

وَقُلْ رَبِّ زِدْنِي عِلْمًا



RESPIRATORY SYSTEM

HAYAT BATCH

SUBJECT : _____

LEC NO. : 1

DONE BY : Rawan Alhindi



Surgical Procedures and Surgical Approaches to Respiratory Diseases

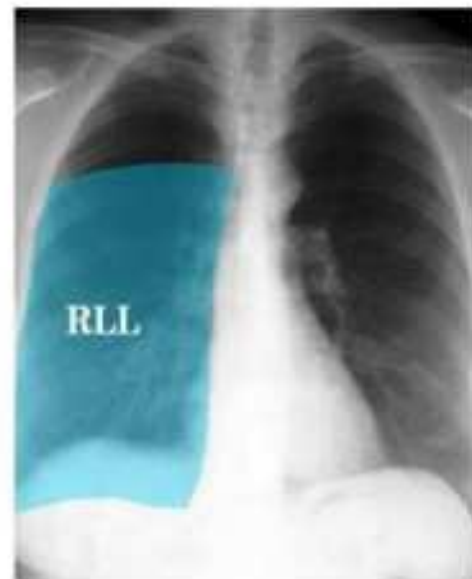
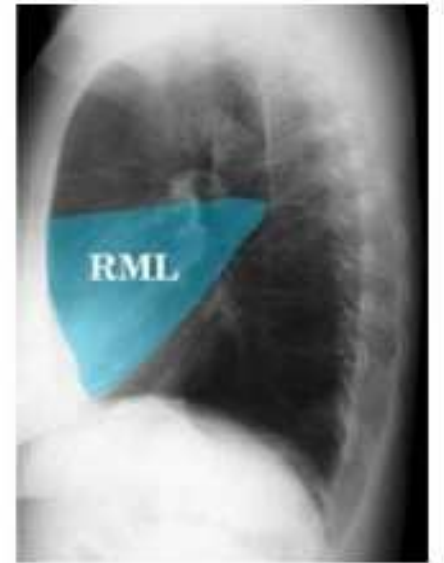
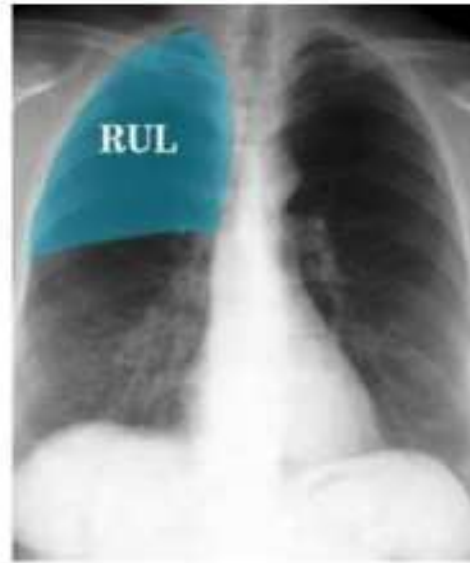
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Assistant Professor of Thoracic Surgery
The Hashemite Univeristy

Thoracic Surgery includes:

- 1 • Chest Tube Insertion
- 2 • Bronchoscopy
- 3 • Mediastinoscopy
- 4 • Video-assisted thoracoscopic surgery
- 5 • Thoracotomy

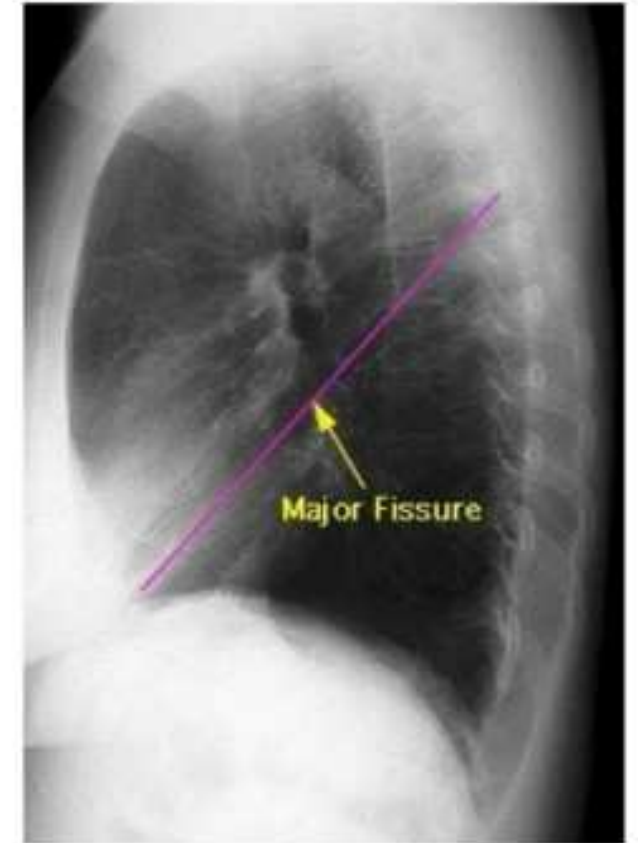
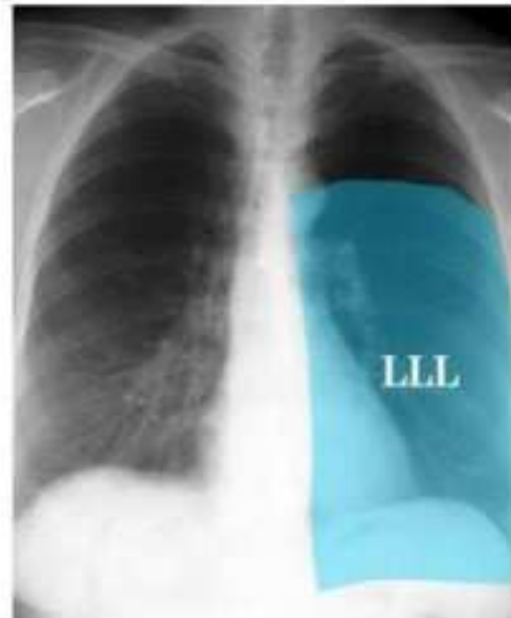
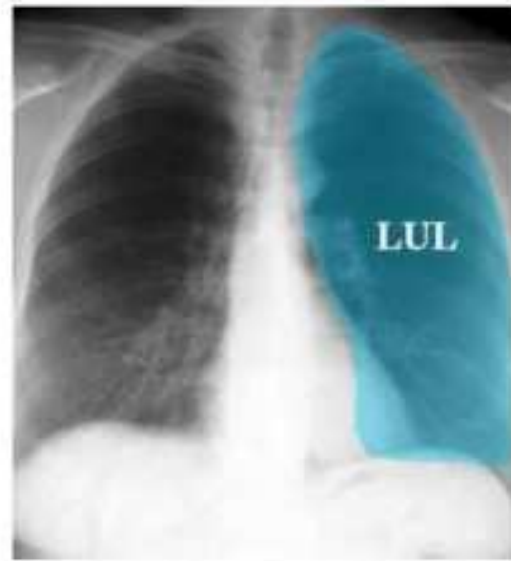
Anatomy

The Right Lung

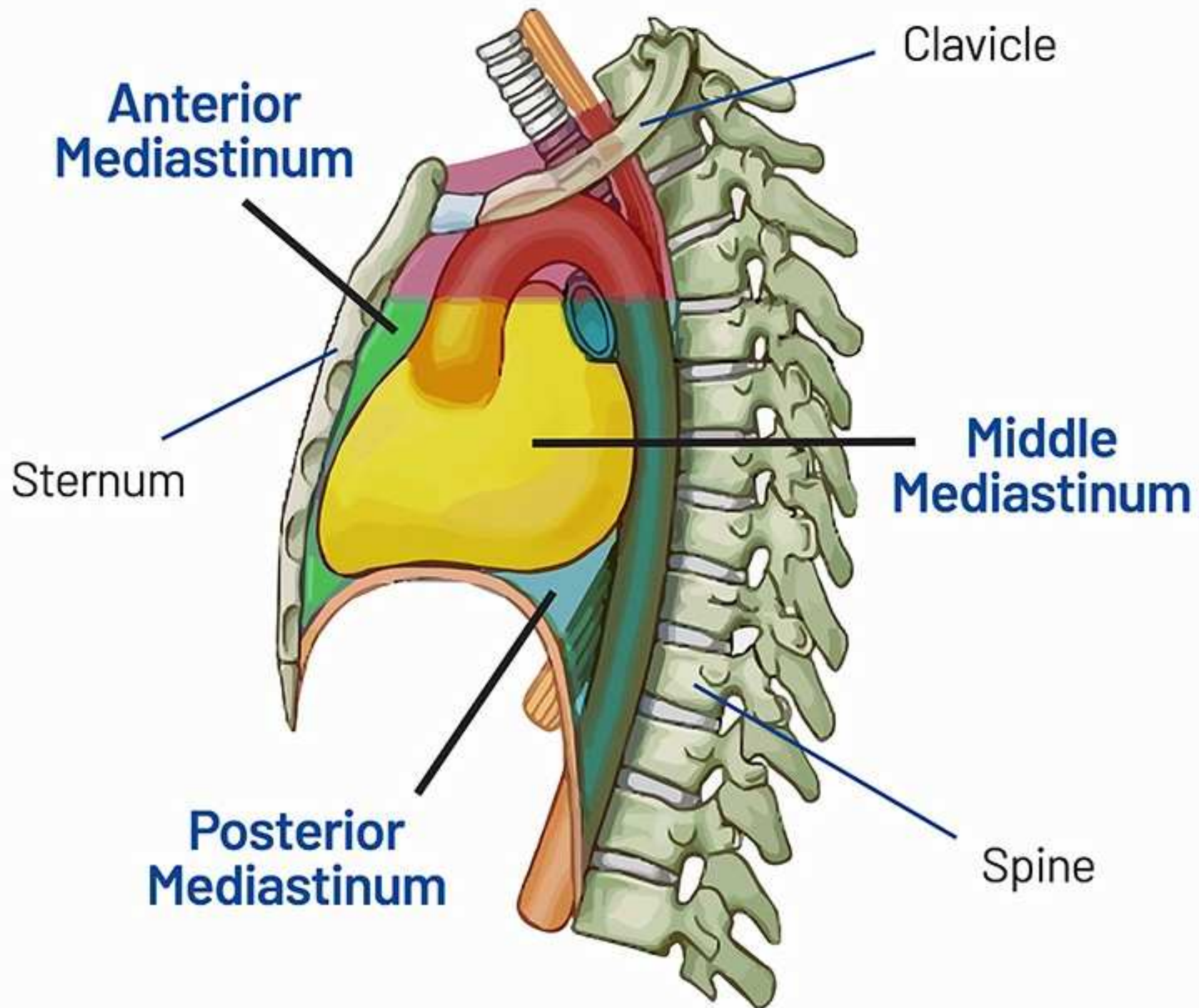


Anatomy

The Left Lung



Anatomy



1 Chest Tube Insertion

• definition

Chest tube insertion (also called tube thoracostomy) is a procedure in which a tube is inserted into the space between the lung and chest wall (called the pleural space).

• Indications

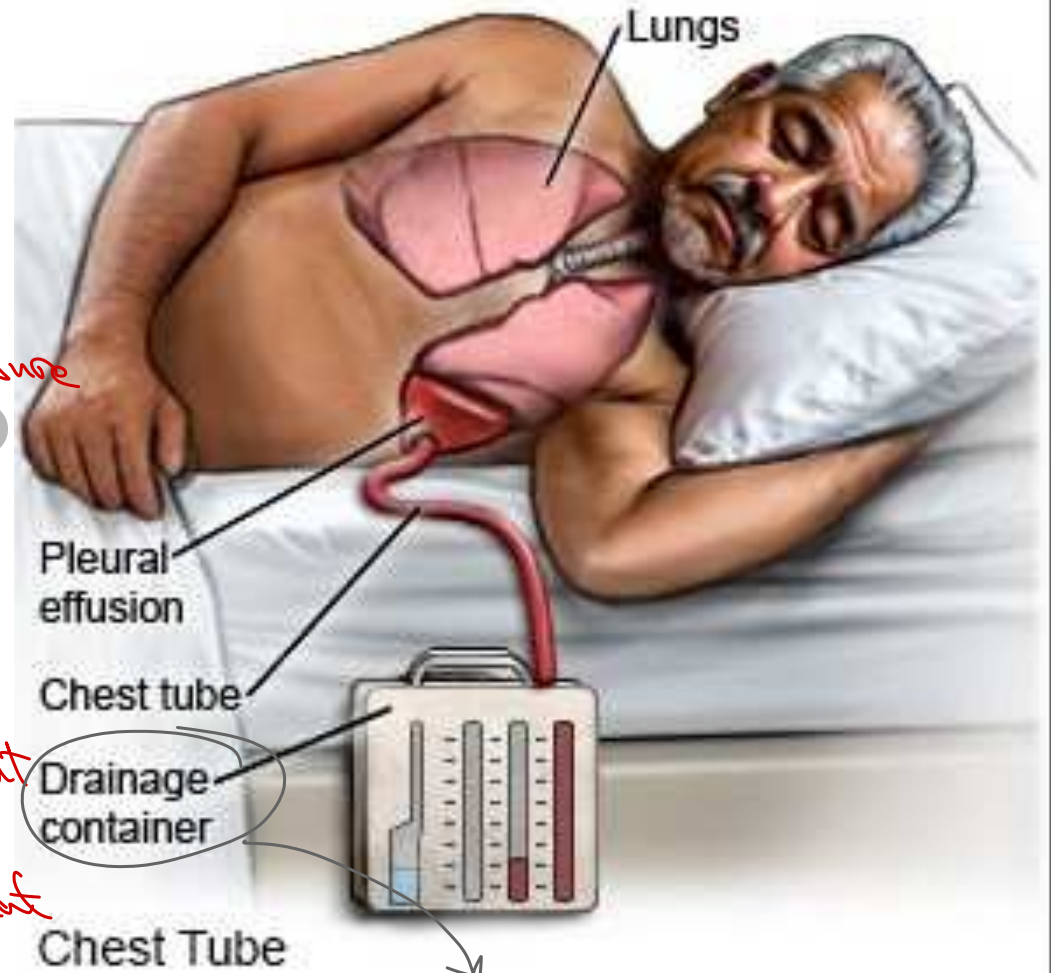
- 1. Pneumothorax
- 2. Hemothorax
- 3. Pleural effusion
- 4. Post operative

• Procedure

سurgery US
 * Iron ?
 * Pulmonary vein inferiorly

• test tube inserted to restore the pressure inside the pleural cavity.

Cavity between visceral pleura that cover the lung & parietal pleura that cover the chest wall.



*
 *
 * under water drainage sys

procedure

خطی است

upper border of the rib



to avoid injury in the vein, Artery & near the intercostal

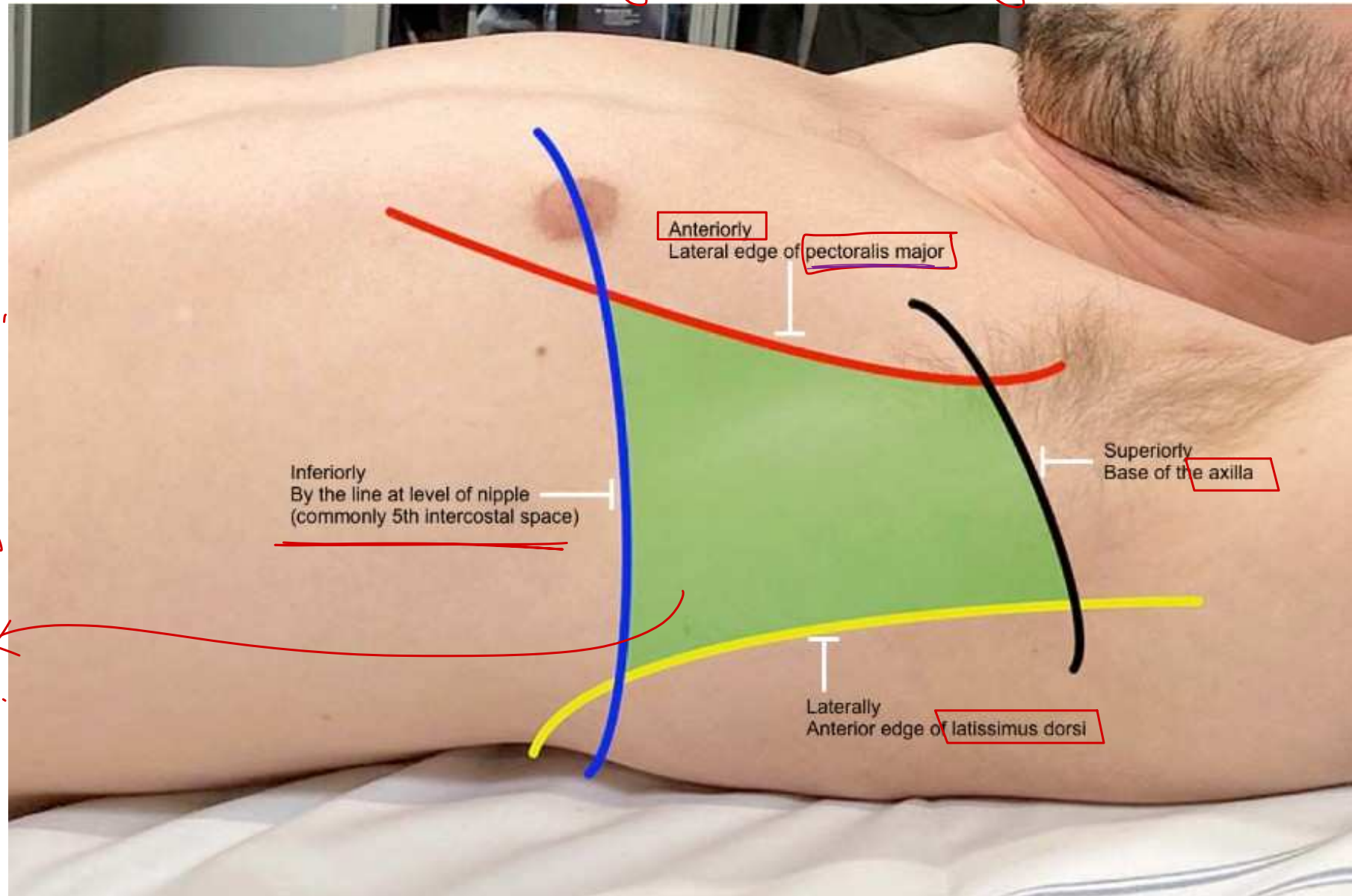
* Green Area

* less — to

* less muscle bulk.

Pectoralis major / latissimus dorsi

Triangle of safety.



Pneumothorax

• Definition → Air inside the pleural cavity.

• Clinical presentation →

- ① Pleuritic chest Pain
- ② SOB
- ③ Chest Pain in general

• Classification

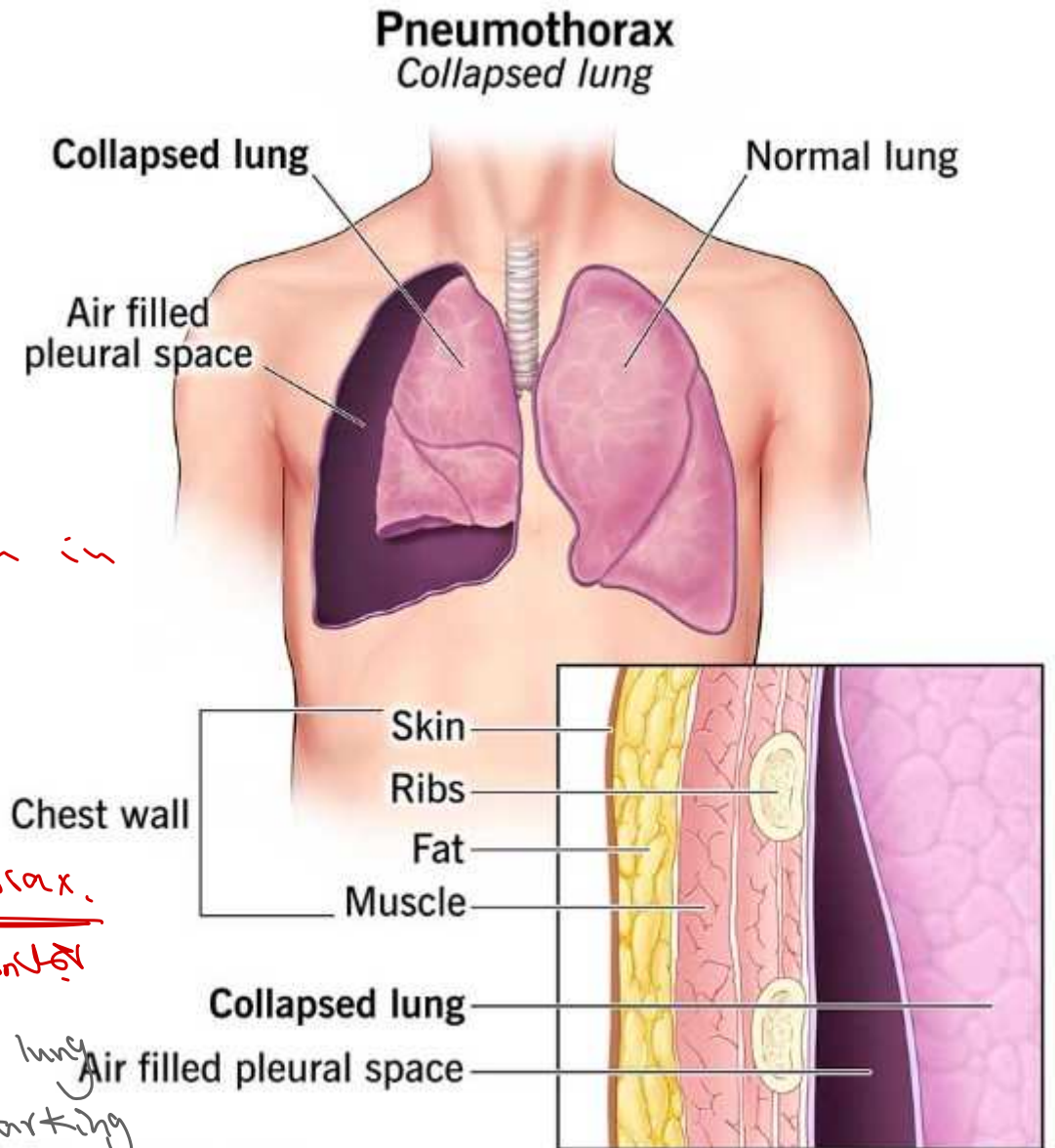
- ① Open vs Closed
- ② Simple vs Tension
- ③ Spontaneous vs Traumatic

• Diagnosis → radiology / اسناد تصويرية
 unless its tension pneumothorax.

• Treatment

finding for Pneumothorax

- ① collapsed of the lung
- ② ↓ in vascular marking
- ③ hyperlucent field. ↓ lung density on images



physical examination.

- ① decrease in breathing sound on affected Area
- ② hyper resonant on percussion.

③ Simple pneumothorax / tension pneumothorax.

tracheal deviation
mediation

- * tracheal deviation on contralateral side
 - * distended neck veins
 - * hyper expansion of the affected side
- توسيع في التنفس ← Fixed > expanded inspiration / Expiration.

Open vs closed

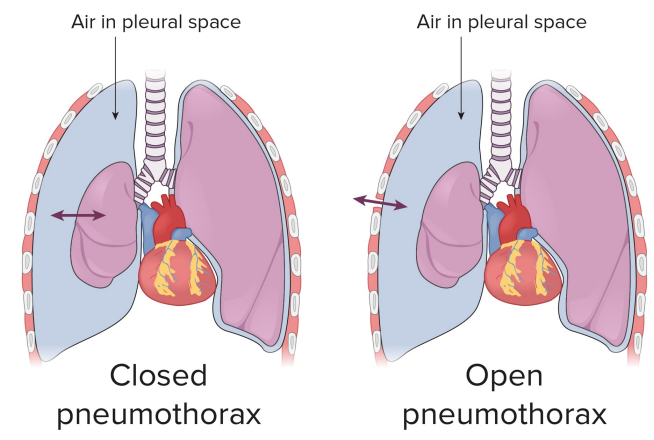
↘ no communication with external environment

↓
Open

↘ no communication with external environment

↓
Closed

الفرق



Simple vs tension

the presence of signs of cardiovascular compromise

findings

• tracheal deviation to the contralateral side

• distended neck veins

• X-ray:

• contraindicated intercostal space wider

depressed diaphragm

mediastinal shifting

• hypotension / tachycardia

Clinically tension / Simple

• ABC

radiology def

he could collapse

in state of shock

radiology def

he should be managed first & resuscitated

send to radiology def to confirm.



obstructive shock

Obstructive Shock

needle decompression

2nd inter costal space
needle connected to a syringe with normal saline

sucking into

bubbles

pneumothorax is confirmed

the diagnosis is confirmed

we proceed for chest tube insertion in the triangle of safety

pneumothorax on right side

presence will build up until certain point because shifting for the mediastinal to the contralateral side

compression SVC / IVC rotation of heart

this will prevent the blood coming to the heart

hypotension & tachycardia

Q: What's the definitive treatment for pneumothorax?

① chest tube insertion.

② Surgery.

① Prolonged ^{active} neoplastic pneumothorax
active neoplastic pneumothorax
chest tubes
chest tubes

so after 5-7 days we should think about surgery.

② recurrent pneumothorax.

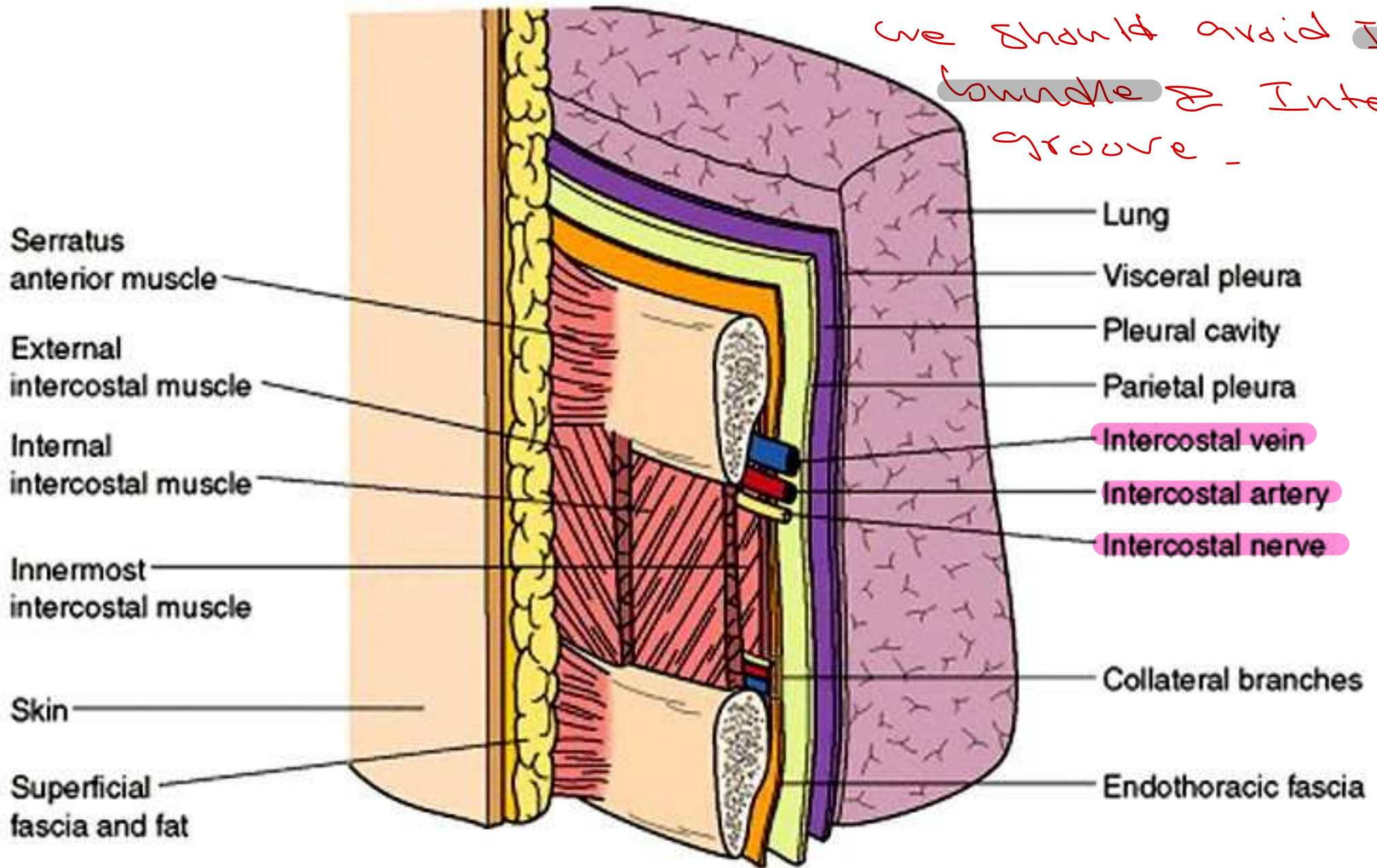
recurrent pneumothorax
Surgery → pneumothorax

③ Jobs - Pilot / diver

- high risk jobs

Pressure ↓
fatal

• Chest tube insertion should be avoided in intercostal bundle & intercostal groove.



Serratus anterior muscle

External intercostal muscle

Internal intercostal muscle

Innermost intercostal muscle

Skin

Superficial fascia and fat

Lung

Visceral pleura

Pleural cavity

Parietal pleura

Intercostal vein

Intercostal artery

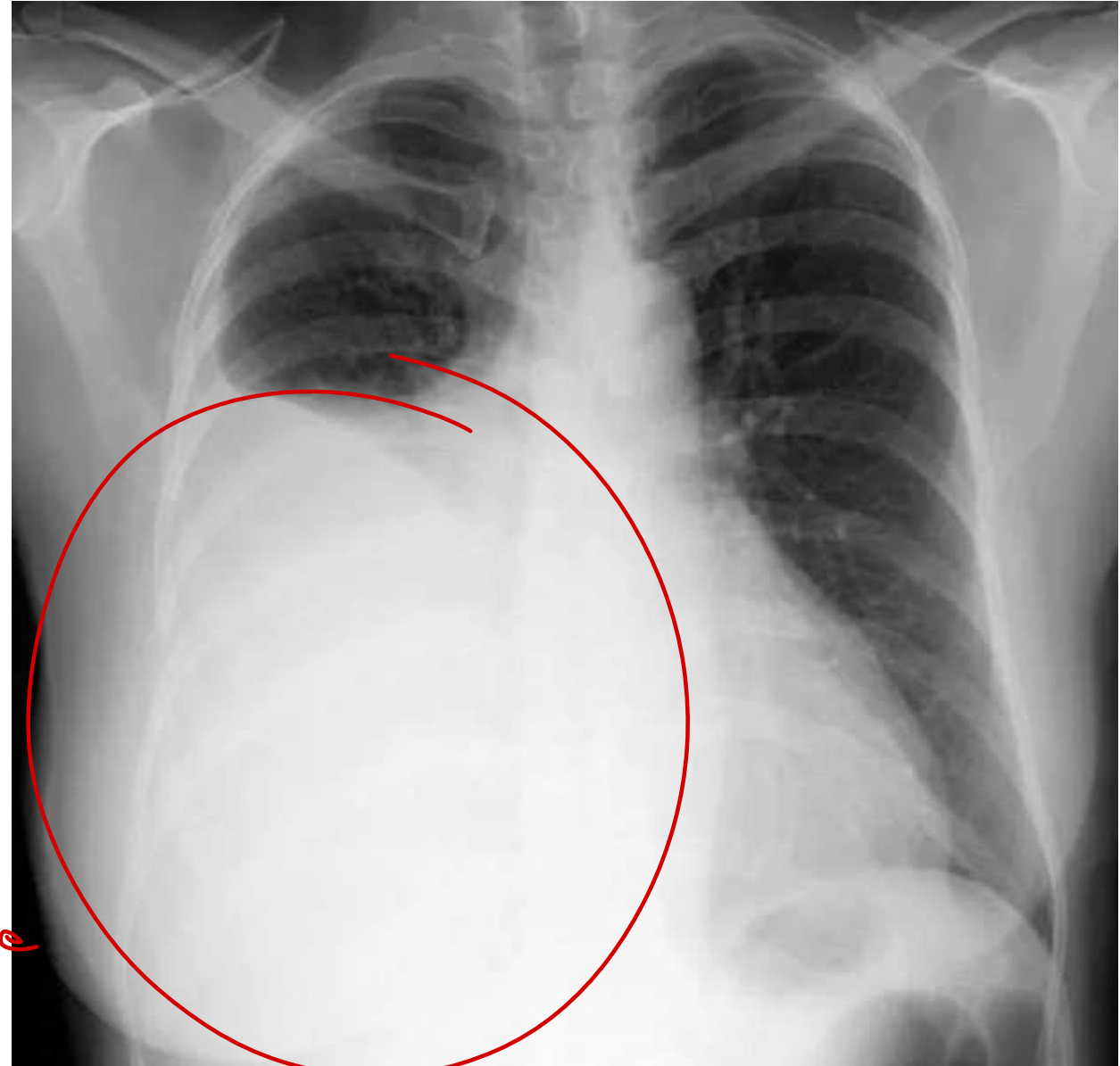
Intercostal nerve

Collateral branches

Endothoracic fascia

(2) Pleural Effusion

- Definition
- Clinical presentation
 - Thoracocentesis > Chest tube insertion > 3 samples
 - Types: Transudate vs Exudate
 - Lights criteria
- decrease in lung size in Right
- decrease in lung volume + white Area compared to left side



* X-ray signs of
Pneumothorax / Pleural effusion

* pleural effusion definition.

accumulation of the fluid in the pleural cavity

is slow

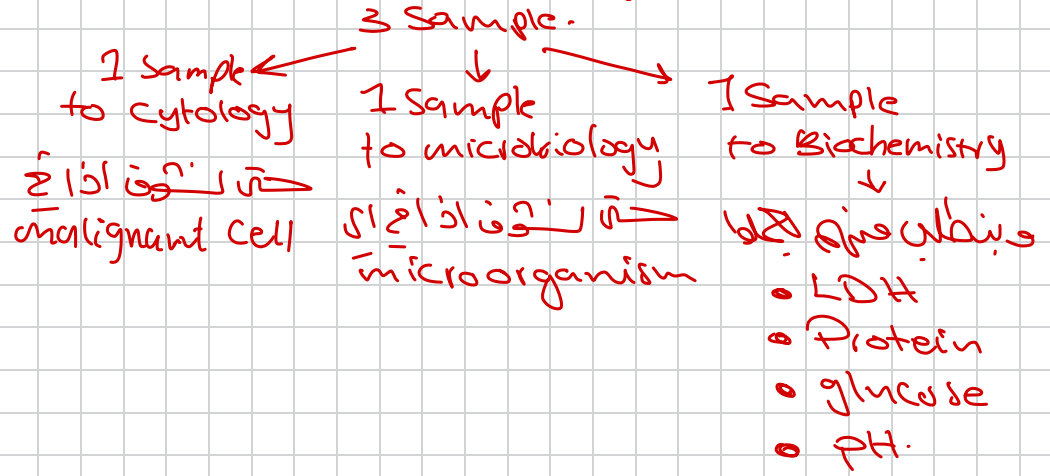
↑ secretion

↓ absorption

- * Infection
- * malignancy

Obstruction of lymphatic drainage

using needle to send some fluid for analysis



* Clinical Presentation.

"minimal"

↓

Asymptomatic.

massive

↓

SOB

↓

thoracentesis.

↓

Chest tube.

transudate vs exudate

Light's Criteria

کرتج لکویا
کار صیغہ

Light's criteria is a test to determine whether a pleural fluid sample is transudative (low protein) or exudative (high protein). This determination narrows down the diagnosis of etiology (causes) of pleural effusion.

95% of malignancy is exudate
5% → transudate

CRITERIA	EXUDATE ↑ Protein.	CAUSES	TRANSUDATE ↓ Protein.	CAUSES
<u>PLEURAL SERUM PROTEIN</u>	≥ 0.5	<ul style="list-style-type: none"> malignancy bacterial/viral pneumonia tuberculosis pulmonary embolism 	< 0.5	<ul style="list-style-type: none"> heart failure cirrhosis nephrotic syndrome pulmonary embolism
<u>PLEURAL SERUM LDH</u>	≥ 0.6	<ul style="list-style-type: none"> pancreatitis esophageal rupture 	< 0.6	<p>↓ lung ال دونه ايسر Outside the lung</p>
<u>PLEURAL FLUID LDH</u>	$> 2/3$ upper limit of normal	<ul style="list-style-type: none"> collagen vascular disease chylothorax hemothorax 	$< 2/3$ upper limit of normal	

+ infection

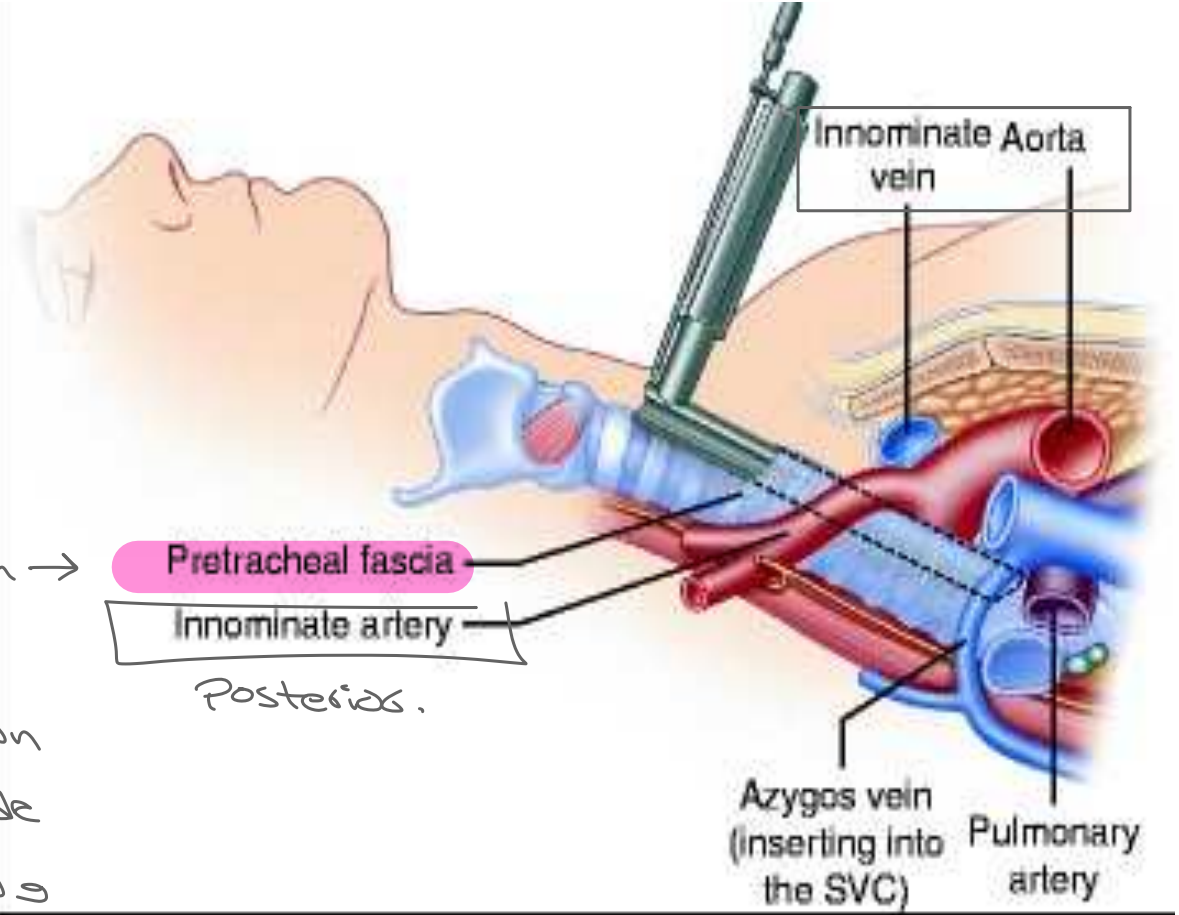
2 Mediastinoscopy

- Indication:

- Diagnostic → therapeutic ❌ purpose
- Staging

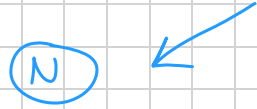
incision لأغراض *
in the lower neck
& we go down to
the Pre tracheal fascia →

Subcarinal منطقة التي
region
- أعلى من ال lymph node
Para- منطقة التي
tracheal lymph node



* Part of Staging system :-

in lung cancer → T & N & M
Staging system



node status

enlargement in lymph node →

we should → CT scan → node

go to mediastinoscopy & take sample

to check of the presence of malignant

cell inside these lymph node

No → malignant cell →

involvement → N1 → N2 in

of lymph node

diagnostic procedure →

lymphadenopathy →

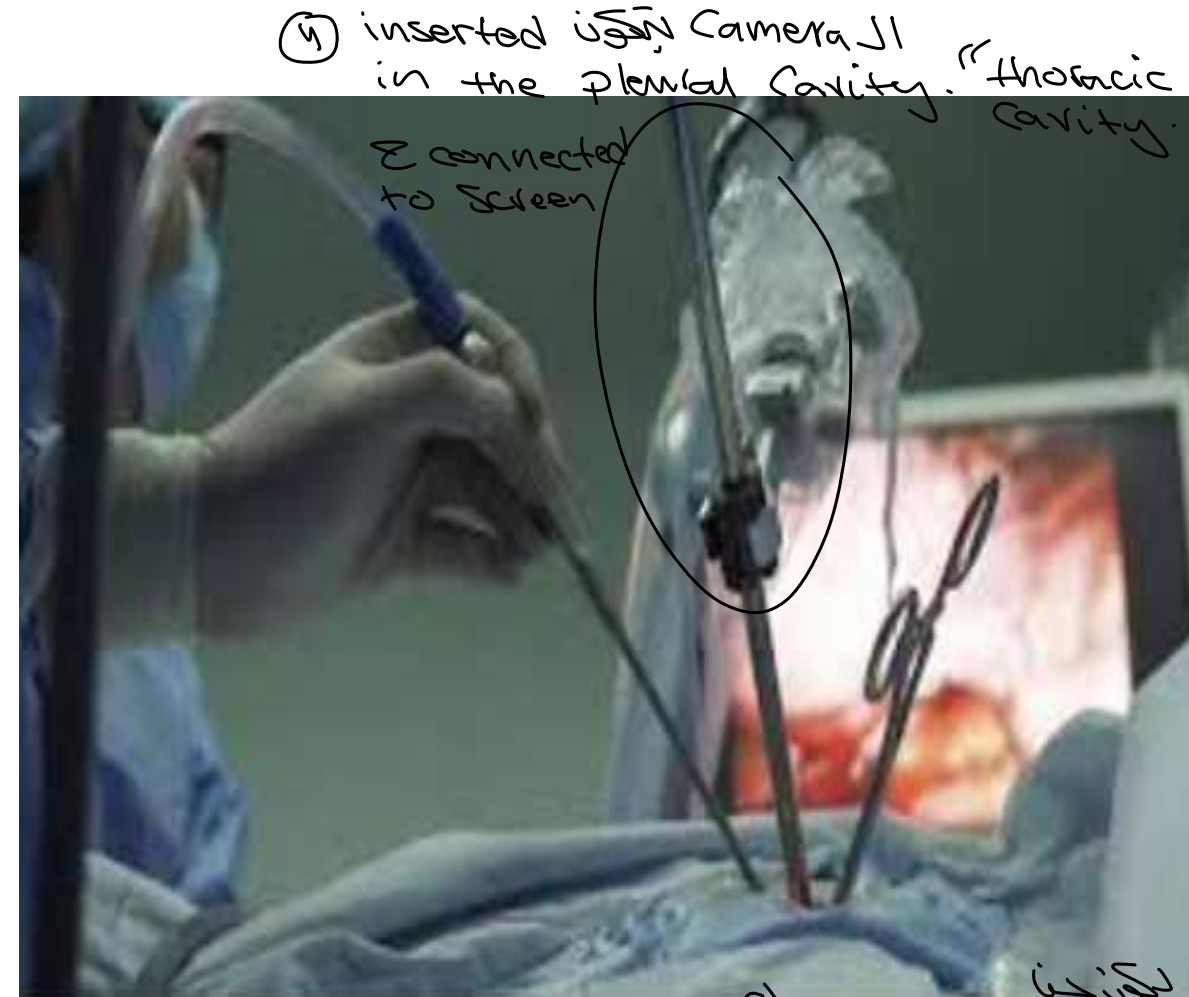
sample is → lymph node →

Histo - N → lymph node →

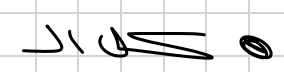
pathology →

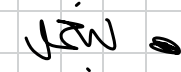
3] Video-Assisted Thoracoscopic Surgery (VATS)

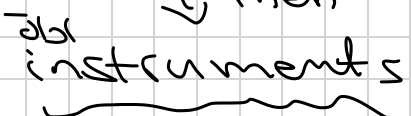
- Minimal Invasive
- Less pain
- Less hospitalization

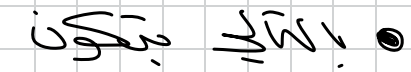


- ① long instrument *in view*
- ② Suction
- ③

Small Open chest procedure (VATS) 

Small incision in thoracic cavity. 

insert long ^{or} instruments 

(1) minimal invasive 

(2) less Pain

(3) less hospitalisation

chronic USG
2 week / 3 week
↓
USG = USG
Pleural effusion

Case 1

- 24-year-old male patient presented to the Emergency department complaining of right sided pleuritic chest pain on acute onset associated with Shortness of breath. O/E there is decreased breathing sounds on right side. His vital signs were within normal ranges except for tachypnea and oxygen saturation 89%.

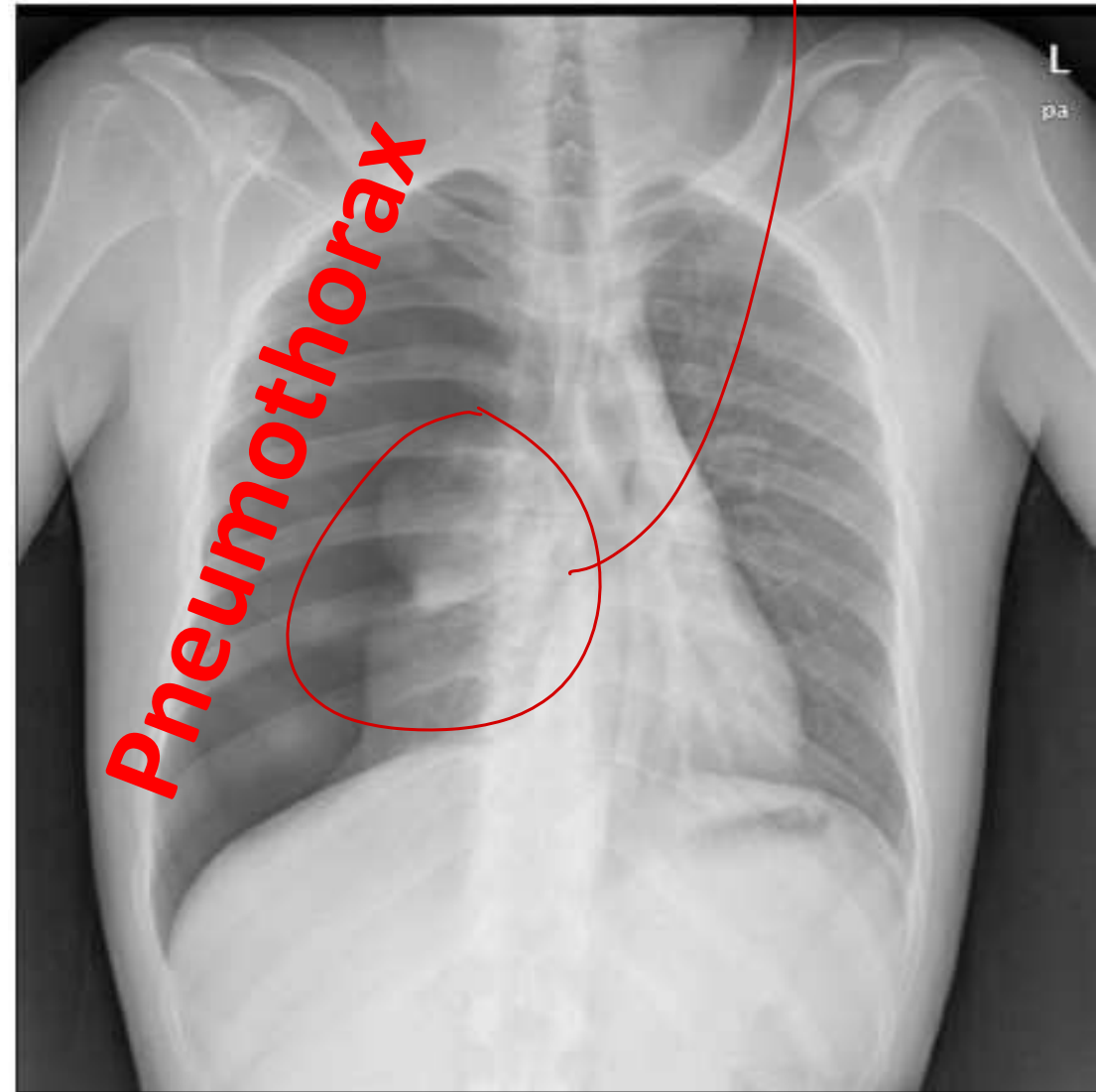
* treatment : Chest tube USG



Case 1

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- ① Chest tube inserted in the right pleural cavity
- ② Lung Expansion



list

- ① visceral line of the pleura
- ② decrease vascular marking
- ③ hyperlucent field



Pneumothorax.

+

- ④ tracheal deviation
- ⑤ mediastinal shifting
- ⑥ increase in intercostal space
- ⑦ depress diaphragm.

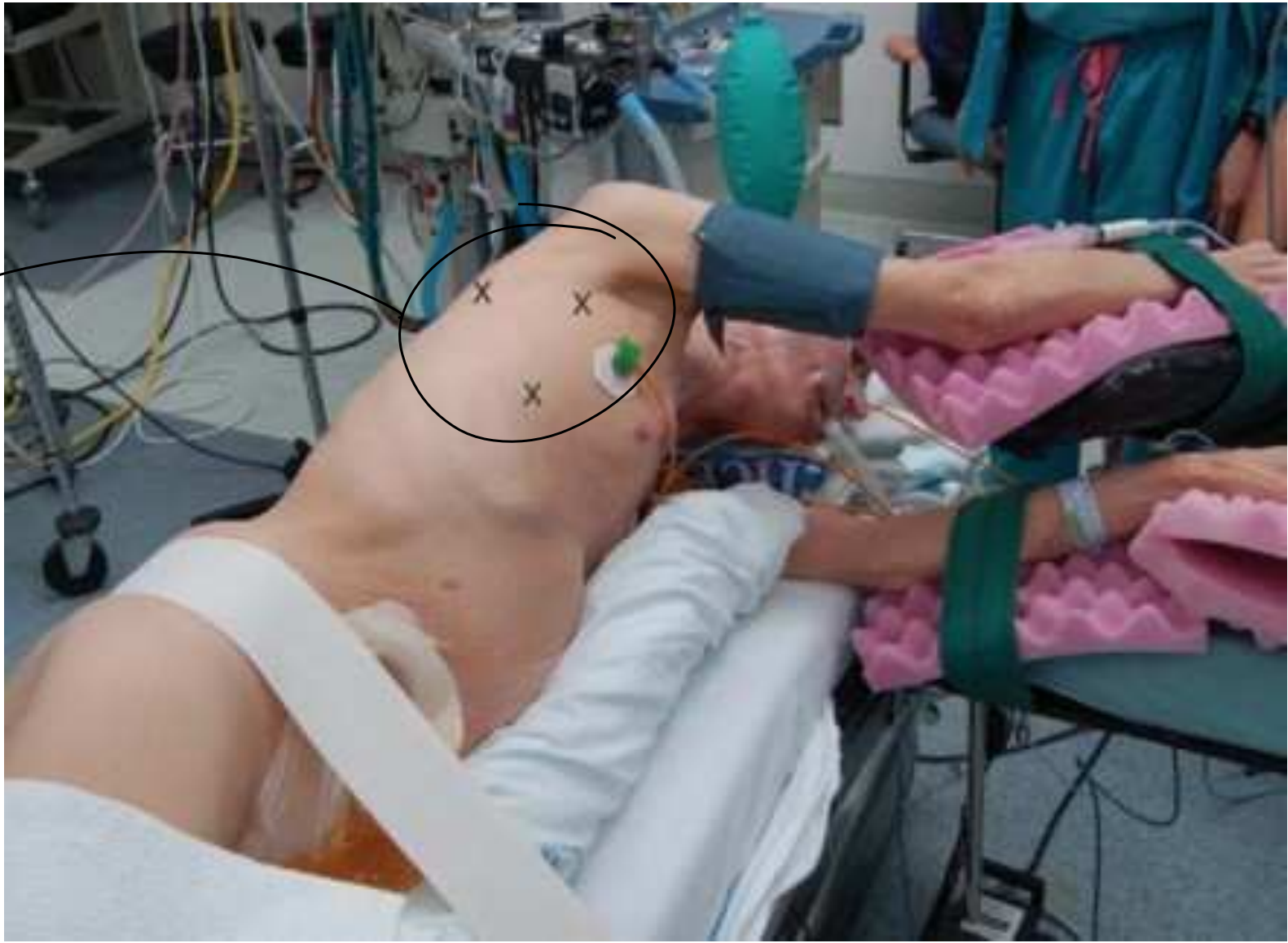


tension Pneumothorax.

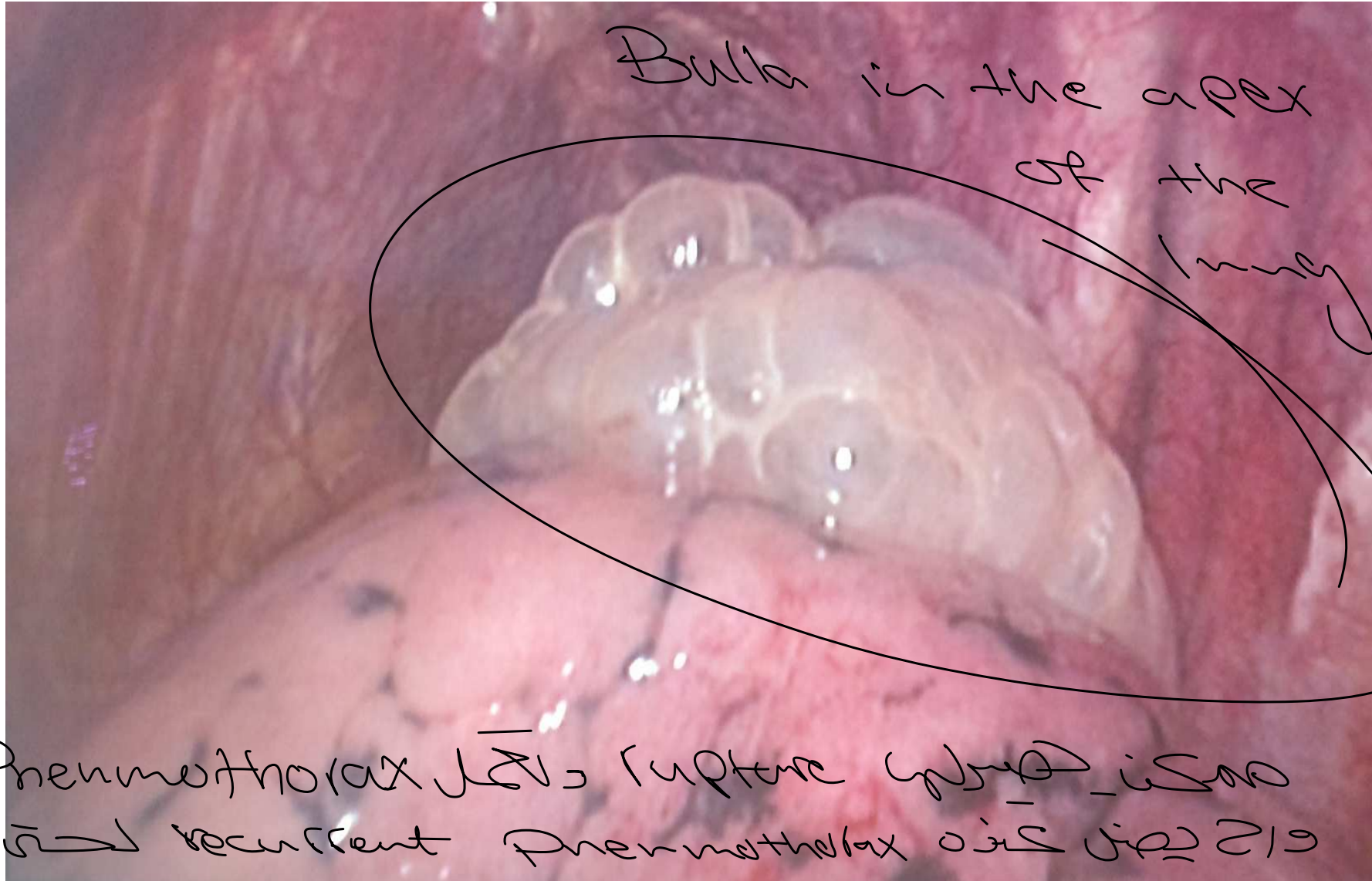
Case 1

- Same patient, Active air leak after 7 days
 - What is the next step ?

Surgery



↓
JANJIAN P, S1
VATS.



Bulla in the apex
of the
lung.

Pneumothorax JTB, rupture of bulla is seen
and recurrent pneumothorax is seen

Send it to histopathology & resect this Bulla

Indications of Surgery

- Recurrent Pneumothorax
- Prolonged air leak (> 5-7 days)
- High risk jobs (pilot, divers)

* Some of complication on Patient with
Pneumo thorax



Fig. 2 Clinical photograph shows our patient with (a) extensive subcutaneous emphysema causing closure of palpebral fissure;

→ Air will track from Pleural Cavity → mediastinum
→ up to the neck → Subcutaneous tissue.

Case 2

Pleural Effusion.

- 54-year-old female patient presented to the ED complaining of shortness of breath of 2 weeks duration associated with productive cough and fever. X-ray chest is shown.
- What is next ?



Pleural fluid sampling

- Cytology
- microbiology
- Biochemistry
 - PH
 - Glucose
 - Protein
 - LDH

Physiological Pleural Fluid

- **Pleural Fluid is clear ultrafiltrate of plasma, and composed of:**
 - **Cellular elements:**
 - **No RBC**
 - **WBC < 1000/mm³**
 - **Protein, Glucose, Ions, and Enzymes:**
 - **PH= 7.6 – 7.64**
 - **Protein: 10-20 g/L**
 - **Glucose level = Serum Level**
 - **LDH < 50% of Serum**

كثيرا يترى
Bleedy effusion ← Hemothorax.

* ليس Hct في pleural fluid
إذا كانت > 50% Hct
فإنها Blood

* إذا كان pleural fluid
Bleedy effusion

إذا لم يكن
It's
Cancer until proven
Other wise

Transudative effusion: is the result of increased formation or decreased absorption of pleural fluid caused by changes in the Starling forces.

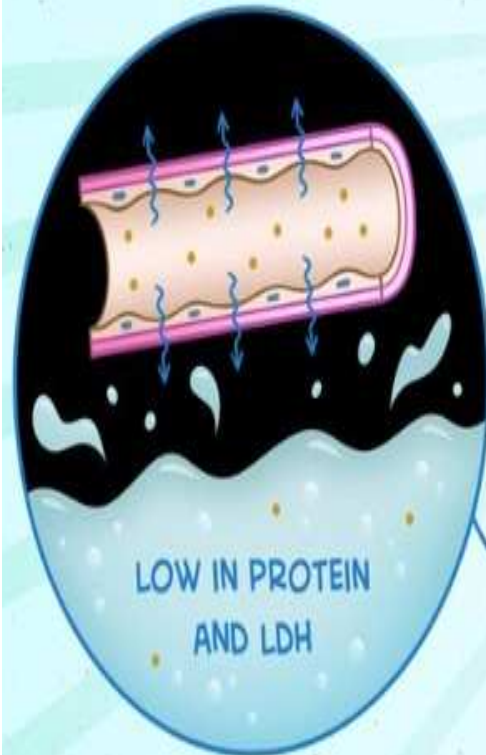
Exudative effusion : results from inflammatory or malignant alterations or diseases of the pleura itself. If analysis shows at least **ONE** of the following according to light's criteria:

- Pleural fluid protein/serum protein > 0.5
- Pleural fluid LDH/serum LDH > 0.6
- Pleural fluid LDH >2/3 of the upper limit of normal for the serum LDH.

TRANSUDATIVE

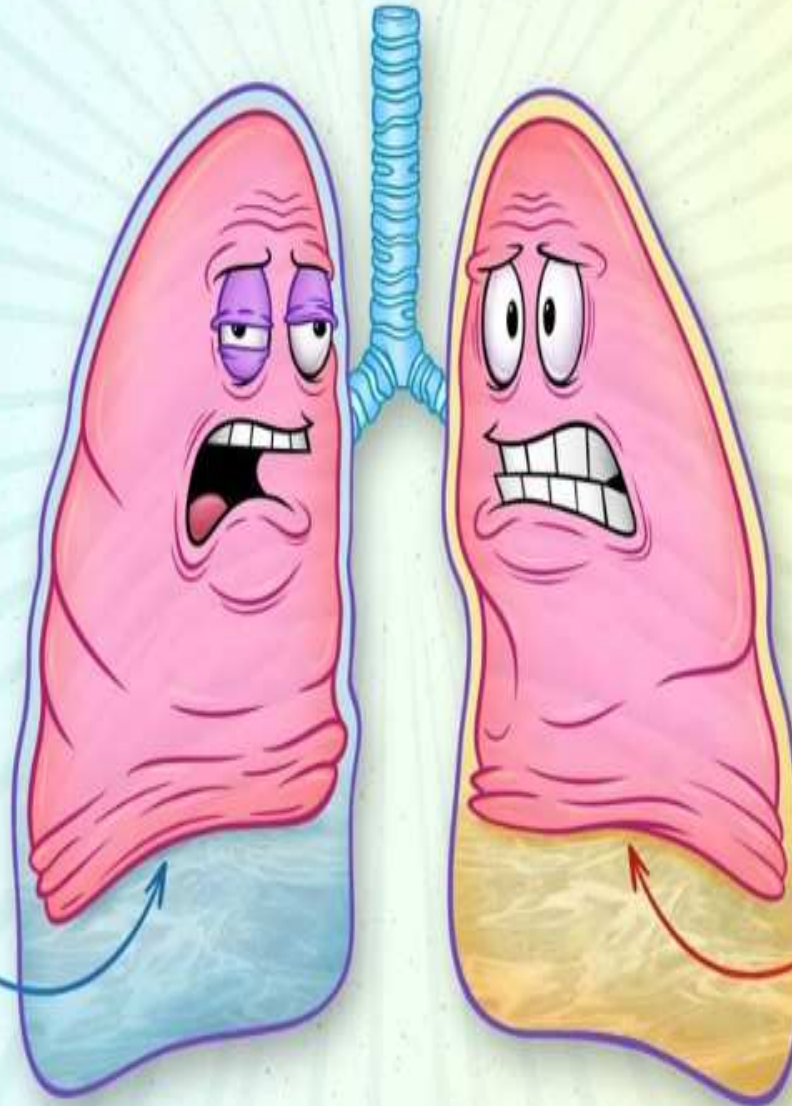
OCCURS DUE TO INCREASED
HYDROSTATIC PRESSURE OR LOW
PLASMA ONCOTIC PRESSURE

E.G., CHF, CIRRHOSIS, NEPHROTIC
SYNDROME, PE, HYPOALBUMINEMIA



PLEURAL EFFUSION

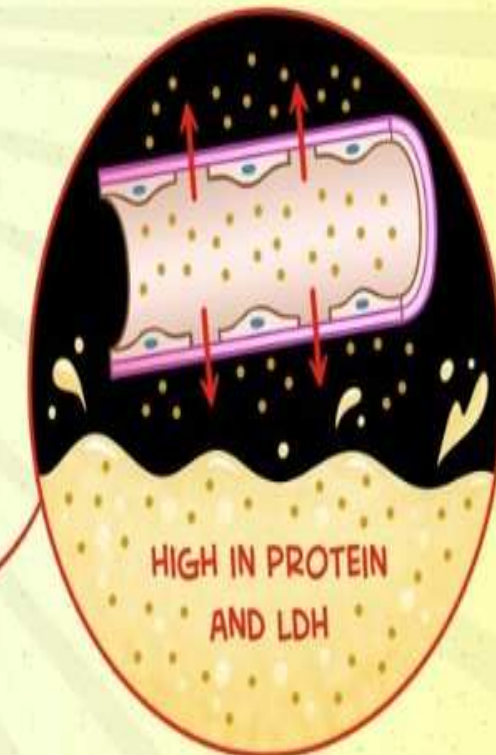
ACCUMULATION OF FLUID WITHIN THE PLEURAL SPACE



EXUDATIVE

OCCURS DUE TO
INFLAMMATION AND INCREASED
CAPILLARY PERMEABILITY

E.G., PNEUMONIA, CANCER, TB,
VIRAL INFECTION, PE, AUTOIMMUNE



Transudate

- LV Failure
- Cirrhosis
- Hypoalbuminemia
- Atelectasis
- Renal Failure
- Peritoneal Dialysis
- PE (10-20%)
- CA (5%)
- MV disease
- Constrictive pericarditis
- Meigs' syndrome

Exudate

- CA (95% of CA cases)
- Parapneumonic effusion
- TB
- SLE
- R. Arthritis
- Pancreatitis
- Esophageal Rupture
- Chylothorax
- Drugs (Amiodarone, phenytoin, methotrexate)

Case 2

- Empyema
 - Definition
 - Stages
 - Treatment
 - Goals of the treatment



Frank Pus is also Chest tube is used

Chest cavity. It is

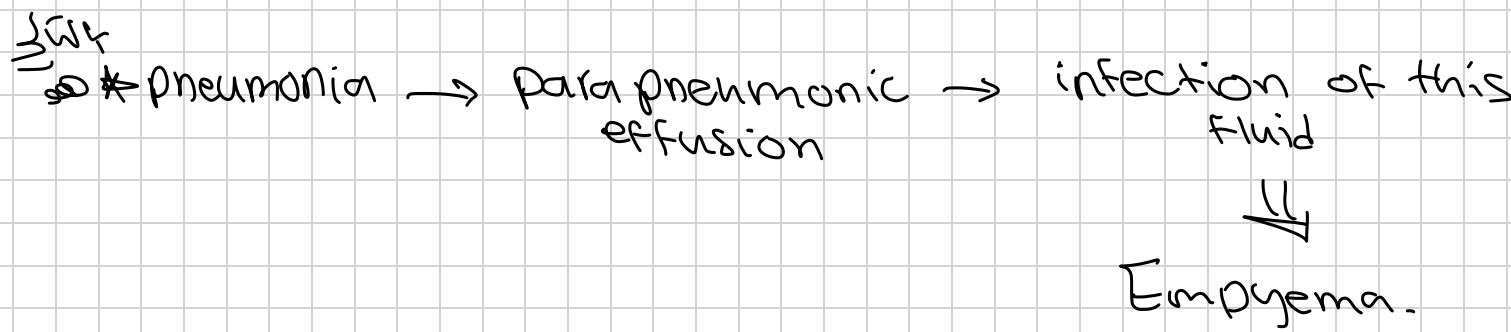


Empyema

Empyema is a collection of

recrudescent fluid ← Pneumonia is a collection of

around pneumonia Parapneumonic effusion



Diagnosis of thoracic empyema

Stage I
Exudative phase

Stage II
Fibrinopulent phase

Stage III
Organizing phase

- ① recurrent effusion
- ② Infection
- ③ restrictive pattern in pulmonary function test.

* free Pus
in this stage diagnosed early + chest tube is enough + Antibiotic

Handwritten notes in Arabic script.

* VATS can managed this case

Handwritten notes in Arabic script.

* thick layer around the lung
lung collapse
thoracotomy.

- Stage I → II in pleural cavity

Acidic environment, Acidic pus in lung *

Fibrinolysis system is deactivated

Pleural cavity is sealed



Chest tube is inserted, but loculated effusion is not drained

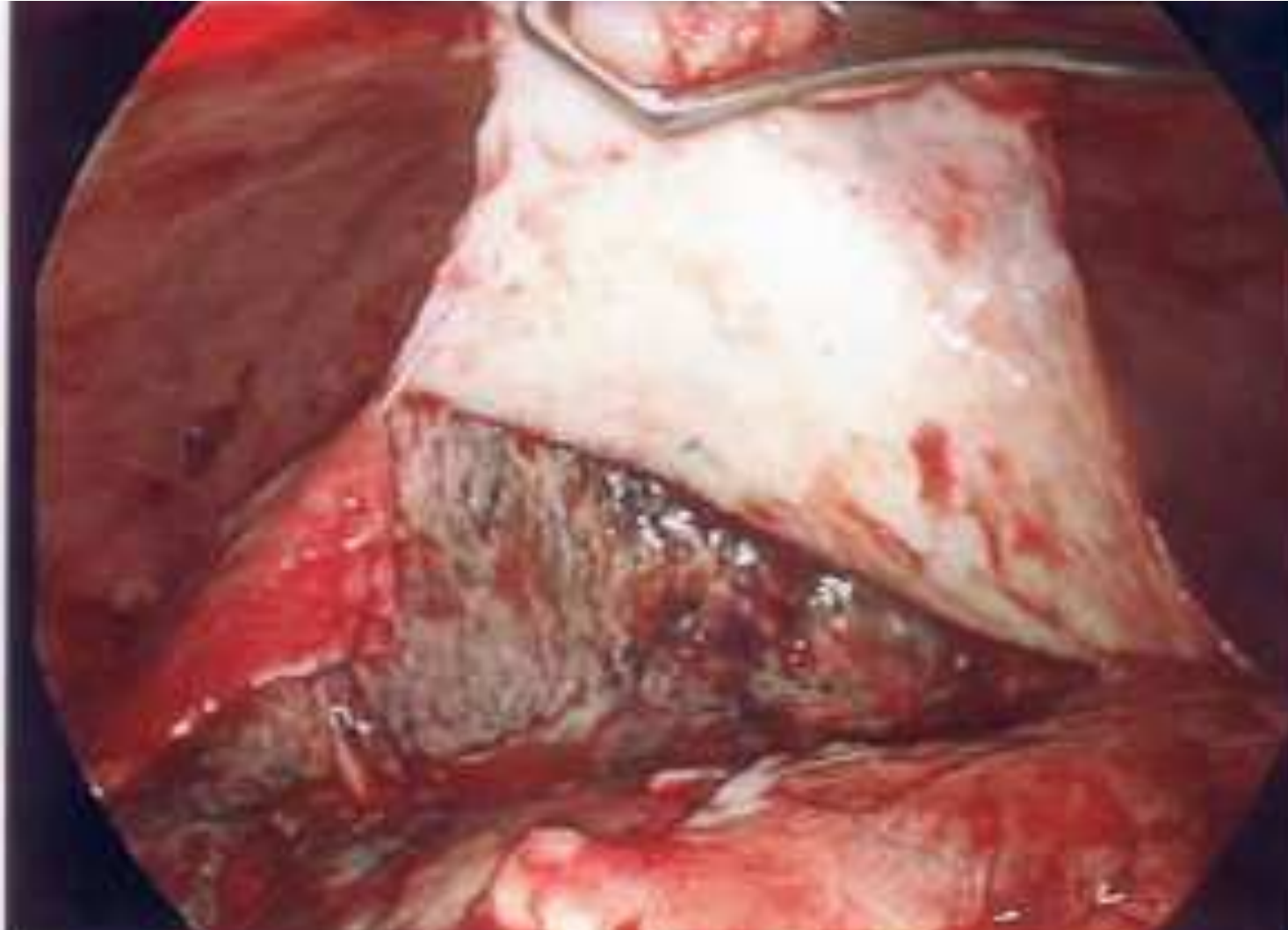
loculated effusion

Chest tube is inserted



Surgery is required

Stage 2
1) Severe inflamed lung.
2) thick layers.



Case 3

Patient with massive hemothorax.

- 23- year-old male patient presented to ED as a victim of Road traffic accident. After completing the primary survey, the patient was complaining of shortness of breath and tenderness over the left chest wall. X-ray chest was performed

What is your next step ?



Hemothorax : Blood inside the pleural cavity.

massive
hemothorax : 1500 ml or more

white = fluid.

pneumothorax = black

~> PC
X-ray.

- On insertion of chest tube, 1500 cc blood came out!

What is your next step ?

Emergency Thoracotomy



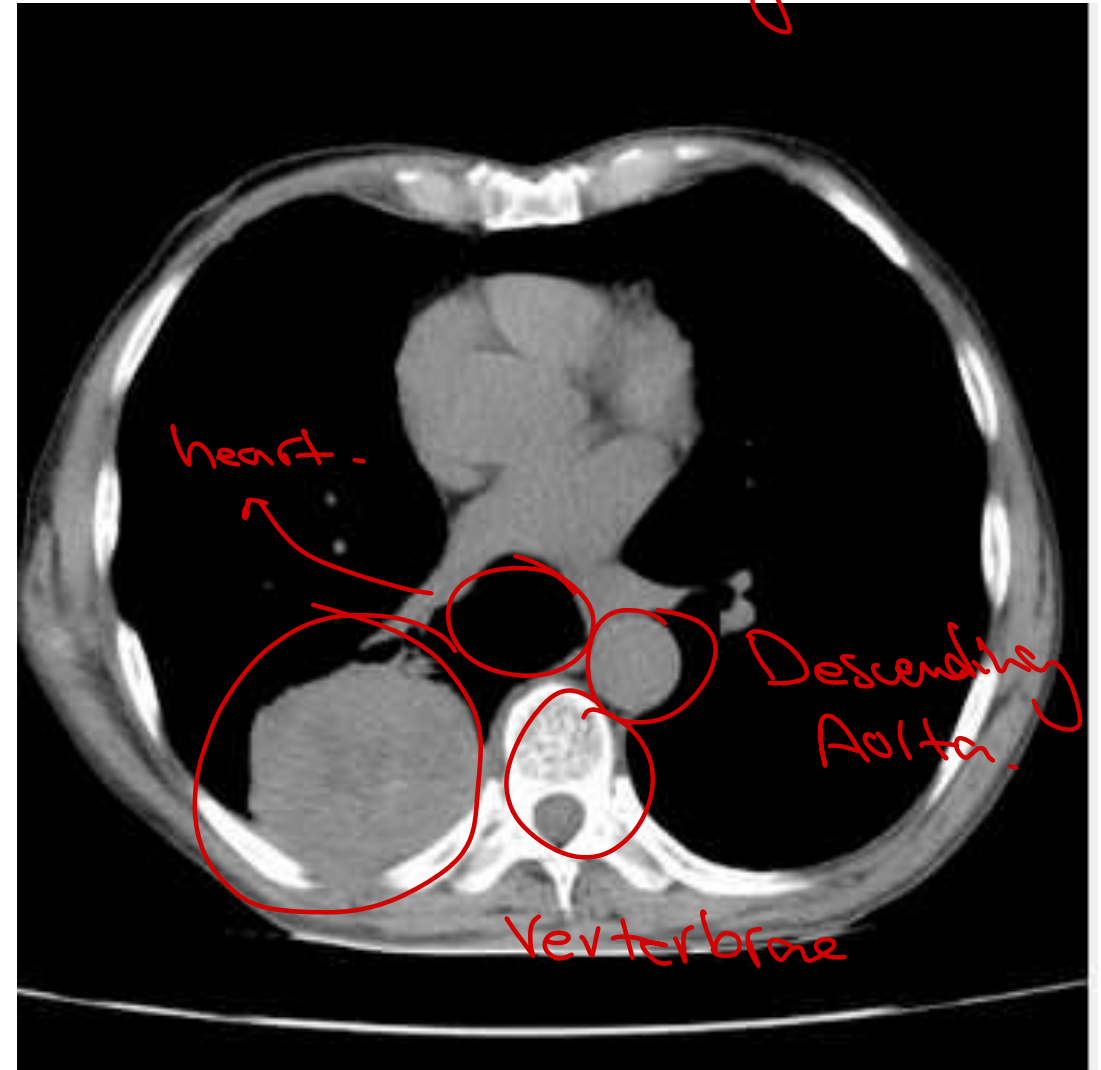
Case 4

Lung mass in the
Right lung.

- 60-year-old male patient, smoker, incidentally, found to have a lung mass on CT scan.

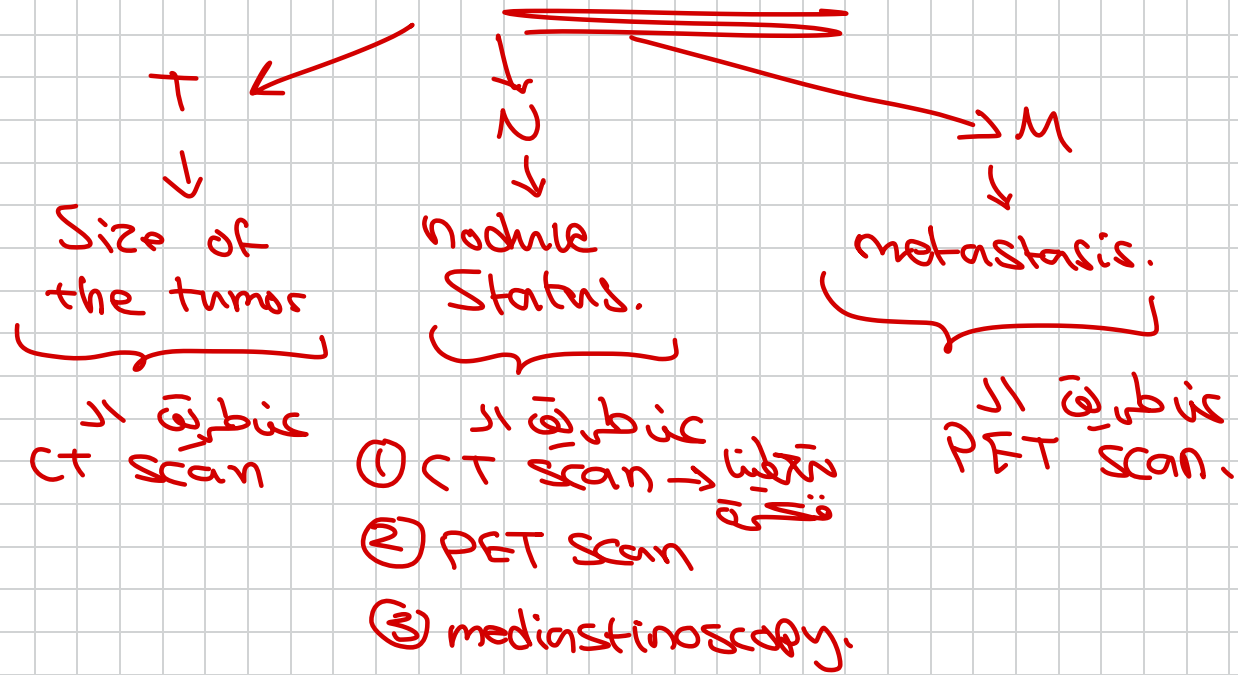
What is your next step ?

Clinical Staging



Patient لا يزال في المرحلة الأولى

Staging of Lung Cancer



Hematological and functional investigation

- CBC
- KFT, LFT, Electrolytes
- PFT (FEV1, VC)
- Diffusion DLCO
- Cardio-pulmonary exercise test.
- Perfusion ventilation scan

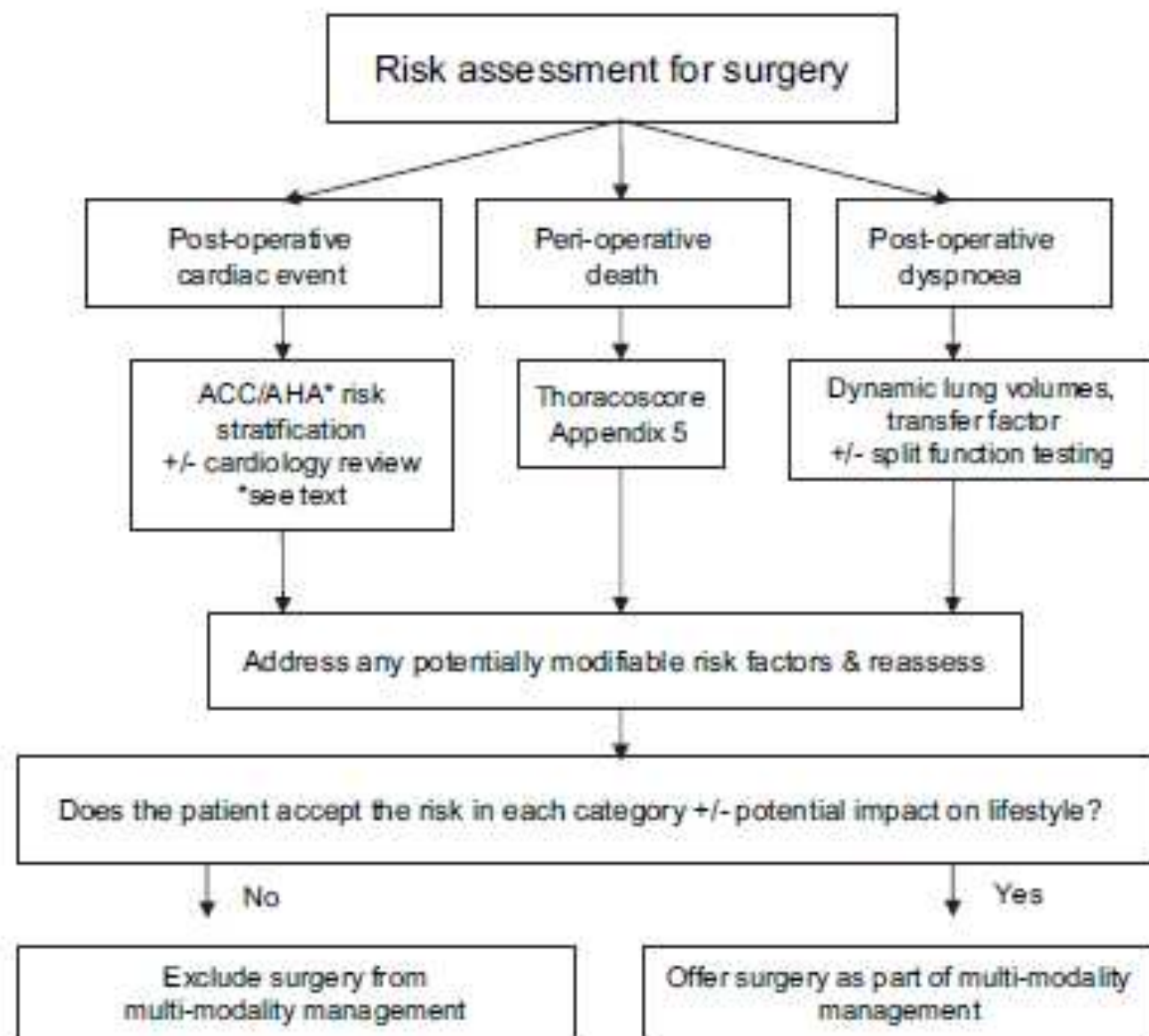


Figure 2 Tripartite risk assessment. ACC, American College of Cardiology; AHA, American Heart Association.

Radiological Evaluation

- CXR
- CT
- PET-CT
- PET

8th TNM staging system

- Invasive vs non-invasive
- Invasive
 - Bronchoscopy and Biopsy
 - Video-Mediastinoscopy
 - Endobronchial US and Biopsy (EBUS)
 - Endo-esophageal US and Biopsy (EUS)
 - Anterior mediastinoscopy
 - Video-assisted thoracoscopy
 - Transthoracic CT-guided biopsy

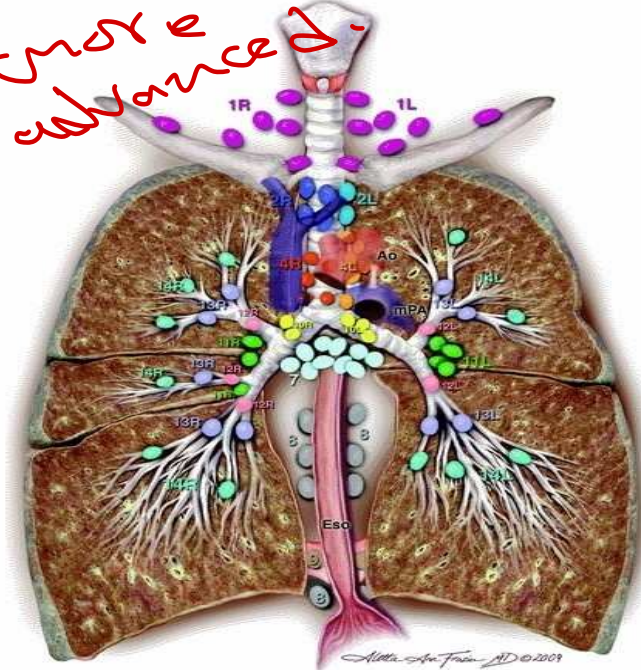
Primary Tumor (T)

T classification	T components on CT
Tis (AIS)	Pure GGN ≤ 3 cm
T1	<p>T1mi ≤ 0.5 cm solid part within part-solid tumor total size ≤ 3 cm</p> <p>T1a 0.6–1.0 cm solid part within part-solid tumor total size ≤ 3 cm Pure GGN >3 cm ≤ 1 cm solid tumor</p> <p>T1b 1.1–2.0 cm solid part within part-solid tumor total size ≤ 3 cm >1–2 cm solid tumor</p> <p>T1c 2.1–3 cm solid part within part-solid tumor total size ≤ 3 cm >2–3 cm solid tumor</p>
T2	<p>T2a 3.1–4 cm Involves main bronchus without involvement of carina</p> <p>T2b 4.1–5 cm Total partial atelectasis Total partial pneumonitis Involves hilar fat Involves visceral pleura (PL1 or PL2)</p>
T3	5.1–7 cm Separate tumor nodules in the same lobe as the primary Involves parietal pleura (PL3) Parietal pericardium Chest wall Phrenic nerve
T4	>7 cm Involves diaphragm Mediastinal fat or other mediastinal structures (trachea, great vessels, heart, recurrent laryngeal nerve, esophagus) Carina Vertebral body Visceral pericardium Separate tumor nodules in the same lung but different lobes as the primary

Nodal Status (N)

N	classification	N component on CT
N0		No lymph node metastasis
N1		Ipsilateral peripheral, intrapulmonary or hilar nodes metastasis
N2		Ipsilateral mediastinal (upper, aortico-pulmonary, lower), subcarinal nodes metastasis
N3		Ipsilateral or contralateral supraclavicular/scalene lymph node or contralateral mediastinal, hilar/interlobar, or peripheral nodes metastasis

more advanced.



Supraclavicular zone

- 1 Low cervical, supraclavicular, and sternal notch nodes

SUPERIOR MEDIASTINAL NODES

Upper zone

- 2R Upper Paratracheal (right)
- 2L Upper Paratracheal (left)
- 3a Prevascular
- 3p Retrotracheal
- 4R Lower Paratracheal (right)
- 4L Lower Paratracheal (left)

AORTIC NODES

AP zone

- 5 Subaortic
- 6 Para-aortic (ascending aorta or phrenic)

INFERIOR MEDIASTINAL NODES

Subcarinal zone

- 7 Subcarinal

Lower zone

- 8 Paraesophageal (below carina)
- 9 Pulmonary ligament

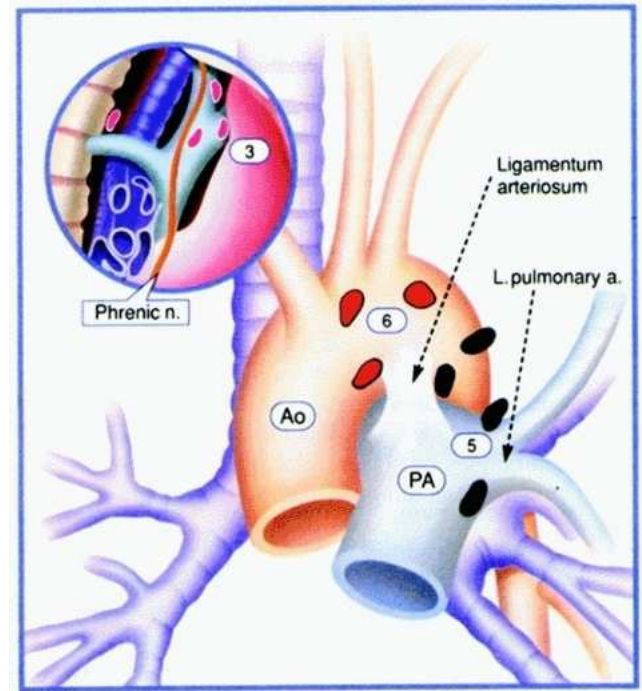
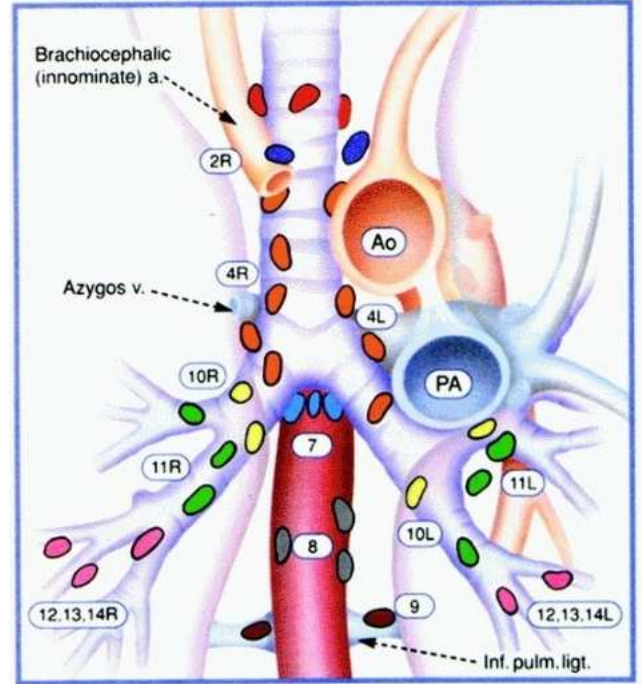
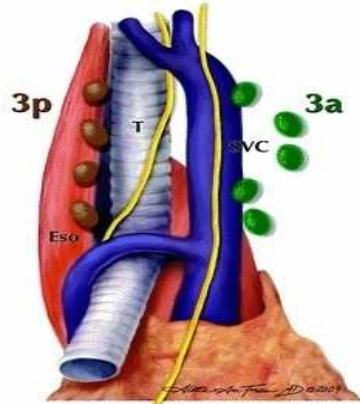
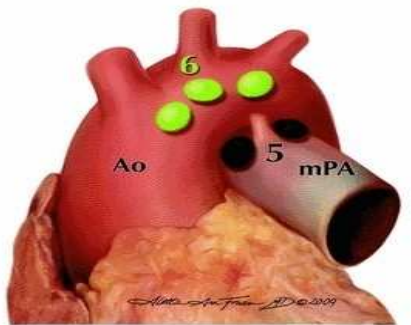
N1 NODES

Hilar/Interlobar zone

- 10 Hilar
- 11 Interlobar

Peripheral zone

- 12 Lobar
- 13 Segmental
- 14 Subsegmental



Superior Mediastinal Nodes

- 1 Highest Mediastinal
 - 2 Upper Paratracheal
 - 3 Pre-vascular and Retrotracheal
 - 4 Lower Paratracheal (including Azygos Nodes)
- N₂* = single digit, ipsilateral
N₃ = single digit, contralateral or supraclavicular

Aortic Nodes

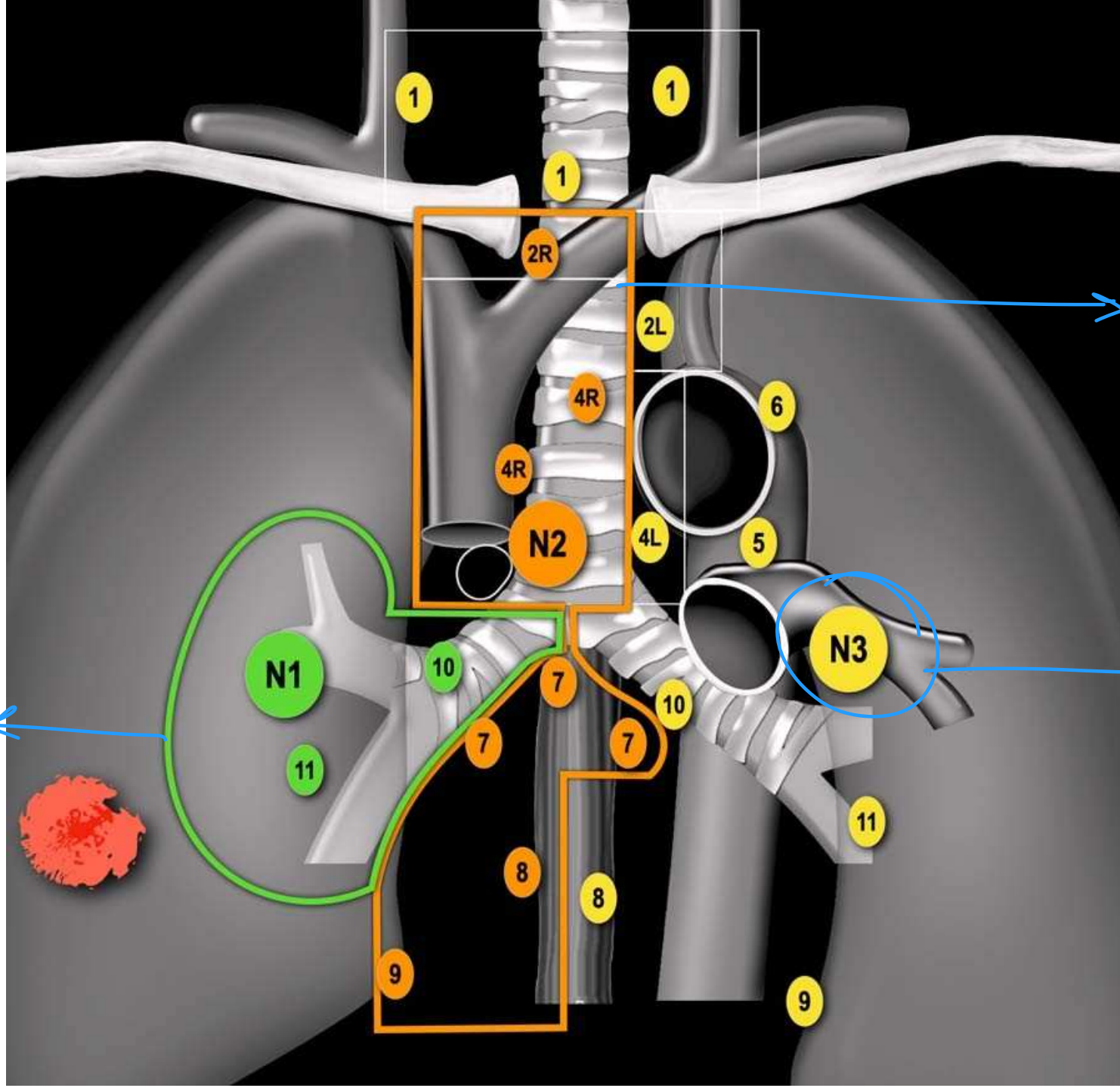
- 5 Subaortic (A-P window)
- 6 Para-aortic (ascending aorta or phrenic)

Inferior Mediastinal Nodes

- 7 Subcarinal
- 8 Paraesophageal (below carina)
- 9 Pulmonary Ligament

N₁ Nodes

- 10 Hilar
- 11 Interlobar
- 12 Lobar
- 13 Segmental
- 14 Subsegmental

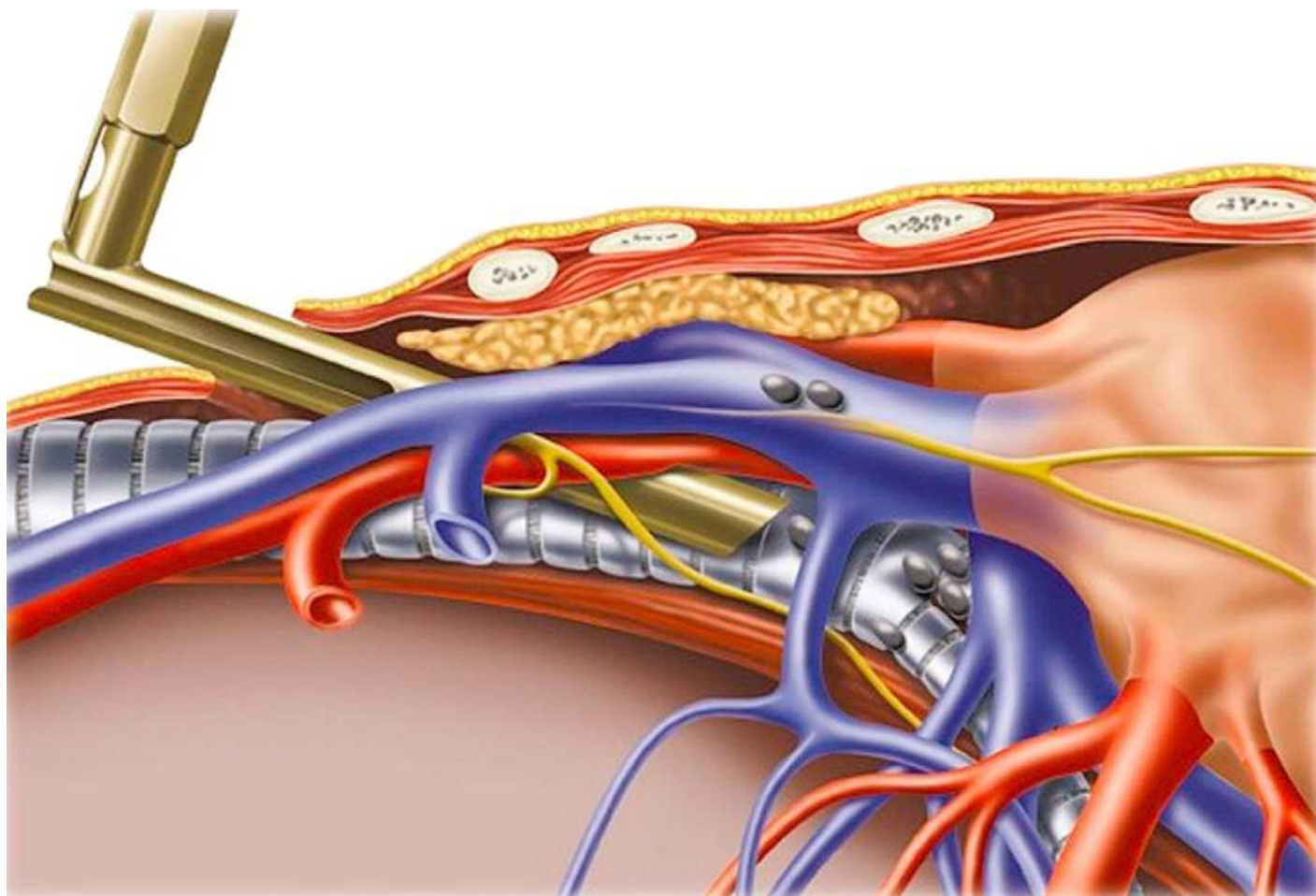


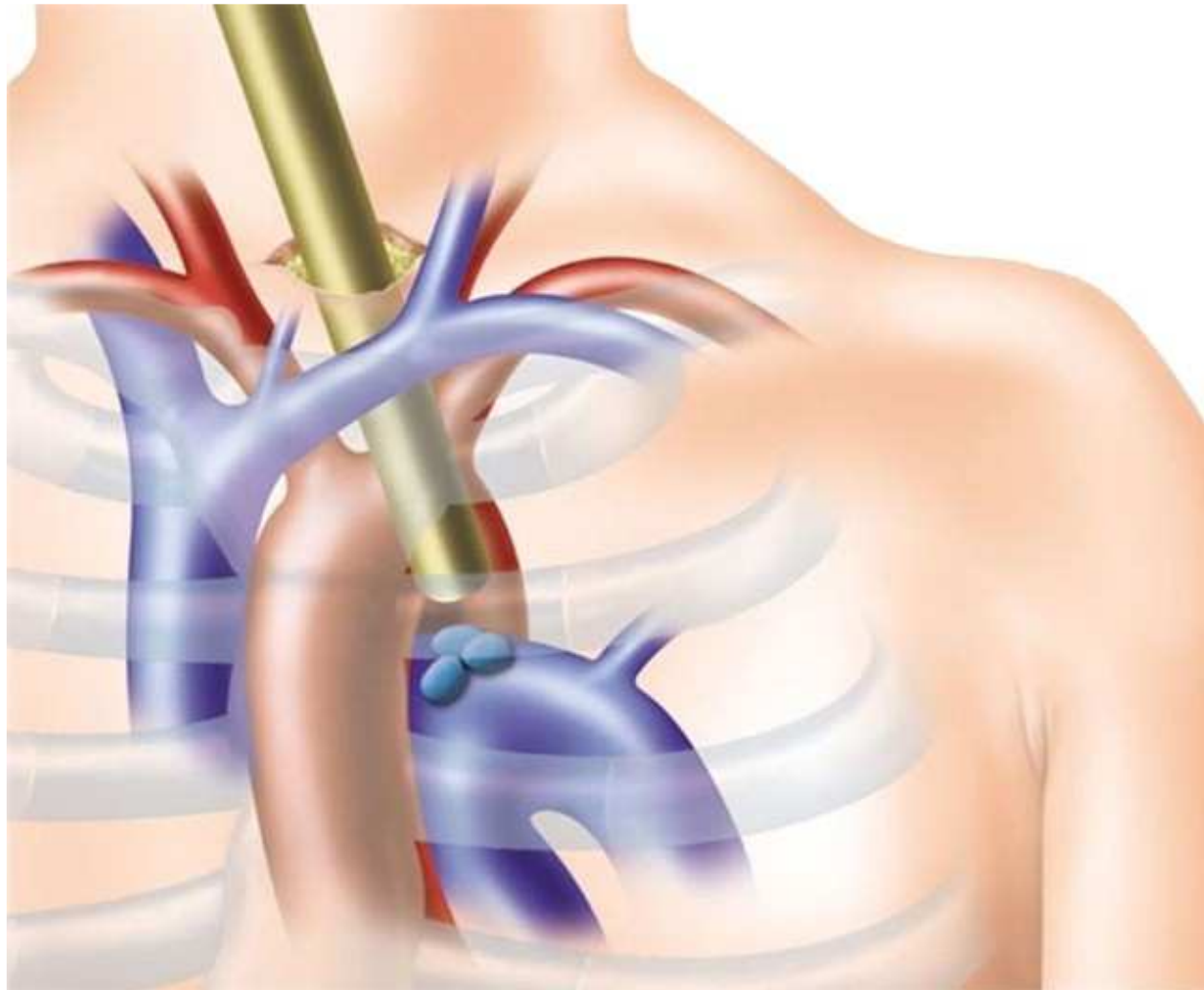
Ipsilateral

mediastinal.

Contralateral
of
Subclavicular

Video-Mediastinoscopy





Distant Metastasis (M)

M classification	M component on CT
M0	No distal metastasis
M1	M1a Intrathoracic metastasis
	Pleural effusion
	Pericardial effusion
	Contralateral lung nodules/pleural nodules
M1b	Single extrathoracic metastasis in a single organ
M1c	Multiple extrathoracic metastasis

از ام ریگیا کجند
 Pleural effusion
 متاستاز
 ممکن است
 کجند
 متاستاز

از ام ریگیا کجند
 Pleural effusion
 متاستاز
 ممکن است
 کجند
 متاستاز

از ام ریگیا کجند
 Pleural effusion
 متاستاز
 ممکن است
 کجند
 متاستاز
 Cytology malignant cell
 this patient is M1

از ام ریگیا کجند
 Cells
 متاستاز
 ممکن است
 کجند
 متاستاز
 Paramalignant D.F.

8th TNM staging system

		N0	N1	N2	N3
M0	Tis	0			
	T1mi	IA1			
	T1a	IA1	IIB	IIIA	IIIB
	T1b	IA2	IIB	IIIA	IIIB
	T1c	IA3	IIB	IIIA	IIIB
	T2a	IB	IIB	IIIA	IIIB
	T2b	IIA	IIB	IIIA	IIIB
	T3	IIB	IIIA	IIIB	IIIC
	T4	IIIA	IIIA	IIIB	IIIC
M1a	Tx	IVA	IVA	IVA	IVA
M1b	Tx	IVA	IVA	IVA	IVA
M1c	Tx	IVB	IVB	IVB	IVB

8th TNM staging system

		N0	N1	N2	N3
M0	Tis	0			
	T1mi	IA1			
	T1a	IA1	IIB	IIIA	IIIB
	T1b	IA2	IIB	IIIA	IIIB
	T1c	IA3	IIB	IIIA	IIIB
	T2a	IB	IIB	IIIA	IIIB
	T2b	IIA	IIB	IIIA	IIIB
	T3	IIB	IIIA	IIIB	IIIC
	T4	IIIA	IIIA	IIIB	IIIC
M1a	Tx	IVA	IVA	IVA	IVA
M1b	Tx	IVA	IVA	IVA	IVA
M1c	Tx	IVB	IVB	IVB	IVB