대한흉부심장혈관외과학회

전공의 연수교육

2021. 05. 13 Thu - 14 Fri | On-line

폐수술의 합병증

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황진욱

강의 내용

STS GTSD Lung cancer resection risk model (2016)

Prolonged Air Leak (PAL)

Bronchopleural fistula and post pneumonectomy (lobectomy) empyema

Lobar torsion and gangrene

Post Operative Atrial Fibrillation (POAF)

STS GTSD Lung Cancer Resection Risk Model 2016

Table 1. Patient Baseline Characteristics

Variable	Values
Total	27,844 (100)
Age, years	67.2 ± 10.1
Male	12,647 (45.4)
Race	
White	24,099 (87.0)
Black	2,369 (8.6)
Other	1,217 (4.4)
Body mass index, kg/m^{2}[a]	27.6 ± 6.2
Coronary artery disease	6,196 (22.3)
Diabetes mellitus	5,158 (18.5)
Renal dysfunction	504 (1.8)
Induction chemotherapy or radiation	1,801 (6.5)
Cigarette smoking	
Never	3,895 (14.0)
Past (stopped more than 1 month)	17,368 (62.4)
Current	6,581 (23.6)
Steroids	965 (3.5)
Minimally invasive	17,153 (61.6)
Thoracotomy	10,691 (38.4)
Primary procedure	
Wedge resection	5 (13.7)
Segmentectomy	(6.1)
Lobectomy	6 (71.2)
Sleeve lobectomy	412 (1.5)
Bilobectomy	980 (3.5)
Pneumonectomy	1,116 (4.0)

27,844

61.6%

Table 2. Frequency of Complications

Variable	Values
Tracheostomy	283 (1.0)
Reintubation	899 (3.2)
Initial ventilatory support >48 hours	148 (0.5)
Adult respiratory distress syndrome	
Bronchopleural fistula	
Pulmonary embolus	131 (0.5)
Pneumonia	
Unexpected return to operating room	
Myocardial infarction	
Deep vein thrombosis requiring treatment	
Atrial arrhythmia requiring treatment	
Renal failure, RIFLE criteria	209 (0.8)
Blood transfusion	
Intraoperative	
Postoperative	
Sepsis	
Chylothorax	
Requiring surgical ligation	49 (0.2)
Medical treatment only	100 (0.4)
Recurrent laryngeal nerve paralysis	139 (0.5)

0.5%

4.0%

3.8%

10.7%

2.5%

5.2%

STS GTSD Lung Cancer Resection Risk Model 2016

Table 3. Mortality, Major Morbidity, and Composite Mortality or Major Morbidity Rates Stratified by Procedure Type

Procedure	Mortality	Major Morbidity	Composite Mortality or Major Morbidity
Wedge	0.8 (30/3,815)	5.3 (204/3,815)	5.6 (214/3,815)
Segmentectomy	0.8 (14/1,685)	6.5 (109/1,685)	7.0 (118/1,685)
Lobectomy	1.3 (262/19,836)	9.3 (1,852/19,836)	9.7 (1,920/19,836)
Sleeve lobectomy	1.7 (7/412)	12.1 (50/412)	12.9 (53/412)
Bilobectomy	3.4 (33/980)	15.3 (150/980)	15.7 (154/980)
Pneumonectomy	4.9 (55/1,116)	16.1 (180/1,116)	17.5 (195/1,116)

Values are % (n/N).

STS GTSD Lung Cancer Resection Risk Model 2016

Table 4. Predictors of Mortality, Major Morbidity, and Composite Mortality and Major Morbidity[a]

Variable	Mortality Model OR (95% CI)	*p* Value	Major Morbidity Model OR (95% CI)	*p* Value	Composite Model (Mortality or Major Morbidity) OR (95% CI)	*p* Value
Body mass index, kg/m^2		0.006		<0.001		<0.001
≥18.5 to <25	1.00		1.00		1.00	
≥6.0 to <18.5	1.44 (0.85–2.44)		1.33 (1.07–1.65)		1.35 (1.09–1.66)	
≥25.0 to <30.0	0.96 (0.75–1.22)		0.83 (0.75–0.91)		0.83 (0.75–0.92)	
≥30.0 to <35.0	0.61 (0.43–0.85)		0.72 (0.64–0.82)		0.72 (0.63–0.82)	
≥35.0 to ≤99.9	1.17 (0.82–1.67)		0.81 (0.69–0.96)		0.83 (0.71–0.97)	
Cigarette smoking		0.14		<0.001		<0.001
Never	1.00		1.00		1.00	
Past smoker	1.54 (1.00–2.38)		1.20 (1.02–1.41)		1.23 (1.05–1.44)	
Current smoker	1.54 (0.96–2.49)		1.64 (1.38–1.94)		1.64 (1.38–1.94)	
Approach		<0.001		<0.001		<0.001
Minimally invasive	1.00		1.00		1.00	
Thoracotomy	1.87 (1.49–2.36)		1.49 (1.35–1.64)		1.51 (1.37–1.66)	
Procedure		<0.001		<0.001		<0.001
Wedge	1.00		1.00		1.00	
Segmentectomy	0.98 (0.51–1.88)		1.19 (0.93–1.53)		1.24 (0.97–1.57)	
Lobectomy	1.69 (1.14–2.53)		1.96 (1.67–2.30)		1.93 (1.65–2.26)	
Sleeve	1.72 (0.72–4.09)		1.93 (1.36–2.75)		1.96 (1.39–2.77)	
Bilobectomy	3.57 (2.09–6.12)		2.98 (2.34–3.80)		2.91 (2.29–3.70)	
Pneumonectomy	4.80 (2.87–8.02)		2.74 (2.15–3.48)		2.83 (2.24–3.58)	

Prolonged Air Leak

Prolonged air leak after lung surgery defined by STS database:

postoperative days 5

Incidence: 8~26% (most common)

delayed length of stay, increase hospital cost, vulnerable to empyema

Prolonged Air Leak

"Alveolarpleural fistula"

Communication between the distal to segmental bronchus and pleural space

Cerfolio 1998

Post operation air leak:

POD#1 : 30~50% POD#2 : 20%

Brunelli 2004

Prolonged Air Leak (PAL) : 8~15%

TABLE 1] Cerfolio Classification of Air Leaks

Grade 1, FE	During forced expiration only, typically when asking the patient to cough
Grade 2, E	Expiratory only
Grade 3, I	Inspiratory only
Grade 4, C	Continuous bubbling present in the air leak chamber during both inspiration and expiration. These leaks tend to be large and are more likely to be seen in patients receiving positive-pressure ventilation.

Prolonged Air Leak

Risk Factors

poor pulmonary function

Chronic use of steroids

upper lobectomy

sublobar resection (segmentectomy)

presence of a pneumothorax with coinciding an air leak

the presence of pleural adhesions

Prolonged Air Leak

Air leak points

torn or denuded of the visceral pleura

incomplete fissure division

staple lines

the raw surface following segmentectomy

Non-anatomic resections for benign or metastatic lesion

Prolonged Air Leak

Intraoperative prevention

Mobilization of all pleural adhesion

Division of Inferior pulmonary ligament

Apical pleural tenting at upper lobectomy

Pneumoperitoneum at lower lobectomy

Transient diaphragmatic paralysis

Synthetic/fibrin sealant

Staple line buttressing

Prolonged Air Leak

Postoperative chest tube management

Water seal

Reduced suction

Part time-suction

Without large amount
or symptomatic
pneumothorax

Persistent Residual Space (PRS)

Compensations to reduce residual spaces

Expansion of the residual lung

Mediastinal shift

Narrowing of the intercostal spaces

Elevation of the diaphragm

Development of a space

Large or persistent air leak

Bilobectomy/ Leave only LLL basal segment

Fibrosis

Remaining disease to limit expansion of lung/ Incomplete decortication

Post op atelectasis

Fixed mediastinum d/t prior inflammation

Prolonged Air Leak

Non-surgical management

Watchful waiting :a few weeks

One-way valve (small, stable): after provocative clamping trial

Chemical pleurodesis :Tetracycline, Talc, Doxycline OK-436, Mistletoe, autologo us blood

Prolonged Air Leak

Surgical management

Unidirectional endobronchial valve

Decortication

Parietal pleurectomy and mechanical pleurodesis

Muscle or omental transposition

Completion lobectomy

Thoracoplasty/Open thoracotomy window

Bronchopleural Fistula & Post Pneumonectomy (Lobectomy) Empyema

Definition

a communication between the pleural space and the bronchial tree.

Incidence

1.5%~2.8% after pulmonary lobar resection and pneumonectomy

Bronchopleural fistula & Post pneumonectomy (lobectomy) empyema

Risk factors

poor nutrition

septic condition associated underlying infection

TB, Aspergillosis etc

Excessive long stump-> as proximal as possible

Bronchial blood supply: technique of stump closure

Irradiated stump or disease stump

Bronchopleural fistula & Post pneumonectomy (lobectomy) empyema

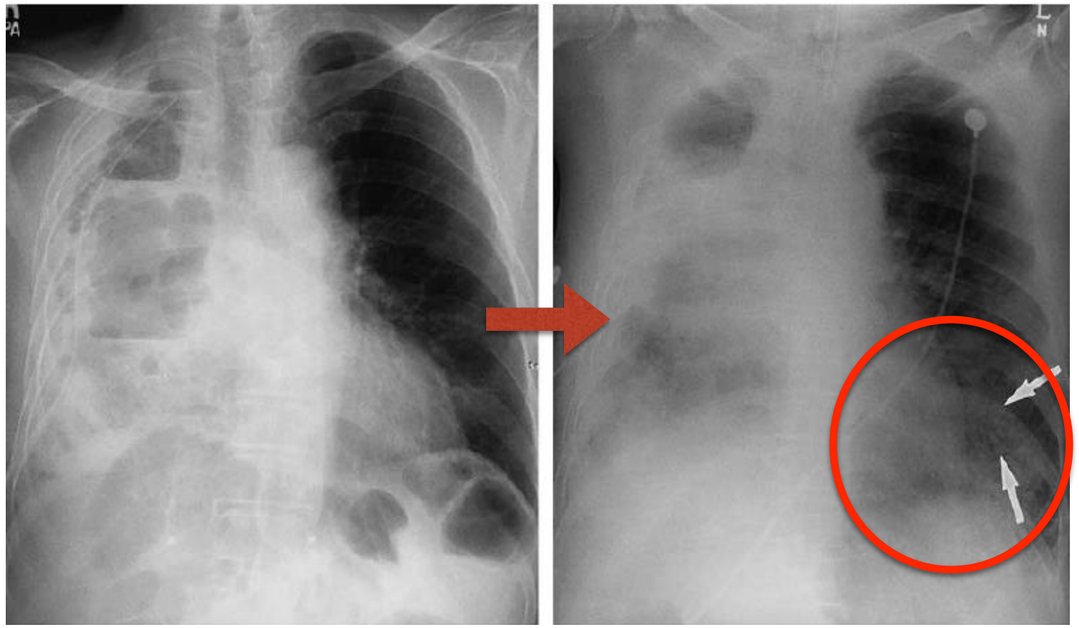
Prevention

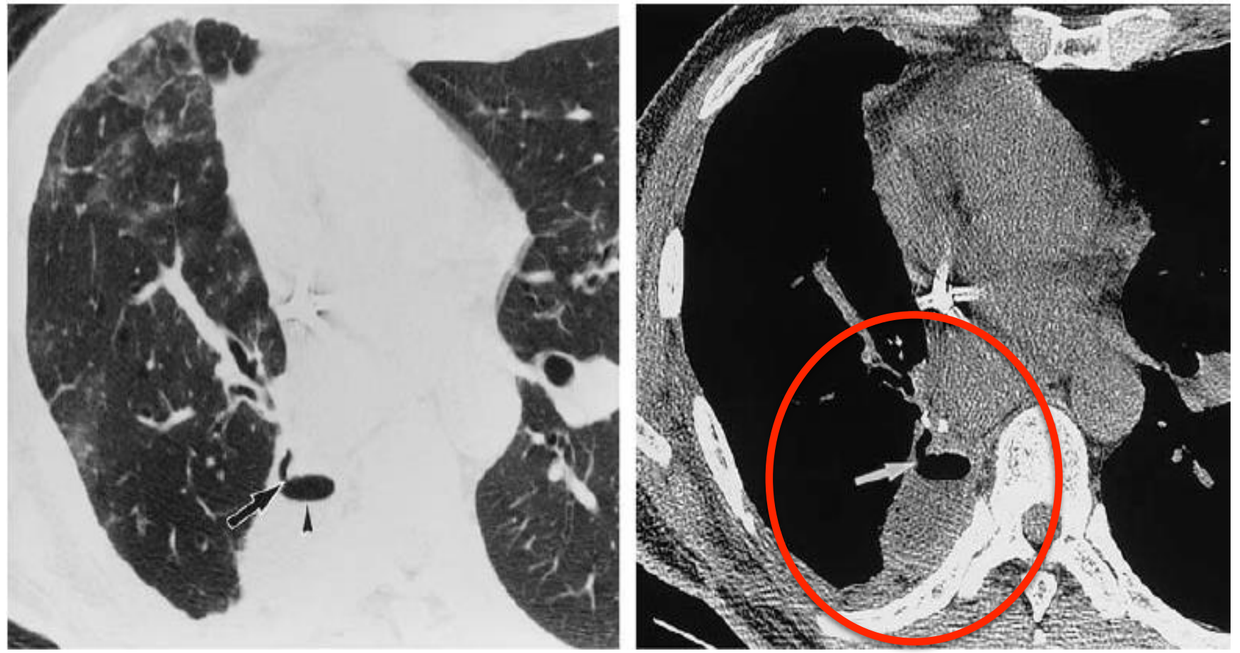
Stump closure techniques:

- Interrupted suture
- Stump coverage: Omentum or pedicled intercostal muscle or mediastinal fat

Preoperative bronchoscopy

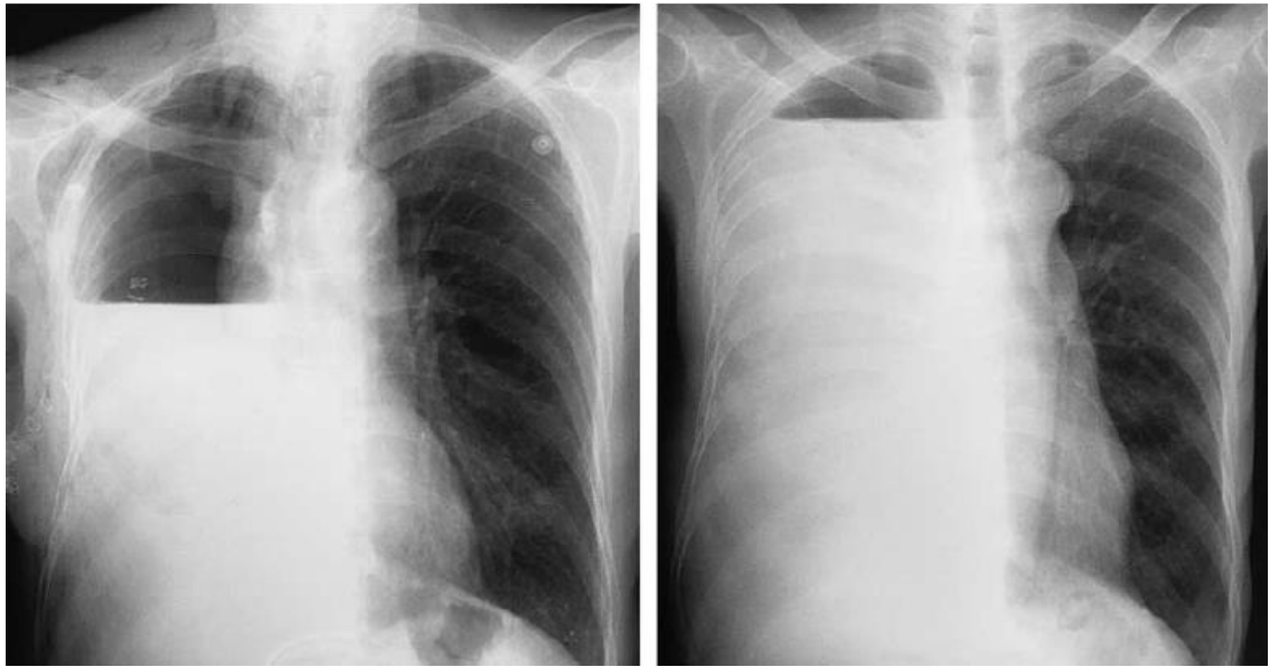
Bronchopleural fistula & Post pneumonectomy (lobectomy) empyema





POD#4

Post pneumonectomy (lobectomy) empyema



POD #5 months

Bronchopleural fistula &Post pneumonectomy (lobectomy) empyema

Management

Acute post pneumonectomy BPF

Debridement of bronchial stump

Interrupted suture

Stump coverage: Omentum or pedicled intercostal muscle or mediastinal fat

Omentum
Serratus anterior
Latissimus dorsi
Pectoralis major
Rectus abdominis

Chronic pneumonectomy fistula

Open window thoracostomy or Eloesser flap

Intrathoracic muscle transposition

Thoracoplasty

Vacuum Assisted Closure Device

Long bronchial stump

Transsternal approach for re-amputation

Open window thoracostomy or Clagett procedure

Open thoracostomy

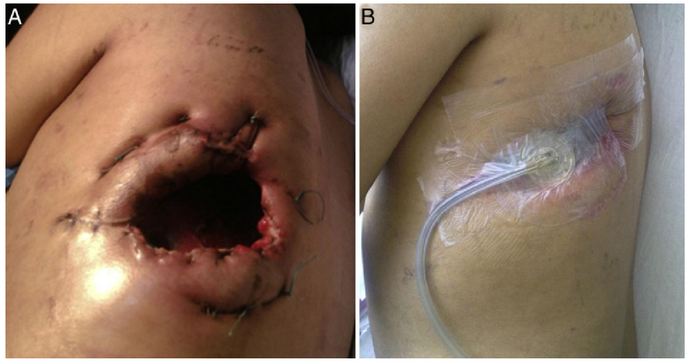
Temporal window for closure after decontamination

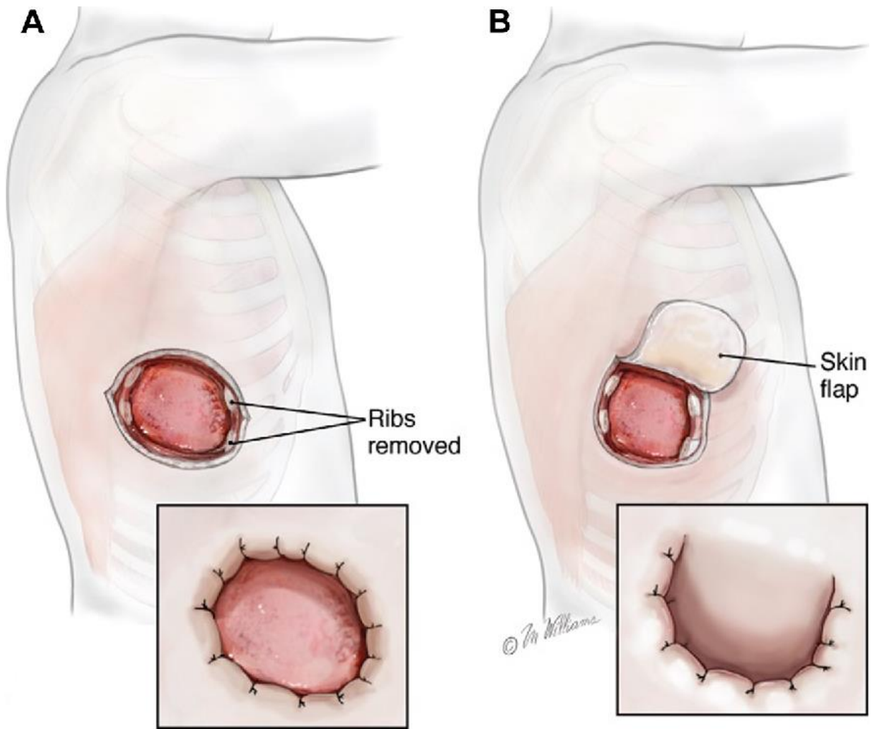
Open dressing

Window closure after instillation antibiotics

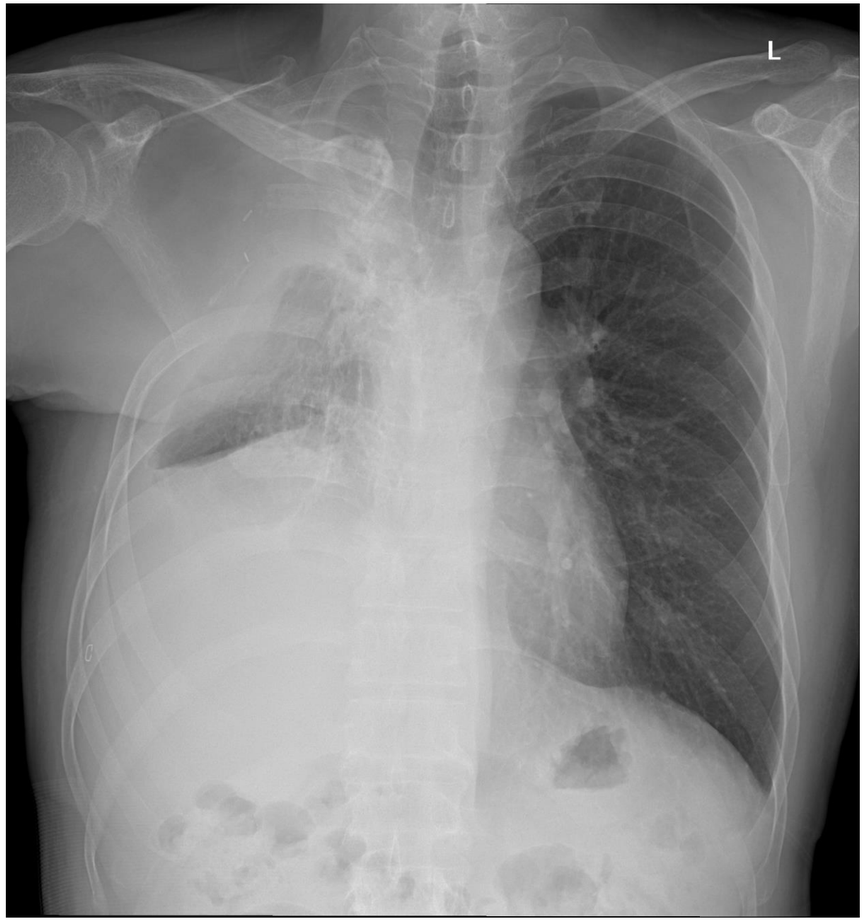
Thoracoplasty

Intrathoracic muscle transposition





Thoracoplasty

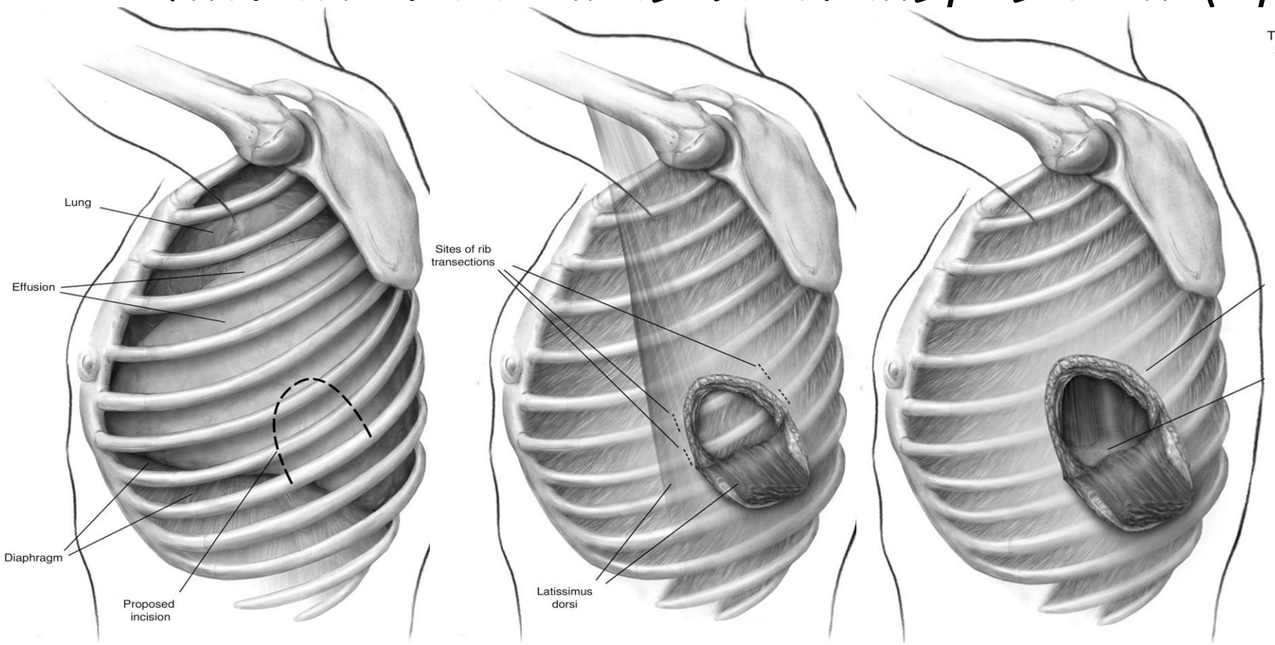


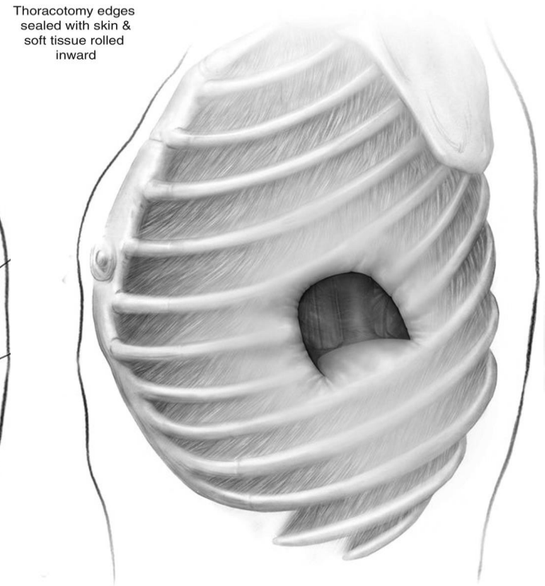
Eloesser flap

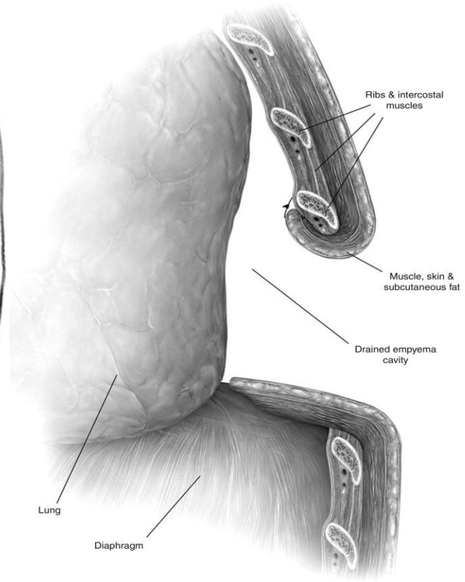
Permanent Open dressing for ill patients

Thoracoplasty (optional)

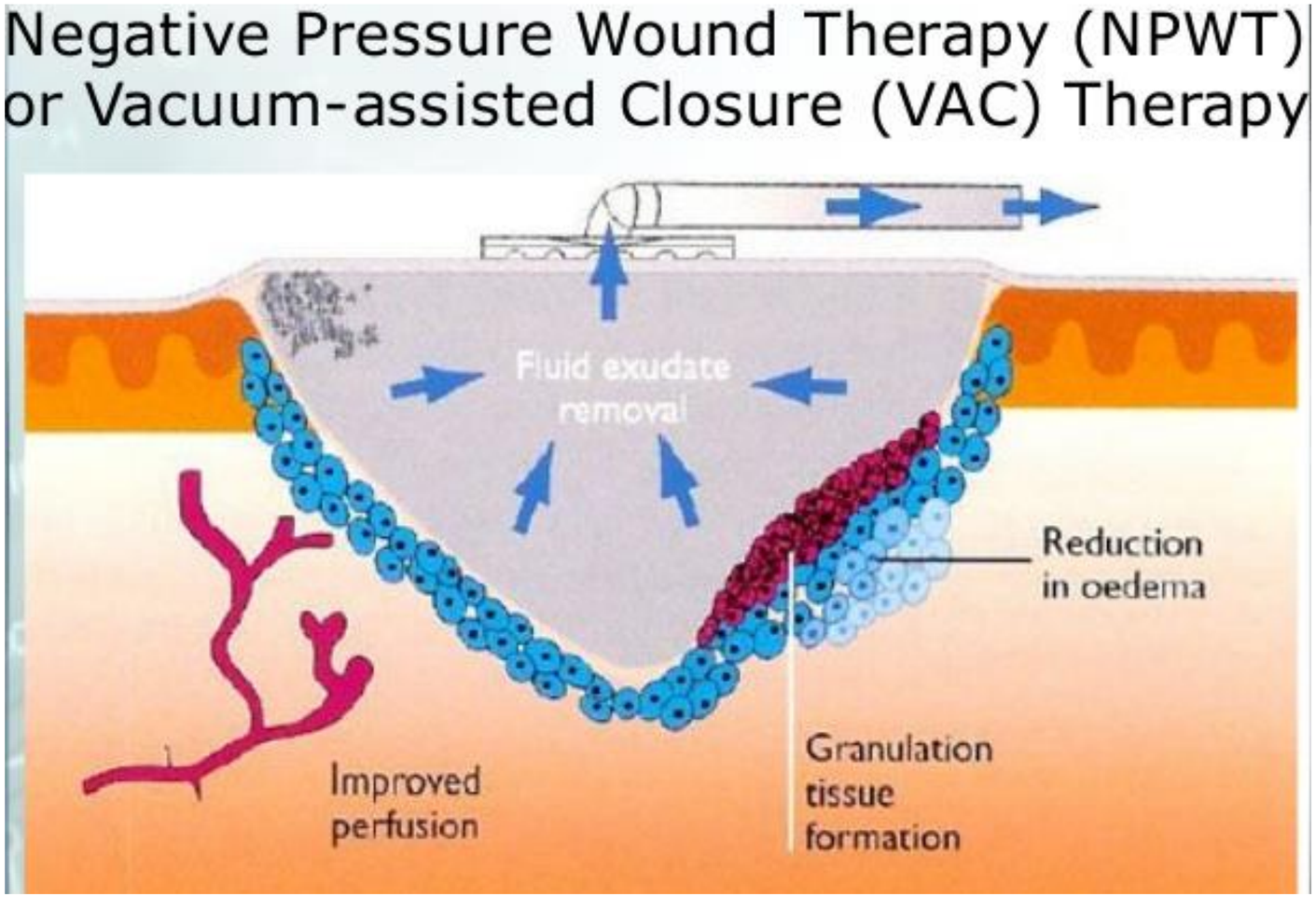
Intrathoracic muscle transposition (optional)







Vacuum Assisted Closure Device

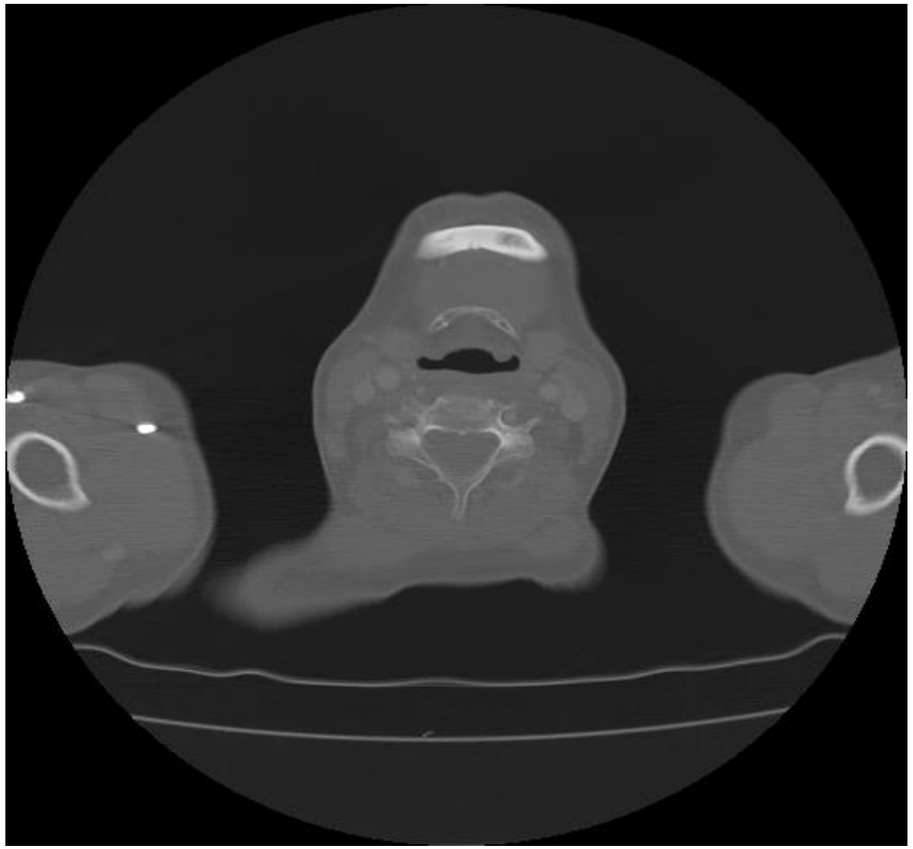


BPF Case

M/56 TB and Aspergilloma

LUL upper division segmentectomy

Fever, chilling, sputum



Lobar torsion & Gangrene

Pathophysiology

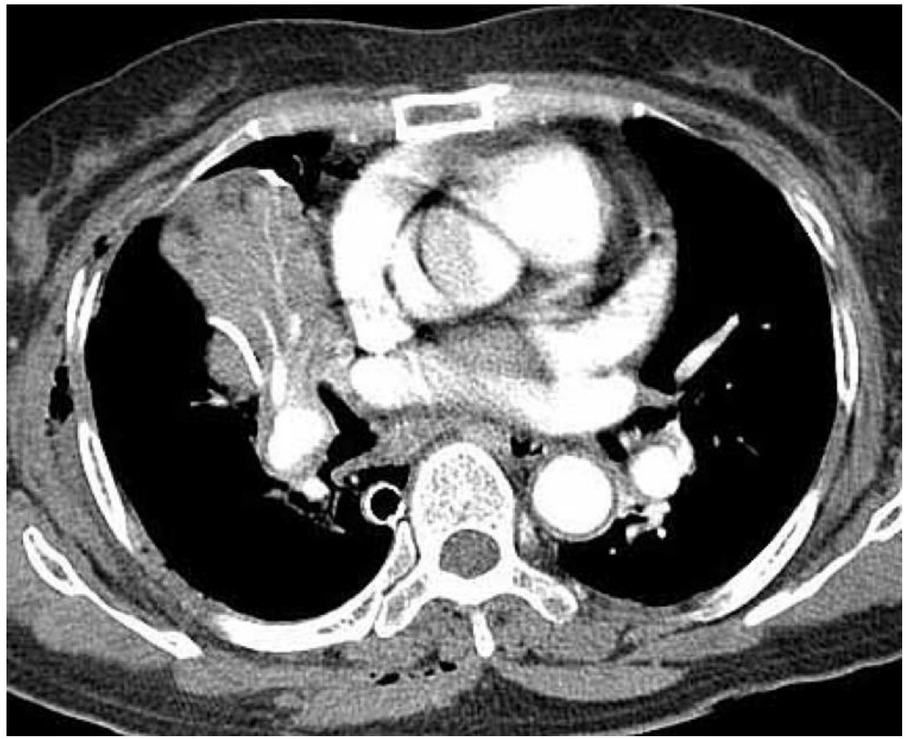
RML torsion > LUL , LLL torsion

Venous occlusion

Arterial occlusion

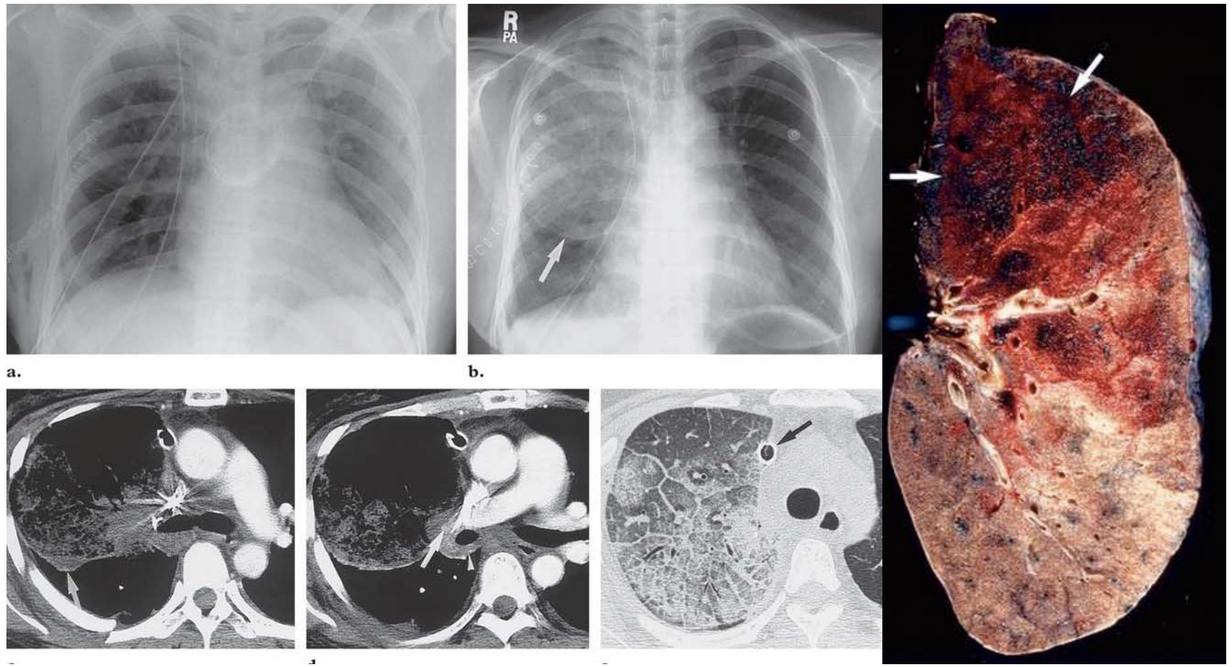
Angulation of bronchus

Hemorrhagic congestion



Lobar torsion & Gangrene

Diagnosis



Chest PA or AP : consolidation

Chest CT

Pulmonary Angiography

Lung perfusion scan

Foul smelling / blood-tinged sputum / fever

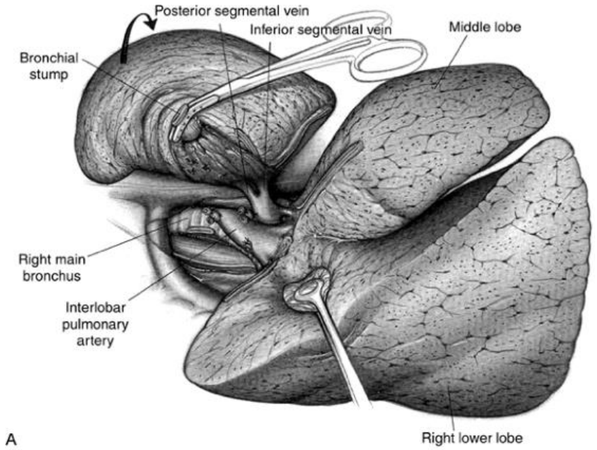
Sepsis / hemodynamic instability

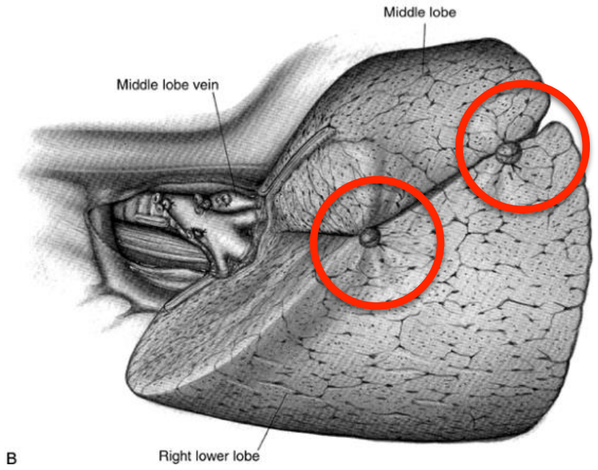
Differential diagnosis : Atelectasis, Hemothorax, hematoma

Lobar torsion & Gangrene

Risk factor and prevention

- Mobile middle lobe or remnant segments
- Unnecessary dissection of fissure
- Anchoring of mobile lobe





Lobar torsion and Gangrene

Treatment

Early detection and urgent operation!!

Torsion: Reposition and fixation (Interlobar and mediastinal anchoring)

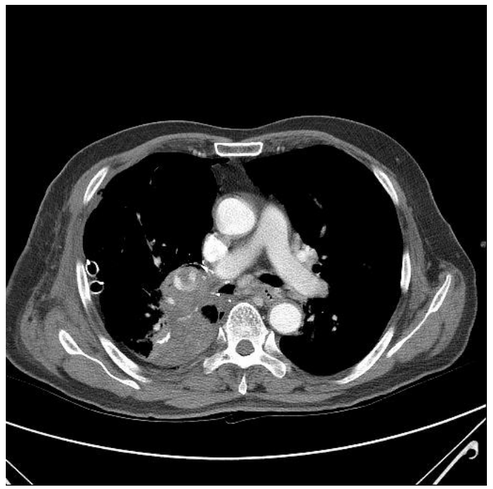
Gangrene: Lobectomy (or Segmentectomy)

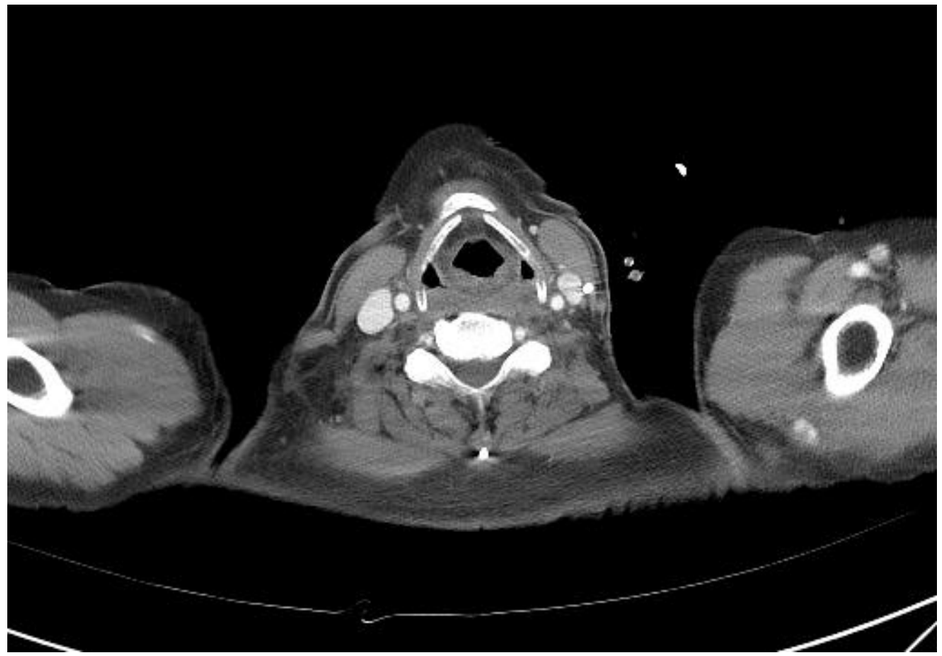
Lobar Torsion Case

M/68 endobronchial tumor

RUL lobectomy

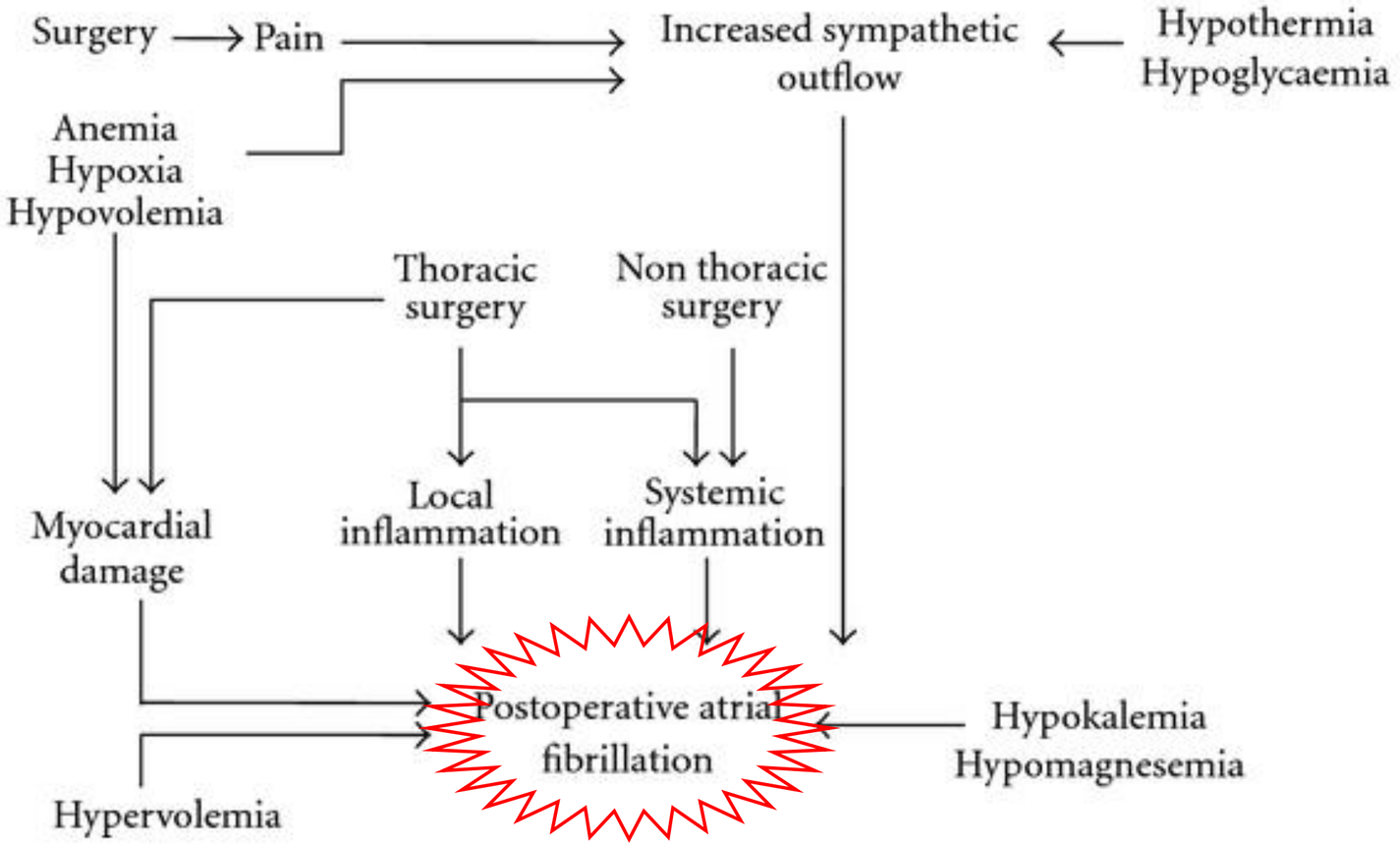
Post Op 3 day





Post Operative Atrial Fibrillation (POAF)

pathophysiology



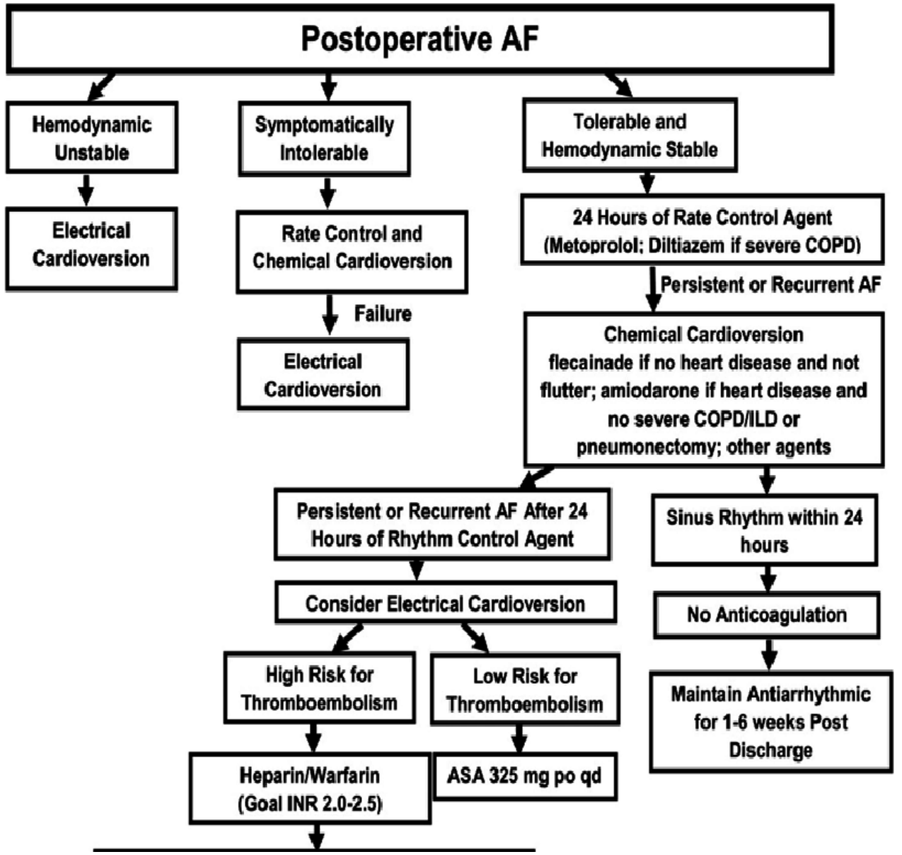
Post Operative Atrial Fibrillation (POAF)

Most common complication after non cardiac surgery 10~16%

Pharmacologic prevention trials

Medical Treatment

- IV diltiazem
- IV or oral amiodarone
- Atenolol
- Digoxin



Summary

All most Prolonged Air Leak (PAL) could be treated non-invasive treatments.

Preoperative identification of the risk factors of Bronchopleural fistula and post pneumonectomy (lobectomy) empyema is very important.

BPF is rare but critical, so life saving treatment is needed.

Summary

Lobar torsion and gangrene could be prevented fixation of mobile lung lobes.

Post Operative Atrial Fibrillation (POAF) is most common complication after lung cancer resection.

전공의 선생님들, 수고 많으셨습니다.!

다음 강의도 열심히!