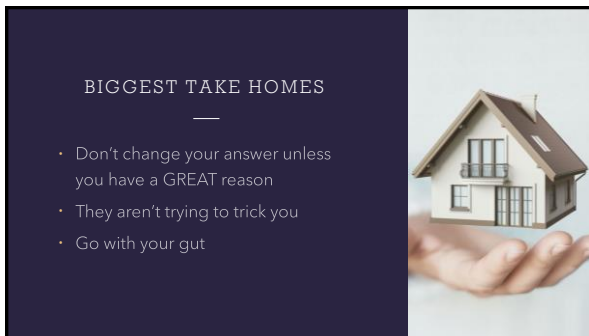




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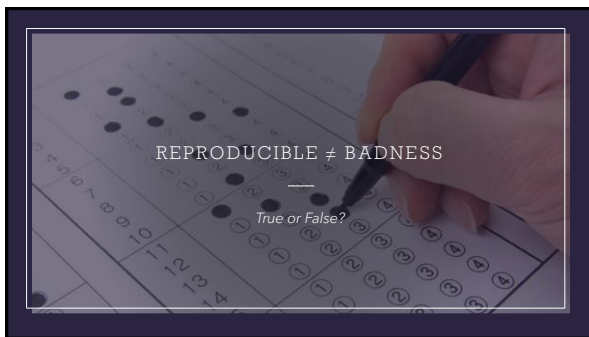
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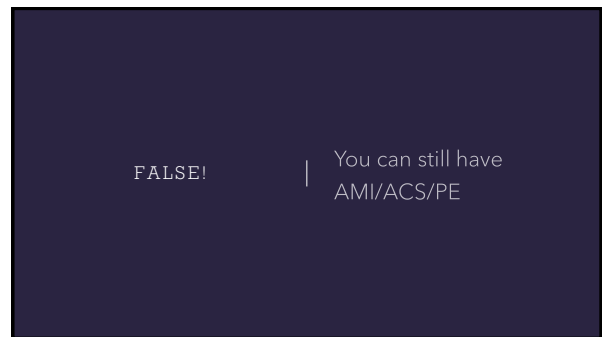
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6



7

PLEURITIS/PLEURISY

- Viral etiology is most common
- Autoimmune
- Bacterial infections
- Blunt chest trauma
- Lung CA
- Lymphoma
- Sarcoidosis
- Pneumothorax
- Smoking

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PLEURITIS/PLEURISY

Non-specific exam (may hear pleural friction rub)

Tests are to R/O other causes

CXR

EKG

CBC

D-dimer (if PERC/Wells criteria +)

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Pleural Effusion

PLEURAL EFFUSION

- Fluid between parietal and visceral pleura
- In addition to CP, may have SOB, DOE, respiratory failure

10

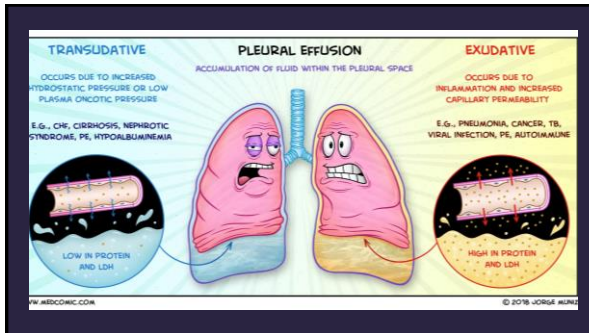
DIAGNOSIS & TREATMENT?

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PLEURAL EFFUSION

Exudative v Transudative

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EASY TO TEST

- Pleural fluid protein/serum protein (AKA TPR) > 0.5
- Pleural fluid LDH/serum LDH (AKA LDHR) > 0.6
- Pleural fluid LDH > 2/3s upper limit of normal serum LDH or >200 U/L

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EXUDATIVE FLUID

- Two-Test Rule**
 - Pleural fluid cholesterol >45mg/dl
 - Pleural fluid LDH > 0.45x upper limit of normal for serum LDH
- Three-Test Rule**
 - Pleural fluid protein > 2.9 g/dl
 - Pleural fluid cholesterol >45 mg/dl
 - Pleural fluid LDH > 0.45 x upper limit of normal for serum LDH

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Always Transudates	
Atelectasis	Due to increased negative intrapleural pressure
CSF leak	Surgery, trauma, ventriculopleural shunts
Heart failure	Diuresis may make this appear exudative
Hepatic hydrothorax	On the right, should have ascites as well
Hypoalbuminemia	Rare
Nephrotic	Bilateral and subpulmonic
Peritoneal dialysis	Acute and large 48 hours after initiating dialysis
Urothorax	Ipsilateral obstructive uropathy, i.e., a stone
Some selected exudates (there are a lot...)	
Infectious	Pneumonia, Tb, hepatic and splenic abscess/infarction, hepatitis, esophageal rupture
Iatrogenic	CVC migration (s/p Fontain), drug-related, RFA of lung nodules
Malignancy	Carcinoma, Mesothelioma, Leukemia, Mult. Myeloma and Waldenstrom's
CTD	SLE, RA, MCTD, EGPA, GPA, FMF
Endocrine	Hypothyroidism, ovarian hyperstimulation
Lymphatic	Malignancy, chylothorax, yellow nail syndrome, LAM, lymphangioectasia
Abdominal	Pancreatitis, Meigs' syndrome, Malignant ascites, Subphrenic abscess,
Other	Trapped lung, benign asbestos effusion, PE, Radiation therapy, Sarcoidosis, post cardiac injury

https://paccm.pitt.edu/MICU/PACCM_Fellows_Ed_2017/handouts/Pleural%20Disease%20Diagnostics.pdf

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OTHER TESTS ON THE FLUID

- Amylase: ↑ in pancreatitis effusions
- Adenosine deaminase: ↑ in TB effusions
- BNP: ↑ in CHF
- Tumor markers
- Cell count: WBC >10,000 in infectious exudates
- Diff: Lymphocytes > 85% → lymphoma/TB/Sarcoid

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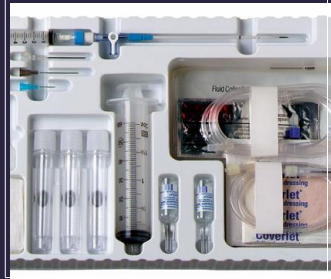
Disease	Fluid Findings
Empyema	gross pus, C&S, high WBC
Malignancy	+ cytology, + tumor markers
Lupus pleuritis	LE cells, fluid ANA > 1:0
Tb pleurisy	+ AFB stain, C&S
Esophageal rupture	+ food, low fluid pH
Fungal pleurisy	+ KOH stain, C&S
Chylothorax	High triglyceride, chylomicrons
Hemothorax	Fluid/serum HCT > 0.5
Urinorhorrax	Fluid/serum creatinine > 1:0
Peritoneal dialysis	Glc 300-400 mg/dl, protein < 1g/dl

PLEURAL EFFUSION

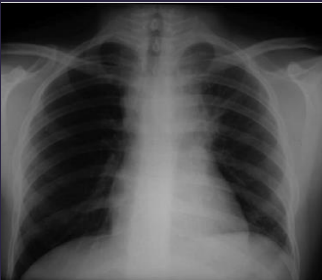
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DRAINING THE PLEURAL EFFUSION

- Patient position?
- Rib Space?



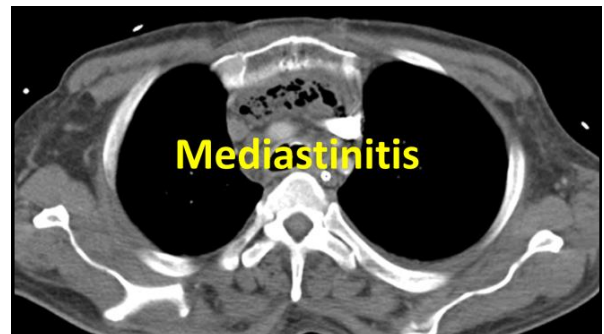
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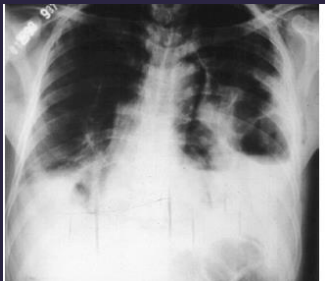
MEDIASTINITIS

- 4 days post thyroidectomy
- Gradual onset, pleuritic pain
- WBC 23.5

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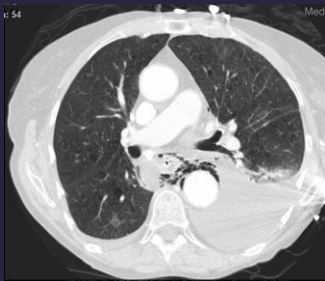


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CXR showing air adjacent to the aorta and left pleural effusion in a patient with mediastinitis secondary to esophageal rupture and infection

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ESOPHAGEAL RUPTURE

Causes?

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ESOPHAGEAL RUPTURE

Vomiting/instrumentation of the esophagus → severe CP → radiating to back (+/- dysphagia, melena)

Can have subq emphysema, fever, shock, epigastric abdominal pain

MACKLER TRIAD: vomiting, lower chest pain, cervical subq emphysema (seen in ~50% of cases)

ANDERSON TRIAD: subq emphysema, rapid respirations, abdominal rigidity

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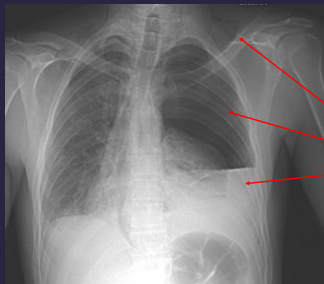
ESOPHAGEAL RUPTURE DIAGNOSIS

CXR- often LEFT sided effusion, subq air, pneumothorax

CXR, Gastrographin swallow or CT

Emergency EGD

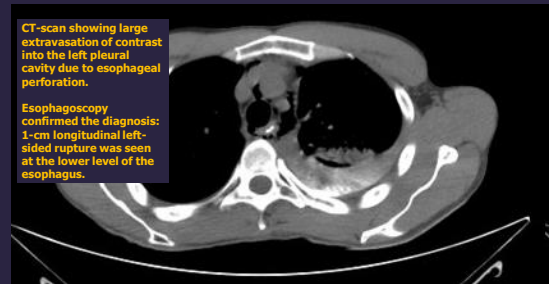
26



ESOPHAGEAL RUPTURE CXR

- Sub Q Air
- Pneumothorax
- Left sided effusion

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TREATMENT?

Fluid resuscitation

Chest tube if necessary

Intubation if necessary

Empiric abx → cover Gram+ and Gram -

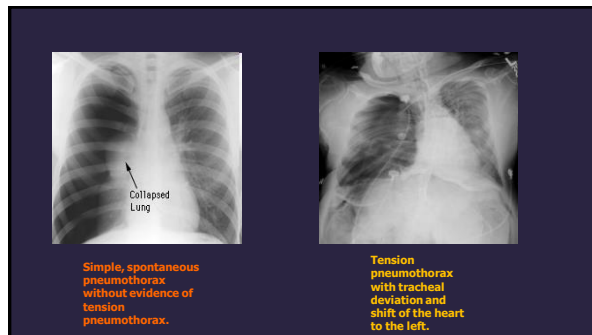
Surgical repair for large tears

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DIAGNOSIS & TREATMENT?

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TREATMENT OPTIONS

- Small, spontaneous → oxygen and observation
- Large, large air leaks, traumatic → may need chest tube with continuous drainage
- CASP (catheter aspiration of spontaneous pneumothorax) is also an option for smaller ones

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INTERSTITIAL LUNG DISEASE

"COUGH COUGH"
I THINK I HAVE THE BLACK LUNG. POP

- Environmental or occupational MCC etiologies (asbestos, silica, flour, cotton, smoke, soot, coal dust)
- Rheumatic diseases (sarcoid, SLE, scleroderma)

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INTERSTITIAL LUNG DISEASE

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INTERSTITIAL LUNG DISEASE

An example of sarcoid perihilar reticular pattern infiltrate characteristic of interstitial lung disease – bat wing pattern

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INTERSTITIAL LUNG DISEASE

- Clinically: CP, DOE, dry non-productive cough, crackles (Velcro sound) abn CXR, restrictive ventilatory pattern on PFTs, clubbing, cor pulmonale
- Work-up: routine labs, ABGs, CXR, Chest CT, PFTs
- Treatment: symptomatic, refer to pulm, emergent trx usually end stage of dz

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LUNG CANCER

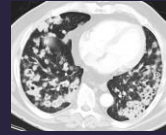
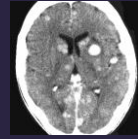
MCC cause of cancer mortality worldwide

Cigarette smoking MCC both non-small cell and small cell

May present to ED for pain from mets or endocrine issues

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LUNG CANCER



Diffuse squamous cell carcinoma of the lung with local metastatic spread and mets to the brain.

Mets most common to where?

Paraneoplastic problems

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WHAT MAKES THIS LIKELY LUNG CA?

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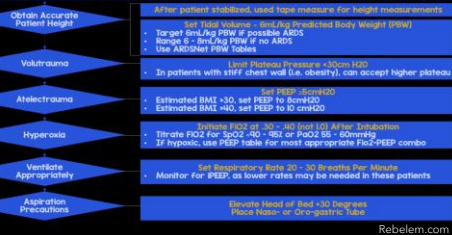
ARDS

- High mortality (25-80%)
- MODS
- Acute to hyperacute onset
- Bil infiltrates c/w pulm edema
- PaO₂/FIO₂ ratio <200 (ALI: 200-300)
- CXR main diagnostic test



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Initiate ED Lung Protective Strategy Protocol



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ARDS NET VENTILATOR RECOMMENDATIONS

INCLUSION CRITERIA for ARDS:

Acute onset of:

1. PaO₂/FIO₂ ≤ 300.
2. Bilateral patchy, diffuse, or homogeneous infiltrates c/w pulmonary edema.
3. No clinical evidence of left atrial hypertension.

VENT SETUP & ADJUSTMENT:

1. Calculate predicted body weight: (males=50+2.3*(ht. in inches)-40; females=45.5+2.3*(ht. in inches)-40)
2. Select vent mode (AC, pressure, APRV).
3. Initial TV = 8 ml/kg PBW.
4. Reduce TV by 1 ml/kg at 2-hour intervals to achieve TV of 6 ml/kg.
5. Initial rate at baseline minute ventilation, not > 35/minute.
6. Adjust Vt and RR to achieve pH and plateau pressure goals (see next).

Lower PEEP/Higher FIO ₂											
FIO ₂	0.5	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.7
PEEP	5	5	7	8	8	10	10	10	10	12	12

Higher PEEP/Lower FIO ₂											
FIO ₂	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4
PEEP	5	8	10	12	14	14	16	16	16	16	16

OXYGENATION GOALS:
PaO₂ = 55-60 mmHg, consider FIO₂/PEEP combinations as below:

PLATEAU PRESSURE GOALS:

1. Goal ≤ 30 cmH₂O.
2. If Pplat > 30 decrease Vt by 1 ml/kg increments as in #4.
3. If Pplat < 25 and Vt < 6 ml/kg increase Vt by 1 ml/kg until Pplat is > 25 or Vt = 6 ml/kg.
4. If Pplat < 30 and breath stacking or not synched increase Vt 1 ml/kg to 7-8 ml/kg as long as Pplat < 30.

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ARDS

Airways collapse → alveoli fill fluid/debris → loss of surfactant leading to loss of compliance → impaired oxygen and CO₂ exchange

High PEEP to promote airway recruitment and keep airways open that do open

Pressure control may be more useful than volume control

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SMOKE INHALATION



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SMOKE INHALATION

Smoke has high temperature but is often dry → not much thermal injury beyond the oropharynx and upper airway

Smoke containing water particles → more thermal energy as do superheated gases particularly those under pressure → serious direct burns deep into the lung tissue

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SMOKE INHALATION

Fires in confined spaces use up the available O₂ causing hypoxia and suffocation

The plastics in buildings burn toxic gases such as arsenic, cyanide, acrolein, formaldehyde, phosgene, SO₂, NO

Bronchorrhea, dyspnea, wheezing, and respiratory failure up to 24-36 hours post-exposure if they do not kill outright

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SMOKE INHALATION

CO is the most common lethal toxic gas produced in a fire

It tightly binds to hemoglobin preventing the release of oxygen at the tissue level

Clinically: headache, nausea, confusion, fatigue, dyspnea, angina, CHF, seizures, coma, and death

Diagnosis is by measurement of **carboxyhemoglobin** either by photometric oximetry or venous and/or arterial measurement with co-oximetry

What level is symptomatic and what level is fatal?

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A WORD ON HYPERBARICS

Pregnant → the answer is always yes to hyperbarics because of ↑ risk of fetal demise

For everyone else- oxygen

Hyperbarics have not shown significant clinical or outcome improvement

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SMOKE INHALATION

Cyanide is a common by-product of burning plastics and synthetic fabrics

It binds to the mitochondrial cytochrome a3 decoupling electron transport and oxidative phosphorylation

It takes very little cyanide to produce cardiac dysfunction, apnea, coma, and death

Direct measurement of cyanide levels is not helpful

Have a high index of suspicion in a smoke inhalation patient particularly one who remains in shock despite treatment and adequate oxygenation and fluids

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IN CASE WE DIDN'T COVER IT IN TOX

The older cyanide antidote kit included administration of three medications: amyl nitrite pearls (inhalation), sodium nitrite and sodium thiosulfate (infusion) - however methemoglobin was a by-product that could contribute to the oxygenation problems

The newer Cyanokit contains hydroxycobalamin that reacts with cyanide to form cyanocobalamin that can be eliminated by the kidneys - this is a simpler and more effective antidote than the older Lilly kit

Have a low threshold for the administration of hydroxycobalamin in the appropriate clinical situation

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TRACHEOSTOMY IN 3 EASY STEPS

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TRACH EMERGENCIES

Tube falls out or plugs up

May need to change out the tube or suction it

Replace with a new Shiley cuffed trach tube

Granulation or scar tissue to stoma → could make tube replacement difficult → surgery consult

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TRACH EMERGENCIES



Shiley cuffed tracheostomy tube with stylet and inner cannula.



A Shiley tube in place

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TRACH EMERGENCIES

Obstructed tube? Suction cannula can help differentiate btw debris obstruction or tracheal stenosis distally

Infections/skin breakdown → abx, admit for surgical consultation, may need ETT to let area heal

Change in mental status? Aspiration pneumonia and nosocomial pneumonia is frequent

Low threshold for obtaining CXR

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TRACH EMERGENCIES... THE ONE YOU WORRY THE MOST ABOUT

Bleeding from erosion of an arterial vessel (innominate) or a tracheoarterial fistula

The bleeding can be massive, causing compromise of the airway and even exsanguination as controlling the hemorrhage can be very difficult

The trach has to be removed → may have to intubate the patient from above, sometimes this maneuver can tamponade the bleeding but not often

Occasionally you can see the bleeder and control it, MOST need to be taken to the OR to obtain control of the bleeding

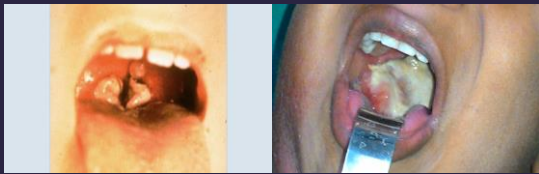
Vigorous resuscitation with fluids and blood

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CRICOTHYROTOMY



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WHEN DO YOU PERFORM A CRIC IN THE ED?

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WHAT GOES WRONG?

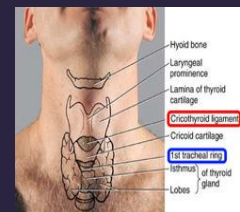
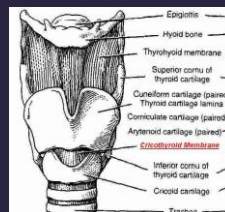
- Done in the wrong place
- Waited too long
- Bleeding
- Cannula outside of the trachea
- Above thyroid cartilage
- Go over the steps regularly, on your free time, during lecture, while working out...



Source: Orlando R, Hung, Michael F. Murphy: Murphy's Difficult and General Airway Management, 3rd edition
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CRICOTHYROTOMY



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CRICOTHYROTOMY



This is the Cook Melker Emergency Cricothyrotomy kit with a needle to penetrate the skin and cricothyroid membrane, a wire to secure access to the trachea, scalpel to widen the skin incision, and cannula with dilator.

New iteration has a cuffed tracheostomy tube.

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KNOW YOUR STEPS.. WHICHEVER TECHNIQUE YOU USE

- Knife-finger-bougie
- Andy Heard's bougie-assisted cric technique
- <https://litfl.com/surgical-cricothyroidotomy/>
- Good idea to mark the skin before intubation

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GOOD LUCK!!
YOU'LL DO GREAT!
SPECIAL THANKS
TO DR. BRADFORD
WALTERS

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