# Surgical Technique for Expansion Thoracostomy (ET):

*- When - Where*

*- How Many - How Much*

*- Pleural Reconstruction* ?

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# Disclosures: John Emans

- *Consultant:*
  - Synthes
  - Medtronics
- *Research support:*
  - Synthes
  - Children's Orthopedic Surgical Foundation
- *Royalties:*
  - Synthes - VEPTR II

# *When* to use Expansion Thoracostomy:

- When *chest wall* is part of the primary problem/deformity
  - *Congenital rib fusion*
    - Jarcho-Levin – Spondylocostal, spondylothoracic
  - *Thoracogenic deformity*– TEF, esophageal atresia with multiple thoracotomies, tumors
- Severe windswept and parasol deformity
  - Minimal experience

# *Where* to use Expansion Thoracostomy

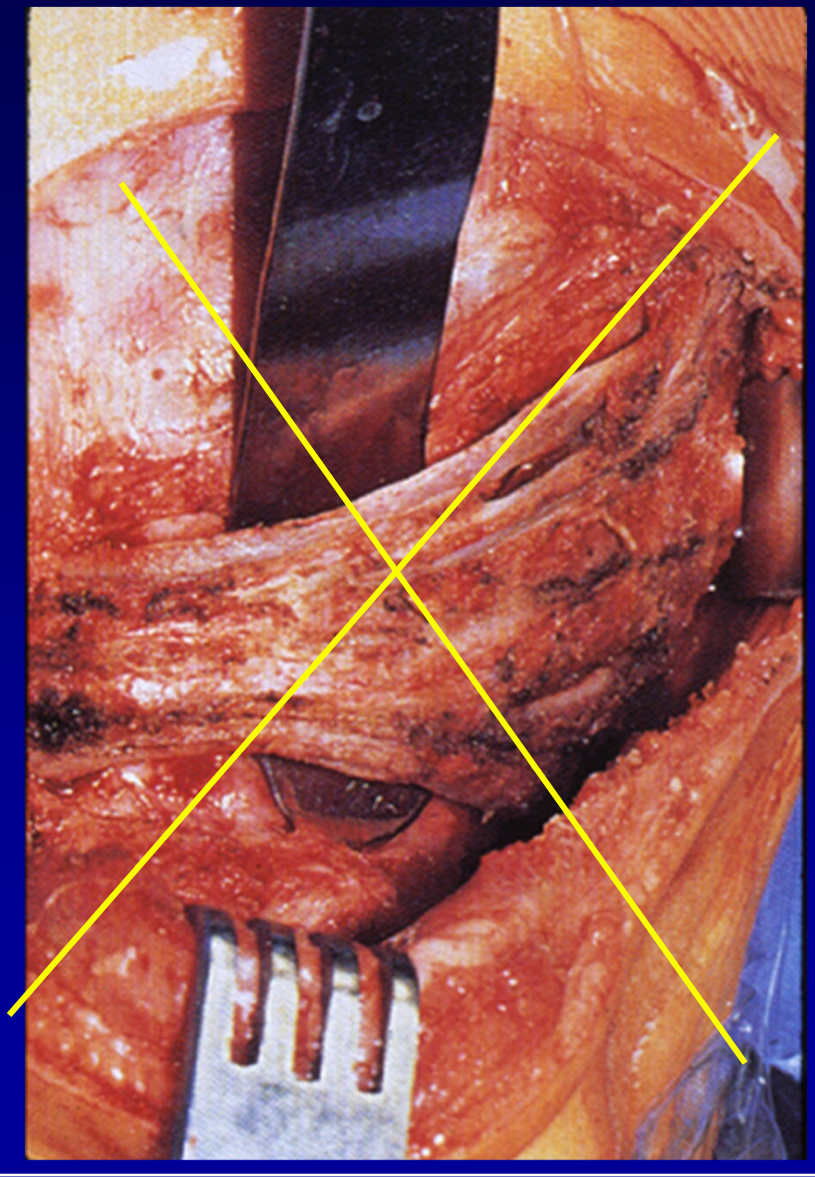
- 1 - Areas of *thoracic constriction*
  - How to tell?
  - Clinical assessment
    - Visual exam
    - Thumb excursion
  - 3-D CT
- 2 - Concavity of *spine deformity*
- *3 - Open disc spaces* in congenital deformity

# *How Many* Expansion Thoracostomies?

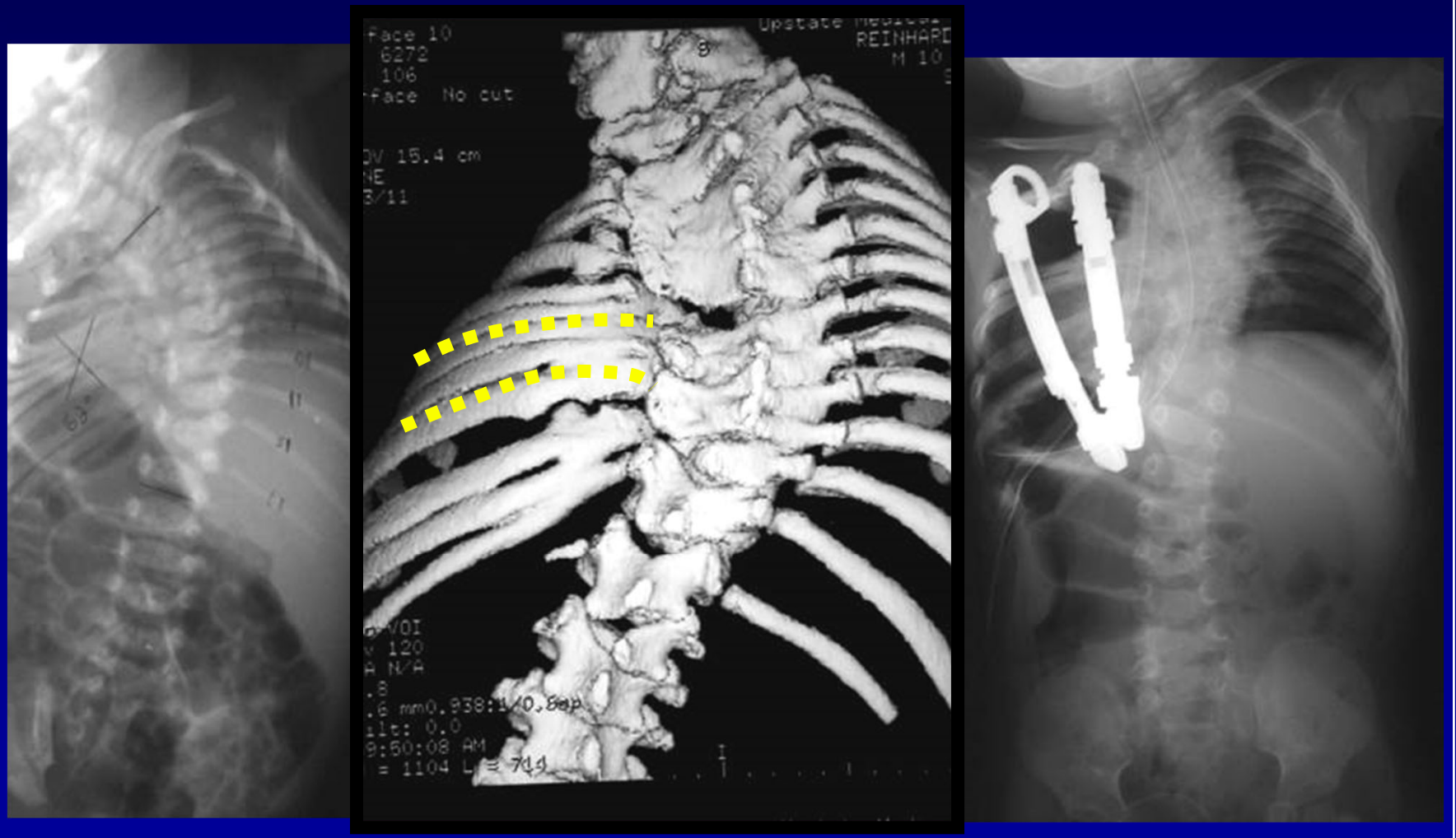
- Define by scope of constriction, fusion, scarring
  - *One ET*?
    - Problem: all the expansion is localized
  - *Many ETs*?
    - Problem: expansion may be mal-distributed
  - *All ribs*?
    - Separated ribs may be non-viable
  - Typical congenital rib fusions – two thoracostomies employed

# How many thoracostomies?

- Goal:
  - Viable ribs
  - Avoid too many, too close
  - Avoid devascularization of ribs

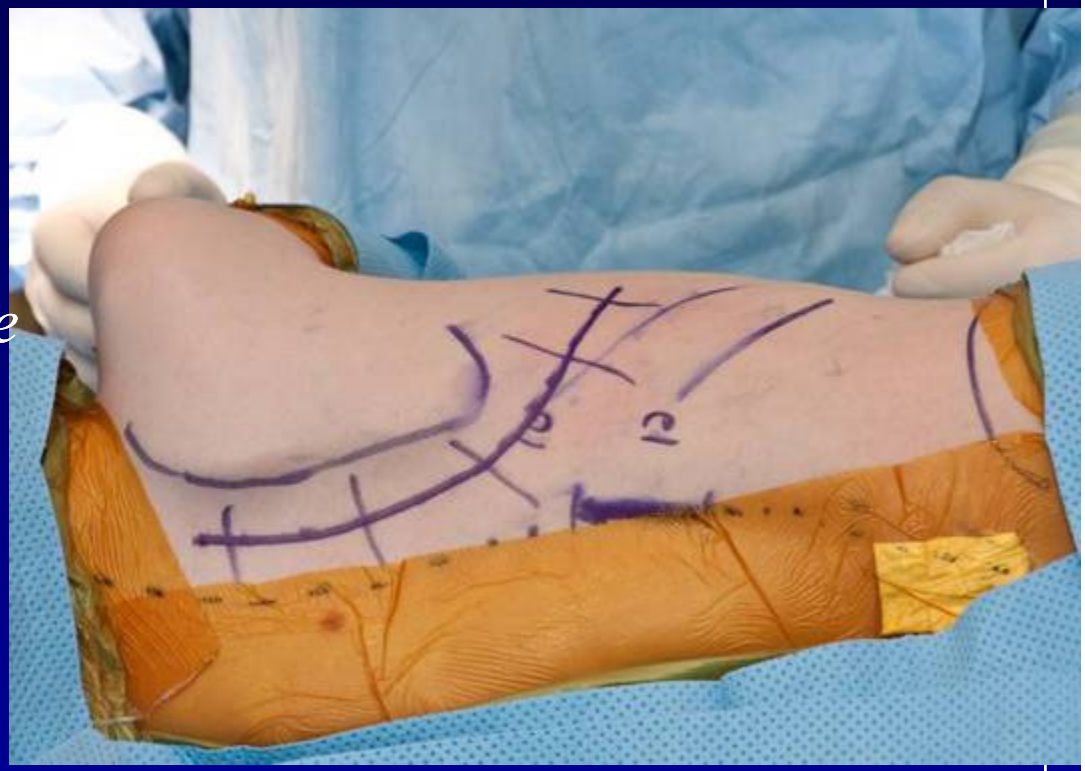


# Expansion thoracostomy at age 13 mos



# *How* to perform expansion thoracostomy?

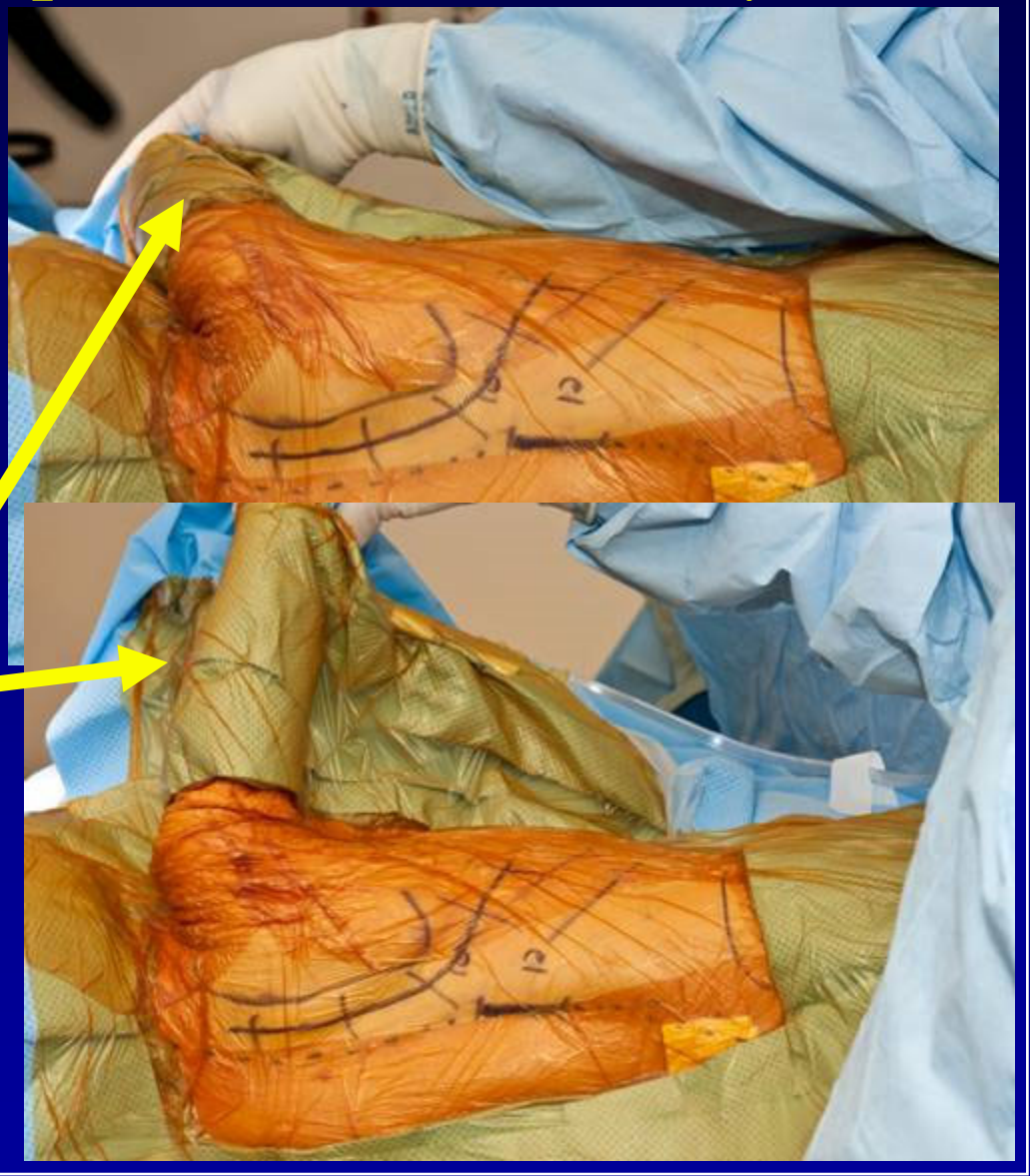
- Surgical approach
  - *Incision* planning
    - Relative to *muscles*
    - Relative to final *spine fusion* incision
    - Relative to *ET's*
    - Relative to *devices*
      - *Access*
      - *Prominence*
  - *Goal is healthy musculocutaneous flap*



JBE2

# *How* to perform expansion thoracostomy?

- *Patient positioning*
  - Lateral best
    - Access to ribs
    - View of chest shape
  - *Arm moveable*
  - Lateral position makes lumbar hook insertion awkward



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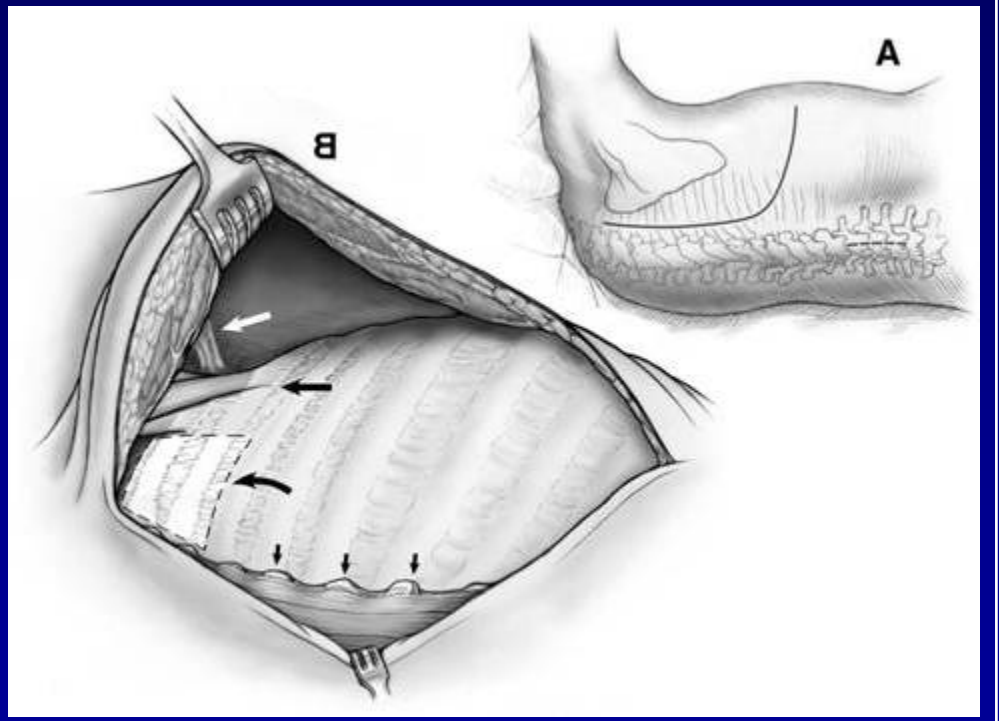
**JBE2** John Emans, 10/7/2010

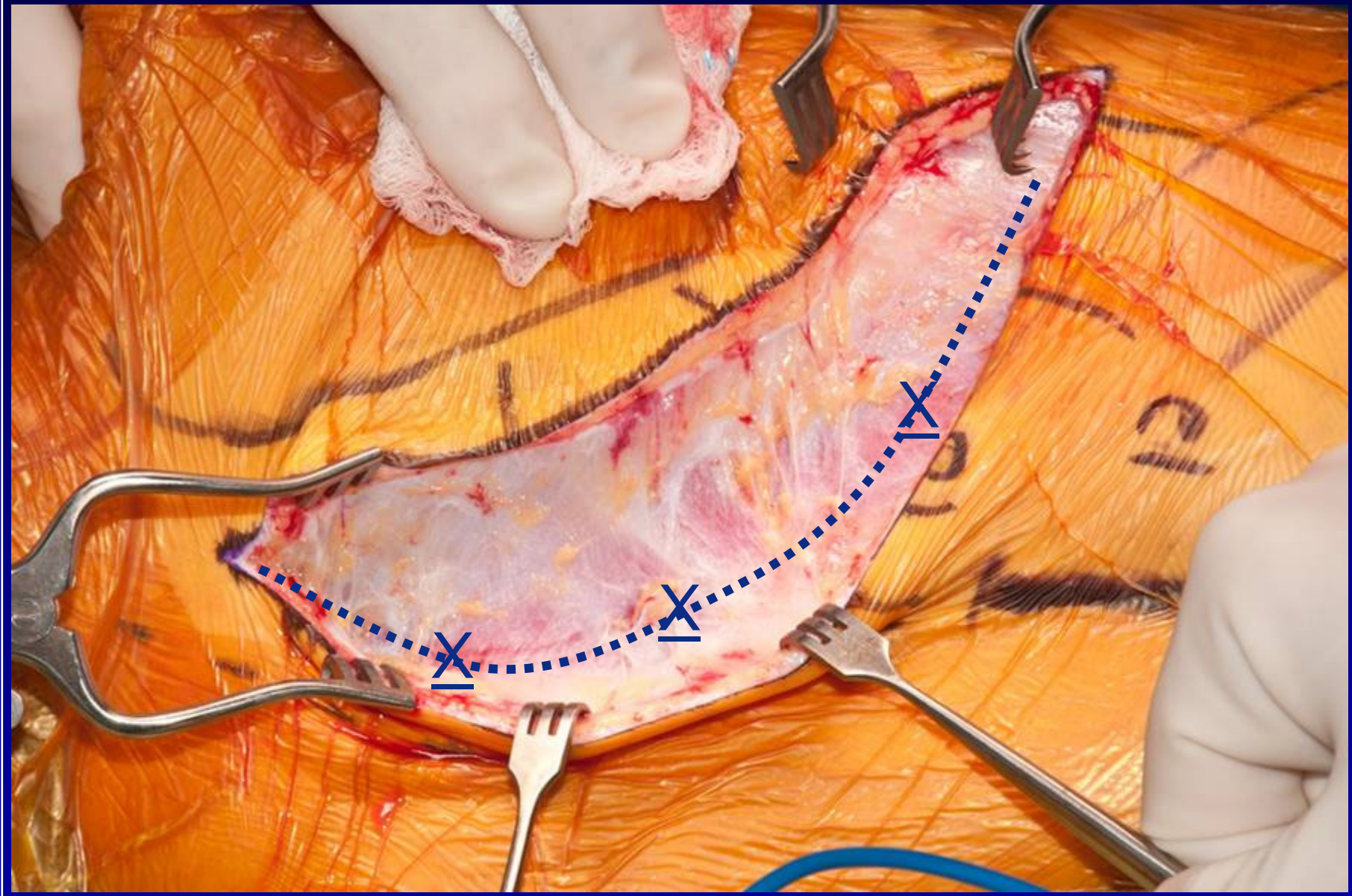
# *How* to perform expansion thoracostomy?

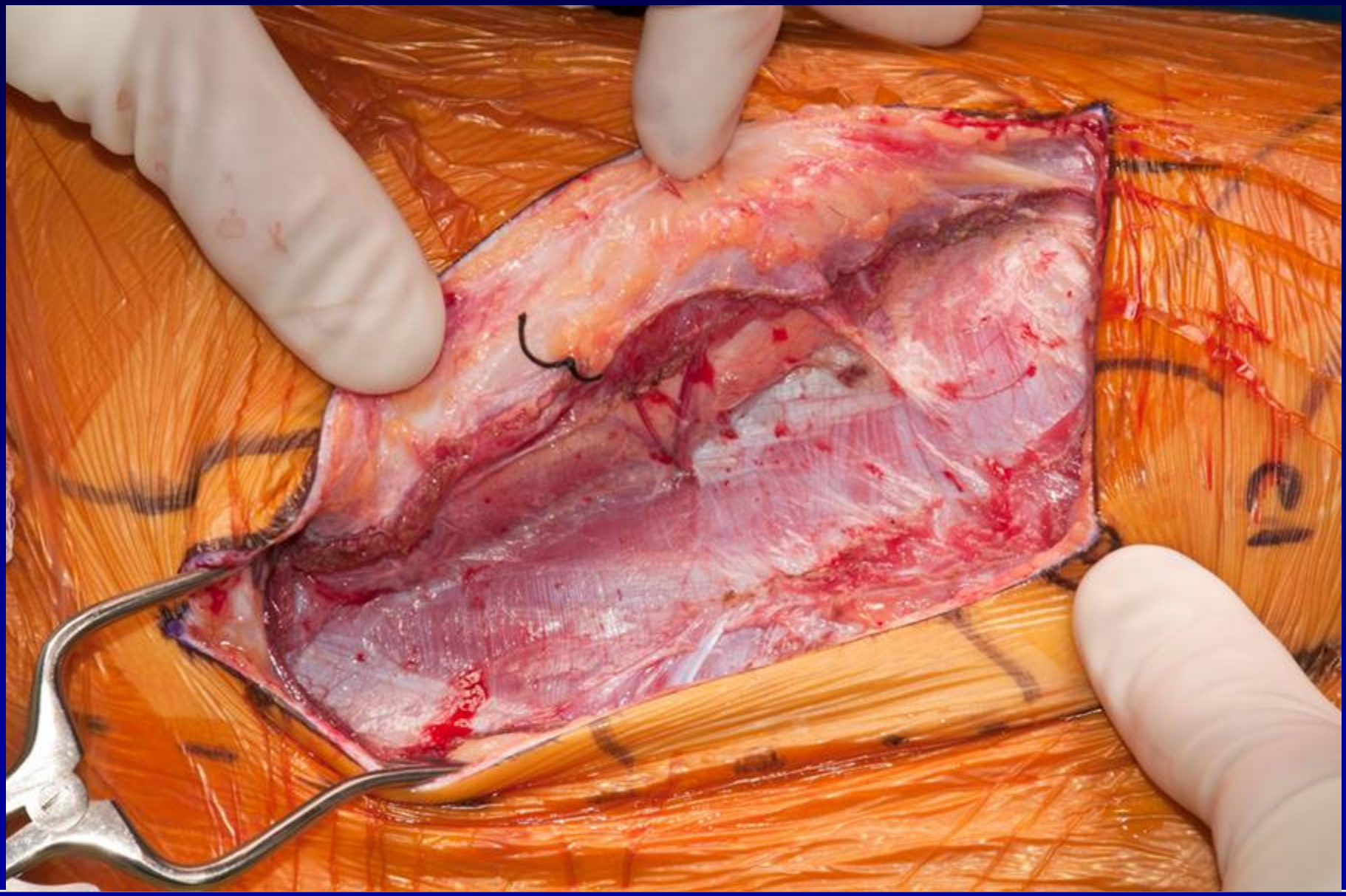
- Surgical approach *well described in Campbell JBJS technique articles*
  - *Incision* planning
    - Relative to *muscles*
    - Relative to final *spine fusion* incision
    - Relative to *ET's*
    - Relative to *devices*
      - *Access*
      - *Prominence*



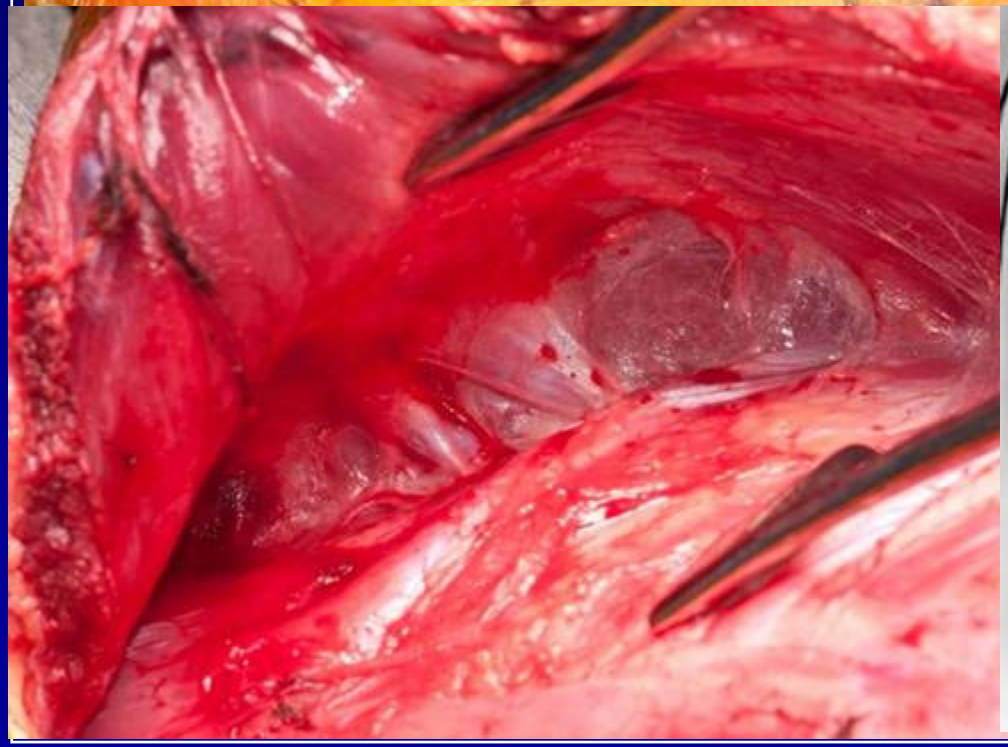
# *Creation of skin flaps critical to soft tissue coverage, ?complications?*

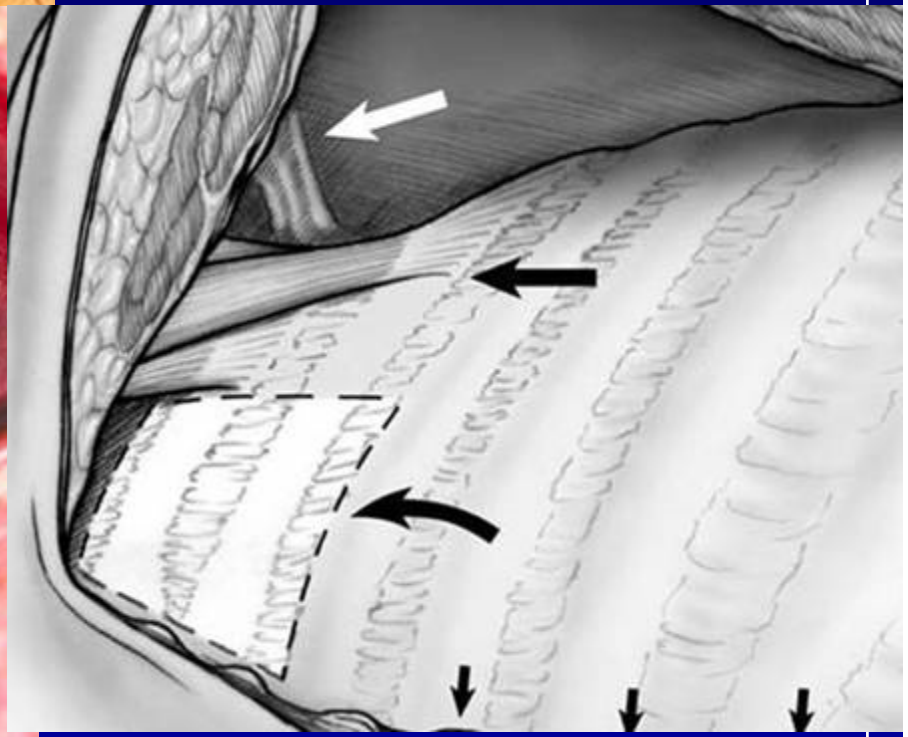
- Exposure:
- Preservation of maximum soft tissue envelope
- Full thickness elevation:
  - Skin
  - All muscles, scapula
- Medial elevation of paraspinals





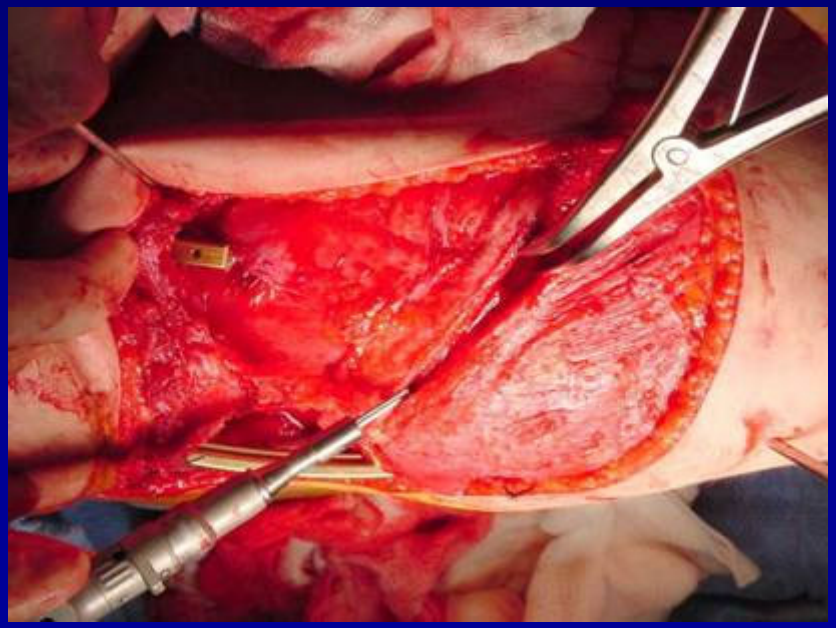
Palpate first rib and visualize scalenes



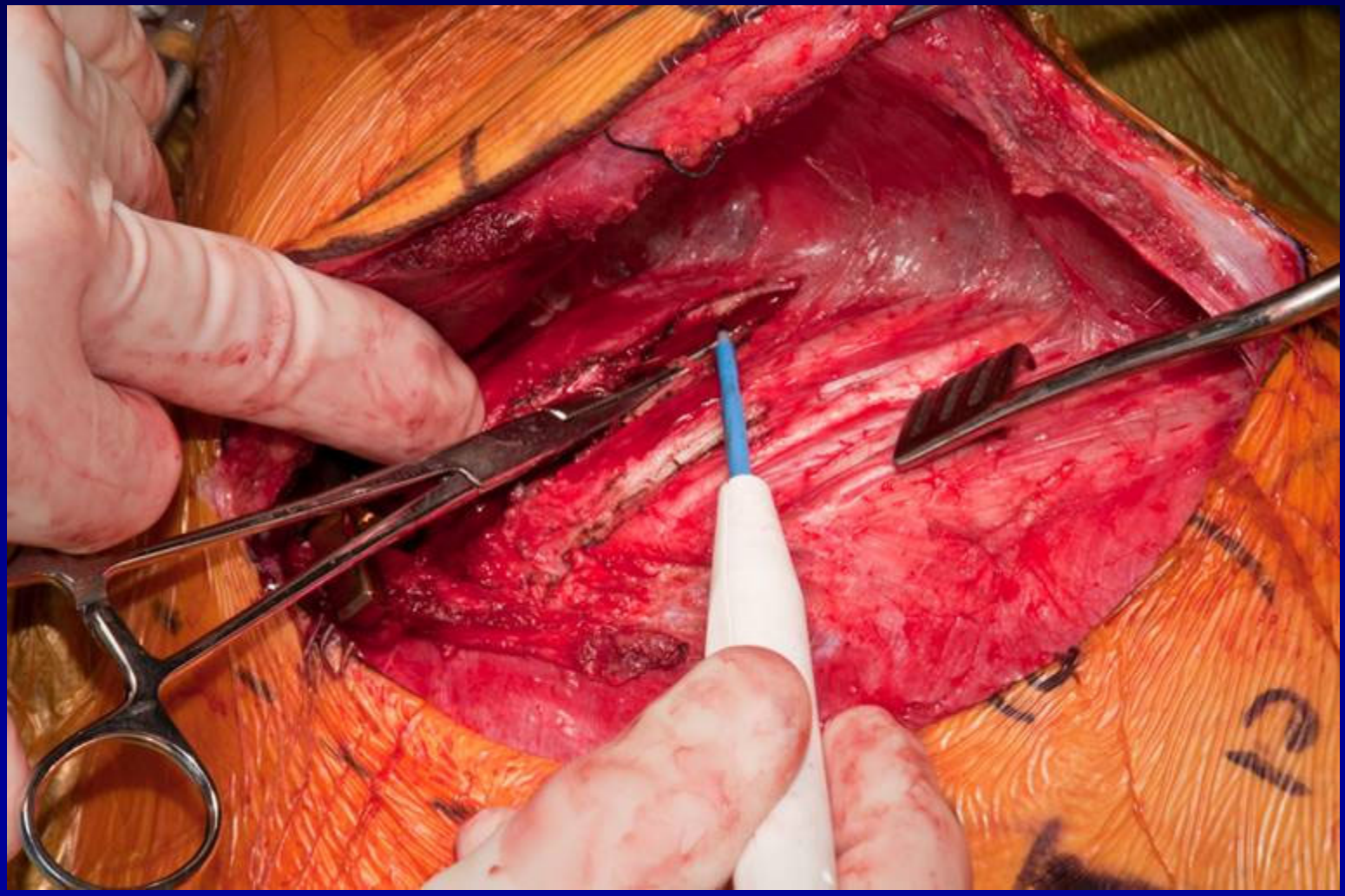


# *How* to perform expansion thoracostomy?

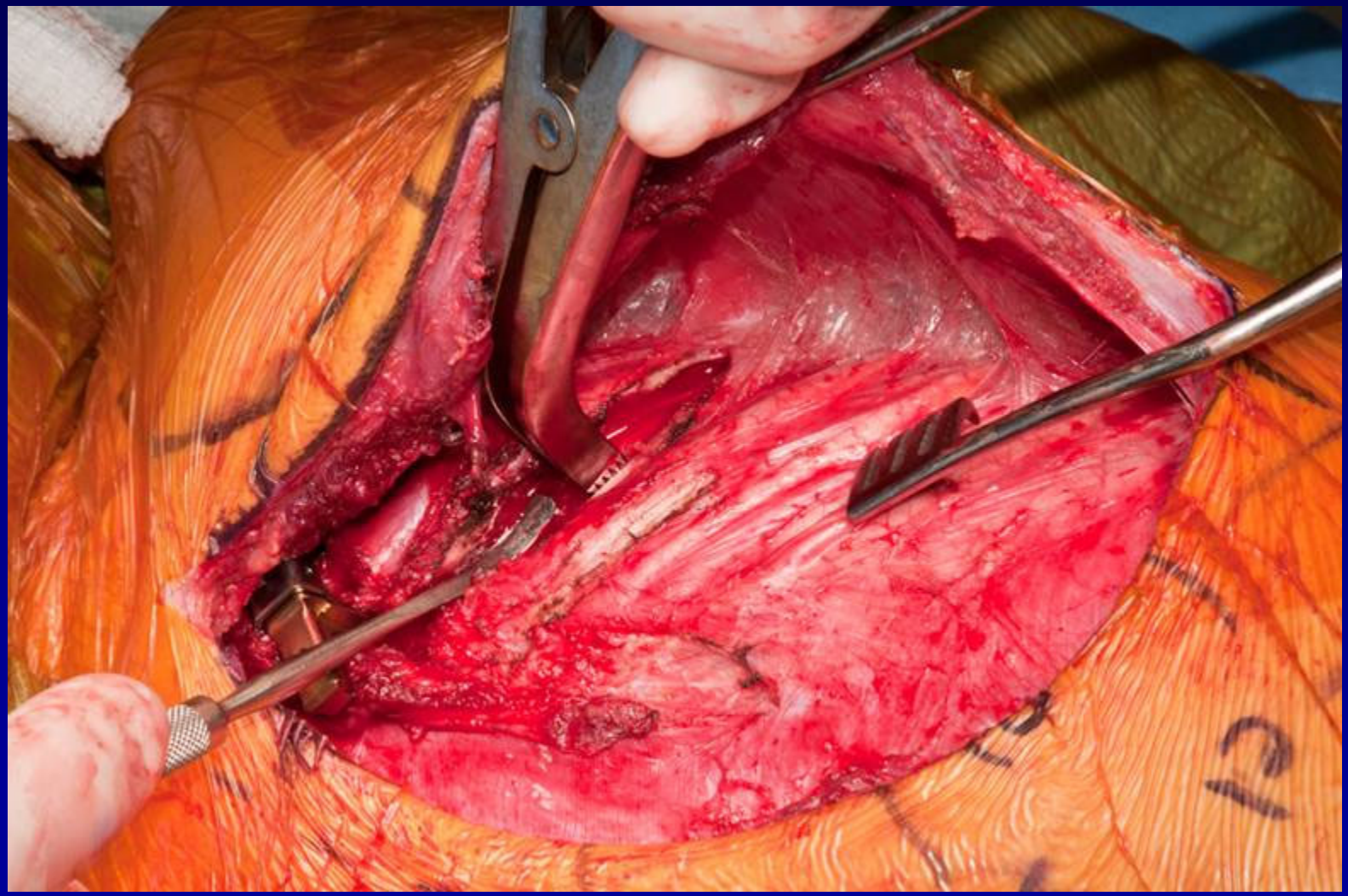
- How to separate fused ribs?
  - Many not completely fused
  - Bone cutter
  - Kerrison
  - Craniotome
  - Goal:
    - *retain viability of ribs*
    - *Safety*
    - *Complete separation*



# Separation with protective curved snap or Penfield and bovie

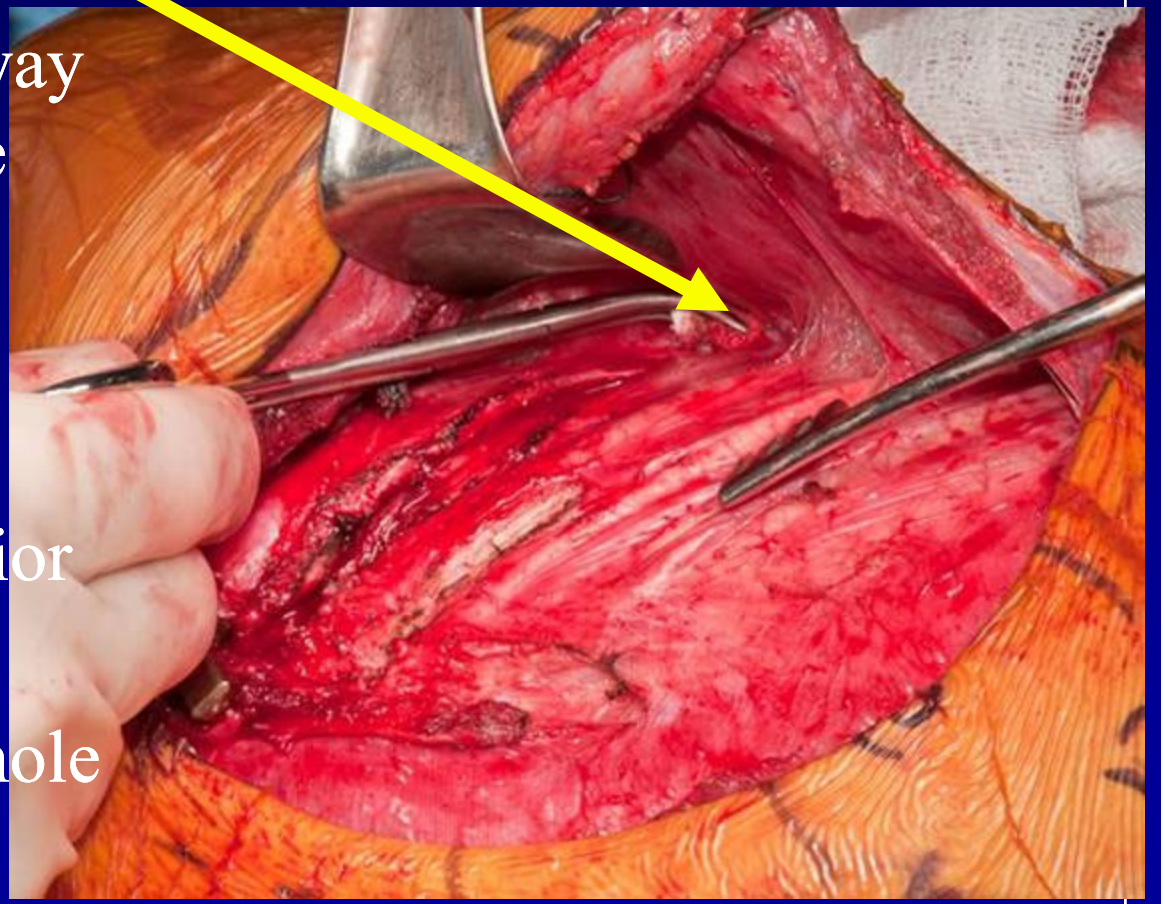


# Distraction with lamina spreader



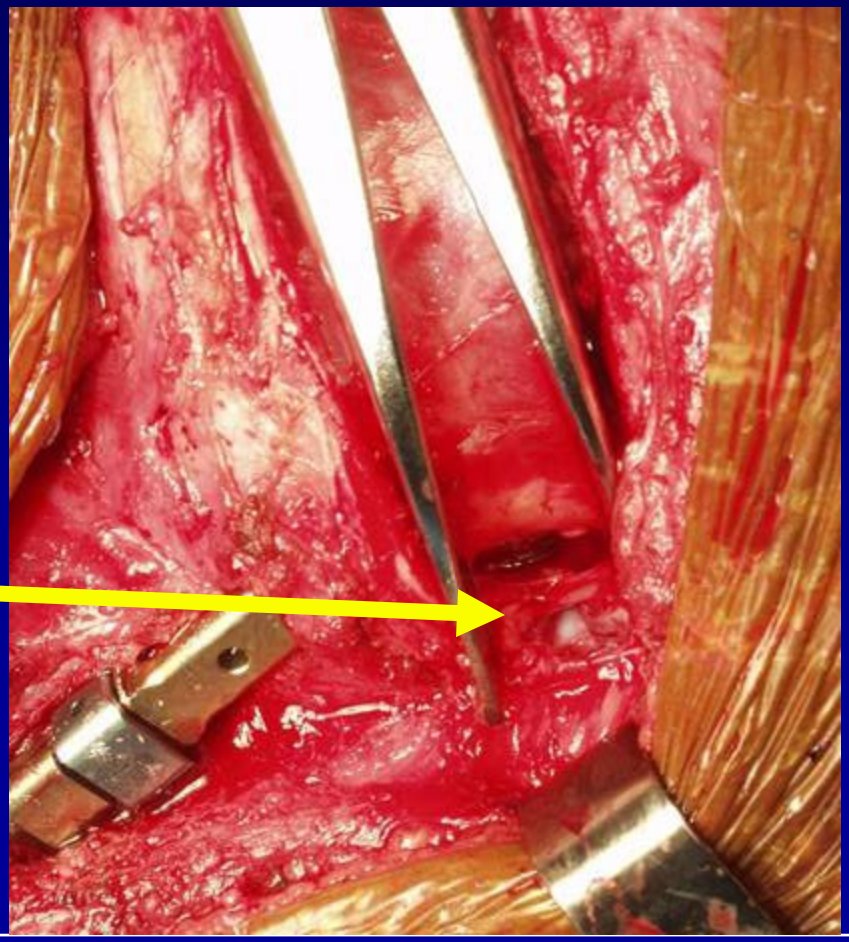
# *How Much* of rib interspace to release?

- *Anterior limits*?
  - Rib fusions rarely continue all the way to costal cartilage
  - If too forceful, dislocate anterior costal cartilage
  - Inadvertent anterior rib deformity
  - Helpful to see whole chest wall



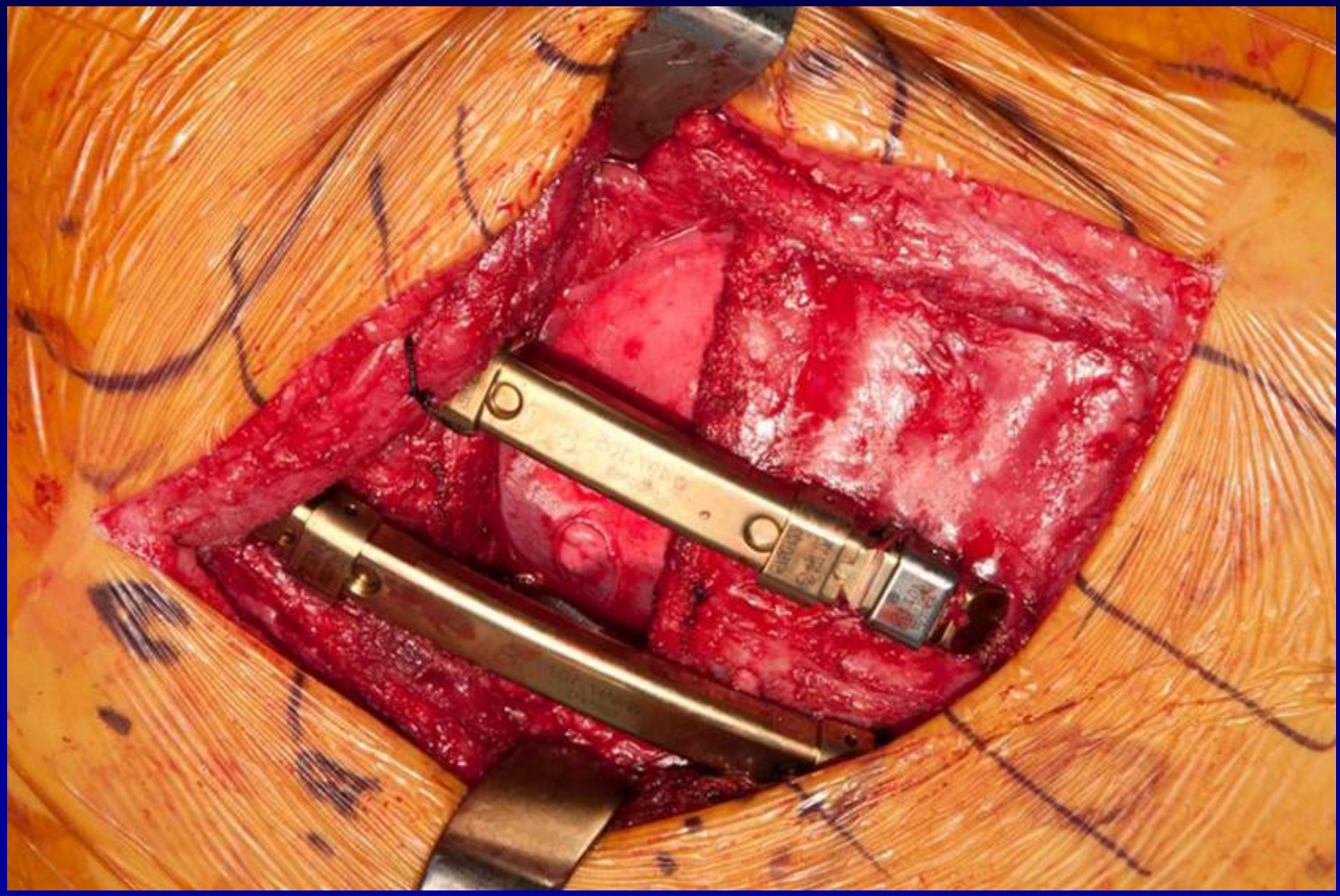
# *How Much* of rib interspace to release?

- *Medial, posterior limits*:
  - If not enough, effect of thoracostomy not transmitted to spine
  - Dissect to *rib heads*.
  - Visualize *disc*
  - Resect rib head or medial rib fusion

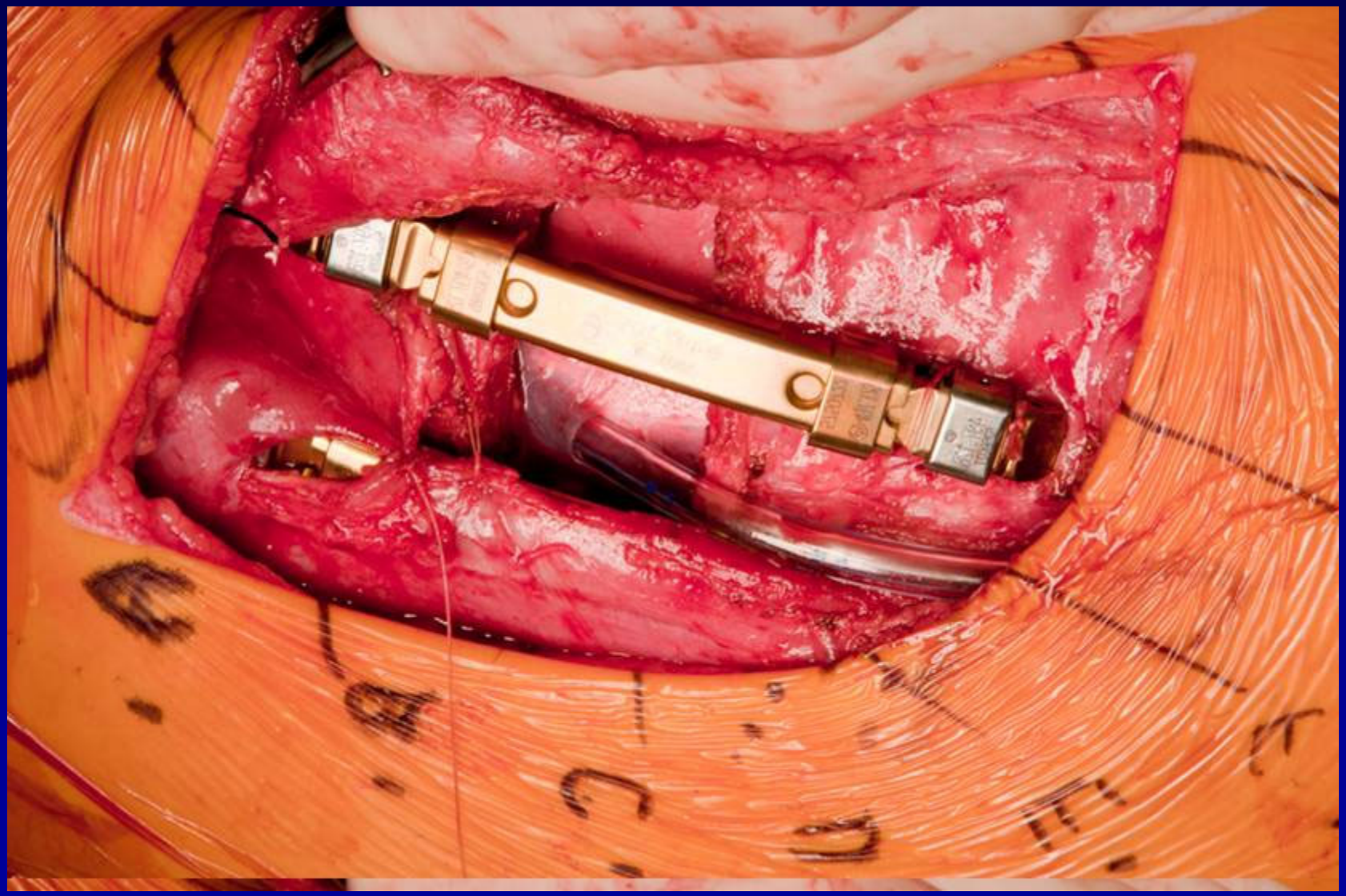


# Spread further with modified Cloward retractors

# Preserve pleura if possible

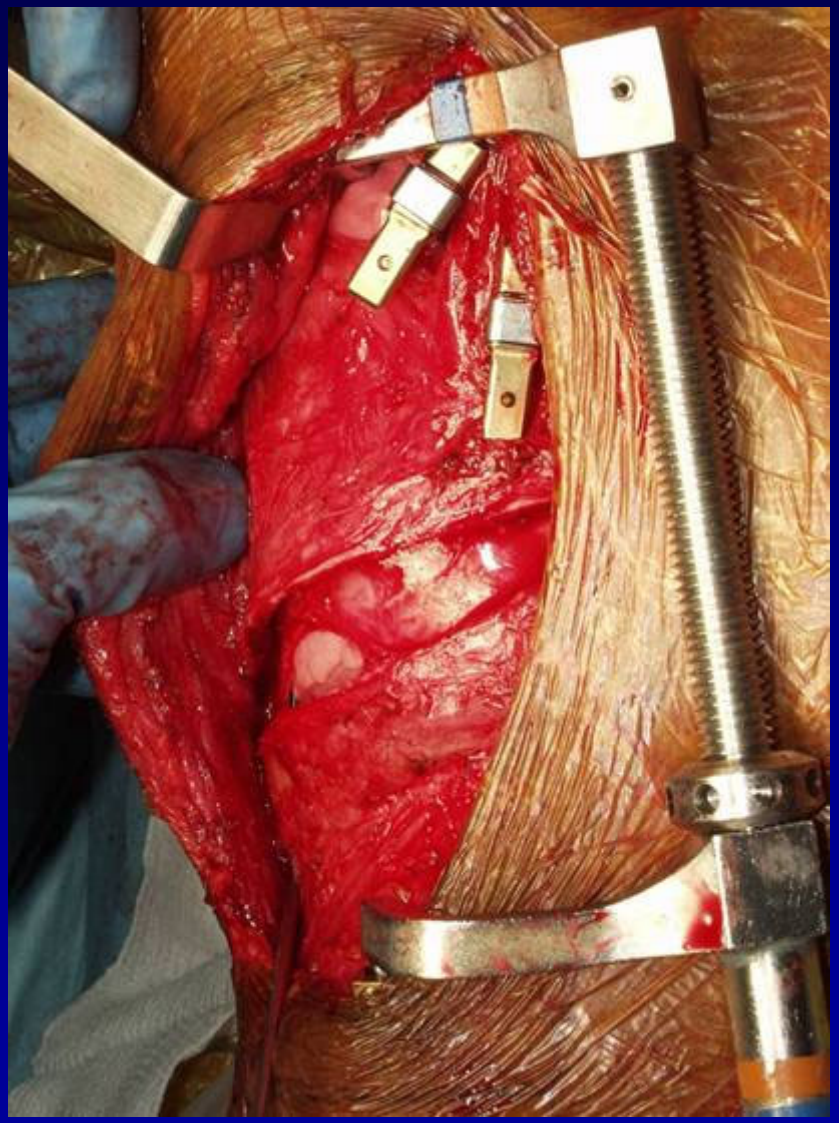


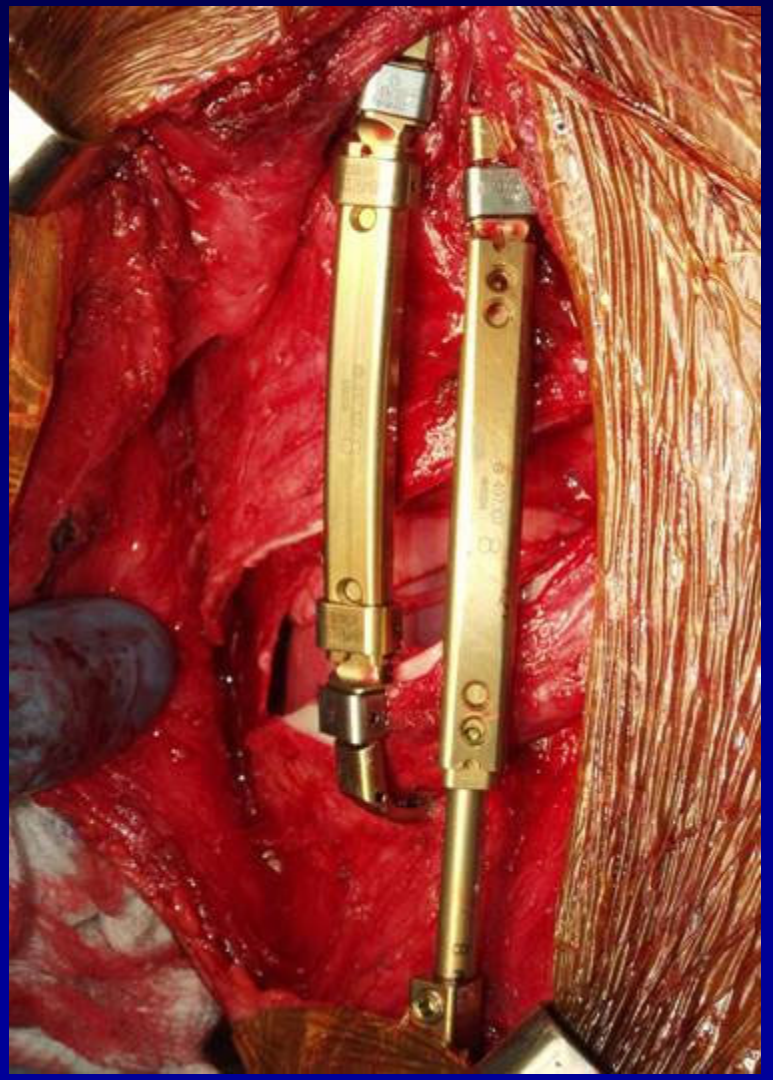
# Properly elevated paraspinals will cover medial device



# Expansion, preserve pleura if possible:

# Also can expand with Harrington outrigger or similar

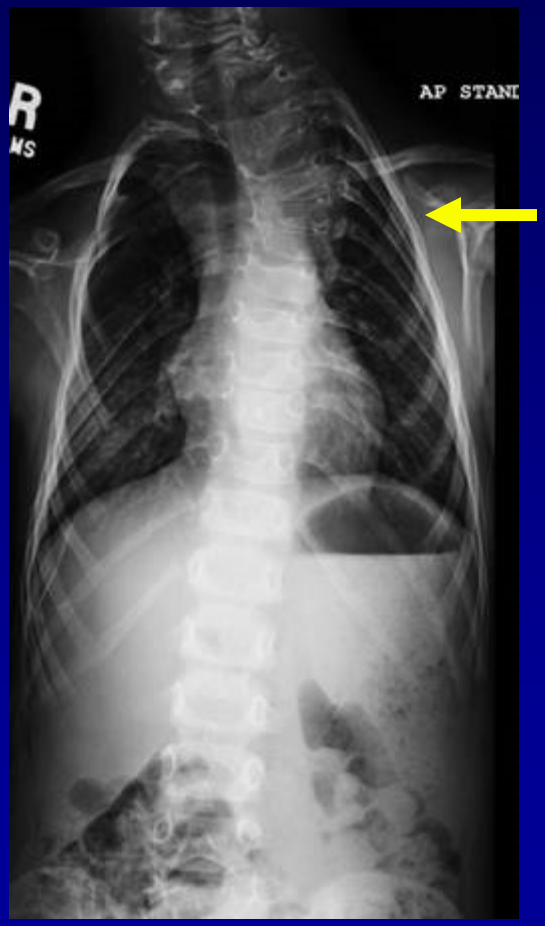


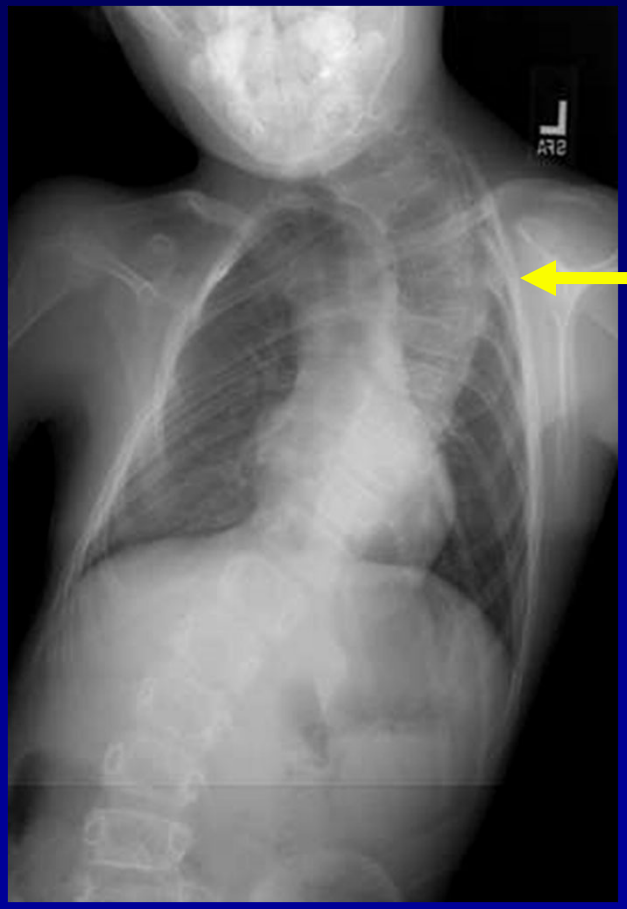


# Intraoperative change with thoracostomy

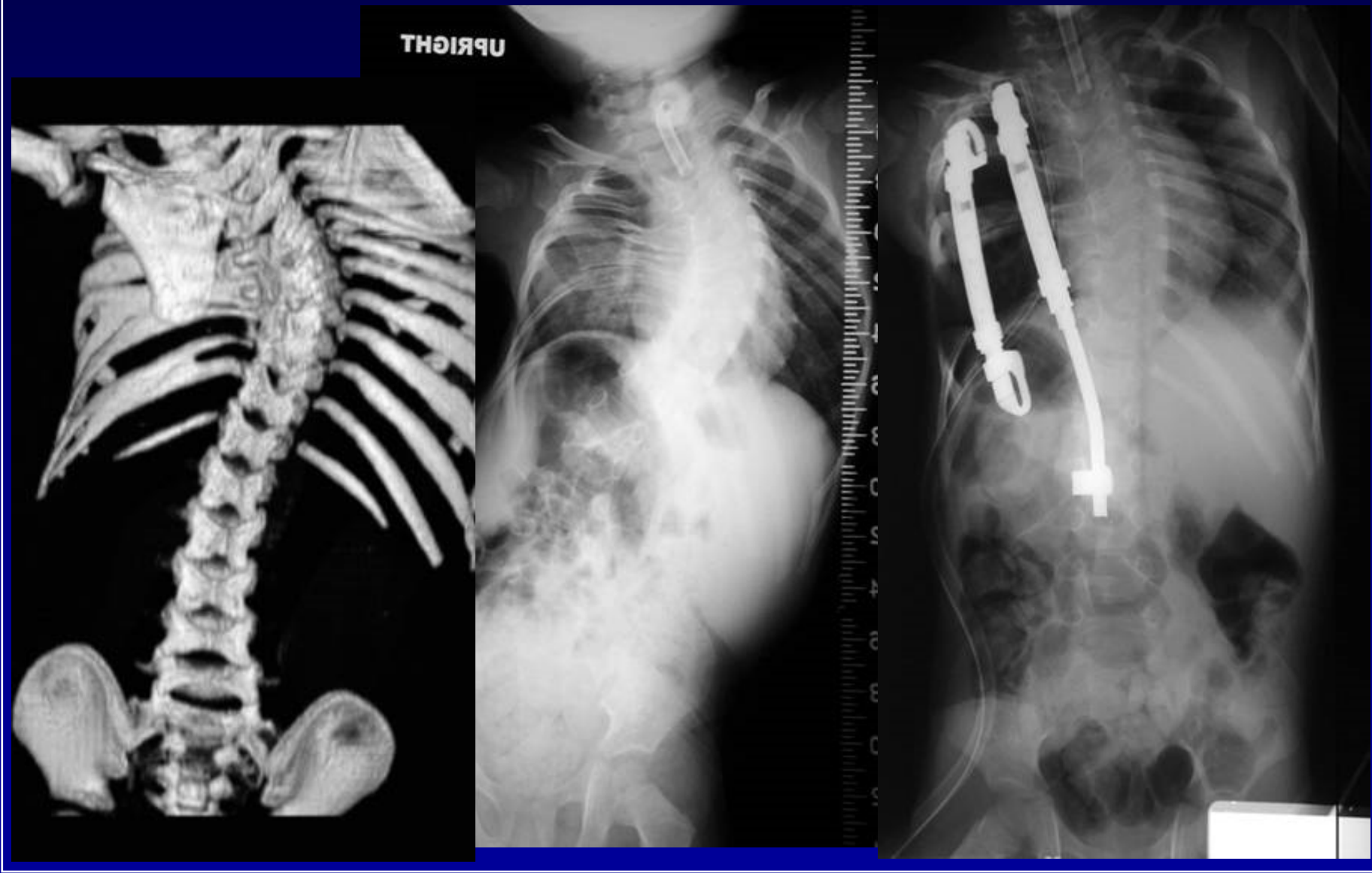
*Convex* chest suffers the most!

*Expansion thoracostomy should have been done earlier*



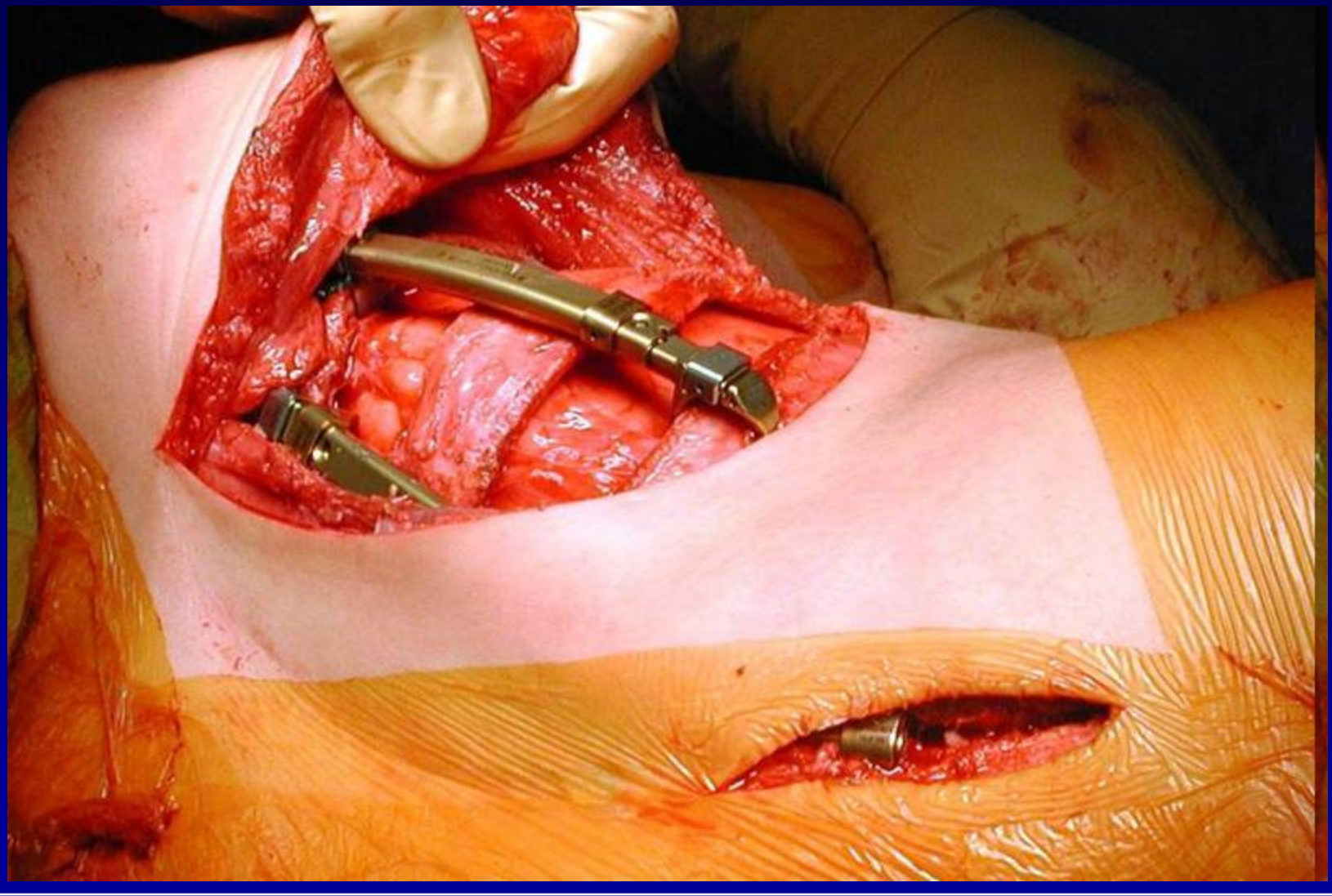




# 30 mo old with multiple fused ribs, congenital scoliosis



30 mo old with multiple fused ribs

*When do you need pleural reconstruction?*

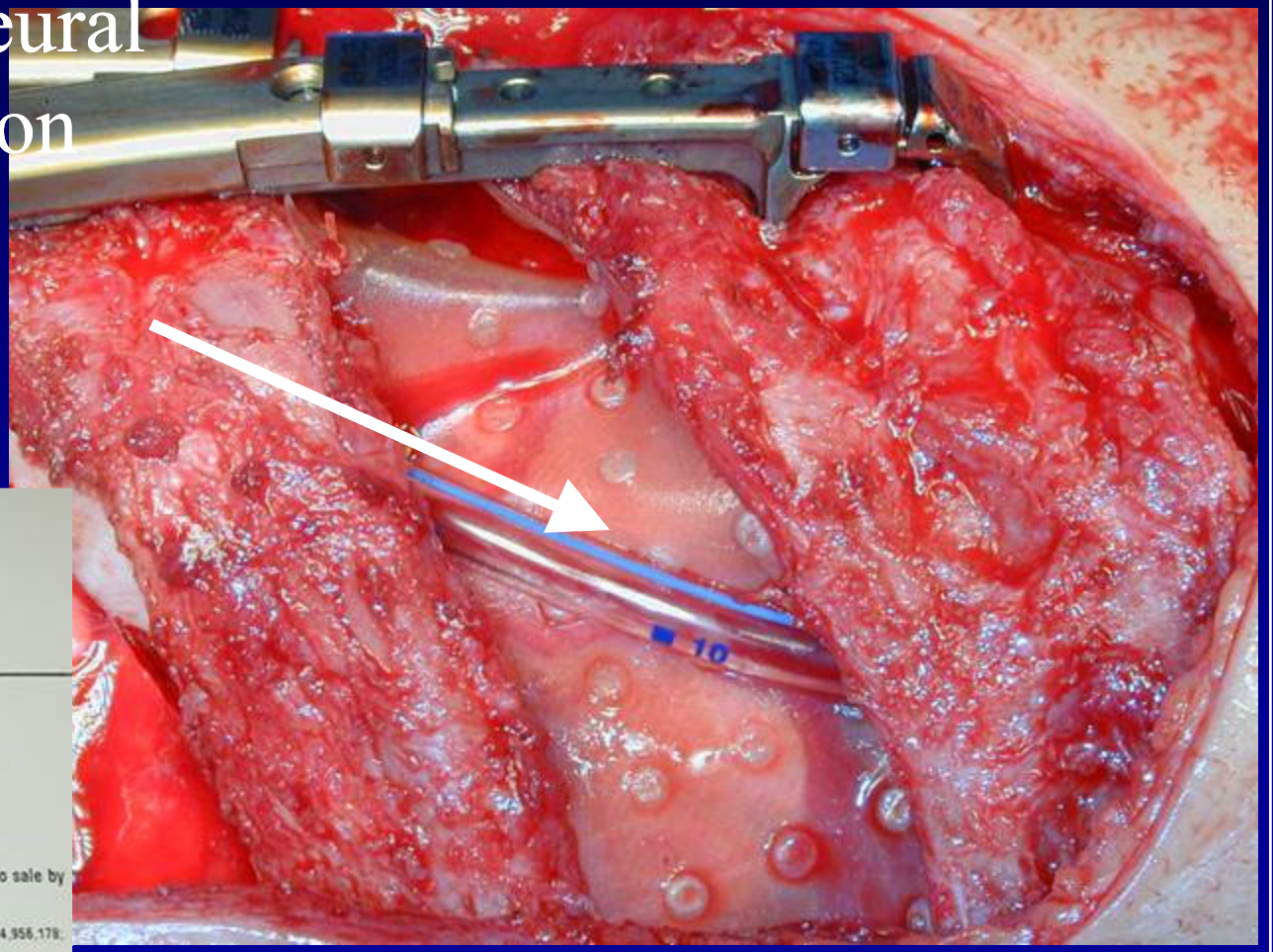


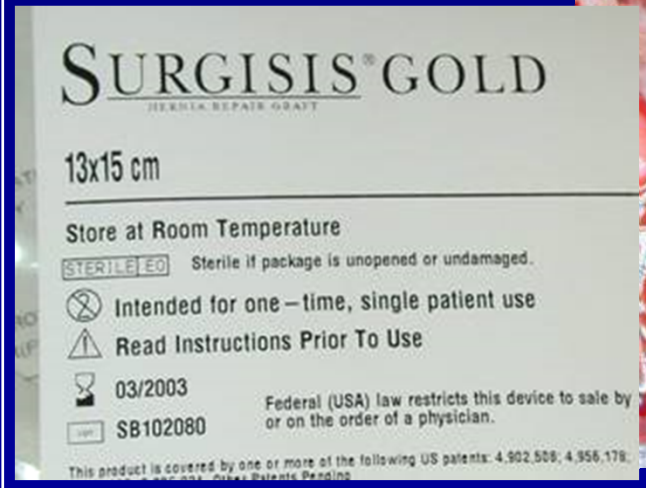
# Pleural reconstruction?

- *Musts*:
  - *Large gap* not well covered by muscles or scapula - ?5 cm?
  - *Protruding lingula* or catching lobe of lung
- Advantages?
  - ??Fewer lung adhesions??
  - Easier secondary approaches?
  - More or less scar?
- Disadvantages:
  - More work
  - Focus for infection?
- Materials:
  - GoreTex in small child won't grow or expand
  - SurgisisTM

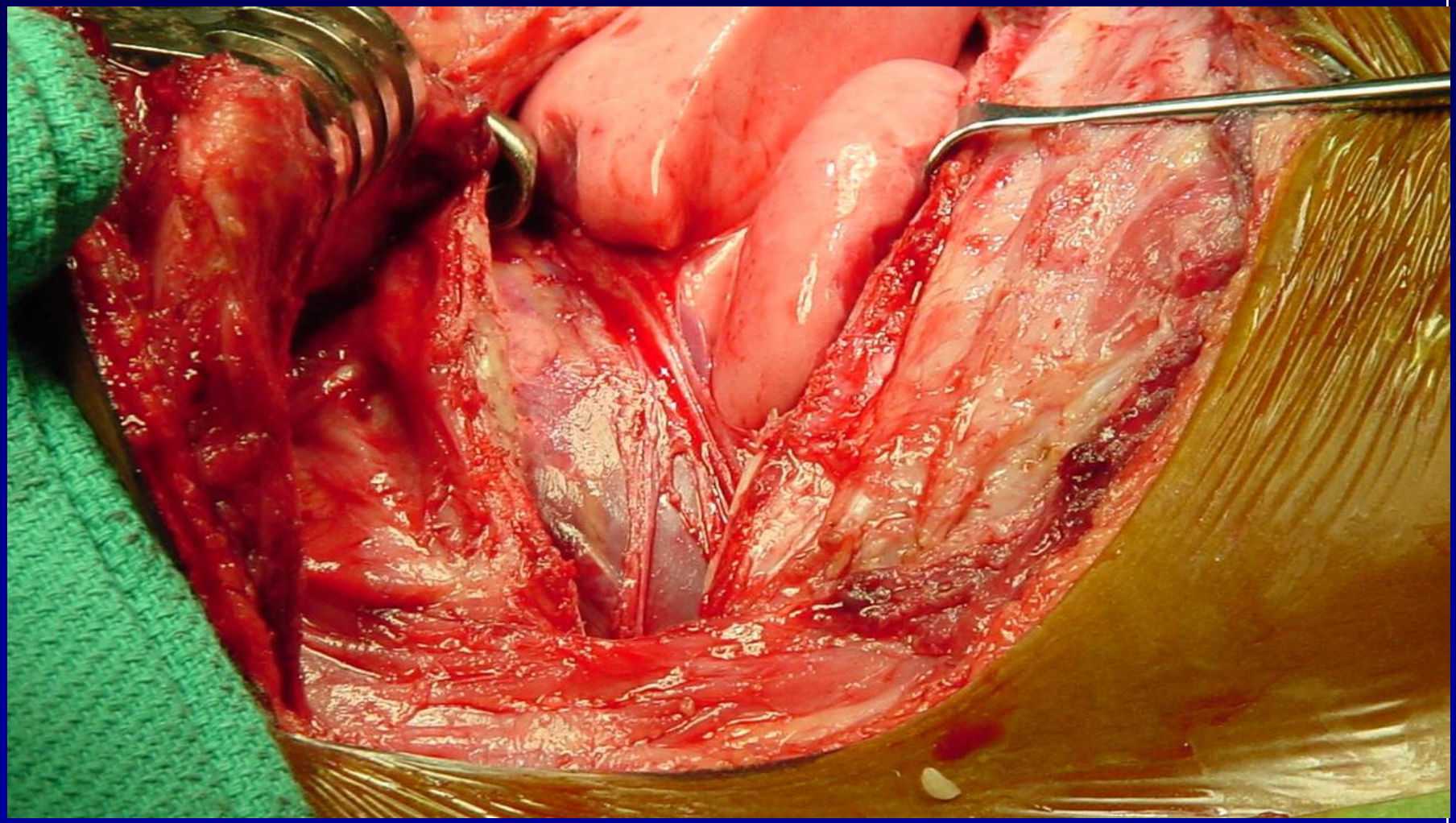
# Surgisis TM pleural reconstruction?

- Optional pleural reconstruction
- When?



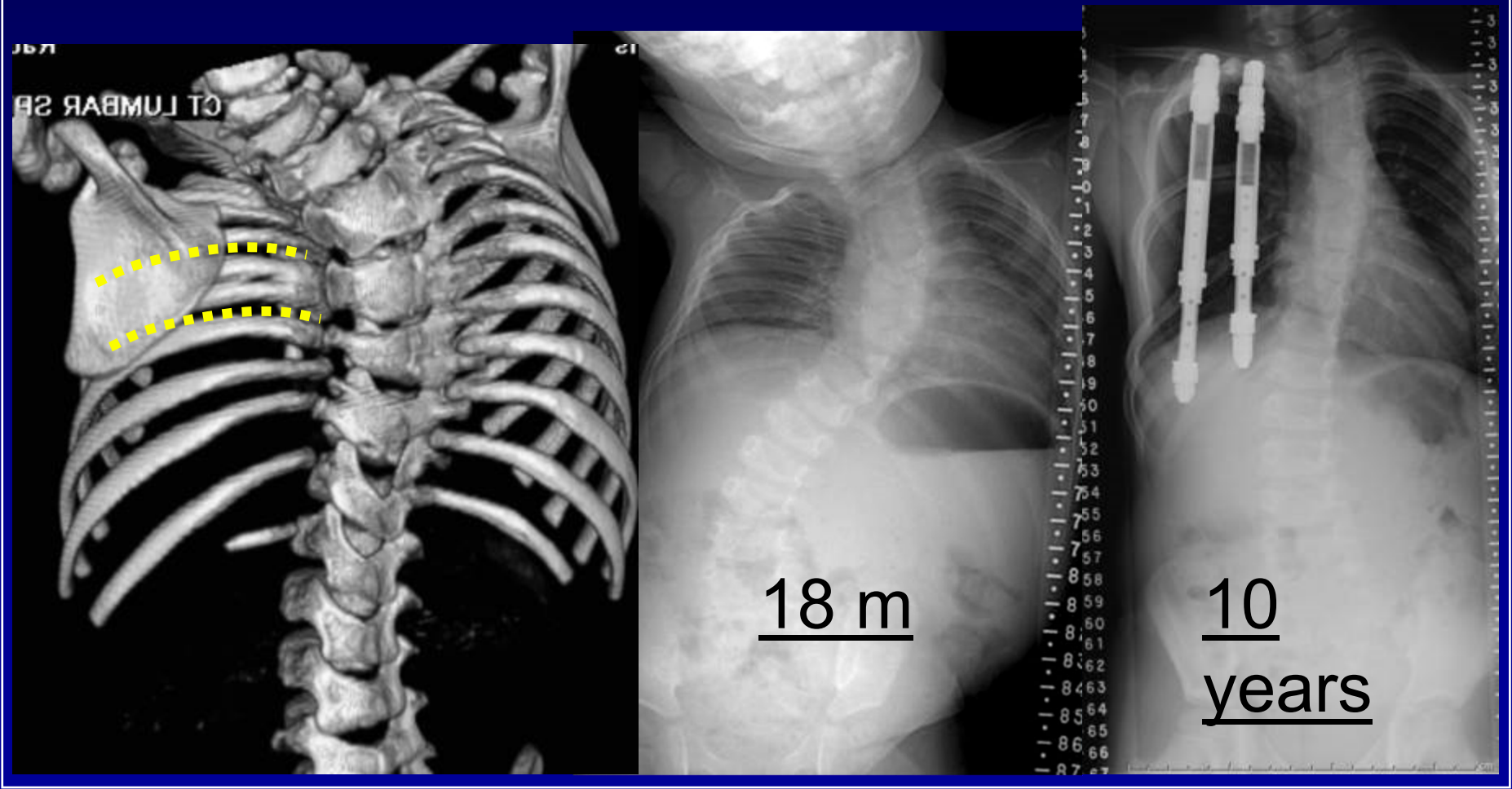


# Pleural reconstruction suggested



Fused ribs and progressive congenital scoliosis age 18 mo at first procedure – now age 10. One device exchange for growth

*Expansion thoracostomy fundamental, necessary*



Possible *adverse results* from expansion thoracostomy:

- Poorly placed devices
- Too much distraction
- Repetitive distraction of lateral device
- Distraction unevenly distributed between thoracostomies
- Re-fusion:
  - Congenital ribs
- Auto-fusion
  - Beneath device (without expansion thoracostomy)
- General chest wall scarring

# Conclusion:

- Expansion thoracostomy a fundamental part of VEPTR technique for constricted thorax.
- Many variables in placement, technique.