Minimally invasive repair of pectus excavatum

December 6, 2011


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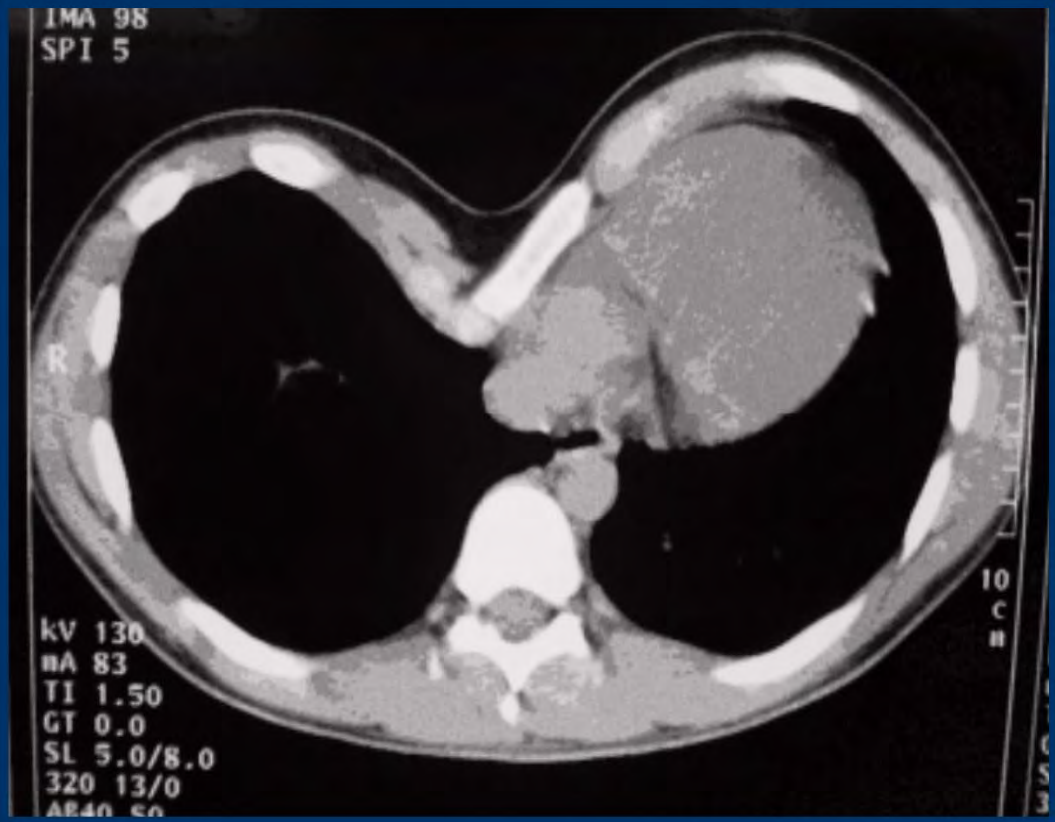
IMA 98
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320 13/0
10 cm

Overview

- What is pectus deformity?
- Indications for repair
- Surgical approach
- Operative considerations
- Postoperative care
- Results

Pectus deformity of chest wall

- Pectus excavatum
- Pectus carinatum
- Combination disorder

- Symptoms of exercise intolerance and chest pain/tenderness

Pectus excavatum

- Demographics
  - Congenital deformity
  - Becomes more pronounced with growth spurt
- Associated conditions
  - Marfan’s, Marfan-like syndrome, connective tissue disorder: 15%
  - 32% scoliosis
  - Cardiac anomalies

Indications for repair

- Who is eligible?
  - Severity of concavity: pectus index
  - Symptoms of cardiopulmonary compromise
  - Quality of life, self-image

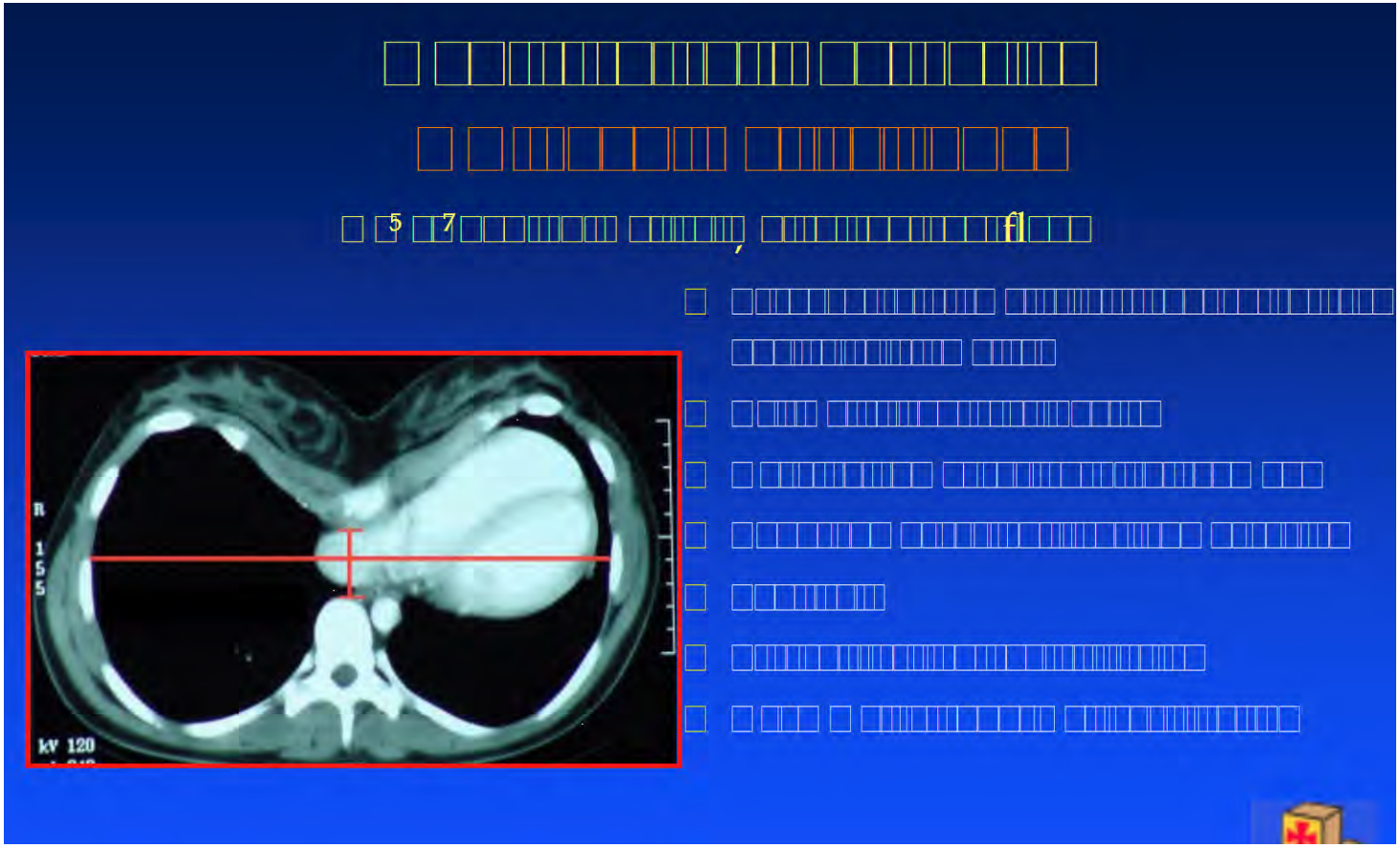
Preoperative workup

- History
- Physical exam

- CT chest: determine pectus index
- PFTs
- Transthoracic echocardiogram

- Cardiopulmonary stress test

Pectus (Haller) index >= 3.25



- CT chest may show cardiac compression or displacement
- PFTs may show restrictive or obstructive pattern
- Cardiology evaluation may document mitral valve prolapse, arrhythmias, murmurs, etc

PECTUS EXCAVATUM EXERCISE PROGRAM

Poor posture often contributes to the sunken chest appearance common with pectus excavatum. The typical pectus posture includes forward sloping shoulders and a belly that sticks out. A mild pectus may appear to be severe simply because of poor posture.

Purpose:

The purpose of the exercise program is to develop a "military" posture with shoulders pulled back and the back in straight alignment.

Technique:

Your child will need your encouragement. To be successful, this exercise program requires the cooperation of both the child and the parent. At the beginning of the exercise program, the best way to motivate your child is to set up a regular routine and watch your child while he/she exercises, or do the exercises with your child.

Ask your child to stand in front of the mirror and show how improving posture improves the appearance of the chest.

Exercise #1: Back Straightening Exercise

Do this exercise 25 times each morning and evening. The goal of this exercise is to straighten the back and pull the shoulders back.

1. Hands are placed behind the head and fingers interlocked.
2. The elbows are pulled back as much as possible and the head and neck needs to remain straight. This posture causes the chest to fill out in front.
3. Bend from the hips, forward and down, to a horizontal position. This position is held for 2-3 seconds. It is very important that the elbows, head, and neck remain straight during the exercise.

Exercise #2: Strengthening the Chest and Back Muscles

1. Do 25 push-ups each day.
2. Another exercise to strengthen the chest muscles:
   - Lie with your back on the floor and with arms stretched out on each side.
   - Place small weights in each hand.
   - Keeping arms straight, bring them together over the chest.
   - Do this exercise 25 times each day.

Exercise #3: Chest Expansion - Deep Breathing with Breath Holding:

Do this exercise in the morning and evening.

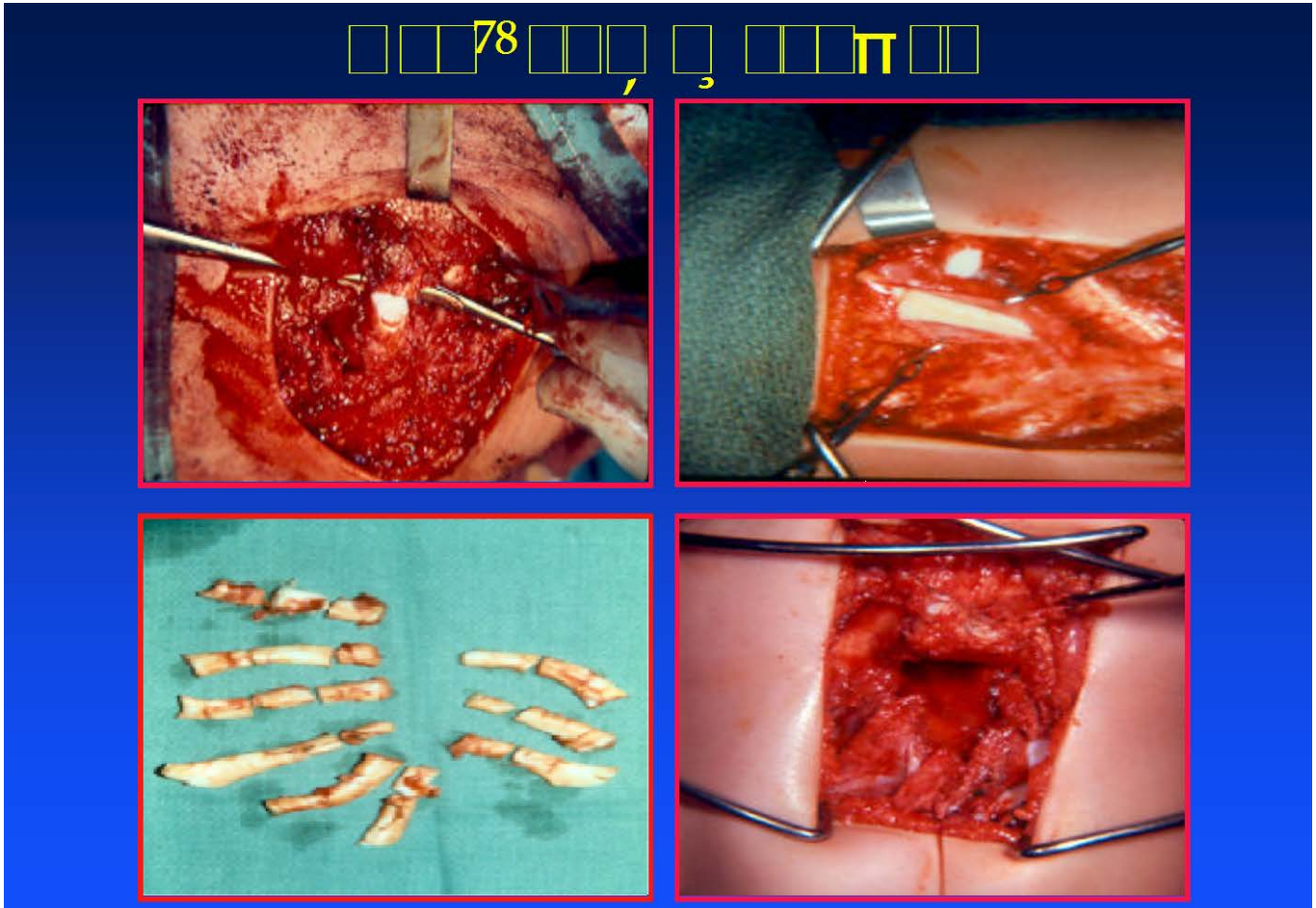
1. Stand up straight with the shoulders pulled back. Breathe in as deeply as possible and hold your breath for 10 seconds.
2. Repeat 20 times.

Remember:

- Total exercise time should be no more than 10 minutes.
- Your child should do these exercises immediately upon getting out of bed in the morning and before going to bed in the evening.
- During the day your child should be active and do aerobic activities.
- Motivation and monitoring are very impotant. Taking an interest in your child's activity will motivate him/her and will also build good communication. It is also vital to monitor and encourage your child during exercise on a regular basis, otherwise he/she could lose interest.
- This exercise program will not cure a severe pectus excavatum; however, it will help to correct poor posture, prevent progression of a mild pectus excavatum, make surgical correction easier and help prevent recurrence after bar removal.
- Please ask your child's nurse if you have any questions regarding this exercise program.

Surgical approach

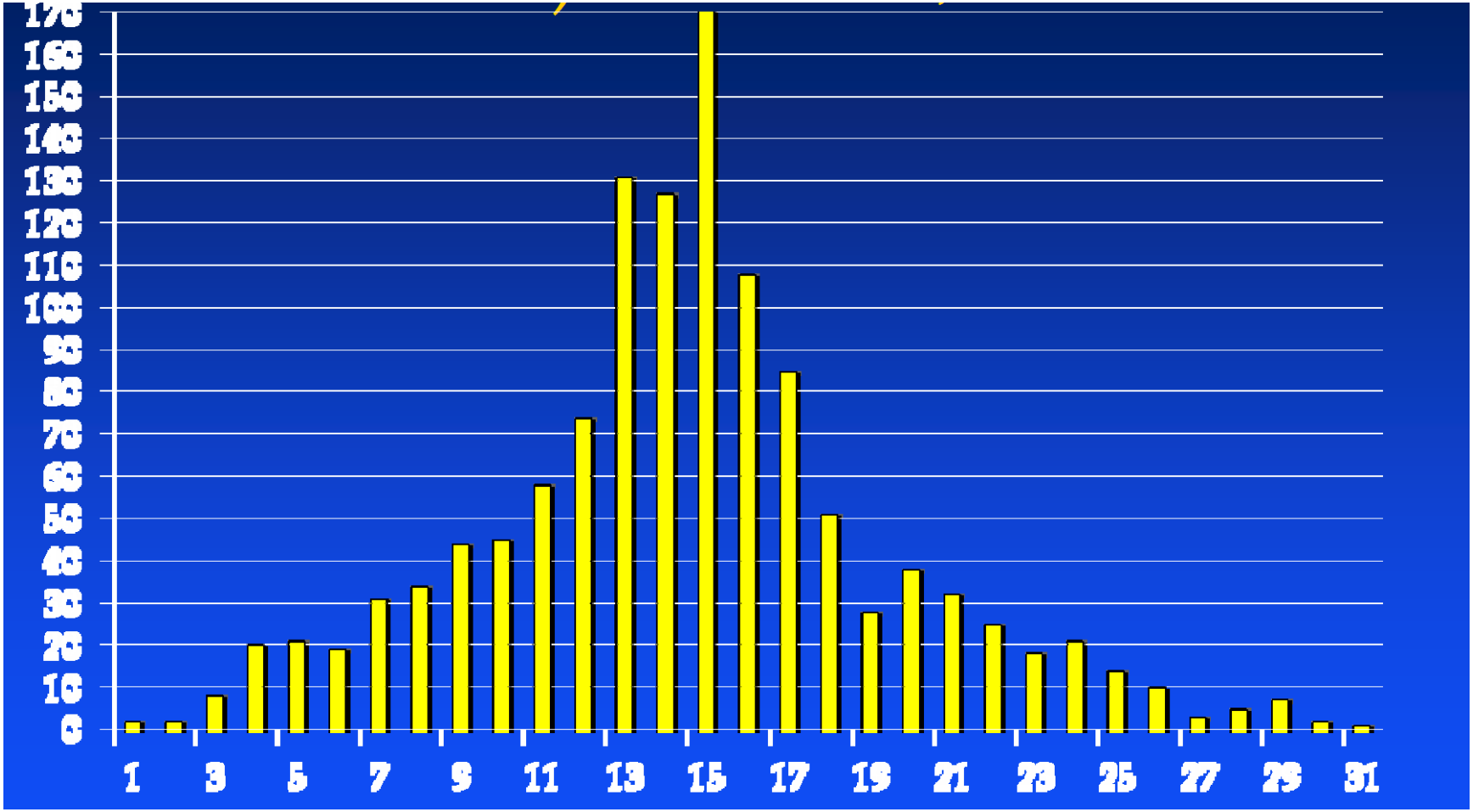
- Open (“Ravitch”) operation reported 1948
- Inframammary incision
- Elevation of pectoralis muscles
- Sternal wedge osteotomy
- Subperiosteal cartilage resections bilaterally
- Strut versus suture closure of osteotomy



Nuss Procedure

- Placement of substernal metal bar under the sternum
- A “retainer” to mold the chest wall
- Performed under VATS guidance
- Excellent long-term results
- Usually performed in teen years

2009: 1235 patients
Median age 15 y



Nuss Procedure

- When performed in adult patients, long-term results are equally excellent
- 53% >1 bar is implanted
- Bar removal occurs after 3 years, instead of 2 years

Marfan’s

- 0 81A85 - 95E123 6'VJNOH0 81A8524E PbJROJ
- - 43 4>81'G65E61'18@42CVJO'LBPVOJ
- S 4GD61'* +'%5E6IC bJWLB`JVJ
- S 4GD61'45 74E6576'0 ") J
- S 4GD61'18@42'2A3 ; >@4<>6': 81BC] VO'LB]QOJ
- - 43 4>81'45A67@425'18@6CVO'LBPJ`OJ
- - 43 4>81'167; 1165 76'18@6CVJ`O'LBPJWOJ
- - 43 4>81'B8@4BA87@425'18@6'VPO'LBV`O
- - 43 4>81'2; @723 6'VbO'LBVNO

Operative considerations

- Anesthesia requirements
  - Epidural
  - Single-lumen ETT should be adequate
- Positioning: arms abducted

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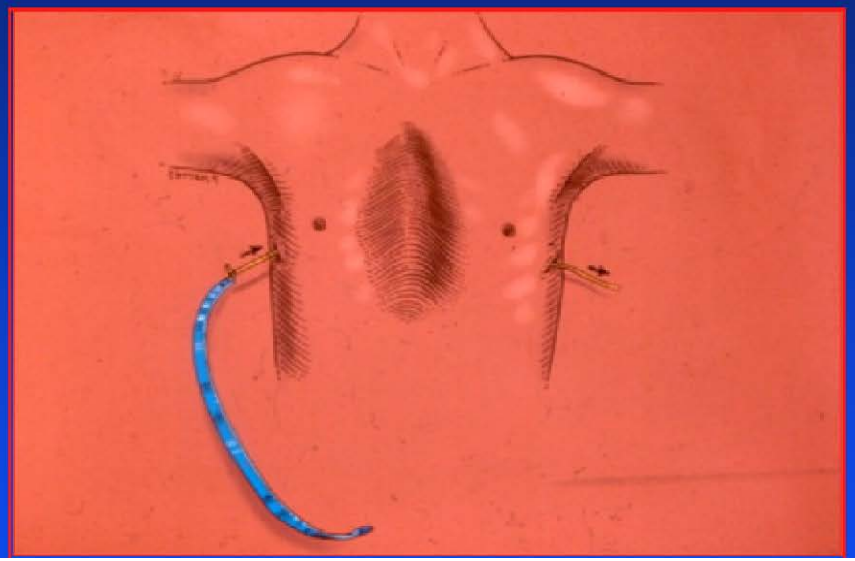
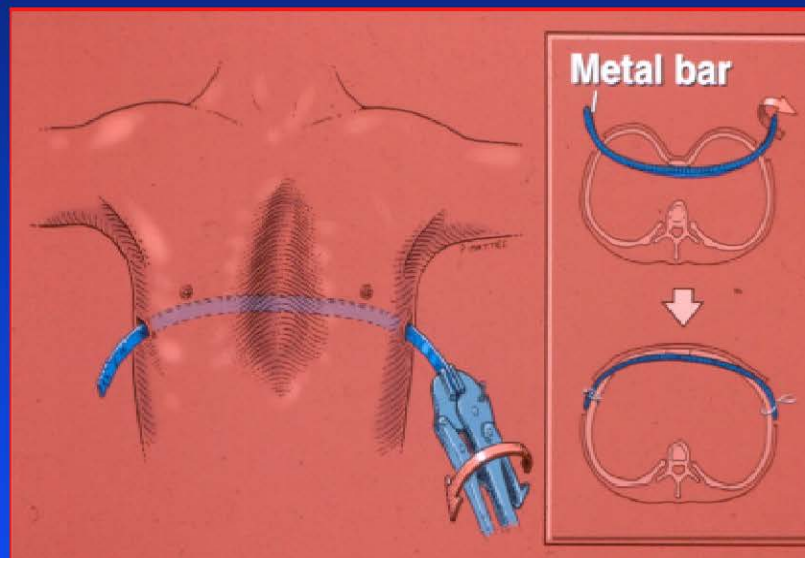
Operative steps

- Mark the patient
- Select bar, configure
- Thoracoscopy
- Subcutaneous tunnel
- Sternal elevation
- Bar insertion and rotation
- Bar fixation (using stabilizer)
- Evacuate pneumothorax +/- chest tube




Metal bar

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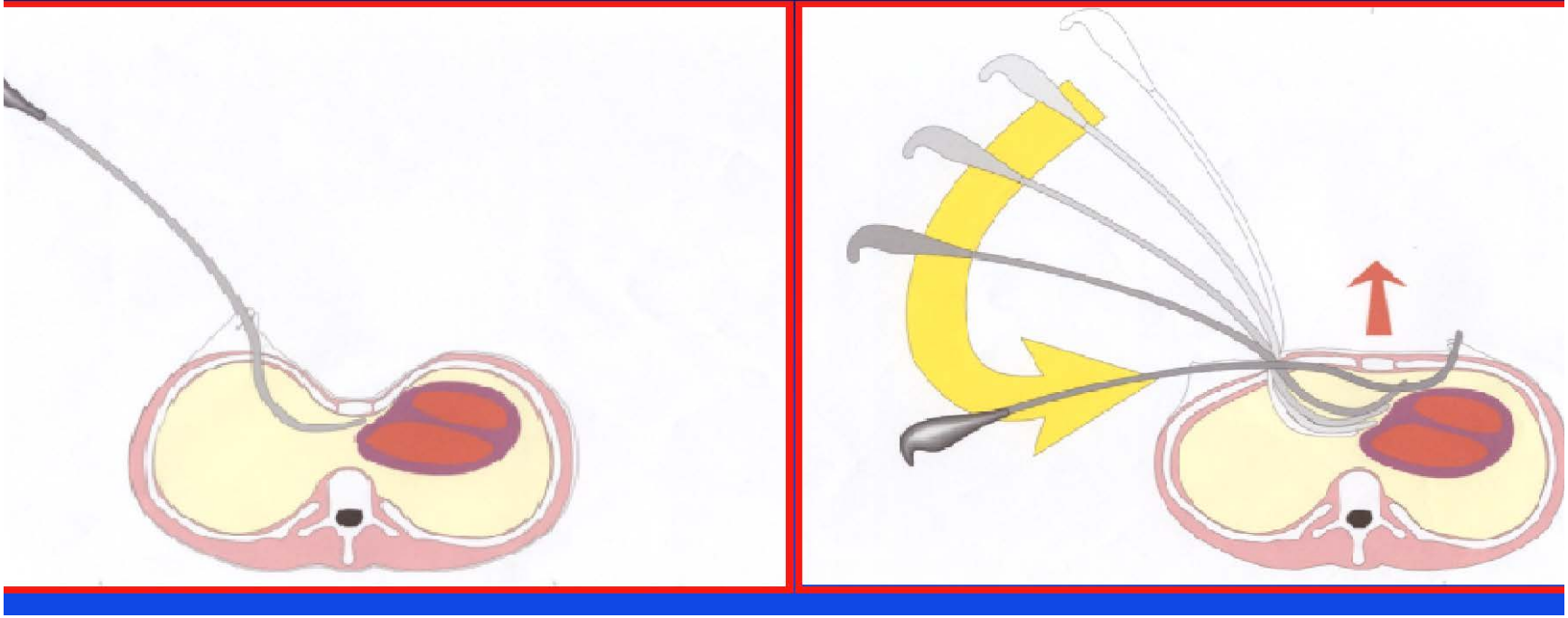

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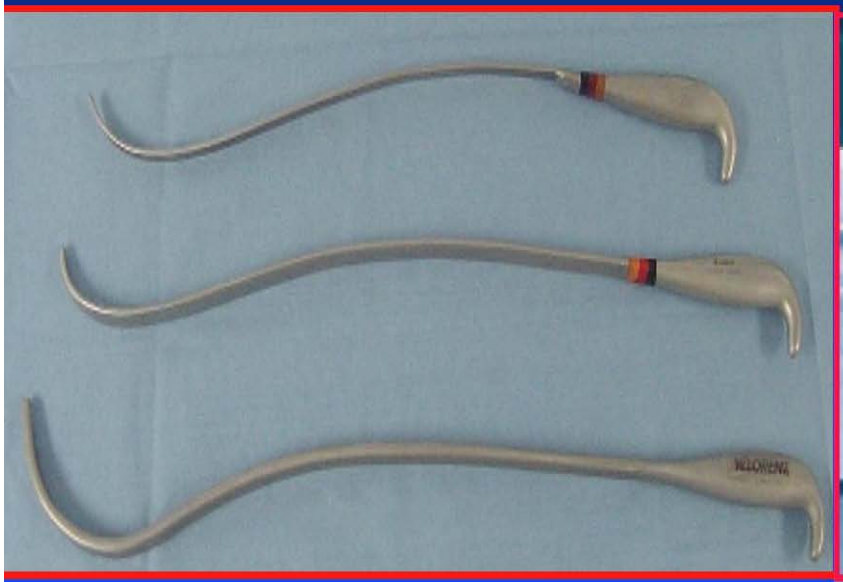

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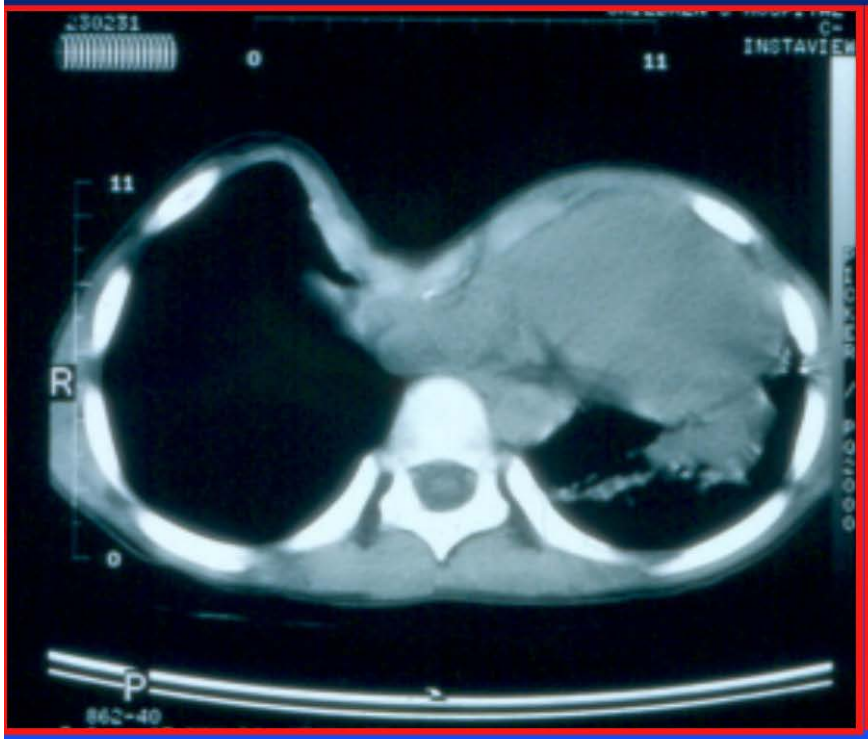

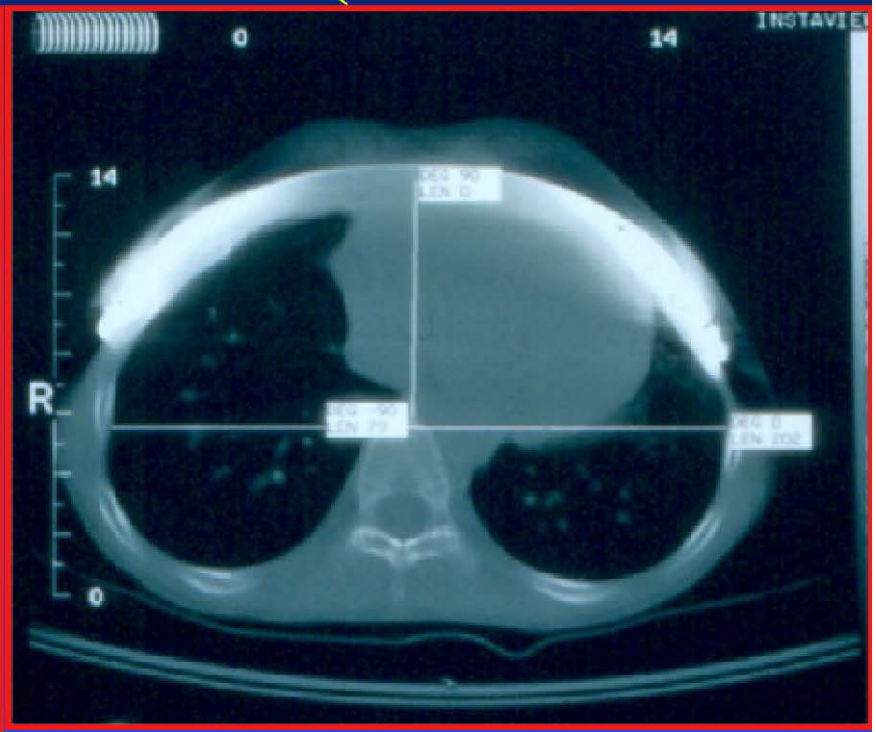

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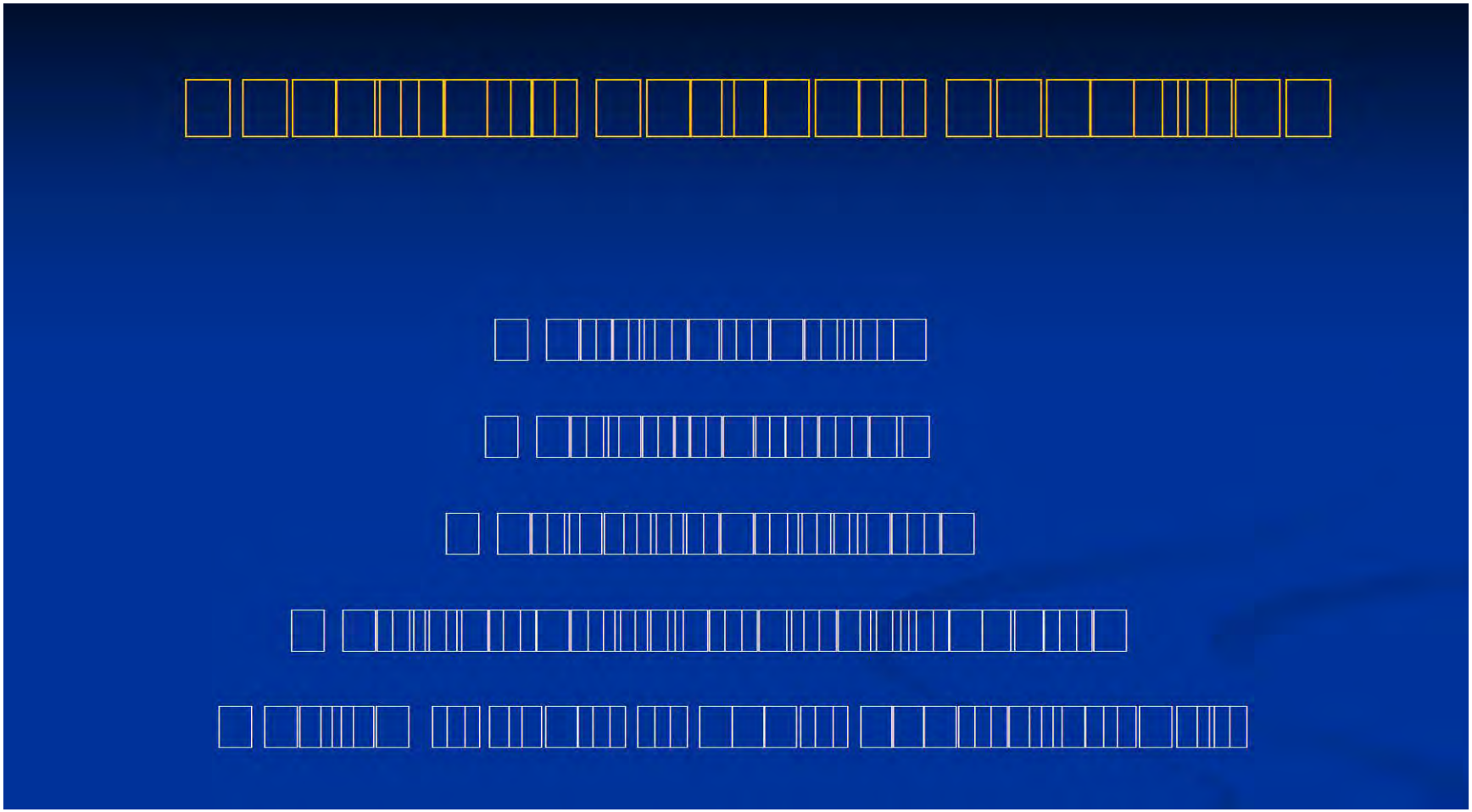
Postoperative care

- Mean length of stay: 5 days
- Physical therapy
  - No bending at the waist, no log-rolling or lying on one's side, no raising of the arms above head
  - Emphasis on posture
- Respiratory therapy
  - Incentive spirometer, thoracic walker
- Pain control
  - Epidural stays in place for 3 days



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Follow-up with MD

- Initial postoperative visit
  - Obtain medic bracelet/necklace alerting presence of substernal bar
- Interval clinic visits until 3 years postop for physical exam, CXR (PA and lateral)
  - 6, 12, 24, 36 months

Possible complications

- Bleeding
- Infection
  - Allergic reaction
- Bar dislocation/rotation
  - Need for revision
- Failure of repair

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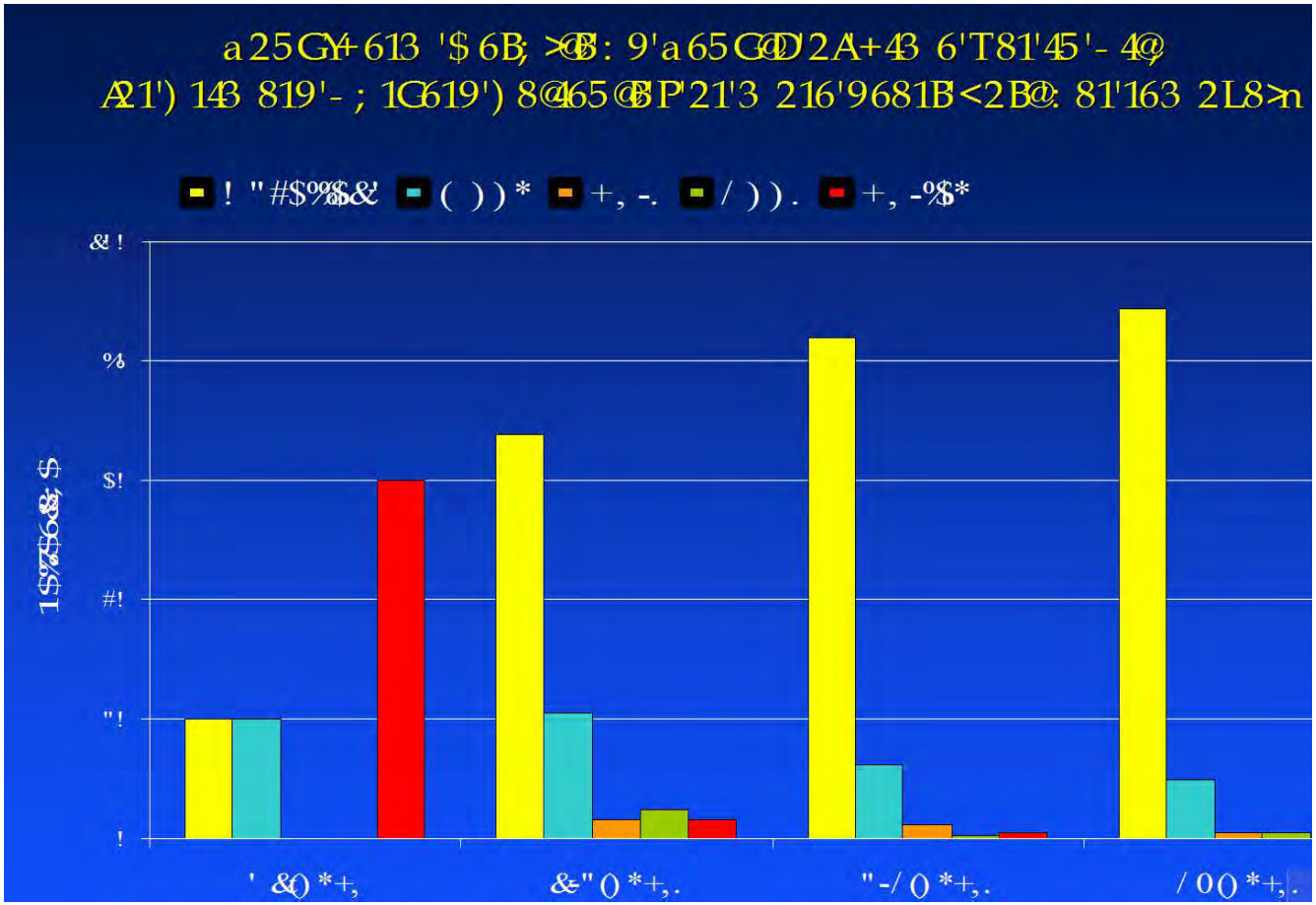
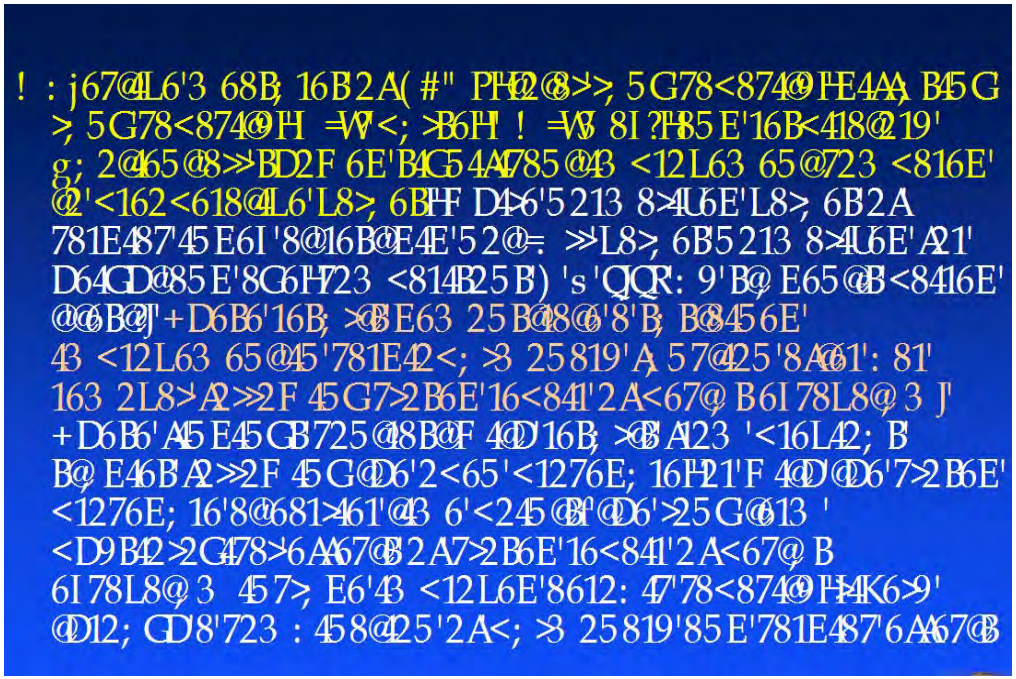
Bar removal: timing



Long-term results

- Improved lung function
- Improved postoperative exercise tolerance
- Improved cardiac function (SV, CO, CI)



Improved psychosocial status

- Improved quality of life
- Improved body image
- Improved perception ability for physical activity
  - Pediatrics, Vol 122, 2008: 1218-1222