2015. 5. 20 대한흉부외과학회 신입전공의 워크샵. 강촌

흉부외과 1년차의 기본술기
-이론과 실제-

Dep. Of Thoracic and Cardiovascular Surgery,
Chuncheon Sacred Heart Hospital, S. Korea

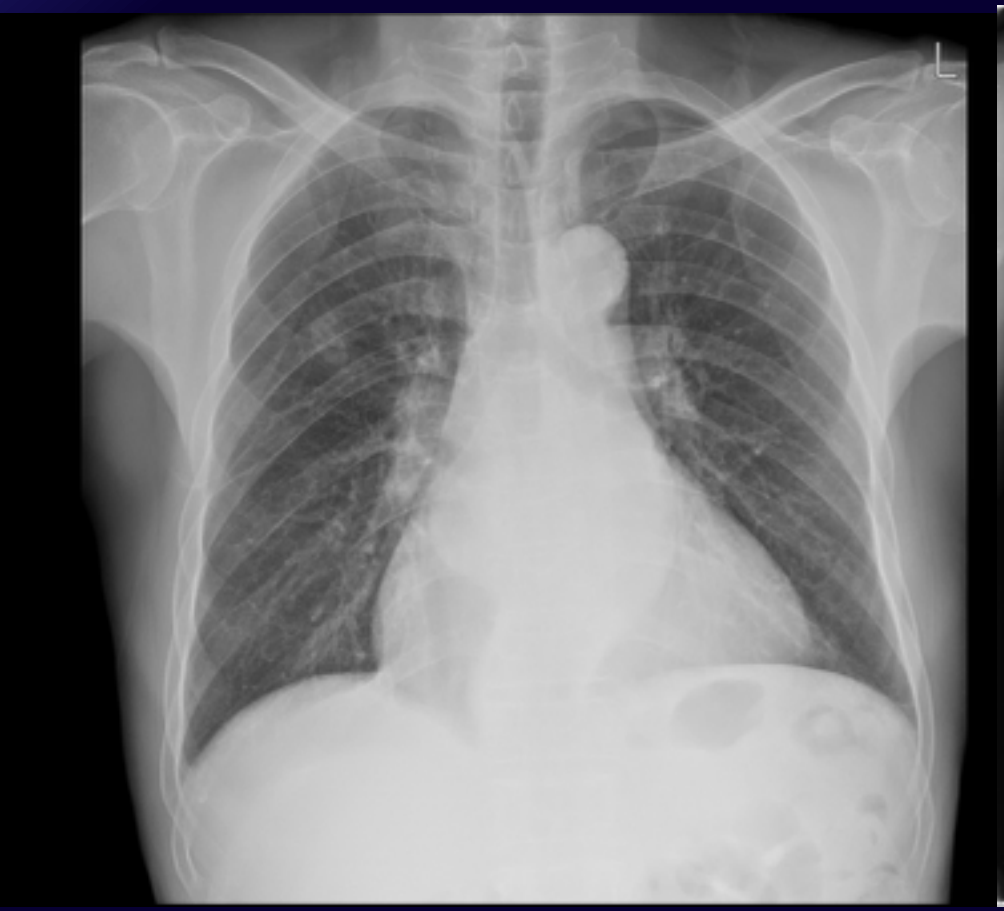
Kilsoo Yie M.D

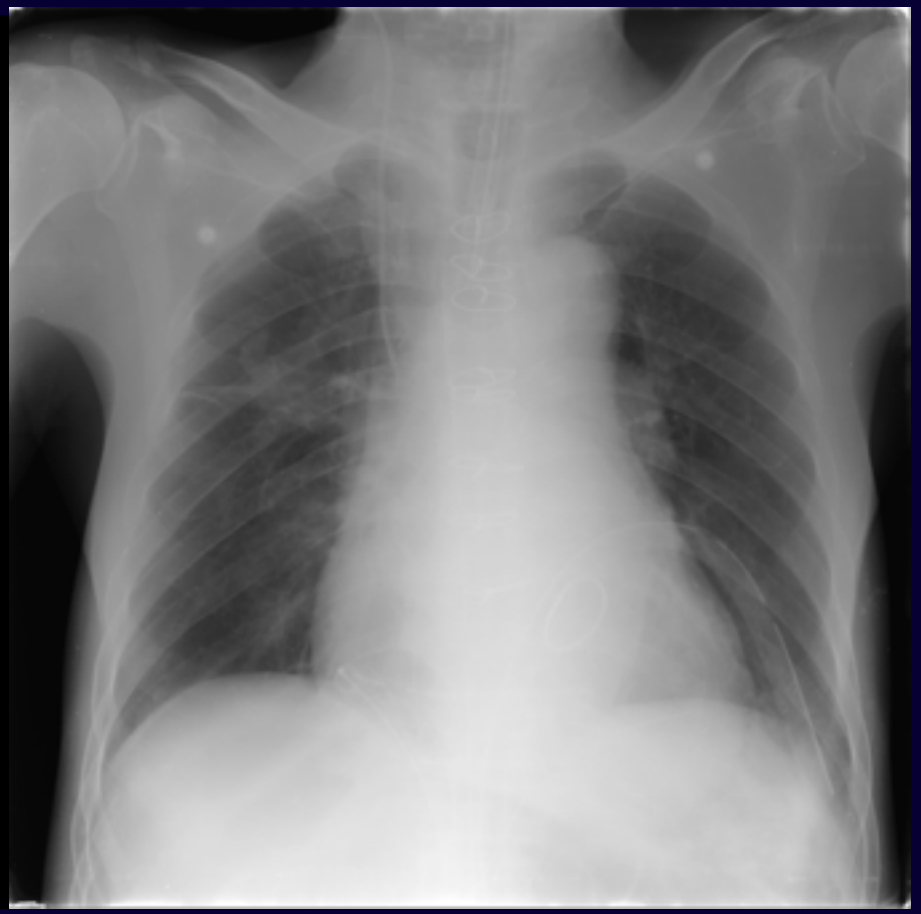
31 May 2011

I do believe……

Faith, Passion, Devotion
→ Meaning of CTS

Post OP change





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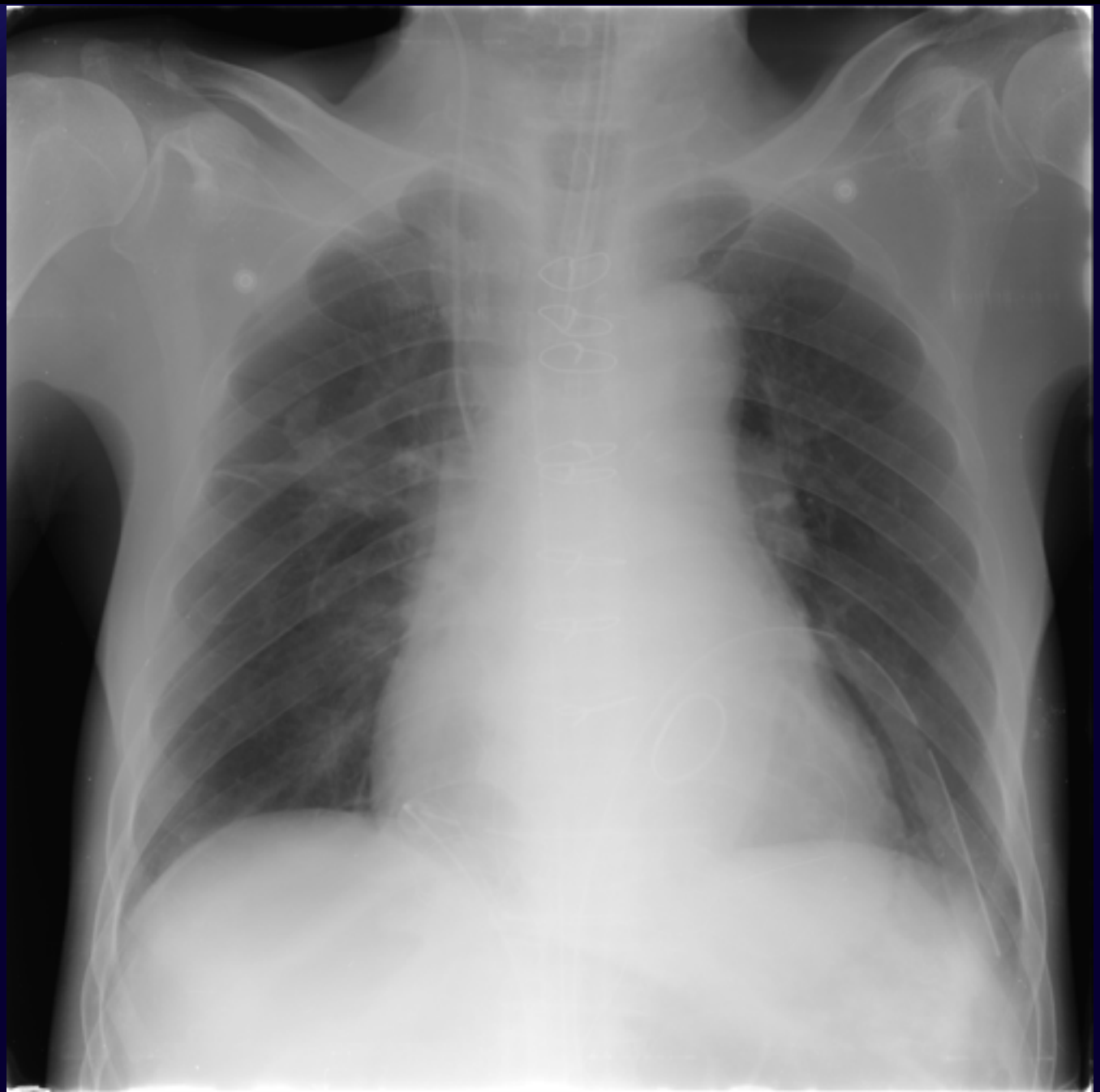
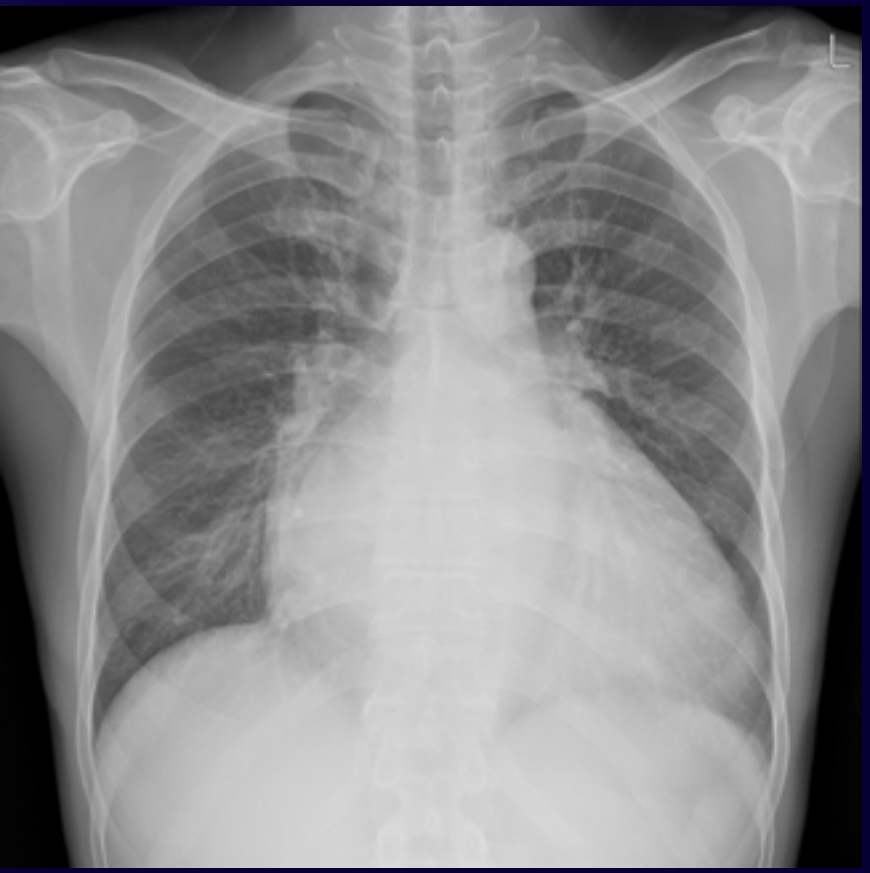
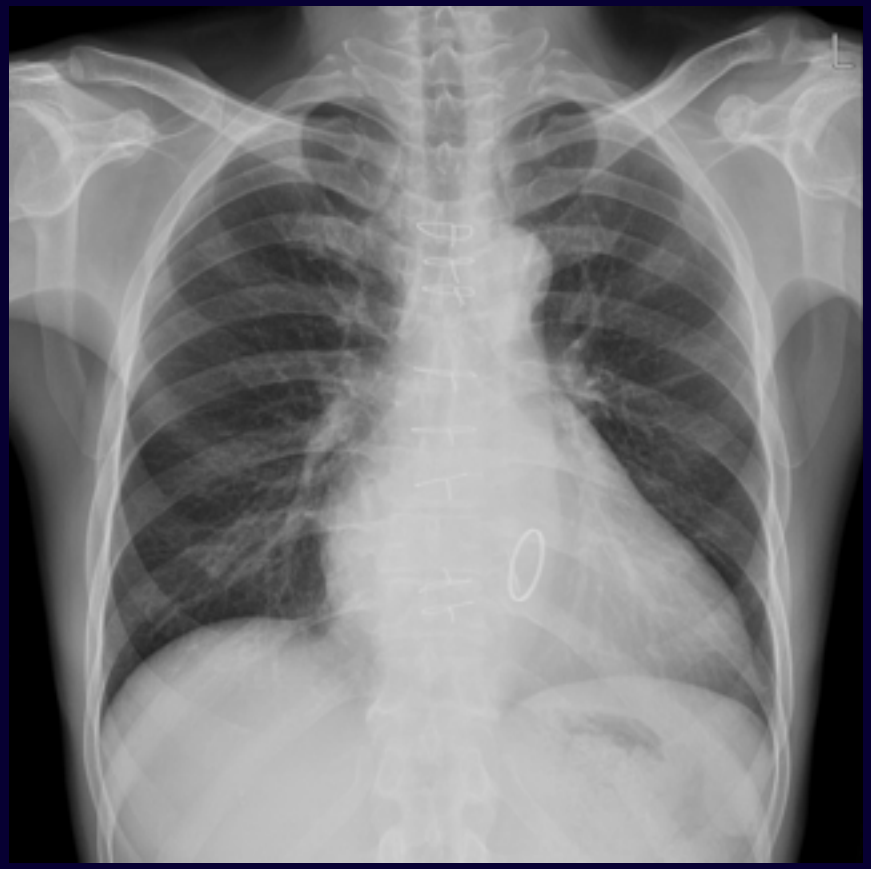


Post OP change

Post OP change

Post OP change





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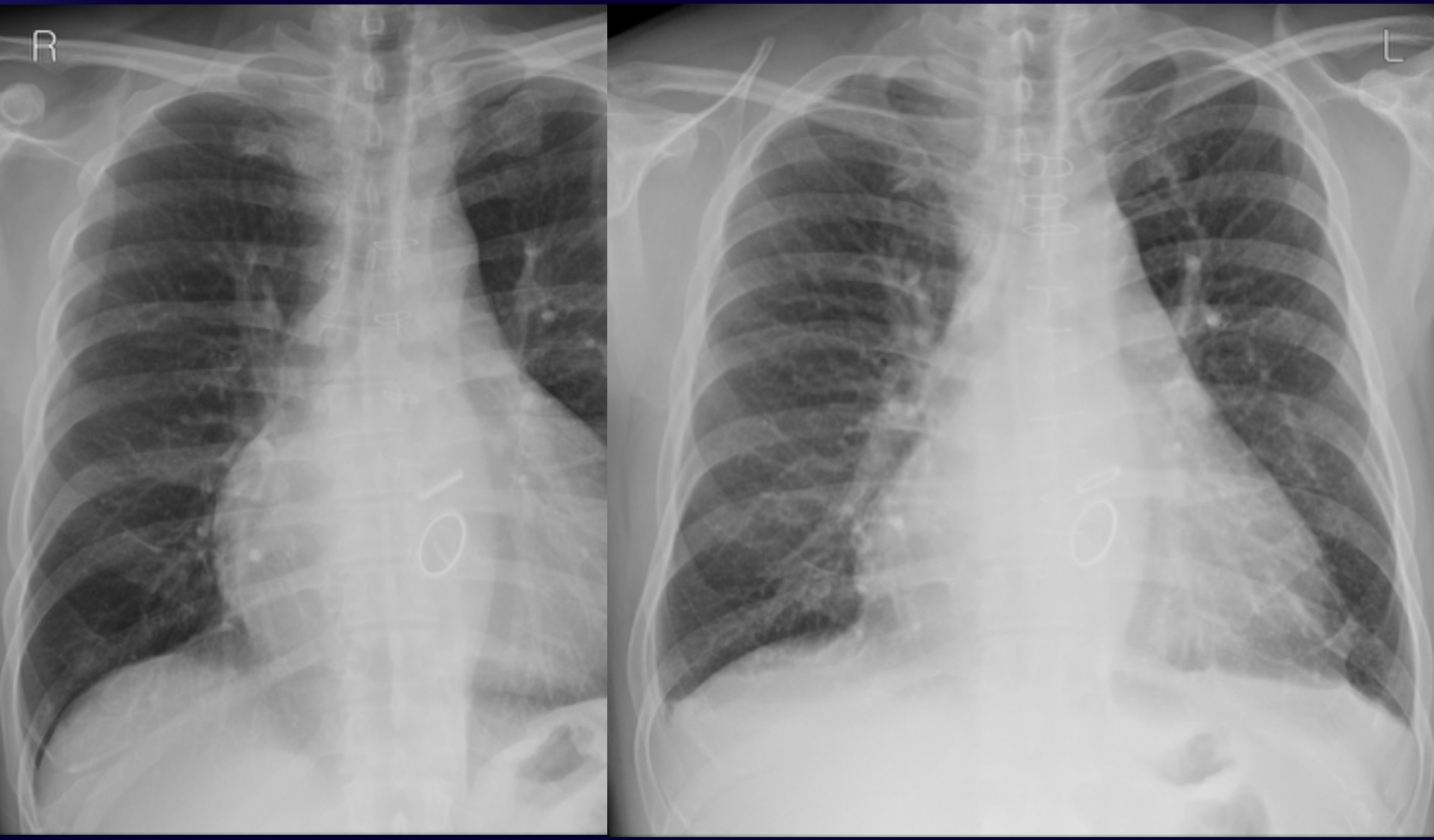
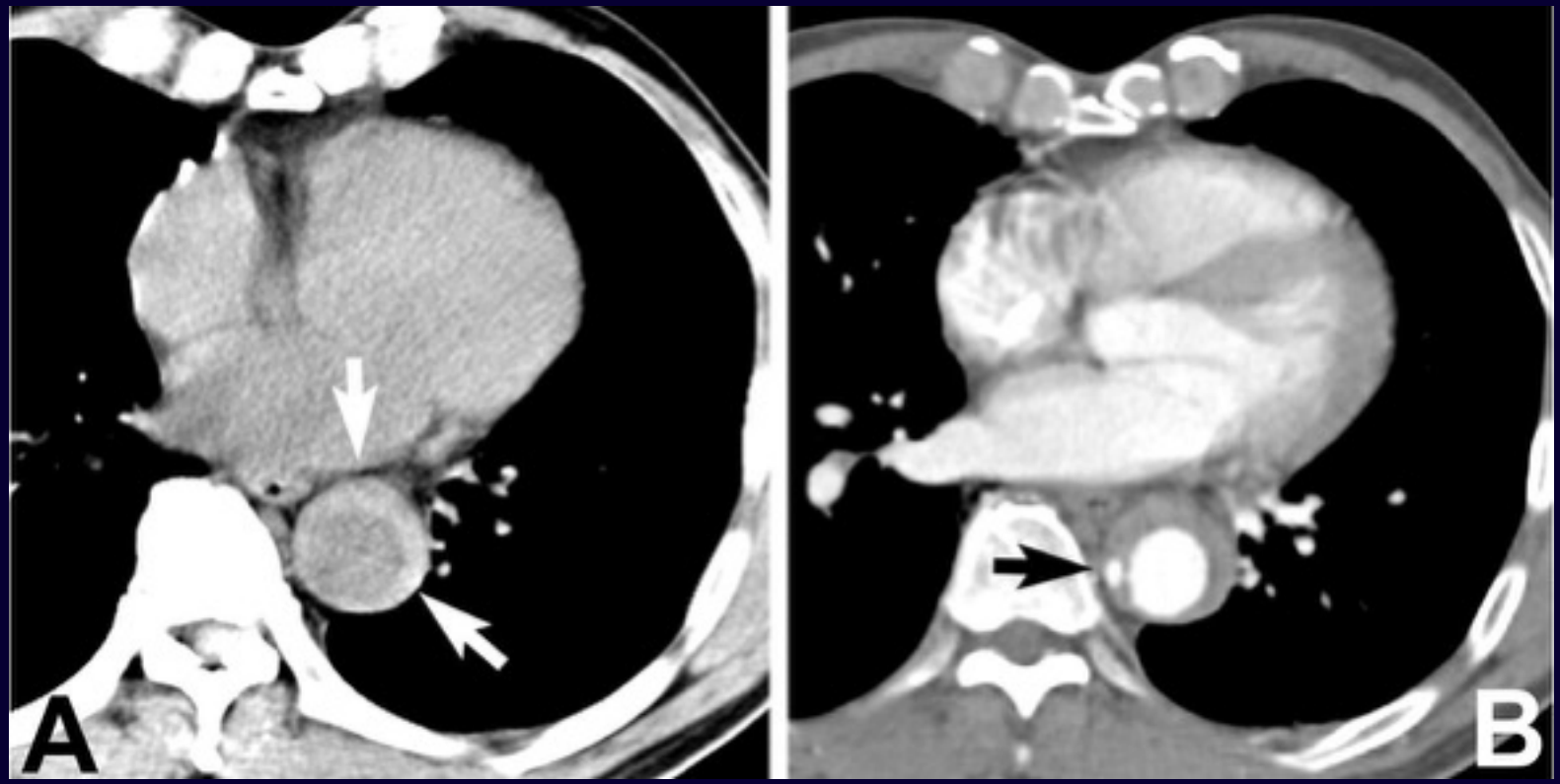


Acute chest pain with dyspnea
Total hip replacement 7 days earlier

Acute chest pain with dyspnea

Acute chest pain



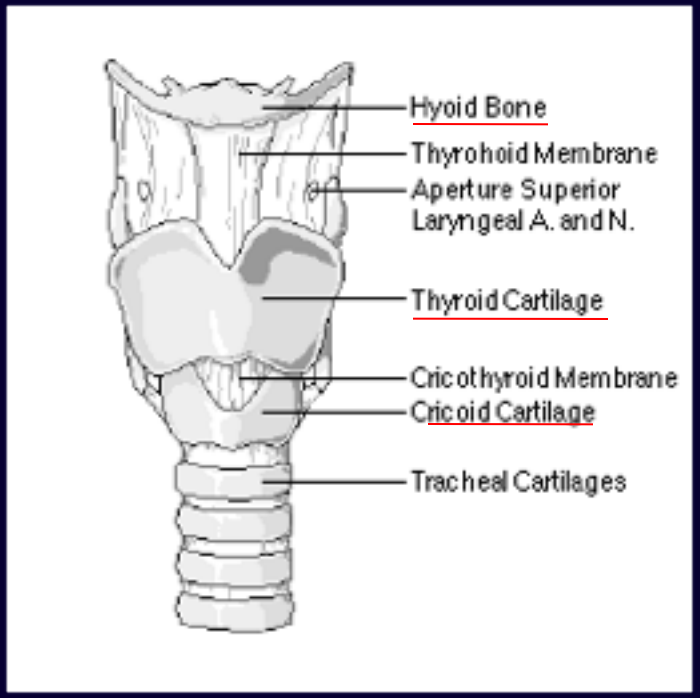
1. Endotracheal Intubation
2. Central line Insertion
3. A-line Insertion
4. Closed Thoracostomy

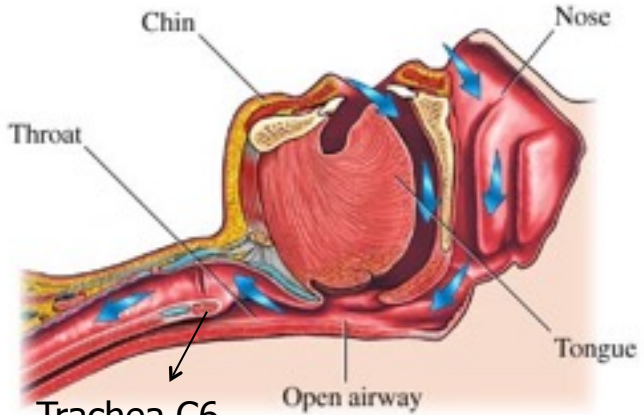
1. Endotracheal Intubation

Anatomy

Upper Airway

-Oral cavity, Pharynx, Larynx, Trachea
-Vallecula fossa





Trachea C6 level

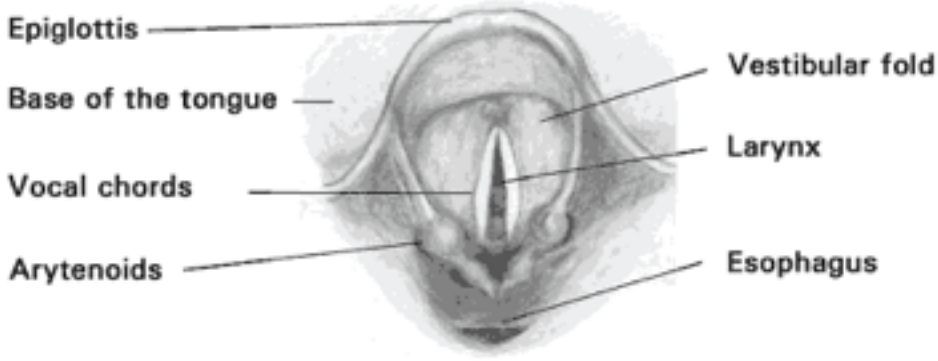


Figure 1 - View of the glottic area via direct laryngoscopy

T Matsumoto et al. J. Pediatr.2007;83(2)sup 0

Anatomy

Upper Airway -3 Axis

-Oral Axis, Pharyngeal Axis, Tracheal Axis
-Need pillow under subscapular lesion (children) or occipital bone(Adult)

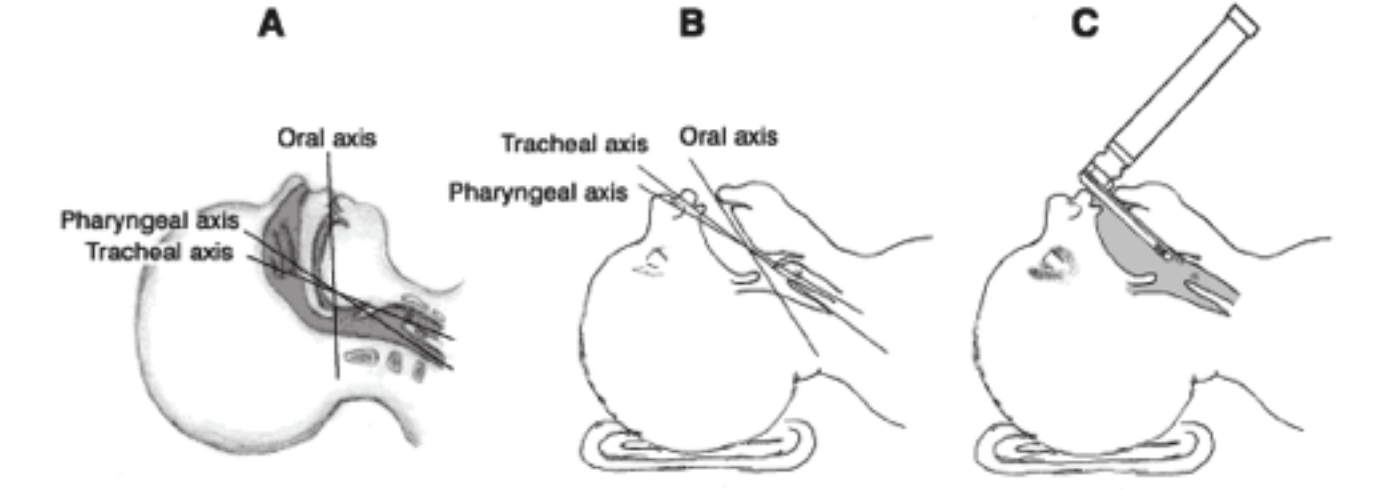


Figure 3 - A) Illustration of the axes (oral, pharyngeal and tracheal); B) alignment of these axes with correct positioning; C) viewing the glottic fold with a straight blade

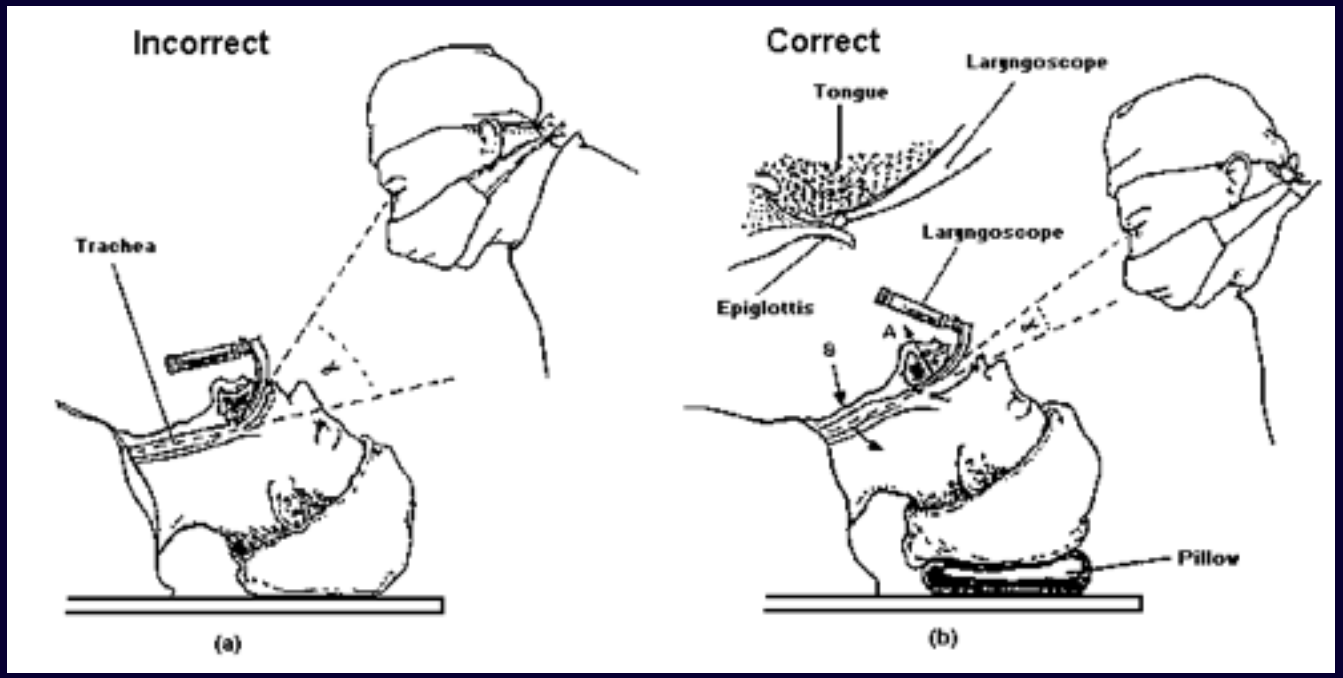
T Matsumoto et al. J. Pediatr.2007;83(2)sup 0

Anatomy

Upper Airway -3 Axis

-Oral Axis, Pharyngeal Axis, Tracheal Axis
-Need pillow under subscapular lesion (children) or occipital bone(Adult)

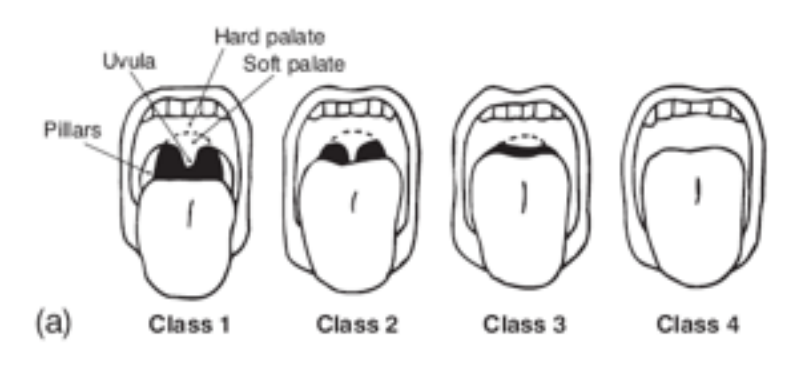
" Sniffing Position"



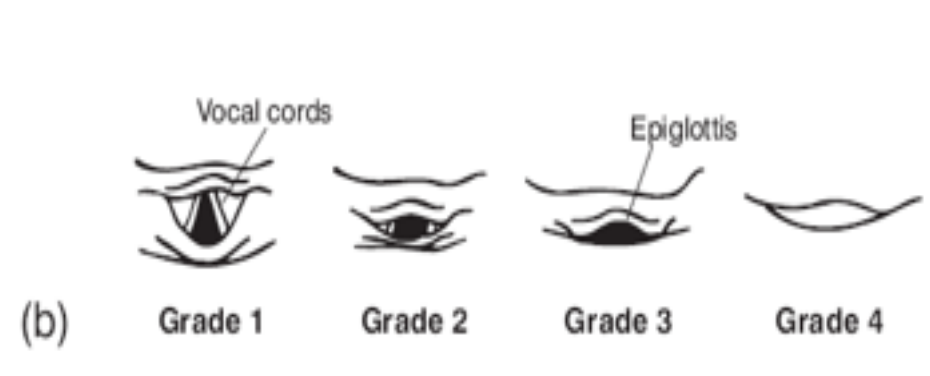
Anatomy

Difficult Airway ;

-Correlation between Samsoon Class and Cormack Grade
-Importance of preoperative checking



Samsoon Classification



Cormack Grading system

Deem S al. Cri Care Clin. 1995;11(1)1-27

Non Intubation Management

Triple Airway Maneuver, 삼중기도처치법

-Unconsciousness but (+) self respiration
-Head tilting, jaw thrust, chin lift : supra-laryngeal airway patency

D Benson et al. Resuscitation.1996;32(1):51-62

Endotracheal Intubation

Endotracheal tube, General

-Internal Diameter :

8.0(=8mm), 7.5(=7.5mm), 7.0(=7mm Bronchoscopic limit)

Adult male = 7.0-8.0

Adult female=6.5-7.5

In Children, Size=(Yrs+16)/4

-Depth :

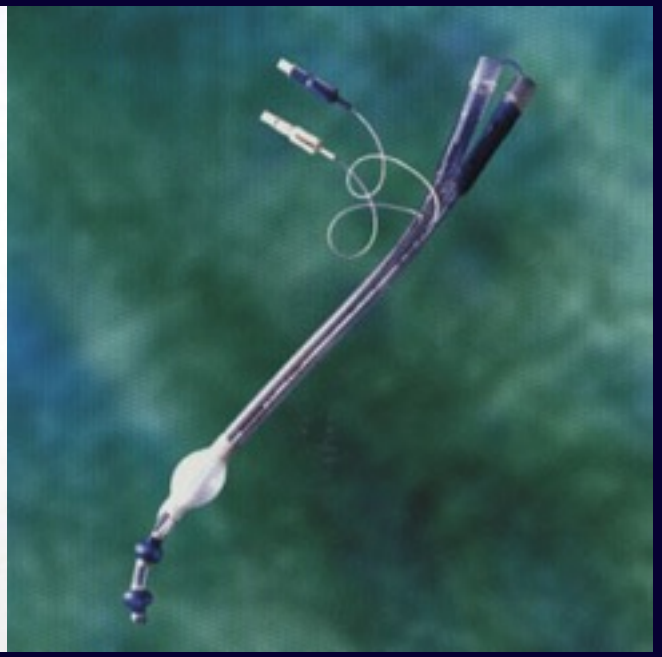
21Cm for women, 23Cm for men

In Children, Depth Cm=10+Yrs/2

Endotracheal Intubation

Types of endotracheal tube

-Uncuffed tube : children under 12 yrs (narrowest in the subglotic area)
-Reinforced tube : intermal metal ring
-Double lumen tube : protection of healthy lung
-Southfacing tube, Northfacing tube : no role in ICU



Endotracheal Intubation

Indications : any situation to maintain a patent and safe airway

PaO2↓, not corrected by conventional oxygen supplement by mask and nasal prongs

PaCO2↑or Failure to maintain airway patency
-Swelling of upper airway : anaphylaxix, infection
-Facial or neck trauma with OroPharyn bleeding
-Decreased consciousness and loss of airway reflex

Bronchial Toiletting
-Failure to protect airway aspiration

Failure to ventilate
-General Anesthesia

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Endotracheal Intubation

Contra-Indications :

Severe Airway Trauma or Obstruction, that does not permit safe passage of an endotracheal tube. → Emergency Cricothyrotomy

Cervical spine injury need for complete immobilization.→ Fiberoptic intubation

Inability to open mouth (e.g. trismus, scleroderma)→ nasal intubation

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Endotracheal Intubation

Double lumen Endotracheal tube

Absolute Indication

-Soilage risk – hemoptysis pts.
-Ventilation control
-Bronchopulmonary lavage

Relative Indication

-Lung resection surgery
-Thoracoabdominal aneurysm repair
-Esophageal surgery
-VATS
-Thoracic spine surgery

Endotracheal Intubation

Preparing the Precedure : Equipments

1. Ambu bag & Oxygen line
2. Suction tip
3. Laryngoscope : curved and straight
4. E-tube : size, type
5. Oral airway
6. Stylets
7. Syringe : 10mml
8. Sedative and relaxative drug
9. Lubricant
10. gloves

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Endotracheal Intubation

Preparing the Precedure : SALT !!

Suction : remove the oral contents

Airway : lift the tongue off the post. Pharynx.

Laryngoscope : confirming the light

Tube : available size

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Endotracheal Intubation

P/Ex : Difficulty Check !!

1. Head shape
   micrognathia, mandibular hypoplasia, Down SD.

2. Protruding or prosthetic teeth

3. Large big tongue
   trisomy 21, mucopolysaccharidoses

4. T-M joint mobility ↓
   ankylosis, type 1 DM, trauma, RA

5. Oral cavity malformation
   Laryngeal CA, edema, post OP edema

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Endotracheal Intubation

Induction(sedative) Agent !!

Etomidate dose- 0.3 mg/kg
advantage-Good for low blood pressure; okay in hypovolemia
cautions- Nausea and vomiting on emergence

Ketamine dose- 1.5 mg/kg
advantage- Good for low blood pressure, hypovolemia; good in asthma
Caution in elevated intracranial pressure or heart disease

Propofol dose- 2-2.5 mg/kg
advantage- Rapid onset and recovery
Caution if hypovolemic or risk of hypotension

Thiopental dose- 3-5 mg/kg
advantage- Multiple drug interactions
caution if hypovolemic or risk of hypotension

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Endotracheal Intubation

Muscle relaxant !!

Succinylcholine dose 1 - 1.5 mg/kg
characteristic- Rapid onset, rapid recovery; fasciculation
Contraindicated in hyperkalemia, crush injury, renal failure, extensive burns, elevated intracranial or intraocular pressure

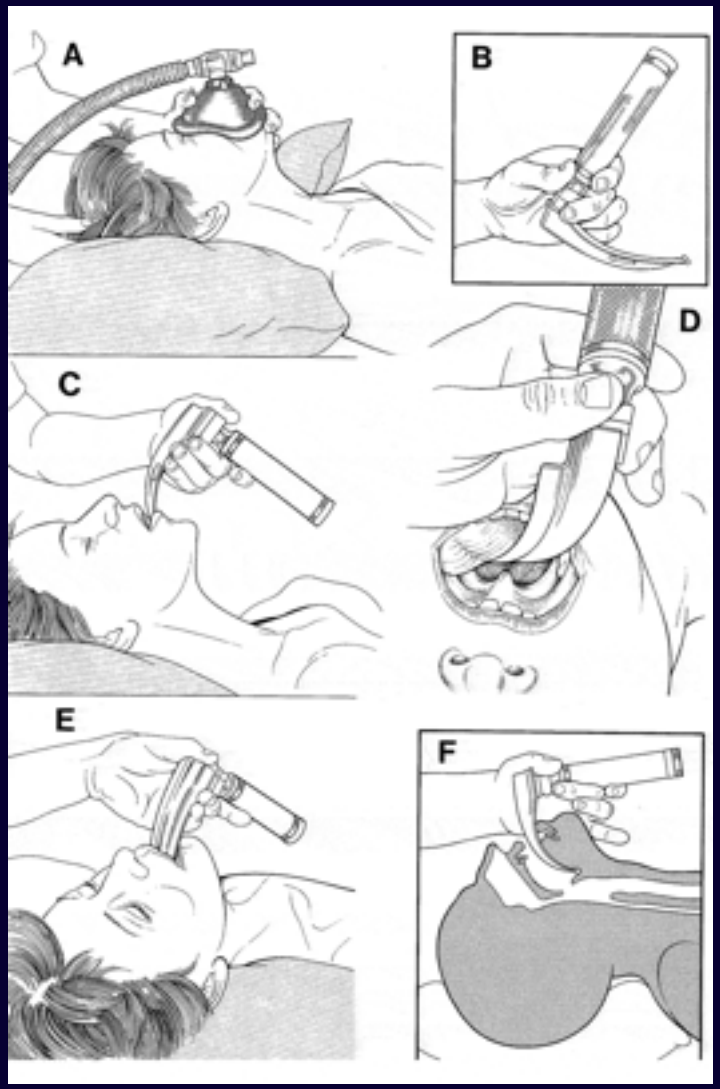
Rocuronium dose 0.6- 1.2 mg/kg
characteristic- No fasciculation
cautions- Longer acting-may be problematic if intubation attempt fails

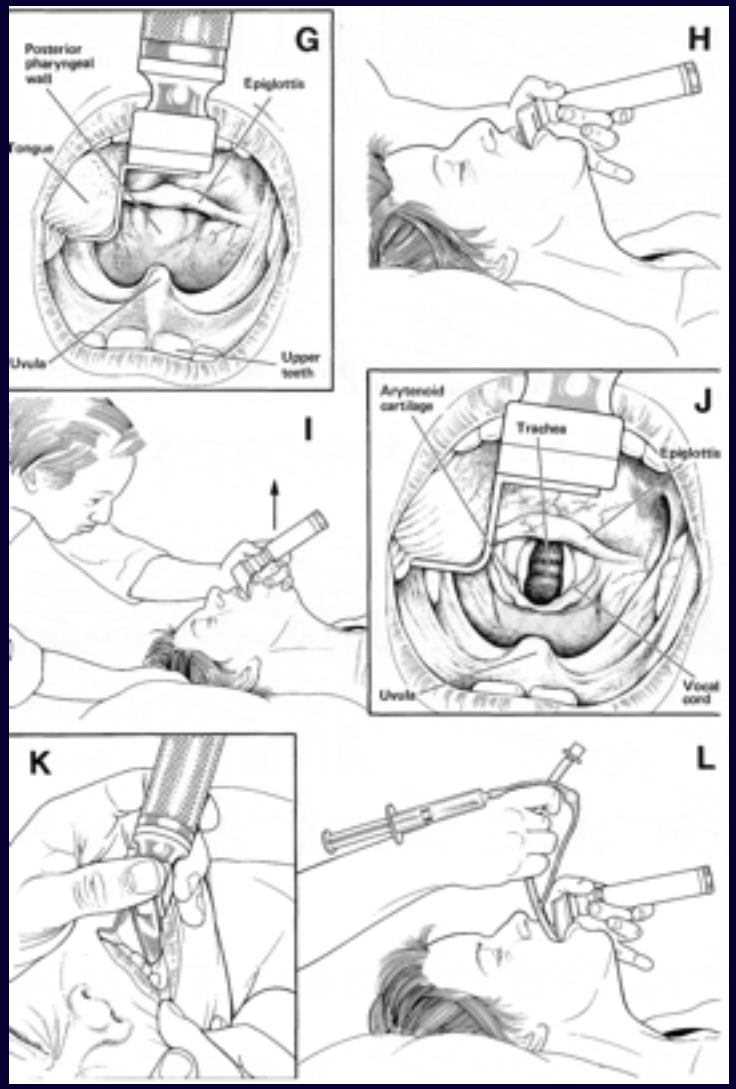
Vecuronium dose 0.08 - 0.1 mg/kg, **Atracurium dose** 0.4 - 0.5 mg/kg

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Endotracheal Intubation

Protocol :

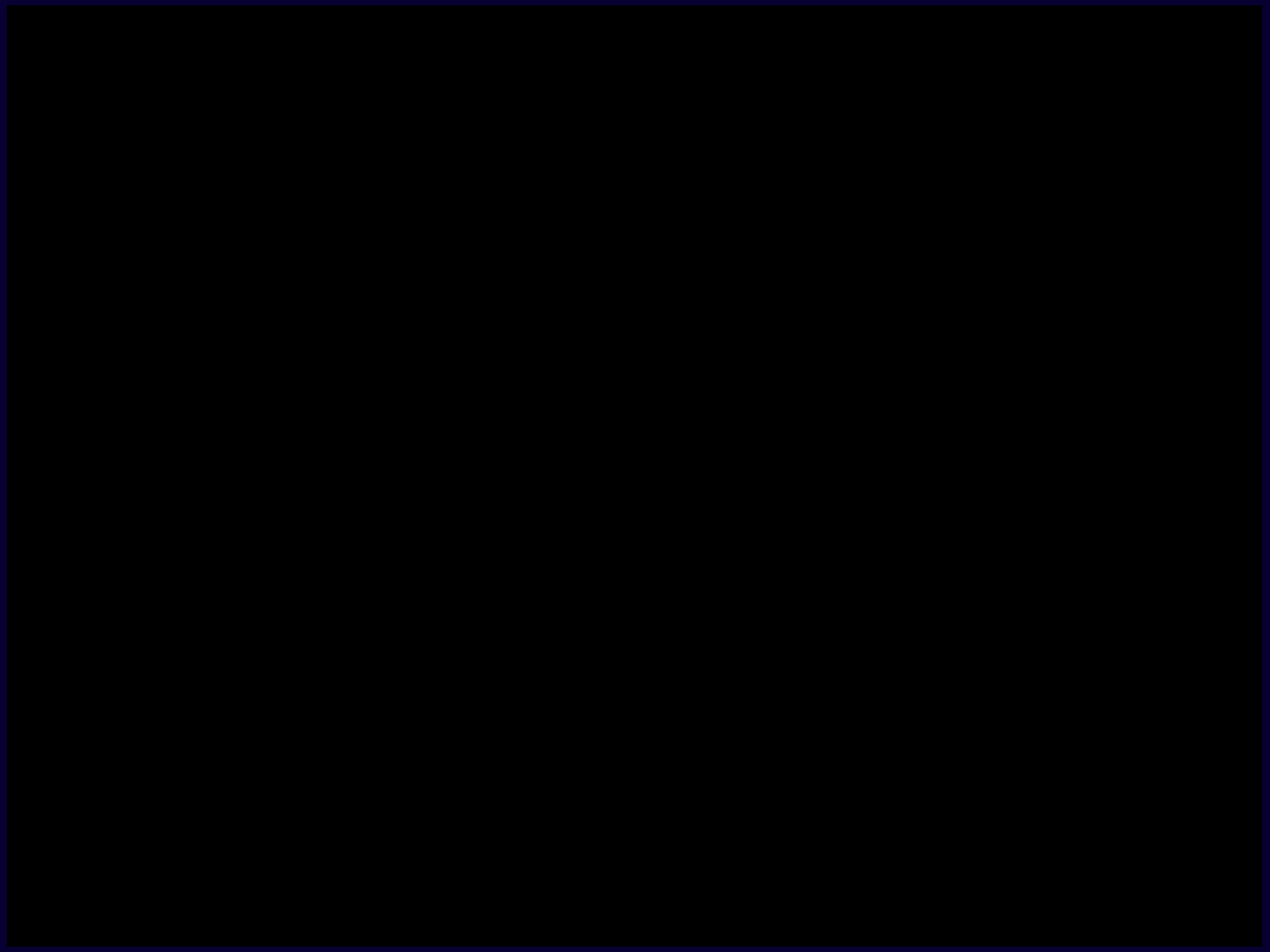




Endotracheal Intubation

intubation video.mp4

Protocol :



Endotracheal Intubation

Complications :

During intubation

Laryngospasm

Laceration lips,tongue,pharynx

Dislogement of teeth

Perforation trachea,esophagus

Cervical spine injury

Haemorrage

Aspiration gastric content/ FB

Endobrachial or esophageal intubation

Arytenoid cartilages injury

Hypoxemia, hypercarbia.

Chalkley Estes J. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Endotracheal Intubation

Complications :

Complication with tube in-situ

-Accidental extubation

-Endobrachial intubation

-Obstruction / kinking

-Bronchospasm

-Ignation of tube by laser device

-Aspiration

-Sinusitis

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Endotracheal Intubation

Complications :

Complication after extubation

-Laryngospasm

-Aspiration

-Glottic,subglottic, uvular edema

-Dysphonia,aphonia

-Paralysis of vocal cord

-Sore throat

-Noncardiogenic pulmonary edema

-Laryngeal incompetance.

-Tracheomalacia

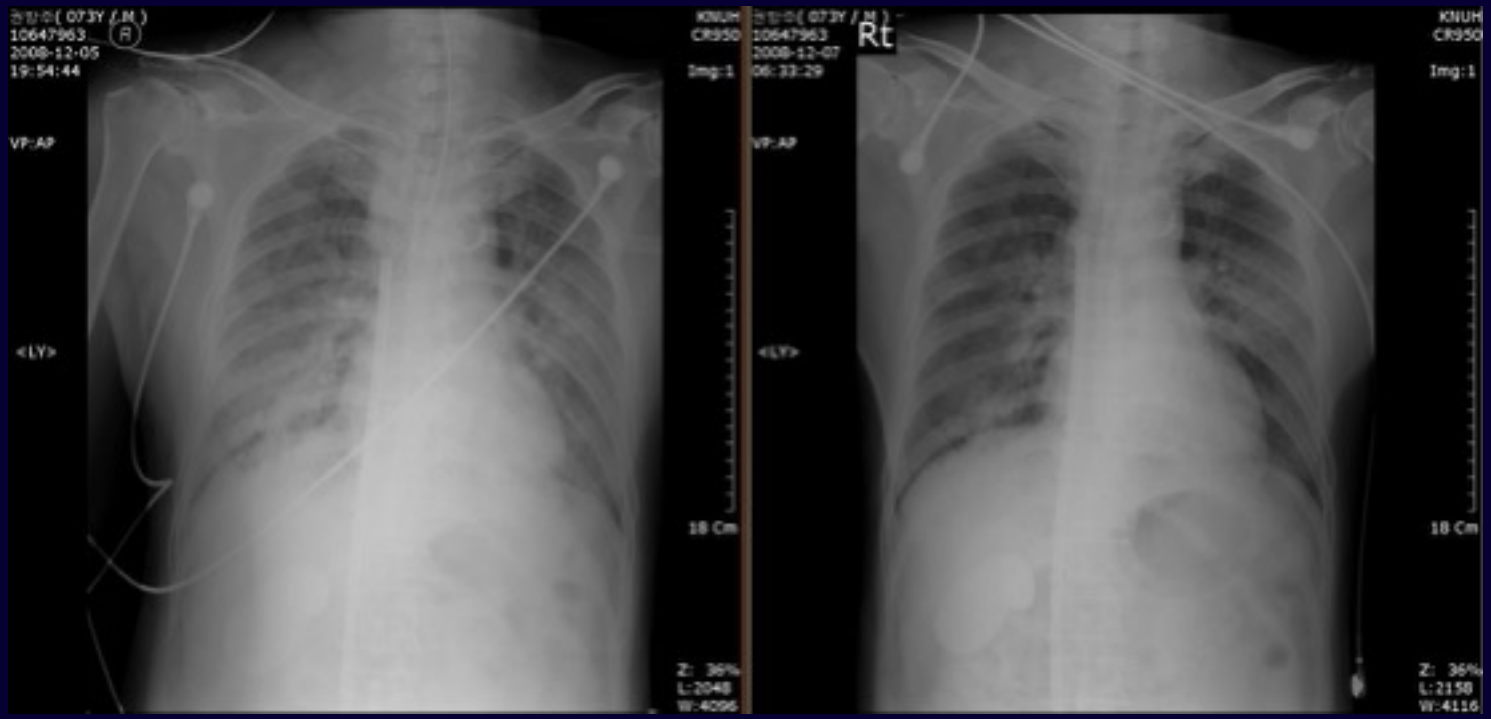
-Glottic,subglottic or tracheal stenosis

Clarke E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Endotracheal Intubation

Verification Of Correct Tube Placement

- Direct vision of the endotracheal tube passed through the vocal cords
- Symmetric Chest Movement , Symmetric Breath Sounds
- End tidal Carbon Dioxide : > 30 For 3-5 Breaths
- Fiberoptic Bronchoscopy



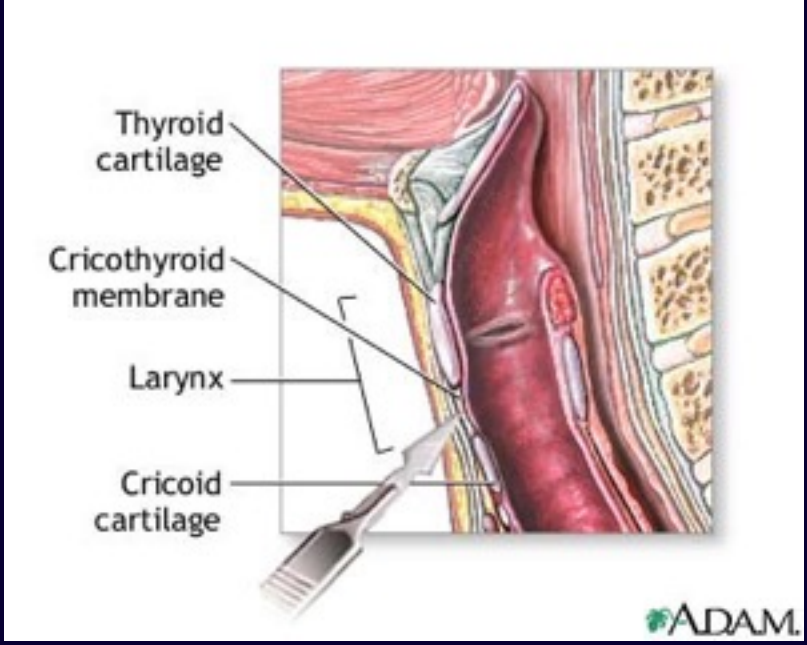
Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

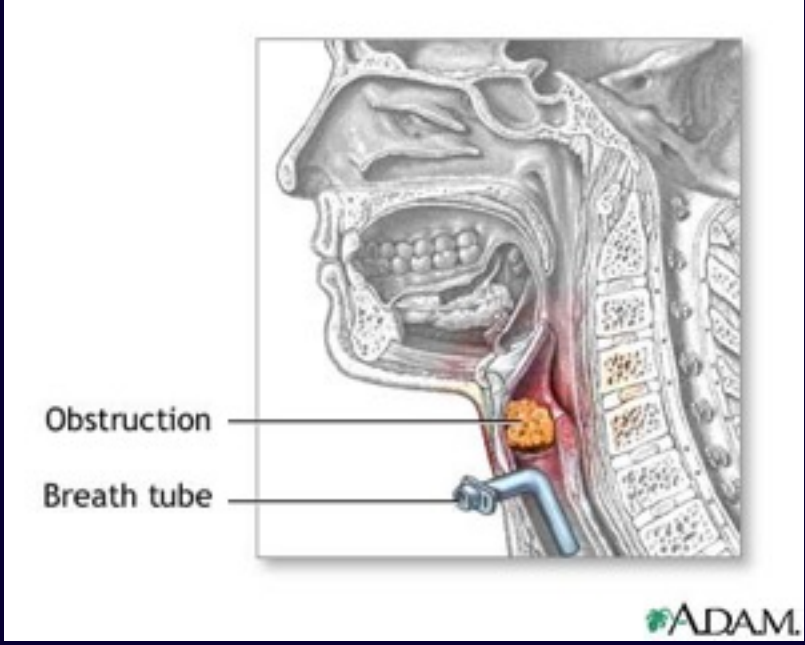
Emergency airway puncture

Indication of Cryco-thyrotomy

-Laryngopharynx level airway obstruction
-Foreign body, abnormal tissue growth
-Res. Arrest with impossible NT or OT intubation due to neck injury

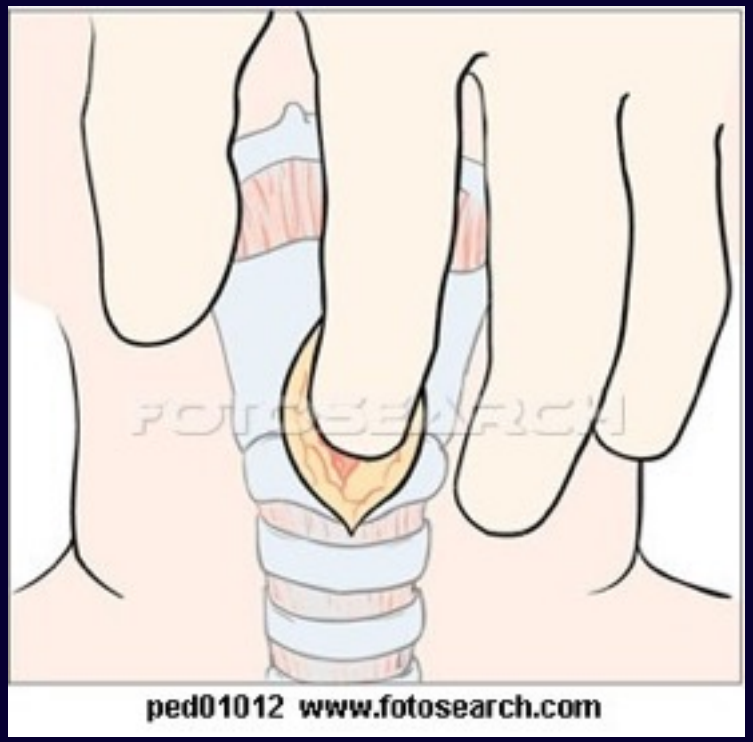
P Eisenburger et al. Anesthesiology. 2000;92(3):687-690

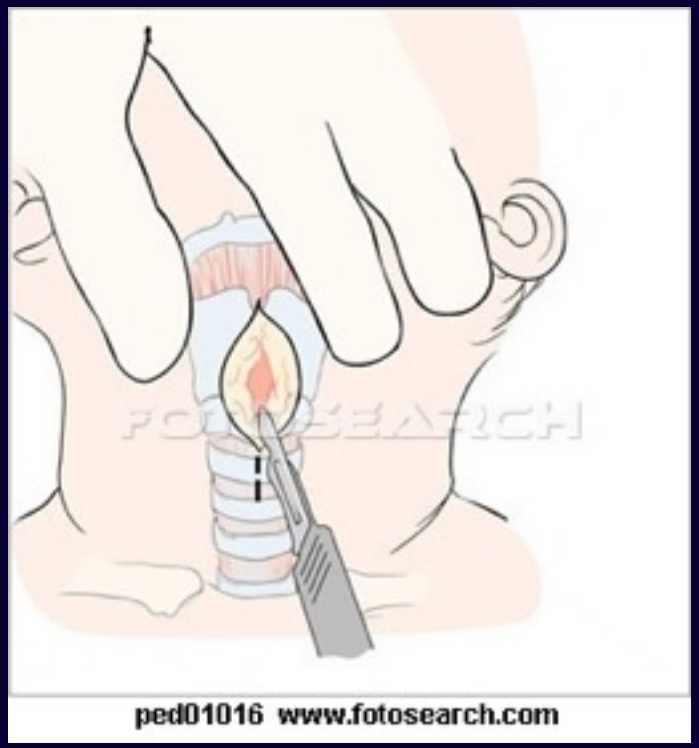




Emergency airway puncture

Procedure of Cryco-thyrotomy

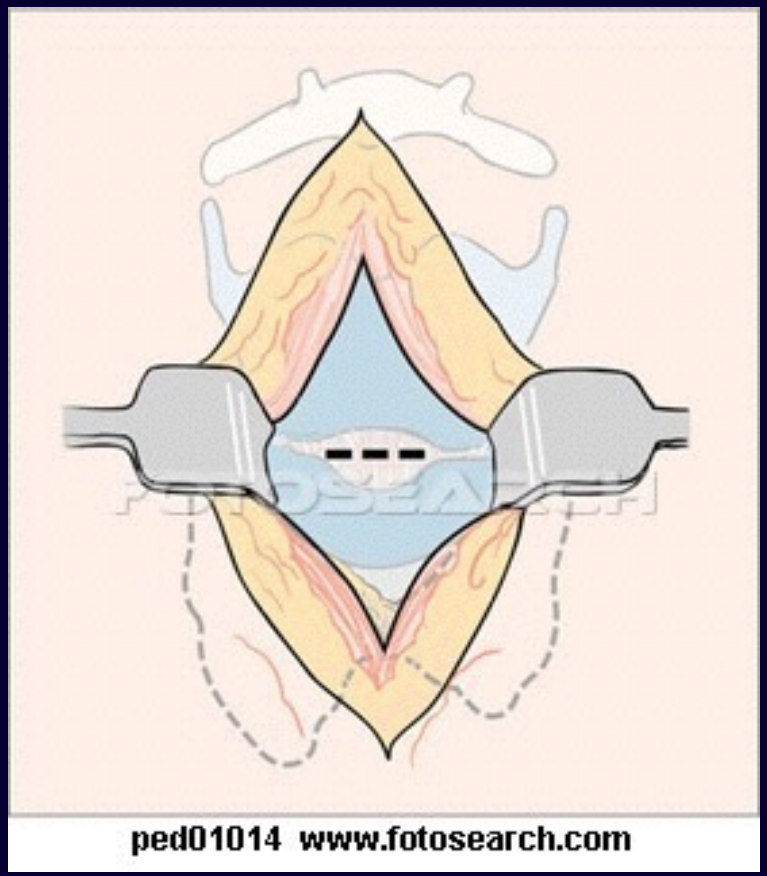


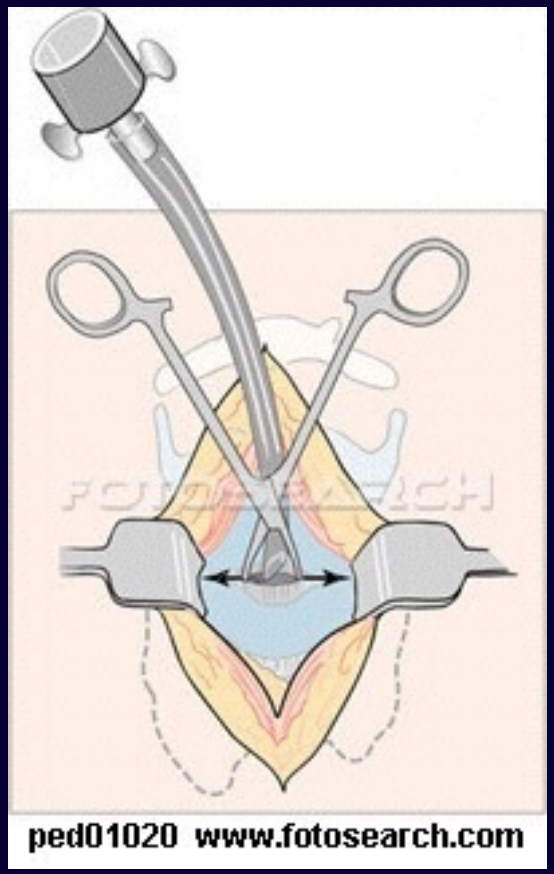


Photographed by www.fotosearch.com/LIF145

Emergency airway puncture

Procedure of Cryco-thyrotomy

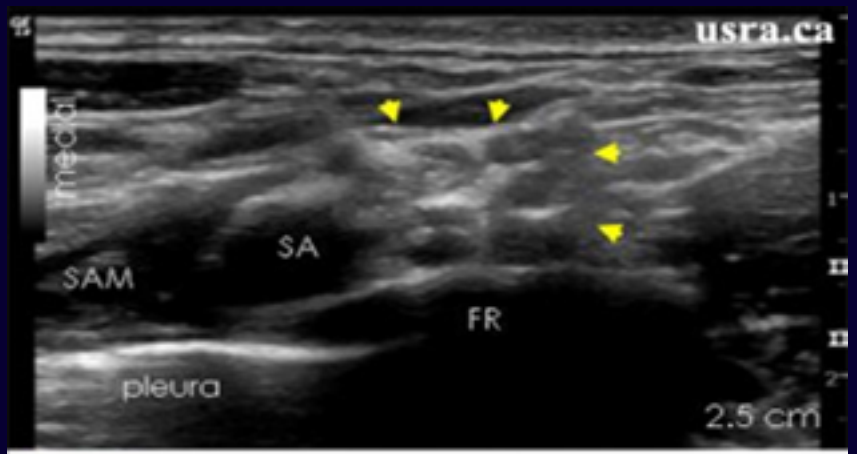


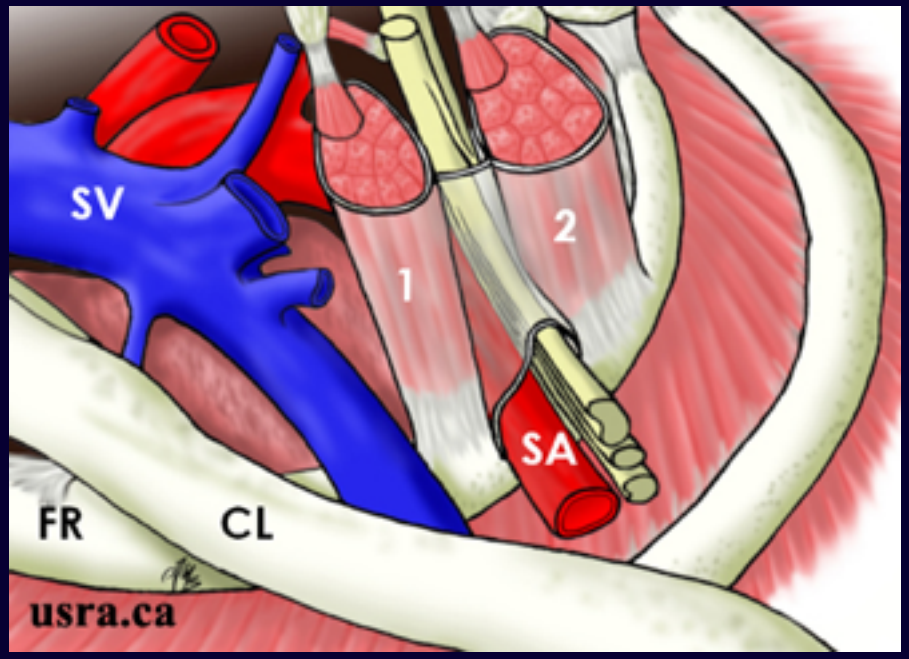


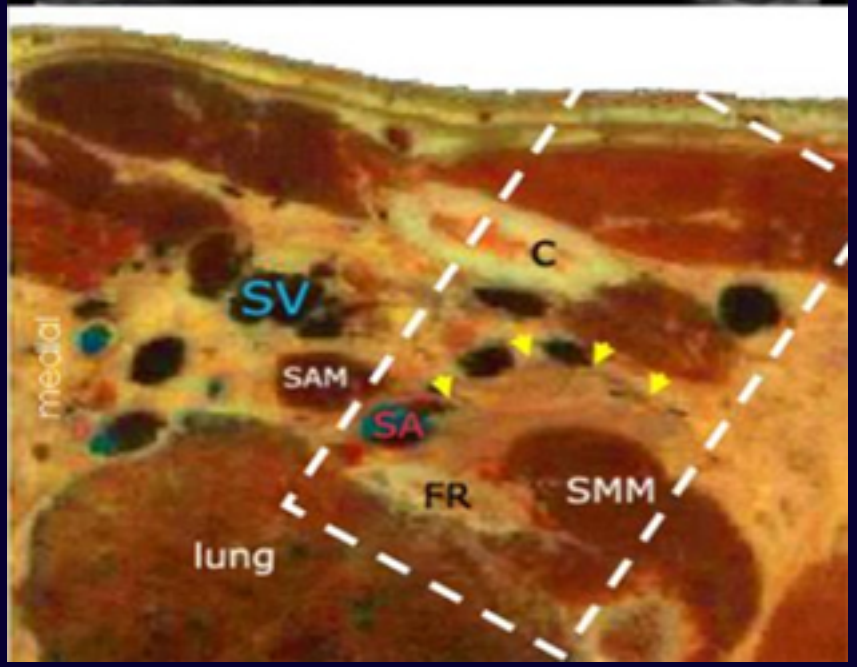
Photographed by www.fotosearch.com/LIF145

2. Central Line Insertion

Anatomy Subclavian vein, SCV

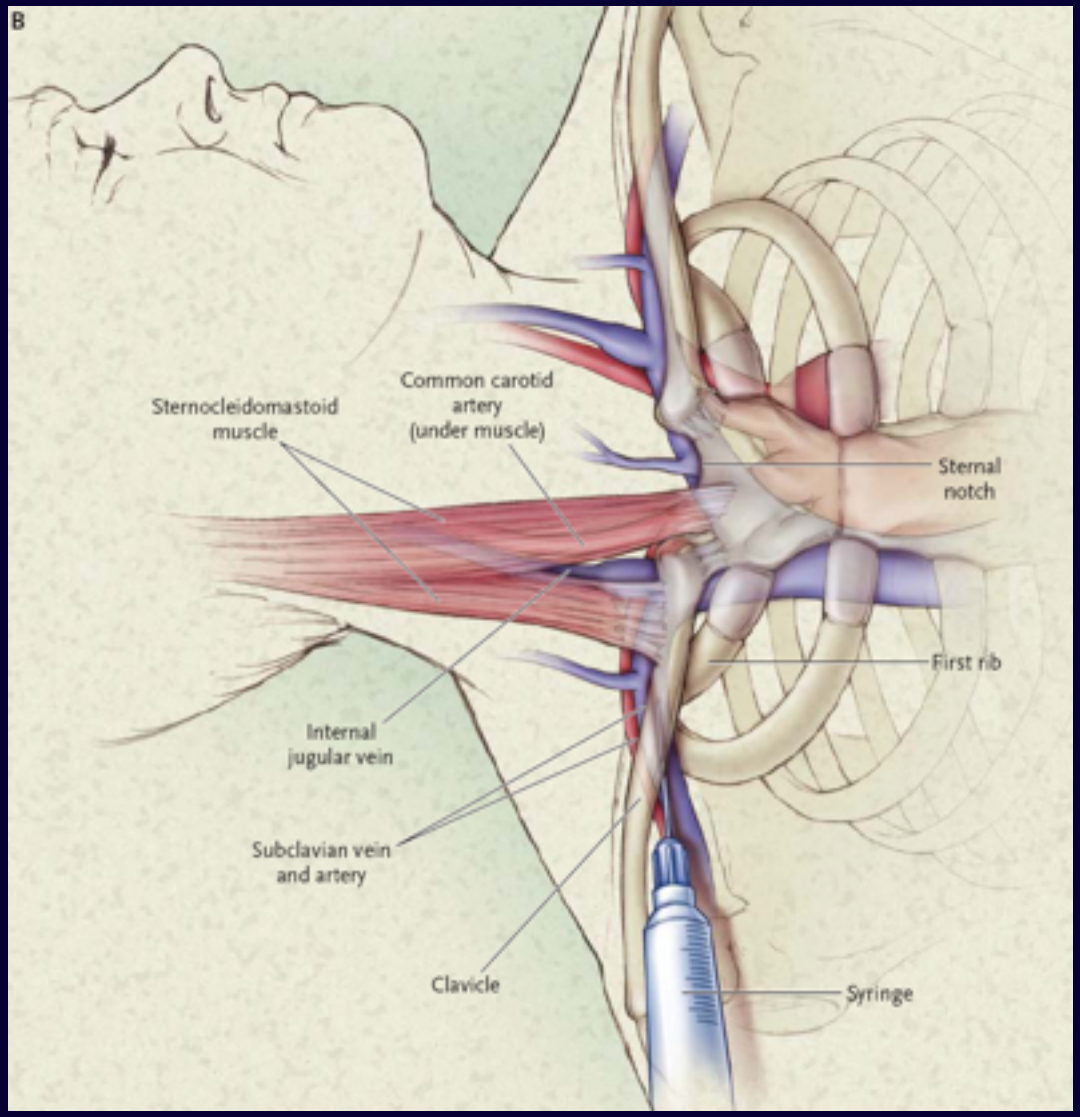






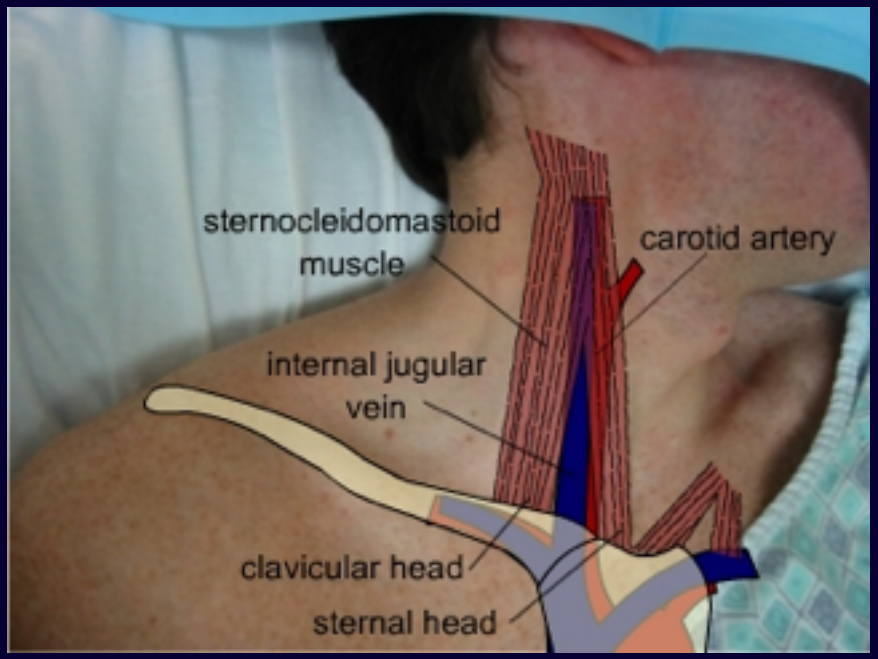
Chan VW et al. Anesth Analg 2003;97:1514-7

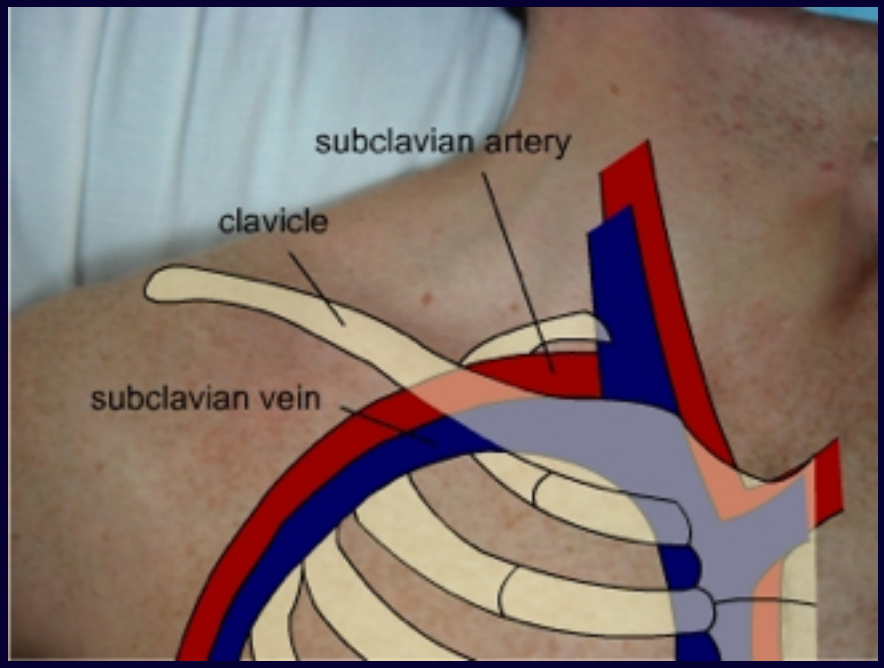
Anatomy Subclavian vein, SCV



DC McGee et al. N Engl J Med 2003;348(11):1123-33

Anatomy Internal Jugular vein

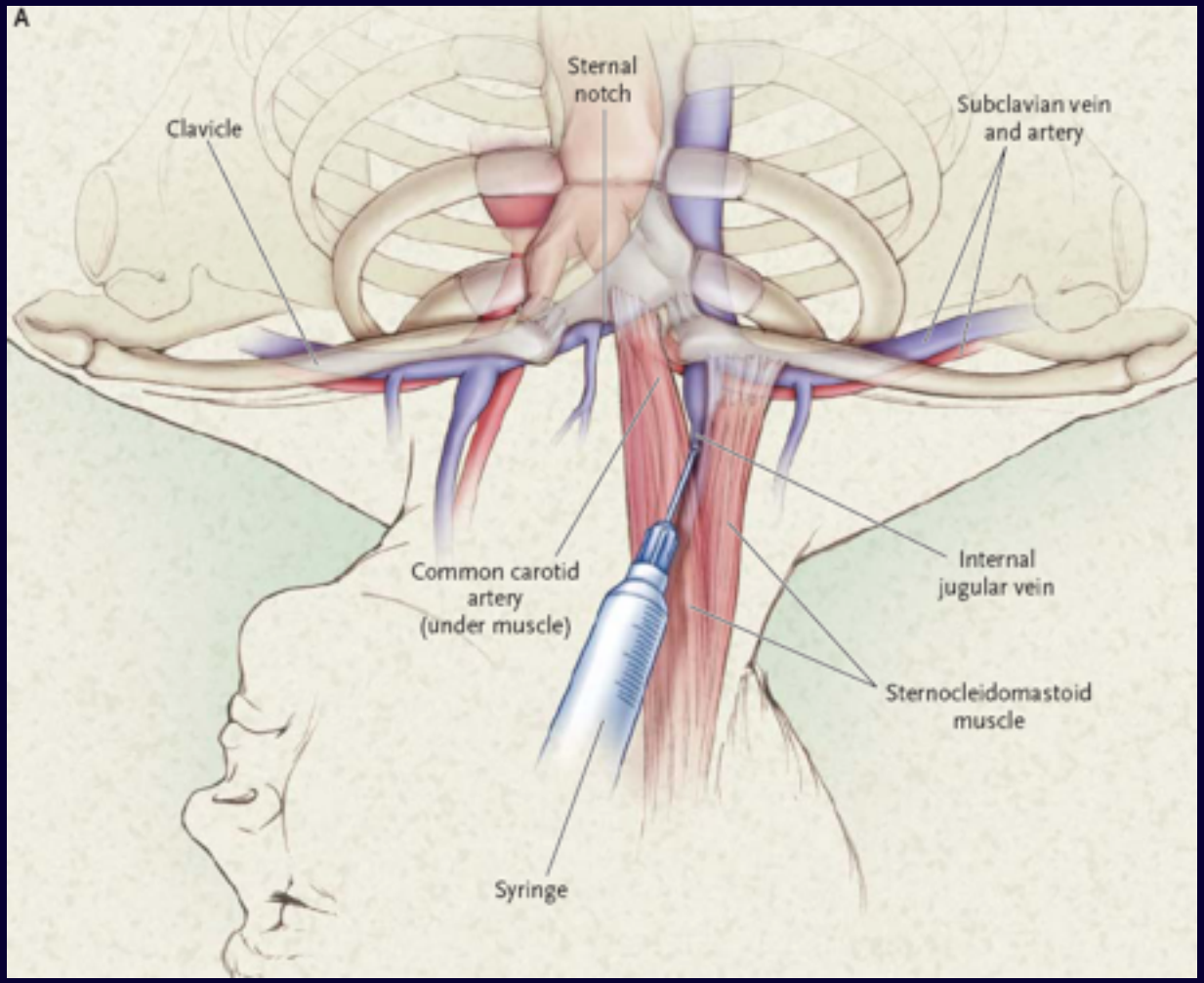




Chan VW et al. Anesth Analg 2003;97:1514-7

Internal Jugular Vein

Surface Anatomy



DC McGee et al. N Engl J Med 2003;348(11):1123-33

Internal Jugular Vein

Surface Anatomy

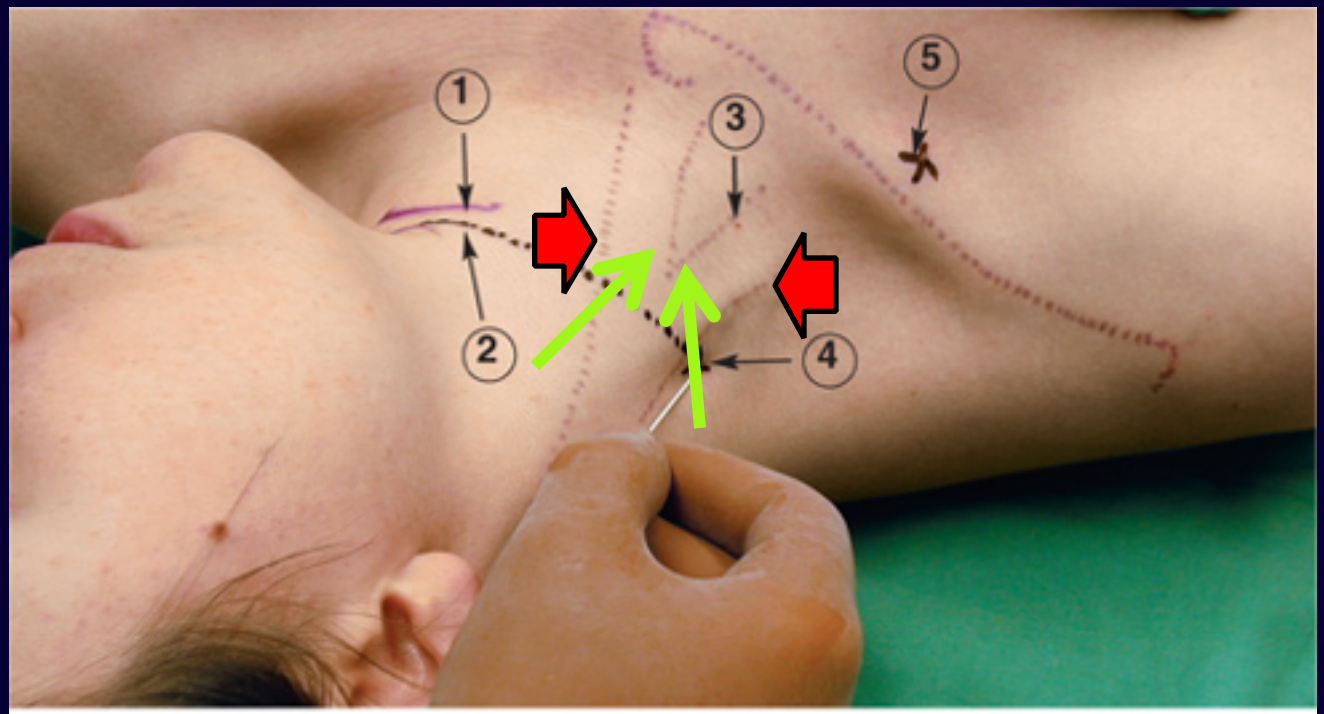
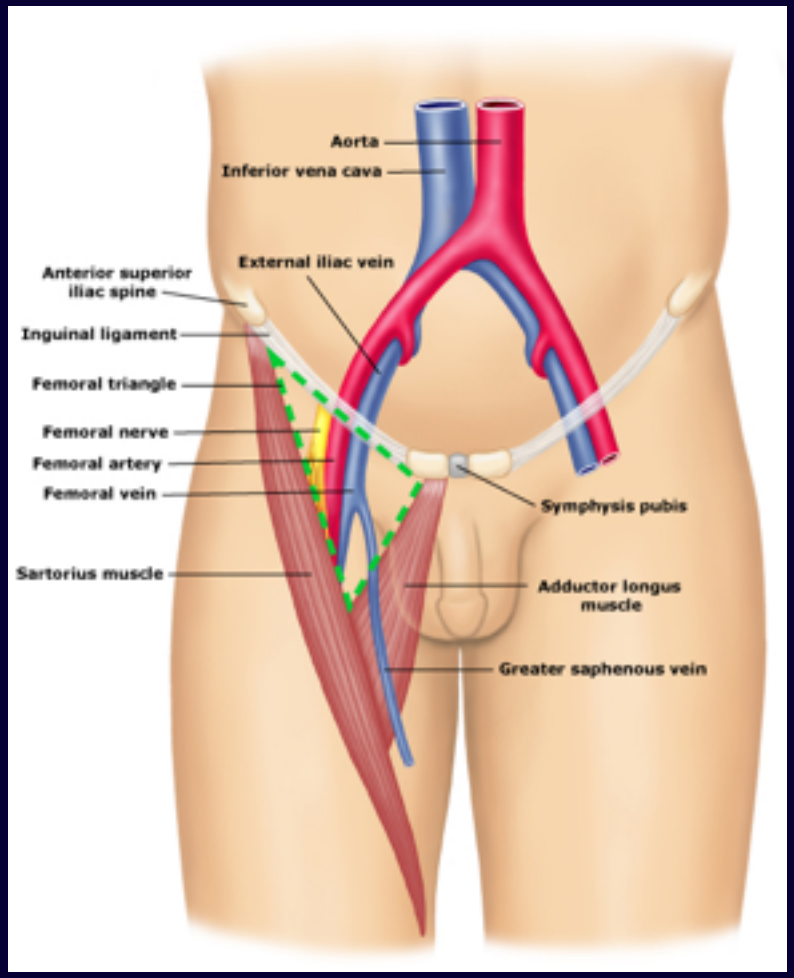


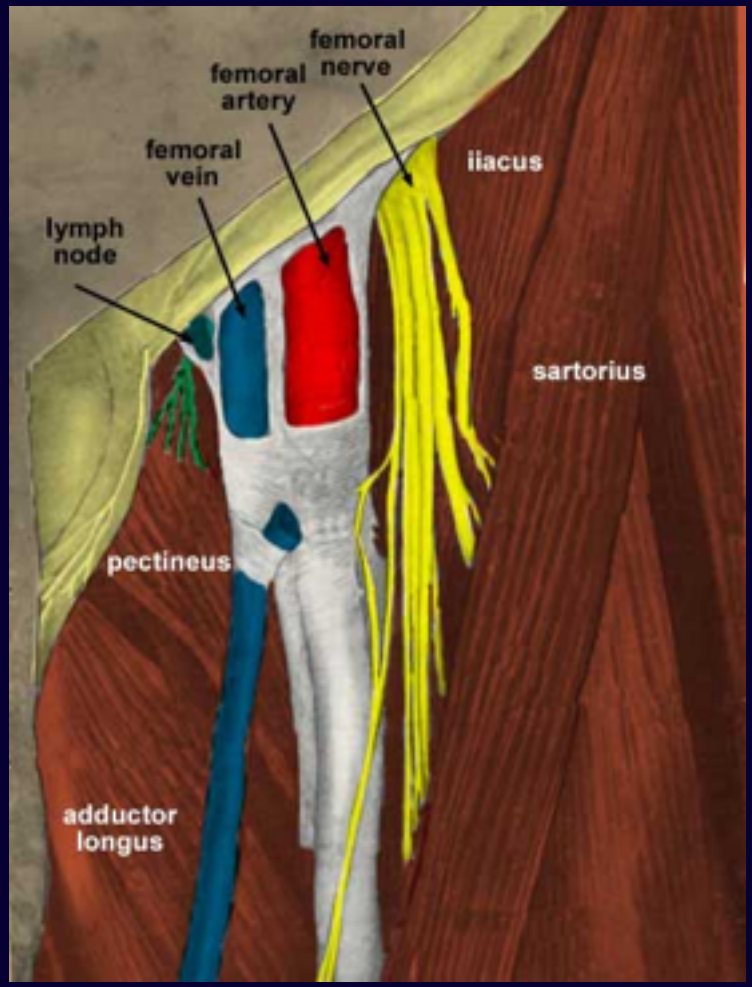
Fig. 11: Interscalene nerve block: Modification according to G. Meier

1. Cricoid
2. Superior thyroid notch
3. Sternocleidomastoid muscle
4. Puncture site for anterior access
5. Vertical, infraclavicular puncture site

Anatomy

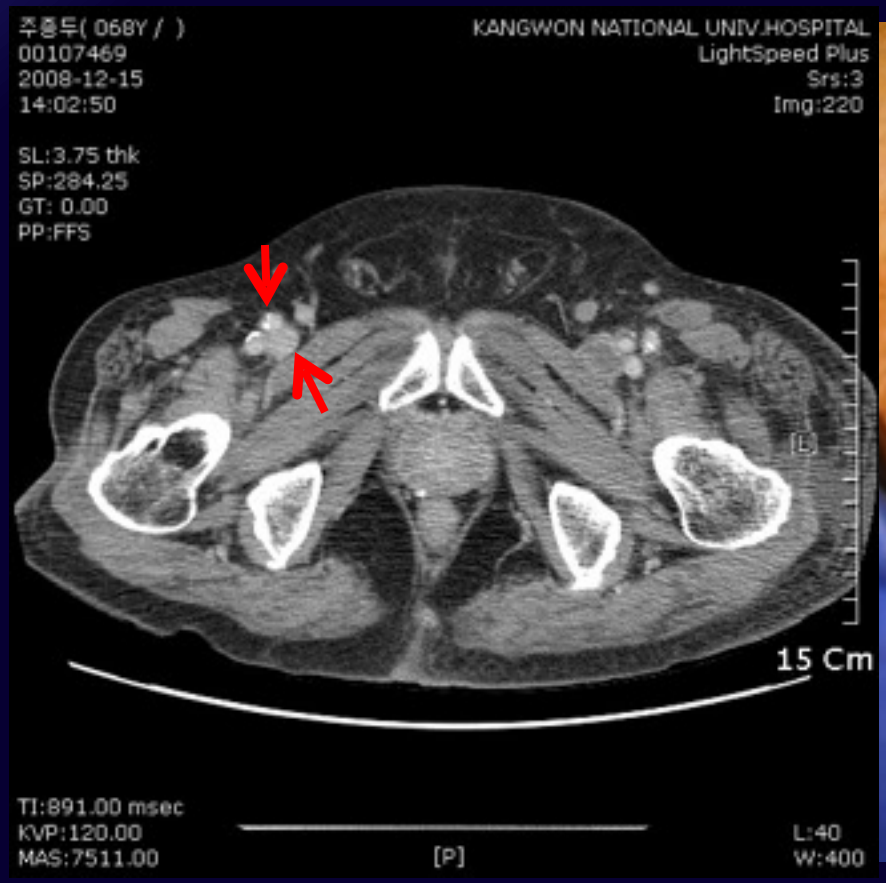
Femoral Vein, FV





Anatomy

Femoral Vein, FV



Indication of C-line insertion

Major Indication

Administration of Medication ; vasopressor, chemotheraphy, TPN
Hemodynamic monitoring ; CVP
Plasmapheresis, hemodialysis, CVVH

Minor Indication

Poor peripheral access
Volume resuscitation – large bore cath.
Frequent blood draw

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Contra-Indication of C-line insertion

Absolute

Peripheral IV access is adequate for the clinical needs of the patient
Infection over catheter site
Operator inexperience (unless supervised by an experienced practitioner)
Uncooperative or combative patients
Clot in the selected vein

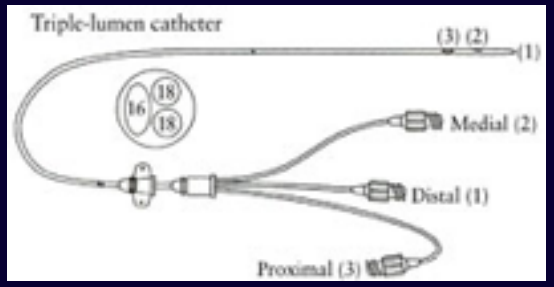
Relative

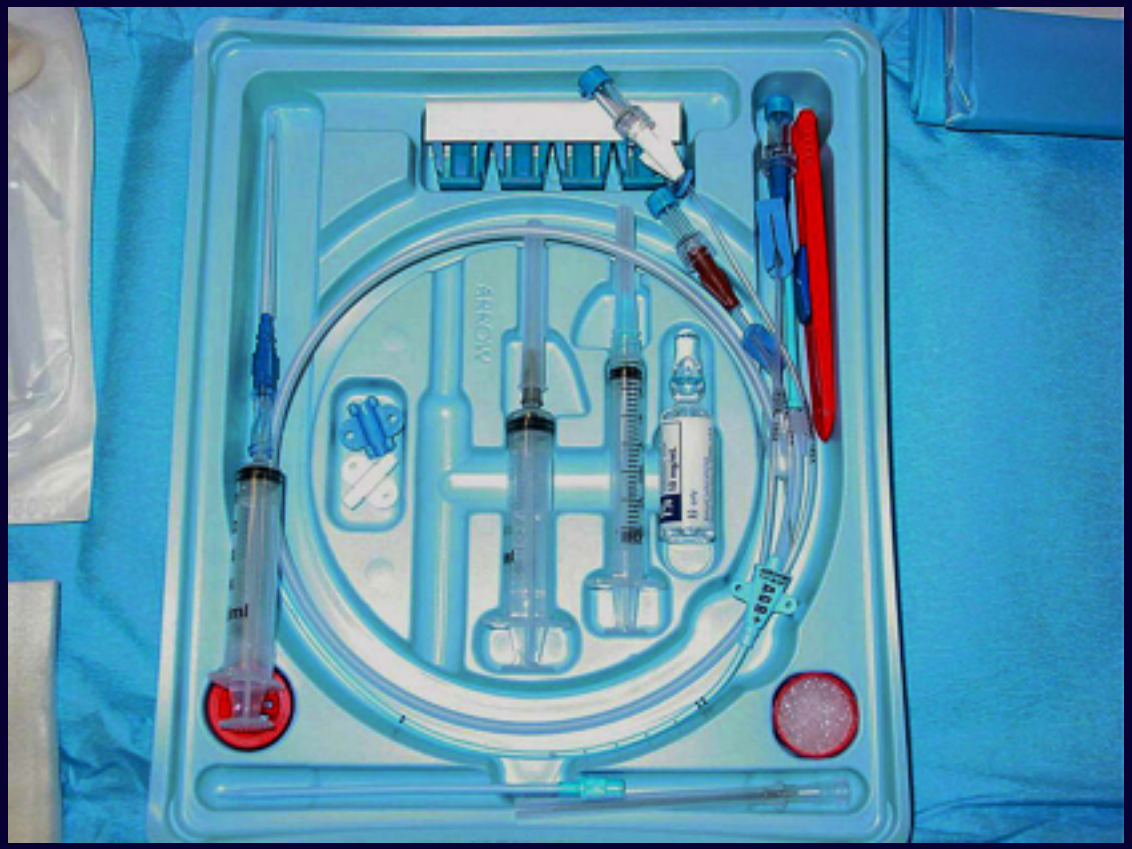
Coagulopathy and thrombocytopenia (platelets are < 50k and INR >1.5)
Injury or previous surgery to superior vena cava (e.g., superior vena cava syndrome)
Complications that can be life-threatening (i.e pneumothorax in COPD or bleed).

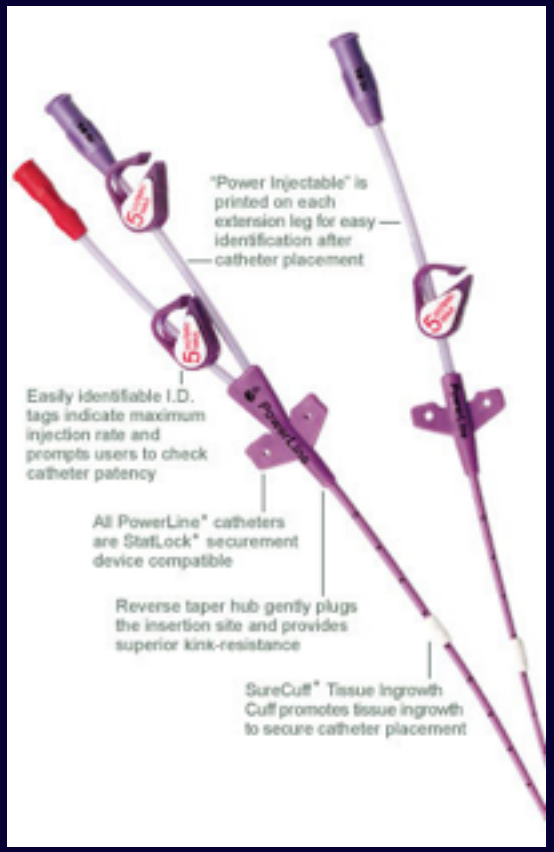
Site Selection

Location	Advantages	Disadvantages
Femoral Vein	*Fast, easy, high success rate* *Does not interfere with Intubation* *0% risk of pneumothorax*	*No CVP monitoring* *Prevents patient mobilization* *Higher rates of thrombosis, infection than SCV* *Femoral artery puncture more frequent than SCV*
Internal Jugular Vein	*Easy to control bleeding* *Pneumothorax is less common* *Straight shot into SVC*	*Difficult to access (intubation, tracheostomy)* *Poor landmarks in obese, short neck patients* *Carotid puncture more frequent than SCV* *Higher rates of thrombosis than SCV*
Subclavian Vein	*Most comfortable for patient* *Bony landmarks in obesity* *Lowest risk of thrombosis* *Lowest risk of line infection*	*Higher risk for pneumothorax* *Compression of bleeding site difficult* *Long pass from skin to vein (consider in obesity)* *Contraindications in lung disease, coagulopathy*

Equipment


Triple-lumen catheter
(3) (2)
(1)
16
18
18
Medial (2)
Distal (1)
Proximal (3)




"Power Injectable" is printed on each extension leg for easy identification after catheter placement
Easily identifiable I.D. tags indicate maximum injection rate and prompts users to check catheter patency
All PowerLine® catheters are StatLock® securement device compatible
Reverse taper hub gently plugs the insertion site and provides superior kink-resistance
SureCuff® Tissue Ingrowth Cuff promotes tissue ingrowth to secure catheter placement

Procedure

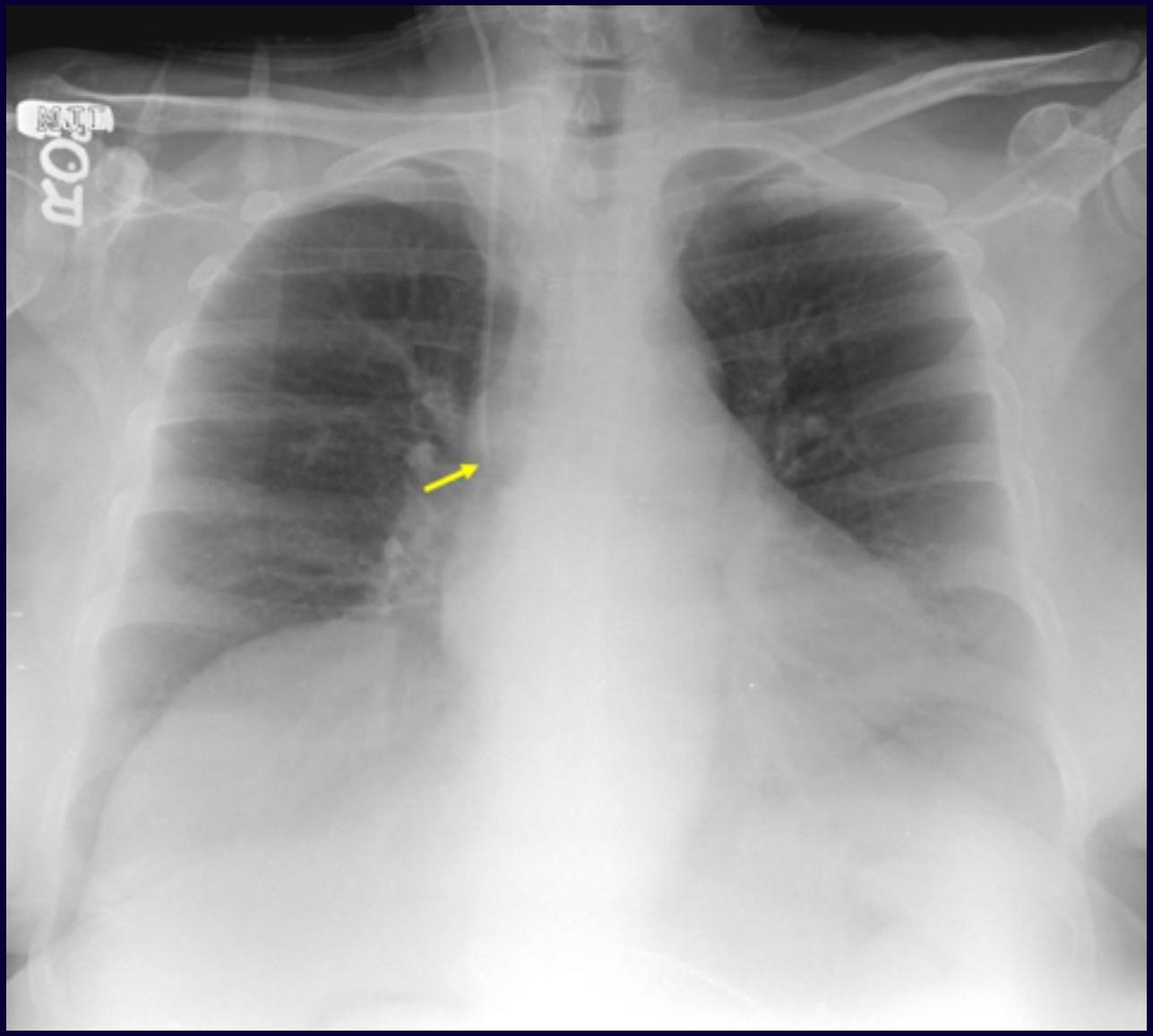
Internal Jugular vein

1. Informed consent from patient
2. Skin preparation : both area using povidone-iodine or 2% chlorhexidine
3. Turn head in the opposite direction and head down
4. Local anesthesia and U/S guided marking, lateral to CCA
5. puncture the top of triangle at 30° and aspiration. (if not, 3 finger rule)
6. Guide wire insertion –caution
7. Note the arrhythmia
8. Remove the needle
9. Skin dilator insertion – twisting and No. 11 blade
10. Remove the dilator
11. Place catheter over guide wire – brown cap
12. Remove the guide wire
13. Flush the line through all port
14. Suture
15. Confirm chest film – SVC and RA junction.

Procedure

Subclavian vein

Procedure



General Complications

Complications during insertion

Arterial puncture
Pneumothorax
Arrhythmias
Bleeding, haematoma, haemothorax
Damage to thoracic duct, chylothorax
Nerve injury
Air emboli
Catheter shearing/fragment
Malplacement
Airway obstruction
(rare : may be due to large bilateral hematoma)

Table 1. Risk of Complications Associated with Internal Jugular, Subclavian, and Femoral Central Venous Catheterization.

Complication	Risk of Complication at Catheterization Site*		
	Internal Jugular Vein	Subclavian Vein	Femoral Vein
Pneumothorax (%)	<0.1 to 0.2	1.5 to 3.1	NA
Hemothorax (%)	NA	0.4 to 0.6	NA
Infection (rate per 1000 catheter-days)	8.6	4	15.3
Thrombosis (rate per 1000 catheter-days)	1.2 to 3	0 to 13	8 to 34
Arterial puncture (%)	3	0.5	6.25
Malposition	Low risk (into inferior vena cava, passing through right atrium)	High risk (crossing to contralateral subclavian vein, ascending internal jugular vein)	Low risk (lumbar venous plexus)

Lat
Infe
- lo
- systemic
- endocarditis

Thrombosis, thromboembolism

AS Graham et al. N Engl J Med 2007;356(e21)

Complications

Infectious Complication (SC<IJ or FV)

3 Mechanism

1) local insertion site infection→ Ascending infection
2) Intra luminal hub colonization
3) Hematogenous seeding

5 step consideration : all (+) evidence

1) hand hygiene
2) adherence to maximal barrier precautions
3) 2% chlorhexidine skin antisepsis
4) optimal catheter site selection
5) daily review of the necessity

DC McGee et al. N Engl J Med 2003;348(11):1123-33

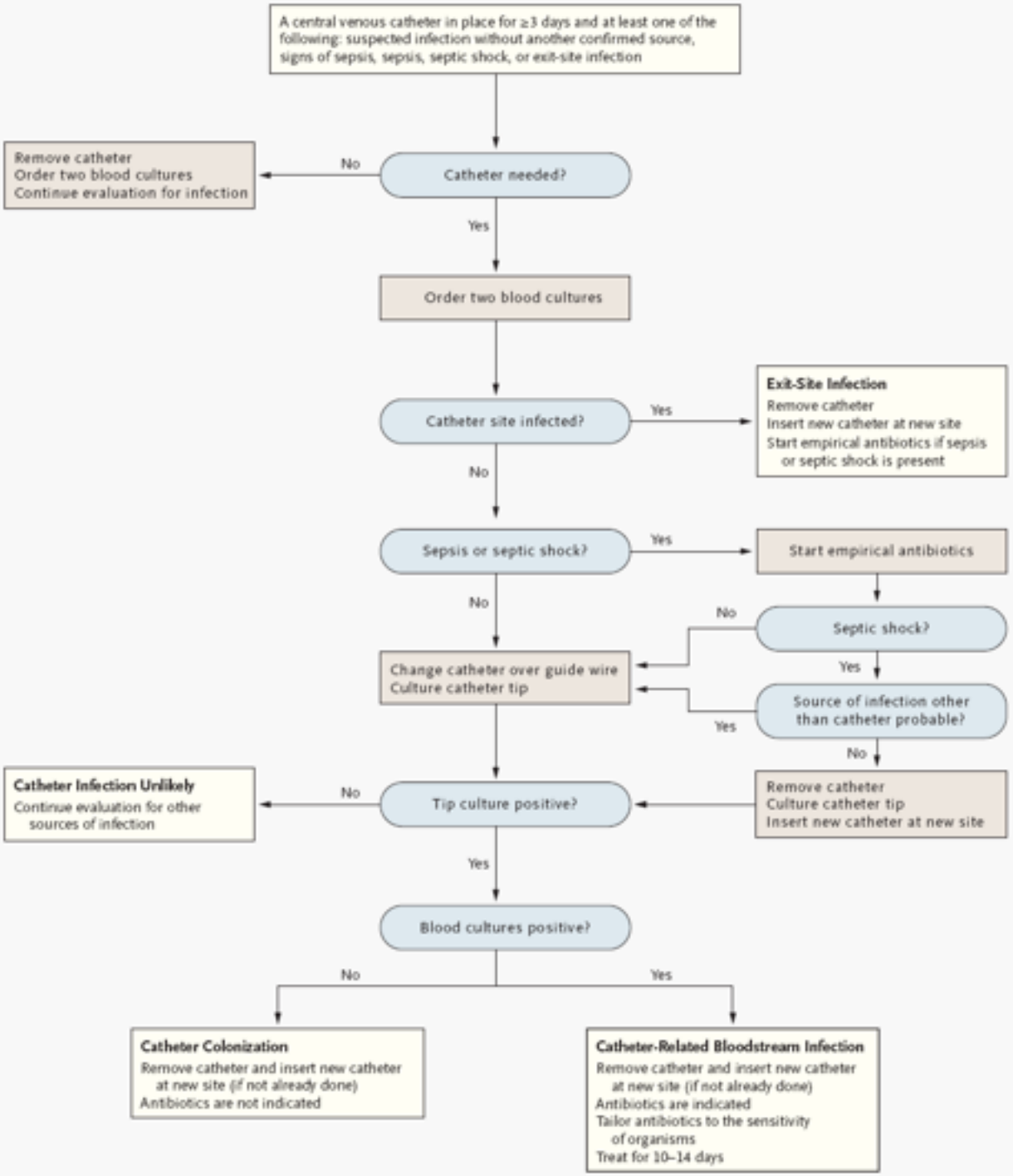
Complications

Cath related infection

Blood cultures : peripheral sites are preferred.

Empirical antibiotic therapy
- include vancomycin.
- gram-negative organisms

In patients with a catheter-related bloodstream infection, treatment for more than 14 days is indicated in patients with endocarditis (duration of treatment, 4 to 6 weeks) or *Staphylococcus aureus* bacteremia (2 to 3 weeks).



DC McGee et al. N Engl J Med 2003;348(11):1123-33

Complications

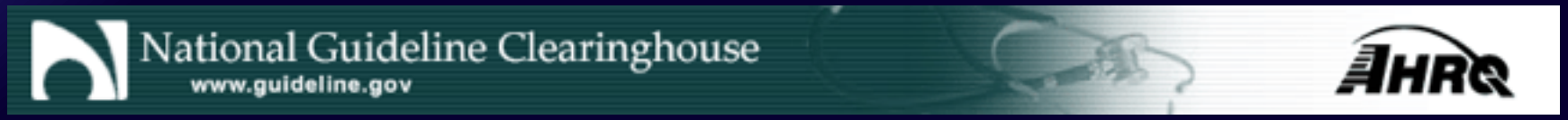
Mechanical Complications : IJ or SC < FV
Arterial puncture, hematoma, Px, Hx, arrhythmia, improper location.

5 step consideration : all (+) evidence
Recognize risk factors : prior surgery, skeletal deformity, scarring
Seek assistance from experienced clinician : >50 times
Avoid femoral vein : serious complications are similar
Use US guidance for IJV :
Do not scheduled routine Cath change

Thrombotic complication : SCV(1.9%) < FV(21.5%) or IJV (8%)

DC McGee et al. N Engl J Med 2003;348(11):1123-33

Concerns



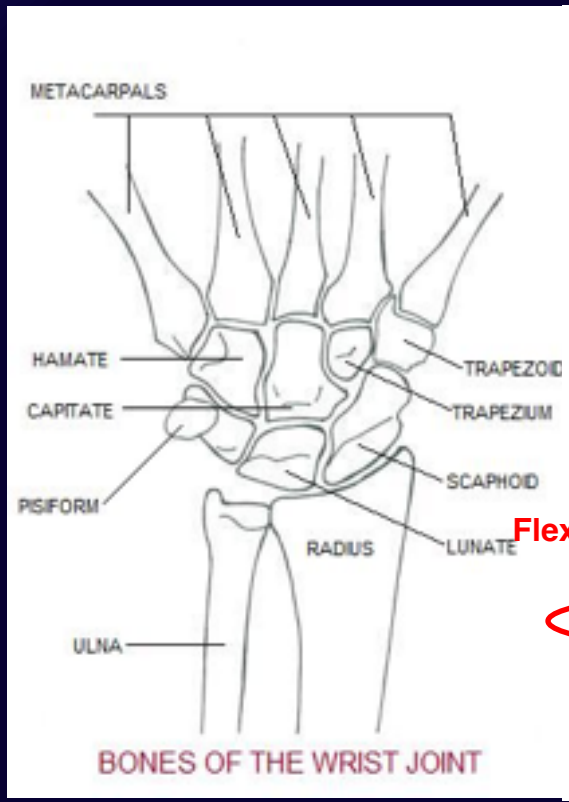
Scheduled change : increase mechanical and infectious Cx.→ not recommended
Topical antibiotics ointment : ineffective, promote resistant colonization
Dressing type (gauze vs. tape), frequency ; No Evidence-Based recomendadion
24hr after then weekly
Antiseptic containing hubs, anti-impregnated cath→↓cath related infection.
Antibiotic prophylaxix : not recommended
Heparin : effective at high risk for thrombosis
Flushing with heparin vs NS : controversal.
Concurrent infusion of blood product and drug : possible through dual lumen
Low dose warfarin : not recommended
Therapeutic dose warfarin : recommended in high risk of thrombosis

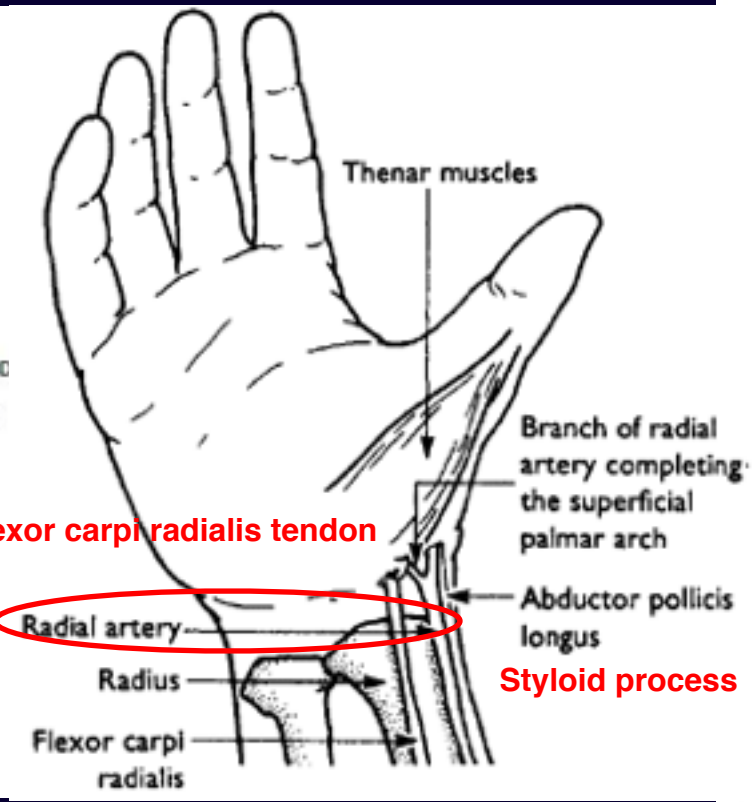
2008 NGC Guidelines on the insertion and management of central venous access devices in adults.
Maruo et al. ESPEN guideline. Clin Nutr. 2009 In Press
DC McGee et al. N Engl J Med 2003;348(11):1123-33

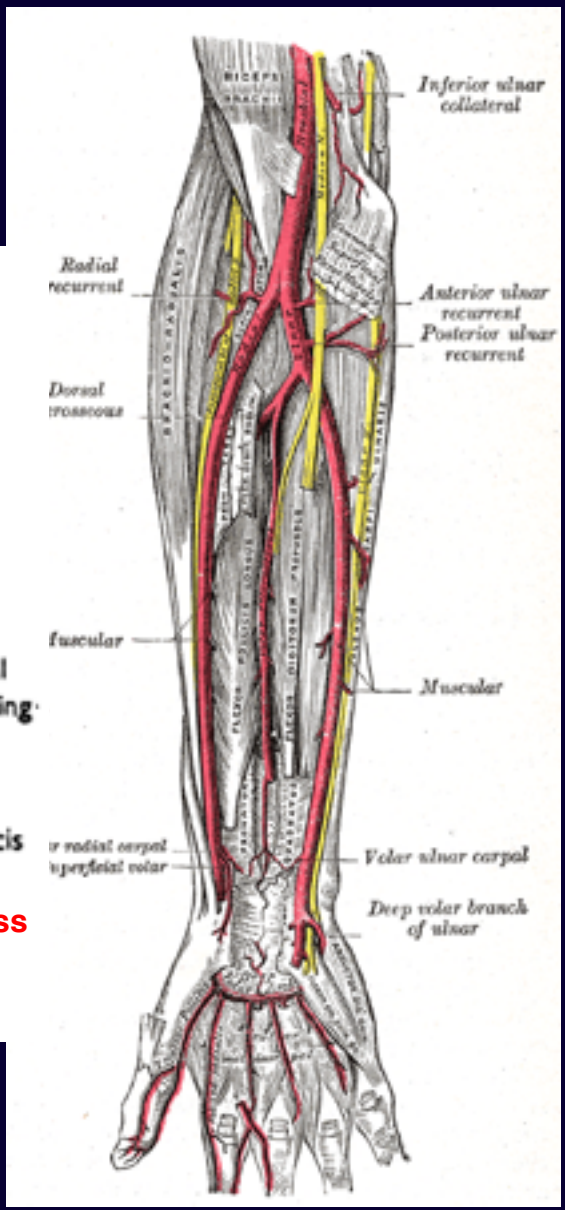
3. A-line insertion

Anatomy

Radial artery



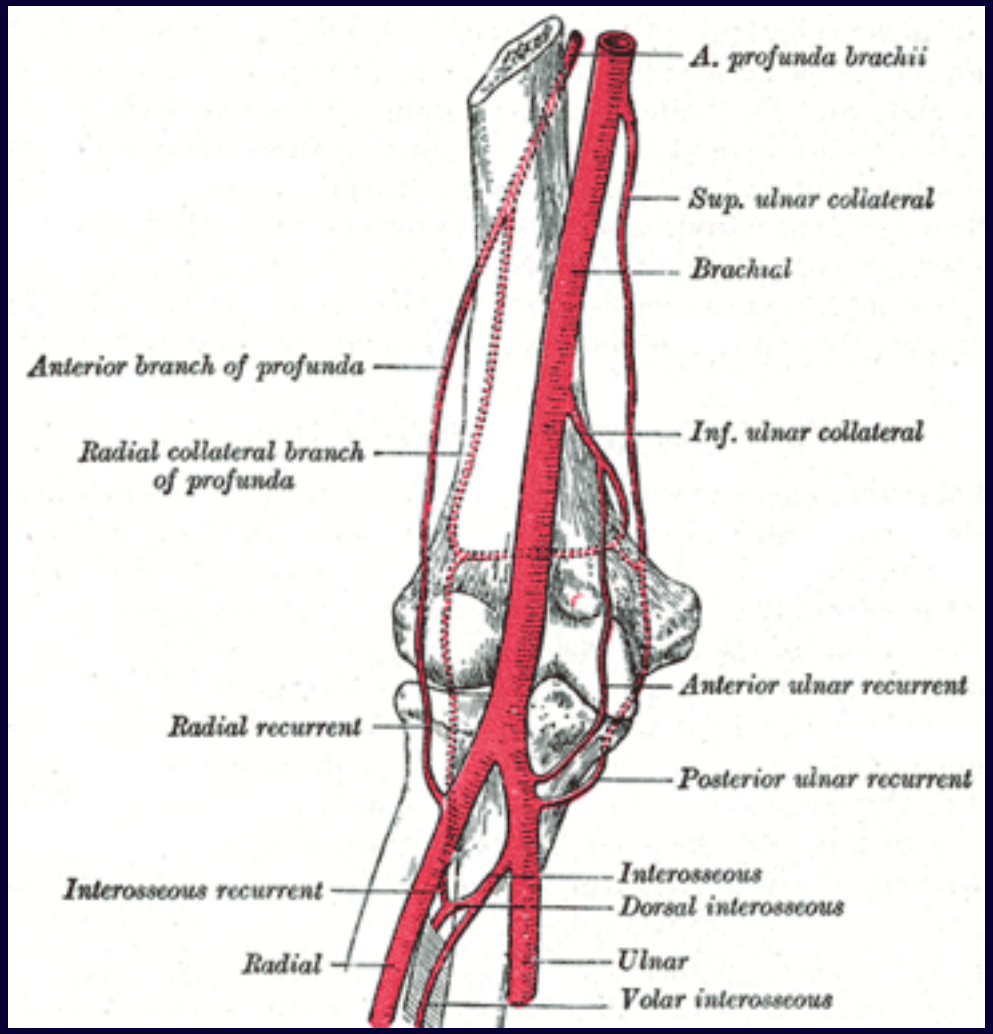


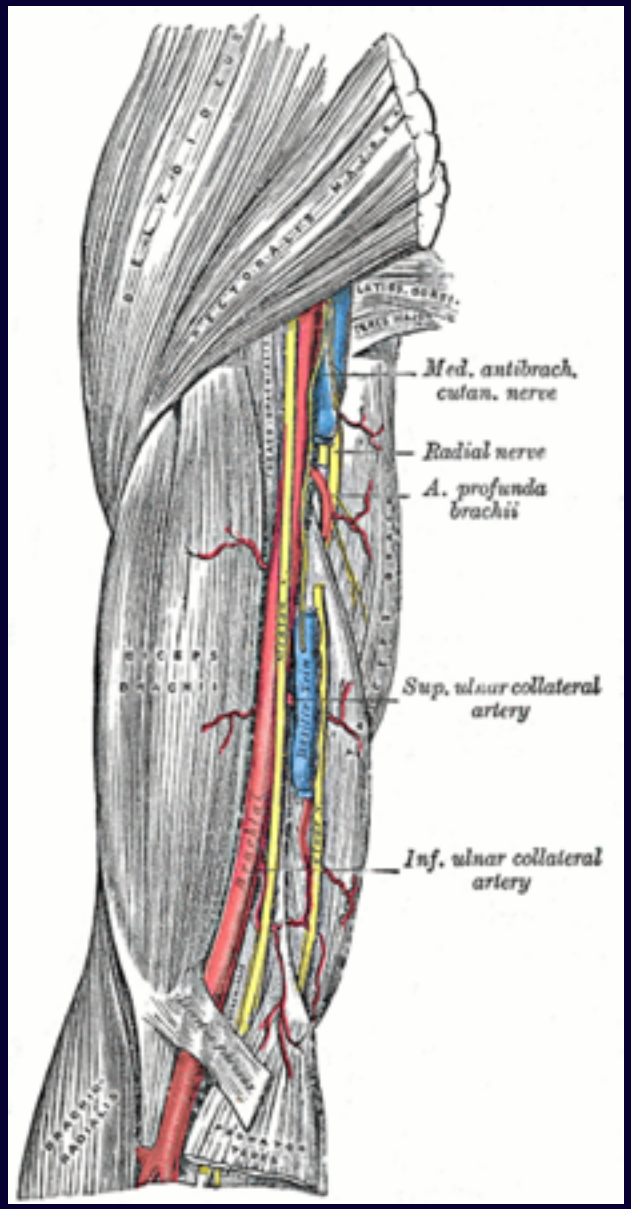


Chan VW et al. Anesth Analg 2003;97:1514-7

Anatomy

Brachial artery

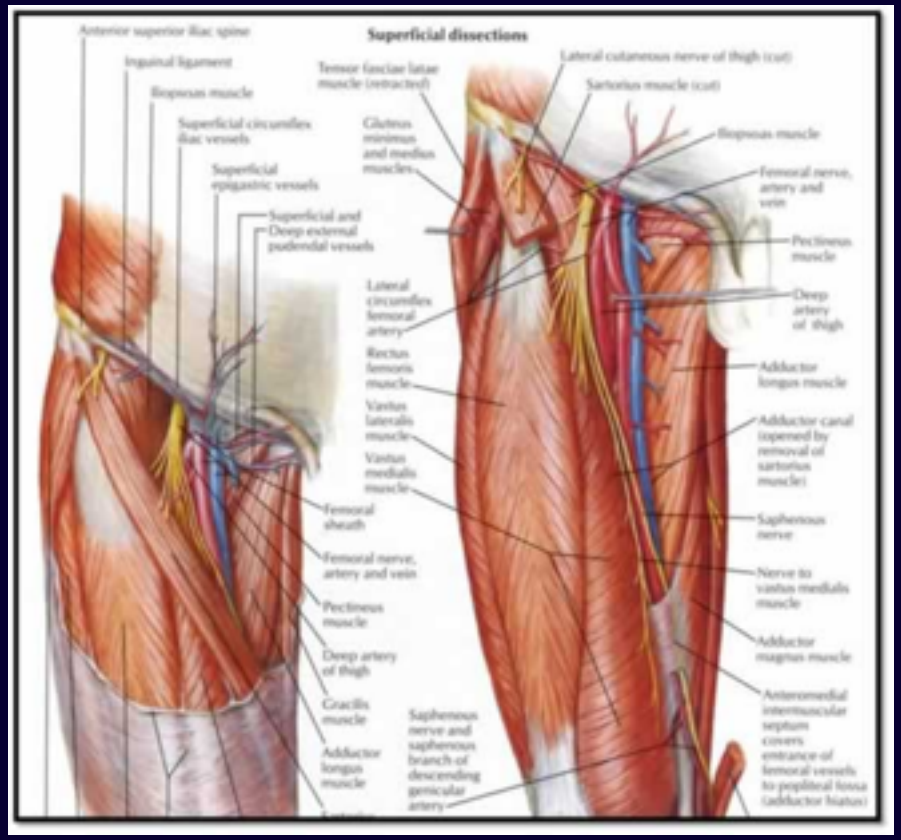


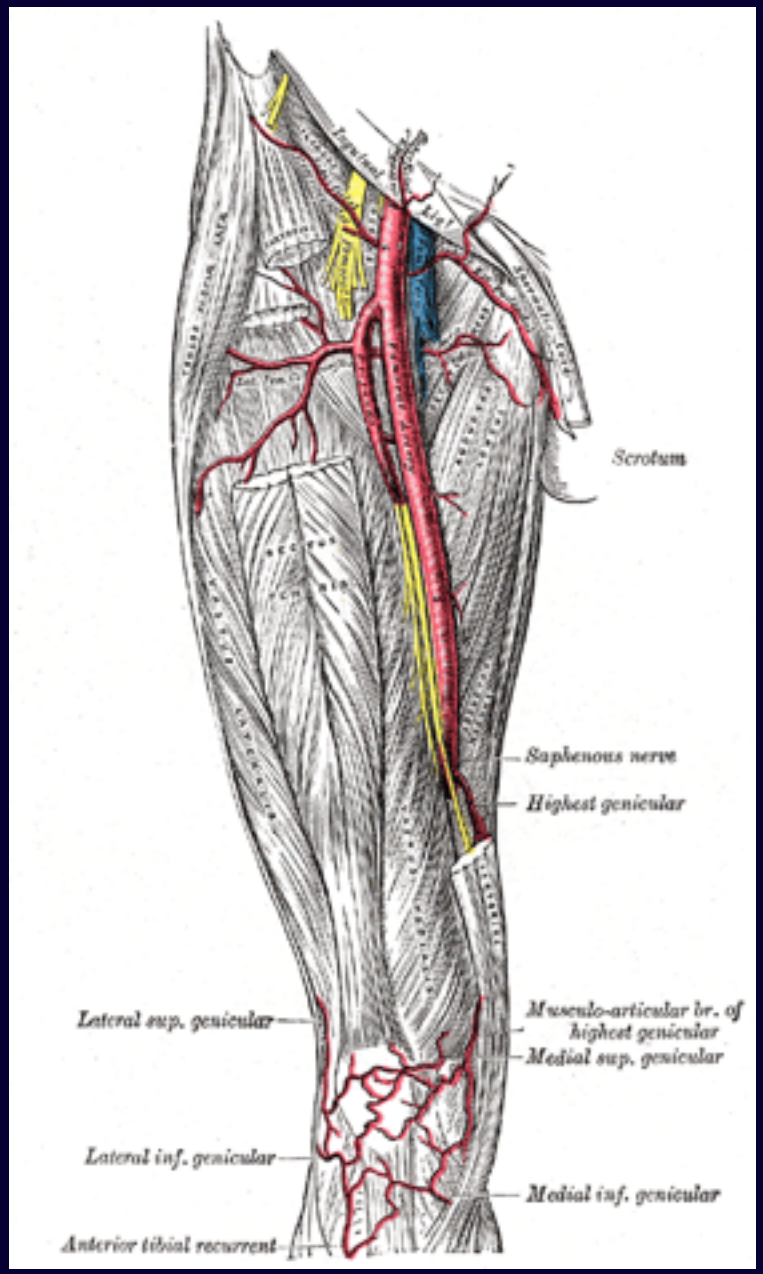


Chan VW et al. Anesth Analg 2003;97:1514-7

Anatomy

Femoral artery

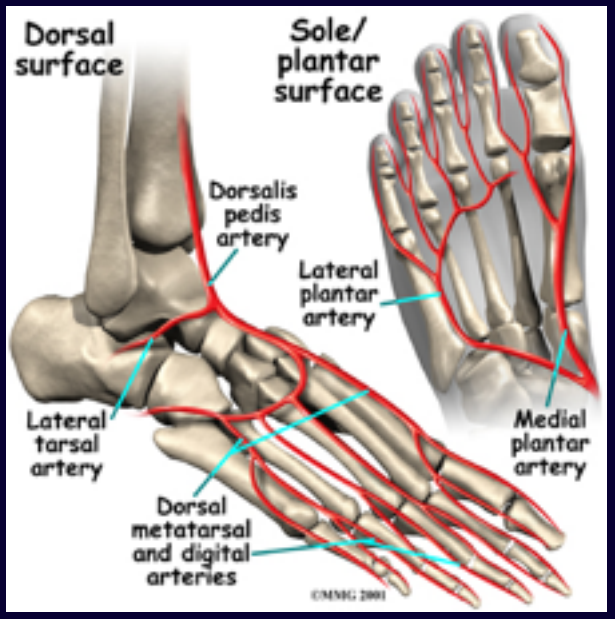


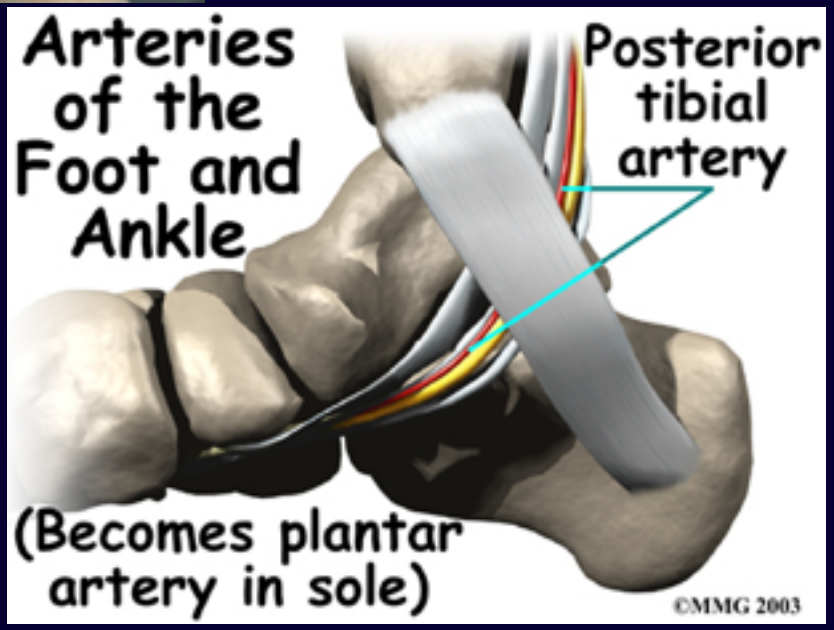


Chan VW et al. Anesth Analg 2003;97:1514-7

Anatomy

DPA and PTA





Indication & CIx of A-line insertion

Indication

Frequent ABGA, blood sample
Consistant monitoring of blood pressure, wave form (IABP)
Impossible to checking NBP : burn, obesity, multiple trauma

Contra-Indication

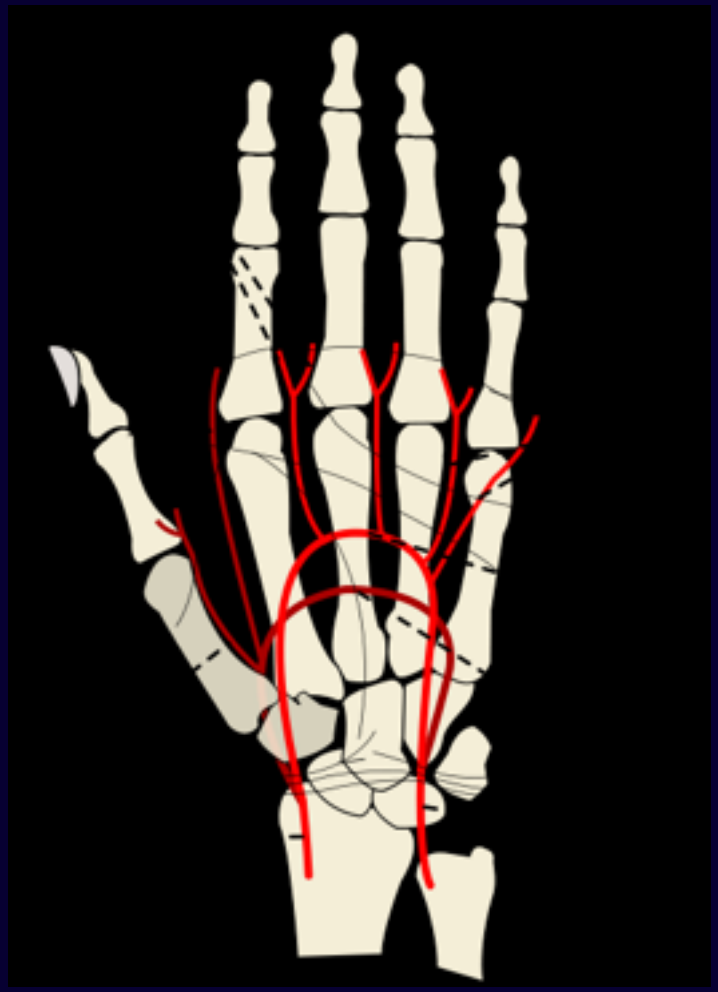
Cellulitis or other infections over the radial artery
Absence of palpable radial arterial pulse
Positive Allen test
Coagulation defects and bleeding tendency

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

(+) Allen Test

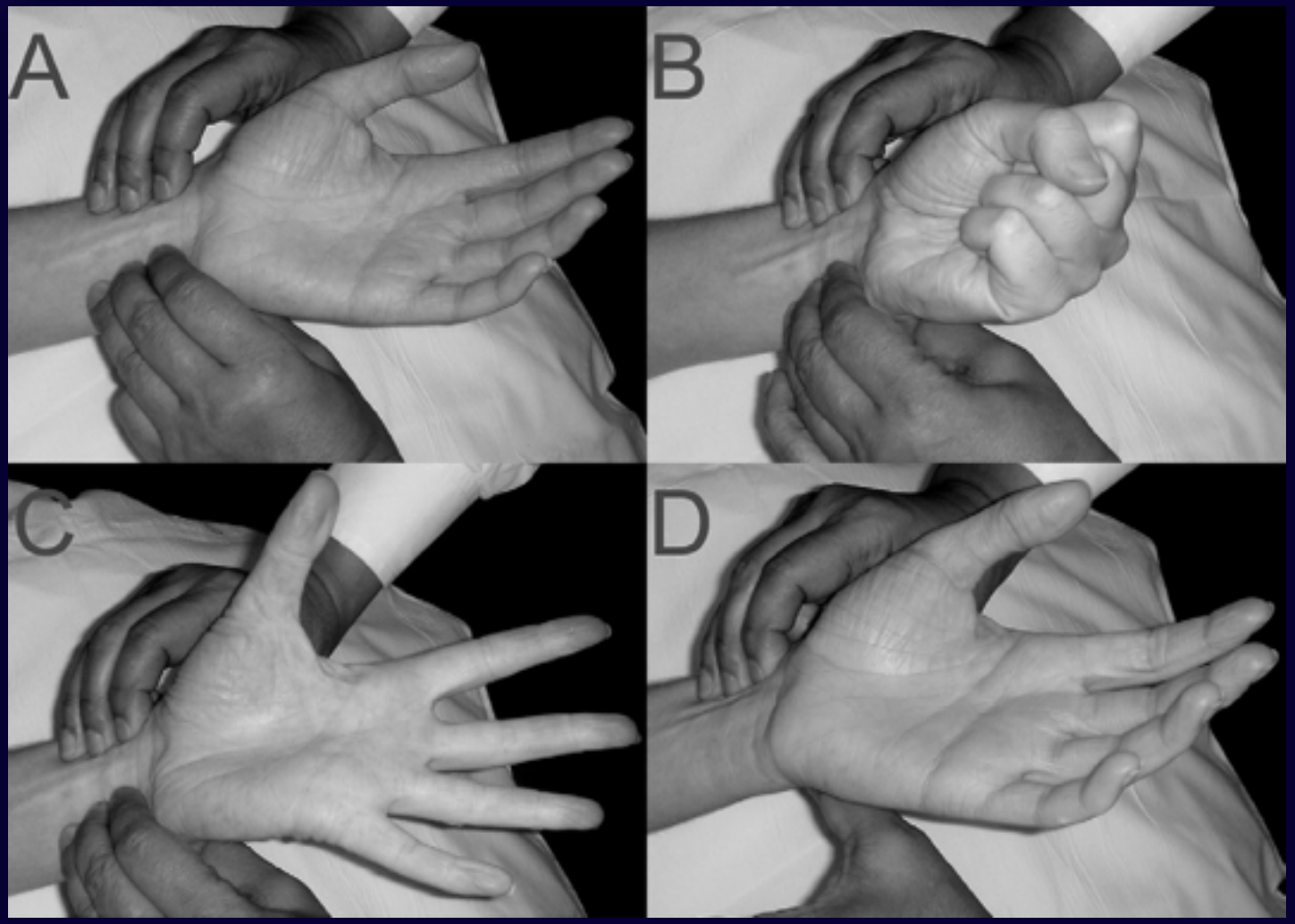
1) The hand is elevated and the patient is asked to make a fist for about 30 seconds.
2) Pressure is applied over the ulnar and the radial arteries so as to occlude both of them.
3) Still elevated, the hand is then opened. It should appear blanched.
4) Ulnar pressure is released and the color should return in 7 seconds.

If color does not return or returns after 7–10 seconds, then the ulnar artery supply to the hand is not sufficient and the radial artery therefore cannot be safely pricked/cannulated.



Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

3 digit Mod. Allen Test



M Ashf et al. Ann Thorac Surg.2007;84:686-7

Equipment

Equipment

Una Srejic et al . Int J Health cal Anesthesia. 2003;3(1)

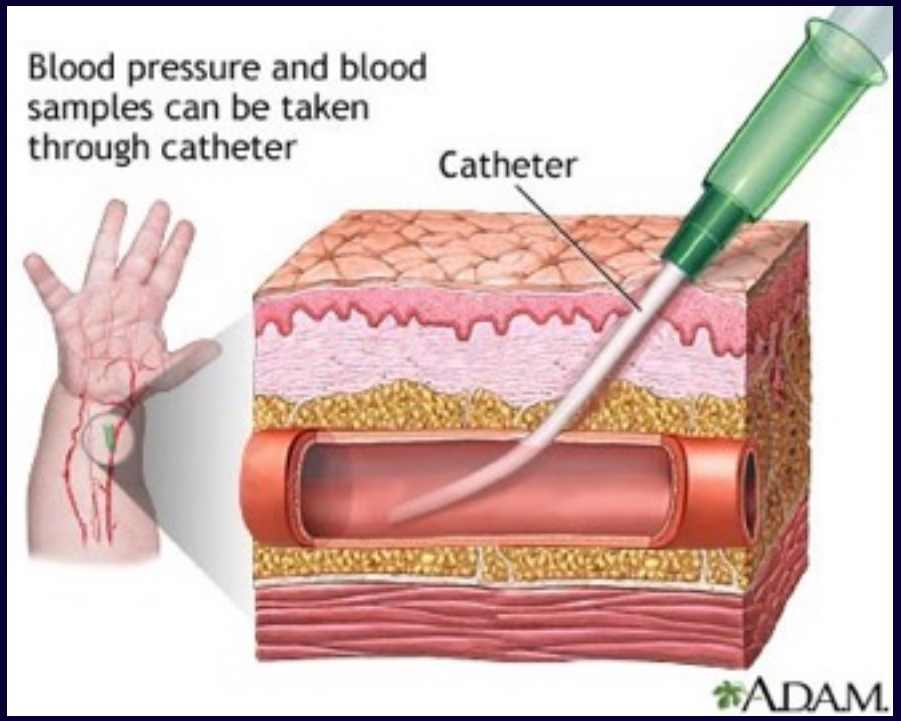
Procedure

Complications

Rare fatal complication (less than 1%)

Ischemia :
- PAD,
- indwelling time,
- puncture time

Pseudoaneurysm
Hematoma
Nerve injury
Infection

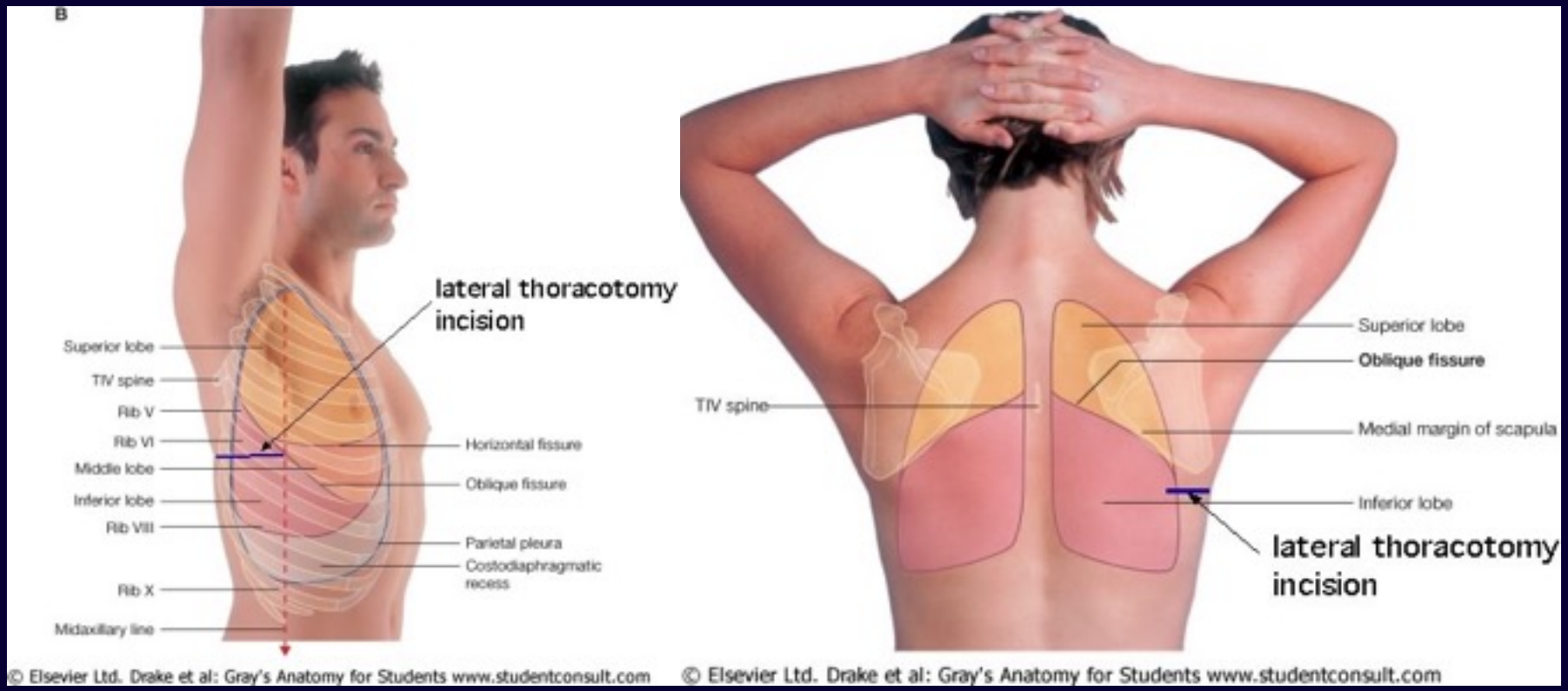


Una Srejic et al . Int J Health cal Anesthesia. 2003;3(1)

4. Closed Thoracotomy

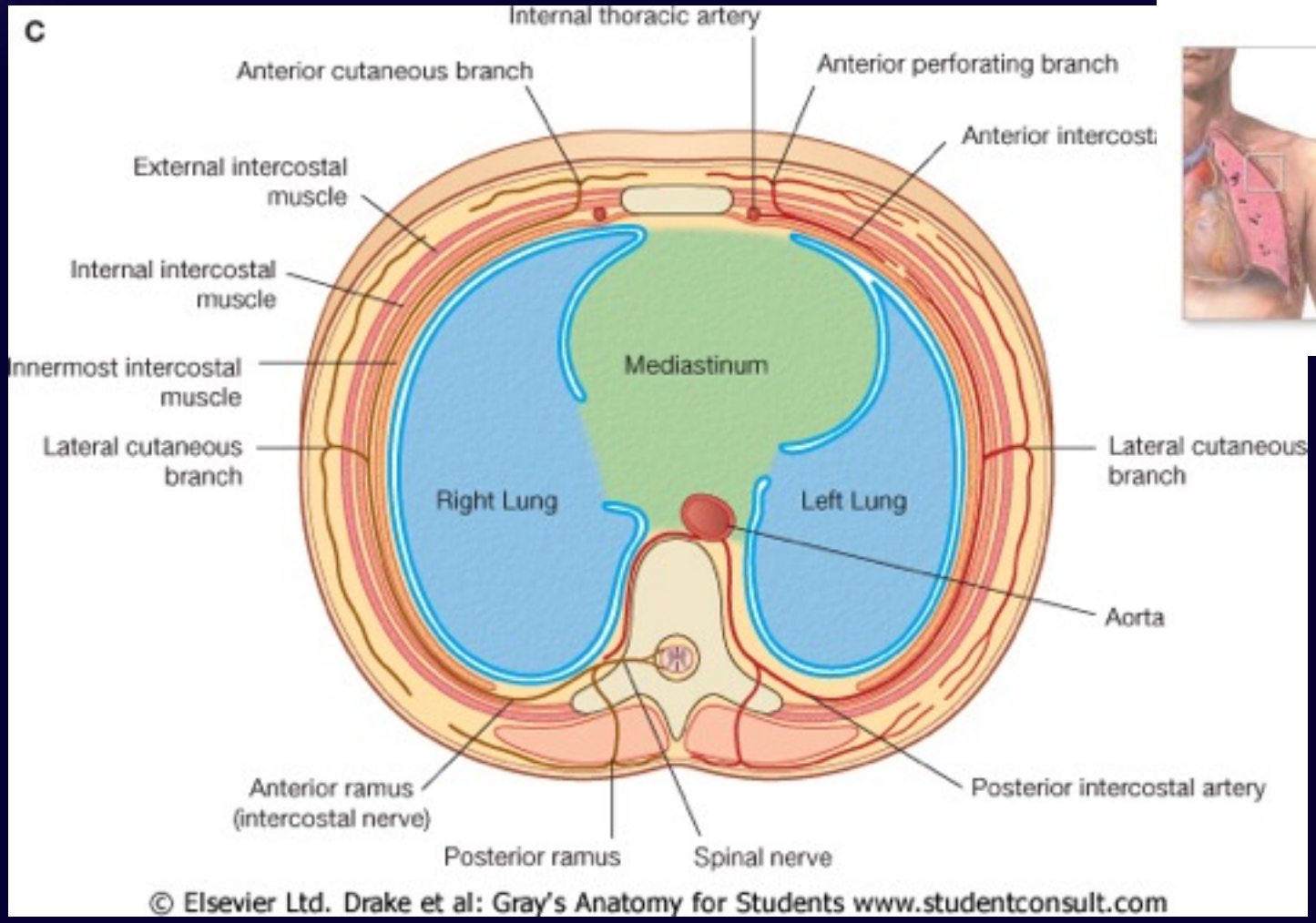
Anatomy

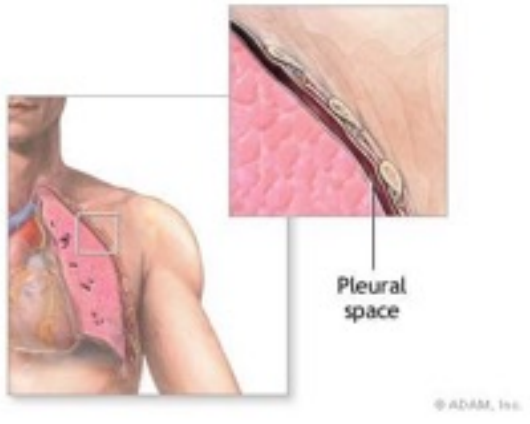
Surface Anatomy ; 4th, 6th, 8th ICS



Anatomy

Intercostal muscle, Endothoracic fascia, Parietal pleura





Indication & Contra-Ix

Indication – Drainage and Lung expansion

1. Pneumothorax
   - ventilated pts.
   - tension Px
   - large seconadary pneumothorax over 50 years.
2. Malignant pleural effusion
3. Empyema, Complicated parapneumonic effusion.
4. Traumatic hemopneumothorax
5. Post thoracotomy

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Indication & Contra-Ix

Contra-Indication : no absolute Cix, if pt in respiratory distress

1. Infection over insertion site
2. Uncontrolled bleeding diathesis

Never forget caution when the pt has

*** Obesity**
*** Adhesion possibility**
*** Giant bullae**
*** LVH**

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Procedure

Equipments

1. Gowning and Scrubbing
2. Confirm Chest film or CT
3. Patient positioning – Supine, Lateral decubitus, Sitting position
4. Target point marking (4^{th},5^{th},6^{th} ICS MAL→ lateral line of Nipple)
5. Skin scrubbing
6. Diagnostic thoracentesis and Lidocain insertion (ETF and Parietal Pleura)
7. 2-3Cm transverse incision
8. Blunt dissection
9. Tube insertion using hemostat (advance the tube superiorly and posterioly)
10. Connect tube to under water seal
11. Wound closure
12. Dressing
13. Confirm Chest film

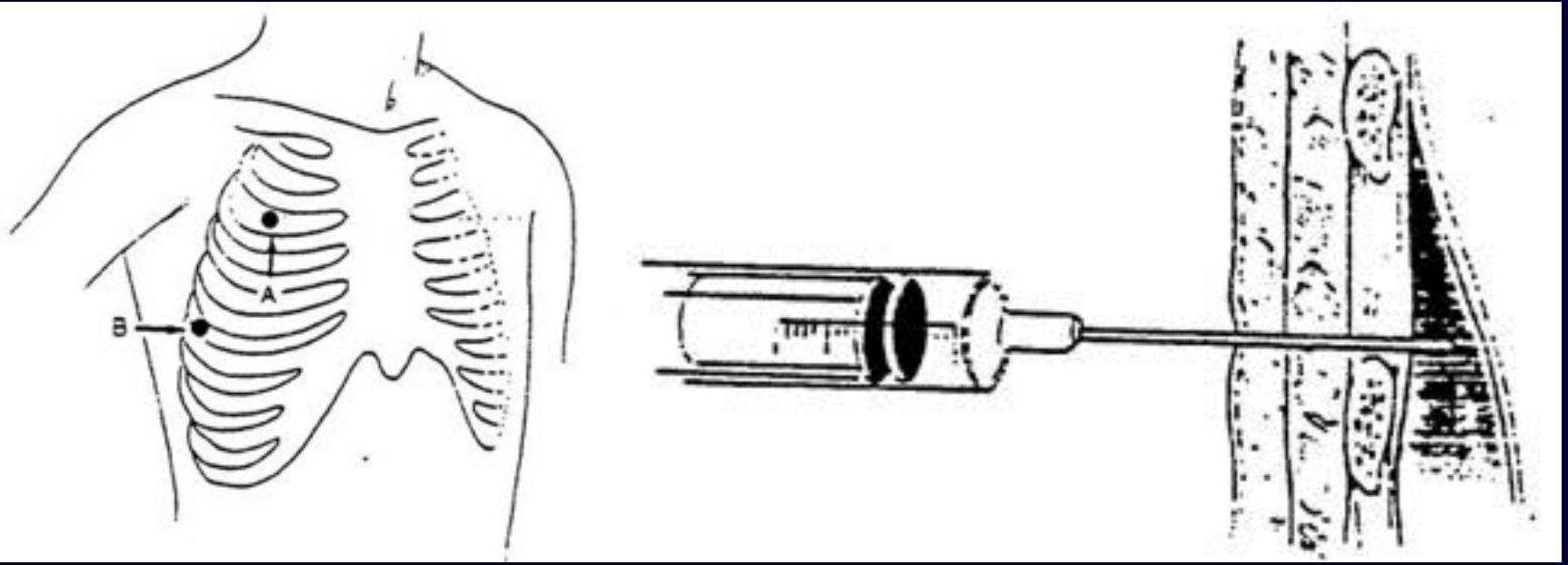
Charles E et al. In Current Emergency Diagnosis and Treatment. 4^{th} Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Procedures

Size of Chest Tube	
Adult or Teen Male	28-32 Fr
Adult or Teen Female	28 Fr
Child	18 Fr
Newborn	12-14 Fr

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Procedure



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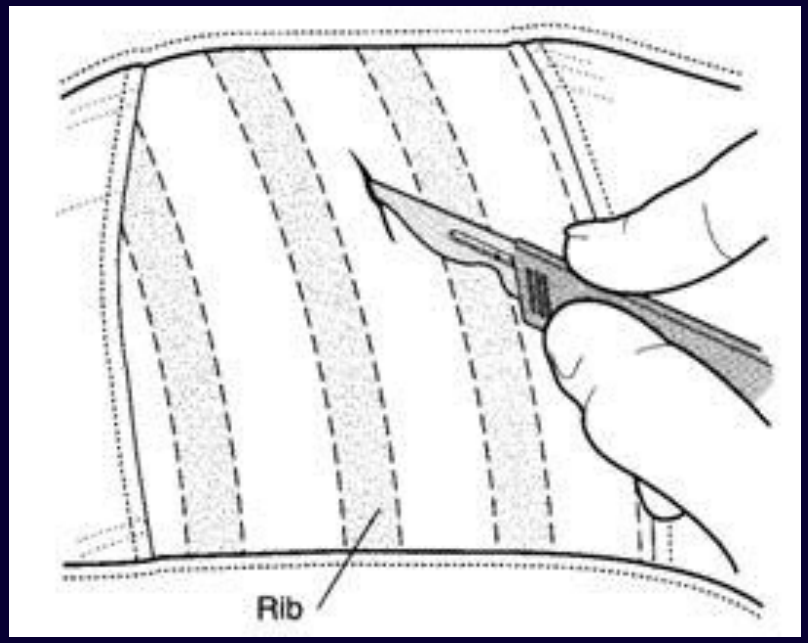
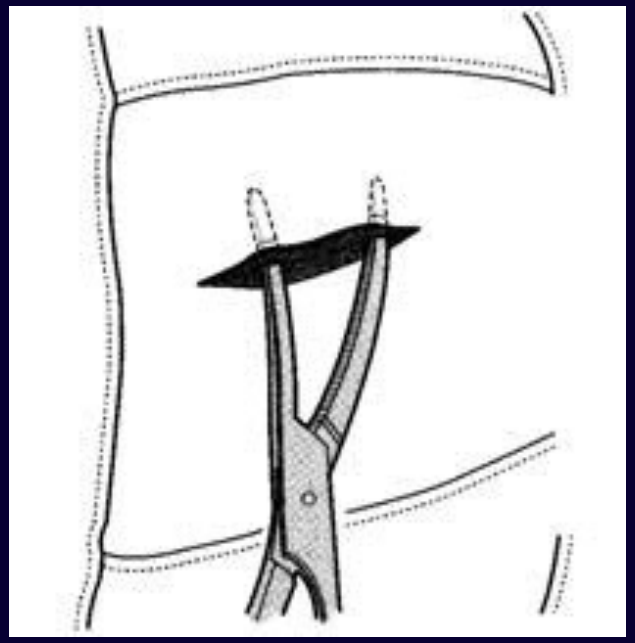
Procedure





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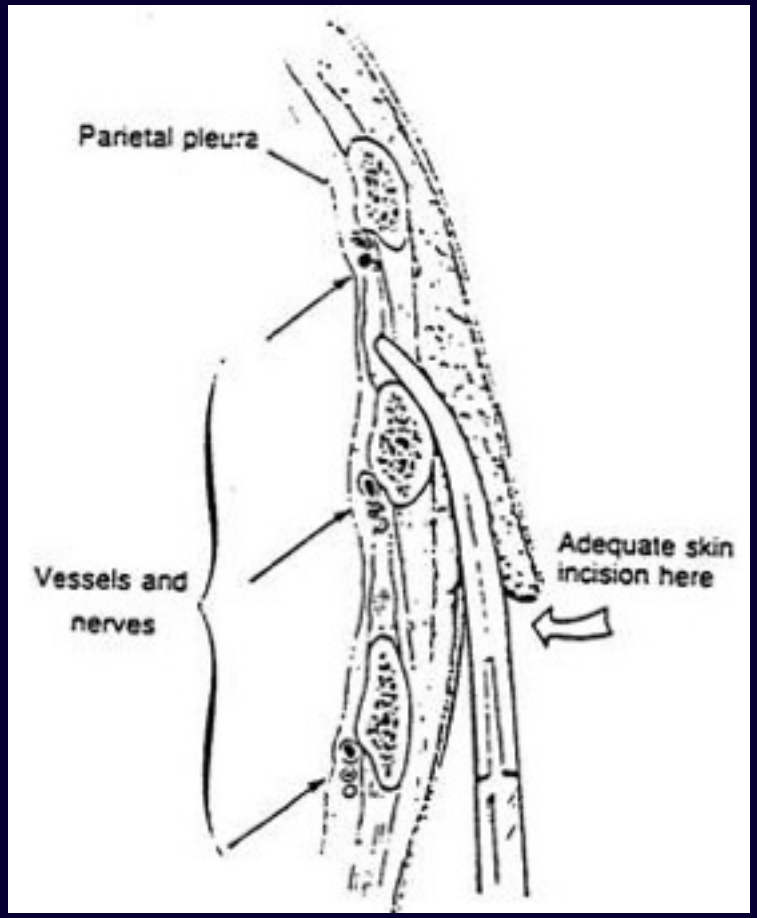
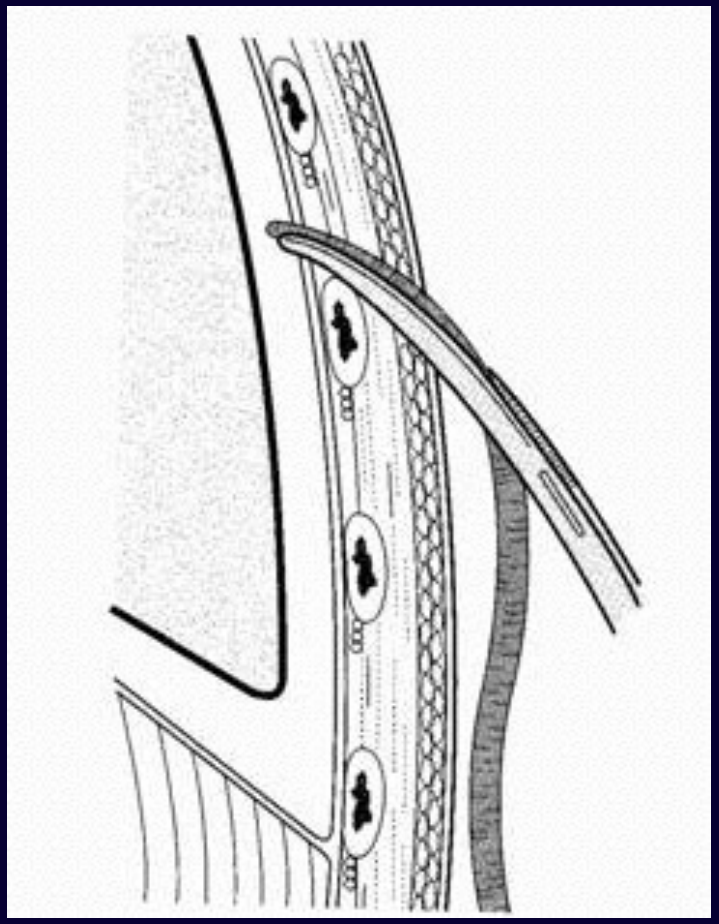
Procedure





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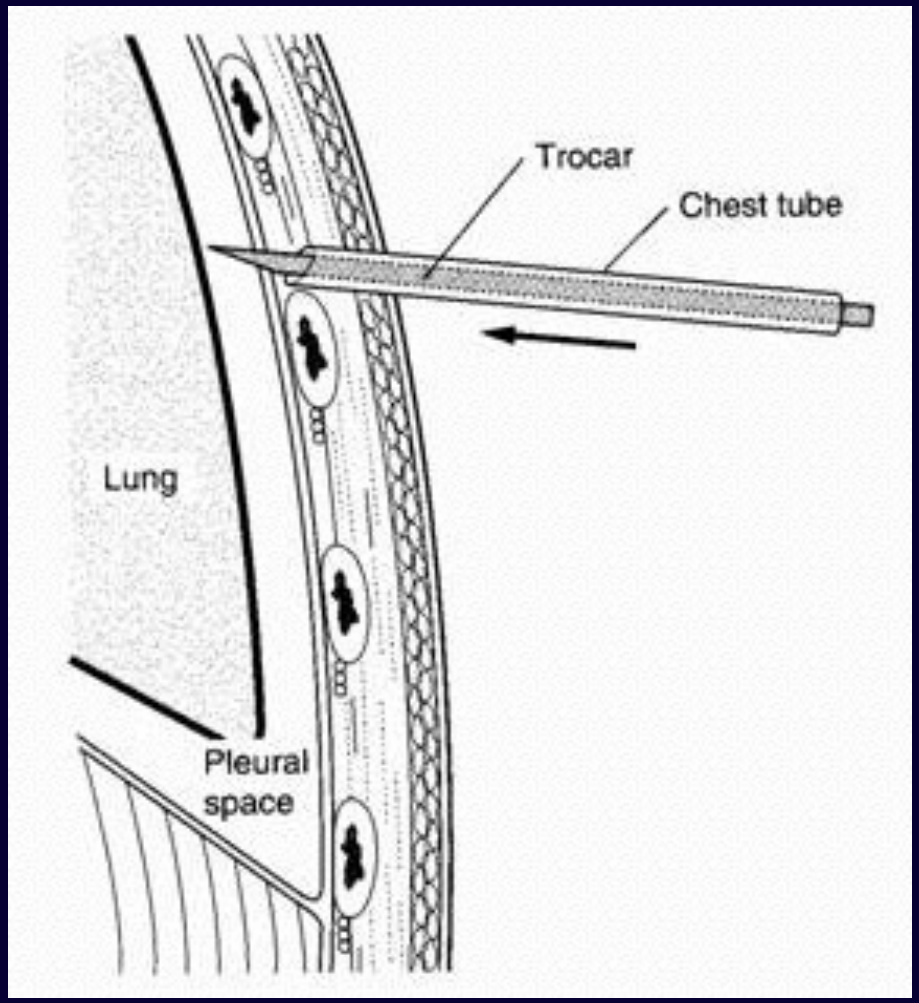

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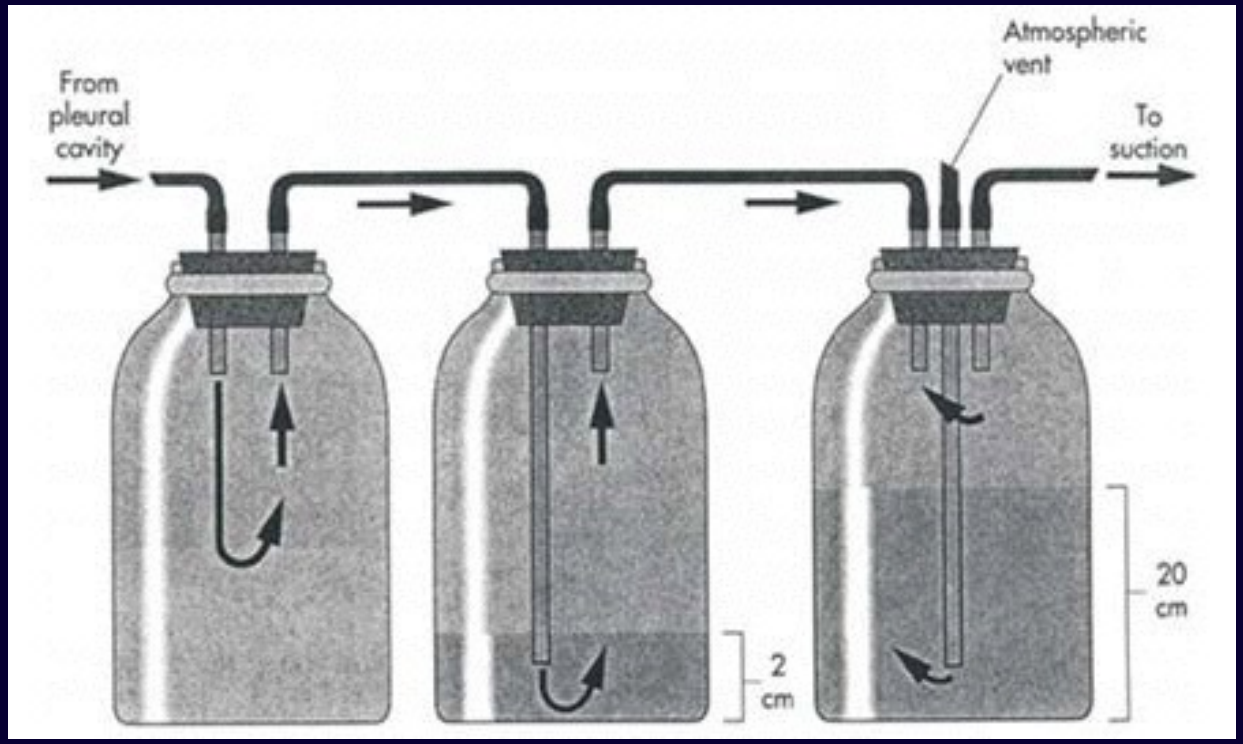
Procedure



Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Procedure

Complications

1. Malposition – Abdominal cavity (liver, spleen, diaphragm injury)
2. Insertion into pulmonary parenchyme
3. Mediastinal organ injury (Left Ventricle)
4. Intercostal neurovascular Injury (pain, bleeding)

Charles E et al. In Current Emergency Diagnosis and Treatment. 4th Edi. 1992. SAUNDERS.
Barash PG, Clinical Anesthesia. 1992. Lippincott.

Failure to Prepare is Preparing to Failure !

누구나 흉부외과를 할 수
있다면
나는 결코 흉부외과를 선
택하지
않았을 것입니다