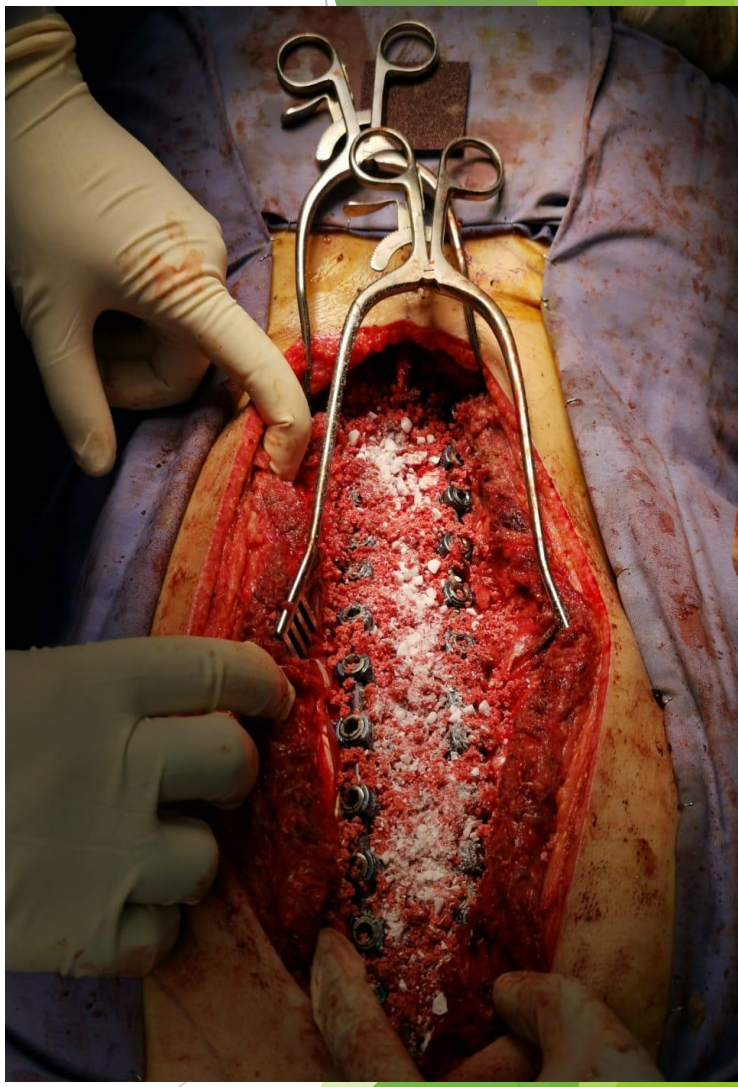
scoliosis



Omar Bashmaf .MD. RMS

PLEASE CLICK ON THE FOLLOWING LINK TO WATCH THE LECTURE ONLINE:-

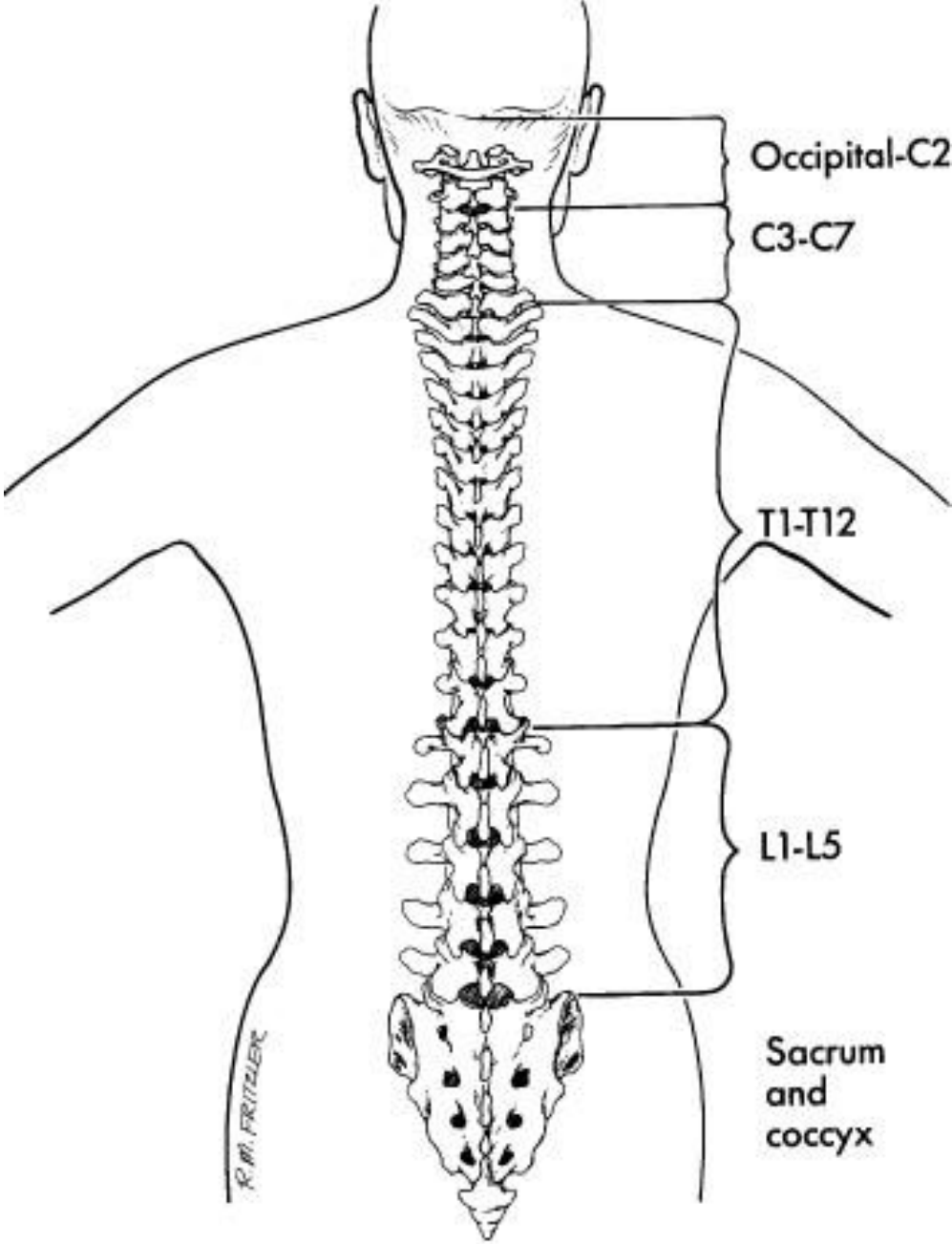
https://www.youtube.com/watch?v=lQzkOtp7AGg&list=PLuBRb5B7fa_embZp8jWG_hG8_o1JXLEeo&index=6

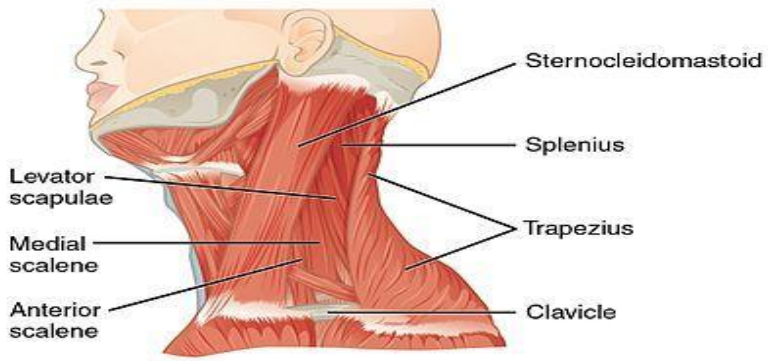
Topics

- 1. anatomy of the spine and development
- 2.What is scoliosis how to see it
- 3. the different kinds of scoliosis
- 4. How do you diagnosis and treat scoliosis?

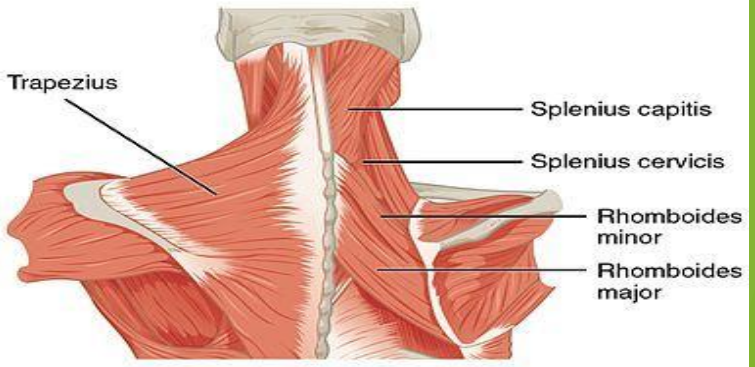
Anatomy

- 7 cervical,
- 12 thoraic,
- 5 lumbar connected to a fused Sacral and coccygeal vertebrae

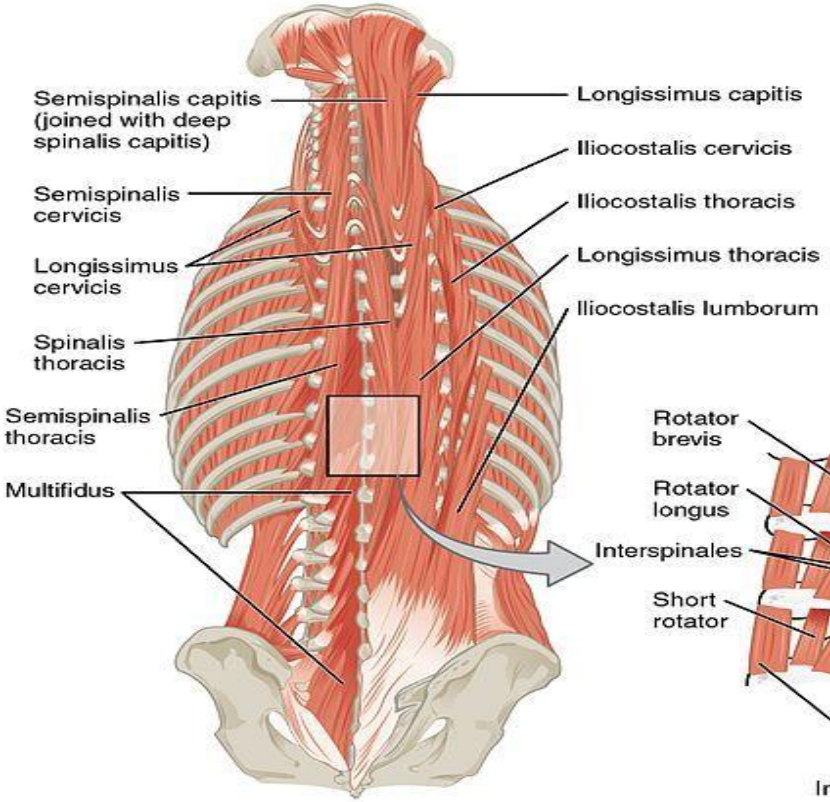




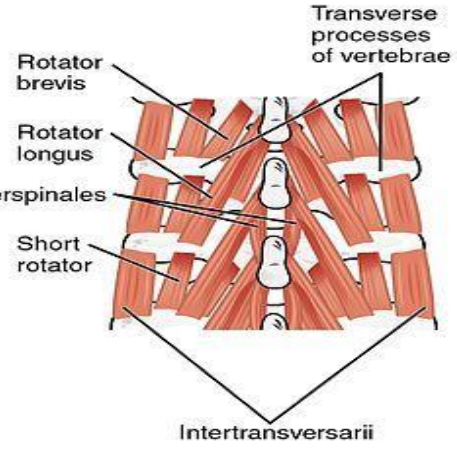
Muscles of the neck (left lateral view)



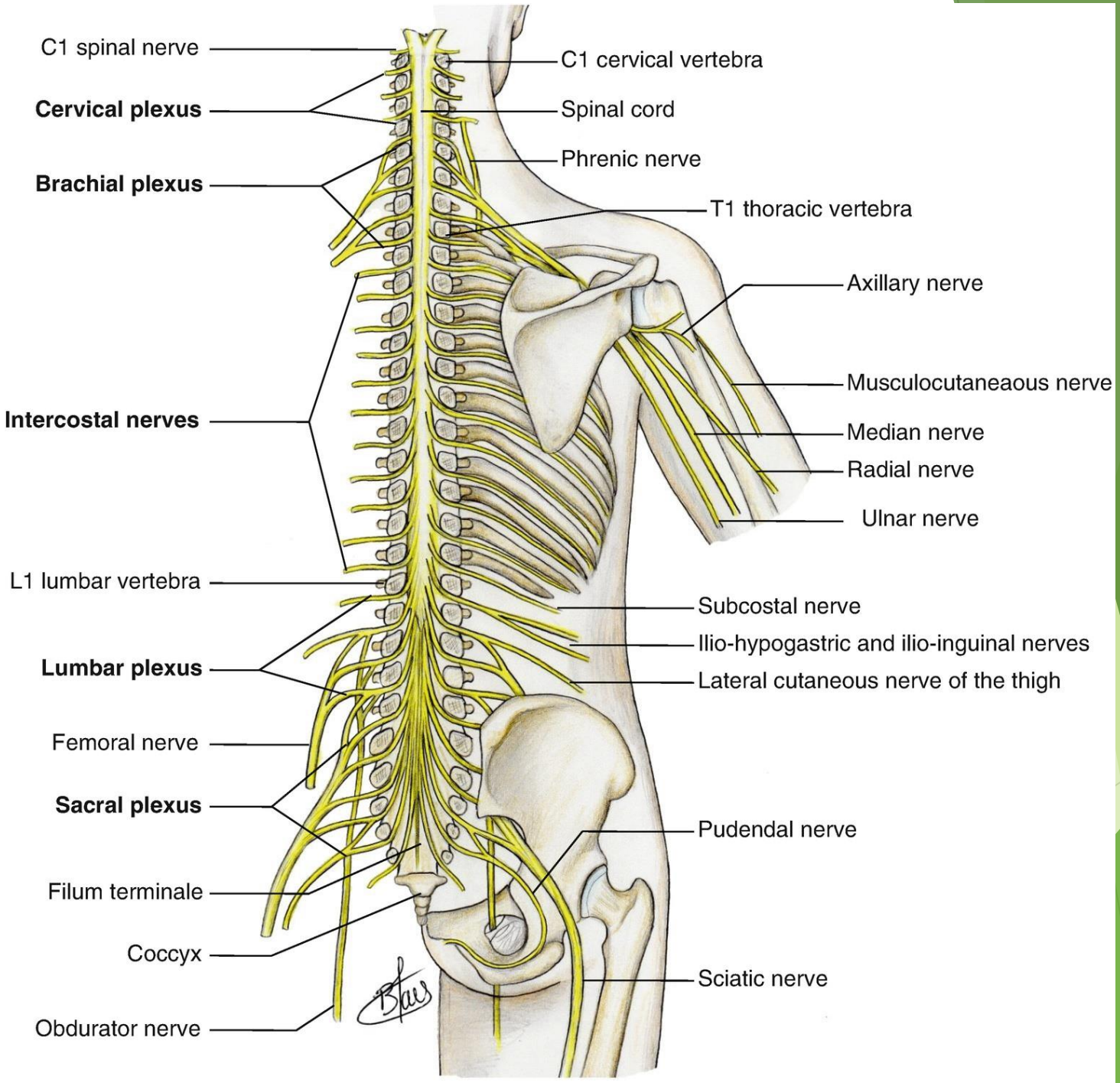
Superficial (left side) and deep (right side) muscles of the neck and upper back (posterior view)

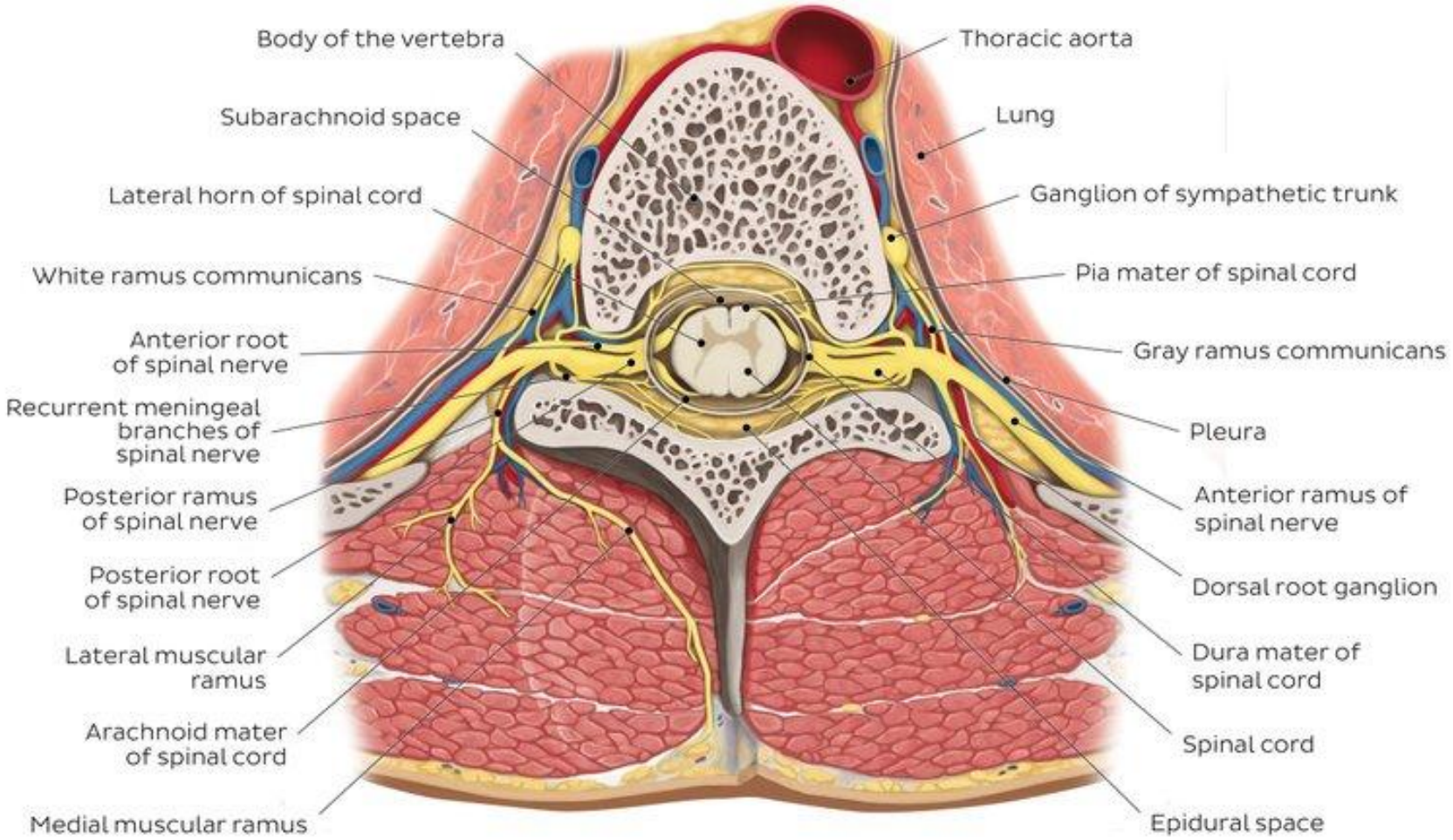


Deep muscles of the back (posterior view)



Deep spinal muscles (multifidus removed)


C1 spinal nerve
Cervical plexus
Brachial plexus
Intercostal nerves
L1 lumbar vertebra
Lumbar plexus
Femoral nerve
Sacral plexus
Filum terminale
Coccyx
Obdurator nerve
C1 cervical vertebra
Spinal cord
Phrenic nerve
T1 thoracic vertebra
Axillary nerve
Musculocutaneaous nerve
Median nerve
Radial nerve
Ulnar nerve
Subcostal nerve
Ilio-hypogastric and ilio-inguinal nerves
Lateral cutaneous nerve of the thigh
Pudendal nerve
Sciatic nerve



Pathological alterations → Spine-Thorax

1. Spine is mostly cartilaginous
2. Spinal growth is not linear
3. Deformity progression → thoracic cage distortion

Before age 5 spine is mostly cartilaginous

Age 4 months

Age 3 years

Birth → ossification 30%

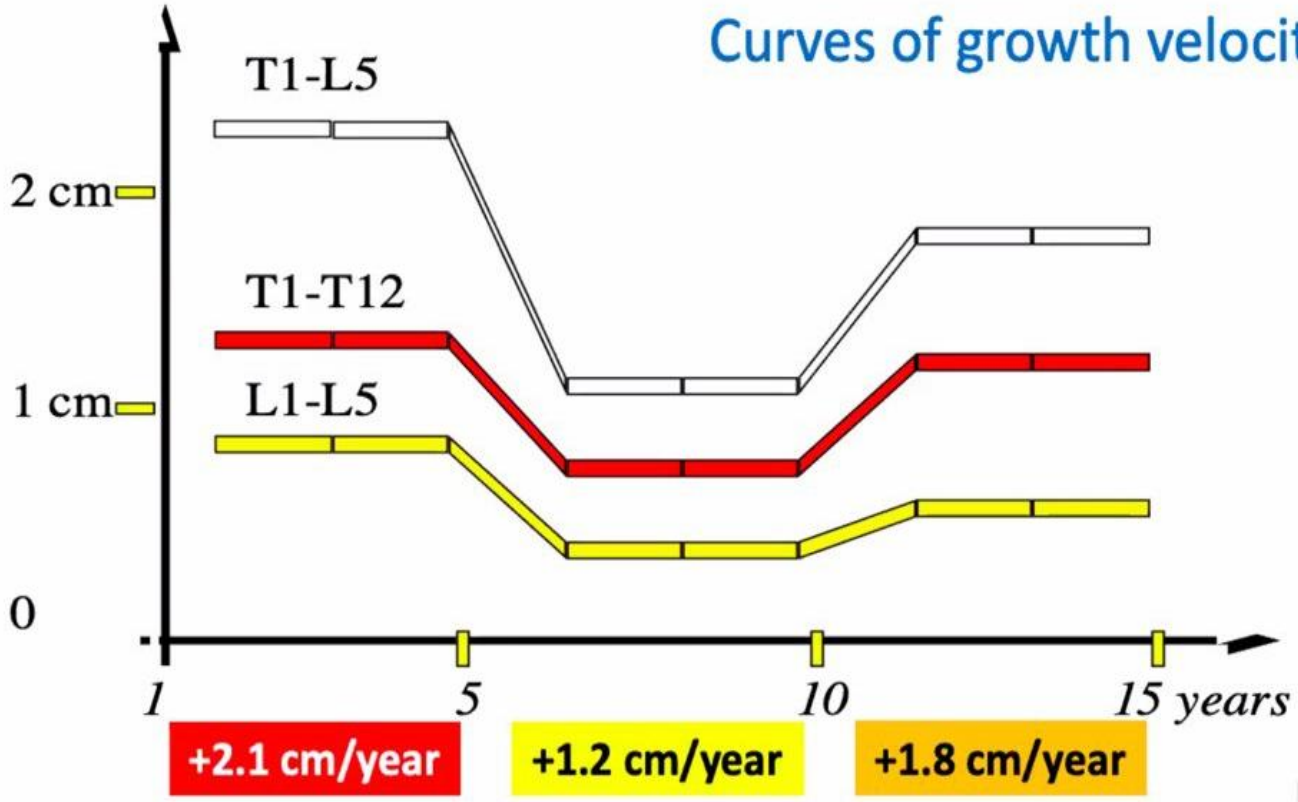
5 years → ossification 65%

SPINE

souple → sensitive

growth +++

After birth, spinal growth is NOT linear

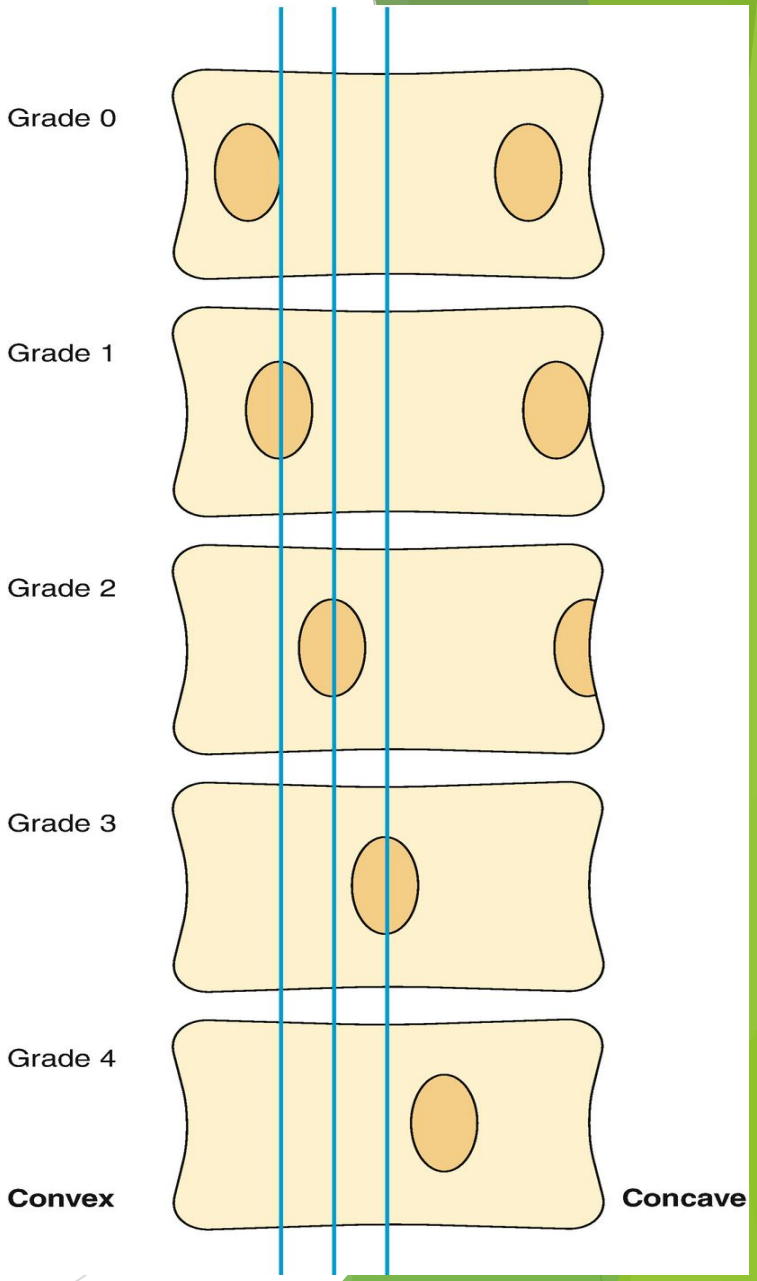


Dimeglio A. *JPO* 2001

SCOLIOSIS

Lateral DEVIATION of the spine (10 degrees or more of Cobb's angle) with fixed rotation of the spine

Vertebral rotation defined as the angle between the longitudinal axis of the vertebra and the mid-sagittal axis of the trunk



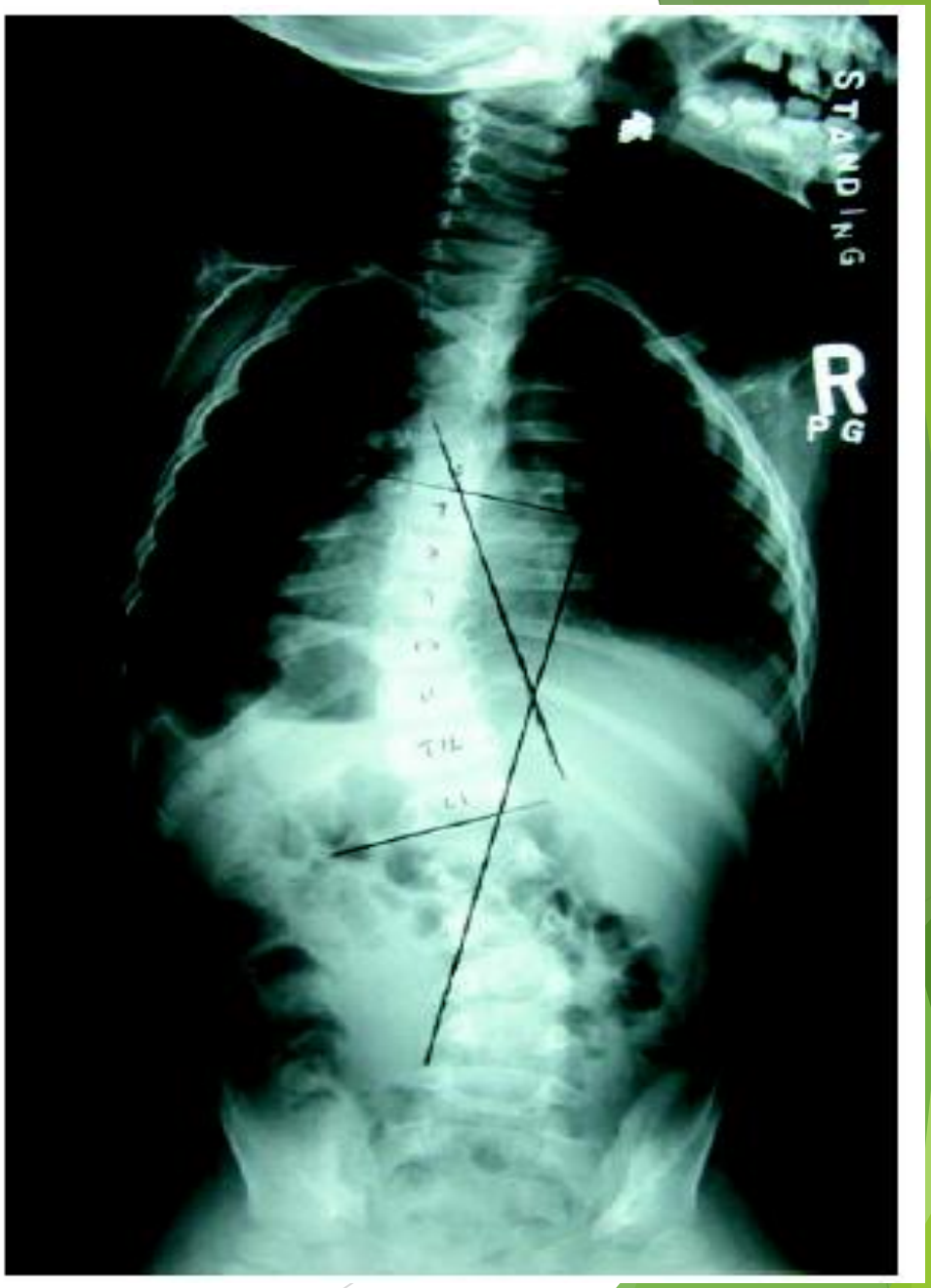
Apical vertebra

The most rotated vertebra in a curve ; the most deviated vertebra from the vertical axis of the patient .

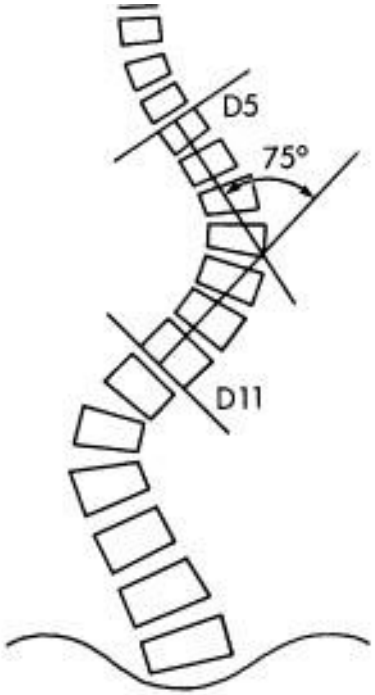
End vertebrae

The most caudal and cephaled vertebrae that telt maximally to the concavity of the curve

Cobb’s angle



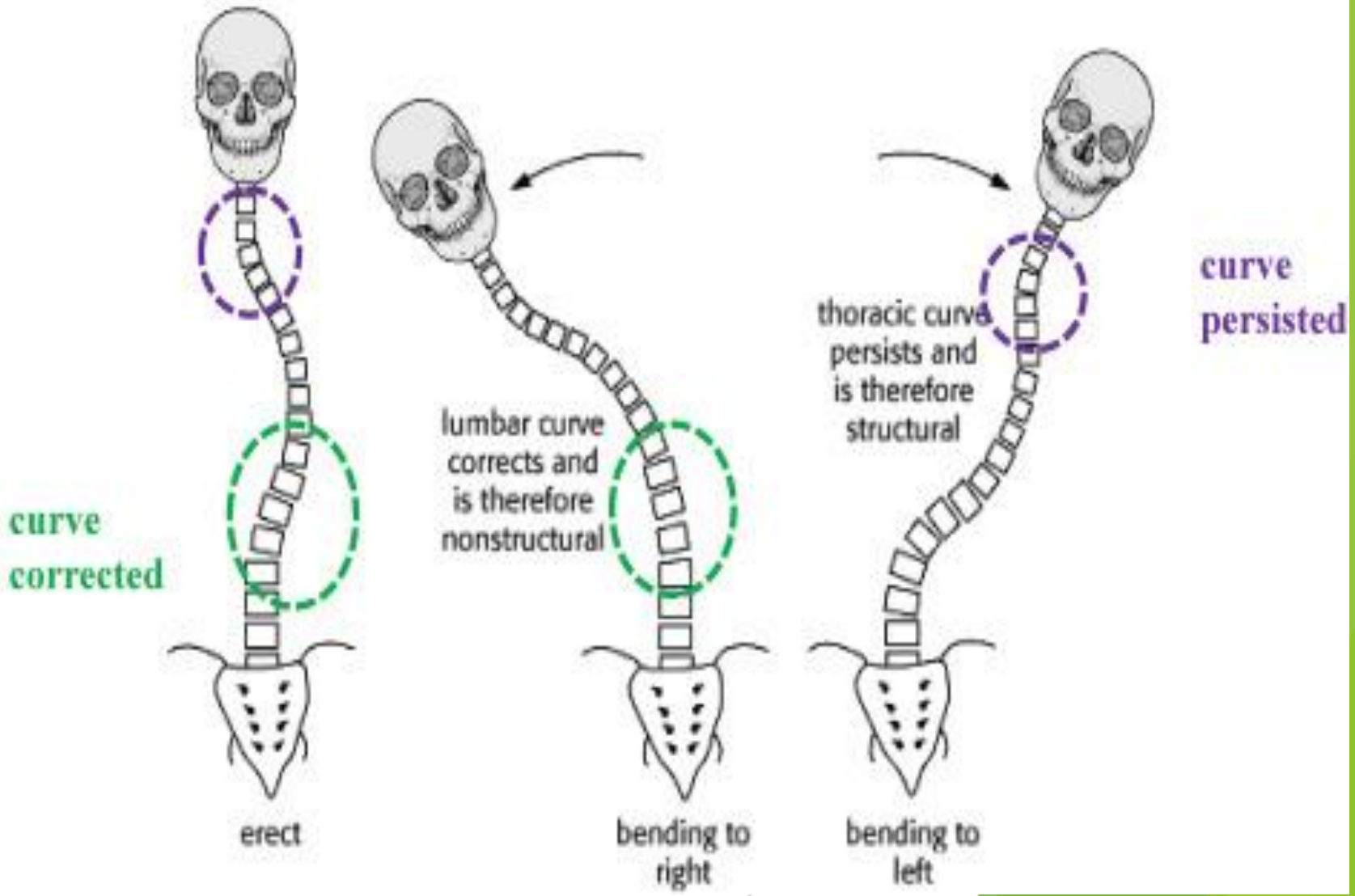
Cobb's angle



Classification

- ***Structural***
- ***Non-structural***

Canonical Illustration:
Structural and Non-structural Scoliosis



Strutural

Idiopathic:

1 . Infantile….. 0-3

2 . Juvenile ….. 3-10

3 . Adoloscent ….. >10

EOS early onset scoliosis

Congenital:

1. Failure of formation.
2. Failure of segmentation

Failure of formation Failure of segmentation

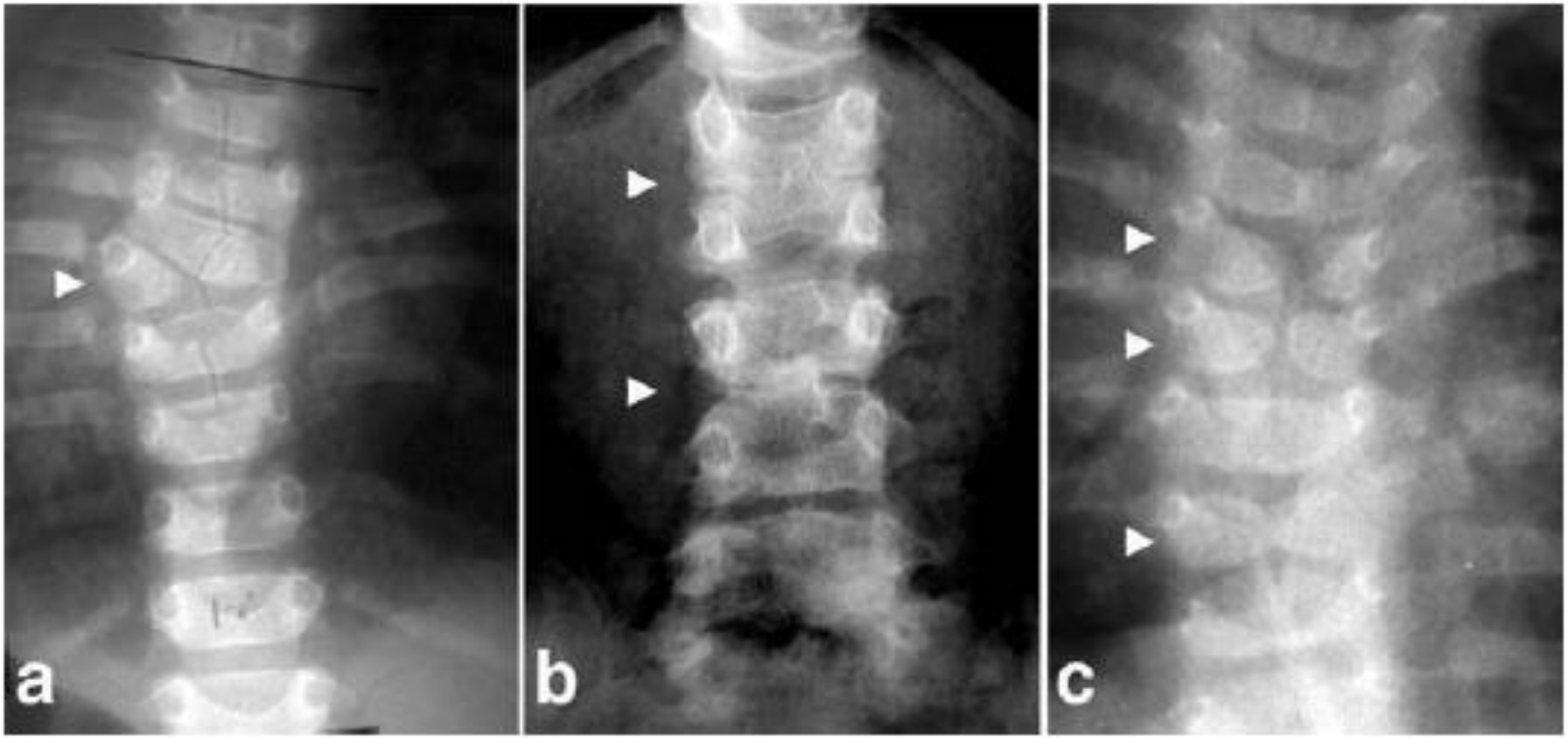
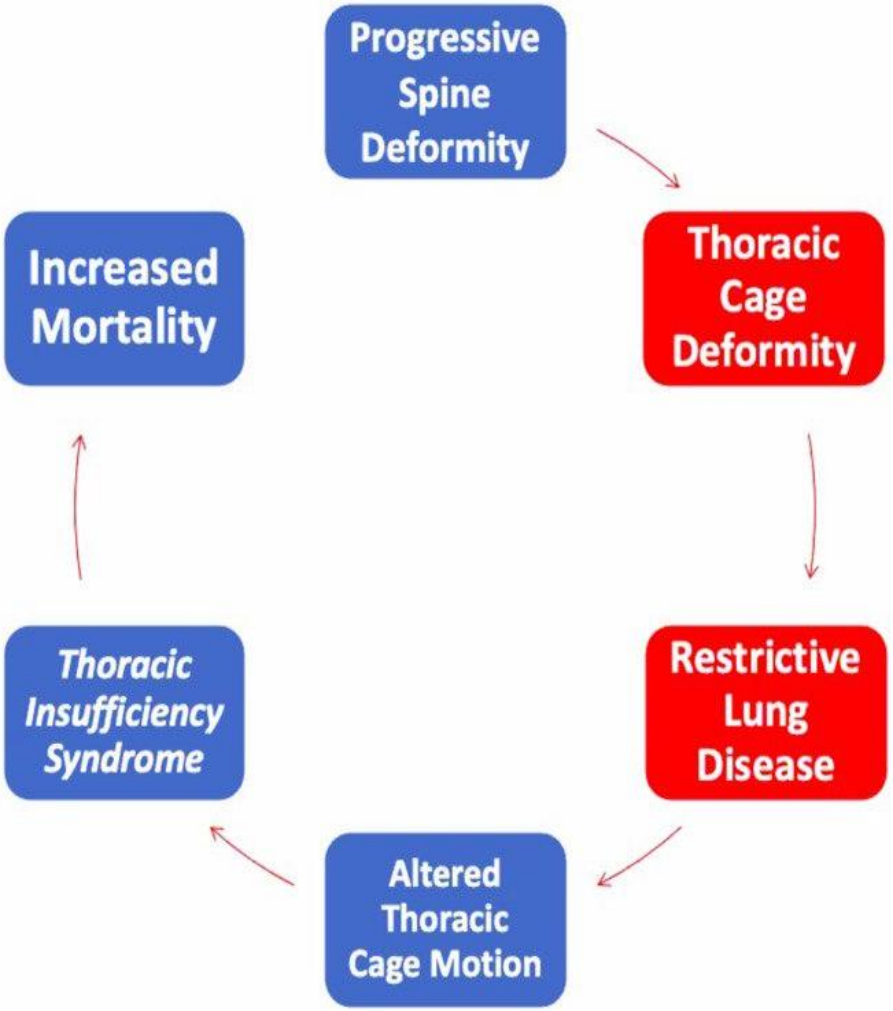


Fig. 4

Radiographs showing vertebral defects in congenital scoliosis, including hemivertebrae *(a)*, vertebral fusions *(b)*, and midline defects *(c)*. White arrowheads point to malformations.

Natural Evolution

- Penetration Spine > Thorax
- Reduced number of alveoli



Structural

- Neuromuscular
- Mesenchymal(Marfans)
- Rheumatoid
- Trauma
- Osteochondrodystrophies
- Infection
- Metabolic(Rickets,OI)

Non-structural

- PosturalHysterical
- Nerve root irritation
- Inflammatory(Appendix)
- LLD
- Hip contracture

CURVE TYPE

Type	Proximal Thoracic	Main Thoracic	Thoracolumbar/Lumbar	Description
1	Non-Structural	Structural (Major)*	Non-Structural	Main Thoracic (MT)
2	Structural	Structural (Major)*	Non-Structural	Double Thoracic (DT)
3	Non-Structural	Structural (Major)*	Structural	Double Major (DM)
4	Structural	Structural (Major)*	Structural (Major)*	Triple Major (TM)§
5	Non-Structural	Non-Structural	Structural (Major)*	Thoracolumbar/Lumbar (TL/L)
6	Non-Structural	Structural	Structural (Major)*	Thoracolumbar/Lumbar-Main Thoracic (TL/L-MT)

STRUCTURAL CRITERIA
(Minor Curves)

Proximal Thoracic
- Side Bending Cobb ≥ 25°
- T2-T5 Kyphosis ≥ +20°

Main Thoracic
- Side Bending Cobb ≥ 25°
- T10-L2 Kyphosis ≥ +20°

Thoracolumbar/Lumbar
- Side Bending Cobb ≥ 25°
- T10-L2 Kyphosis ≥ +20°

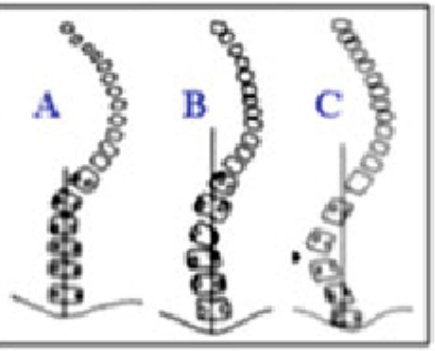
*Major = Largest Cobb measurement, always structural
Minor = All other curves with structural criteria applied
§Type 4 - MT or TL/L can be major curve

LOCATION OF APEX
(SRS Definition)

CURVE	APEX
Thoracic	T2-T11/12 Disc
Thoracolumbar	T12-L1
Thoracolumbar/Lumbar	L1/2 Disc-L4

Modifiers

Lumbar Spine Modifier	CSVL to Lumbar Apex
A	CSVL between pedicles
B	CSVL touches apical body(ies)
C	CSVL completely medial



Thoracic Sagittal Profile T5-T12	
- (Hypo)	< 10°
N (Normal)	10° - 40°
+ (Hyper)	> 40°

Curve Type (1-6) + Lumbar Spine Modifier (A, B, C) + Thoracic Sagittal Modifier (-, N, +)
Classification (e.g. 1B+):

Patient evaluation

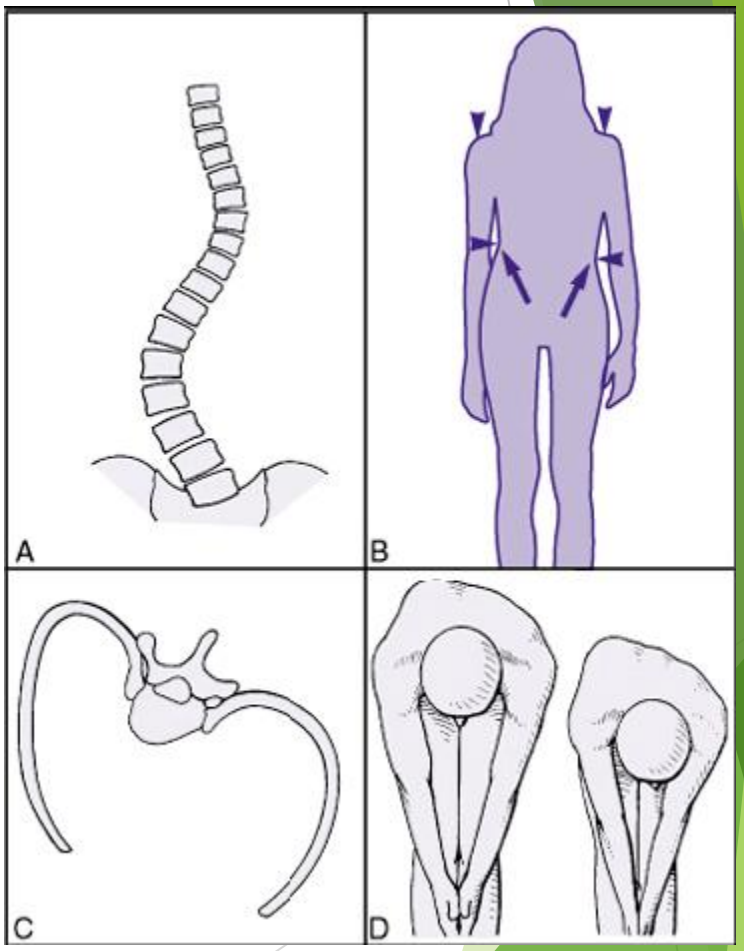
- History
- Physical examination
- Radiology

History

- Deformity
- Pain
- Neurologic symptoms
- Decrease in DLAs
- Cardio-Pulmonary symptoms
- Family history
- Development milestones
- Maturity signs
- Past surgeries

Physical examination

- Neck line asymmetry
- Shoulder height
- Rib cage deformities
- Waistline and pelvic balance
- Lower ext.(LLD)
- Skin lesion
- Gait



Evaluation

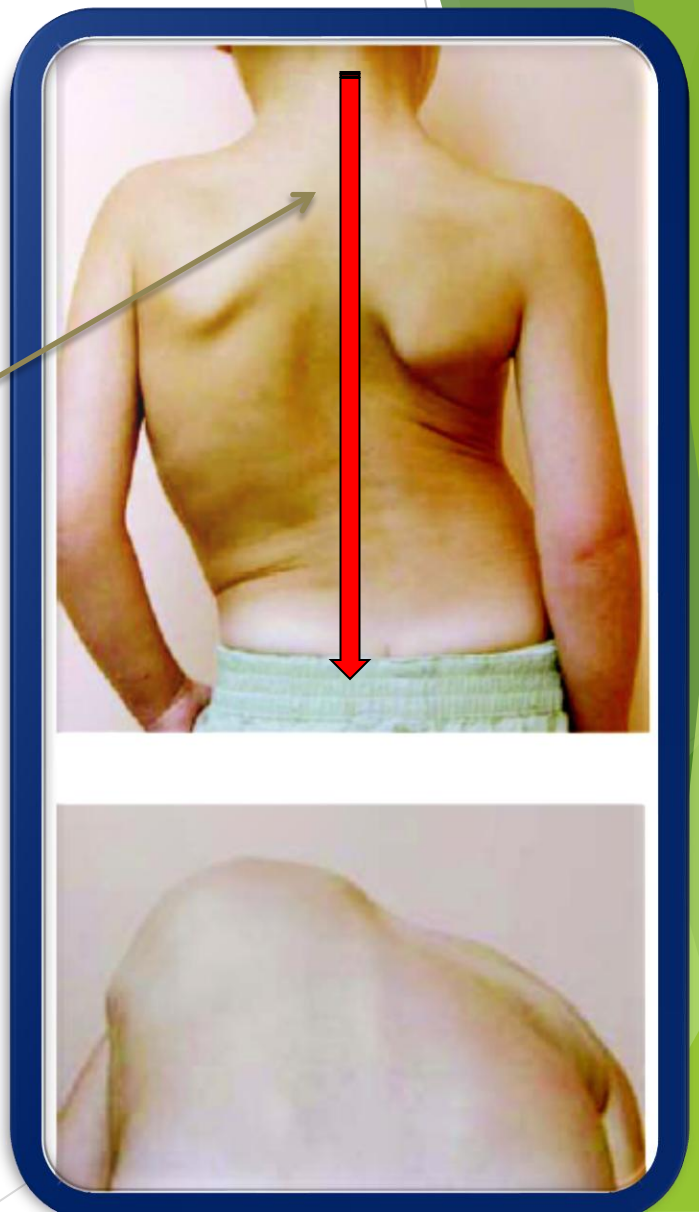
Palpation

Spinous process tenderness

Step-offs

Evaluation

- Range of motion: Flexion,extention,side-bending,rotation
- Neurological exam:Sensory, motor ,reflexes.
- Coronal alignment: Plumb line.
- Sagital alignment: Ear,shoulder,greater trochanter line.
- Extremities and related body systems



Evaluation

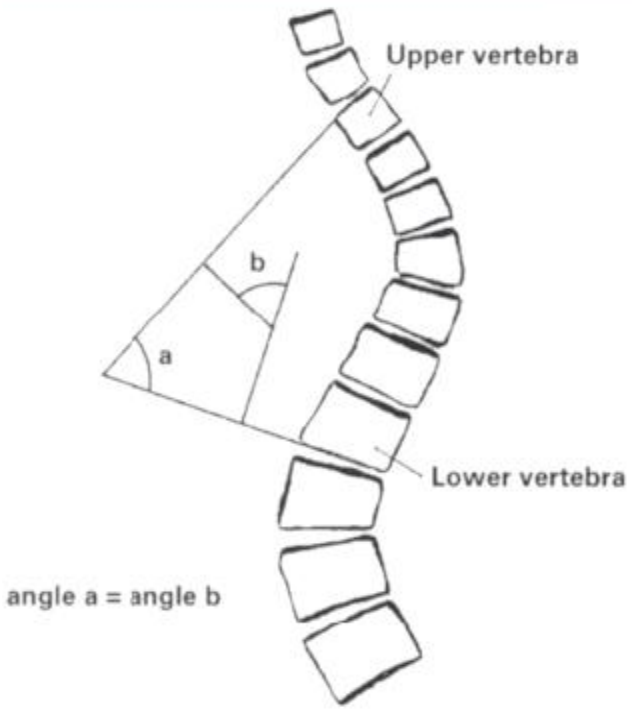
- Radiology:

  Cobb's angle

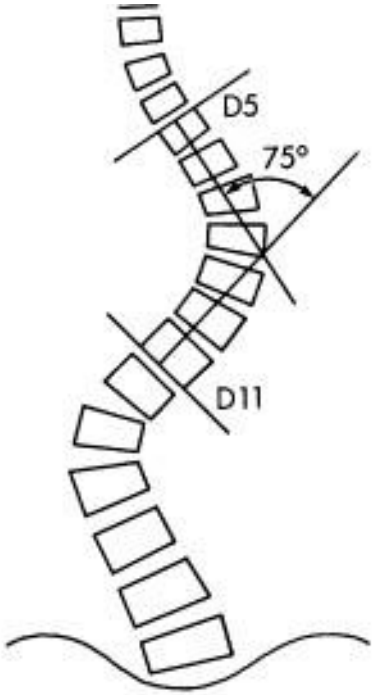
  Risser's sign

  Rib vertebral angle difference

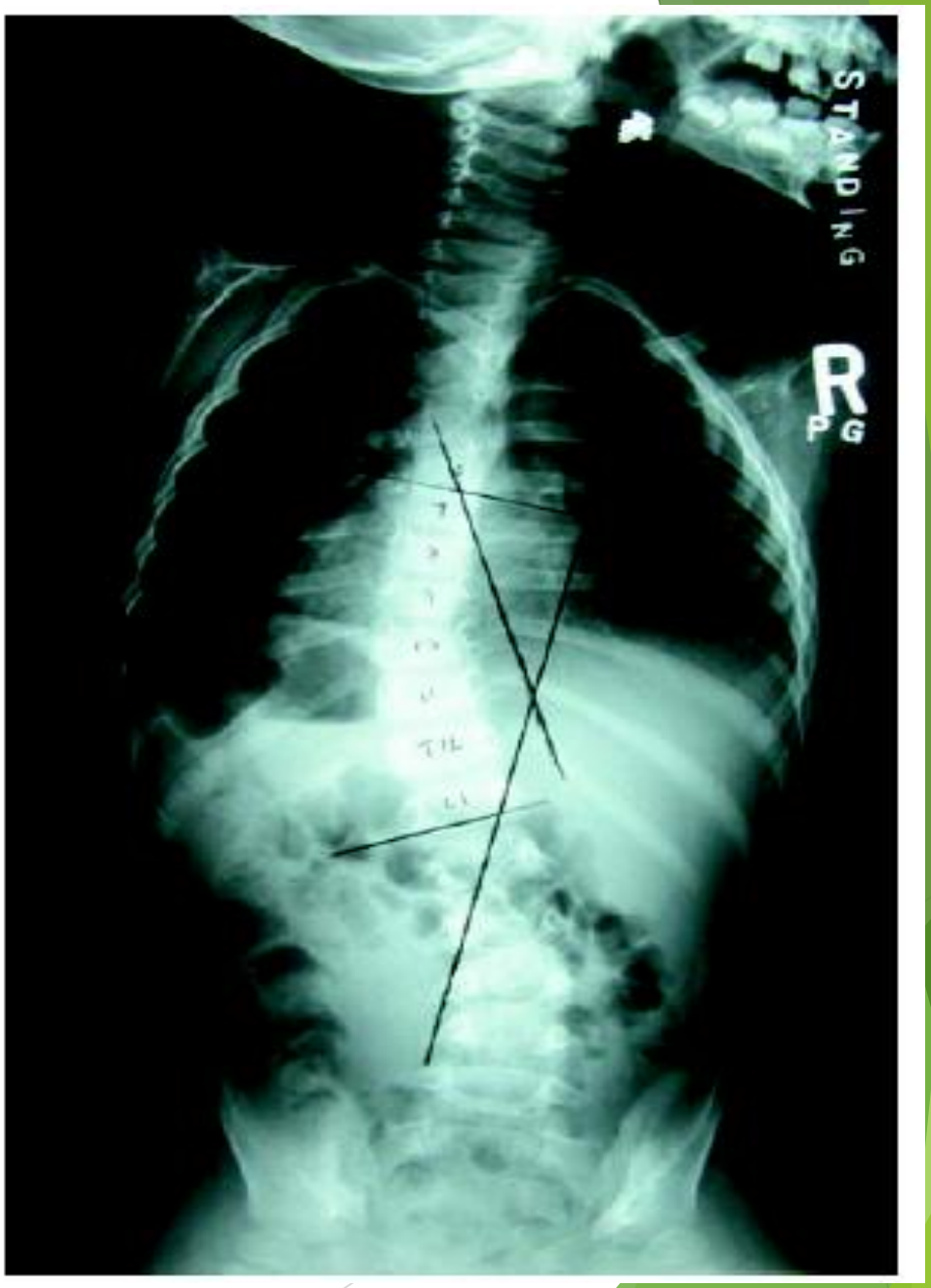
  Flexibility assessment



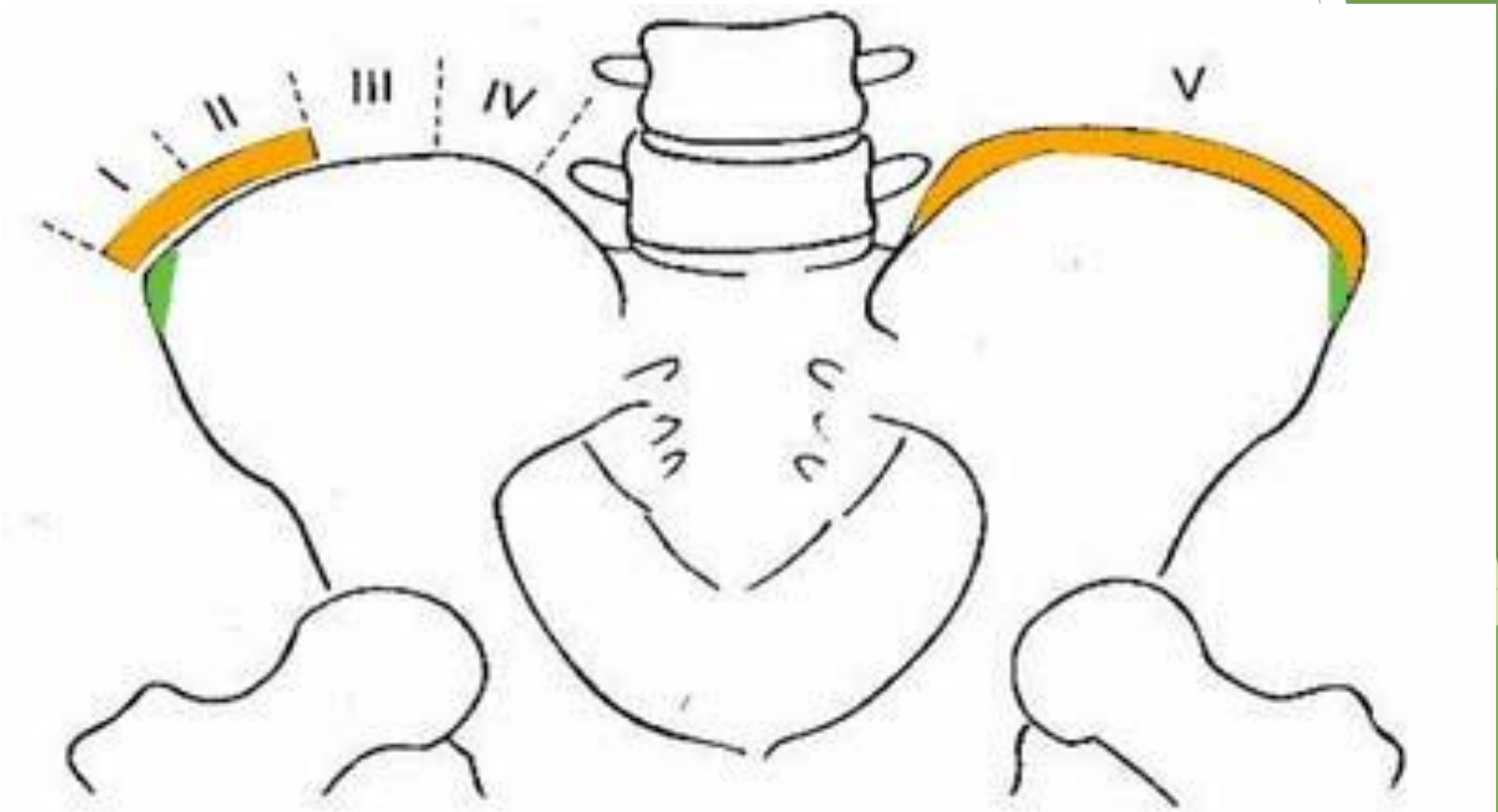
Cobb's angle



Cobb’s angle



Risser’s sign



Flexibility assessment

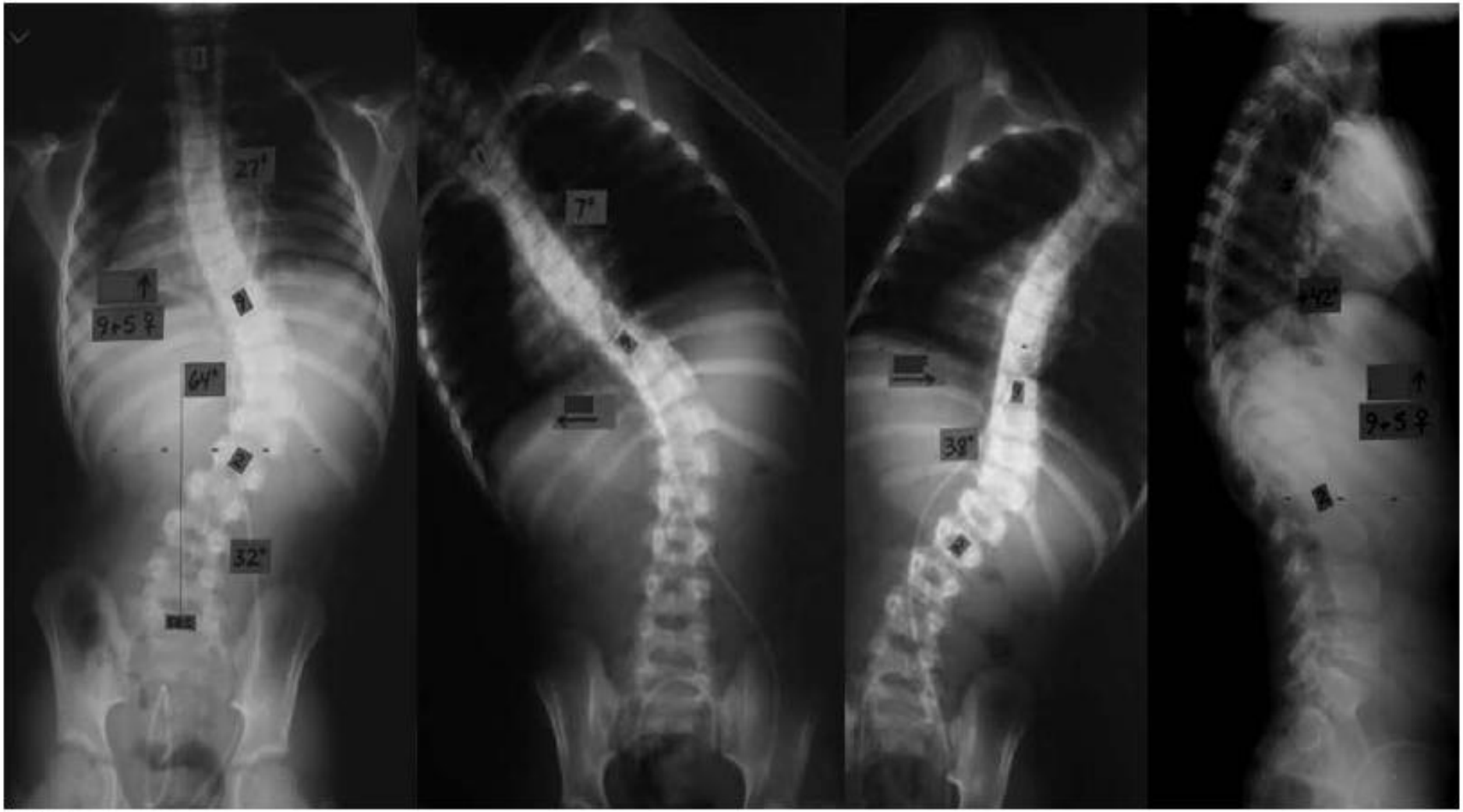


Fig. 2-A

(Left to right). Anteroposterior, left-side-bending, right-side-bending, and lateral radiographs showing a progressive left thoracic curve to 64° with ap-

Fig. 3.14 Fulcrum bending radiograph (FBR): The patient is positioned on the lateral decubitus position. A padded cylinder (fulcrum) of appropriate size is placed on the side of the curve at the level of the rib corresponding to the apex of the curve. The fulcrum should be positioned to allow the shoulder and the pelvis to be lifted off the table.

MRI

Very important for cord lesions

Diastematomyelia

Dysraphism

Syrinx

Lipoma

CT Scan

- For pre-operative bony assessment

Natural history

- 20-25 degrees……..no progression
- 25-40 degrees……..Probably progressive
- >45 degrees…….. Progression

Natural history

Each patient is an individual and not a statistic.

Treatment (3Os)

- Observation
- Orthotics
- Operation

Observation

- Up to 25 degrees of Cobb's angle
- Every 4-6 months follow up X-rays
- Non congenital type usually

Orthotics

The decision is complex

Depends on:

- ……Biologic age of patients
- ……Location
- ……Severity
- ……Progression
- ……..Cosmetic deformity
- ……Psychology of patint and Family
- ……Skill of the orthotist

Orthotics

Most important is the specific diagnosis of the deformity

Decreases pulmonary function by 15%

Orthotics

- General rule

20-25 deg.---Observation

25-45 deg.---Orthotics

>45 ---Surgery

Orthotics

- Goals:

  >>>>>> Initially to improve the curve

  >>>>>> Prevent progression

Orthotics

How?

Molded body cast under GA >>> Exchange casting 6-12 weeks till max carrection >>> Replace with Milwaukee Brace full time(23hrs) >>> Brace worn for~2 years minimum and till no change in Cobb's angle & RVDA.


Scoliosis Bracing
Innovations




CH
AU
PG

Surgery

Aim

Stop progression of the curve while allowing the spine ,lungs and thoracic cage to grow

Goals of surgery

- Correct or improve the deformity while maintaining sagittal balance.
- Preserving or improving pulmonary function.
- Minimizing morbidity or pain.
- Maximizing postoperative function.
- Improving or at least not harming the function of the lumbar spine.

Surgery

- Indications:

Progressive curves(any congenital and idiopathic of >45 deg.)

Methods of surgery

Fusion

>>> Anterior

>>> Posterior

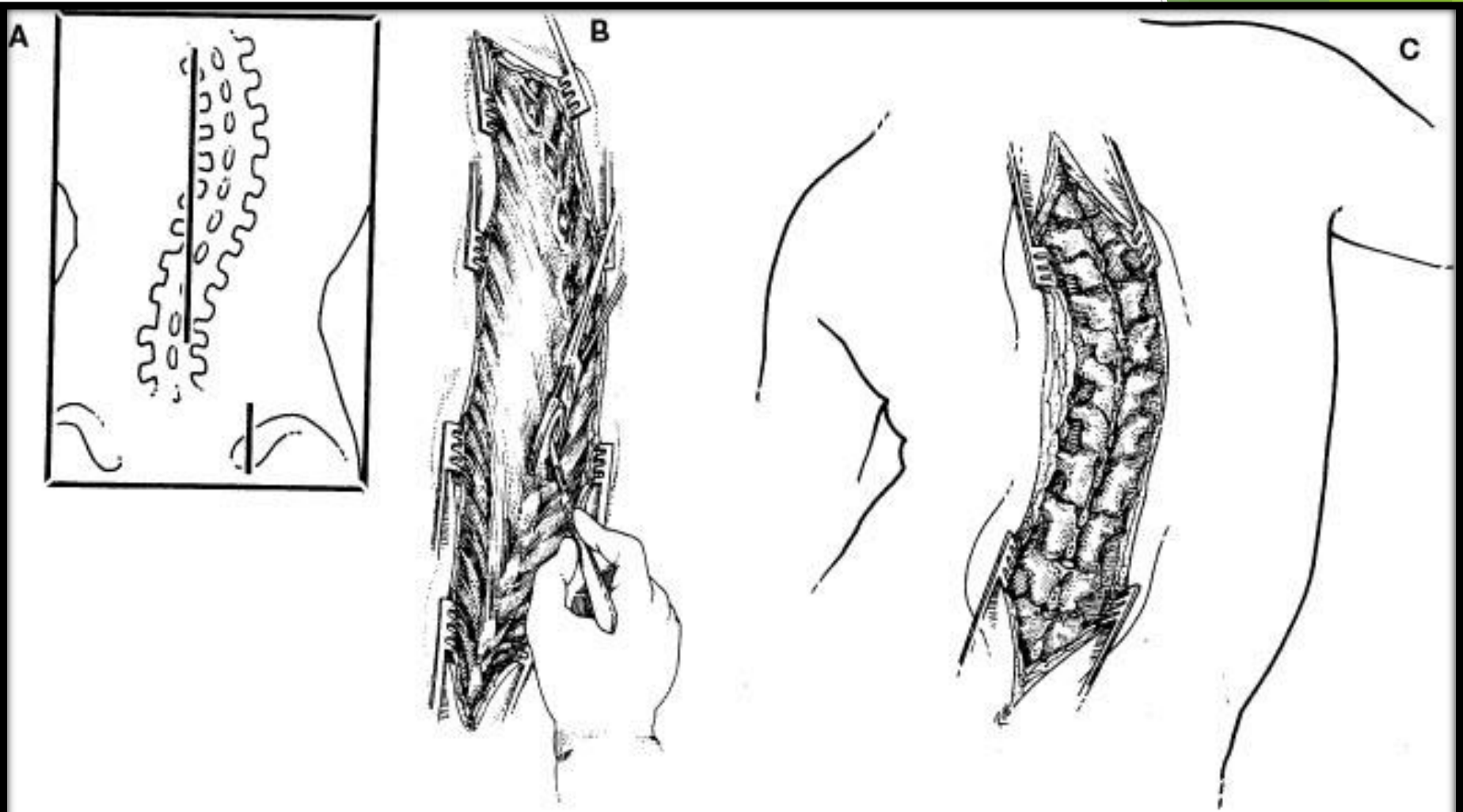
>>> Combind

Fusion less

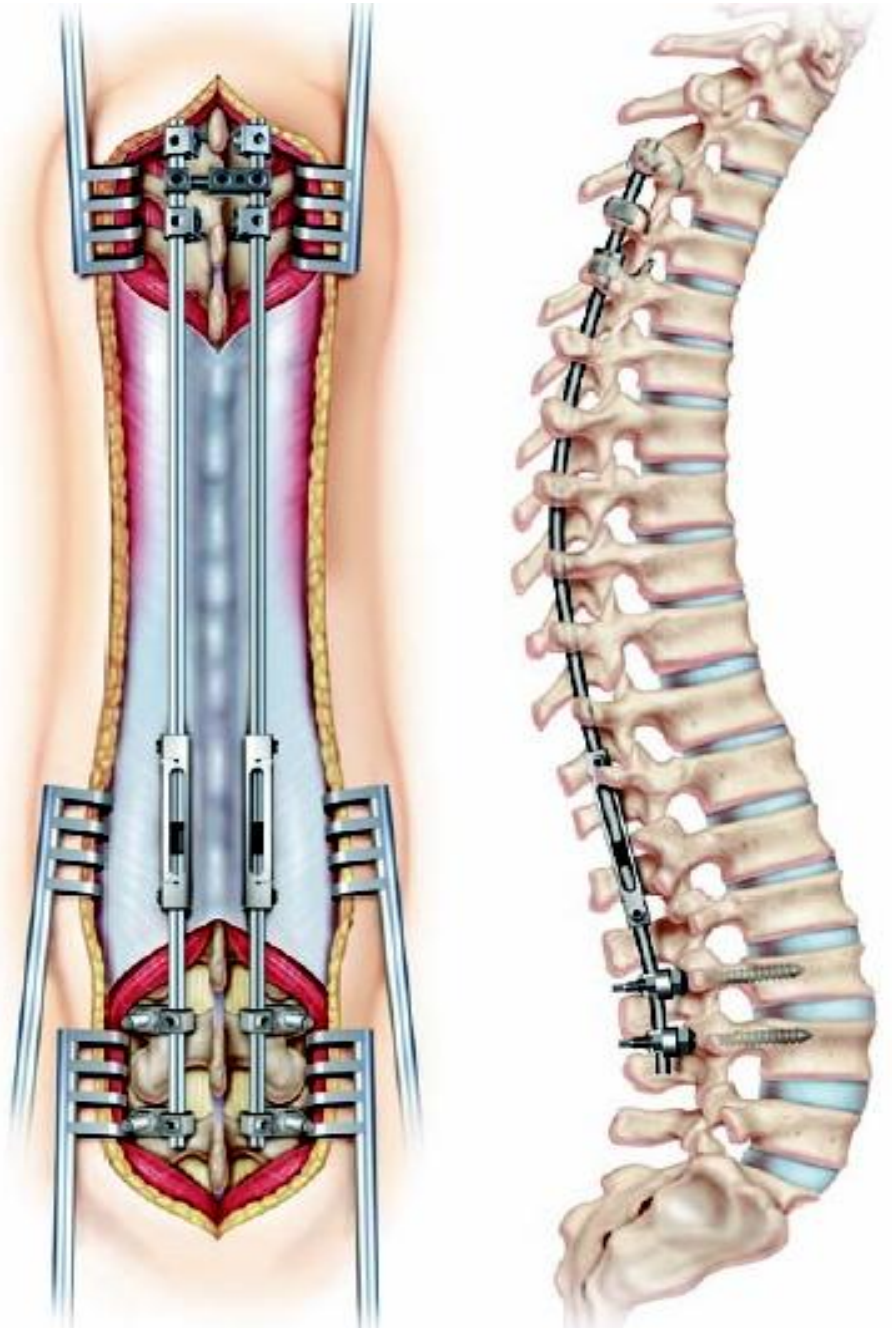
>>> Hemiepiphysiodesis

>>> Vertical expandable prosthetic Titanium rib (VEPTR)

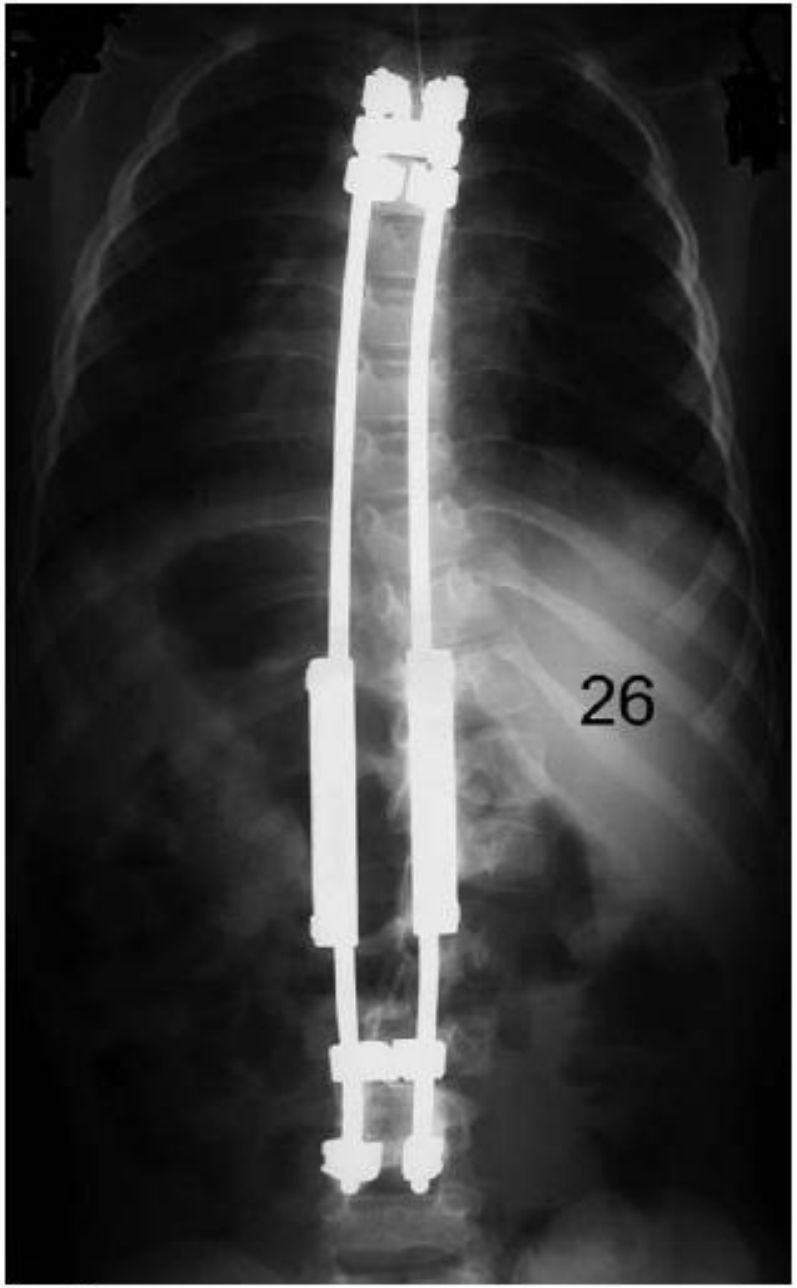
>>> Growing rod instrumentation



Growing Rod

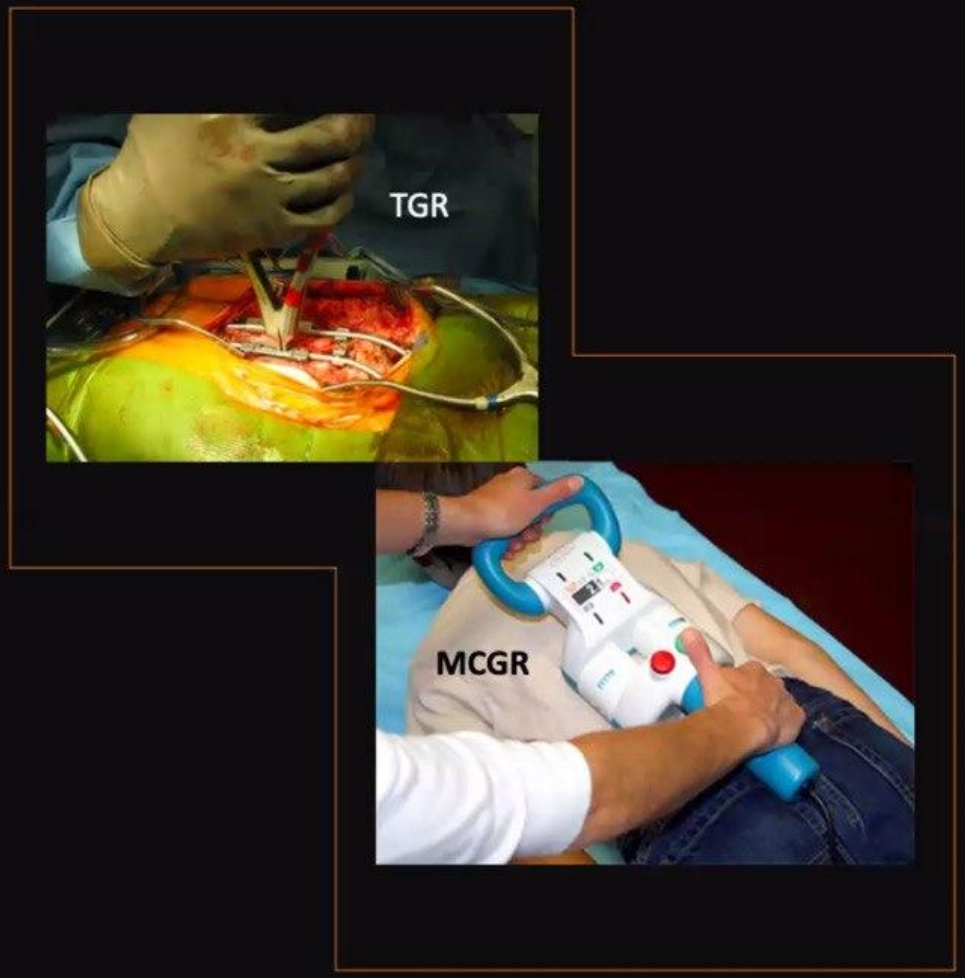


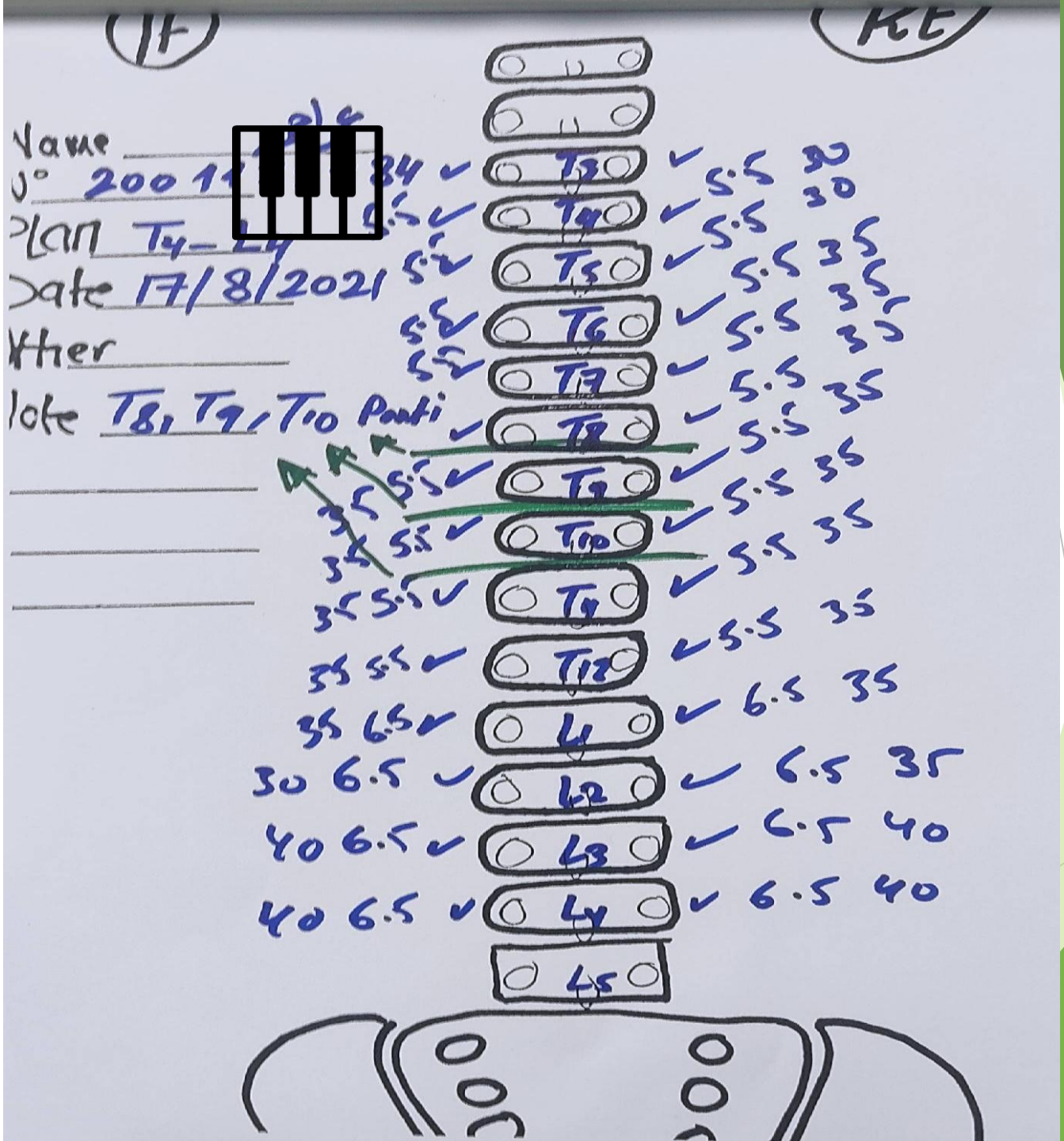
Growing rod

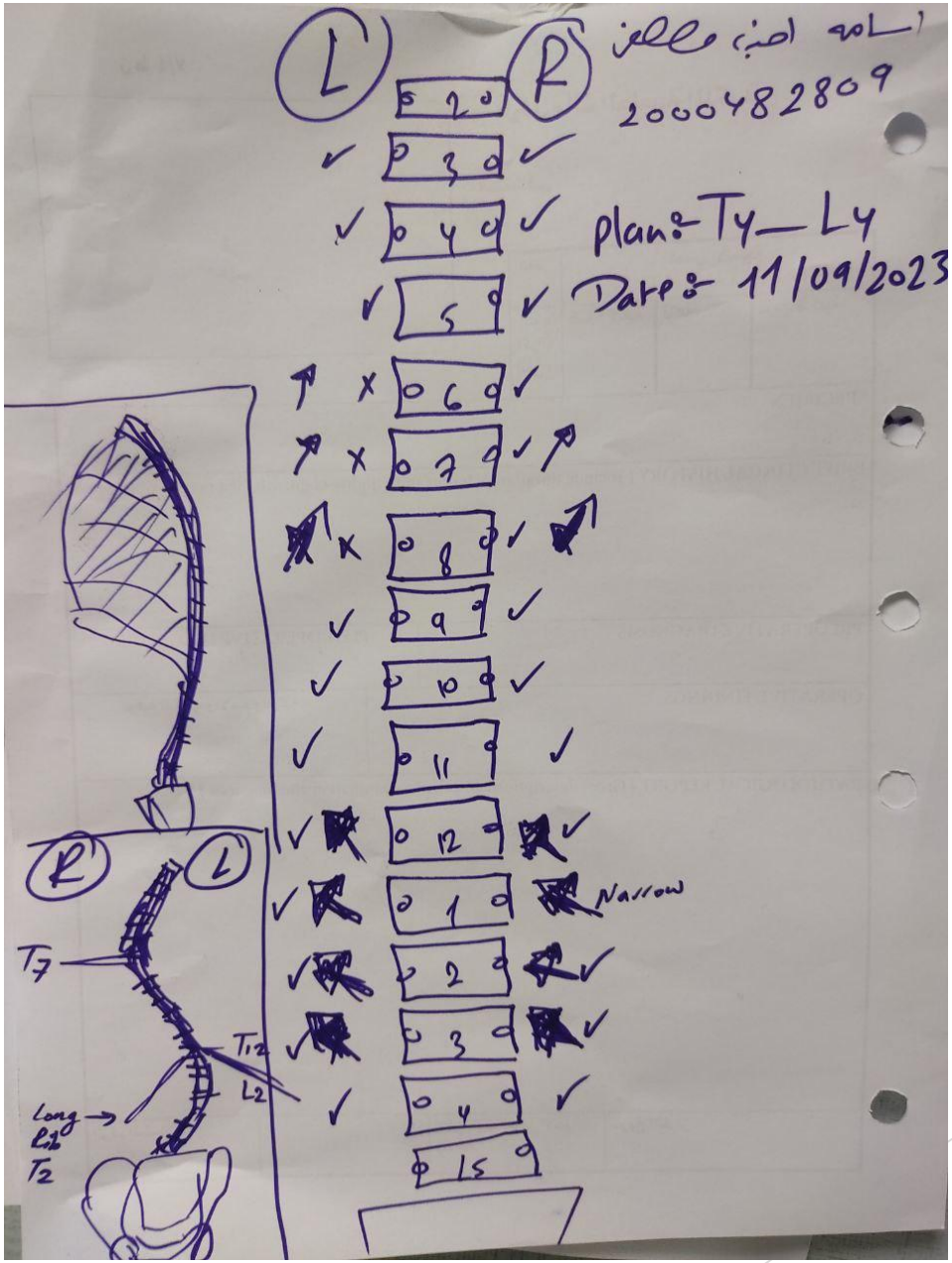


REC

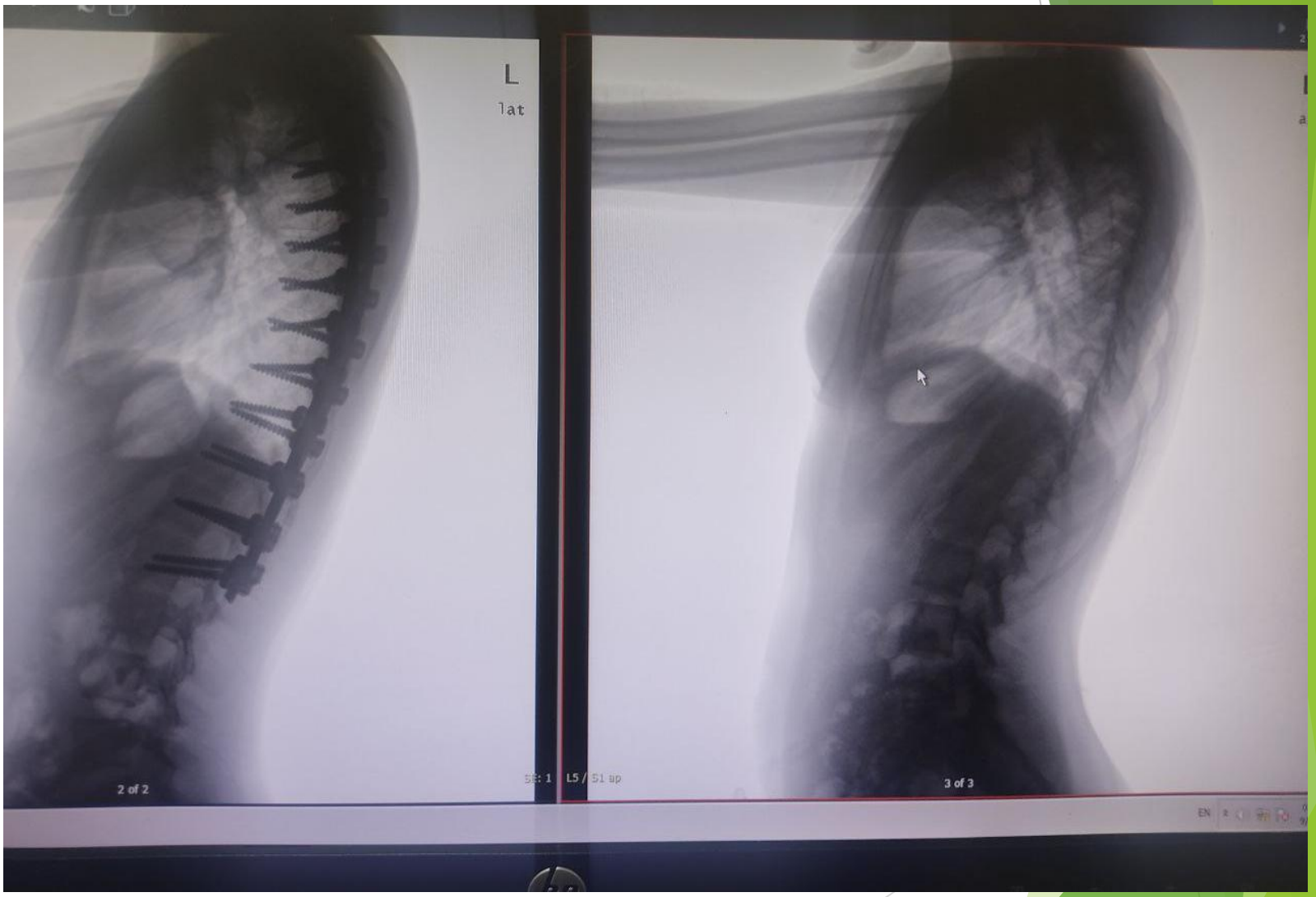
Growing Rod Lengthening Techniques

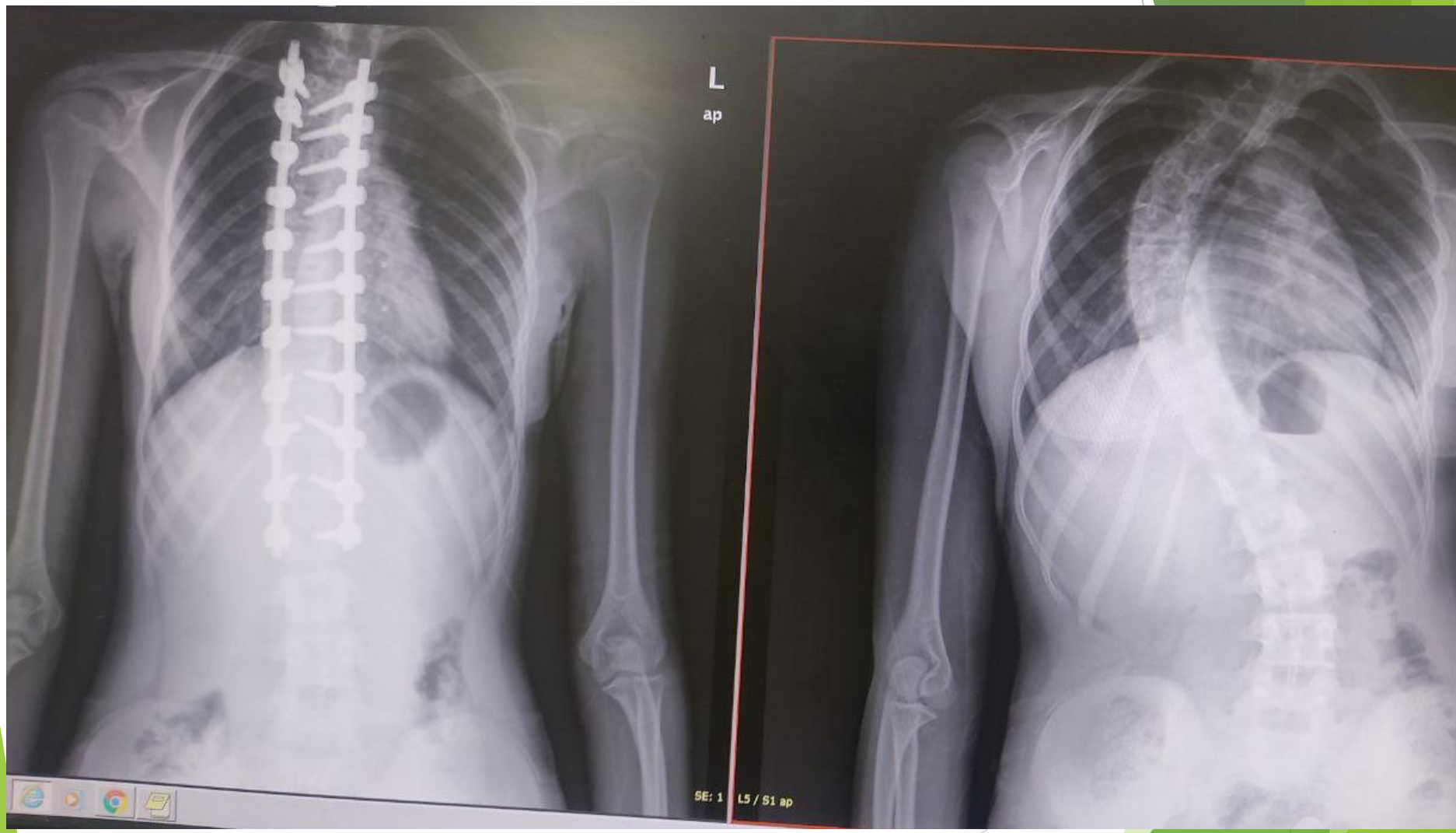


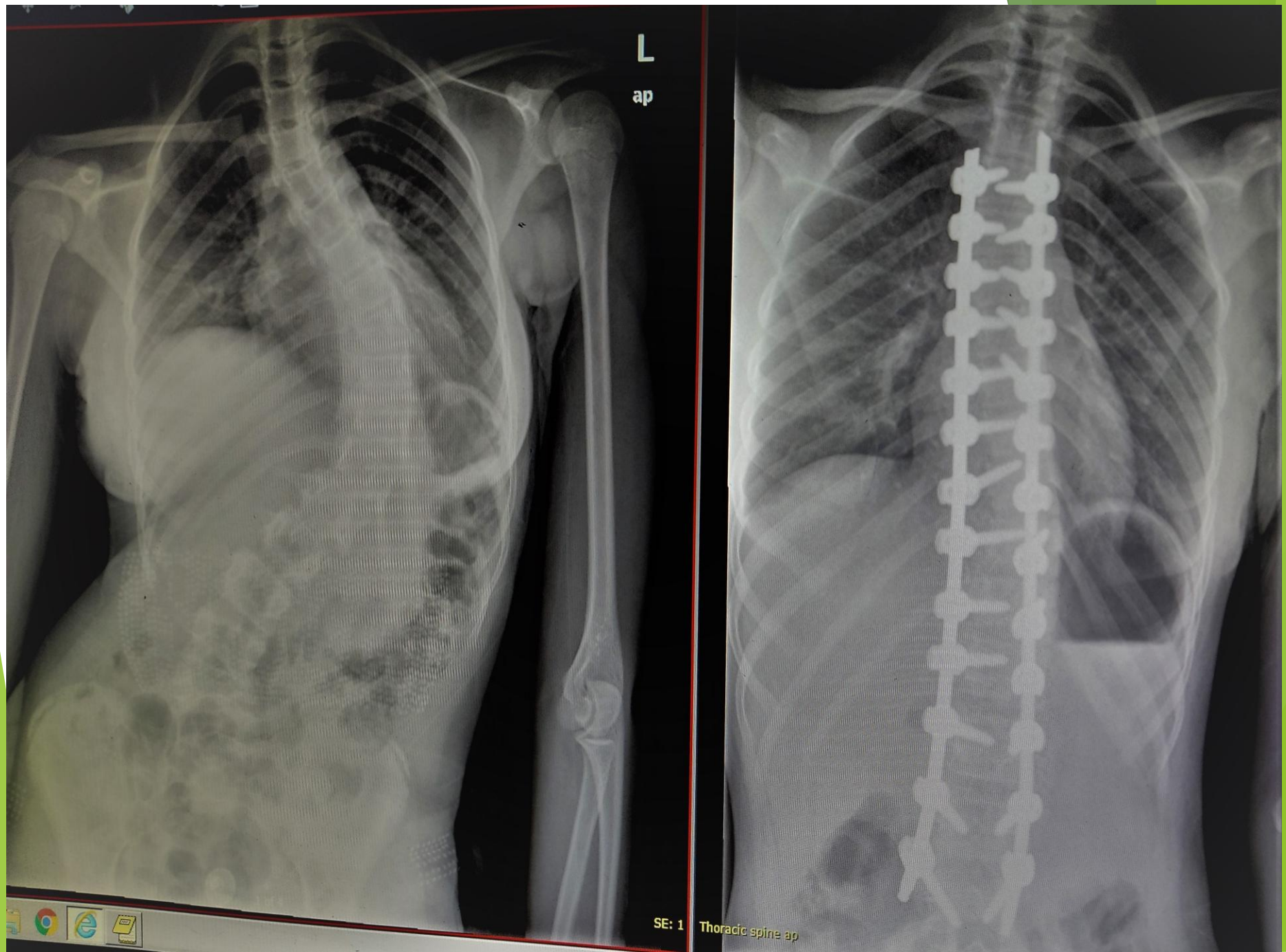

Name
Plan T4–L4
Date 17/8/2021
Other
Note T8, T9, T10 Ponti
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
L2
L3
L4
L5

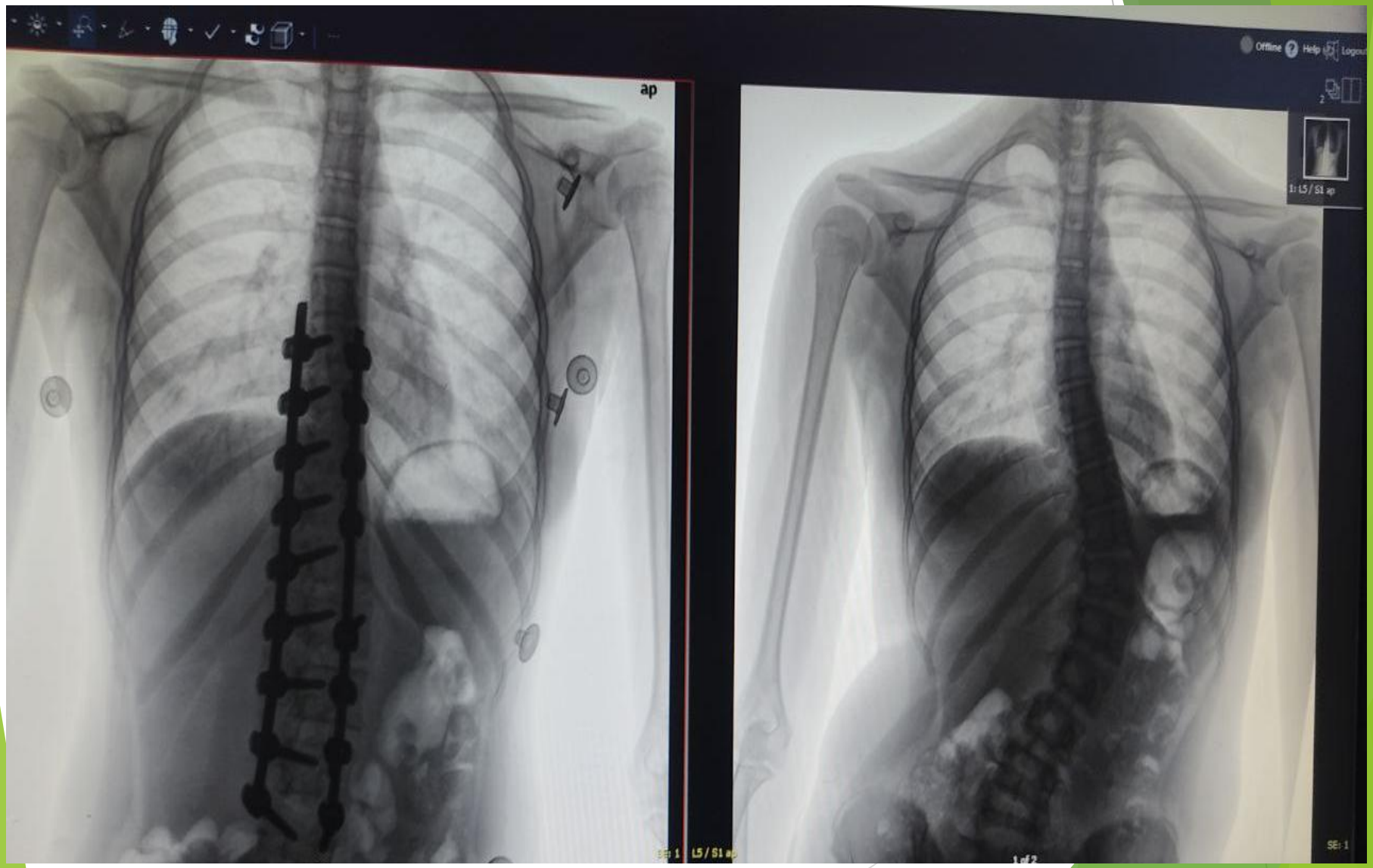

L
R
2000482809
plan: T4 — L4
Date: 11/09/2023
Narrow
R
L
T7
T12
L2
Long
L2
T2

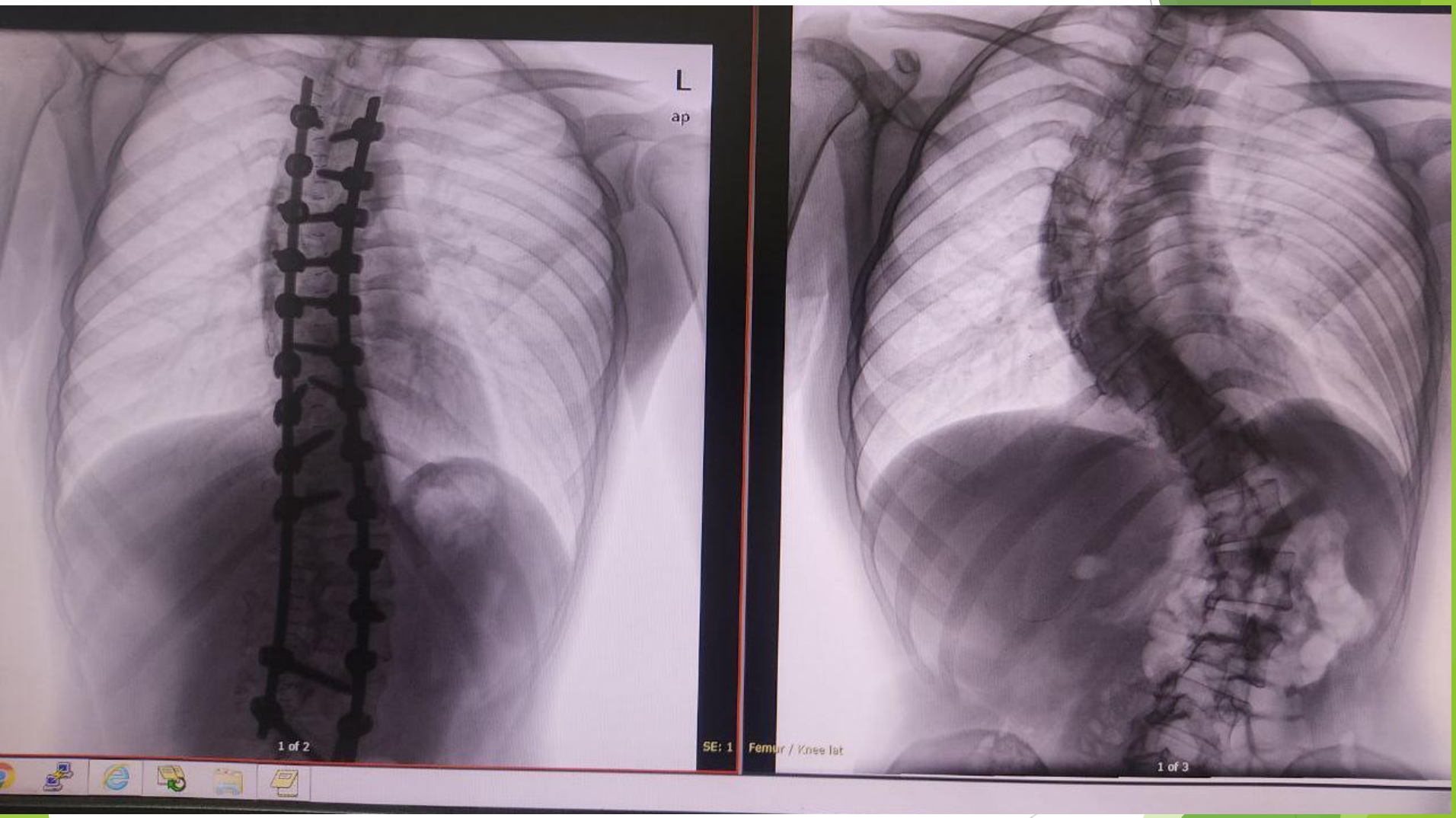

L
ap
1 of 2
L
ap
1 of 3

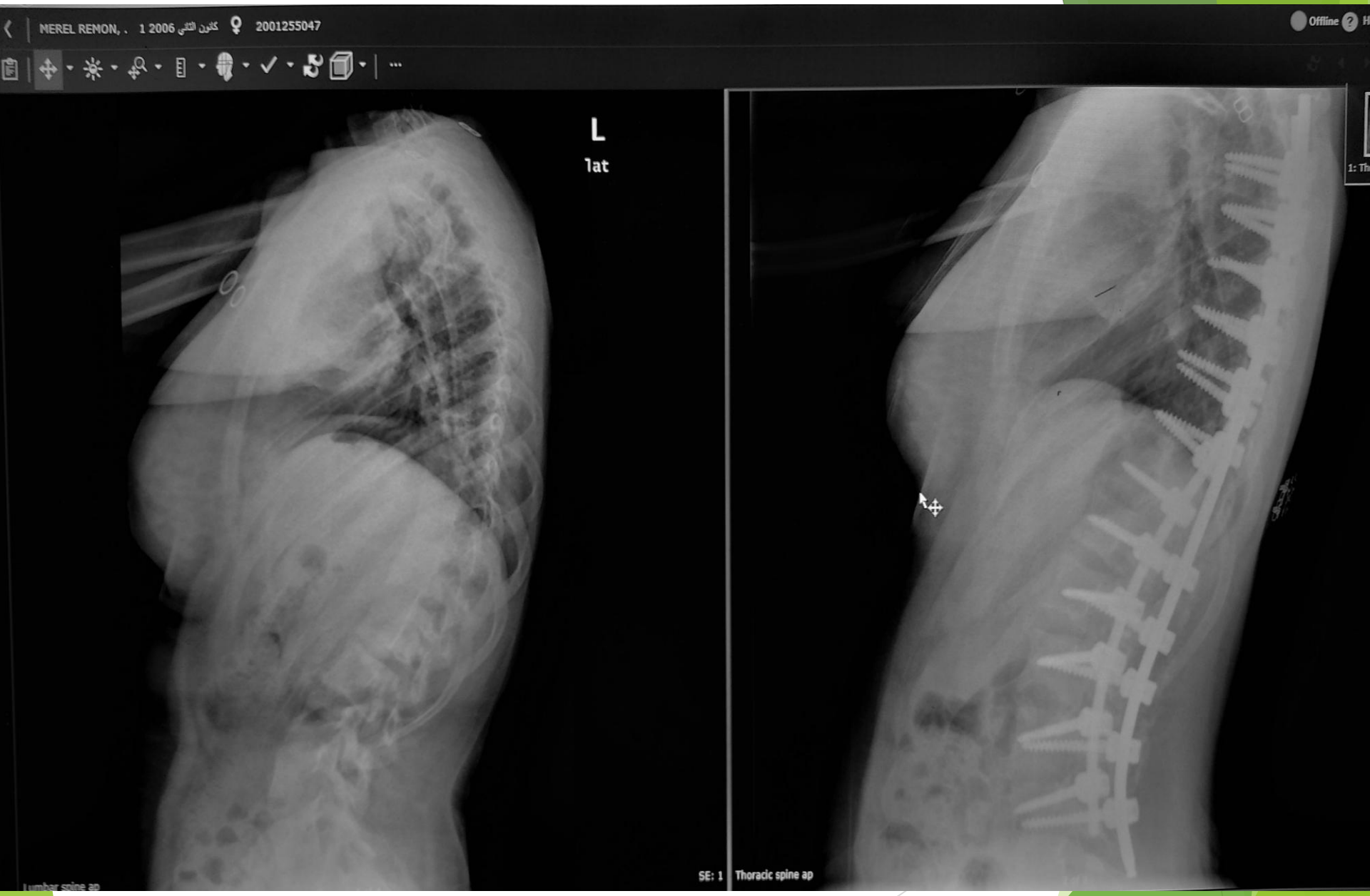

L
lat
2 of 2
SE: 1 L5 / S1 ap
3 of 3

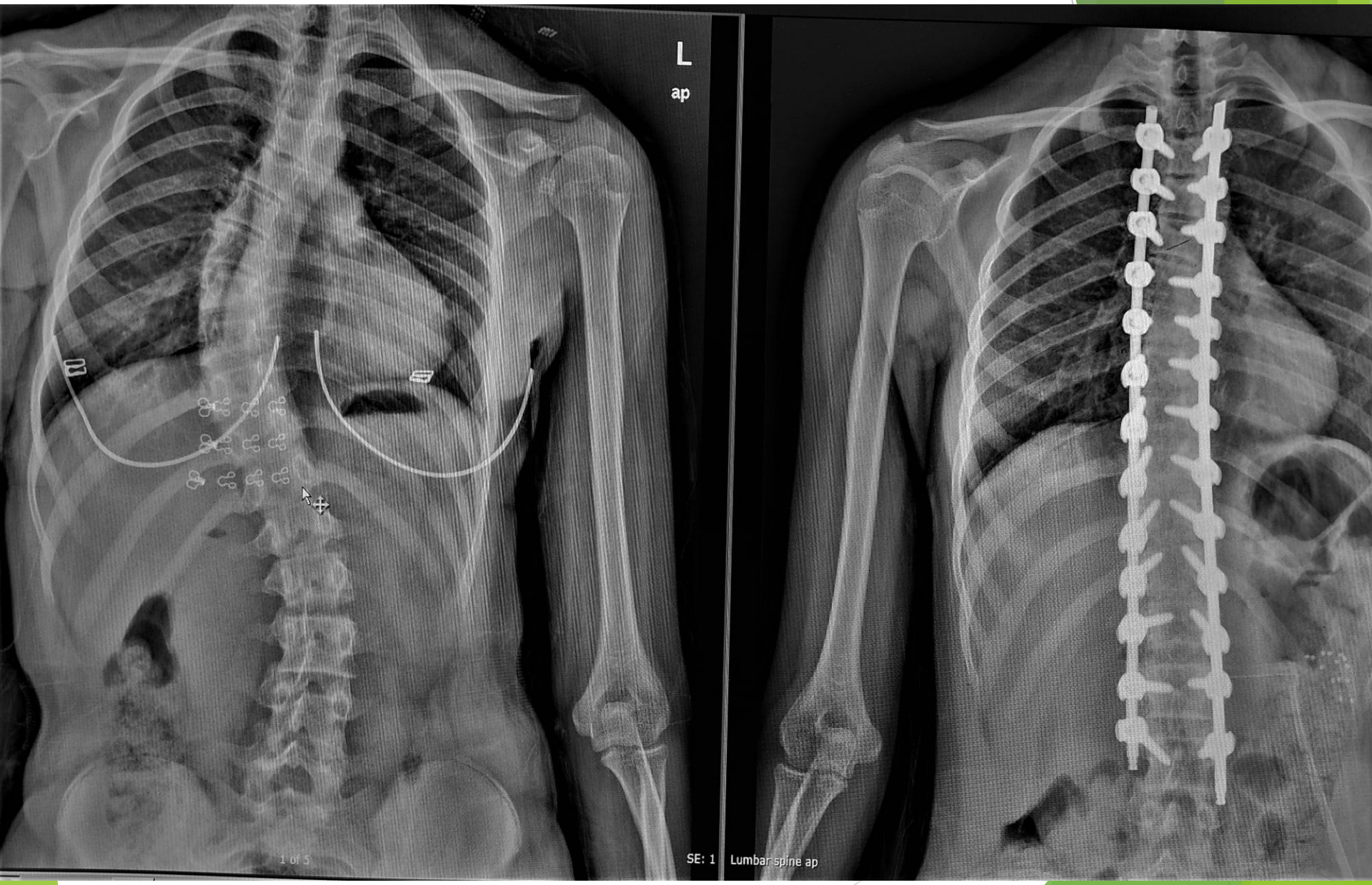

L
ap
SE: 1
L5 / S1 ap


L
ap
SE: 1
Thoracic spine ap


ap
Offline
Help
Logout
1: L5 / S1 ap
L5 / S1 ap
SE: 1

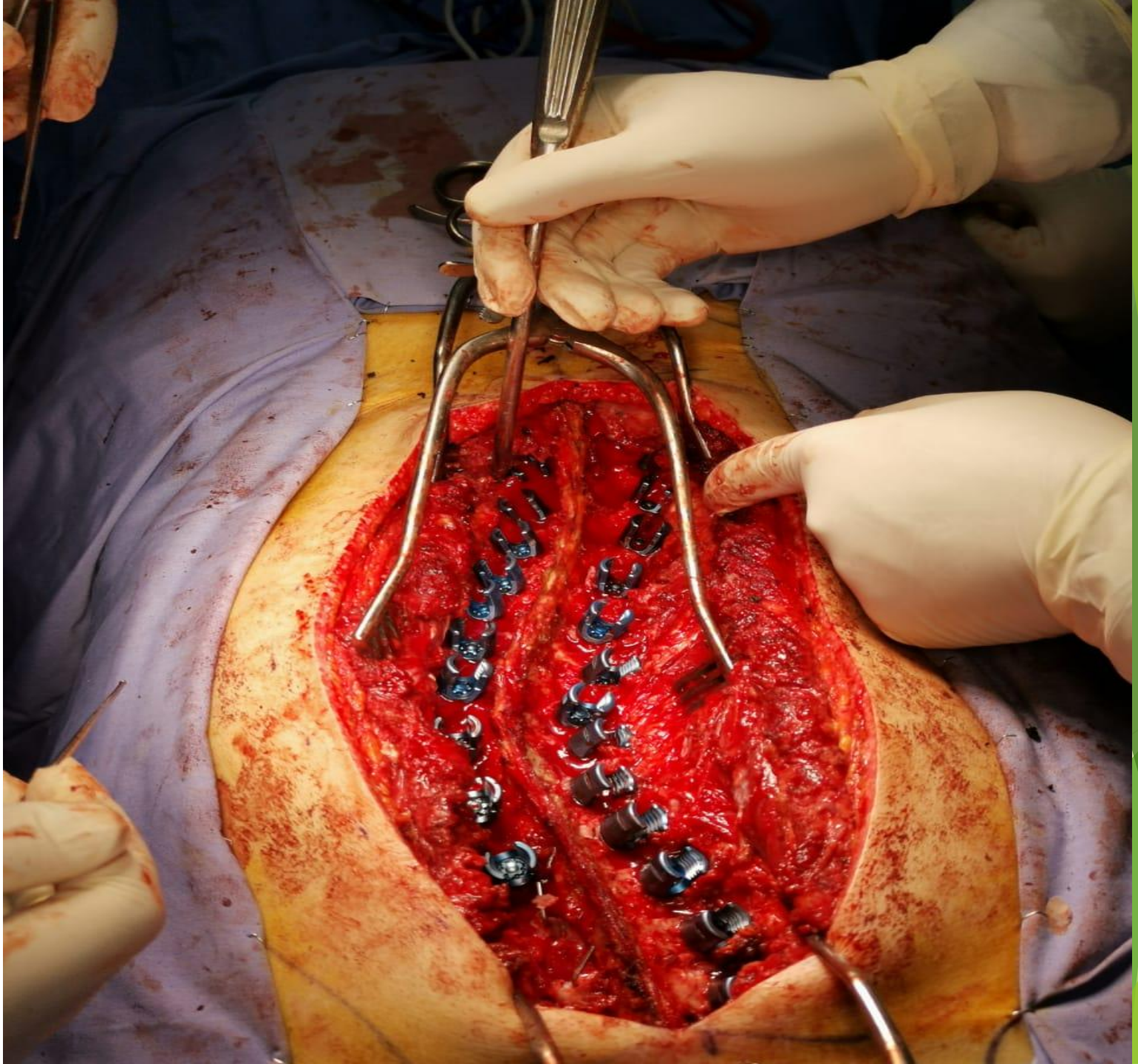

L
ap
1 of 2
SE: 1
Femur / Knee lat
1 of 3

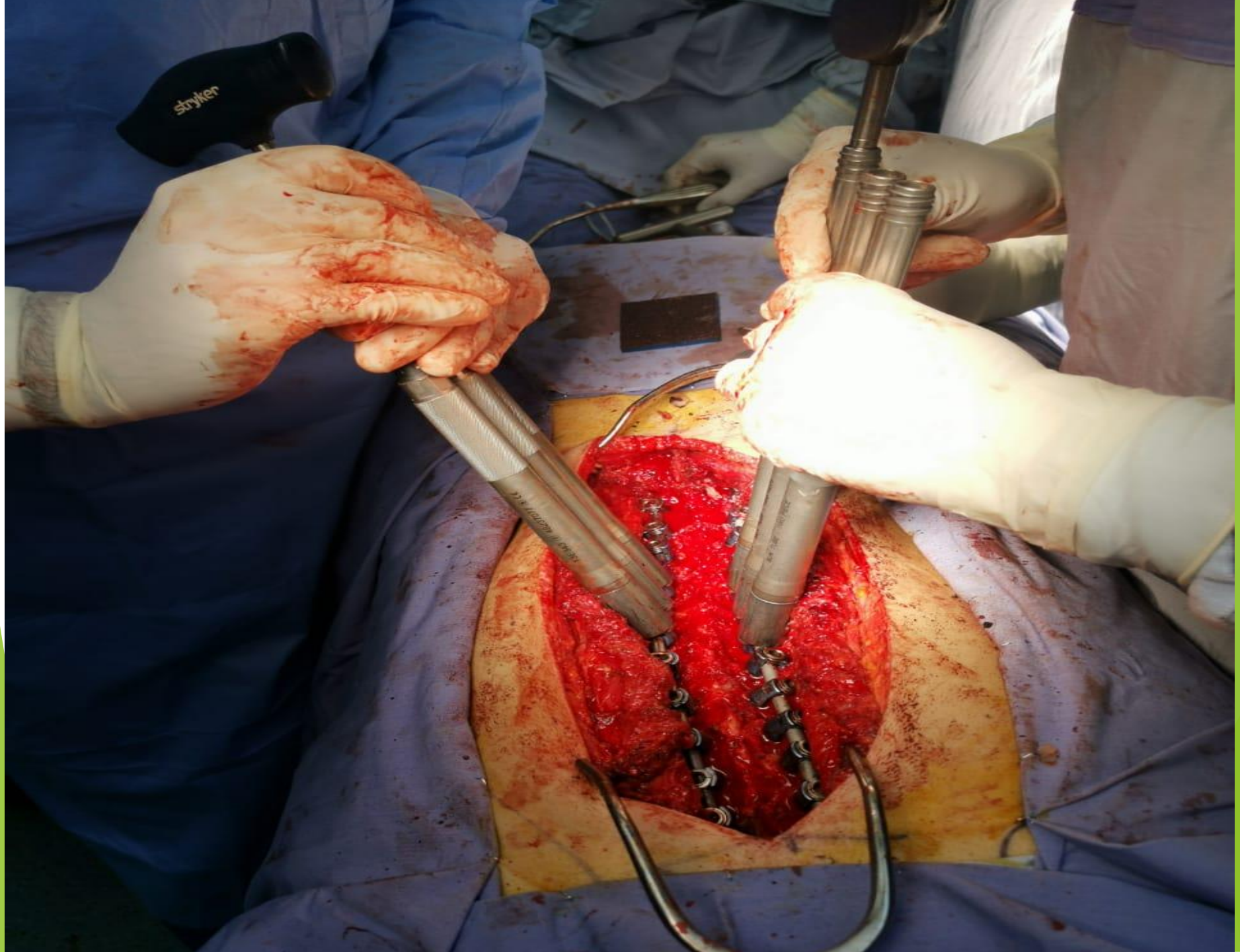

MEREL REMON, . 1 2006 كانون الثاني 2001255047
Offline
L
lat
SE: 1
Thoracic spine ap

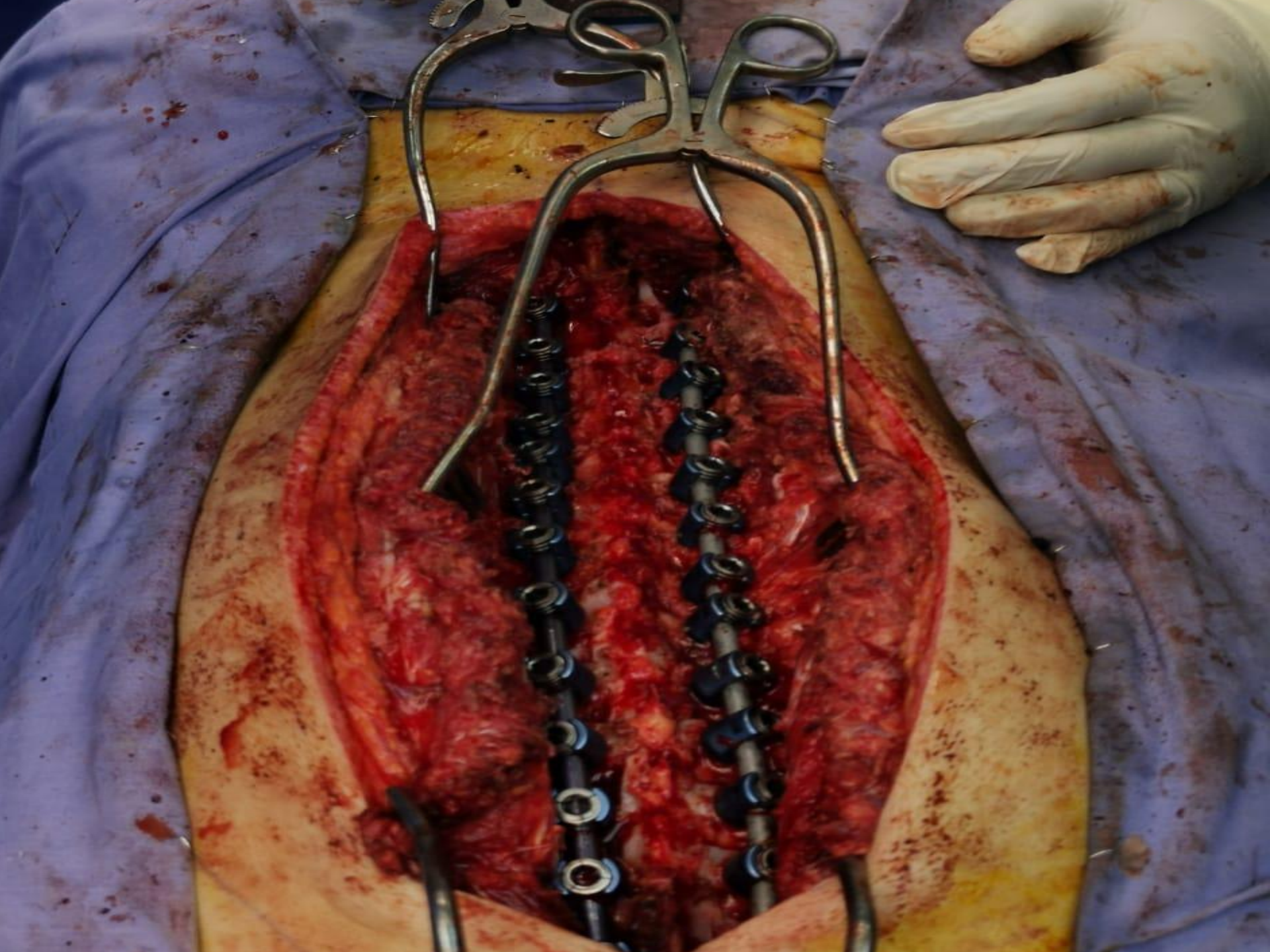

L
ap
1 of 5
SE: 1
Lumbar spine ap


L
1at
Lumbar spine ap
4 of 5
SE: 1


Lumbar spine ap
2 of 3




stryker



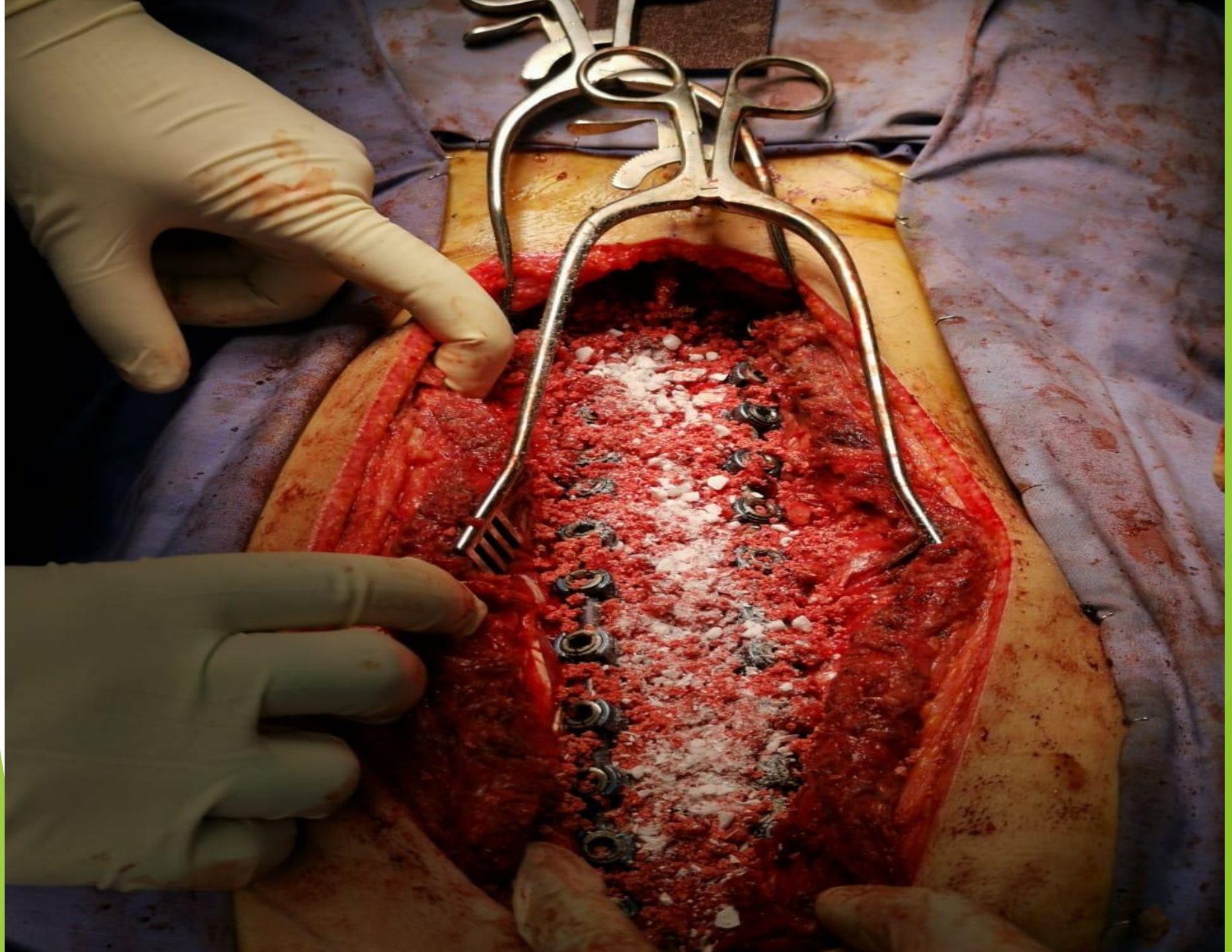





Fig. 3-D

Preoperative (left) and postoperative (right) clinical photographs of the deformity.


Thank you