



# *Femoral Neck Fracture Study*

CORTICES Beta Testing

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

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# Retrospective Study

**Primary Aim:** To determine the incidence and risk factors of adverse outcomes (AVN, non-union, repeat surgery, etc.) after treatment of femoral neck fracture in a pediatric population.

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 sustaining a femoral neck fracture in children treated at CORTICES institutions..

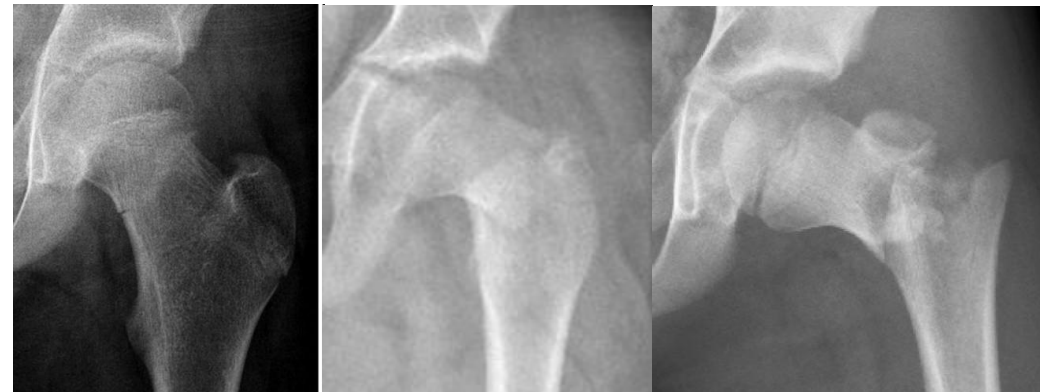
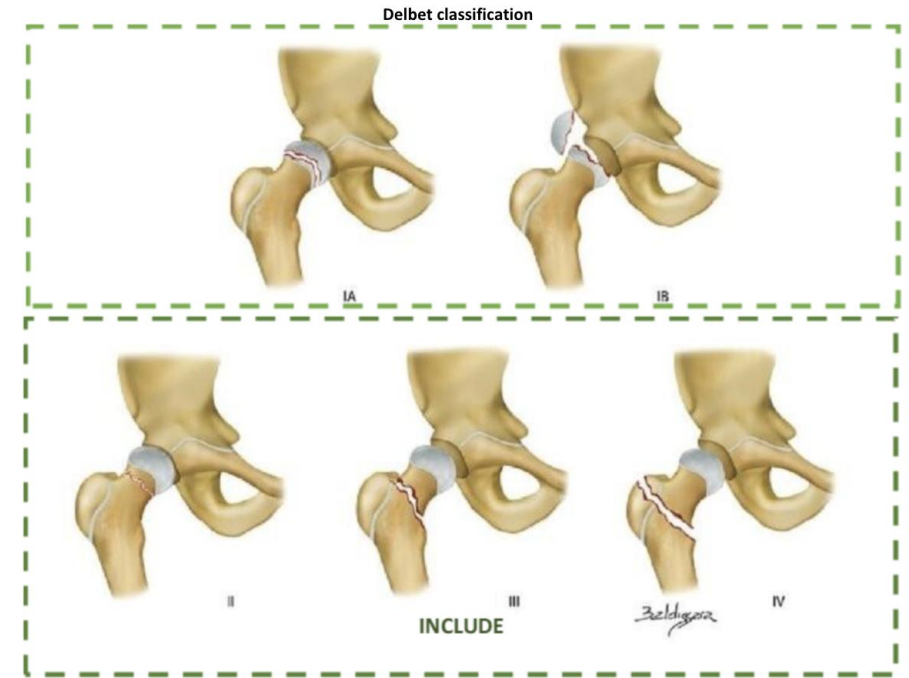
Hypothesis: Various patient characteristics (i.e older age), treatment factors (delayed surgical intervention), and imaging data (i.e severe displacement) will be significantly associated with higher incidence of adverse outcomes following femoral neck fractures in children treated at CORTICES institutions.

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** including physeal fractures proximal to the lesser trochanter
- Between **1/10/2010 and 5/30/2025**
- 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**



# DAR Pull based on ICD9 / ICD10

**ICD-10 Codes Search Query**

<b>S72.00</b>	Fracture of unspecified part of neck of femur	
<b>S72.01</b>	Unspecified intracapsular fracture of femur	
<b>S72.03</b>	Midcervical fracture of femur	
<b>S72.04</b>	Fracture of base of neck of femur	
<b>S72.05</b>	Unspecified fracture of head of femur	
<b>S72.09</b>	Other fracture of head and neck of femur	
<b>S72.10</b>	Unspecified trochanteric fracture of femur	
<b>S72.14</b>	Intertrochanteric fracture of femur	
<b>S72.2</b>	Subtrochanteric fracture of the femur	
<b>S72.8</b>	Other fracture of the femur	
<b>S72.9</b>	Unspecified fractures of the femur	

**ICD-9 Codes Search Query**

<b>733.14</b>	Pathologic fracture of neck of femur	
<b>733.15</b>	Pathologic fracture of other specified part of femur	
<b>733.96</b>	Stress fracture of femoral neck	
<b>820.02</b>	Closed fracture of midcervical section of neck of femur	
<b>820.03</b>	Closed fracture of base of neck of femur	
<b>820.09</b>	Other closed transcervical fracture of neck of femur	
<b>820.10</b>	Open fracture of intracapsular section of neck of femur, unspecified	
<b>820.12</b>	Open fracture of midcervical section of neck of femur	
<b>820.13</b>	Open fracture of base of neck of femur	
<b>820.19</b>	Other open transcervical fracture of neck of femur	
<b>820.20</b>	Closed fracture of trochanteric section of neck of femur	
<b>820.21</b>	Closed fracture of intertrochanteric section of neck of femur	
<b>8202.2</b>	Closed fracture of subtrochanteric section of neck of femur	
<b>8203.0</b>	Open fracture of trochanteric section of neck of femur, unspecified	
<b>8203.1</b>	Open fracture of intertrochanteric section of neck of femur	
<b>8203.2</b>	Open fracture of subtrochanteric section of neck of femur	
<b>820.8</b>	Closed fracture of unspecified part of neck of femur	

# XR Screening for femoral neck (205 -> 61)

Patient_name ▾	MRN_dummy ▾	Birth_date ▾	Fem_neck_YN ▾	Procedure ▾	Admission_date ▾	ICD_code ▾	Admission_provider ▾
Dummy1	4143580	04/27/2009	N		07/08/2022 05:22 AM	820.21	
Dummy2	7826482	01/04/2000	N	Fem shaft	05/15/2015 02:06 PM	S72.091A	
Dummy3	6242363	04/20/2000	Y	cannulated screws	09/05/2018 11:43 PM	S72.001A	
Dummy4	500036	06/21/2000	N		07/05/2020 10:03 AM	S72.109A	
Dummy5	9264519	12/16/1997	N		09/21/2019 12:53 AM	820.2	
Dummy6	2950308	09/07/2013	N	SCFE	03/09/2010 10:31 AM	820.8	
Dummy7	9508923	08/21/1998	N	Fem shaft	11/06/2021 04:24 PM	S72.032A	
Dummy8	9515944	08/20/2013	Y	DHS	11/22/2019 10:14 PM	S72.009A	
Dummy9	1509243	11/18/1995	N	Fem shaft	08/31/2010 10:14 AM	S72.22XA	
Dummy10	3104853	08/20/2004	N		11/01/2011 10:22 PM	820.8	
Dummy11	2806491	05/19/1998	N	Intertroch	10/11/2017 08:13 PM	S72.142A	
Dummy12	1649282	12/08/2001	N		07/13/2023 04:46 PM	S72.002A	
Dummy13	3459730	10/05/2000	Y	non-op	10/01/2022 09:08 AM	S72.002A	
Dummy14	4139237	08/07/2005	N	cannulated screws	02/17/2020 08:52 PM	S72.059A	
Dummy15	852115	07/02/1995	Y		01/04/2021 09:50 PM	S72.101A	
Dummy16	5242038	06/29/2013	N	cannulated screws	10/02/2013 06:19 PM	S72.001A	
Dummy17	991919	09/13/2006	N		04/14/2020 10:29 AM	S72.001A	
Dummy18	9413158	11/24/2011	Y	cannulated screws	04/18/2016 05:12 PM	S72.002A	
Dummy19	6949518	10/15/2005	N	cannulated screws	02/05/2024 09:30 PM	S72.002A	
Dummy20	5645463	12/08/2014	N		05/03/2018 06:01 PM	S72.123A	
Dummy21	6825427	08/22/2010	N	Fem shaft	08/14/2021 12:55 AM	S72.002A	
Dummy22	8769697	01/27/2014	Y	cannulated screws	09/22/2013 05:33 AM	S72.002A	


**\* Dummy variables created to avoid PHI; only used to demonstrate the screening efforts undertaken by lead site at Lurie Children's**

# Excluded

- Atraumatic physeal injuries: Slipped Capital femoral epiphysis (ICD-9 732.2 or ICD-10 code M93.0)
- 5 excluded for age >16 at time of surgery
- 1 excluded for lost to follow-up within 2 weeks of surgery
- 2 excluded for no initial injury imaging available



When entering your patient data, you will be asked to enter a new or existing Record ID. **Please use your 2-digit Unique Site Number (shown below) for your site's data.**



Logged in as [jlaron@luriechildrens.org](#)  
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**Project Home and Design**

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 Project status: **Development**

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 - Create new records or edit/view existing ones  
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Childrens Hospital  
 Childrens Hospital

**Pediatric Femoral Neck Fracture: CORTICES**
PID 5419

### Add / Edit Records

You may view an existing record/response by selecting it from the drop-down lists below. To create a new record/response, type a new value in the text box below and hit Tab or Enter. To quickly find a record without using the drop-downs, the text box will auto-populate with existing record names as you begin to type in it, allowing you to select it.

**NOTICE:** This project is currently in Development status. **Real data should NOT be entered** until the project has been moved to Production status.

Total records: **61**

Choose an existing Record ID


Enter a new or existing Record ID

### Data Search

Choose a field to search

Search query

SITE #	SITE	SITE #	SITE
20	Boston Children's	30	Le Bonheur Children's
21	Carolinas Medical Center	31	Lurie Children's
22	Children's Atlanta	32	Nationwide Children's
23	Children's Colorado	33	Rady Children's
24	Children's Dallas	34	Seattle Children's
25	Children's LA USC	35	St. Louis Children's
26	Children's Philadelphia	36	Texas Children's
27	Cincinnati Children's	37	Vanderbilt Children's
28	CS Mott Children's (Michigan)	38	UCSF
29	Gillette Children's		



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**Project Home and Design**

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 Project status: **Development**

**Data Collection**

Record Status Dashboard  
 - View data collection status of all records  
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Record ID **1**
[Select other record](#)

**Applications**

Project Dashboards  
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Childrens Hospital  
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**Pediatric Femoral Neck Fracture: CORTICES**
PID 5419

**Record Home Page**



The grid below displays the form-by-form progress of data entered for the currently selected record. You may click on the colored status icons to access that form/event.


[Choose action for record](#)


**Record ID 1**

Data Collection Instrument	Status
Eligibility	
General	
Imaging upload	
Imaging findings	

**Legend for status icons:**

 Incomplete
  Incomplete (no data saved) ?

 Unverified

 Complete



Designer · Dictionary · Codebook

Project status: **Development**

**Data Collection**

**Record Status Dashboard**  
- View data collection status of all records

**Add / Edit Records**  
- Create new records or edit/view existing ones

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**Record ID 1** [Select other record](#)

Data Collection Instruments:

**Eligibility**

General

Imaging upload

Imaging findings

**Applications**

Project Dashboards

Alerts & Notifications

Multi-Language Management

Calendar

Data Exports, Reports, and Stats

Data Import Tool

Data Comparison Tool

Logging and Email Logging

Field Comment Log

File Repository

User Rights and DAGs

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NEW FEATURES v6.17

Request a New User Account

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**Help & Information**

Help & FAQ

Video Tutorials

Suggest a New Feature

**Record ID** 1

**Site:** Lurie Children's

**Inclusion Criteria**

**Has the patient presented with a femoral neck fracture between 1/10/2010 and 5/30/2025?**

☒ Yes  
☐ No

\* must provide value

Patients with femoral neck fracture defined as Delbet 1, 2, 3, and 4 fractures distal to the physis and proximal to the lesser trochanter, or Salter Harris 2 fractures.

**Is the participant between 2 and 16 years of age?**

☒ Yes  
☐ No

\* must provide value

Patient considered to be no older than 16.00 at time of presentation

**Presented at, transferred to, or followed up at a CORTICES-participating institution.**

☒ Yes  
☐ No

\* must provide value

\*Patients who were not initially treated at a participating center will be included if injury films are available.

**Ambulatory Status for Inclusion**

☒ Ambulatory prior to injury  
☐ Non-ambulatory or with poor bone quality (CP, arthrogryposis, SMA, Spina bifida, etc)

\* must provide value

**Initial injury films and at least one follow-up image.**

☒ Yes  
☐ No

\* must provide value

For Patients who underwent surgery, intra-op or early post-op is also required.

**Exclusion Criteria**

**Atraumatic physeal injuries: Slipped Capital femoral epiphysis (ICD-9 732.2 or ICD-10 code M93.0)**

☐ Yes  
☒ No

\* must provide value

**Eligibility**

**If you answered NO for any of the inclusion questions or YES for exclusion questions, the patient is **NOT** eligible for data collection. Please do not continue further.**

**Is the participant eligible for data collection**

☒ Yes  
☐ No

Save & Exit Form

Save & Go To Next Record

- Cancel -

Record ID1

ID

31-001

Patient Characteristics

Date of Birth

01-15-2006

Today

M-D-Y

Sex

☒ Male

☐ Female

☐ Unknown

reset

Height in centimeters

187.1

Weight in kilograms

69.7

BMI

19.9

View equation

Health Equity - Child Opportunity Index (COI) - National percentile

61

<https://www.diversitydatakids.org/child-opportunity-index>

Health Equity - Area Deprivation Index (ADI) - National percentile

43

<https://www.neighborhoodatlas.medicine.wisc.edu/>

Ambulatory Status

☒ Ambulatory prior to injury

☐ Non-ambulatory prior to injury

reset

History of long bone fractures

☐ Yes

☒ No

reset

Medical conditions associated with abnormal bone quality?

☒ None

☐ Osteogenesis Imperfecta

☐ Rickets

☐ Cerebral Palsy

☐ Autism

☐ Spinal Muscular Atrophy

Injury Characteristics

Date of injury

08-21-2021

Today

M-D-Y

Time of injury

05:00

Now

H:M

Mechanism of Injury

☐ Low-energy: Including falls from < 4 feet (ground level, chair, bed, etc.), sports injuries

☒ High-energy: Including motor vehicle accidents and falls >4 feet, gunshot injuries, skiing accidents with collisions

reset

Polytrauma status

Yes = i.e ISS>15, PICU admission, multiple fractures, need for intubation in the ED, etc

No = isolated fracture

reset

Open fracture?

☐ Yes

☒ No

reset

Prodromal symptoms prior to fracture?

☐ Yes

☒ No

reset

Treatment Characteristics

Date of admission to hospital

08-21-2021

Today

M-D-Y

Time of admission to hospital

05:00

Now

H:M

Surgery performed at home institution

☐ Yes

☒ No

reset

Date of surgery

08-22-2021

Today

M-D-Y

OR In-room time

11:20

Now

H:M

OR out of room time

14:15

Now

H:M

Surgical table used

☒ Flat Jackson table

☐ Hana table

☐ Traditional fracture table

☐ Regular table

☐ other

reset

Northwestern Medicine®

Feinberg School of Medicine

# Chart Review

Encounters Medications Labs Imaging Cardiology Home Monitoring Notes/Trans Procedures Nursing Orders Other Orders Referrals Media

Refresh Preview Encounter lifeIMAGE Upload lifeIMAGE View

Filters Filter Encounter Type... Me ORTHOPAEDICS ORTHOPAEDICS Admissions PT MMT Lurie Children's Hos...

FYI	Date	Type	Department	Specialty
	09/14/2022	Office Visit	LCORTH	ORTHOPAEDICS
	09/14/2022	XR EXTREMITY	LCXR	X-RAY
	03/09/2022	Office Visit	LCORTH	ORTHOPAEDICS
	03/09/2022	XR EXTREMITY	LCXR	X-RAY
	09/03/2021	Physical Therapy	CLK PT	PT
	09/03/2021	XR ORTHO	CLKXR	X-RAY
	09/03/2021	Office Visit	CLKORT	ORTHOPAEDICS
	08/22/2021	Surgery	LCOR	Orthopedics
	08/22/2021	Anesthesia Event	LCOR	OR
	08/21/2021	ED to Hosp-Admissi...	LC19	INPT
5 Years Ago				
	11/13/2018	Office Visit	Pediatric Orthopa...	ORTHOPAEDICS
	11/05/2018	ED	Comer Children's...	EMERGENCY
	10/23/2018	OP Visit	Radiology-GMI-C...	
	10/23/2018	Office Visit	Pediatric Orthopa...	ORTHOPAEDICS
	10/11/2018	Telephone	ACCESS Family ...	AGP
	10/09/2018	Office Visit	UChicago Medici	ORTHOPAEDICS

General Information

Date: 8/22/2021  
Location: LC OPERATING ROOM  
Patient class: Inpatient

Time: 1149  
Room: OR 06 - 7floor  
Case classification: Semi-Urgent (Within 2-24 hours)

Status: Posted  
Service: Orthopedics

Staff Information

Staff Type	Staff Member	Start	End	OT
Circulating RN	Yesenia Moreno, RN	1120	1345	
Scrub Person	Violeta Morales, RN	1120	1345	
Circulating RN	Erin Debs, RN	1120	1232	
Circulating RN	Erin Debs, RN	1345	1415	
Scrub Person	Yesenia Moreno, RN	1345	1415	

Anesthesia Staff Information

Type	Staff	Start	End
Anes Attending	Eric Cheon, MD		
CRNA	Audrey E Rosenblatt, APRN-CRNA		

Case Tracking Events

Event	Time In
Arrived 5	
Arrived 6	
Arrived 7	
Sent for Patient	1019
Pre-Op	1038
Off Unit (pre-op)	
Returned to Pre-Op	
OR/Proc Room Ready	1115
Intra-Op In	1120
Update Pt Location to 6	
Update Pt Location to 7	1120
Closing Start	1333
Intra-Op Out	1415
Sent to ICU/Medical Imaging	
Taken to Morgue	
PACU In	1416

<b>Surgical table used</b> <small>* must provide value</small>	<input type="radio"/> Flat Jackson table <input type="radio"/> Hana table <input checked="" type="radio"/> Traditional fracture table <input type="radio"/> Regular table <input type="radio"/> other	<small>reset</small>
<b>Was skeletal traction used pre-operatively?</b> <small>* must provide value</small>	<input type="radio"/> Yes - skin/Bucks traction <input type="radio"/> Yes - bi-cortical traction pin <input checked="" type="radio"/> No	<small>reset</small>
<b>Was skeletal traction used intraoperatively?</b> <small>* must provide value</small>	<input type="radio"/> Yes - skin/Bucks traction <input type="radio"/> Yes - bi-cortical traction pin <input checked="" type="radio"/> No	<small>reset</small>
<b>Fracture reduction technique</b> <small>* must provide value</small>	<input checked="" type="radio"/> Closed <input type="radio"/> Percutaneous assisted <input type="radio"/> Open	<small>reset</small>
<b>Surgical approach(es) (select all approaches used)</b> <small>* must provide value</small>	<input type="checkbox"/> Anterior (Smith-Peterson) <input checked="" type="checkbox"/> Anterolateral (Watson-Jones) <input type="checkbox"/> Direct lateral <input type="checkbox"/> Surgical Dislocation approach	<small>reset</small>
<b>Instrumentation technique</b> <small>* must provide value</small>	<input checked="" type="checkbox"/> Percutaneous instrumentation <input type="checkbox"/> Instrumentation through the surgical approach used for reduction <input type="checkbox"/> Separate approach for instrumentation	<small>reset</small>
<b>Final hardware construct</b> Do not include temporary wires used to provisionally hold the fracture but may select more than one below if a "mixed-hardware" construct used. <small>* must provide value</small>	<input type="checkbox"/> K-wires <input type="checkbox"/> Solid screws <input checked="" type="checkbox"/> Cannulated screws <input type="checkbox"/> Locking plate <input type="checkbox"/> Fixed angle device (e.g., Angled blade plate, DHS, FNS) <input type="checkbox"/> Intramedullary nail	<small>reset</small>
<b>Was femoral head perfusion monitored intraoperatively? (A-line, Camino, etc.)</b> <small>* must provide value</small>	<input type="radio"/> Yes <input checked="" type="radio"/> No	<small>reset</small>
<b>Was capsulotomy done?</b> <small>* must provide value</small>	<input checked="" type="radio"/> Yes <input type="radio"/> No	<small>reset</small>
<b>Capsulotomy technique</b> <small>* must provide value</small>	<input checked="" type="radio"/> Percutaneous (e.g., using a Cobb elevator) <input type="radio"/> Open approach	<small>reset</small>

<b>Surgical table used</b> <small>* must provide value</small>	<input type="radio"/> Flat Jackson table <input type="radio"/> Hana table <input checked="" type="radio"/> Traditional fracture table <input type="radio"/> Regular table <input type="radio"/> other	<small>reset</small>
<b>Was skeletal traction used pre-operatively?</b> <small>* must provide value</small>	<input type="radio"/> Yes - skin/Bucks traction <input type="radio"/> Yes - bi-cortical traction pin <input checked="" type="radio"/> No	<small>reset</small>
<b>Was skeletal traction used intraoperatively?</b> <small>* must provide value</small>	<input type="radio"/> Yes - skin/Bucks traction <input type="radio"/> Yes - bi-cortical traction pin <input checked="" type="radio"/> Yes - table traction (Hana or fracture) <input type="radio"/> No	<small>reset</small>
<b>If traction was used, what was the duration?</b> <small>* must provide value</small>	<input type="text" value="UNK"/> <b>Unknown (UNK)</b>	<small>reset</small>

## Post-operative course

### Post-operative immobilization

\* must provide value

- ☒ None  
☐ Spica cast  
☐ Brace  
☐ Traction  
☐ Other

reset

### Date full weight-bearing was allowed

\* must provide value

NA M-D-Y

Not applicable (NA)

### Was the patient referred to bone health/endocrinology and completed an evaluation?

\* must provide value

- ☐ Yes  
☒ No

reset

### Vitamin D level

\* must provide value

UNK

Unknown (UNK)

### Did the patient have an Adverse Outcome?

- ☐ Yes  
☐ No

reset

### Date of Adverse Outcome

M-D-Y Today

### Date of Adverse Outcome (2)

M-D-Y Today

### Date of Adverse Outcome (3)

M-D-Y Today

### Was hardware removed?

\* must provide value

- ☐ Yes  
☒ No

reset

### Date of hardware removal

\* must provide value

NA M-D-Y

Not applicable (NA)

### Functional Outcome at Final Follow-up

\* must provide value

- ☒ Back to pre-operative baseline  
☐ Other

reset

### Did the patient have an Adverse Outcome?

- ☒ Yes  
☐ No

reset

### Date of Adverse Outcome

M-D-Y Today

### Time period of adverse outcome since surgery date

\* must provide value

- ☐ ≤ 3 months  
☒ ≤ 6 months  
☐ ≤ 12 months  
☐ ≤ 18 months  
☐ ≤ 24 months

reset

### Grade of Adverse Outcome

\* must provide value

- ☐ Grade 1  
☐ Grade 2  
☐ Grade 3  
☒ Grade 4  
☐ Grade 5

reset

Review data entry guide for reference

### Specifics of the adverse outcome

\* must provide value

- ☐ Superficial infection  
☐ Deep infection (requiring return to the OR)  
☒ AVN  
☐ Nonunion  
☐ Malunion  
☐ Hardware related complications  
☐ Other

### Treatment of adverse outcome

\* must provide value

- ☐ I&D  
☒ Hardware removal  
☐ Hardware revision  
☐ Revascularization procedure (Drilling, BMAC, Core decompression, fibular grafting)  
☐ Femoral Osteotomy  
☐ Pelvic Osteotomy  
☒ Arthroplasty  
☐ Other

### Date of Adverse Outcome (2)

M-D-Y Today

### Date of Adverse Outcome (3)

M-D-Y Today

### Was hardware removed?

\* must provide value

- ☒ Yes  
☐ No

reset

### Date of hardware removal

\* must provide value

M-D-Y Today

### Reason for removal of hardware

\* must provide value

- ☐ Elective (not related to any adverse outcomes)  
☐ Symptomatic hardware  
☐ Infection  
☐ Joint penetration  
☒ Other

### Other

\* must provide value

AVN

### Functional Outcome at Final Follow-up

\* must provide value

- ☐ Back to pre-operative baseline  
☒ Other

reset

### Other (please explain the course and final outcome)

\* must provide value

AVN leading to hardware removal. Found to have low bone density after hardware removal. eventual arthroplasty in Dec. 2015.

ago®

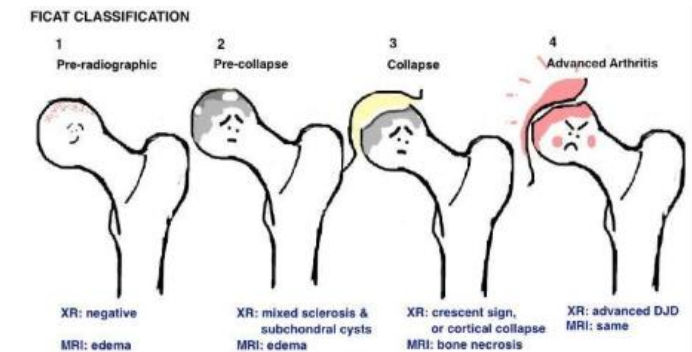
# Adverse Outcomes

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 ( <b>IIIa</b> ); or unplanned surgical, endoscopic, or interventional radiology procedure(s) ( <b>IIIb</b> )
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. <u>No long-term disability</u>
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. <u>With long-term disability</u>
V	Death



# Adverse Outcomes

- Grade 1 – complication requires no treatment, no deviation from post-op course
- Grade 2 – deviation from normal post-op course requiring outpatient treatment (pharm/close monitoring)
  - Superficial infection: resolved with observation or antibiotics / LLD < 2cm
- Grade 3 – treatable, but requires surgical, endoscopic, or interventional radiology procedures or unplanned hospital admission
  - Deep infection: required a return to the operating room and/or admission
  - Hardware related complications: This includes hardware prominence, broken hardware, loose hardware, or hardware penetrating the joint. Does NOT include planned hardware removal for surgeon/family preference.
- Grade 4 – life- or limb-threatening and/or requires ICU admission
- 4a – potential for long-term disability, but treatable (may require organ/joint resection/replacement).
  - Nonunion (lack of healing at >6 months and/or loss of mechanical integrity with respect to implanted hardware)
  - Malunion (vertical or femoral neck shortening of >15 mm)
  - AVN with cortical drilling
- 4b – not treatable or with long-term disability, requiring require organ/joint resection/replacement)
  - AVN: as diagnosed on MRI or evidence of collapse on x-rays (according to the modified Ficat system with type 2b and greater defined as clinical failure)
  - Subsequent major reconstructive surgery required (conversion to THA or proximal femur osteotomy)
- Grade 5 – Death








































# Tips for Finding Data

- Zip code at time of injury – in initial ED note/ambulance report
- Surgical table – in operative report
- OR Nursing report for time in/time out of OR and skeletal traction
  - Fracture table or Hana use not considered skeletal traction
- Utilization of Care Everywhere for adverse outcomes information

# Imaging Upload

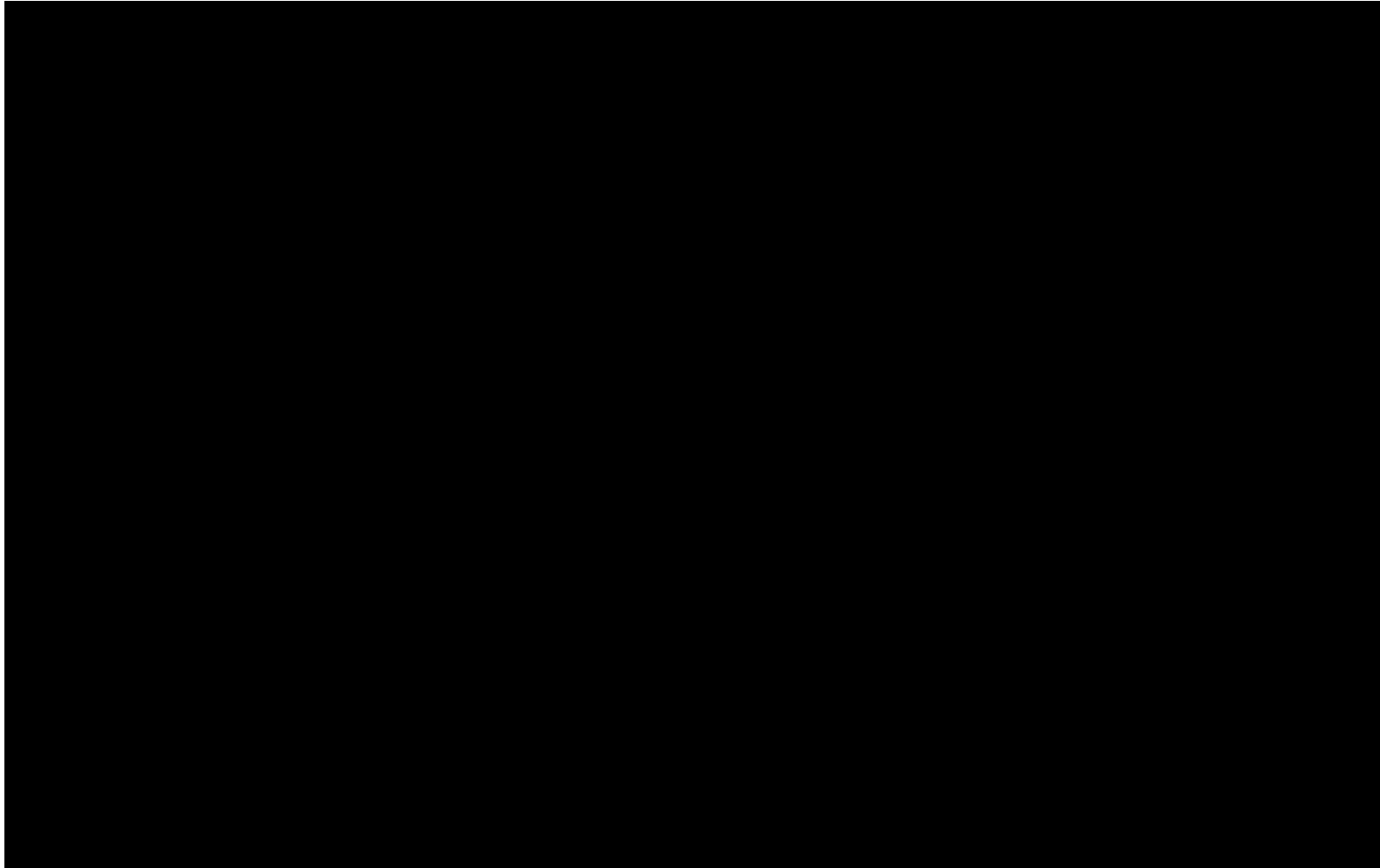
Injury imaging		
*Must be de-identified*		
Injury radiographs	 	<a href="#">Upload file</a>
Optional: Other injury radiographs ?	<input type="radio"/> Yes <input type="radio"/> No	<a href="#">reset</a>
Injury CT scan	 	<a href="#">Upload file</a>
Injury MRI	 	<a href="#">Upload file</a>
Intra-operative imaging		
Intra-operative fluoroscopy	 	<a href="#">Upload file</a>
Intra-operative other imaging	 	<a href="#">Upload file</a>
First post-operative imaging		
First post-op X-rays	 	<a href="#">Upload file</a>
First post-op CT Scan or MRI	 	<a href="#">Upload file</a>
First post-op bone scan. only a photo of the report is sufficient, no DICOM needed	 	<a href="#">Upload file</a>
Adverse event imaging		
Adverse event X-rays	 	<a href="#">Upload file</a>
Other adverse event X-rays	 	<a href="#">Upload file</a>
Adverse event CT-Scan	 	<a href="#">Upload file</a>
Adverse event MRI	 	<a href="#">Upload file</a>
Final outcome imaging		
Final X-rays	 	<a href="#">Upload file</a>
Other final X-rays	 	<a href="#">Upload file</a>
Final CT-scan	 	<a href="#">Upload file</a>
Final MRI	 	<a href="#">Upload file</a>
Form Status		
Complete?	 	Incomplete 



<b>First post-op imaging available?</b> <small>* must provide value</small>	<input checked="" type="radio"/> Yes <input type="radio"/> No	reset
<b>Date imaging was performed</b>	<input type="text" value="09-03-2021"/> <input type="button" value="Today"/> <input type="button" value="M-D-Y"/>	
<b>Quality of reduction</b> 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		
	<input checked="" type="radio"/> Excellent <input type="radio"/> Good <input type="radio"/> Fair <input type="radio"/> Poor	reset
<b>Femoral Neck Length - Affected Side</b>	<input type="text" value="N/A"/> <small>(measurement of tip of greater trochanter to femoral head center on an AP Pelvis radiograph)</small>	
<b>Femoral Neck Length - Non-affected Side</b>	<input type="text" value="N/A"/> <small>(measurement of tip of greater trochanter to femoral head center on an AP Pelvis radiograph)</small>	
<b>Hardware stable from surgery?</b>	<input checked="" type="radio"/> Yes <input type="radio"/> No	reset
<b>Comments on first post-op imaging</b>	<input type="text"/> <input type="button" value="Expand"/>	
<b>Was bone scan done?</b> <small>* must provide value</small>	<input type="radio"/> Yes <input checked="" type="radio"/> No	reset
<b>Adverse event imaging available?</b> XR/CT/MRI images that demonstrate progression or presence of AVN/malunion/non-union/hardware complication/etc. <small>* must provide value</small>	<input type="radio"/> Yes <input checked="" type="radio"/> No	reset
<b>Time period of adverse outcome IMAGING since surgery date</b>	<input type="radio"/> ≤ 3 mo <input type="radio"/> ≤ 6 mo <input type="radio"/> ≤ 12 mo <input type="radio"/> ≤ 18 mo <input type="radio"/> ≤ 24 mo	

<b>Final imaging available?</b> <small>* must provide value</small>	<input checked="" type="radio"/> Yes <input type="radio"/> No	reset
<b>Date final imaging was done</b>	<input type="text" value="03-05-2023"/> <input type="button" value="Today"/> <input type="button" value="M-D-Y"/>	
<b>Quality of reduction</b> 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		
	<input checked="" type="radio"/> Excellent <input type="radio"/> Good <input type="radio"/> Fair <input type="radio"/> Poor	reset
<b>Femoral Neck Length - Affected Side</b>	<input type="text" value="N/A"/>	
<b>Femoral Neck Length - Non-Affected Side</b>	<input type="text" value="N/A"/>	
<b>Is hardware in stable position compared to initial post-operative images?</b>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> removed	
<b>Adverse outcomes noted on final imaging</b>	<input type="checkbox"/> AVN <input type="checkbox"/> Malunion <input type="checkbox"/> Nonunion <input type="checkbox"/> Hardware complications (backing out, breakage, penetrating joint, etc.) <input type="checkbox"/> Fracture displacement post-op <input type="checkbox"/> Other <input checked="" type="checkbox"/> None	
<b>Comments on final imaging</b>	<input type="text" value="No AP Pelvis available so no femoral neck length comparison"/> <input type="button" value="Expand"/>	

# Video of Fracture Description / Classification



**Fracture location:** A line is drawn from the proximal femoral physis to the lateral cortex, parallel to the neck, and divided in thirds. The most proximal site of fracture line exiting the cortex determines the type. Type I includes the proximal third (Transcervical), Type II middle third (basicervical), and Type III when there is involvement of the trochanters (intertrochanteric). Examples:

**Type I:**



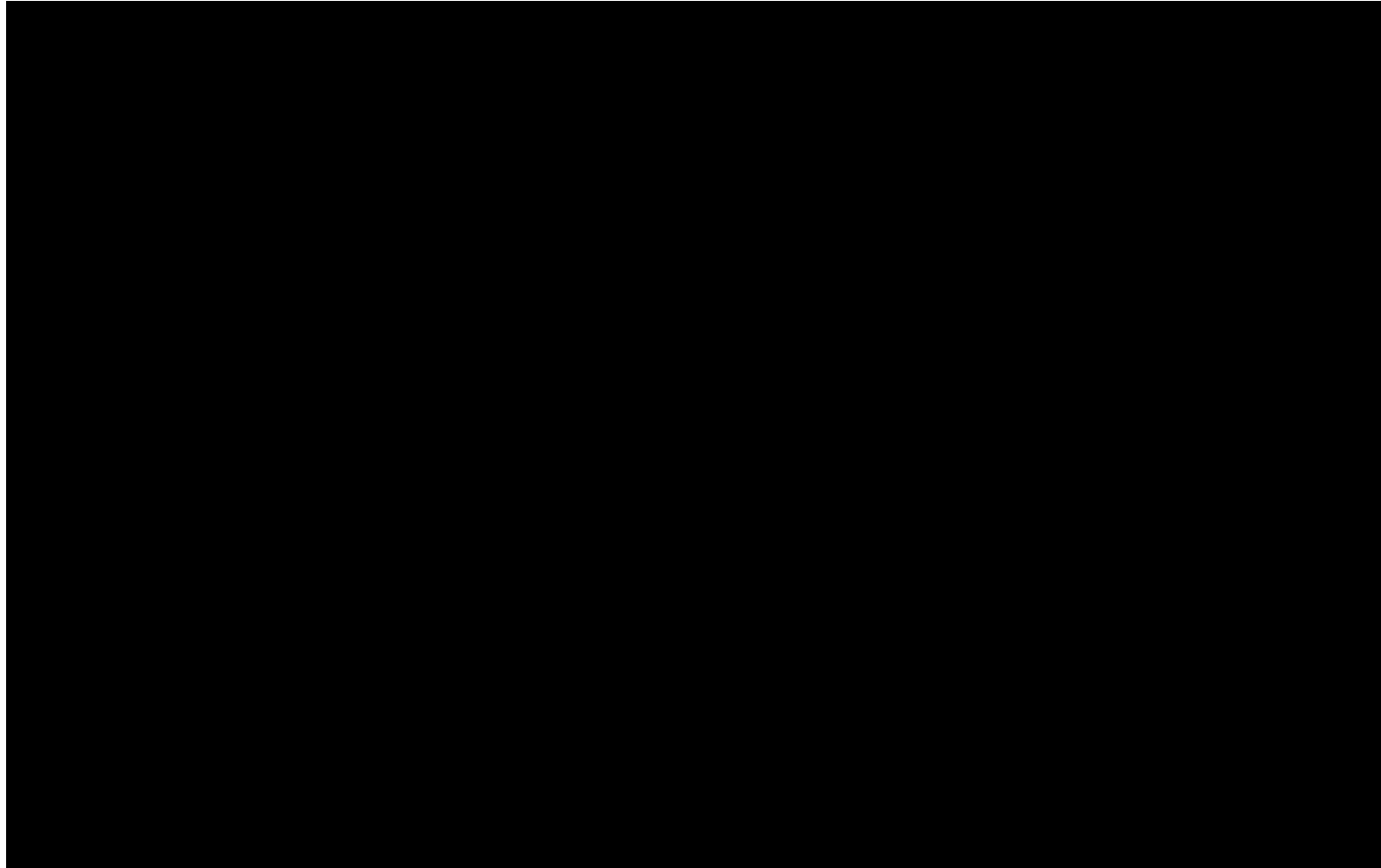
**Type II:**



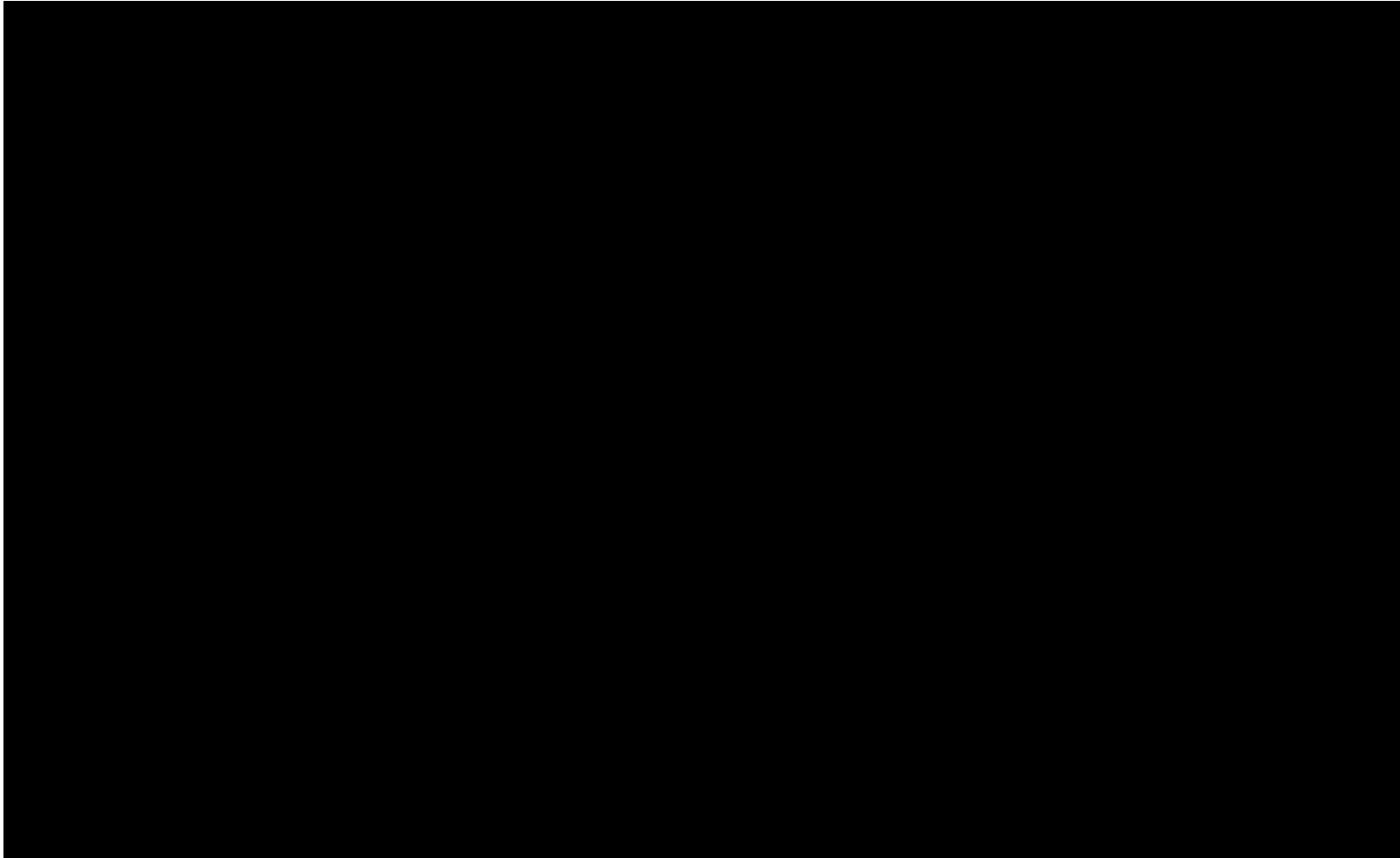
**Type III:**



# Video of Assessment of Reduction

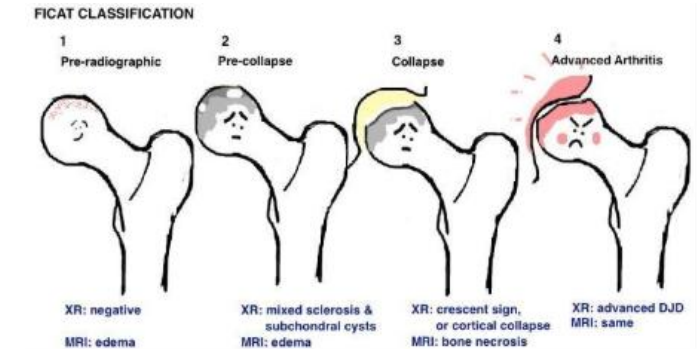


# Video of Neck Length Measurement





# AVN Adverse Outcome – FICAT staging



# Tips for XRs

- How to determine if it is calibrated?
- Pauwels angle is measured off the distal fragment
- Unilateral XR of hip (can't compare Neck length – N/A)

# 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 cartilage (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 ( $\leq 3$ mo, $\leq 6$ mo, $\leq 12$ mo, $\leq 18$ mo, $\leq 24$ mo)

- Quality of reduction
  - Excellent:  $<2$ mm 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

# What is missing

- LLD -
  - Pelvic obliquity on standing AP radiograph?
  - Chart review of LLD?

<b>Was a limb length difference noted at final follow-up?</b> <i>* must provide value</i>	<div><div>H</div><div>M</div></div> <div><input type="radio"/> Yes <input type="radio"/> No</div>	<a href="#">reset</a>
<b>Measured limb length difference in centimeters (cm)</b>	<div><div>H</div><div>M</div></div> <div><input type="text"/></div>	

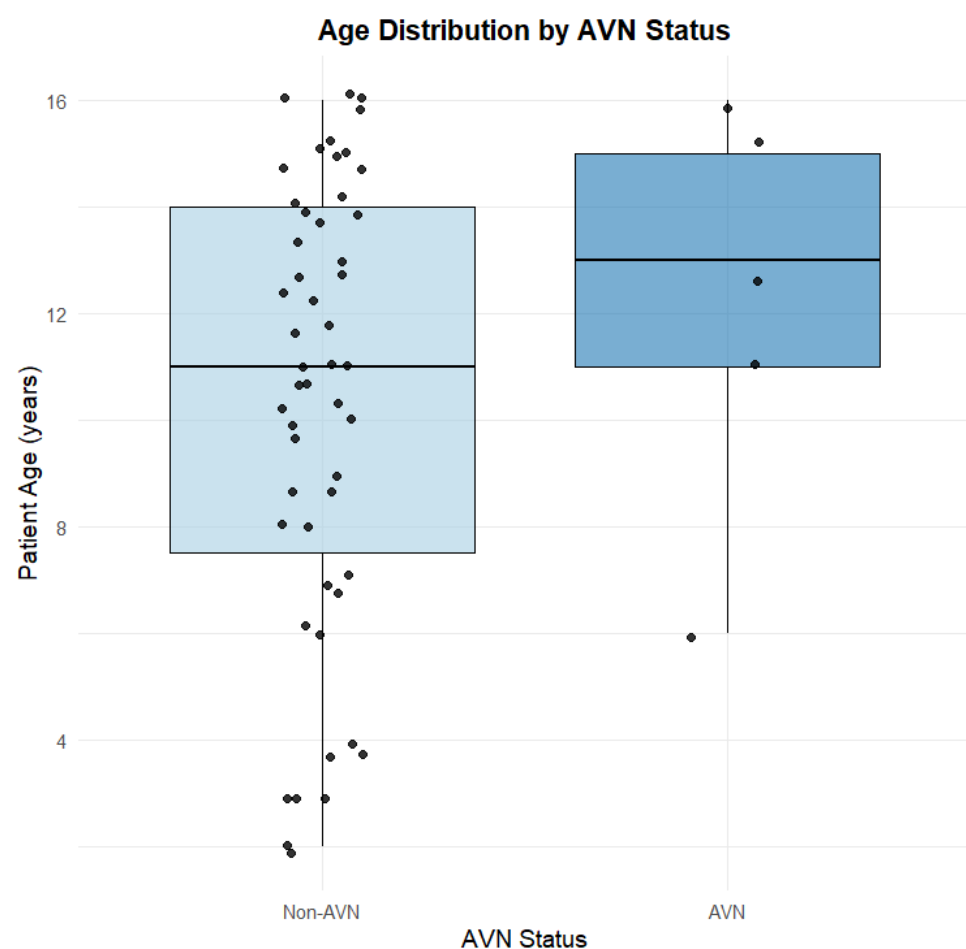
# Lurie Data

- 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  $\geq$  12 months and 1 case  $\geq$  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  $\Rightarrow$  likely underpowered to detect difference (power calculation around 300)

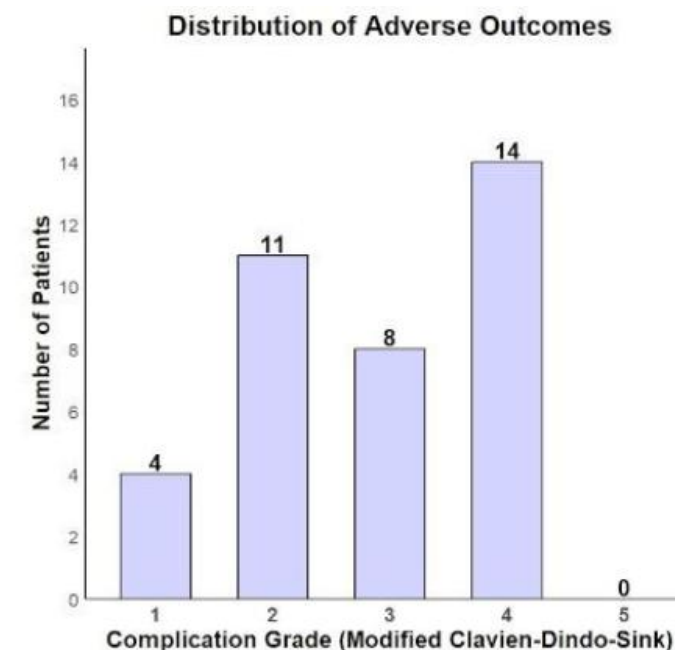


# AVN and Adverse Outcomes

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

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