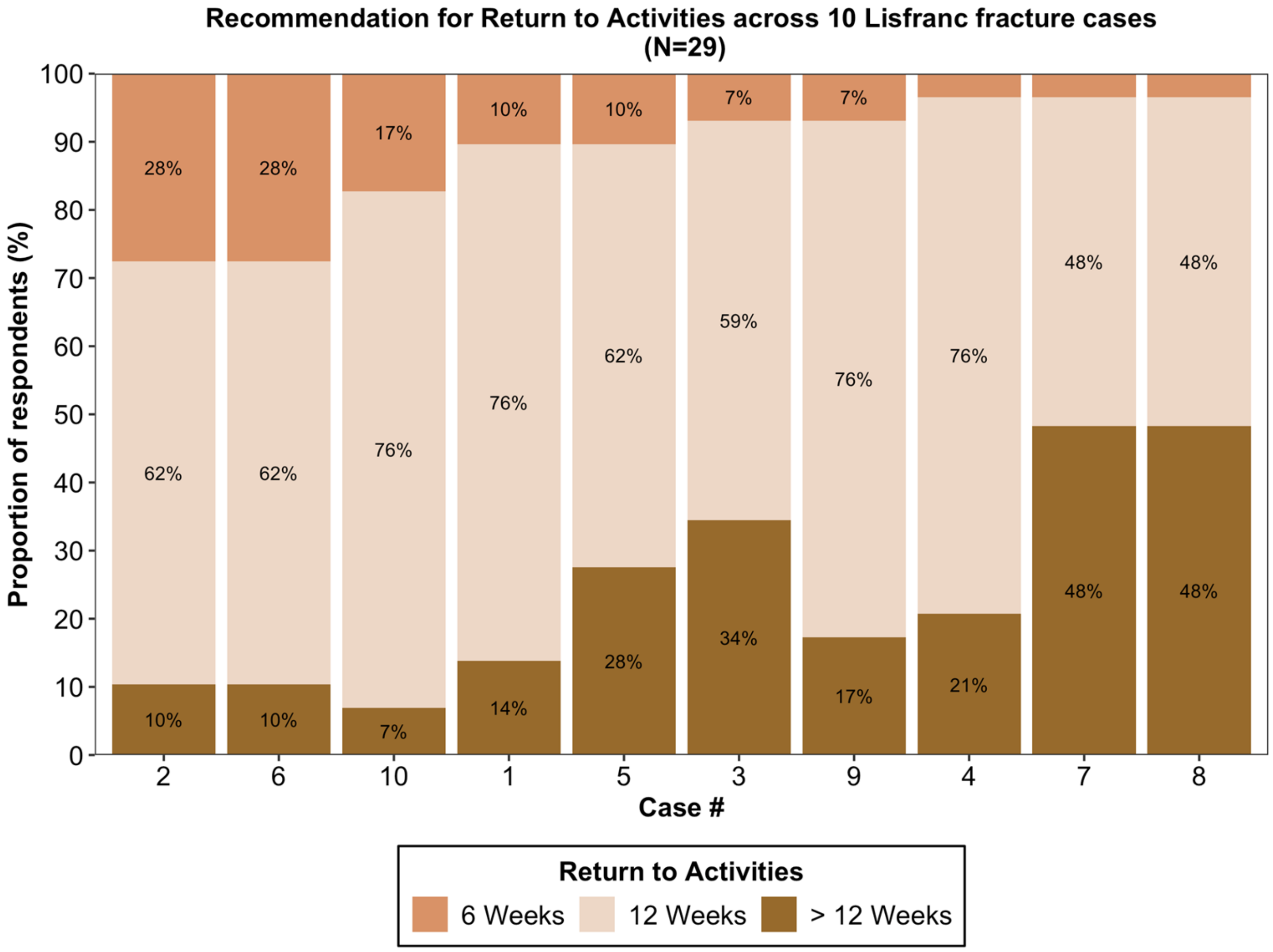


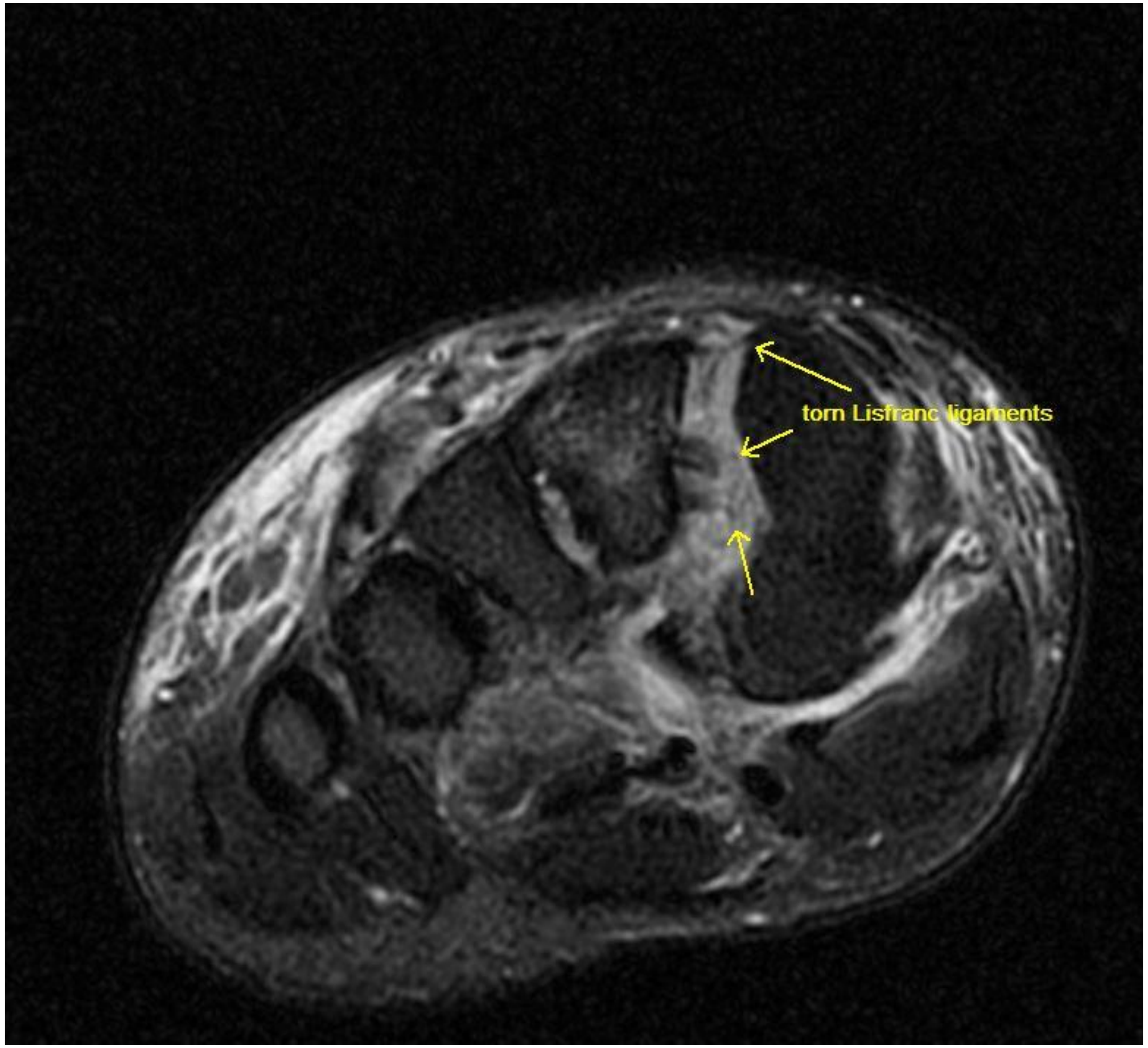
Figure 4. Return to Activities recommendations among 29 CORTICES respondents across 10 distinct Lisfranc fracture cases.

Case #1 (8+11F) – Injury films (NWB)

Case #2 (10+5F) – Injury films (NWB)

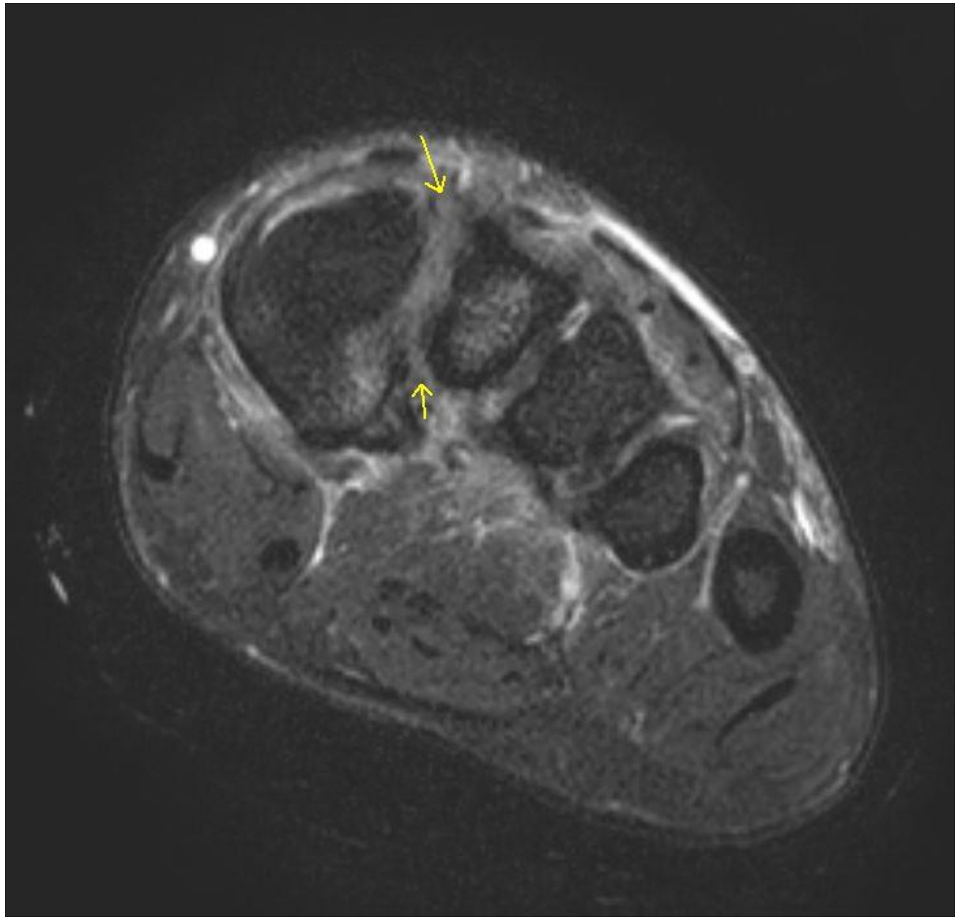
Case #3 (15+5F) – Injury films (NWB)

Case #3 (15+5F) – Injury MRI (NWB)



Case #4 (13+9F) – Injury films (NWB)

Case #4 (13+9F) – Injury MRI (NWB)



Case #5 (16M) Injury Films (NWB) sp

Case#6 (13F) Injury Films NWB

Case#7 17F Injury Films NWB

Case#8 16M Injury Films NWB

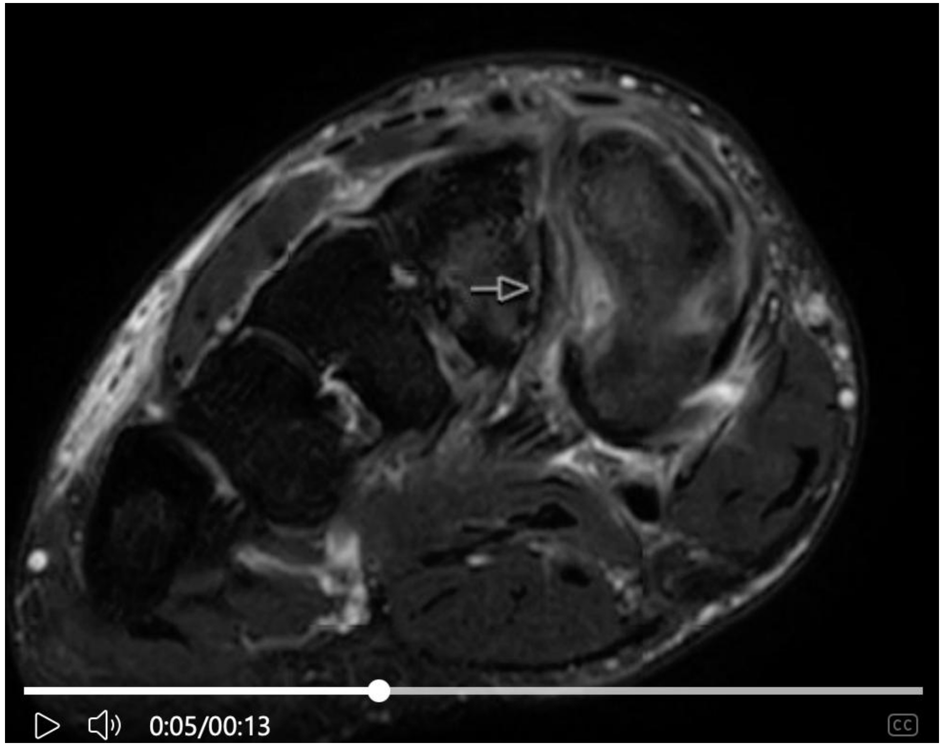
Case#9 15M Injury Films WB

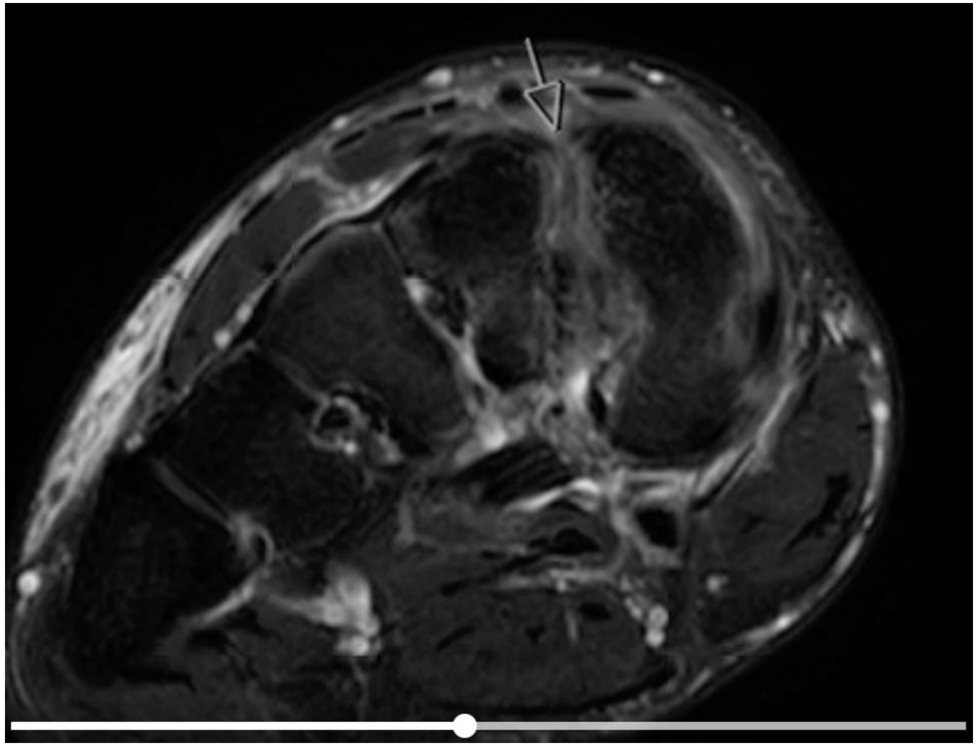
Case#9 15M Injury MRI

Impression:

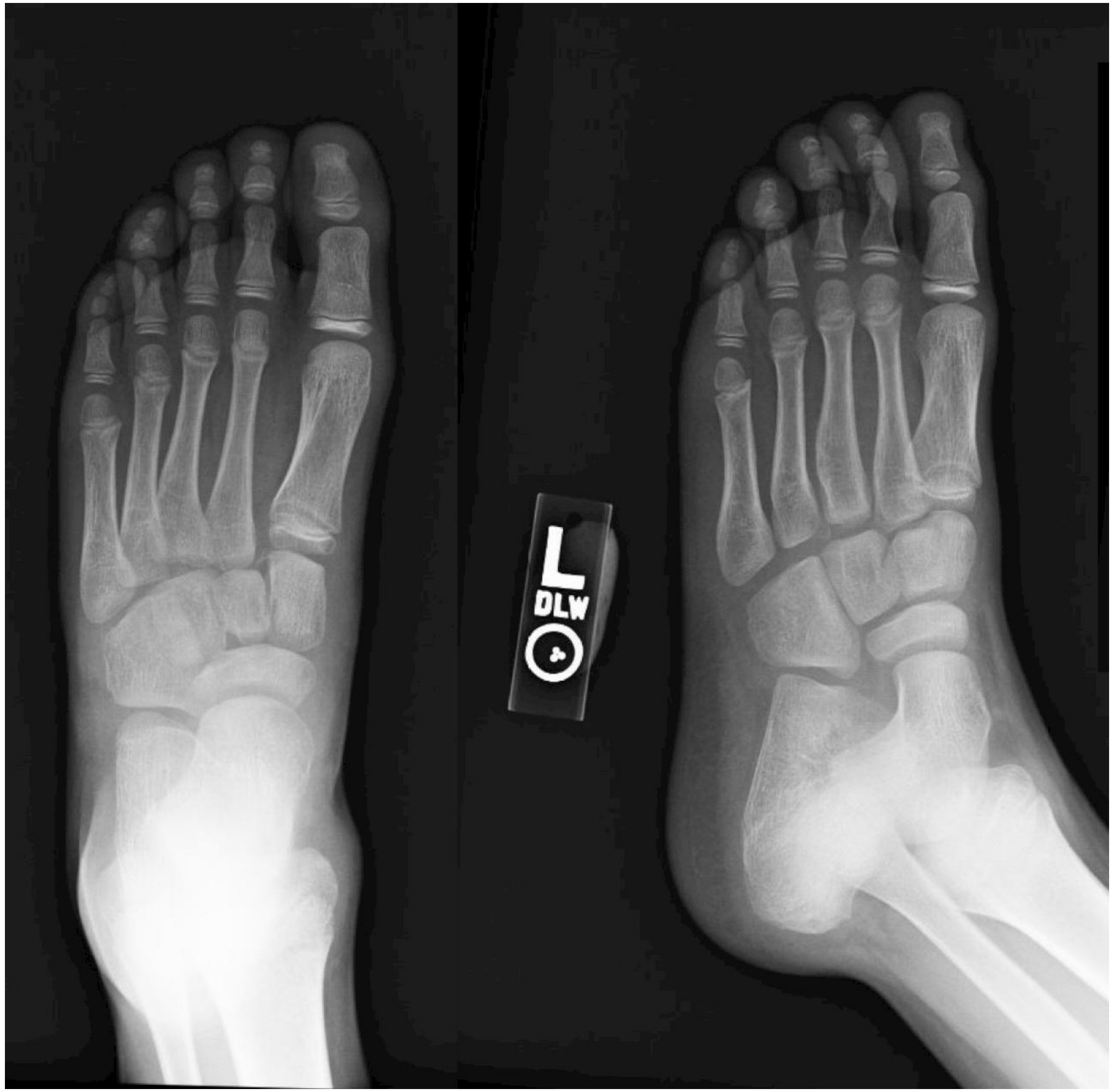
1. High-grade partial to complete avulsion tear of the interosseous component of the Lisfranc ligament from its second metatarsal attachment. Complete disruption of dorsal and plantar components of the Lisfranc ligament complex.

2. Medial cuneiform, proximal second metatarsal, and dorsal intermediate and lateral cuneiform bone contusion.





Case#10 8+11M Injury NWB



Case#10 8+11M Injury MRI

Impression:

1. Lisfranc ligament tear with subsequent subluxation of the middle cuneiform-first metatarsal joint alignment. There is an osseous avulsion at the Lisfranc ligament attachment on the medial cuneiform as well.

2. Partial tears of the plantar foot muscles.

3. Nondisplaced fractures involving the bones of the midfoot and proximal forefoot.

Lisfranc Fracture

Retrospective Study Design & Protocol Updates

Presenter(s): Denning

Additional Collaborator(s): Johnson, Baldwin, Riccio

Specific Aims

- **Primary Aim**
- **To retrospectively characterize pediatric Lisfranc injuries at participating CORTICES institutions between 2010 and 2025 including demographics, injury mechanisms, radiographic injury patterns, treatment strategies, and clinical outcomes, and to compare to historical adult Lisfranc injury cohorts.**
  - Hypothesis: Mechanism of injury, fracture pattern, treatment modalities and outcomes will differ between pediatric and adult patients
  - Primary outcome: Ability to return to baseline activity and ability/time of return to sport (if previously involved), peri-operative complications, postoperative complications, need for supervised therapy services, radiographic outcome (residual displacement, arthritic changes and deformity)

Specific Aims

Secondary Aims

1. **To evaluate the impact of treatment approach (operative vs non-operative) on outcomes and to determine if a threshold of displacement exists beyond which non-operative management is associated with worse outcomes.**

- Hypothesis: Surgical and non-surgical management will yield similar outcomes in cases with minimal displacement, however, non-operative management will be associated with worse outcomes beyond an undefined displacement threshold or in specific fracture patterns.

Specific Aims

<u>Secondary Aims</u>

2. **To assess whether skeletal maturity influences outcomes by comparing pediatric patients with open physes to those under 18 with closed physes.**

- Hypothesis: Pediatric patients with Lisfranc injuries and open physes will have worse outcomes than those with closed physes.

Specific Aims

Secondary Aims

3. **To develop a classification system of pediatric Lisfranc injuries based on the patterns of injury observed in this population accounting for skeletal maturity**

- Hypothesis: Pediatric patients with Lisfranc injuries, particularly those with open physes, will have different injury patterns than adult patients with Lisfranc injuries.

Design/Methods

- Retrospective
- Inclusion:
  - Age 0-18, Lisfranc injury based on imaging (XR, CT, MRI), can include other associated foot fractures, open or closed injuries
  - Non-operative or operative treatment (any fixation method)
  - Treated at CORTICES institution b/w 1/1/10 – 12/31/24
  - At least 6 month f/u
- Exclusion:
  - Patients with known neuromuscular/syndromic conditions or metabolic bone diseases that may independently affect midfoot
  - Less than 6 months of follow-up

Design/Methods

- Nonoperative or operative treatment (any fixation method)
- Primary Outcome:
  - Return to previous level of activity including sport (chart review)
  - Radiographic outcome (residual displacement, arthritic change, deformity)
  - Complications (chart review)

Update/To Do

- Protocol/Data Dictionary ✅
  - Will email to everyone who is interested in this study
  - Protocol (most updated version)
  - Data Dictionary (most updated version)
- IRB
- REDCap
  - Once done, TSRH/CCHMC/CHOP will pilot ~5 patients each, then open it up

Complication of Septic Arthritis of the Hip (MSKI Database): Updates

Presenter(s): Canizares
Collaborator(s): Shore, Sanders, Patricial Miller (BCH)

Avascular Necrosis in Pediatric Septic Arthritis: Epidemiological Insights from the CORTICES Multicenter Study

Fernanda Canizares MD MPH,

Patricia E. Miller PhD, Benjamin Shore MD MPH FRACS, Julia Sanders, MD

CORTICES Study Group

Pediatric Septic Arthritis

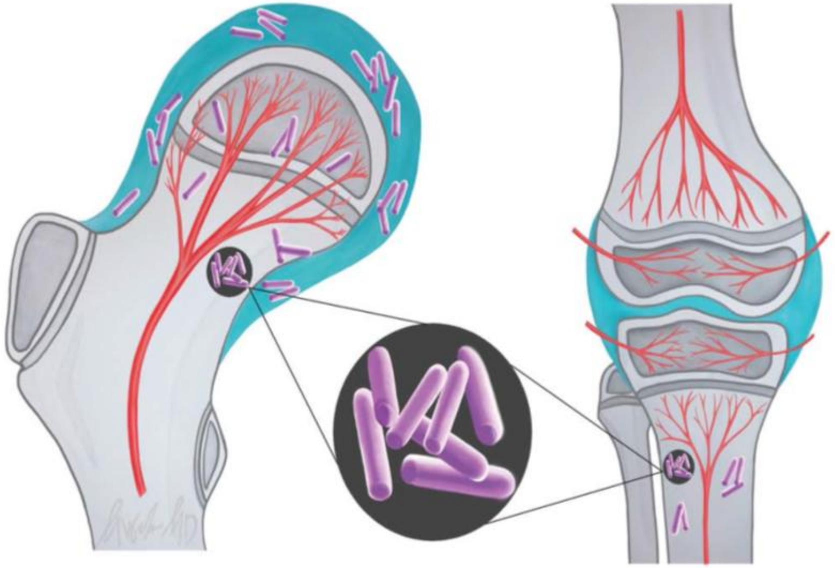
Septic arthritis presents commonly in hip & knee

Children = unique blood supply & anatomy → susceptible to bacterial spread

Increase in intra-articular pressure

Immunothrombosis → In severe infections, the host's defense mechanisms become pathological→ trap the bacteria using fibrin and platelets, leading to vascular occlusion.

Some patients → **Avascular Necrosis (AVN)**



Source: Erkilinc, et al. Current concepts in septic arthritis. *J Am Acad Orthop Surg* 2021;29:196-206

AVN incidence

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Sequelae and Reconstruction after Septic Arthritis of the Hip in Infants*

BY IN HO CHOI, M.D.†, PETER D. PIZZUTILLO, M.D.‡,§, J. RICHARD BOWEN, M.D.§, RAYMOND DRAGANN, M.D.¶, AND TALAL MALHIS, M.D.#, WILMINGTON, DELAWARE

From the Alfred I. duPont Institute, Wilmington

Choi [1990] 31patients →Classified AVN

Avascular necrosis as a complication of septic arthritis of the hip in children

E. C. Vidigal Jr[1], E. C. Vidigal[2], J. L. Fernandes[3]

Vidigal [1997] 20/71 (25%)

Analysis of poor prognostic factors for septic arthritis of the hip in children: a case series of 76 patients

Wei Feng, Qiang Wang, Ziming Yao, Danjiang Zhu, Baojian Song and Xuejun Zhang

Feng et al [2024] 24/76 (32%)

The Price for Delayed Diagnosis of Pediatric Septic Hip: Increased Cost and Poor Outcomes

Ena Nielsen, MD, J. Alexandra Mortimer, MD, FRCSC,† Viviana Bompadre, PhD,‡ and Suzanne Yandow, MD‡*

Nielsen [2024] 6/43 (14%)

Purpose

Primary: To estimate the incidence of AVN post-septic arthritis

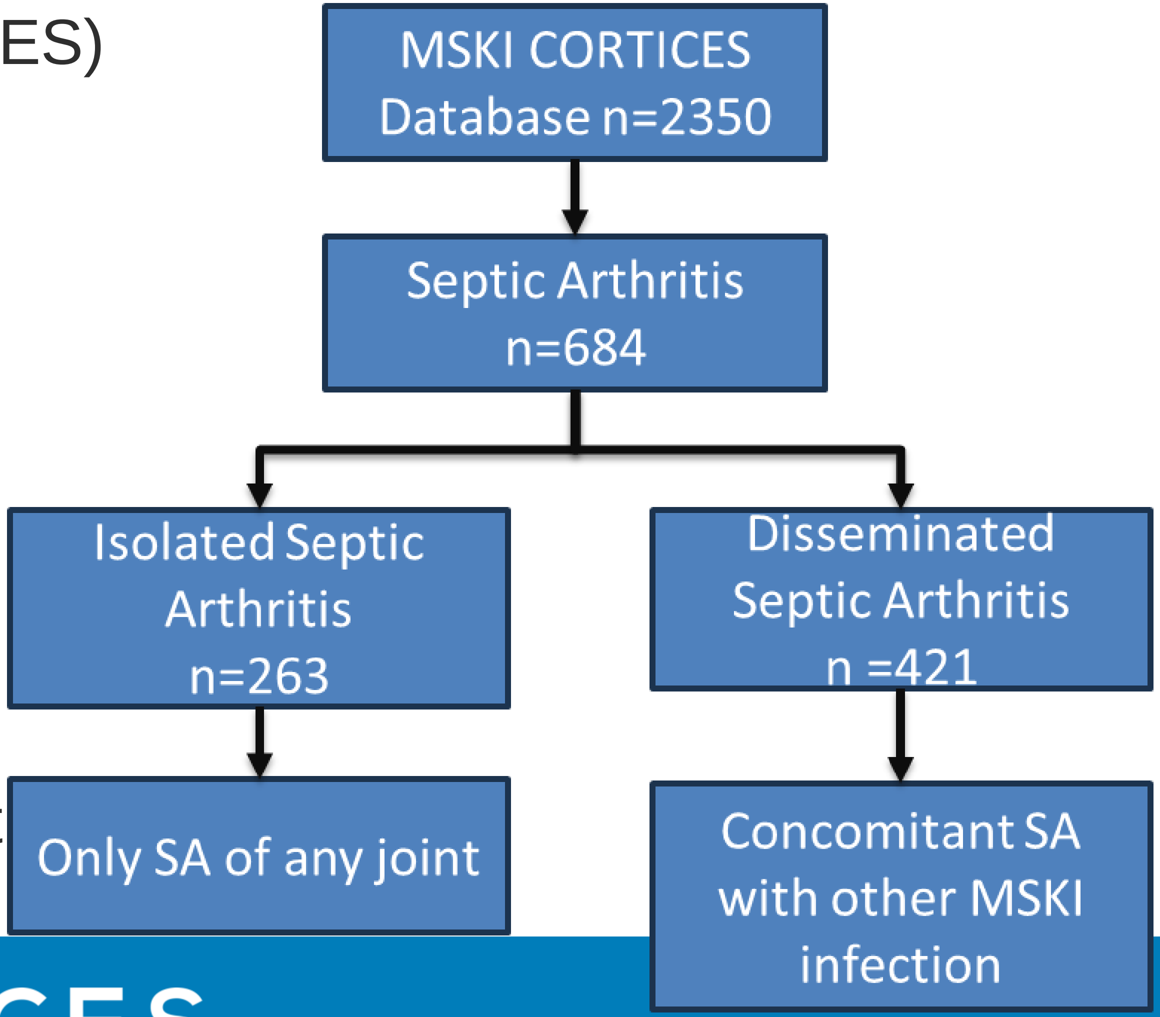
Secondary: Identify risk factors associated with AVN post-septic arthritis

Methods

Musculoskeletal Infection Database (CORTICES)

Multicenter Study

- 18 pediatric U.S. hospitals
- Jan 2010 - Dec 2016
- Retrospective review of EMR
- Patients < 18yr
- Patients diagnosed with SA of any joint



Statistics

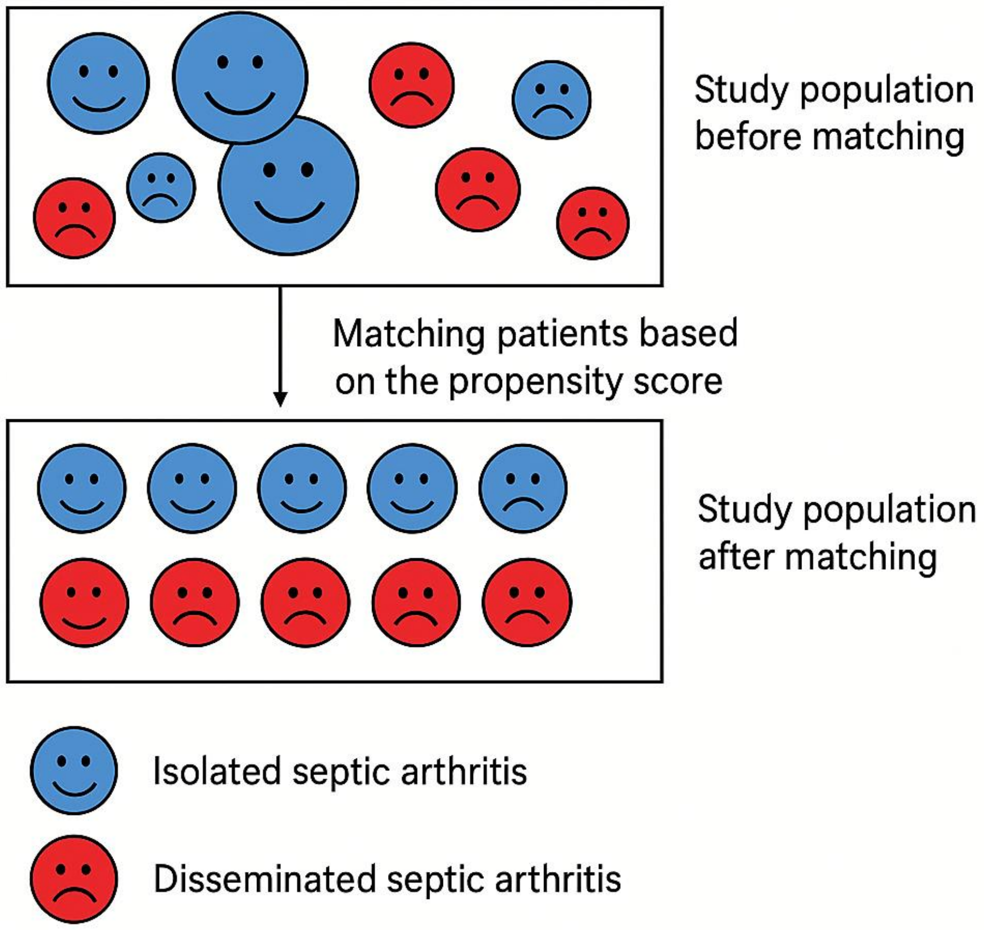
Propensity score matching:

Isolated vs. disseminated SA

- -age
- -infection
- -vital signs
- -affected joint
- -lab values

Multivariable Logistic Regression

Associations b/w clinical factors & AVN risk



Results - Demographics

Total Patients	684 patients
AVN Incidence	25 patients (3.7%, 95% CI: 2.4-5.4%)
Mean Age	6.1 years (SD 4.5)
Non-Ambulatory	67%
Joint Involvement	Hip: 48%, Knee: 28%, Ankle: 12%, UE: <10%
Blood Culture Positive	27%
Tissue Culture Positive	55%
Surgery Required	94% of patients

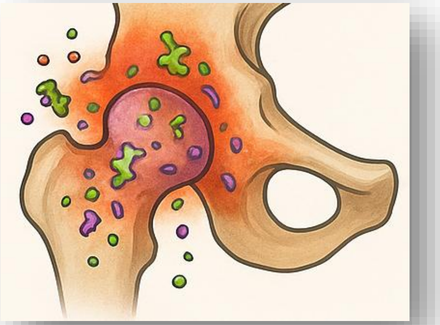
Patient Characteristics - AVN vs No AVN

Characteristic		AVN (N=25)	No AVN (N=324)	P-value
Age (years; mean (SD))	↑	8.4 (4.6)	6.4 (4.5)	0.03
CRP at Admission (mg/L; mean (SD)	↑	173.8 (152.0)	82.7 (68.3)	0.008
CRP Maximum (mg/L; mean (SD)		218.8 (147.1)	110.4 (75.8)	0.002
Platelets Minimum (x10^9 cells/L; mean (SD))	↓	230 (148.2)	312.4 (126.3)	0.01
Hospital Length of Stay (days)	↑	16.83 (11.7)	6.75 (5.1)	<0.001
ICU Admission (yes, %)		9 (36%)	14 (4%)	<0.001
Blood Culture Positive (yes, %)		15 (60%)	96 (30%)	0.006
- MRSA	↑	8 (53%)	22 (22.9%)	0.03
- MSSA		4 (27%)	56 (58.3%)	0.04
Tissue Culture Positive (yes, %)	↑	21 (84%)	205 (63%)	0.097
- MRSA		9 (42.9%)	29 (14.1%)	0.003
Disseminated Disease (yes, %)	↑	23 (92%)	157 (49%)	<0.001
Number of Surgeries (1 surgery only)	↓	11 (44%)	254 (77%)	<0.001

Multivariable Model – Testing for AVN

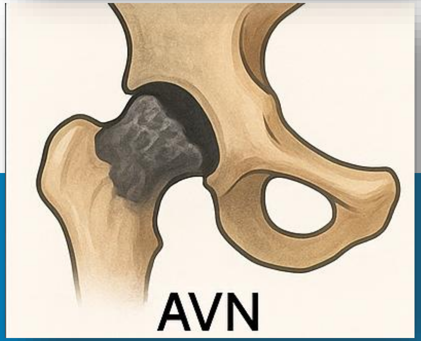
Variable	OR	(95% CI)	P
Disseminated infection	7.36	(2.23-37.64)	<0.001
CRP (>157.5)	5.26	(2.1-14.23)	<0.001
More than 1 surgery	3.27	(1.29-8.26)	0.01

Discussion



Disseminated disease, virulent strains (i.e MRSA) = ↑CRP

Severe or persistent infection → require more surgeries



↑ Risk of vascular compromise that leads to joint damage.

Limitations

Retrospective design → variable documentation

Symptom onset → can't accurately measure diagnosis or treatment delays

F/u limited to patients at our centers → outcomes may be incomplete

Conclusion

Incidence of AVN is lower than single center series: ~4%

Disseminated infection, High CRP, multiple surgeries → AVN risk

May inform a prognostic tool → identify high-risk children early

What is modifiable? → coagulopathy, persistent infection, high virulence

Napkin Idea #5

Grade 3B/C Open Tibia Shaft Fractures

Presenter(s): Sheffer

Authorship Guidelines & Opportunities

Presenter(s): Shore

Research: From Ideas to Publications (*if time permits*)

Presenter(s): Canizares

CORTICES Research Committee

Fernanda Canizares

CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

Research Committee Structure

- **Members**
  - Keith Baldwin
  - Walter Truong
  - Ishaan Swarup
  - Fernanda Canizares

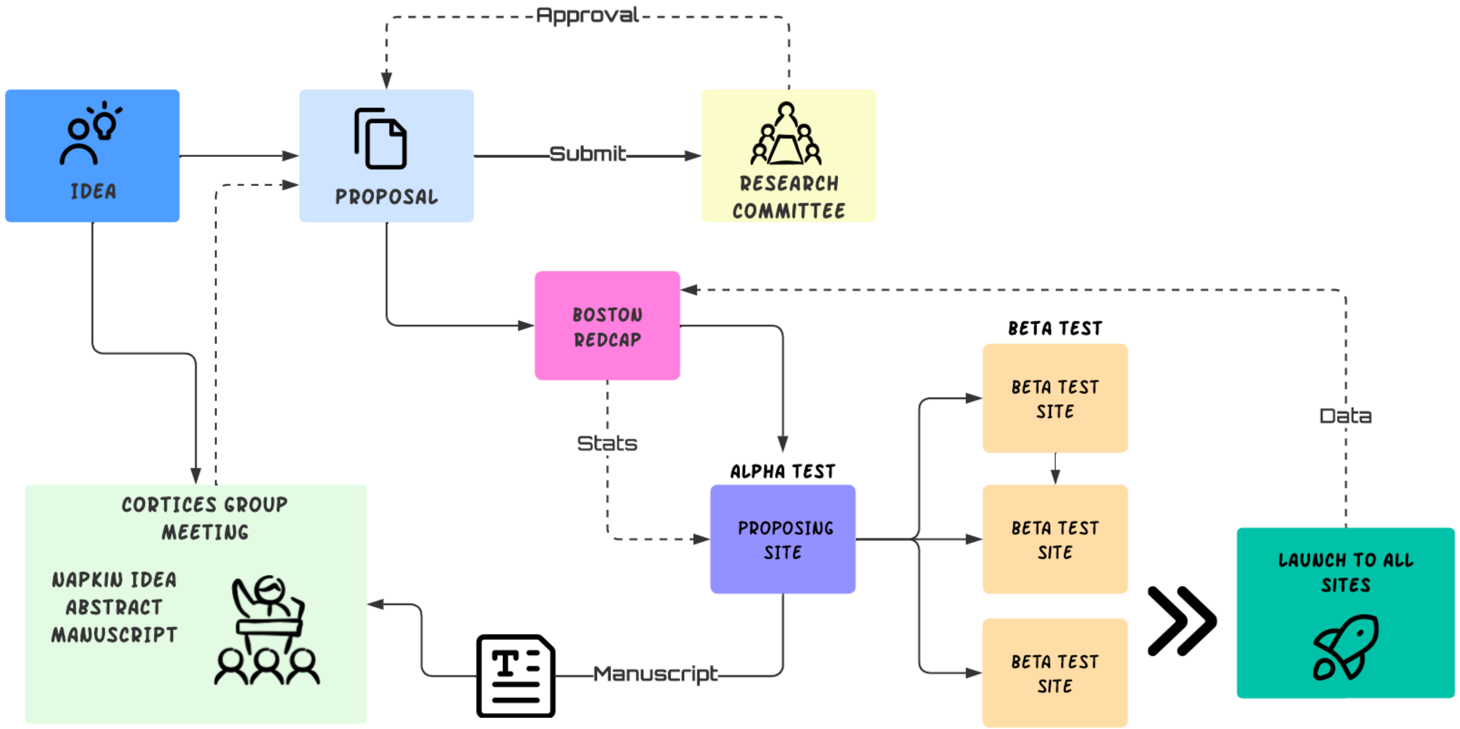
CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

Research Proposal Types

- Prospective: Requires new IRB
- Retrospective: Under current IRB. Chart review
- Expedited:
  - Surveys about practice variation (QI)
  - Use of existing databases (i.e Floating elbow, NAT)
  - Systematic reviews

Research Process

1. Idea presented at CORTICES meeting to gather feedback
2. Create a research Proposal and submit to the research committee (RC).
3. RC reviews, scores, and provides feedback.
4. Proposing team: variable list to Boston.
5. Boston creates REDCap
6. Proposing site tests own data (α-test)
7. Three Sites test database (β-test)
8. Study is launched to all sites.



Website Updates & New Forms (*if time permits*)

Presenter(s): Pandey

15 Minute Break

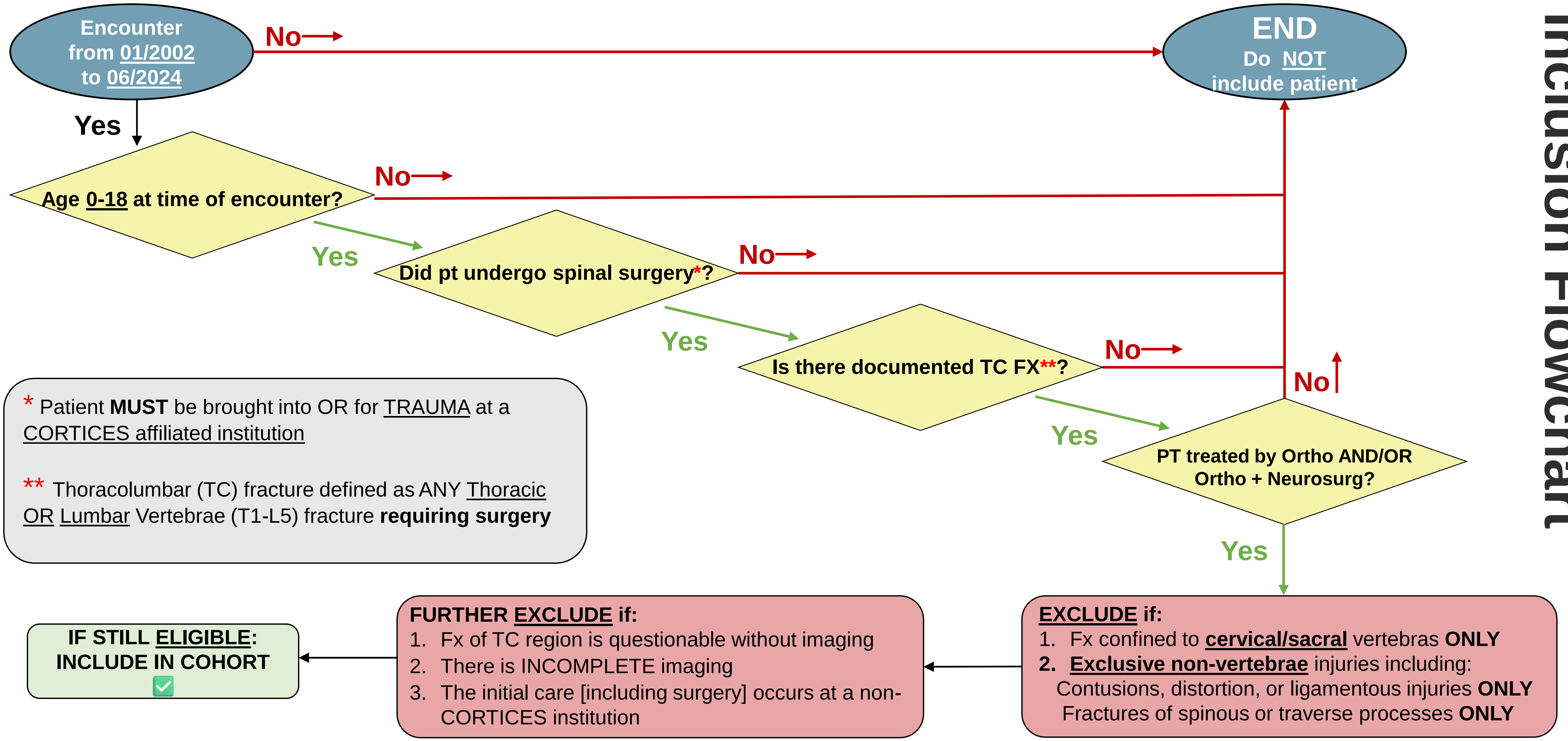
Please reconvene back at 10:45 AM for Day 2: Progress Report Block 2

Thoracolumbar Burst Fractures: REDCap Updates

Presenter(s): Shore

Additional Collaborator(s): Birch

Thoracolumbar Burst Fx Inclusion Flowchart



Status Updates: α-site (Boston)

- **Protocol Developed** ✅
- **Scientific Review Committee Feedback Implemented** ✅
- **Acquired Patient List** ⚠️
    - ⚠️ *Current cohort only captures **2010-2024*** ⚠️
        - Awaiting request with Informatics Team with additional ICD codes for 2002-2010
- **REDCap Nearing Finalization** ✅
    - Requesting Member Feedback
- **Data Collection** ⛔
    - Data collection planned to begin mid-October for α-site

Study Aim 1 & Outcomes

- **Aim 1:** A) Determine **most frequent fracture patterns** and B) **associated treatment characteristics** and compare **intraoperative outcomes** **across injury and treatment variations**, for pediatric thoracolumbar (TL) spinal trauma treated at CORTICES institutions
- **Hypothesis:** Most common fracture pattern in pediatric TC trauma will be **burst type fracture** with **posterior spinal fusion spanning two levels above and below** as predominant surgical treatment across institutions.

- **Outcomes:**
- **Fracture Patterns**
  - Mechanism of Injury
  - Fracture Classification using **AOTL & TLICS**
  - Location of Fracture (Vertebral Level)
- **Sx Treatment & Intraop Outcomes**
  - **Surgical Intervention**
    - Instrumentation? Y/N
    - Fusion? Y/N
    - Decompression? Y/N

    (Instrumentation, Fusion, Decompression:) **Ask For Levels**
  - **Surgical Intervention**
    - Estimated Blood Loss (EBL)
    - Neuromonitoring Changes
    - Durotomy (Trauma vs. Iatrogenic)

Fx Classification: MOI & Vertebral Levels

Injury Characteristics

B1. Date of Injury: [ ] Today M-D-Y

B1a. Age at time of injury: [ ] View equation [Autocalculated]

★B2. Mechanism of Injury:

- ○ Motor vehicle collision (car, truck, van)
- ○ Motorcycle / ATV accident
- ○ Bicycle accident
- ○ Fall from standing / ground level
- ○ Fall from height
- ○ Trampoline injury
- ○ Sports-related injury
- ○ Assault / non-accidental trauma
- ○ Other

Branch:

If MVA accident, car seat involved? Y/N

If Sport, pick from list of sport

Traumatic TC Fx Levels

B5. During the clinical workup, which of the following vertebral levels were found to be fractured?

☐ T1 ☐ T2 ☐ T3 ☐ T4 ☐ T5 ☐ T6 ☐ T7 ☐ T8 ☐ T9 ☐ T10 ☐ T11 ☐ T12 ☐ L1 ☐ L2 ☐ L3 ☐ L4 ☐ L5

Any trauma-induced *thoracic* OR *lumbar* vertebral fractures requiring surgery considered as "Traumatic Thoracolumbar Fracture." Levels = T1—L5

Fx Classification: AO Spine

★B8. Based on the charts, how would this fracture classified under the AO Spine Thoracolumbar system?

- (selected) Compression Injury
- Distraction Injury
- Translation Injury

reset

B8a. If compression injury was selected, what type of compression injury was it?

- Type A0: Minor nonstructural fracture
- Type A1: Wedge-compression
- Type A2: Split
- Type A3: Incomplete burst
- Type A4: Complete burst

reset

B8b. If distraction injury was selected, what type of distraction injury was it?

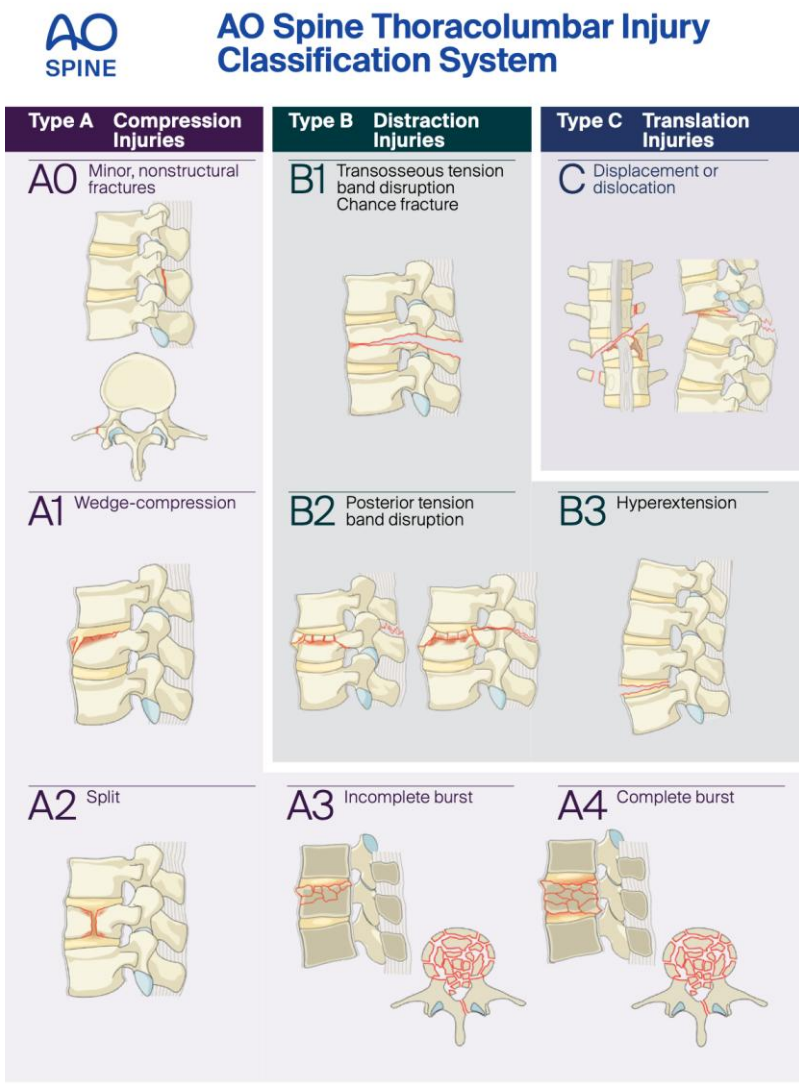
- Type B1: Transosseous tension band disruption (Chance fracture)
- Type B2: Posterior tension band disruption
- Type B3: Hyperextension

reset

B8c. If translation injury was selected, what type of translation injury was it?

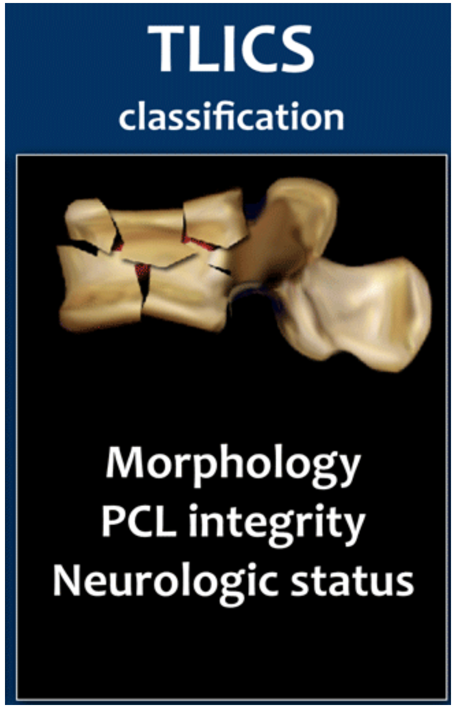
- Type C: Displacement or dislocation

reset



PIs to complete/classify at each institute

Fx Classification: TLICS Scale



Thoracolumbar Injury Classification and Severity Scale (TLICS)

B9. Based on the charts, what injury morphology is most appropriate for the TLICS classification?

- 1 Pt: Compression
- 2 Pts: Burst
- 3 Pts: Translation/rotation
- 4 Pts: Distraction

reset

B10. Based on the charts, what Posterior Ligamentous Complex (PLC) integrity option is most appropriate for the TLICS classification?

- 0 Pts: Intact
- 2 Pts: Suspected Disruption
- 3 Pts: Disruption

reset

B11. Based on the charts, what neurological status option is most appropriate for the TLICS classification?

- 0 Pts: Intact
- 2 Pts: Nerve Root Injury
- 2 Pts: Complete Cord Injury
- 3 Pts: Incomplete Cord Injury
- 3 Pts: Cauda Equina Injury

reset

B11a. TLICS Neurological Status Scoring:

View equation

Auto-calculated

B12. Total Point Tally for Management/Intervention:

1-3 Pts: Non-Surgical
4 Pts: Surgical or Non-Surgical
5-10 Pts: Surgical

View equation

Auto-calculated

PIs to complete/classify at each institute

Surgical Intervention
Fusion & Instrumentation Levels

★C5a. What form of fusion/insturmentation procedure did the patient undergo?

- Posterior Spinal Fusion (PSF)
- Anterior Spinal Fusion (ASF)
- Combined Anterior + Posterior Spinal Fusion

→ Fused [C5b] levels
Instrumented [C5c] levels

- Instrumentation without Fusion

→ Instrumented [C5c] levels only

C5b. What levels were fused in the spinal fusion?

- T1
- T2
- T3
- T4
- T5
- T6
- T7
- T8
- T9
- T10
- T11
- T12
- L1
- L2
- L3
- L4
- L5
- Sacrum
- Pelvis

C5c. What levels were instrumented?

- T1
- T2
- T3
- T4
- T5
- T6
- T7
- T8
- T9
- T10
- T11
- T12
- L1
- L2
- L3
- L4
- L5
- Sacrum
- Pelvis

Surgical Intervention Decompression Levels

★C6. Did the patient undergo some form of decompression procedure?

- (●) Yes
- ( ) No

reset

Please look through operative notes and mark as indicated

★C6a. Which decompression procedures were performed during surgery?

- ☐ Laminectomy
- ☐ Corpectomy
- ☐ Discectomy
- ☐ Other

C6b. What levels were involved in the decompression?

- ☐ T1
- ☐ T2
- ☐ T3
- ☐ T4
- ☐ T5
- ☐ T6
- ☐ T7
- ☐ T8
- ☐ T9
- ☐ T10
- ☐ T11
- ☐ T12
- ☐ L1
- ☐ L2
- ☐ L3
- ☐ L4
- ☐ L5

Surgical Intervention Additional Datapoints

★C7. Was there bone graft used during the course of the procedure?
- ☐ Bone graft not utilized
- ☐ Autograft
- ☐ Allograft
- ☐ Synthetic bone graft
- ☐ Other

Please mark all that apply.

★C8. What type of instrumentation(s) was utilized during the procedure?
- ☐ No instrumentations done at any vertebral level
- ☐ Screws
- ☐ Hooks
- ☐ Cage
- ☐ Other

Please mark all that apply.

C9. Was navigation utilized during the course of the procedure?
- ○ Yes
- ○ No

reset

C10. What type(s) of intraoperative imaging was used during the procedure?
- ☐ No intraoperative imaging
- ☐ C-arm fluoroscopy (2D)
- ☐ O-arm CT spin (CT)
- ☐ Spine ultrasound

C11. Estimated Blood Loss (in mL):

Please make sure EBL is noted in mL

★C13. Was there indication of a dural injury sustained?
- ◉ Yes
- ○ No

reset

C13a. What was the suspected cause for the damage to the spinal dura?
- ○ Traumatic (present before surgery)
- ○ Iatrogenic (caused during surgery)

reset

★C13b. If the spinal dura had indications of injury, was the dural injury repaired?
- ○ Yes
- ○ No

reset

★C14. Was there intraoperative neuromonitoring available during the procedure?
- ◉ Yes
- ○ No

reset

★C14a. If neuromonitoring was used, what type of neuromonitoring was utilized?
- ○ Motor Evoked Potential neuromonitoring (MEPs)
- ○ Somatosensory Evoked Potentials (SSEPs)
- ○ Both MEPs [Option 1] and SSEPs [Option 2]

reset

Please note that MEPs and SSEPs can be used in conjunction. If this is the case, please select option 3 from the available radio options

C14b. Based on the nueromonitor reading, was there any indication of an intraoperative change?
- ○ No change
- ○ Worsening
- ○ Improvement without complete resolution
- ○ Complete resolution

reset

Study Aim 2 & Outcomes

- **Aim 2:** To estimate the **frequency of reoperation** and to determine the **most common complications** following spinal surgery for TL trauma in pediatric patient.
- **Hypothesis:** Pediatric patients undergoing thoracolumbar trauma will have **low rates of reoperations** and **implant related issues** will be the **most common complication**

- **Outcomes:**
- **Frequency of Reoperation**
  - Proportion of patients returning to OR post-index procedure
    - Number of additional surgeries
- **Complications**
  - Indication for reoperation
    - **Infection; Implant failure; Neurologic deterioration; Wound complication**
  - Type of corrective surgery performed
  - EBL of additional surgeries

Outcomes: Post-op Complications

D2. Complications, Additional Surgeries, & Hospitalizations

★D4. Did the patient experience any complications requiring additional surgery following the index procedure?
- (●) Yes
- ( ) No

reset

D4a. If additional procedures were required, how many post-index procedures were performed on the patient? [2]

D4.1a. Date of re-operation (#1): [ ] Today M-D-Y

★D4.1b. What was the primary indication for the reoperation (#1)? [ ]

★D4.1c. What was the type of reoperative (#1) procedure that was performed?

Please mark all that apply:
- ☐ Irrigation & Debridement (I&D for infection)
- ☐ Hardware removal
- ☐ Revision fusion
- ☐ Other

D4.1d. What was the estimated blood loss (EBL) in this reoperative (#1) procedure (in mL)? [ ]
Please make sure EBL is noted in mL

D4.1e. Date when patient was dischared after re-operation (#1): [ ] Today M-D-Y

★D5. Following the index surgery, did the patient require any of the following unplanned healthcare services NOT involving a return to the operating room?
- ☐ No, none of the below
- ☐ Post-op emergency department visit(s)
- ☐ Post-op unexpected hospitalization(s)
- ☐ Post-op ICU Stay(s)

Study Aim 3 & Outcomes

- **Aim 3:** To **determine both regional and surgeon-specific differences in the surgical management** of pediatric thoracolumbar trauma**, including treating surgeon specialties and surgical approaches, across CORTICES institutions**
- **Hypothesis:** There will be **significant differences in the surgical management with variation** in both **regional treatment patterns and surgeon-specific practices**, particularly regarding whether the treating surgeon is from Orthopedics or Neurosurgery.

- **Outcomes:**
- **Variations in surgical management**
  - **Clinical workup variation (resource utilization)**
  - **Operative characteristics across US regions**
    - Surgical approach
    - Levels fused/instrumented/decompressed
    - Use of grafts, instrumentations, etc.
    - EBL, transfusions, etc.
    - %cases treated in neurosurgery vs. ortho vs. combined neurosurgery & ortho

Variability in Resource Management Clinical Work Up at Presentation

★B3. Which inpatient service was the patient first admitted to (following ED evaluation or outside transfer)?

- ◯ Orthopedics
- ◯ General Surgery
- ◯ Trauma Surgery
- ◯ Neurology
- ◯ Neurosurgery
- ◯ Other

★B4. Which department services were formally consulted for this patient (documented consult note/order) between presentation and surgery?

- ☐ Orthopedics
- ☐ Neurology
- ☐ Neurosurgery
- ☐ Emergency Department
- ☐ General Surgery
- ☐ Trauma Surgery
- ☐ Cardiology
- ☐ Radiology
- ☐ Anesthesiology
- ☐ Gastroenterology
- ☐ Pulmonology
- ☐ Intensive Care Team
- ☐ Physiatry Medicine & Rehabilitation (PM&R)
- ☐ Other

Variability in Resource Management Imaging Work Up & Findings

★B7. Which of the following imaging modalities was utilized in documenting the confirmation of spinal fracture within the thoracolumbar region?

- ☑ X-ray
- ☑ MRI

★B7a. If an MRI was performed, is there any skull/brain MRI imaging documented?

★B7a1. If skull/brain MRI was perfromed, what were the findings?

★B7b. If an MRI was performed, is there any spine MRI imaging documented?

★B7b1. If spine MRI was perfromed, what were the findings?

- ☐ Posterior ligamentous complex (PLC) disruption
- ☐ Disc herniation
- ☐ Other

Please look through radiologic notes and mark as indicated

★B7c. If a CT scan was performed, is there any skull/brain CT imaging documented?

- ◉ Yes
- ○ No

reset

★B7c1. If skull/brain CT scan was performed, what were the findings?

- ☐ Normal
- ☐ Skull fracture
- ☐ Intracranial hemorrhage (epidural, subdural, SAH, intraparenchymal)
- ☐ Cerebral edema
- ☐ Midline shift/herniation
- ☐ Other

Please look through radiologic notes and mark as indicated

★B7d. If a CT scan was performed, is there any spine CT imaging documented?

- ◉ Yes
- ○ No

reset

★B7d1. If spine CT scan was perfromed, what were the findings?

- ☐ Normal (only vertebral fracture noted)
- ☐ Retropulsion / canal compromise
- ☐ Pedicle/lamina fracture
- ☐ Other associated injuries (rib fracture, posterior element injury, etc.)
- ☐ Other

Please look through radiologic notes and mark as indicated

Variability in Resource Management: Ortho vs. Neurosurgery

C3. Please indicate which provider(s) were present from each service during the index surgery:

	Orthopaedics	Neurosurgery
Primary Attending	☐	☐
2nd Attending	☐	☐
Fellow	☐	☐
Resident	☐	☐
PA/NP	☐	☐

Next Steps

- **REDCap Nearing Finalization** ✅
  - Requesting Member Feedback
  - Interested members can look through the data collection form
    - **α-site** can send it in survey form for feedback

- **Data Collection**
  - Data collection will begin by mid-October for α-site

- **Seeking β-sites to volunteer**

Publications: Findings & Discussions

Presenter(s): Ying Li, Shore, Baldwin

Study #1

Characteristics of Septic Arthritis of the Foot and Ankle in Children-Review of a Retrospective Multicenter Database

Presenter(s): Ying Li

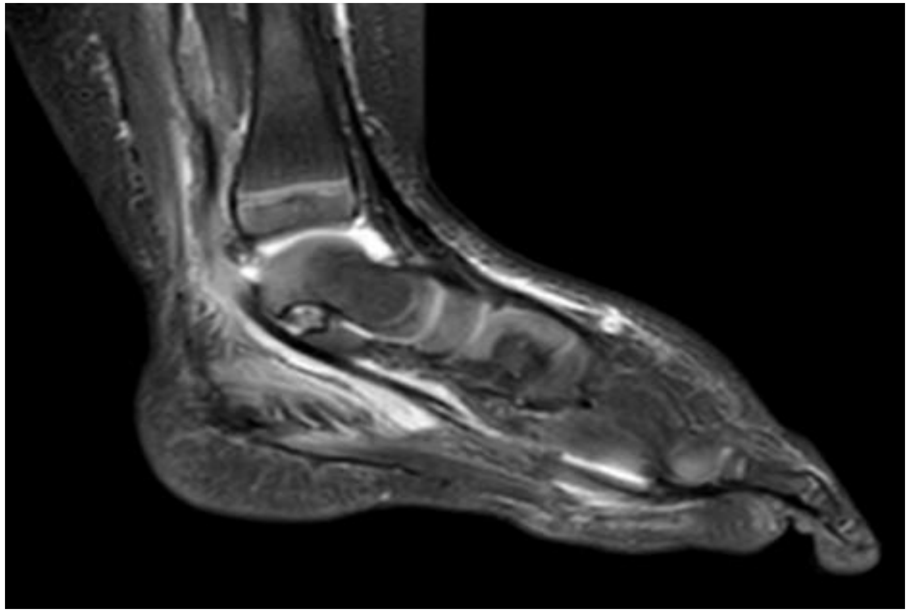
Background and Design

- Septic arthritis of the foot and ankle (SAFA) is relatively uncommon
  - Majority of previous pediatric literature on lower extremity septic arthritis has focused on the hip and/or the knee

- **Purpose:** Report presenting characteristics, microbiological profile and treatment outcomes of SAFA in a pediatric population from a multicenter database

Methods

- Review of patients with SAFA identified from CORTICES retrospective musculoskeletal infection database
- Exclusion
  - Patients with musculoskeletal infection outside of lower leg/ankle/foot
- Data Collected:
  - Demographics
  - Laboratory tests
  - Culture Results
  - Surgical data
  - Complications



Results

- Septic arthritis of the foot and ankle w/wo lower leg concomitant disease involved in 82/684 (12%) of all septic arthritis cases

Group Characteristics	
Age at admission (years; median (IQR))	7 (2.0-10.5)
Sex (% male)	46 (56%)
Blood culture taken (n [%])	73 (89%)
Blood culture Positive (n [%])	16 (22%)
Tissue Culture performed (n [%])	77 (94%)
Tissue Culture Positive(n [%])	59 (77%)
Required Surgery (n [%])	77 (94%)
2	9 (12%)
3 or more	3 (4%)

Additional Diagnoses (n=45)	(n [%])
Osteomyelitis	39 (48%)
Subperiosteal Abscess	15 (18%)
Cellulitis	7 (9%)
Pyomyositis	3 (4%)
Myositis	3 (4%)
Superficial Abscess	1 (1%)

Disseminated disease	9 (11%)
Septic PE	2 (2%)
DVT	1 (1%)

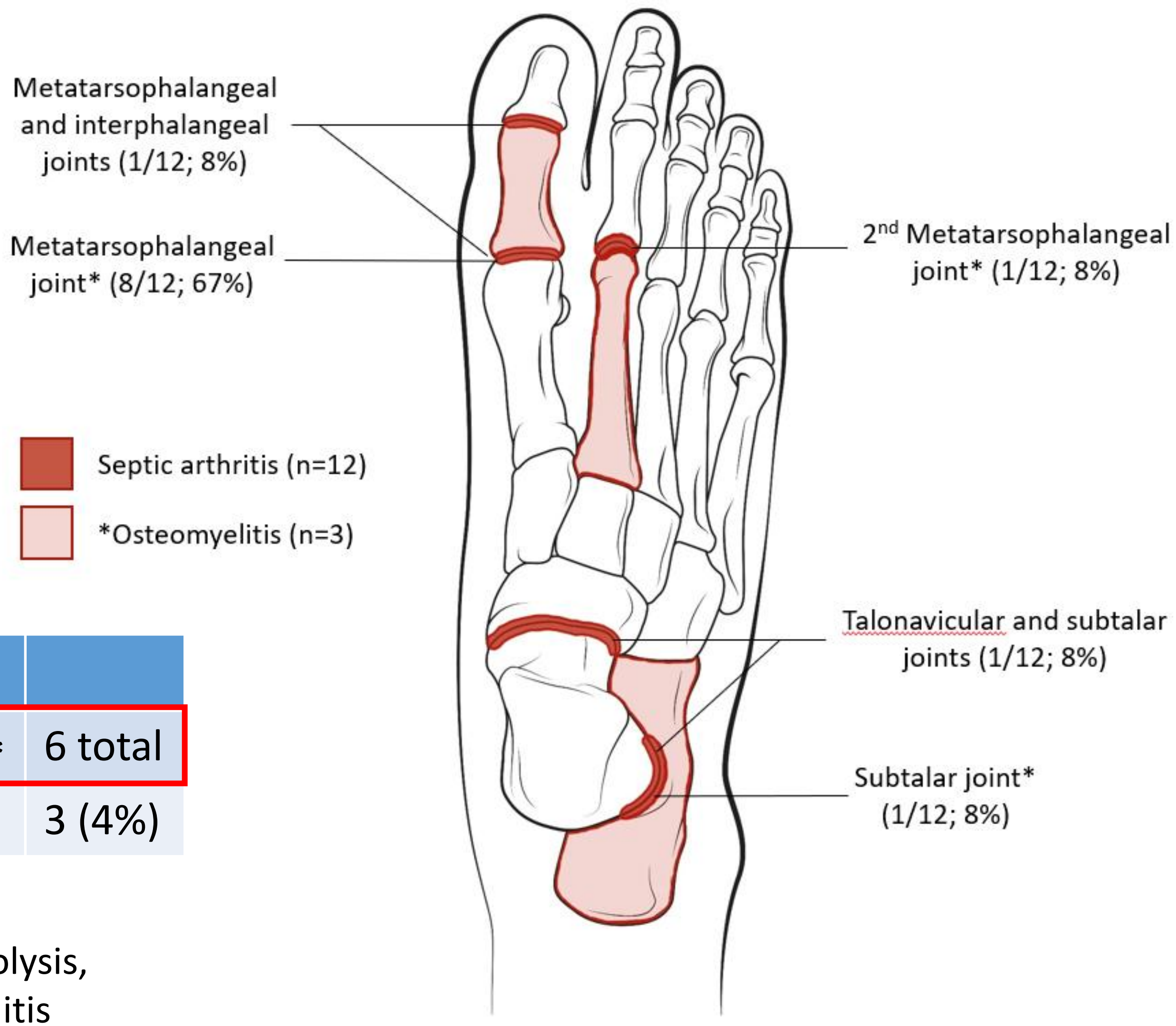
Results

Tissue culture result (n=61)	(n [%])
MSSA	28 (46%)
Strep	13 (21%)
MRSA	12 (20%)
Kingella kingae	4 (7%)
Salmonella	1 (2%)
Other	5 (8%)

Anatomic Location (n=82)	(n [%])
Ankle only	48 (59%)
Foot only	12 (15%)
Ankle and Foot	2 (2%)
Ankle and Leg	20 (24%)

Complications	
Musculoskeletal complications*	6 total
Recurrent Admission (n [%])	3 (4%)

* AVN, pathologic fracture, chondrolysis, chronic pain and chronic osteomyelitis



Results

Characteristics by anatomic location	Ankle only (n=48)	Foot only (n=12)	Ankle + (n=22)	p-value[a]	p-value[b]	p-value[c]
Age (years median (IQR))	5.6 (1.7-9.7)	11 (8.3-14.3)	9 (4.0-10.1)	0.01	0.21	0.09
Sex (% male)	23 (48%)	8 (67%)	15 (68%)	0.50	0.35	0.93
Admission temperature	99.3± 1.54	98.7 ± 1.07	100 ± 1.39	0.12	0.12	0.01
Admission pulse	121.3 ± 18.14	88.1 ± 25.46	121.5 ± 25.3	0.003	0.97	0.003
Admission WBC	13.8 ± 5.15	9.4 ± 2.64	14.8 ± 7.58	<0.001	0.56	0.01
Admission ESR (n=79)*	45.5 ± 30.14	31.9 ± 17.78	50.3 ± 31.22	0.12	0.56	0.12
Admission CRP	70.7 ± 79.46	47.4 ± 37.65	150.3 ± 124.3	0.15	0.02	0.003
Admission platelets (n=81)*	333.8 ± 88.59	243.2 ± 96.05	322.7 ± 167.5	0.03	0.78	0.19

[a] p-value calculated for comparison between ankle only and foot only patients.
[b] p-value calculated for comparison between ankle only and ankle+ patients.
[c] p-value calculated for comparison between foot only and ankle+ patients.

Conclusions

- SAFA ≈ 12% of cases of SA in children
- Ankle only involvement is the most common presentation
- MSSA is the most common causative organism
- Multifocal infection occurs relatively frequently
    - osteomyelitis diagnosed in nearly half of patients (48%)
- Majority of patients can be treated successfully with single surgery (84%)
- Readmission and musculoskeletal complication rates are low

Time Course

POSNA Presentation

↓

JPO rejection

- Reviewed further journal options with authors

↓

JAAOS research submission

- Minor edits

↓

JAAOS publication

Research Article

Characteristics of Septic Arthritis of the Foot and Ankle in Children—Review of a Retrospective Multicenter Database

Matthew Stepanovich, MD
Benjamin J. Shore, MD, MPH
Ryan M. Sanborn, BA
Danielle L. Cook, MA
Jonathan G. Schoenecker, MD, PhD
Ying Li, MD
CORTICES

American Academy of Orthopaedic Surgeons
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Study #2

Descriptive Epidemiology of Venous Thromboembolism in Pediatric Orthopedic Patients: A National, Multicenter Study

Presenter(s): Shore

Study #3

The Identification and Work-Up of Nonaccidental Trauma: Practice Variation Across US Children's Hospitals

Presenter(s): Shore

Study #4

Hold that K Wire! Fixing Nondisplaced Distal Forearm Fractures in Pediatric Floating Elbow Injuries is Unnecessary

Presenter(s): Baldwin

Finances & Company External Funding Updates

Presenter(s): Shore

Final Thoughts & Meeting Adjournment

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Children's Hospital Colorado

UCSF Benioff

Texas Children's Hospital

Boston Children's Hospital
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Le Bonheur Children's Hospital

gillette CHILDREN'S

children's MEDICAL CENTER

SCOTTISH RITE FOR CHILDREN

Children's Hospital of Philadelphia

Monroe Carell Jr. children's Hospital at Vanderbilt

Children's Hospital LOS ANGELES

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