

Heroic Procedures in Emergency Medicine

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Reference: Ammar Al-Kashmiri, MD

A “good” rule

Heroic Procedures

- ✂ *technical difficulty*
- ✂ *no hesitancy to perform*
- ✂ *tricky indication - rely on clinical instinct*
- ✂ *the rule,*
‘think of it - do it’

Case I

- ✶ 31 y/o woman struck by a car
- ✶ Initially responsive at the scene but subsequently LOC and had to be intubated
- ✶ GCS 6T
- ✶ BP 230/125, HR 60
- ✶ Pupils are unequal with a dilated and non-reactive left pupil

What's the likely diagnosis?



Diagnosis =

Epidural hematoma

What should you do next?

The background image shows a surgical site with exposed brain tissue and a large amount of blood. The brain tissue is visible on the left side, and the blood is a deep red color. The surgical site is surrounded by dark, possibly metallic, structures.

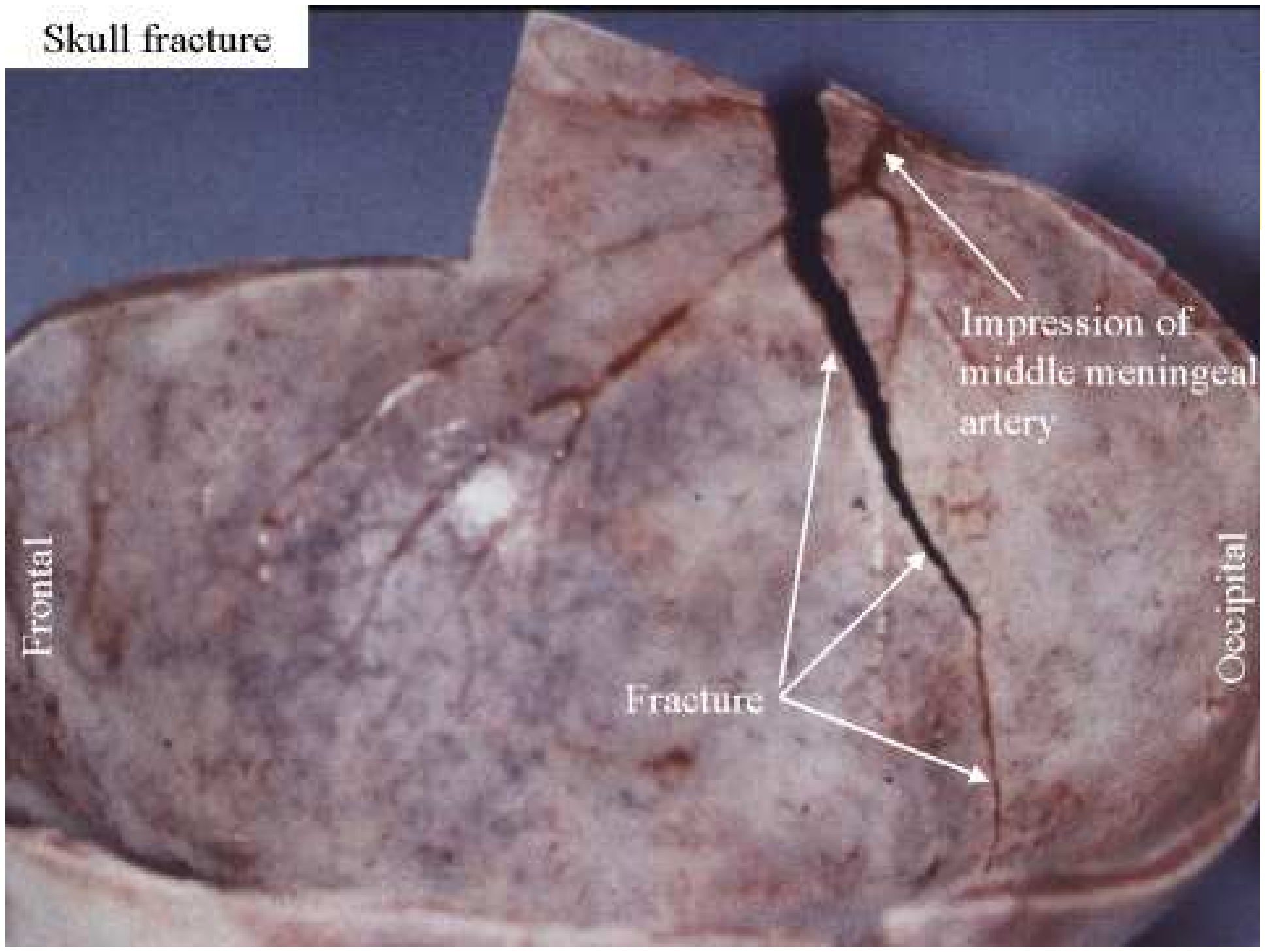
Cranial trephination

頭顱穿洞術

Pathophysiology of EDH

- ✦ **Temporoparietal EDH: 70-80%**
(middle meningeal artery)
- ✦ **Frontal EDH: 10%**
- ✦ **Occipital EDH: 10%**
(occasionally extending above
and below the tentorium)

Skull fracture

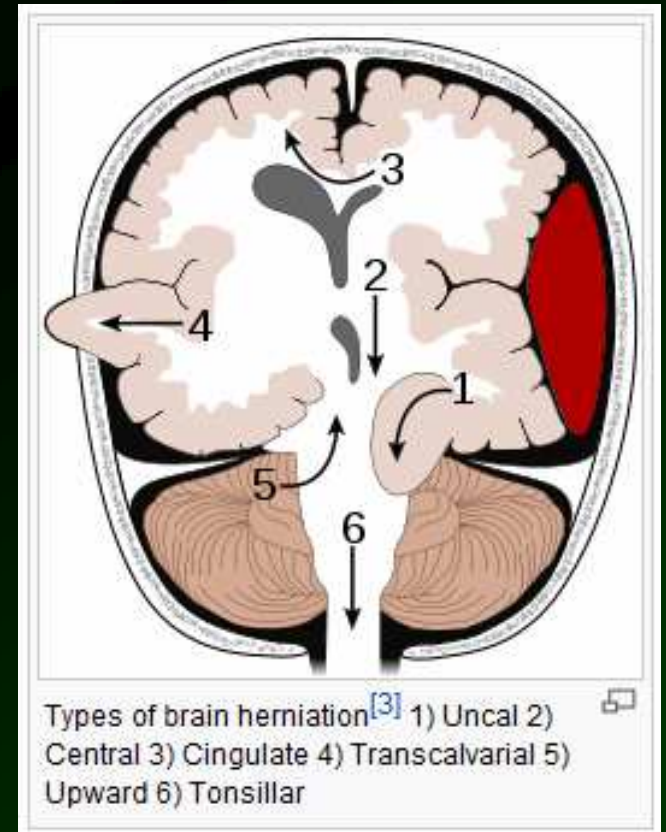


Pathophysiology

- ✱ EDH: 2/3 arterial, 1/3 venous
- ✱ Skull fracture less common in young children because of calvarial plasticity

Pathophysiology

- ✿ Expanding high-volume EDHs can produce a midline shift and impinge on CN III
- ✿ S/S: *ipsilateral pupillary dilation* and *contralateral hemiparesis* or extensor motor response



Pathophysiology

- ✦ EDHs usually are stable, attaining maximum size within minutes of injury
- ✦ Progresses in **10%** during the first 24 hours
 - rebleeding
 - continuous oozing

What is Kernohan's notch syndrome?

Kernohan's notch syndrome

✶ A false-localizing motor exam caused by compression of the contralateral cerebral peduncle against the tentorium cerebelli



✶ S/S: *ipsilateral hemiparesis*

Indications for trephination

1. Patient is herniating
2. All other treatments prove insufficient
3. Neurosurgery is unavailable
4. Air or ground medical transport is prolonged

Equipment

✱ Penetrator

✱ Burr hole bit

✱ Bone rongeur

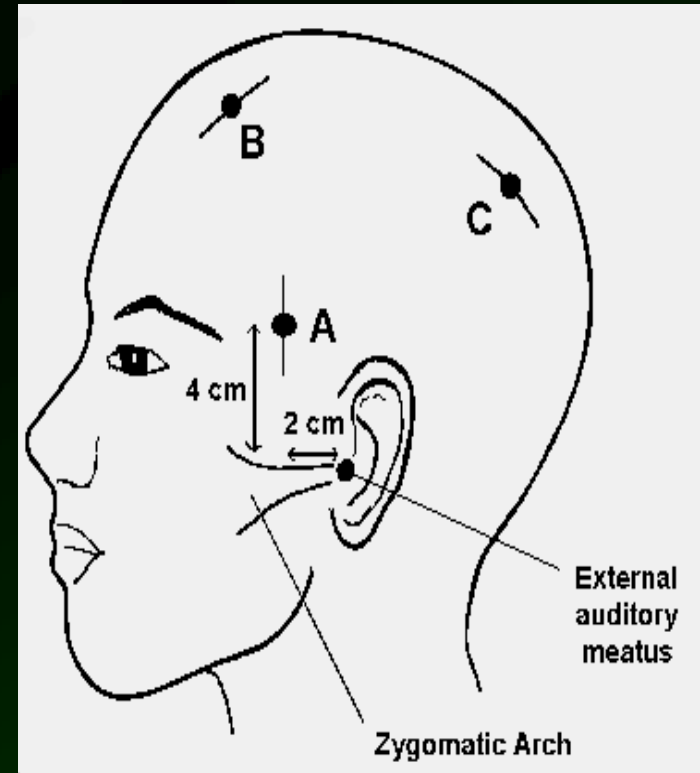
✱ Scalpel



咬骨鉗

Procedure

- ✿ A burr hole is placed on the side of the *dilating pupil*
- ✿ In the absence of a CT scan, the burr hole is placed *2 fb* anterior to the tragus of the ear and *3 fb* above the tragus of the ear

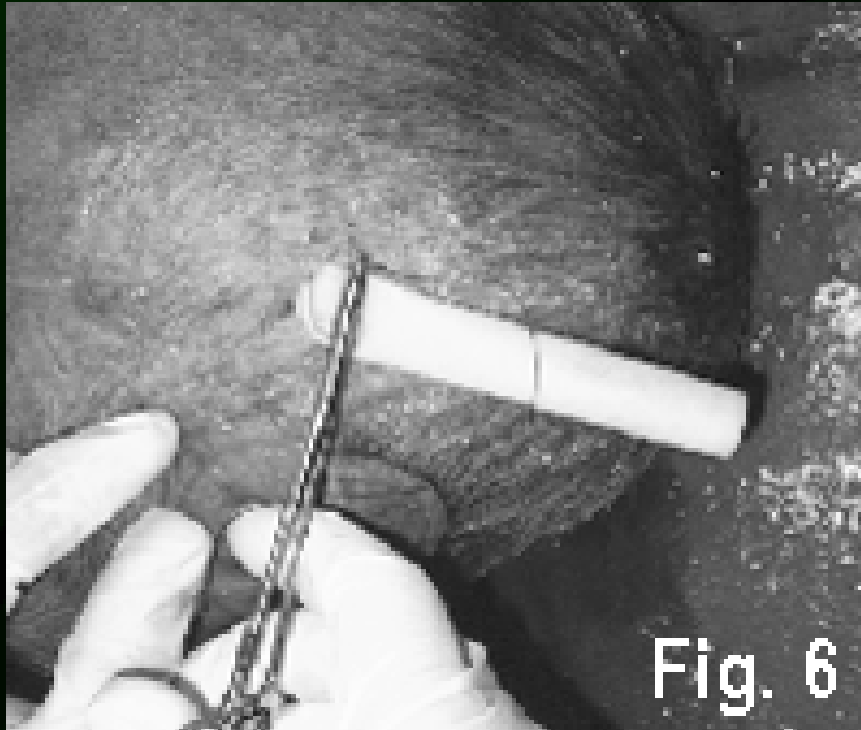


✦ A vertical incision is made approximately 3 cm long, centered over the entry point all the way down to the temporalis muscle dividing the fibers of the muscle vertically

✦ The periosteum is then cut in the same manner

- ✦ The hematoma is evacuated using a soft suction tip
 - ✦ it can be surprisingly voluminous

- ✱ If there continues to be excessive bleeding through the hole, packing the wound should be tried with Gelfoam or by cutting off a piece of temporalis muscle and stuffing it into the hole



- ✿ If all else fails , a bone rongeur is used to eat away at the bone until the bleeding branch of the meningeal artery can be found and cauterized
- ✿ that is probably all the neurosurgeon would do anyway





Case II

- ✱ 37 y/o man, MVA
- ✱ Significant damage to left face
- ✱ GCS 6, intubated
- ✱ Left eye is increasingly proptotic and noticeably firmer than the right
- ✱ Left afferent pupillary defect (Marcus-Gunn pupil)

What's your diagnosis and
what do you do next?

Diagnosis =

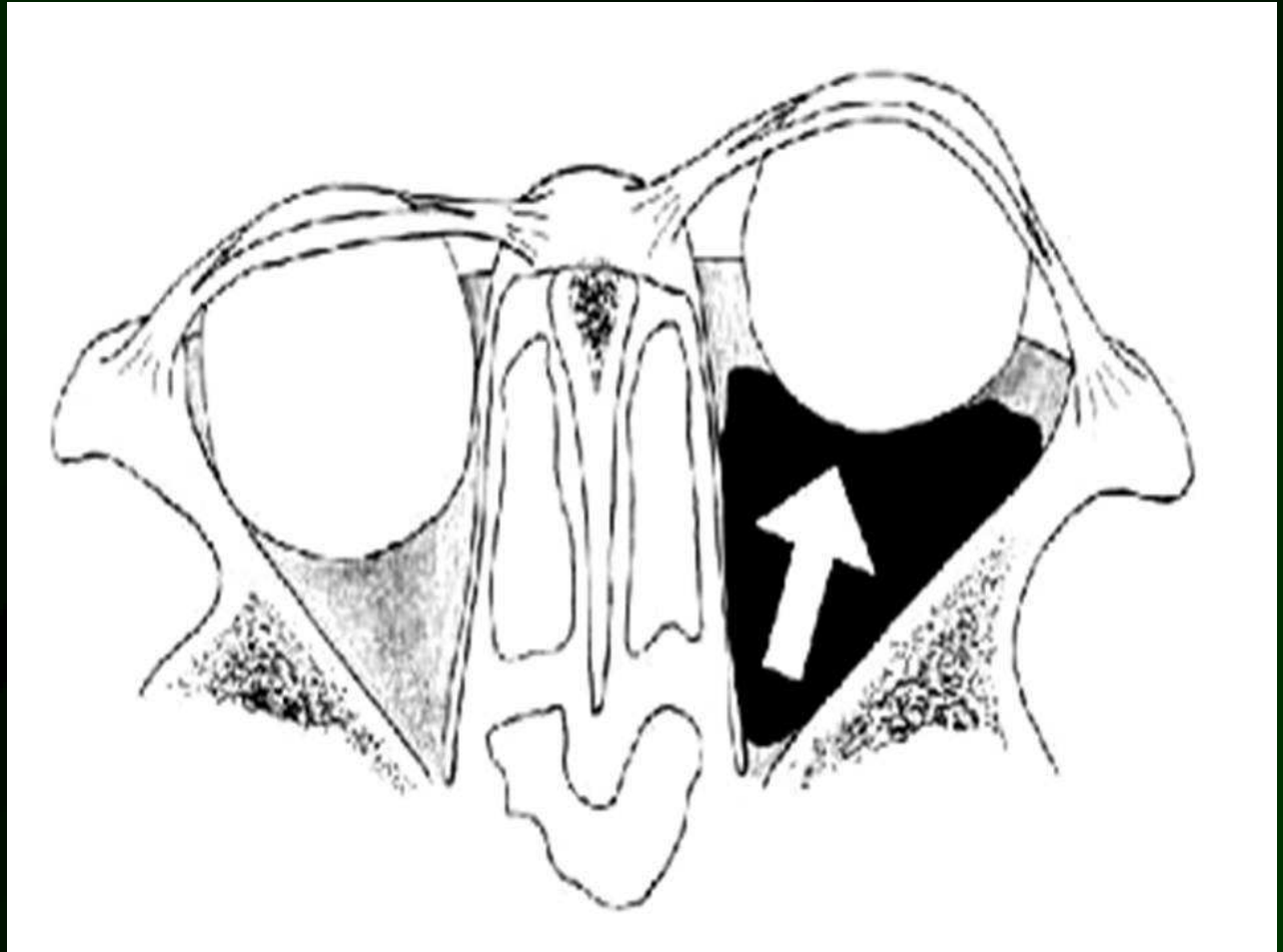
Retrobulbar hematoma



Lateral Canthotomy

外眥韌帶切開及分離術

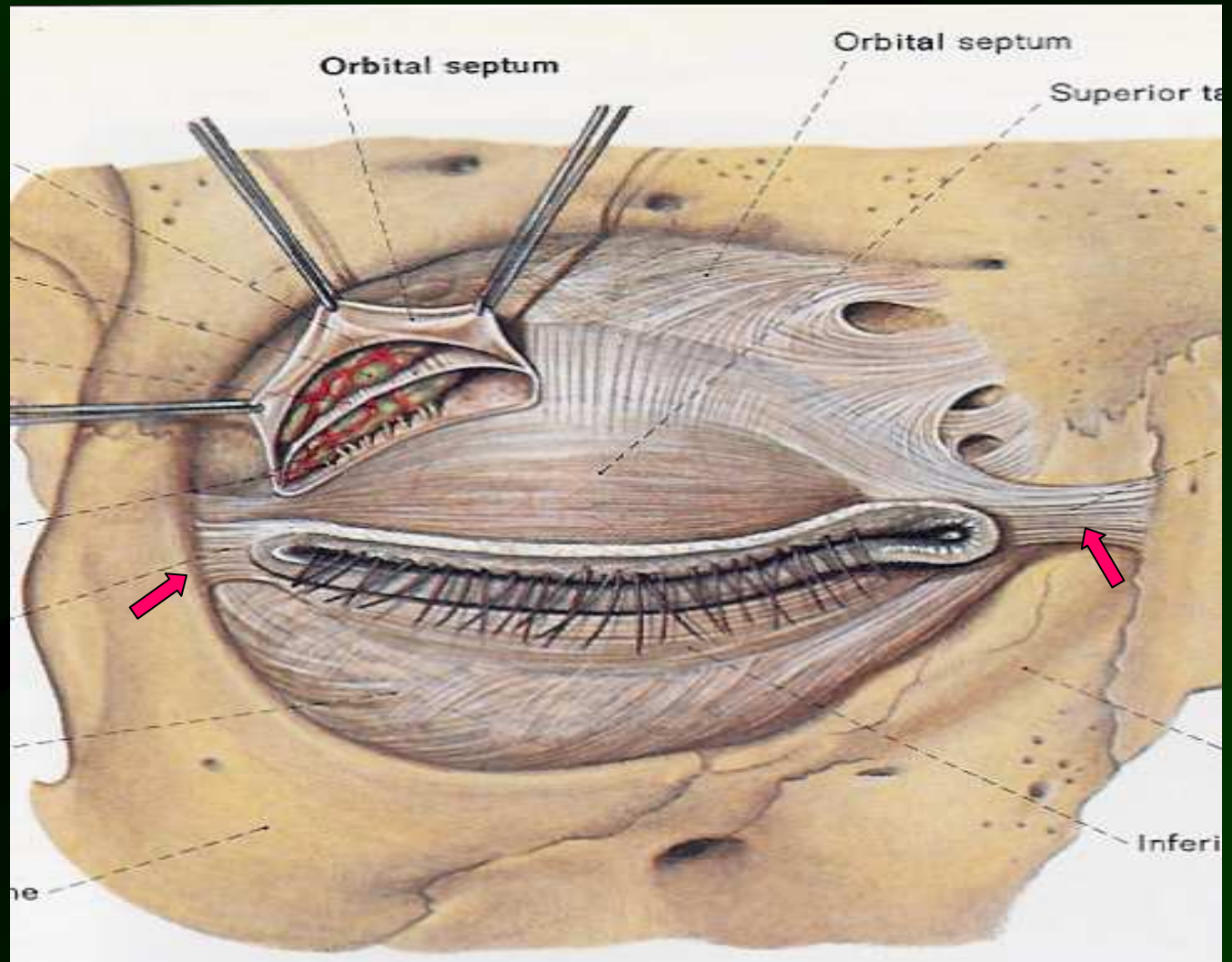
Pathophysiology of RBH



Pathophysiology of RBH

- ✿ The orbit compensates through proptosis, but the *medial and lateral canthal tendons*, which attach the eyelids to the orbital rim limit the forward movement of the globe

Medial and lateral canthal tendons



Pathophysiology of RBH

- ✦ If IOP exceeds central retinal artery pressure, retinal ischemia results
- ✦ In such situations, timely lateral canthotomy can save visual function

Indications

- ✧ Decreased visual acuity
- ✧ Intraocular pressure > 40 mm Hg
- ✧ Proptosis
- ✧ Afferent pupillary defect
- ✧ Cherry red macula
- ✧ Ophthalmoplegia
- ✧ Nerve head pallor
- ✧ Eye pain

Contraindication

✶ Globe rupture

Equipment

✂ *Hemostat or needle driver*

✂ *Iris or suture scissors*

✂ Forceps

The procedure

- ✦ The surrounding skin is prepared with NS to improve visualization and reduce the risk of infection
- ✦ If the patient is awake, an assistant should stabilize the head and maintain cervical immobilization

Anesthetizing the lateral canthus

- ✿ 1-2 cc of 1-2% lidocaine with epinephrine is injected into the lateral canthus
- ✿ This provides both pain relief and hemostasis at the time of devascularization and incision



Devascularizing the lateral canthus

- ✿ A hemostat or needle driver is applied from the lateral canthus towards the bony orbit to devascularize the area for 30-90 seconds



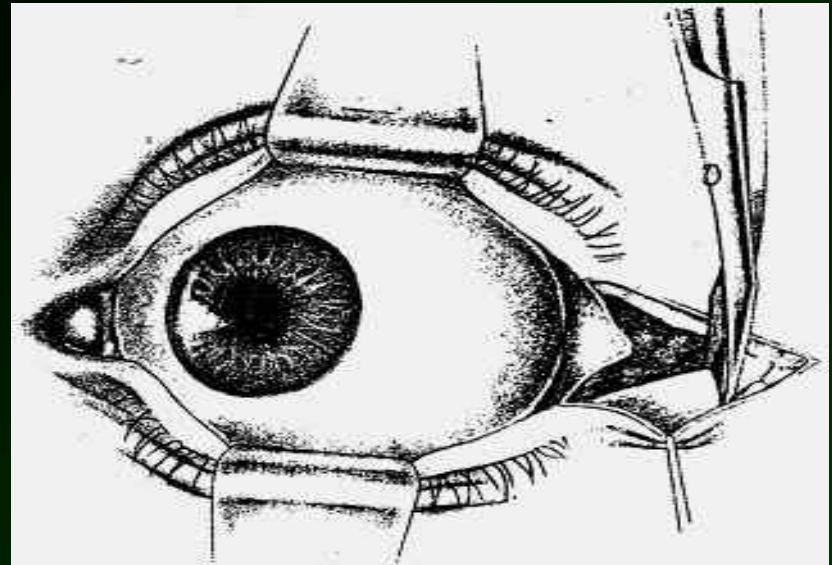
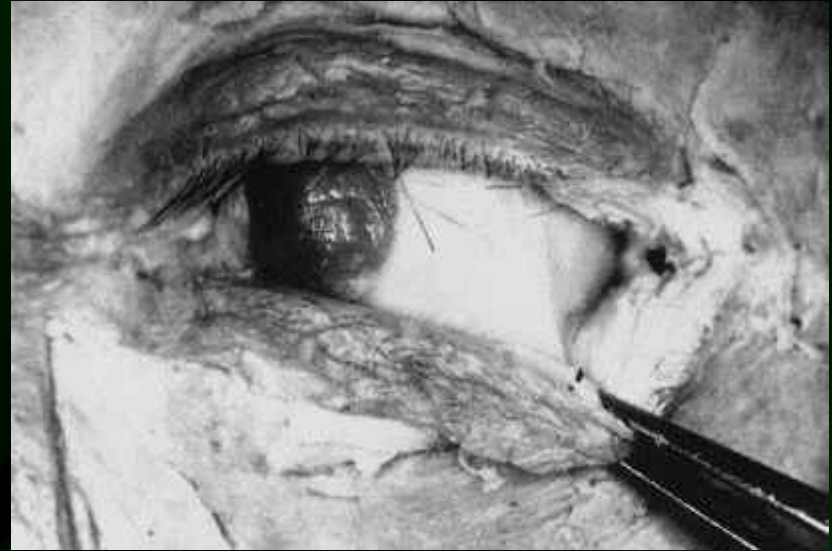
Incising the lateral canthus

- ✿ The instrument is then removed and the demarcated area is cut laterally 1-2 cm in length

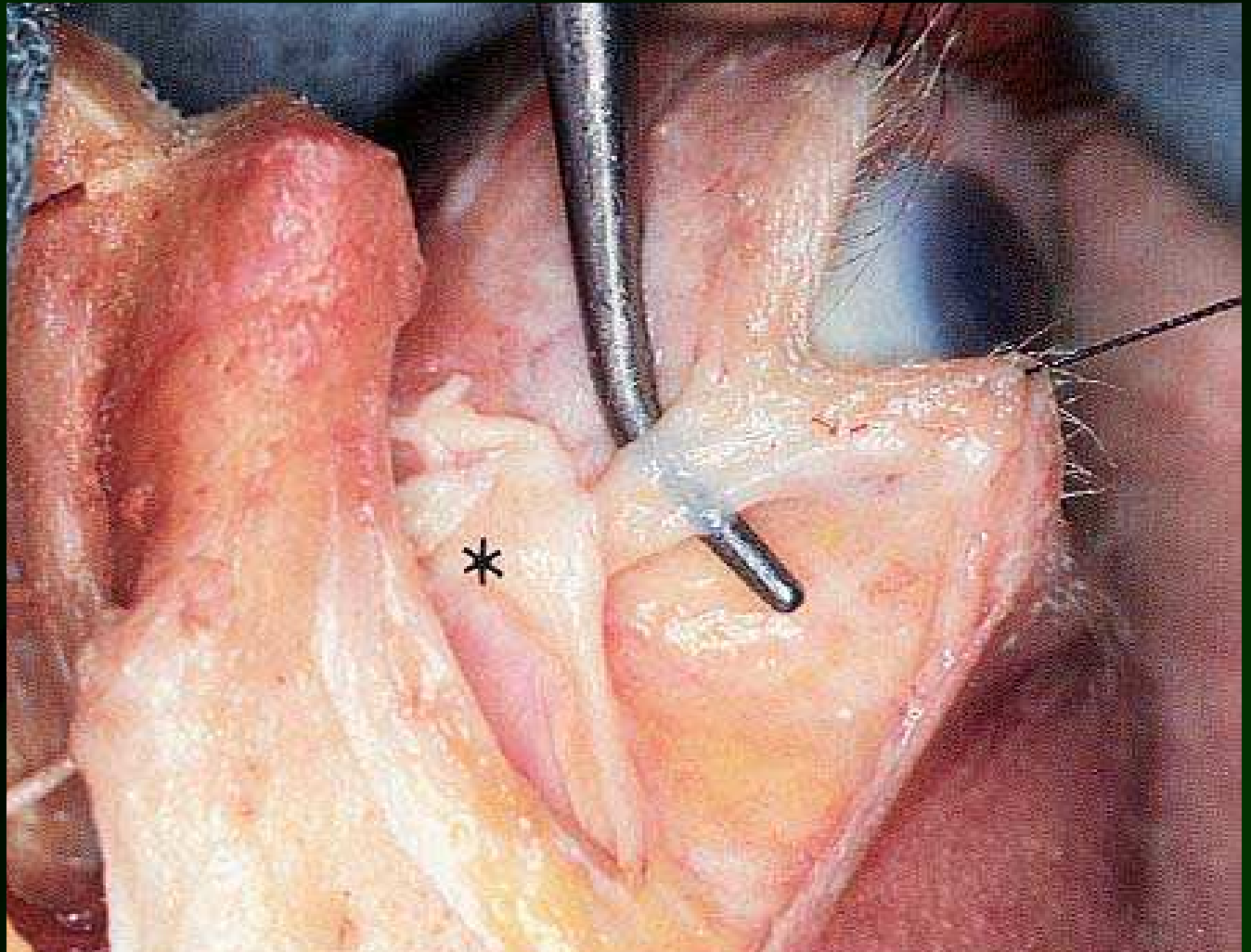


Cutting the lateral canthal tendon

- ✦ Using the forceps, the lower lid is pulled down to visualize the lateral canthal tendon (LCT) which is then completely severed (lateral cantholysis)



Lateral canthal tendon



✦ After the lateral canthal tendon has been cut, intraocular pressure is reassessed with a tonometer

✦ IOP should < 40 mm Hg



Proptosis

IOP > 40



Case III

- ✱ 48 y/o male, MVA
- ✱ On arrival, GCS 13, stable BP but rapid shallow breathing (RR 34)
- ✱ Severe maxillofacial trauma, stridor
- ✱ RSI attempted but fails
- ✱ SpO2 is dropping to 70% despite BVM

What is the immediate
management of this patient?



Surgical Cricothyrotomy

Indications

✱ *Can't intubate, can't ventilate*

- Massive oral, nasal, or pharyngeal hemorrhage
- Massive regurgitation or emesis
- Masseter spasm or clenched teeth
- Structural deformities of oropharynx
- Airway obstruction: oropharyngeal edema, mass effect (cancer, tumor, polyp, web, or other mass), foreign body, laryngospasm

Contraindications (relative)

1. Age less than 8
2. Anterior neck hematoma
3. Previous cricothyrotomy
4. Tracheal tumor or mass
5. Coagulopathy

Equipment

- ✂ Scalpel with No. 11 blade

- ✂ Tracheal hook

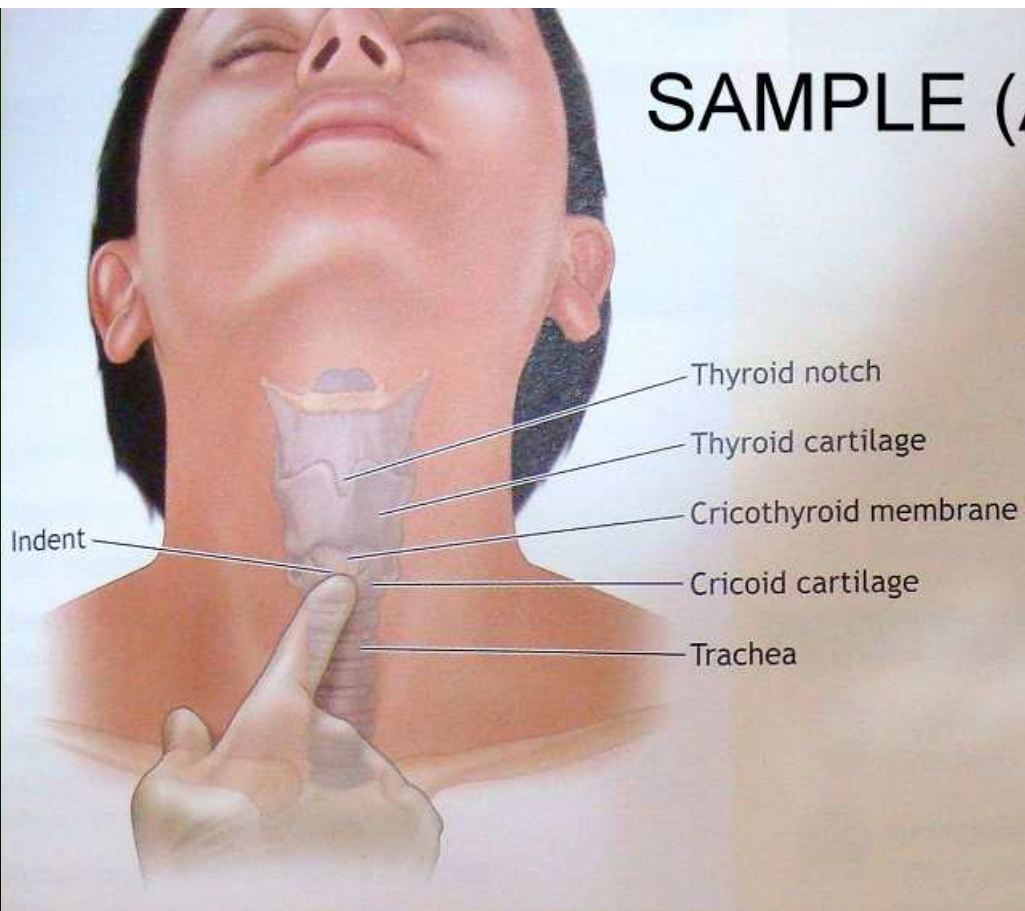
- ✂ No. 5 cuffed endotracheal tube

- ✂ Suction

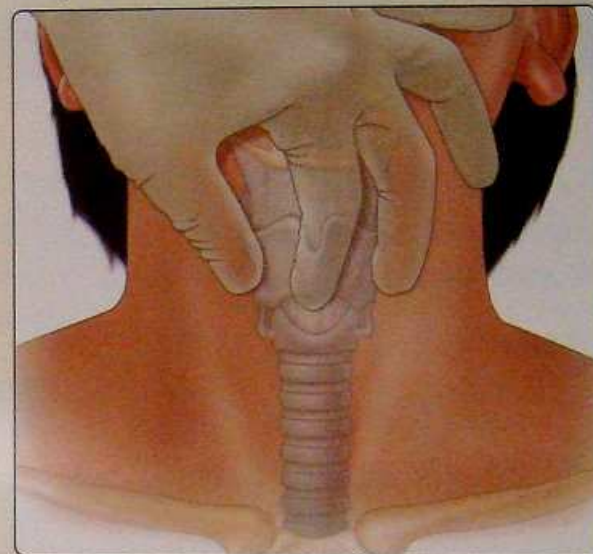
The Procedure

- ✦ Hyperextend the head to identify anatomy and control cricoid space
- ✦ As a guide, a 20 ga needle can be inserted through the membrane with aspiration of air to confirm entry (optional)
- ✦ The larynx is stabilized by holding it between the non-dominant thumb and middle finger

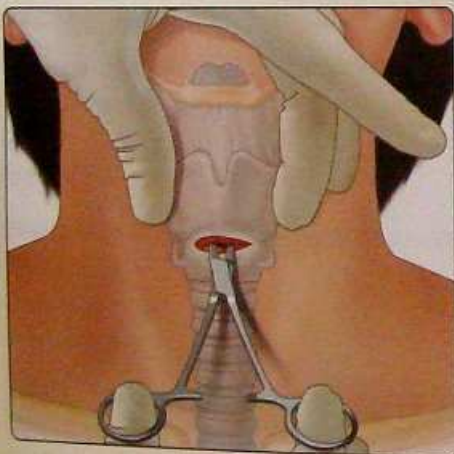
SAMPLE (ATLS 8th Ed.)



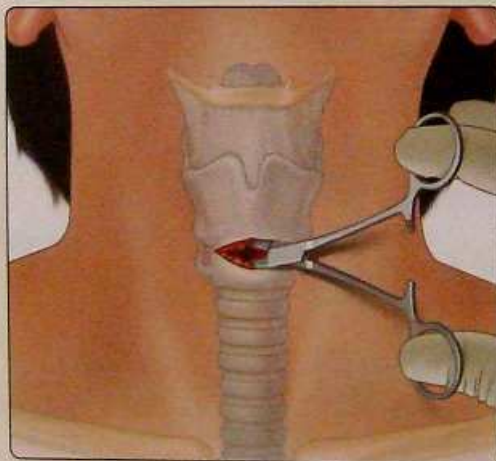
Step 2



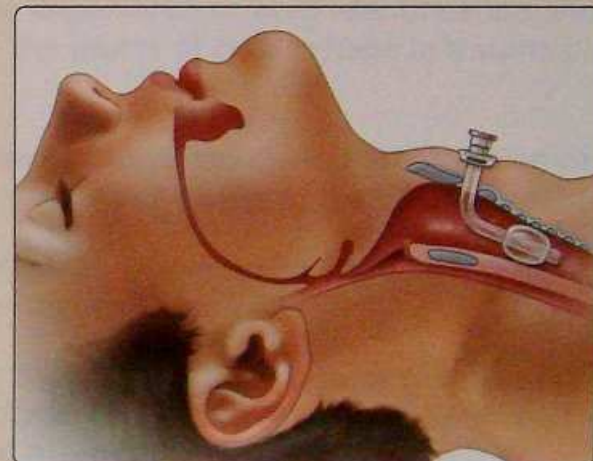
Step 6



Step 7



Step 8



STEP 1. Place the patient in a supine position with the neck in a neutral position.

STEP 2. Palpate the thyroid notch, cricothyroid interval, and the sternal notch for orientation.

STEP 3. Assemble the necessary equipment.

STEP 4. Surgically prepare and anesthetize the area locally, if the patient is conscious.

STEP 5. Stabilize the thyroid cartilage with the left hand and maintain stabilization until the trachea is intubated.

STEP 6. Make a transverse skin incision over the cricothyroid membrane, and carefully incise through the membrane transversely.

STEP 7. Insert hemostat or tracheal spreader into the incision and rotate it 90 degrees to open the airway.

STEP 8. Insert a proper-size, cuffed endotracheal tube or tracheostomy tube (usually a number 5 or 6) into the cricothyroid membrane incision, directing the tube distally into the trachea.

STEP 9. Inflate the cuff and apply ventilation.

STEP 10. Observe lung inflations and auscultate the chest for adequate ventilation.

STEP 11. Secure the endotracheal or tracheostomy tube to the patient to prevent dislodging.

STEP 12. *Caution:* Do not cut or remove the cricoid and/or thyroid cartilages.

Complications

- ✦ Thyroid gland damage
- ✦ Large vessel injury with hemorrhage
- ✦ Esophageal damage
- ✦ Infection
- ✦ Aspiration

Vertical or horizontal incision?

- ✂ Horizontal – quicker
- ✂ Vertical – if obesity and poor landmark



Case IV

- ✦ 29 y/o female G1P0, 34 wks pregnant, presents with chest pain
- ✦ As you are interviewing the patient she suddenly collapses and is found to be in PEA
- ✦ CPR is commenced

**What procedure should be
considered at this stage?**

Perimortem Cesarean Section



Legal-Ethical Considerations

- ✶ No emergency physician has ever been found liable for performing a postmortem cesarean section
- ✶ The emergency physician has the legal right and responsibility to provide the unborn fetus with every possible chance of survival when there is no hope of maternal survival

Legal-Ethical Considerations

- ✦ Permission for the operation should be obtained from the family when possible but not at the expense of delaying the procedure
- ✦ There is no standard of care relating to emergency physicians performing a postmortem cesarean delivery

Legal-Ethical Considerations

- ✶ In the absence of obstetric backup immediately at hand, it is reasonable for the emergency physician to proceed with delivery of the child if the mother cannot be resuscitated
- ✶ Survival rates range from 11-40%

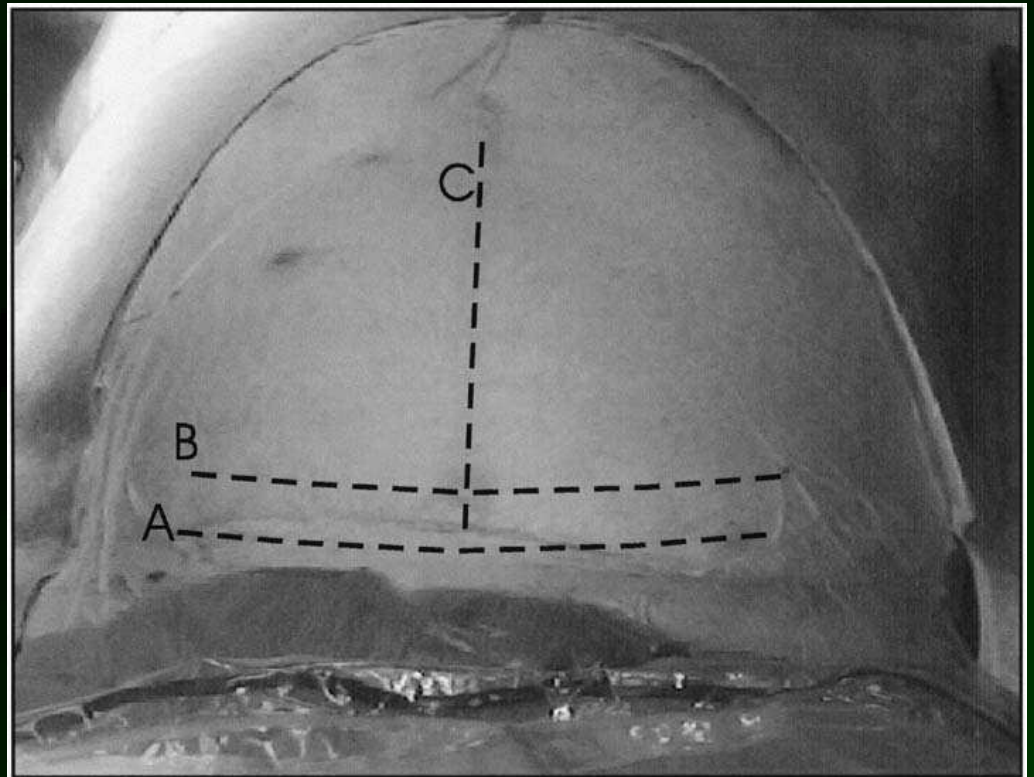
Indications

- ✦ Perimortem cesarean section (PMCS) must be considered in any woman who suffers irreversible cardiac arrest during 3rd trimester (**> 24 wk**)
- ✦ Should be performed **< 5 min** of maternal demise

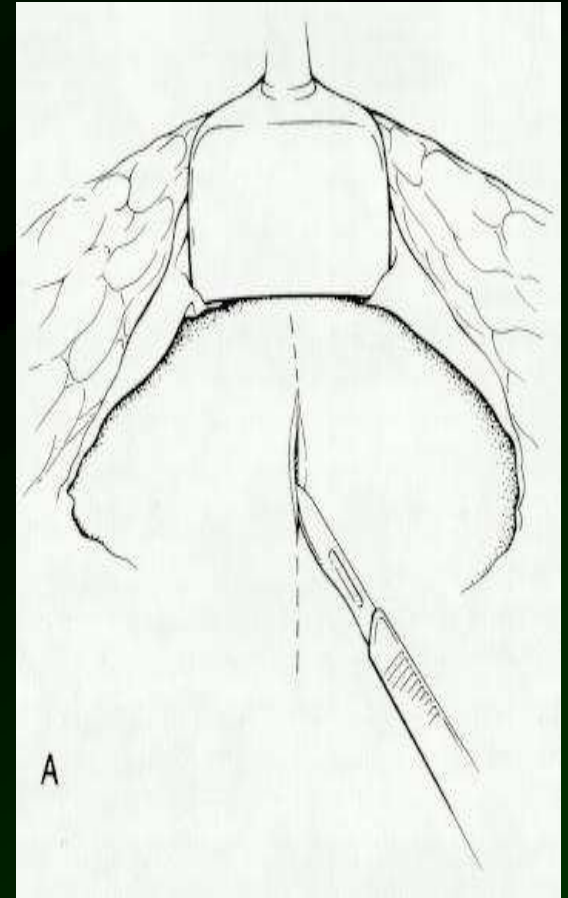
Equipment

- ✂ *Scalpel with a No. 10 blade*
- ✂ *Bandage scissors*
- ✂ Bladder retractor
- ✂ Large retractors (2)
- ✂ Forceps
- ✂ Lap or gauze sponges
- ✂ Hemostats (curved and straight)
- ✂ Suction
- ✂ Obstetric pack

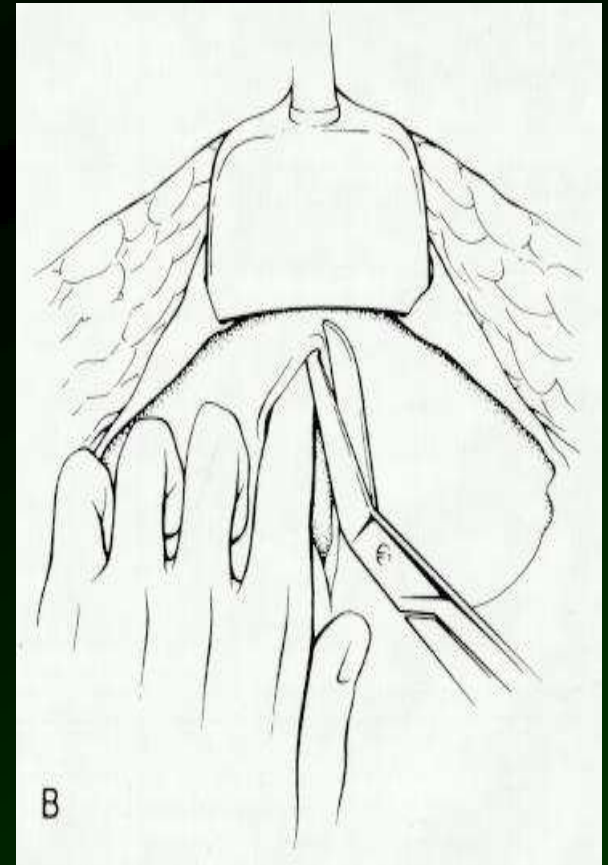
✂ Using the scalpel, a midline vertical incision (C) is made through the abdominal wall extending from the symphysis pubis to the umbilicus and carried through all abdominal layers to the peritoneal cavity



- ✿ The bladder is reflected inferiorly; if full it may be evacuated
- ✿ approximately 5-cm, vertical incision is made through the lower uterine segment until amniotic fluid is obtained or until the uterine cavity is clearly entered



- ✦ The index and long fingers are then inserted into the incision and used to lift the uterine wall away from the fetus
- ✦ A bandage scissors is used to extend the incision vertically to the fundus until a wide exposure is obtained



- ✿ The infant is then gently delivered, the nares and mouth suctioned, and the cord clamped and cut
- ✿ Neonatal resuscitation should be carried out as necessary



Maternal resuscitation

- ✦ CPR should be initiated on the mother at the time of cardiac arrest and continued throughout the procedure
- ✦ Standard BLS and ACLS except...
relief IVC compression

Maternal resuscitation



To relieve aortocaval compression during chest compressions and optimize the quality of CPR

Maternal resuscitation

✱ Gestational age 26-32 wks

- CPR and ACLS

- Consider open-chest cardiac massage (OCM) without aortic cross-clamping

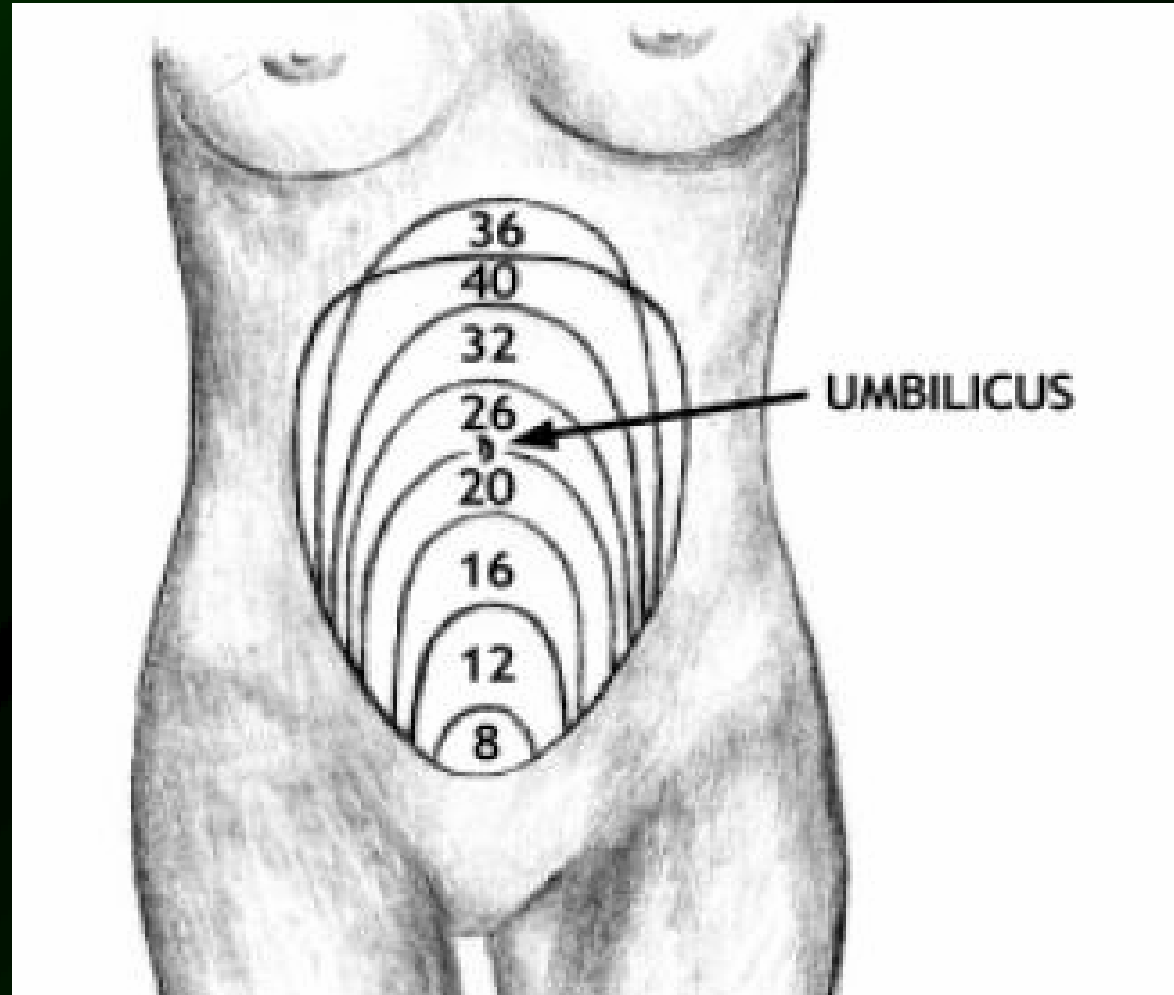
- Delay delivery if CPR successful

- Consider PMCS if CPR failed

Maternal resuscitation

- ✱ Gestational age >32 wks
 - CPR and ACLS
 - Consider PMCS if CPR failed
 - Immediate delivery if CPR successful
 - Consider OCM

Uterine size / weeks of GA



Take home message

Heroic Procedures

- ✦ *Cranial trephination*
 - *Same side to dilating pupil*
- ✦ *Lateral canthotomy*
 - *IOP > 40 mm Hg*
- ✦ *Surgical cricothyroidotomy*
 - *Can't intubate, can't ventilate*
- ✦ *Perimortem C/S*
 - *Within 5 min, > 24 wk*

Thank you