Celebrating 150 years of advancing medical research, education, and patient care to help people live longer, healthier lives

University of Iowa Carver College of Medicine
University of Iowa Health Care

2023 ASCIP Annual Meeting

Surgical Management of Spinal Cord Injuries

Catherine Olinger, MD

September 3, 2023

CHANGING MEDICIN
CHANGING LIVES.®

Disclosures

Proprio – Consultant

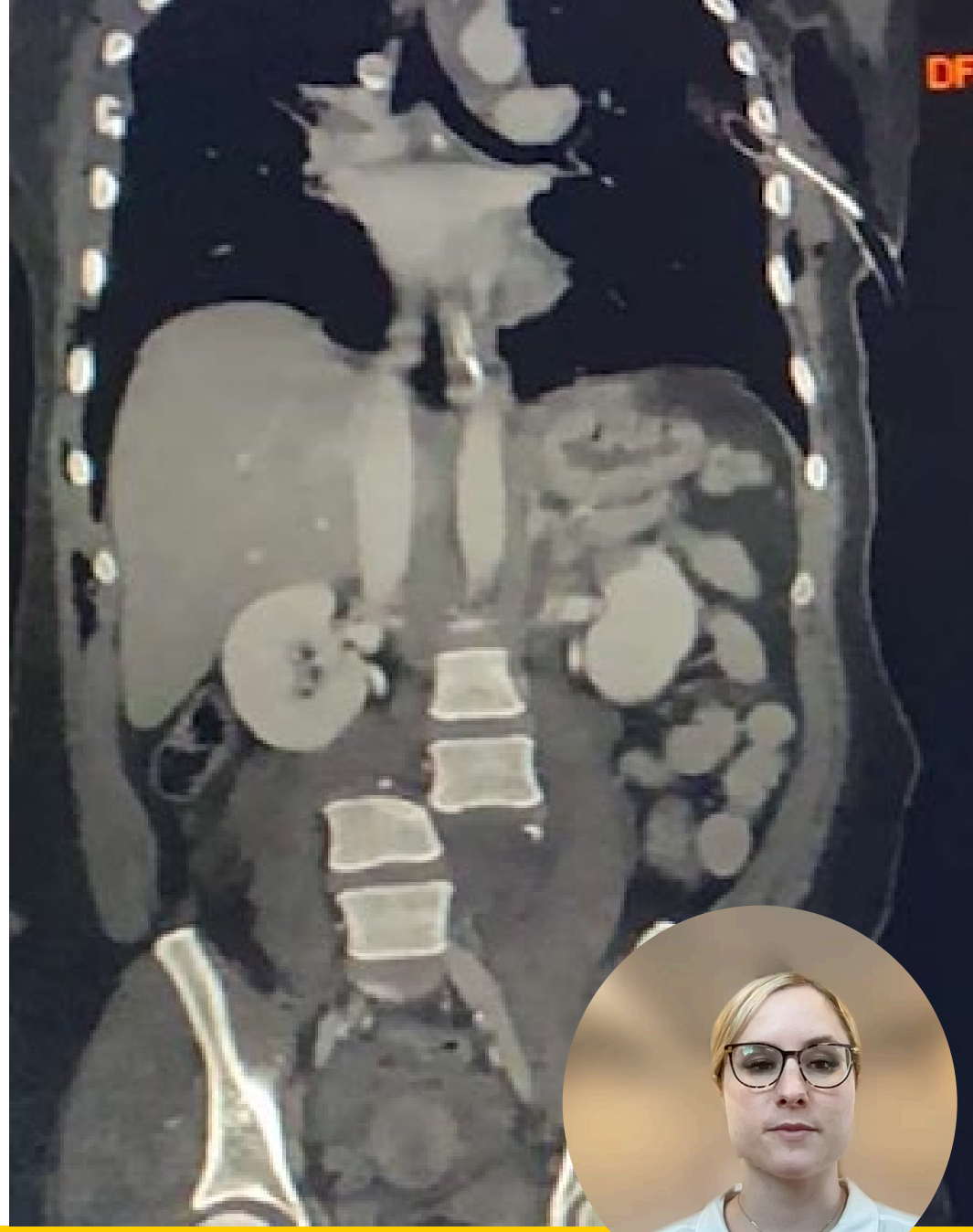
Globus Medical – Consultant

Learning Objectives

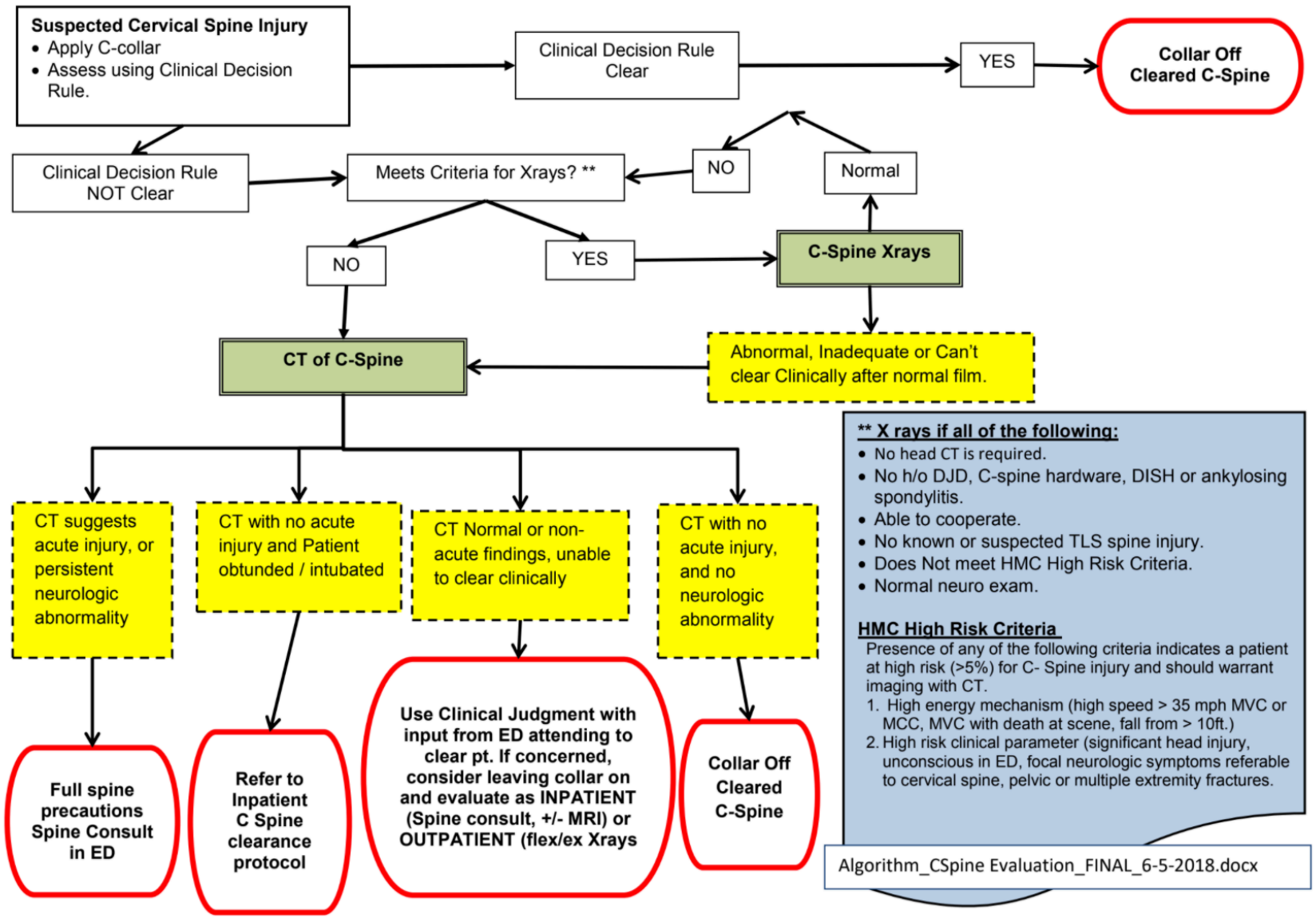
1. How to approach a trauma patient with a spinal cord injury
2. Non-operative interventions
3. Goals of surgery
4. How to deal with complications
5. Case examples and outcomes

How to approach a trauma patient

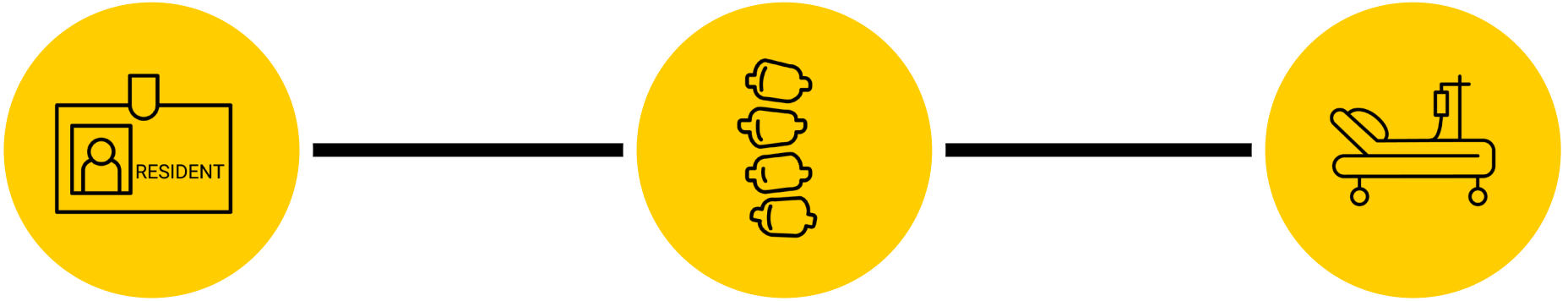
- ATLS
- Resuscitation
  - Who is responsible?
- Early Recognition
  - Education of staff
- Contribution of underlying comorbidities



Cervical Spine Injury Algorithm Adult (age 13-64)



Evaluation



Full neurologic exam

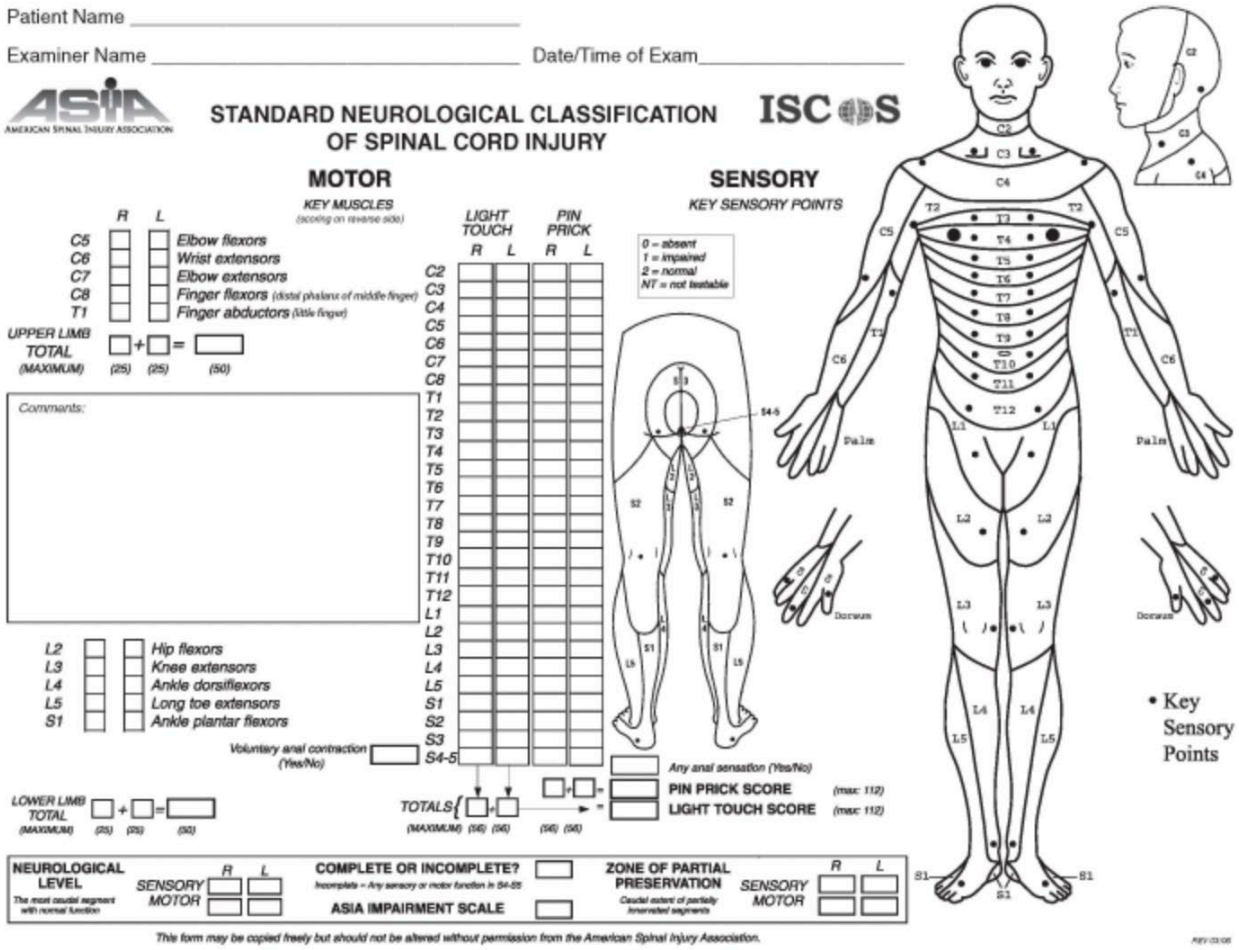
Full spine CT imaging

Resuscitation

Examination

- What does it mean to perform a full spine exam?
  - ASIA classification
  - Reflexes
- How often should a patient be examined?
  - Rates of neurologic change
  - Evolution of spinal cord injury

ASIA Exam


Patient Name _____

Examiner Name _____ Date/Time of Exam_____

STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

ISCOS

MOTOR — KEY MUSCLES (scoring on reverse side)

	R	L	
C5			Elbow flexors
C6			Wrist extensors
C7			Elbow extensors
C8			Finger flexors (distal phalanx of middle finger)
T1			Finger abductors (little finger)

UPPER LIMB TOTAL (MAXIMUM) ☐ + ☐ = ☐ (25) (25) (50)

Comments:

	R	L	
L2			Hip flexors
L3			Knee extensors
L4			Ankle dorsiflexors
L5			Long toe extensors
S1			Ankle plantar flexors

Voluntary anal contraction (Yes/No) ☐

LOWER LIMB TOTAL (MAXIMUM) ☐ + ☐ = ☐ (25) (25) (50)

SENSORY — KEY SENSORY POINTS

0 = absent
1 = impaired
2 = normal
NT = not testable

	LIGHT TOUCH R	LIGHT TOUCH L	PIN PRICK R	PIN PRICK L
C2				
C3				
C4				
C5				
C6				
C7				
C8				
T1				
T2				
T3				
T4				
T5				
T6				
T7				
T8				
T9				
T10				
T11				
T12				
L1				
L2				
L3				
L4				
L5				
S1				
S2				
S3				
S4-5				
TOTALS (MAXIMUM)	☐ (56)	☐ (56)	☐ (56)	☐ (56)

Any anal sensation (Yes/No) ☐

PIN PRICK SCORE (max: 112) ☐ + ☐ = ☐

LIGHT TOUCH SCORE (max: 112) ☐ + ☐ = ☐

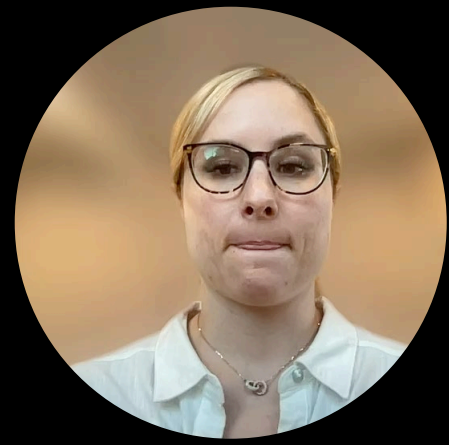
• Key Sensory Points

NEUROLOGICAL LEVEL	SENSORY R	SENSORY L	COMPLETE OR INCOMPLETE?	ZONE OF PARTIAL PRESERVATION	SENSORY R	SENSORY L
The most caudal segment with normal function	MOTOR R	MOTOR L	Incomplete = Any sensory or motor function in S4-S5	Caudal extent of partially innervated segments	MOTOR R	MOTOR L
			ASIA IMPAIRMENT SCALE ☐			

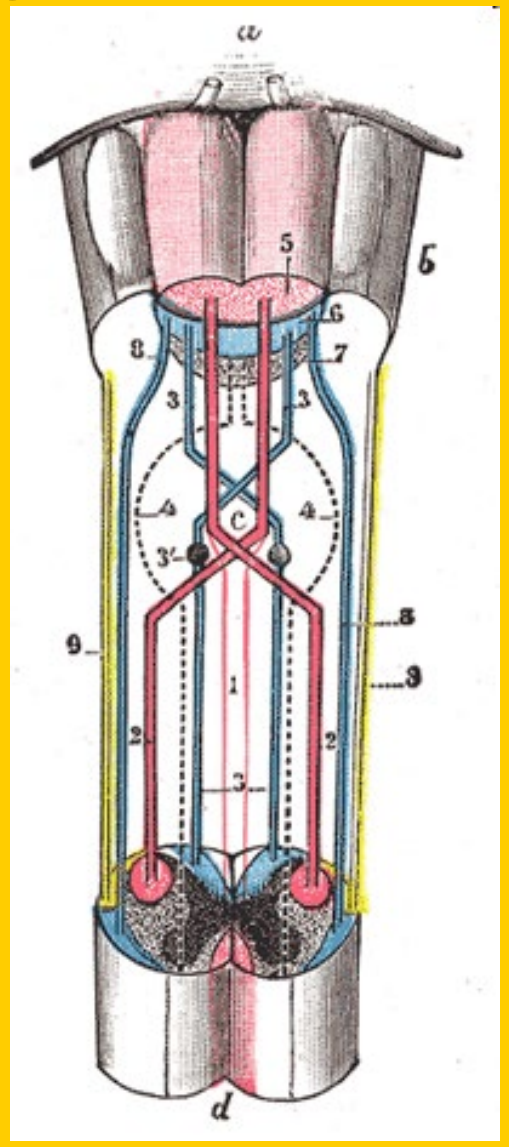
This form may be copied freely but should not be altered without permission from the American Spinal Injury Association.

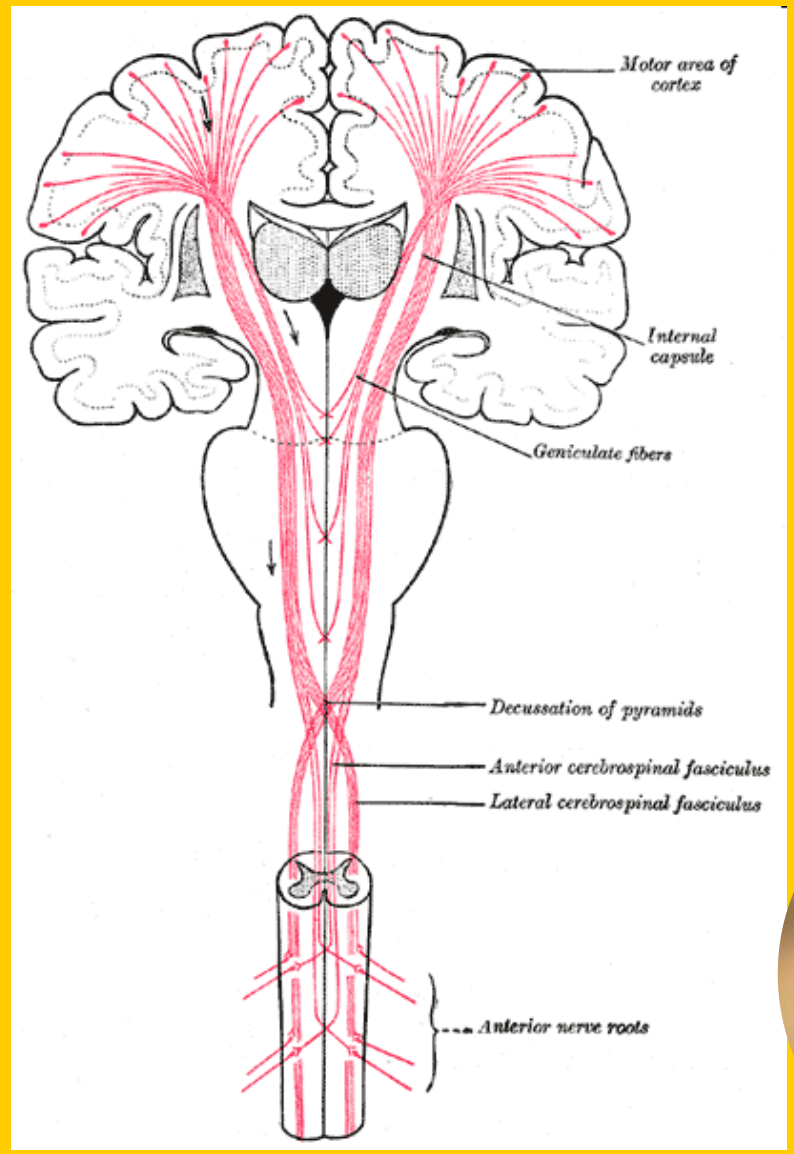
Grade	Definition
A	Complete. No sensory or motor function is preserved in the sacral segments S4-S5
B	Incomplete. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-S5
C	Incomplete. Motor function is preserved below the neurological level, and more then half of key muscles below the neurological level have a muscle grade less then 3 (Grades 0-2).
D	Incomplete. Motor function is preserved below the neurological level, and at least half of key muscles below the neurological level have a muscle grade greater than or equal to 3.
E	Normal. Sensory and motor functions are normal.

Beware of Bizarre Neurologic Presentations

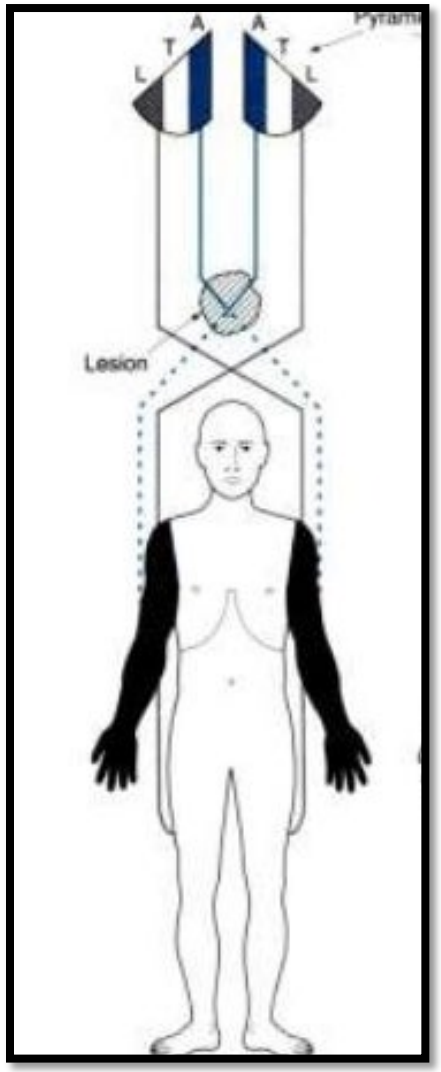


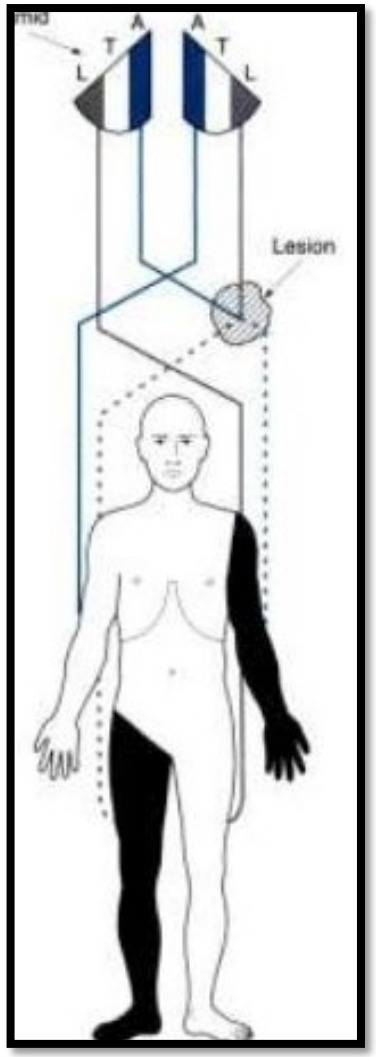
Pyramidal Decussation





Bell’s Cruciate Paralysis vs Hemiplegia Cruciata

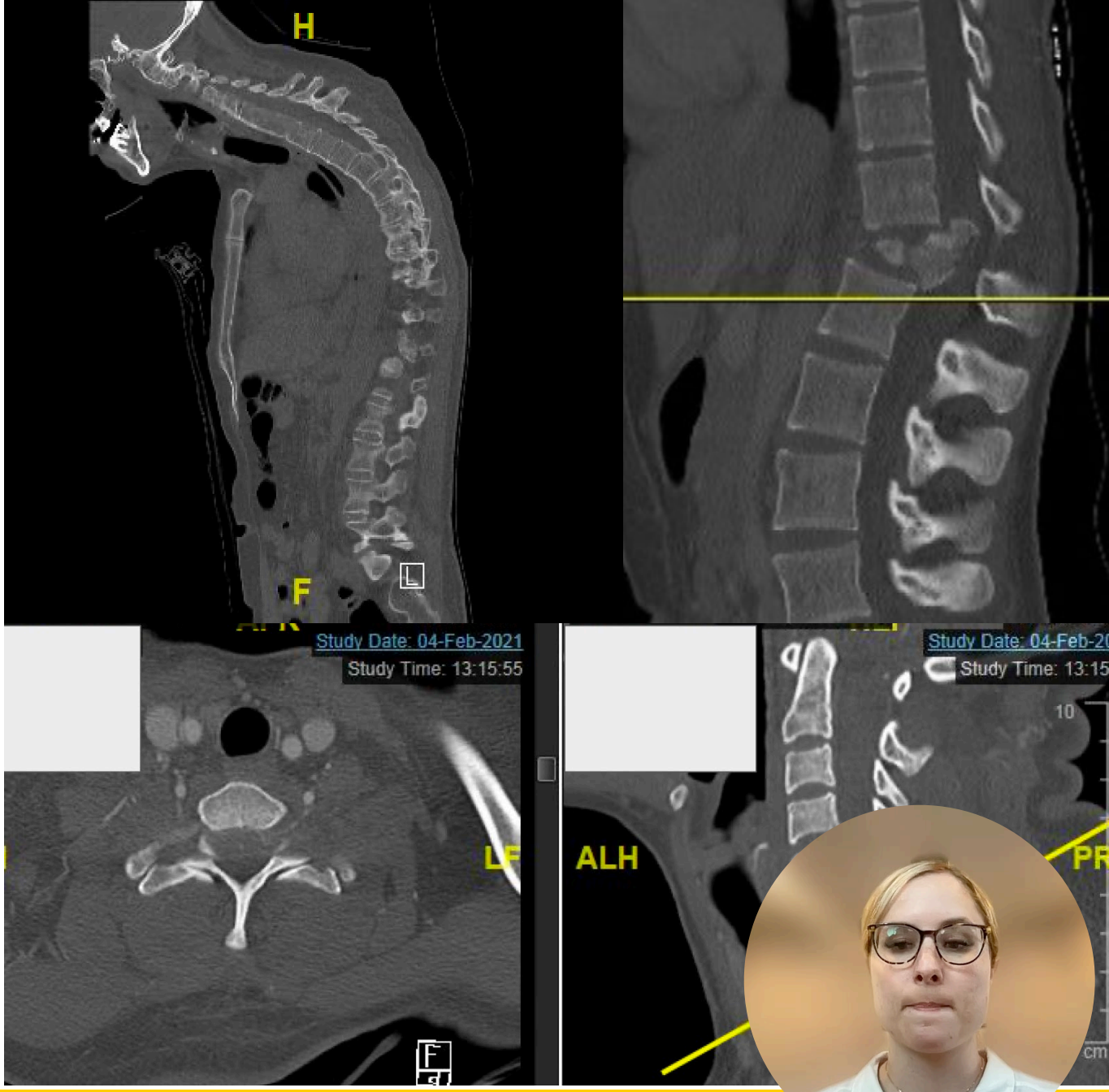




Bell, HS. J Ne 70

Mechanism of injury

- High energy mechanisms
- Ground level falls
- Concurrent injuries



Goals of Treatment

Spine Function

- Provides stability
- Range of motion
- Protection of neural elements

Treatment

- Provide biomechanical support
- Save motion segments
- Necessity of decompression

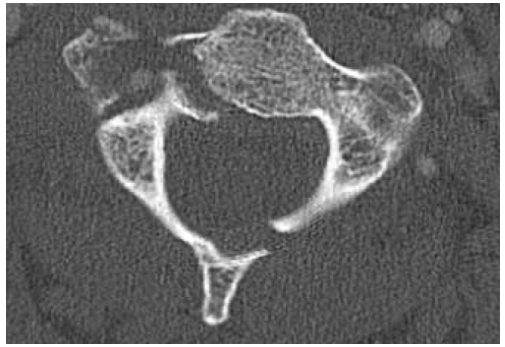
Non-operative management

- Orthosis
  - C collar
  - CTO
  - TLSO
  - CTLO
- Casts
  - Minerva
  - Riser
- Halo

Goals of Surgery

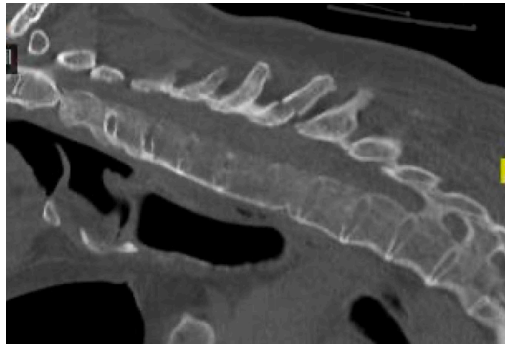
Type of Injury

High energy vs Low energy



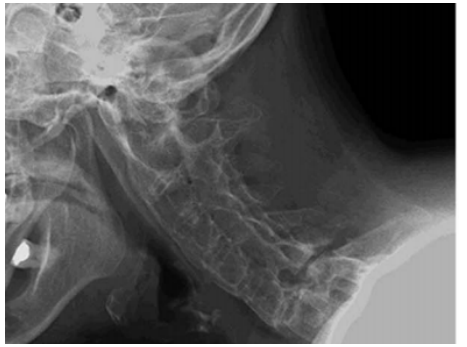
Extent of injury

Single segment vs multiple segments



Degree of deformity

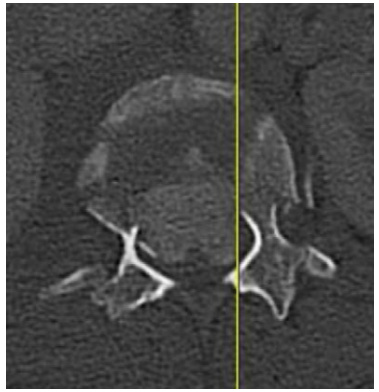
Minimally displaced vs spondyloptosis



Bone Quality

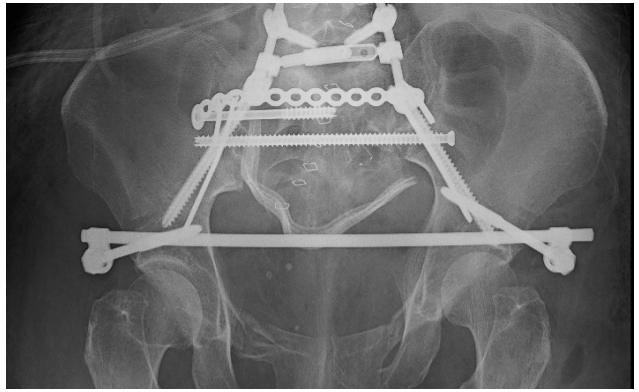
Presence of osteopenia osteopo

Goals of Surgery



Location of dural compression

Anterior vs posterior compression



Coordination with subspecialties

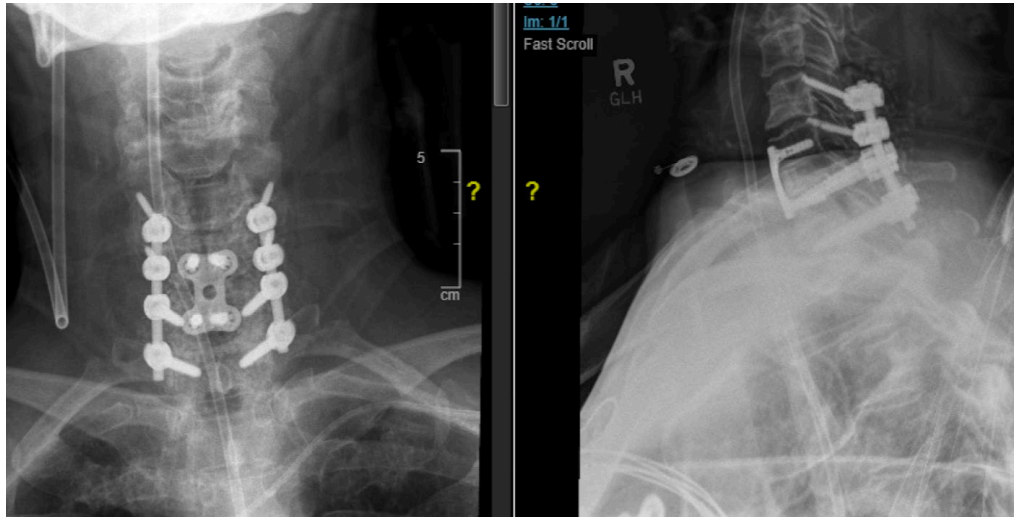
Working closely with neurosurgical or orthopedic trauma colleagues on combo cases

Surgeon capabilities

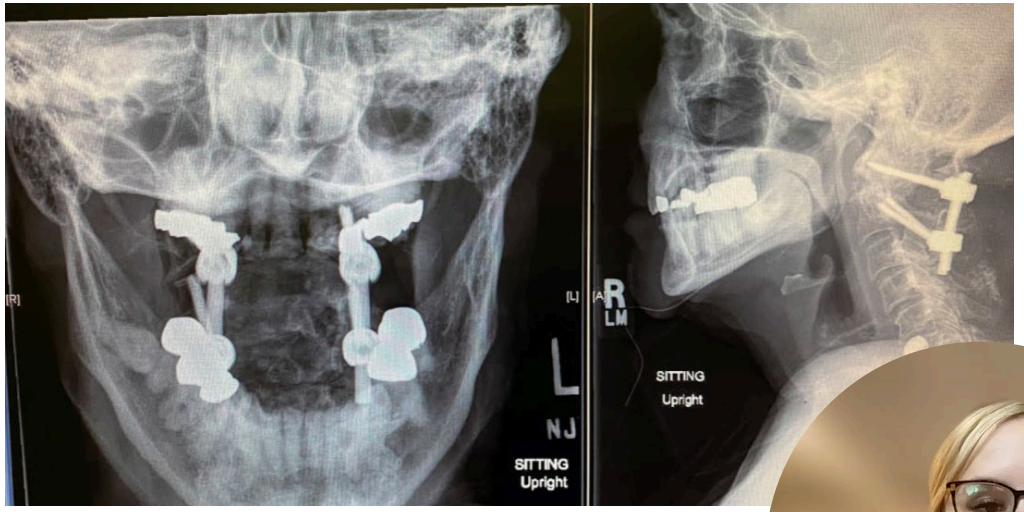
Understanding what you are capable of and what s
procedures are wit
comfort zo

Know when enough is enough?

Higher energy patterns

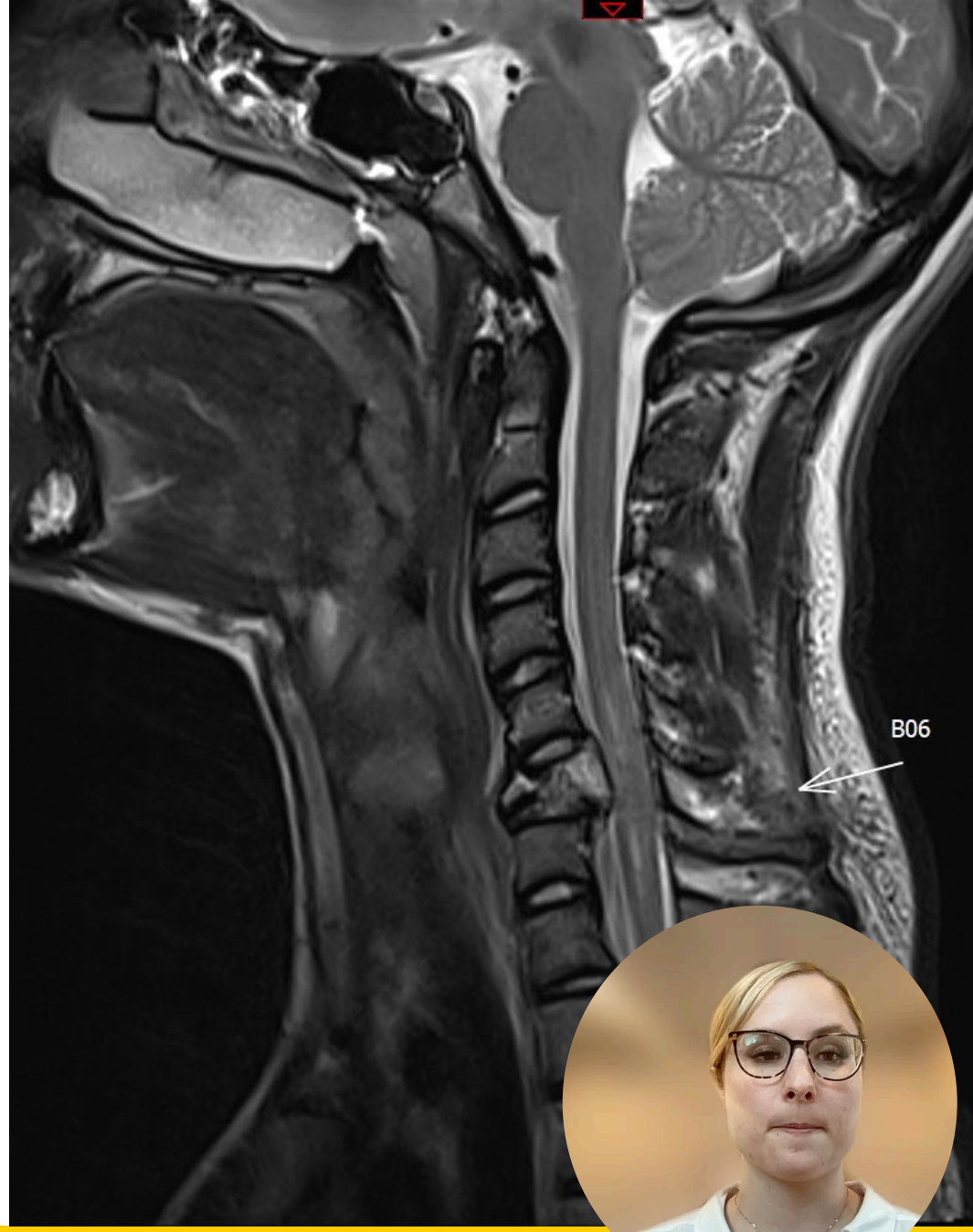


Lower energy patterns



Timing of Intervention

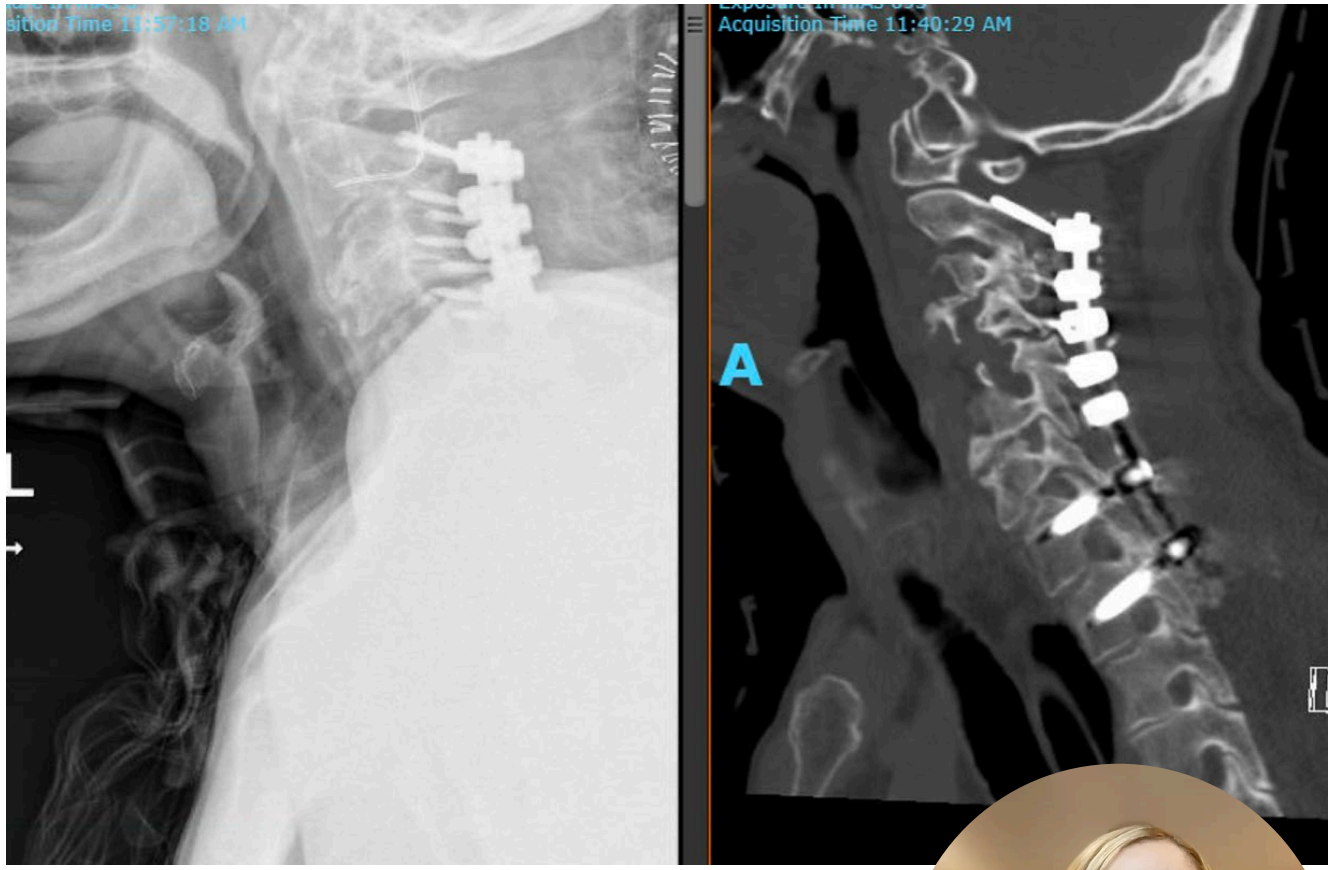
- Surgical Timing in Acute Spinal Cord Injury Study (STASCIS)
  - Surgery within 24 hours
  - Odds of 2 ASIA grade improvement with surgical intervention within 24 hours
    - **bias that ASIA A/B patients were more likely to undergo surgical intervention within 24 hours



Van Middendorp JJ. Letter to the editor regarding: “Early versus delayed decompression for traumatic cervical spinal cord injury: results of the Surgical Timing in Acute Spinal Cord Injury Study (STASCIS).” Spine J. 2012;12:540; author reply 541–542.

Complications

- Screw pull out
- Fixation Failure
- Continued neurologic deficit
  - Utility of repeat imaging
- Spinal cord injury



Handling difficult situations

- Know your resources
- Identify issues prior to starting
- Intraoperative complications
  - Take control of the situation
  - Stay calm

How to best optimize your team

Make a list

Be present

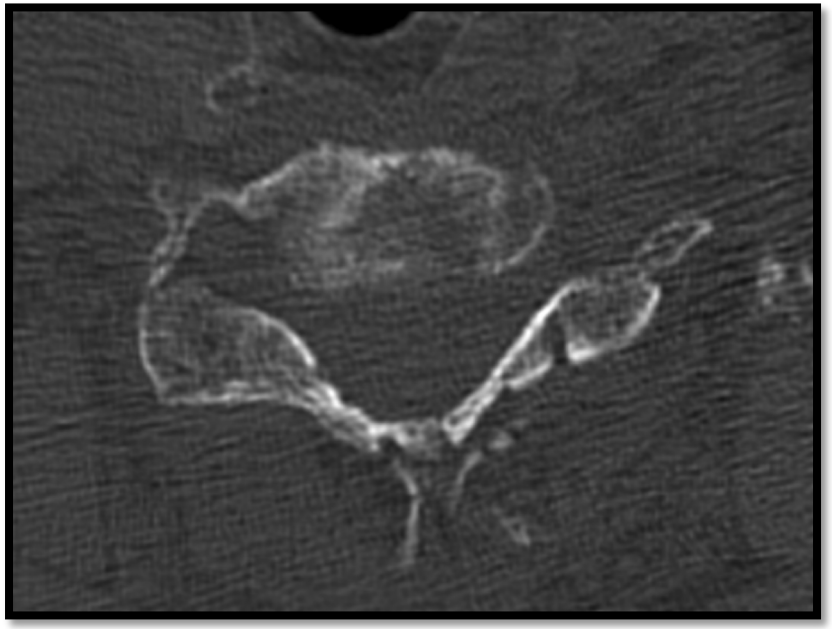
Get everyone involved

Reflection

Taking ownership

Ankylosing Spinal Conditions - AS

C-spine CT read as normal x AS

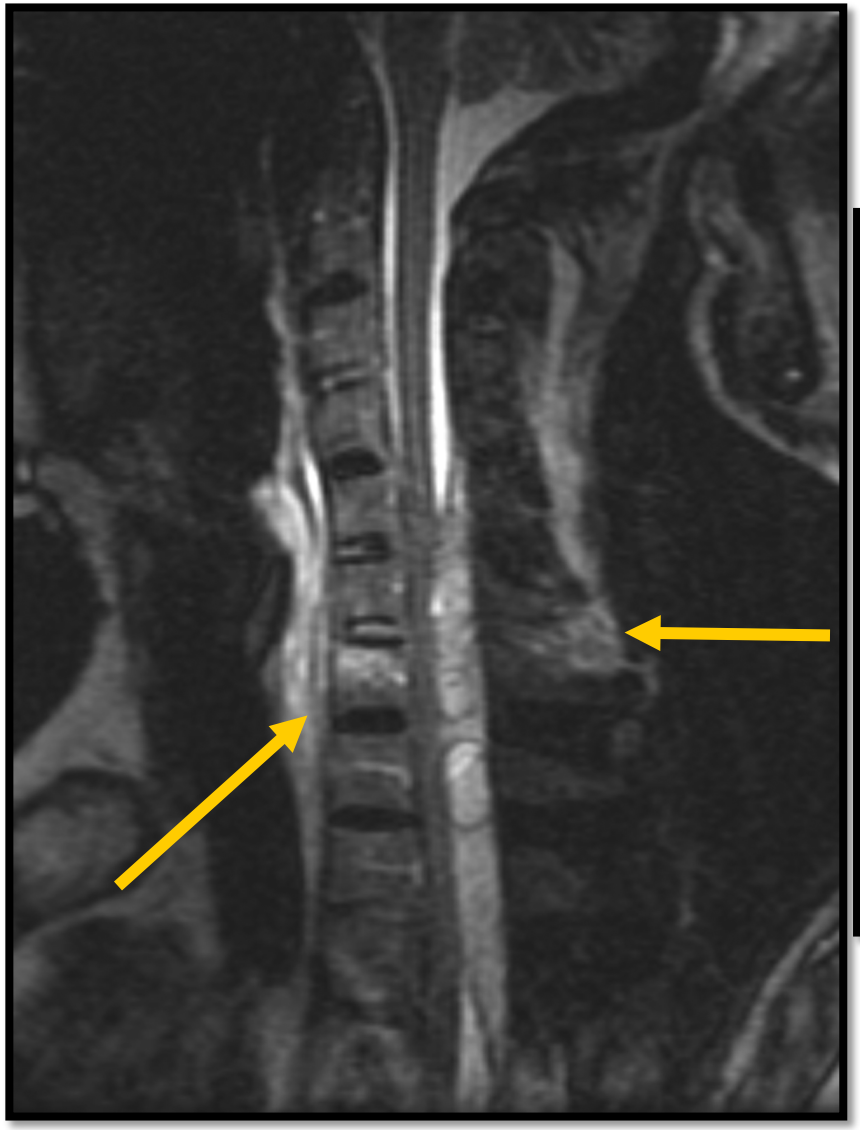


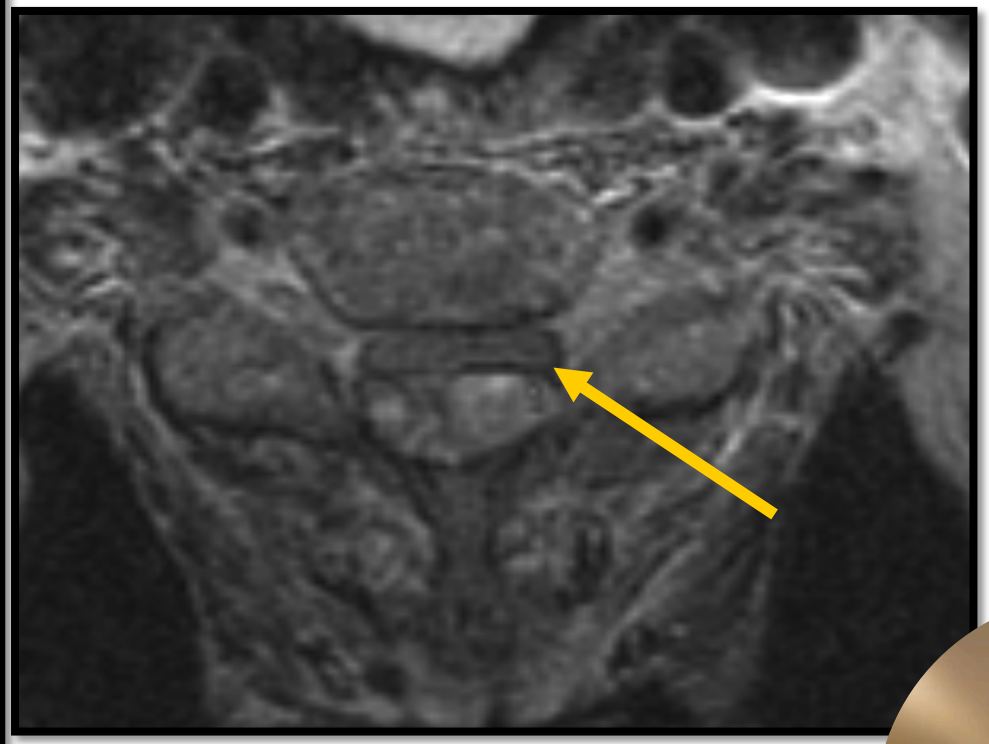
•71 M – Fall from standing – ASIA

•PMH atrial fibrillation - on Couma

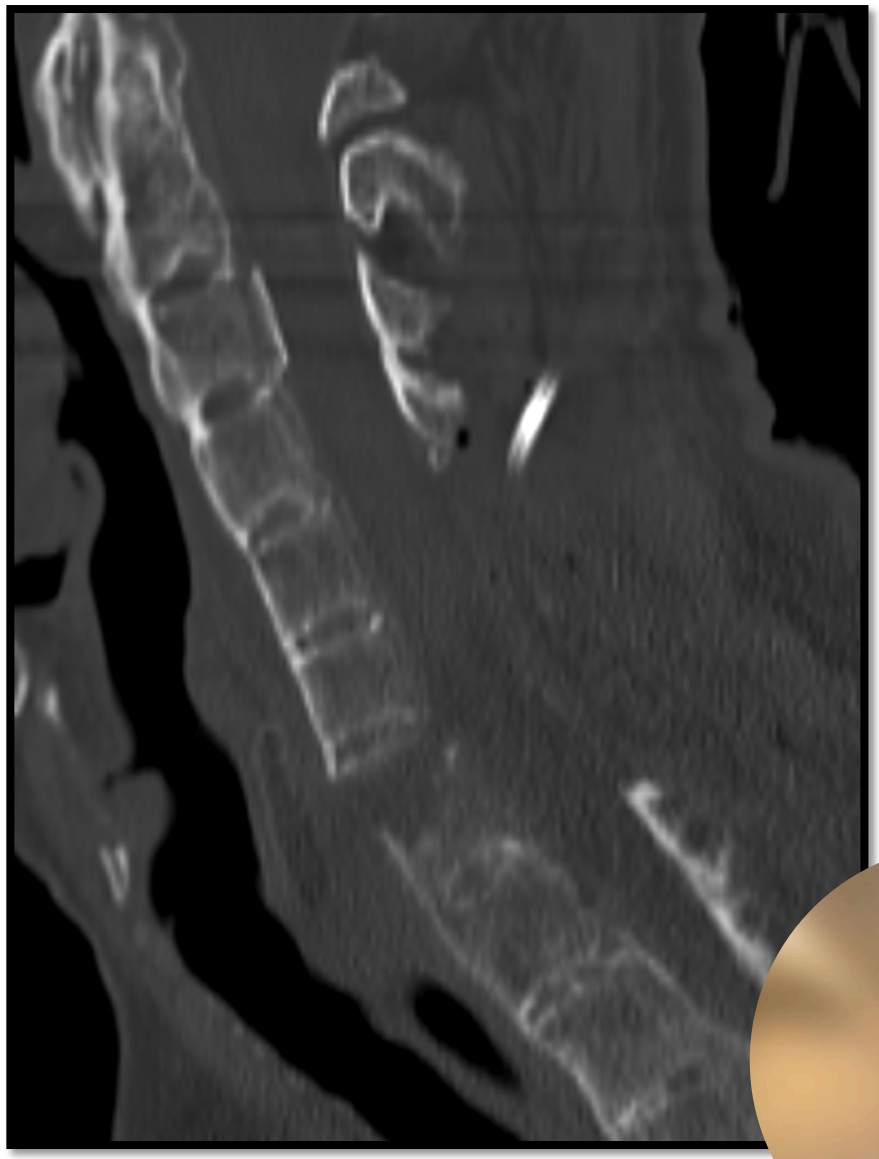
•Progressive weakness to ASIA C (motor scor

Ankylosing Spinal Conditions - AS





Ankylosing Spinal Conditons - AS



Preop

Postop

Ankylosing Spinal Conditions - AS

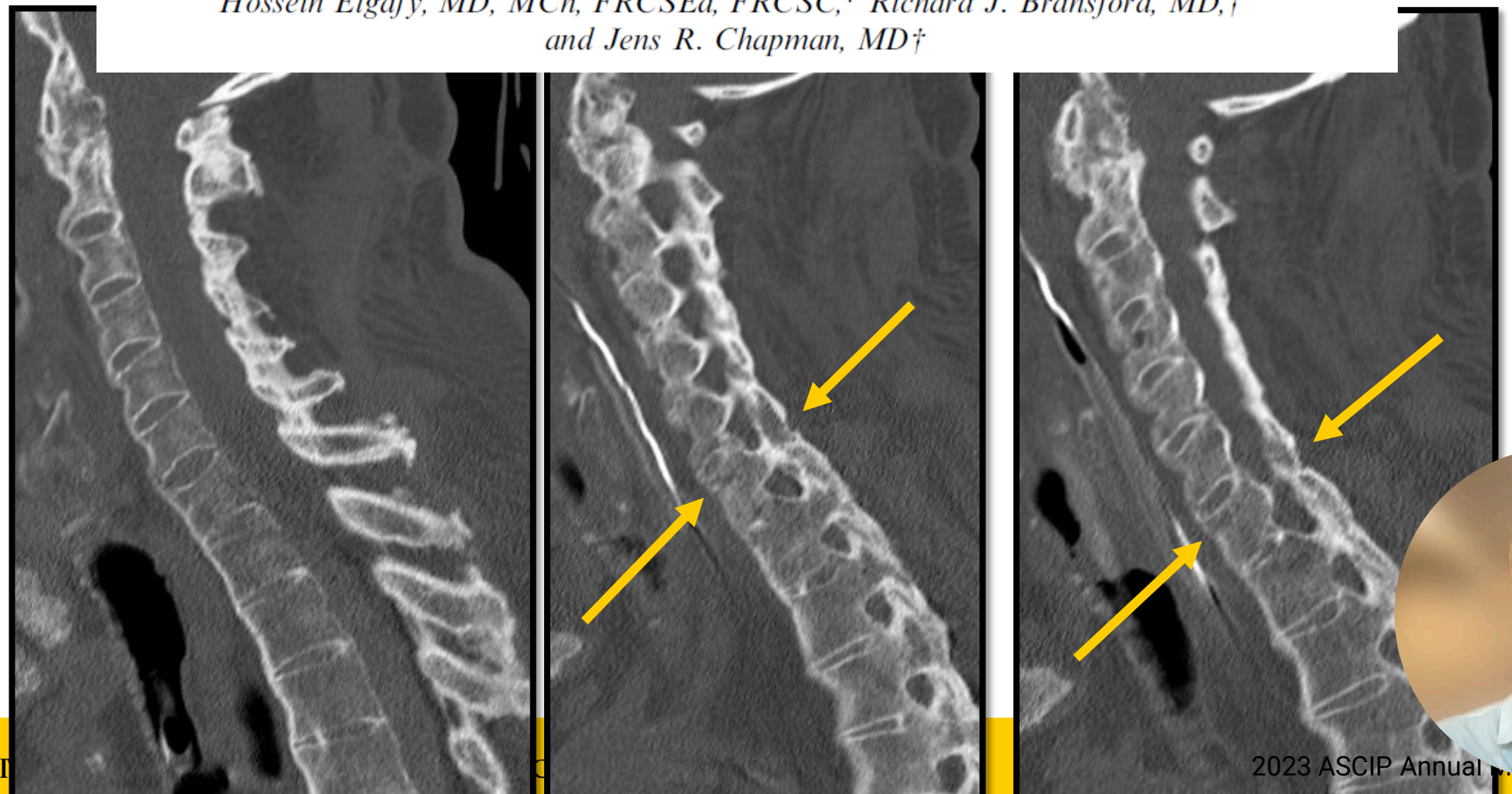
- C4-T3 PSIF

J Spinal Disord Tech • Volume 24, Number 7, October 2011

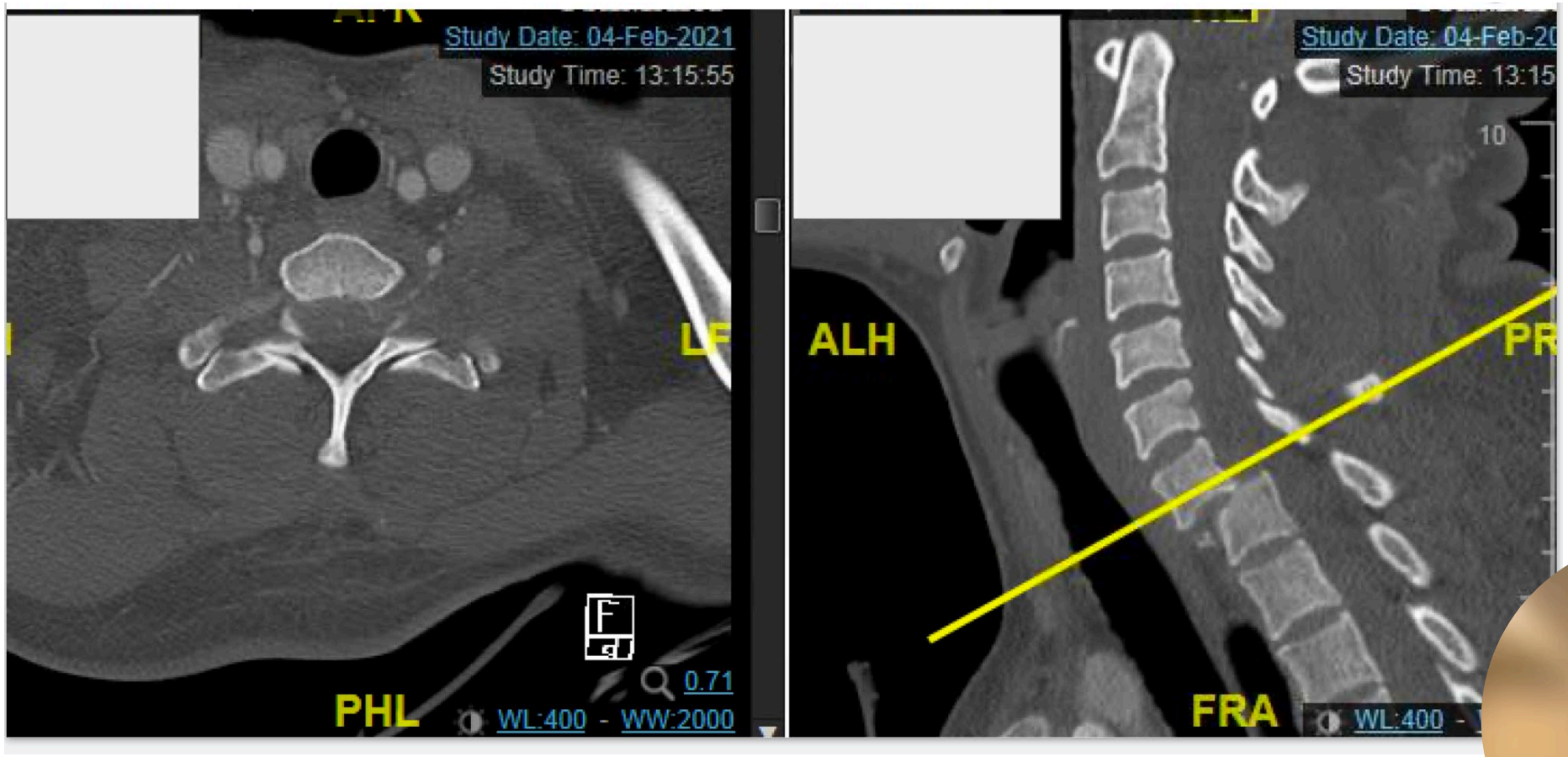
Epidural Hematoma Associated With Occult Fracture in Ankylosing Spondylitis Patient

A Case Report and Review of the Literature

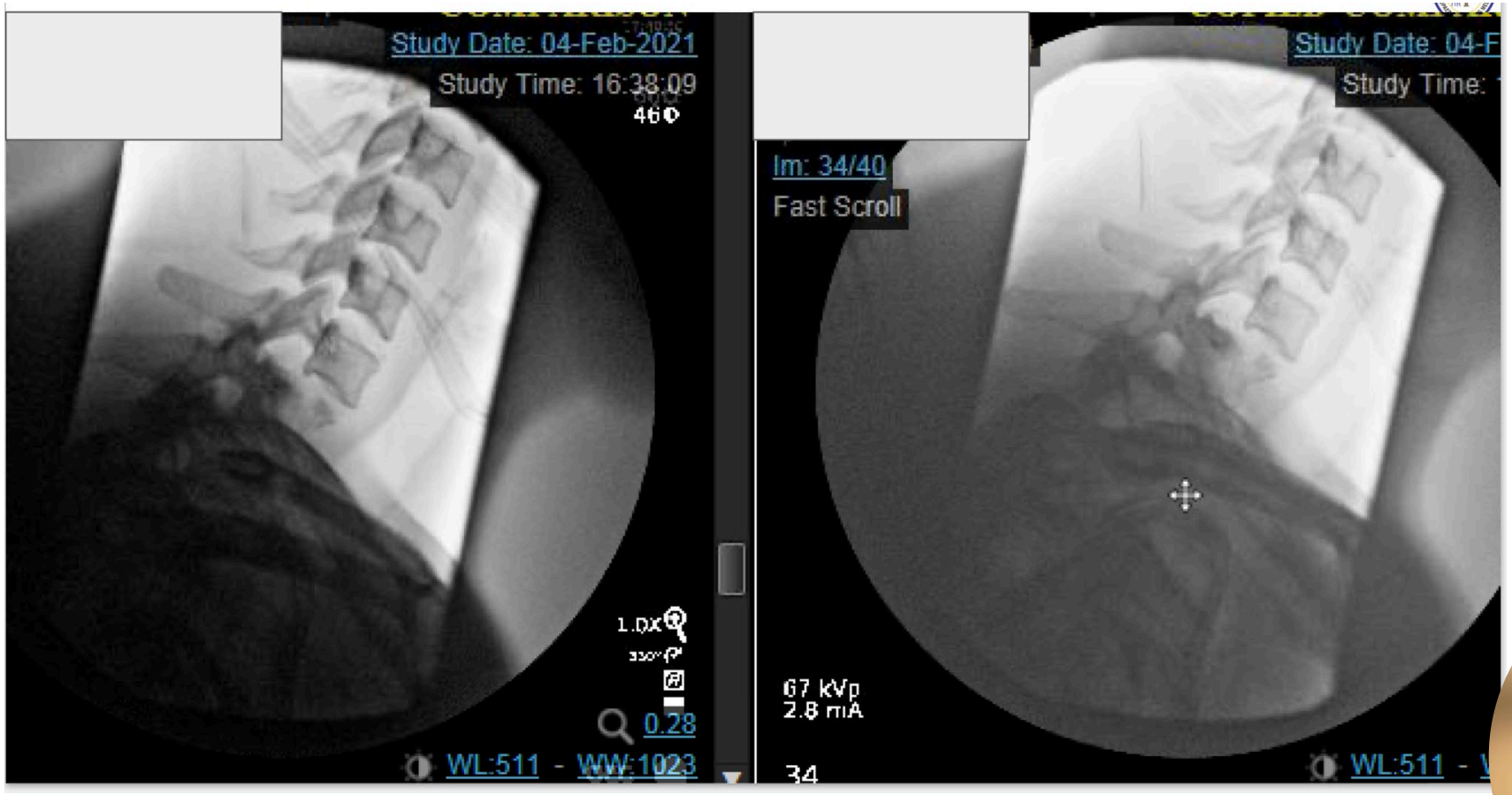
Hossein Elgafy, MD, MCh, FRCSEd, FRCSC, Richard J. Bransford, MD,† and Jens R. Chapman, MD†*



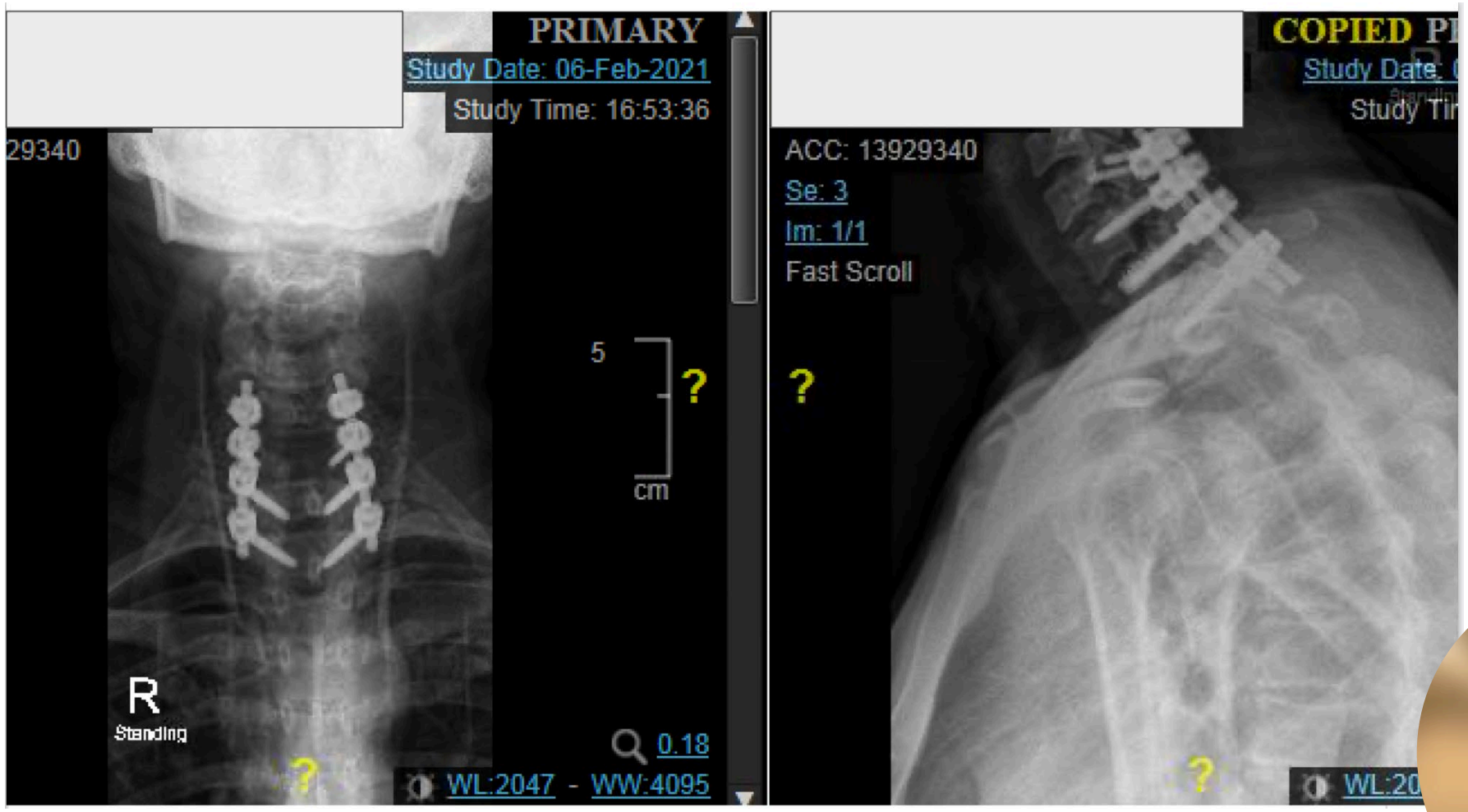
Case 2


Study Date: 04-Feb-2021
Study Time: 13:15:55
LF
PHL
WL:400 - WW:2000
0.71
Study Date: 04-Feb-20
Study Time: 13:15
10
ALH
PR
FRA
WL:400

Case 2


Study Date: 04-Feb-2021
Study Time: 16:38:09
46
1.0X
0.28
WL:511 - WW:1023
Im: 34/40
Fast Scroll
67 kVp
2.8 mA
34
WL:511

Case 2

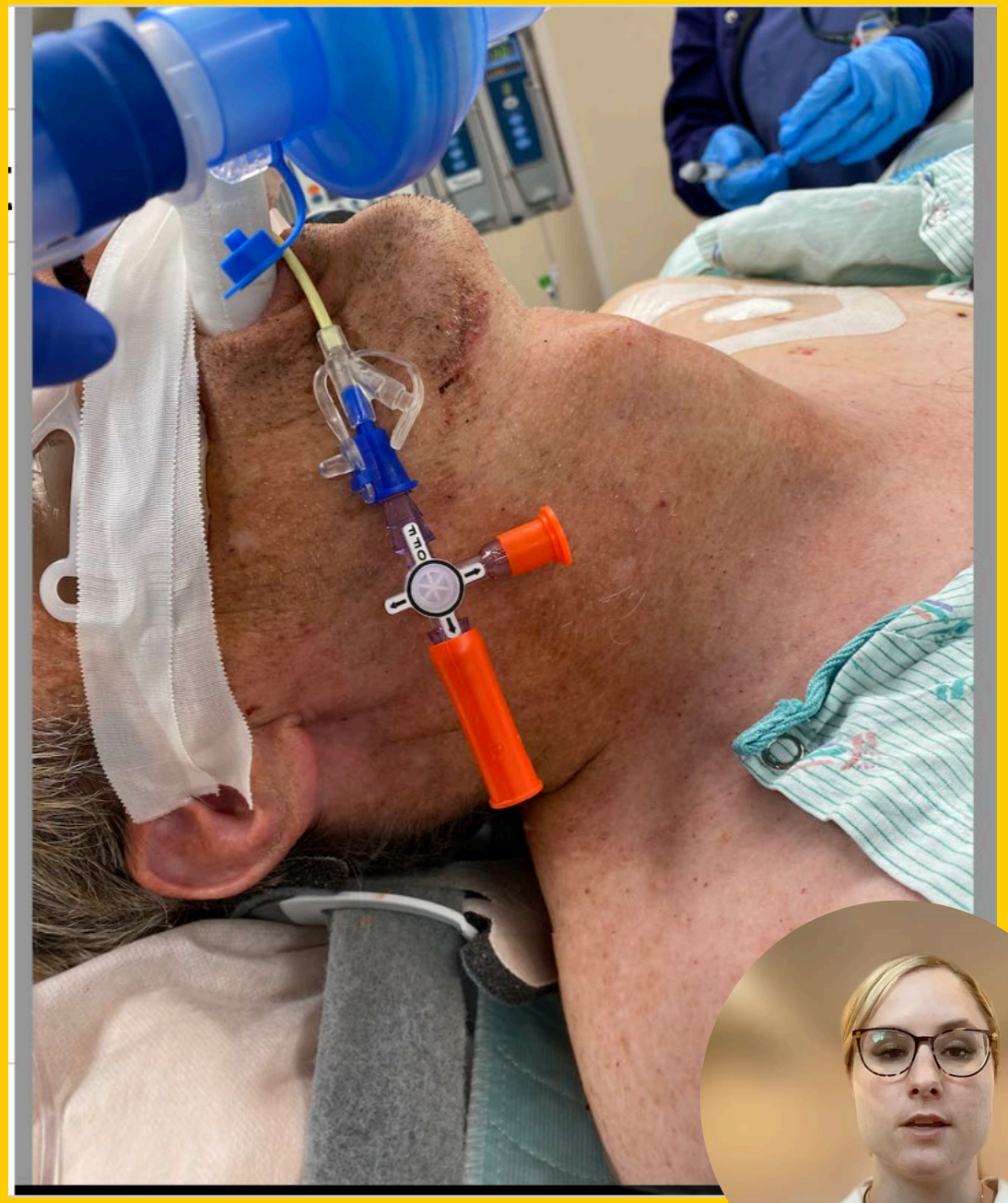

PRIMARY
Study Date: 06-Feb-2021
Study Time: 16:53:36
29340
5
?
cm
R
Standing
0.18
WL:2047 - WW:4095
COPIED PI
Study Date:
Study Ti
ACC: 13929340
Se: 3
Im: 1/1
Fast Scroll
?
WL:20

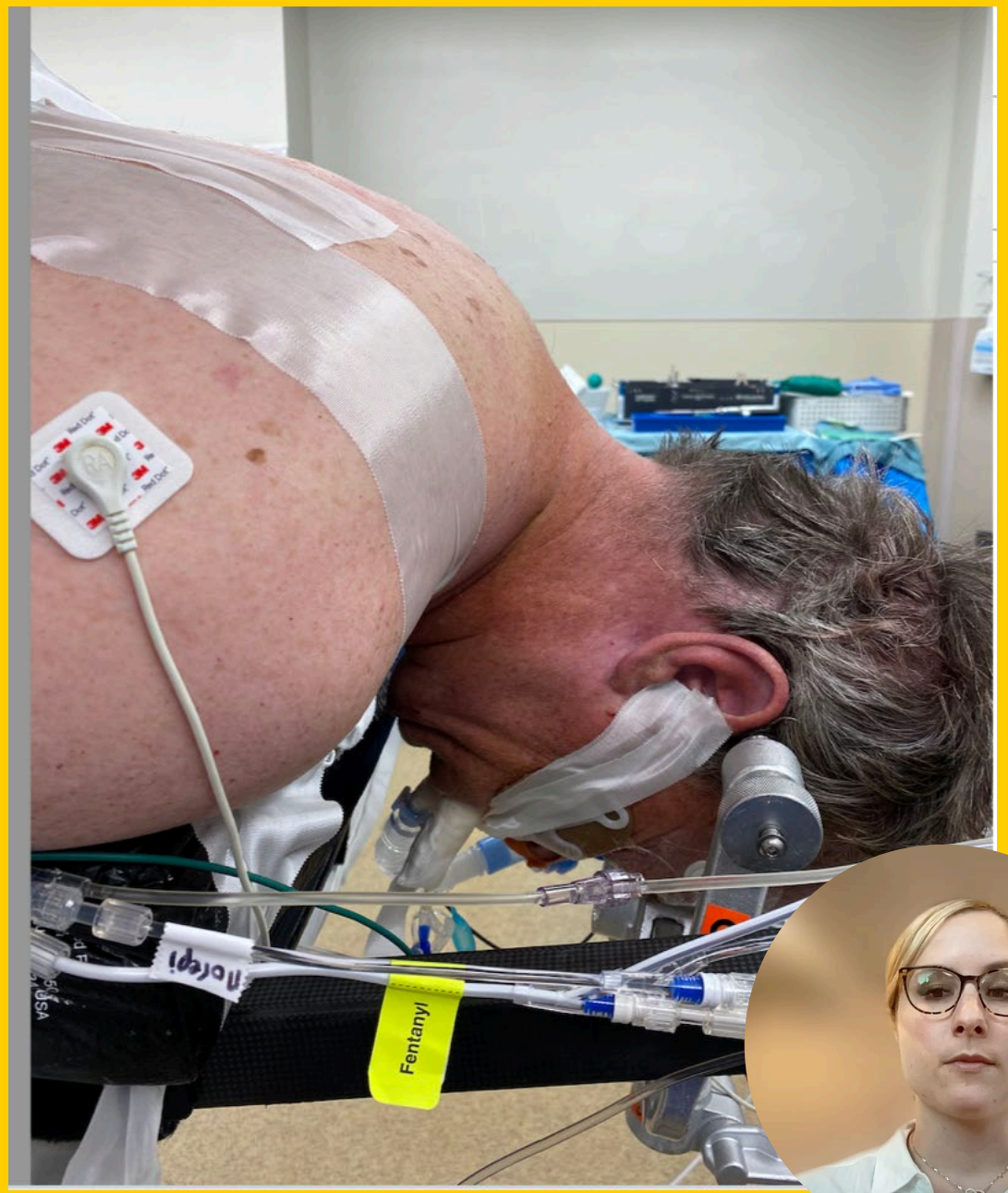
Case 3


FRP

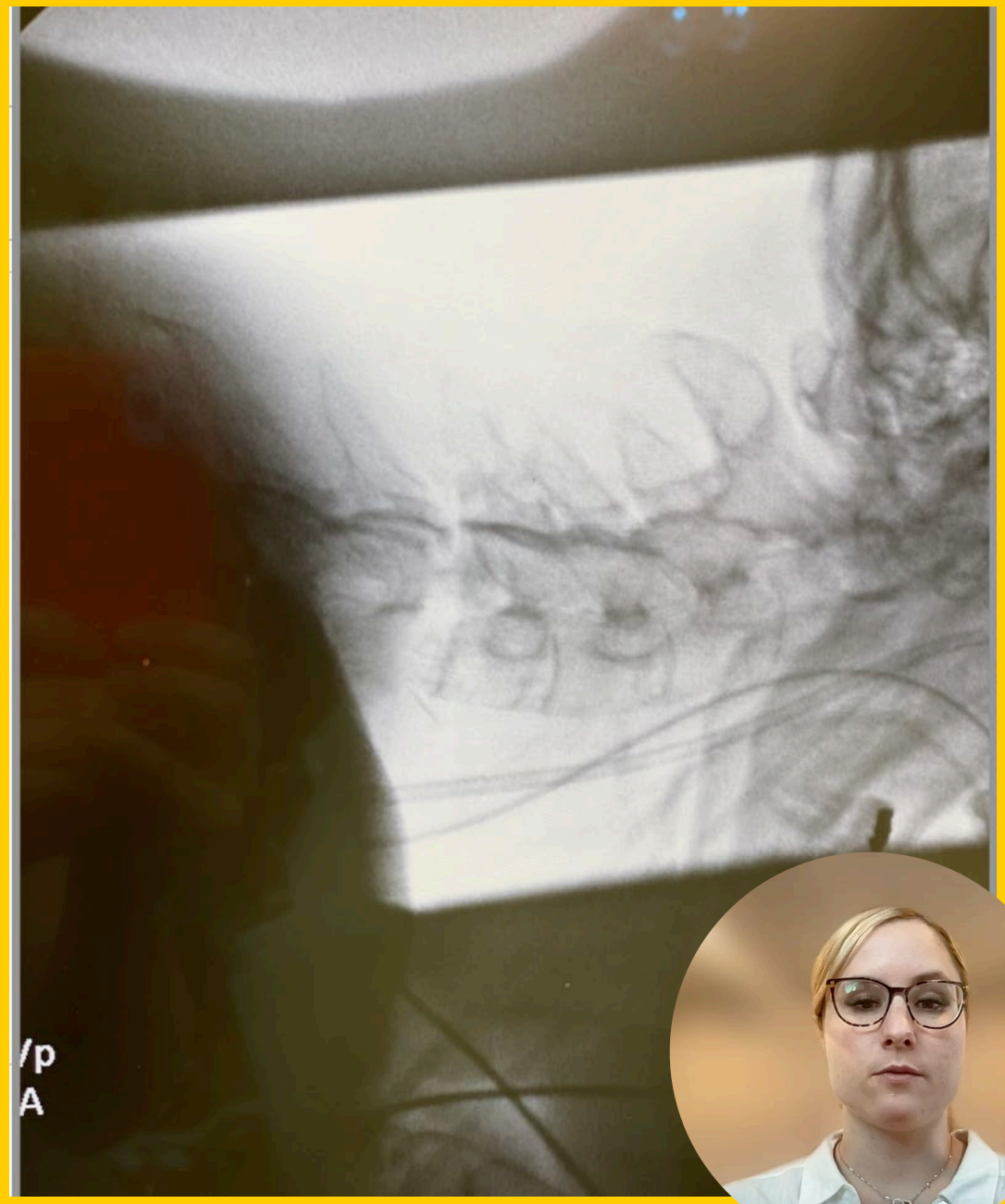

F


BREG
PINNACLE

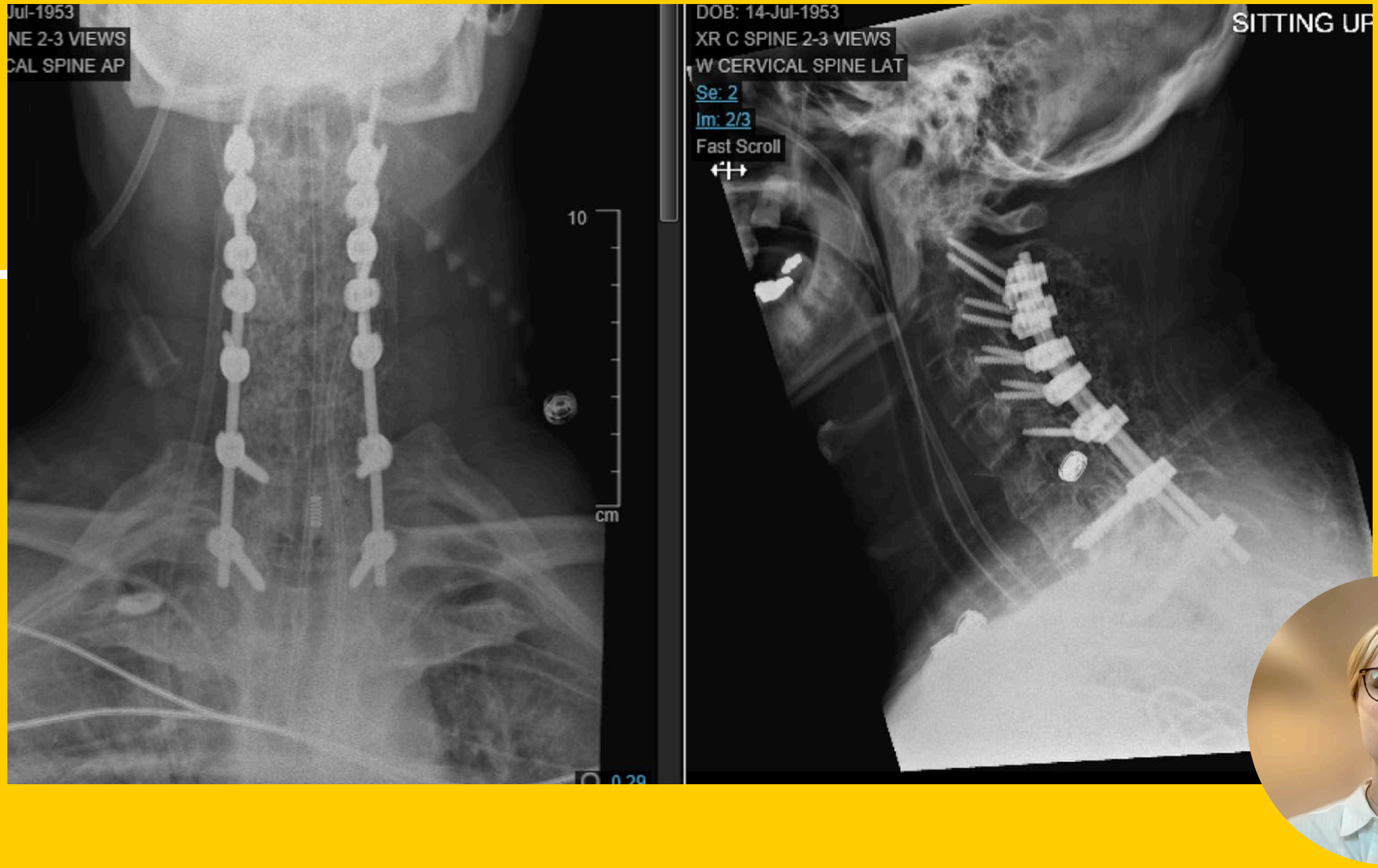



Fentanyl


Mode...
Fluoro
HLF


/p
A


R C T SPINE
e: 1
n: 1/5
XR C T SPINE
Se: 1
Im: 2/5
Fast Scroll


Jul-1953
NE 2-3 VIEWS
CAL SPINE AP
10
cm
DOB: 14-Jul-1953
XR C SPINE 2-3 VIEWS
W CERVICAL SPINE LAT
Se: 2
Im: 2/3
Fast Scroll
SITTING UP

Outcomes

- Increased in hospital mortality (13%):
  - Increased age (>20 years)
  - Male sex
  - Severe systemic injuries (ISS>15)
  - Concurrent traumatic brain injuries
  - 1 or more comorbidities
  - Neurologic grade (ASIA)
  - Admission to level 1 trauma center
- Neurologic recovery
- Functional recovery
  - Improved with < AIS grade
  - Older age and presence of spinal cord edema on MRI imaging worse progno

Witiw, C. D., & Fehlings, M. G. (2015). Acute Spina
of Spinal Disorders & Techniques, *28*(6), 202–
https://doi.org/10.1097/bsd.0000000000000287

Celebrating 150 years of advancing medical research, education, and patient care to help people live longer, healthier lives

University of Iowa Carver College of Medicine
University of Iowa Health Care

2023 ASCIP Annual Meeting

Thank you

medicine.uiowa.edu

CHANGING MEDI
CHANGING LIVES.