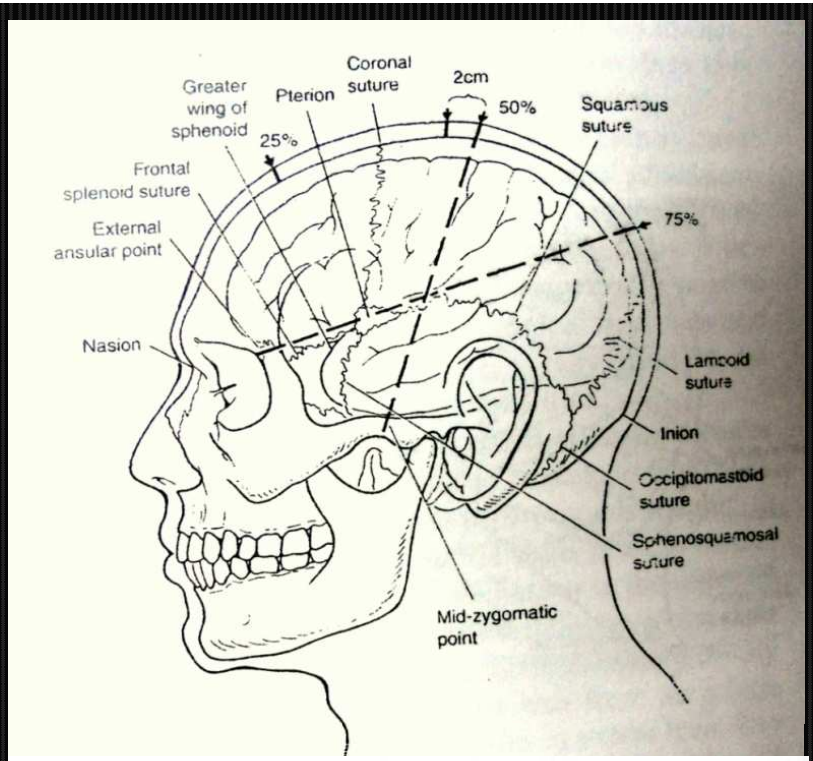
PRINCIPLES OF CRANIOTOMY

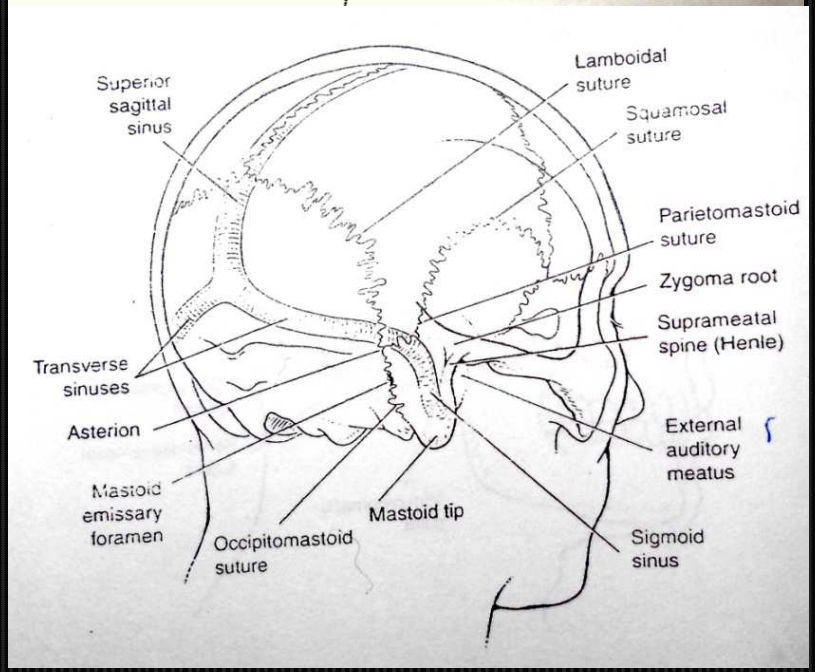
Historical Perspective

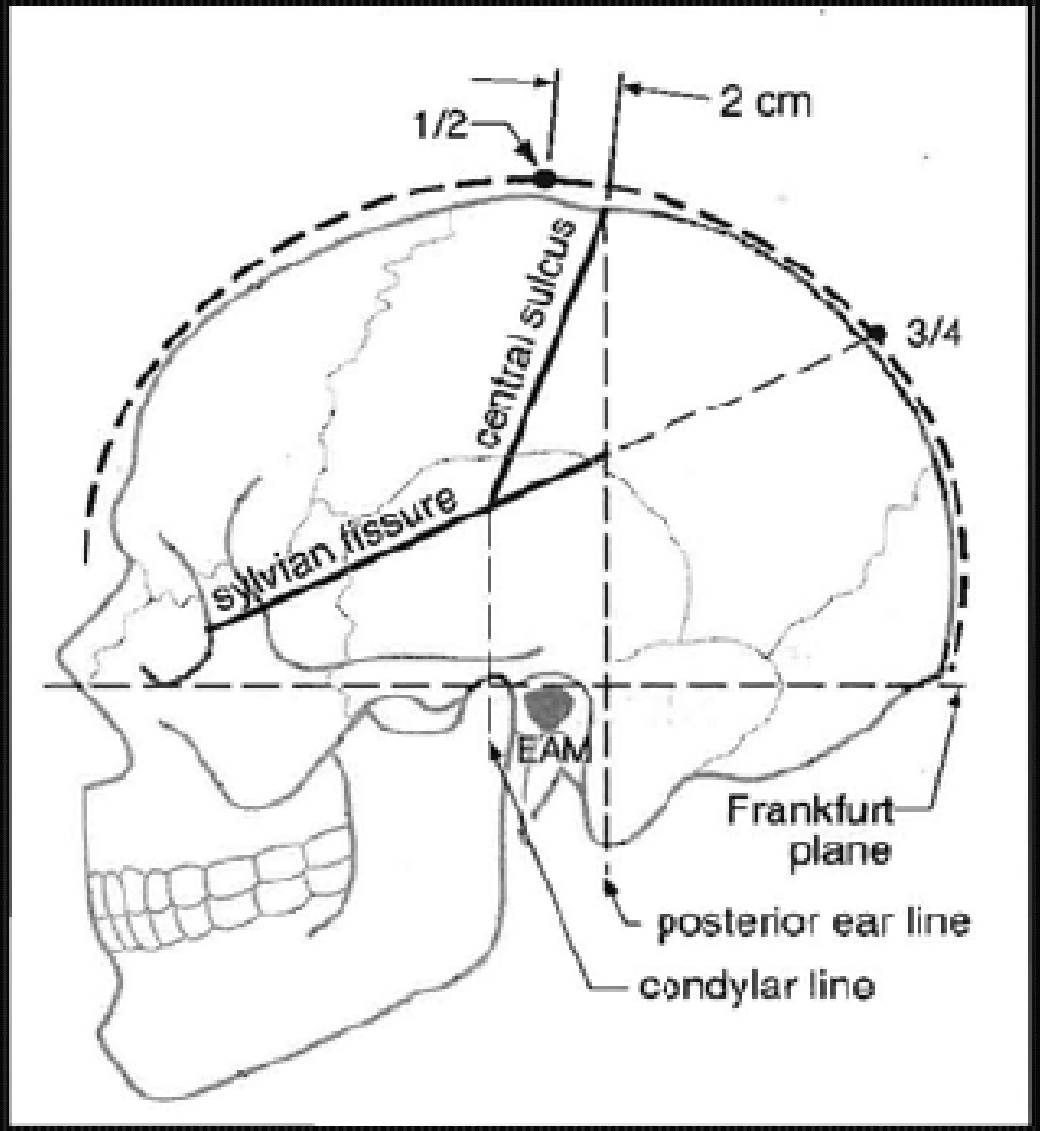
- Trephining : Neolithic period in 2000 B.C
- Trepanations made followed by scrapings of the skull till holes
- 1889 Wagner: First osteoplastic bone flap
- Poirier (1891) : Dural flaps based towards midline
- Gigli saw for craniotomy- Obalinski in 1897
- Power drills: De Martel (1925)

Landmarks

- Nasion
- Bregma
- Lambda
- Inion
- Pterion
- Asterion

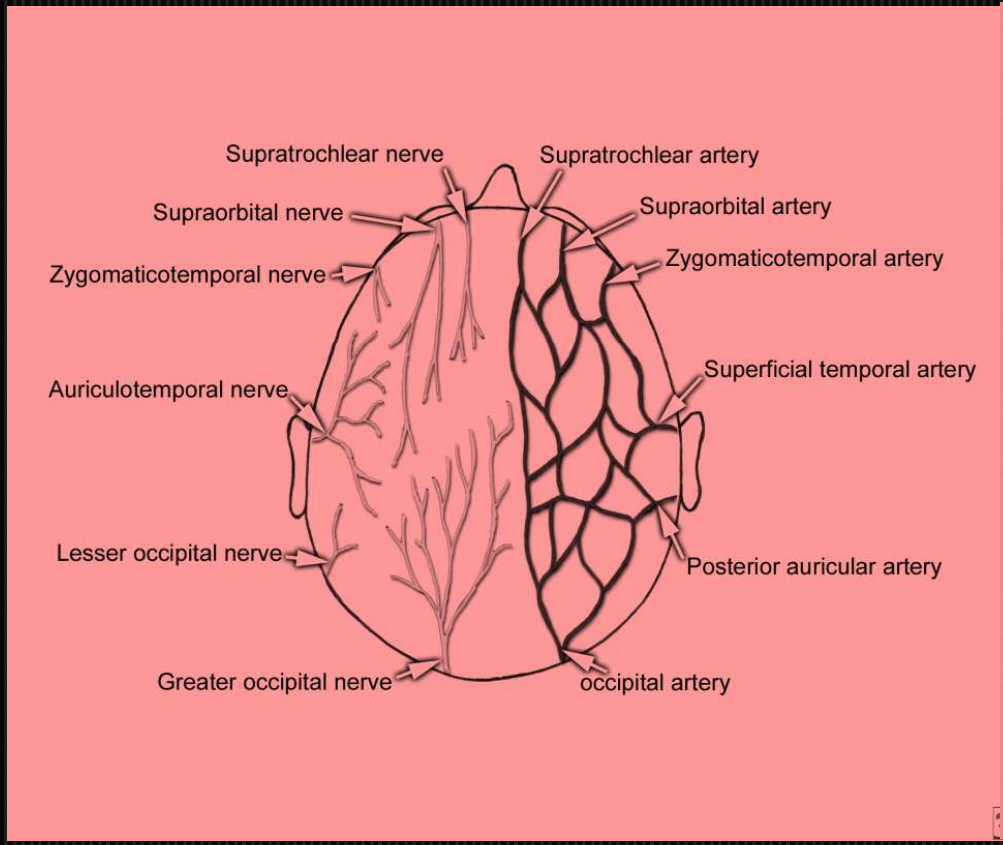


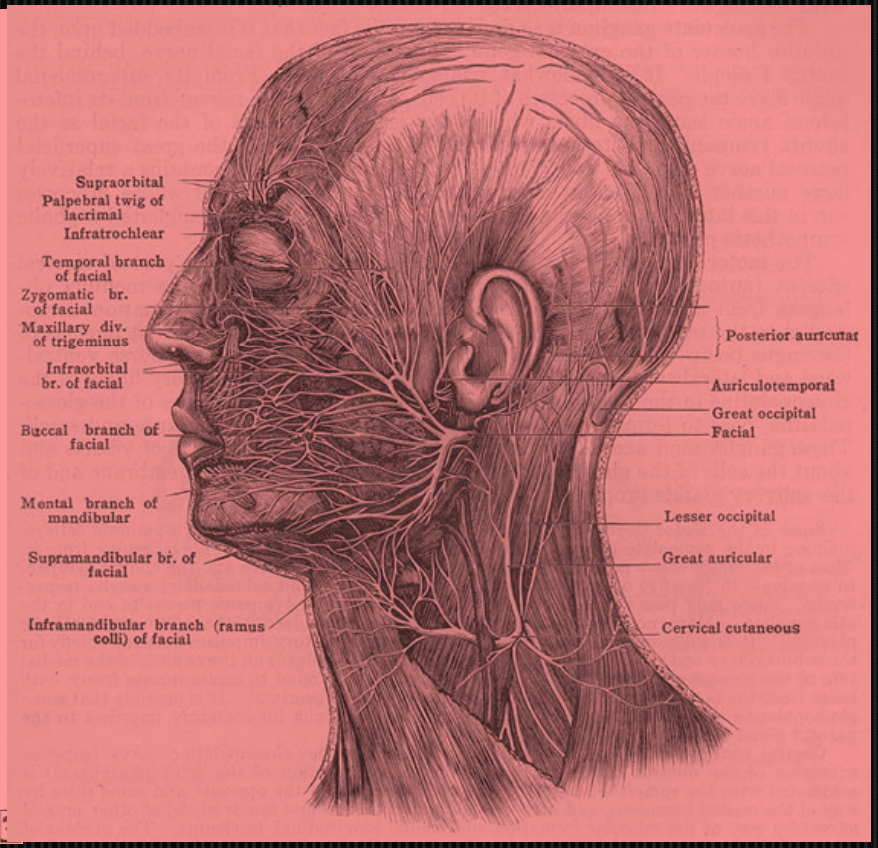




TAYLOR - HAUGHTON LINES

NEUROVASCULAR SUPPLY OF SCALP

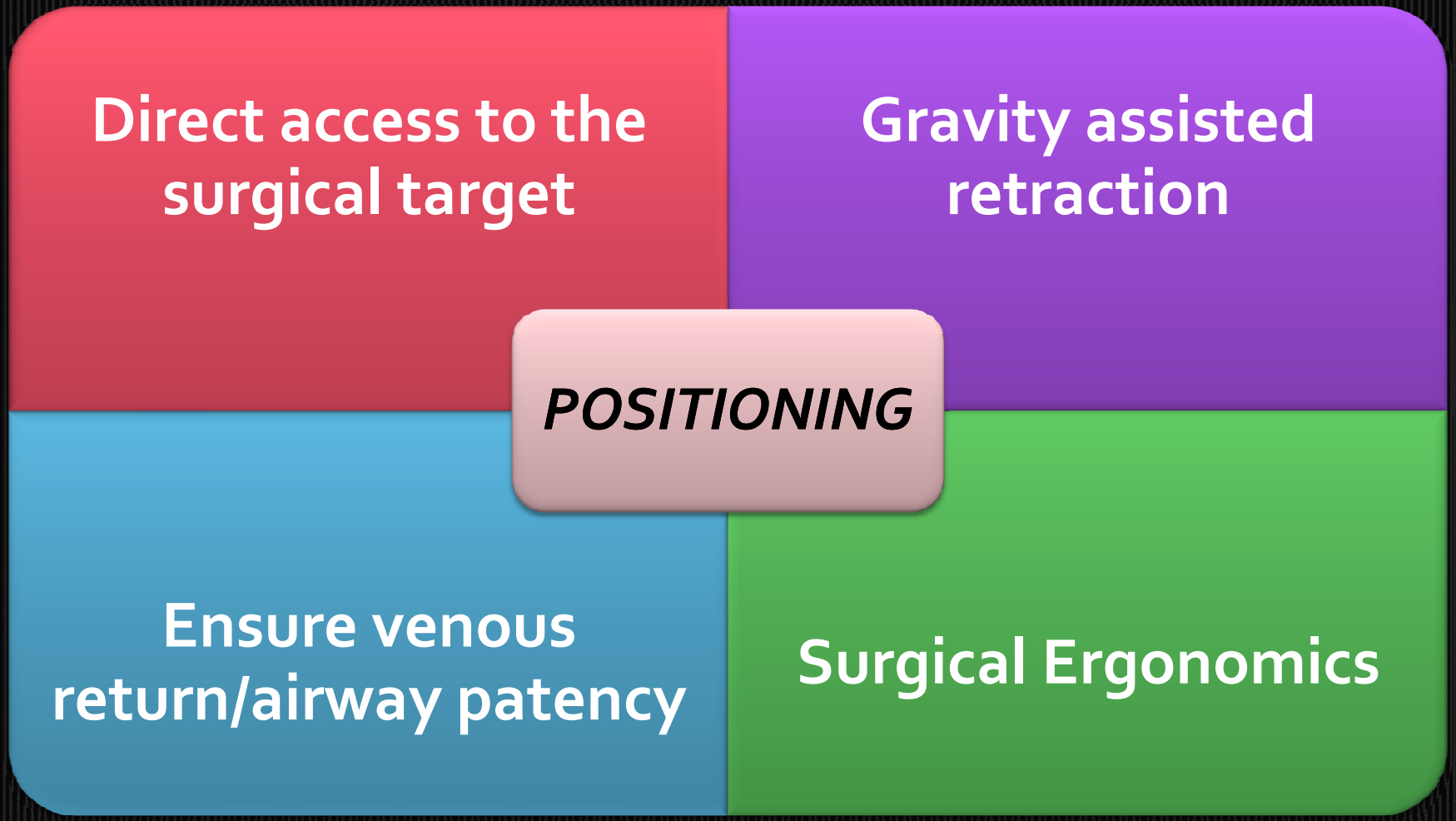




PLANNING

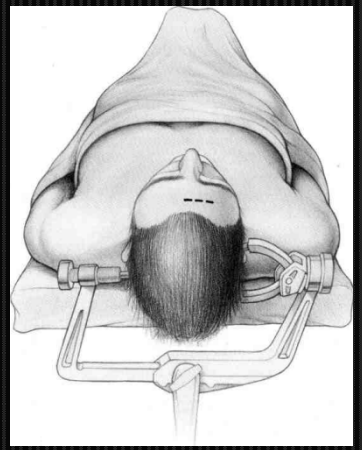
- Location of lesion
- Position of important structures
- Contingency plan for enlarging incision
- Obtain adequate closure
- Minimize brain retraction

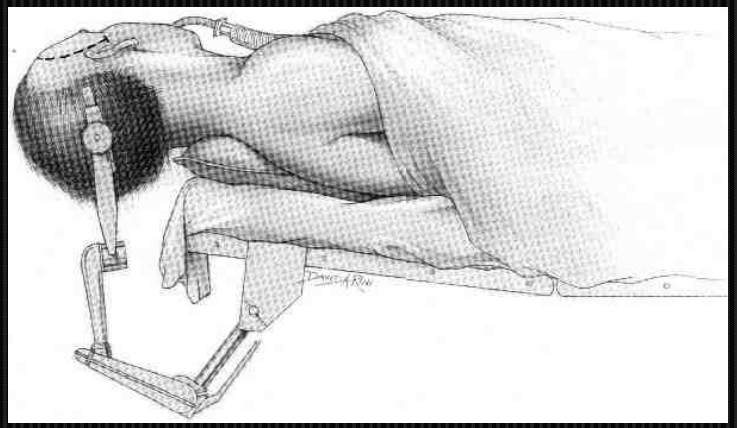
SURGICAL POSITIONING



SURGICAL POSITIONING

- Supine position
  - Frontal
  - Temporal
  - Interhemispheric





SURGICAL POSITIONING

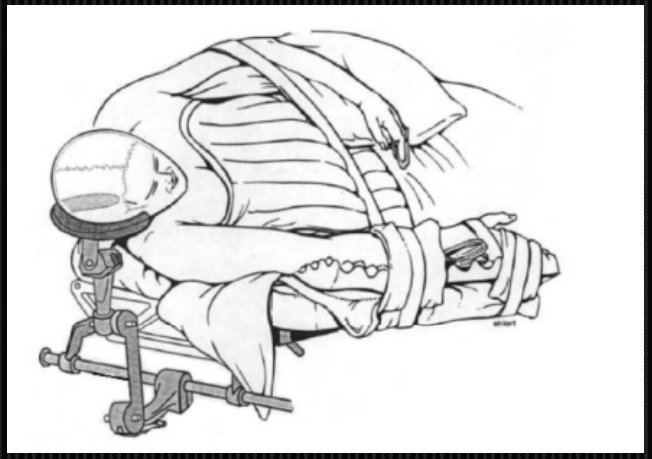
- Prone
  - Cerebellar and 4th Ventricular lesions
- Sitting/Semisitting
  - Infra tentorial approach to pineal region
  - Gravitational cerebellar retraction
  - Air embolism

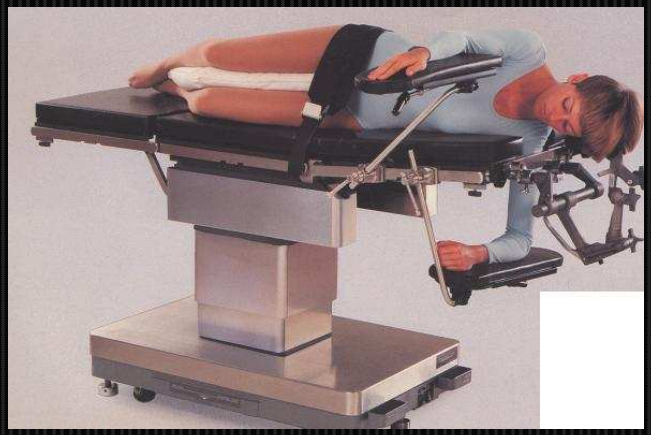
SURGICAL POSITIONING

- Concorde Position
  - Combined occipital transtentorial and supracerebellar infratentorial approach

SURGICAL POSITIONING

- Lateral position
  - Lateral suboccipital/ skull base approaches
  - Gravitational cerebellar retraction
  - Dependent arm axillary artery, Brachial plexus injury
- Park Bench Position
  - Non dependent shoulder moved out of operating field





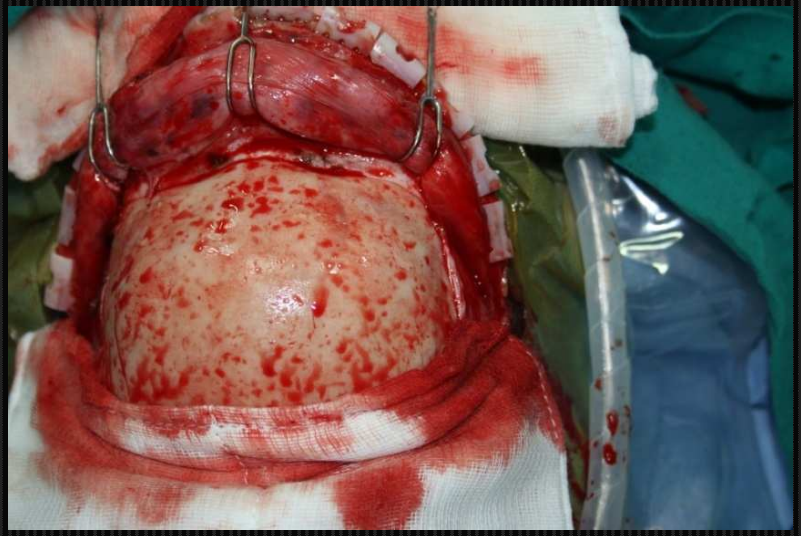
SCALP FLAP

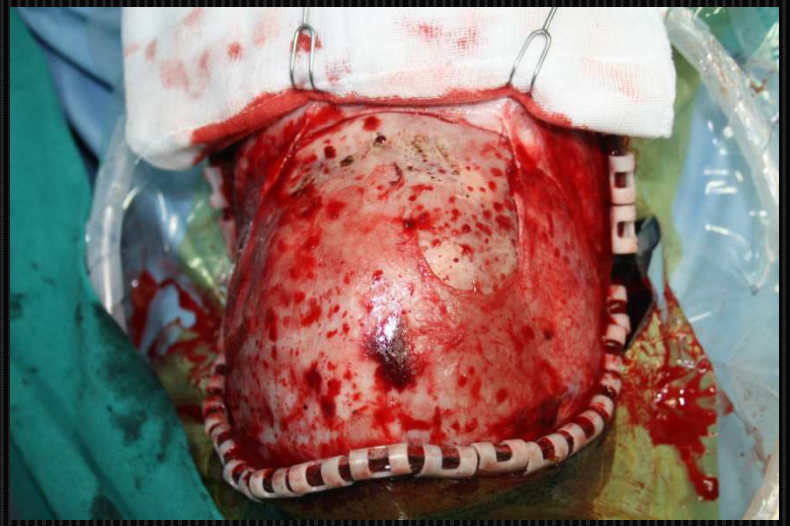
- GENERAL TECHNICAL PRINCIPLES
  - Surgical exposure of the lesion
  - Neuro vascular supply
  - Cosmetic effect
- TYPES
  - Random Pattern
    - Length not > 1.5 times breadth
    - Integrity of a major blood supply to be maintained
  - Based on a named vessel
    - Length may be extended considerably

SCALP FLAP

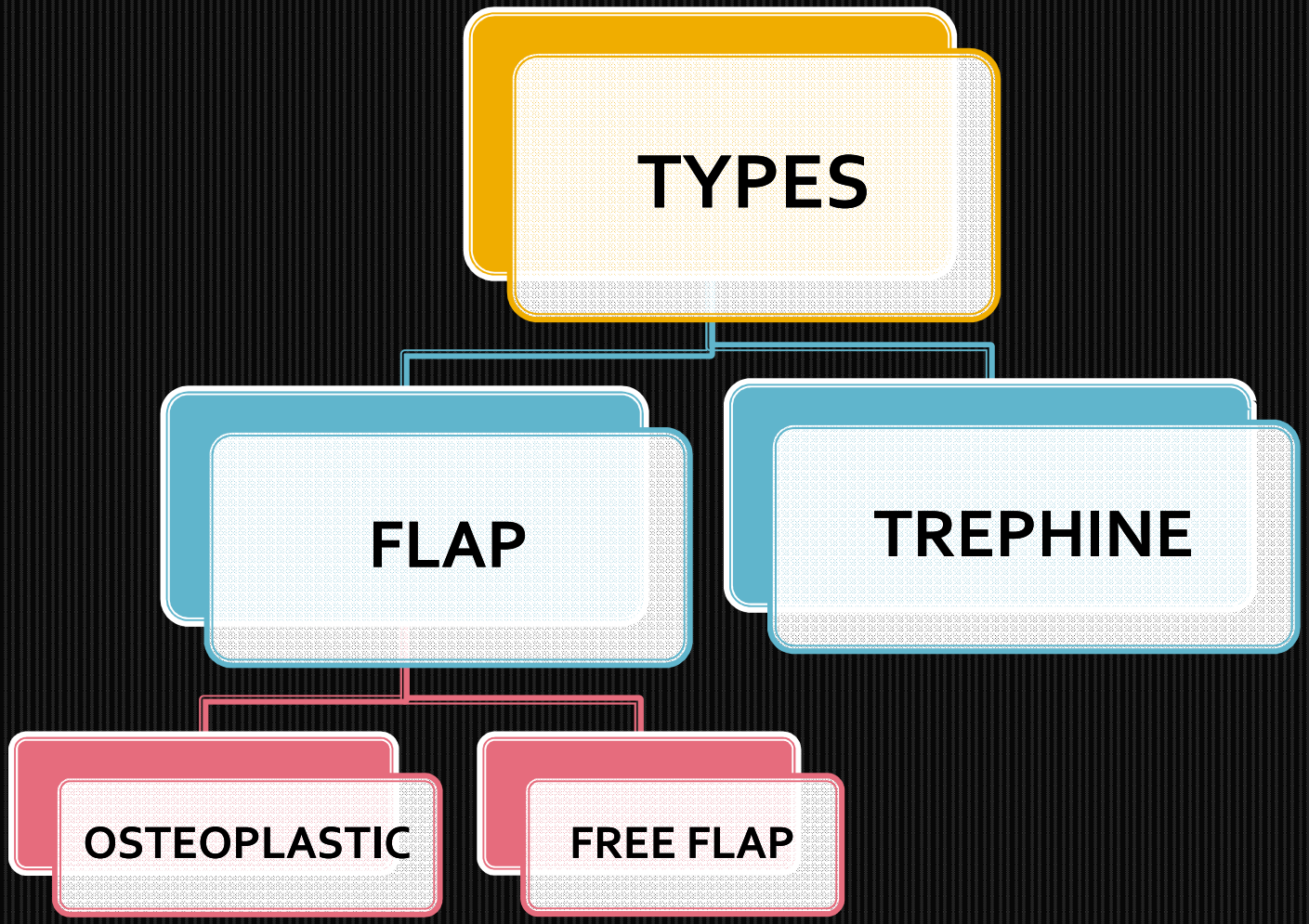
- Skin incised with galea
- Pressure over the scalp
- Periosteum raised with scalp or separately
- Raney's clips, bipolar, Dandy's clamps
- Adequate retraction
- Inner surface protected with moistened gauze
- Roller gauze
- Dissection in intrafascial fat above zygomatic arch

SCALP FLAP





BONE FLAP



BONE FLAP → Fundamentals

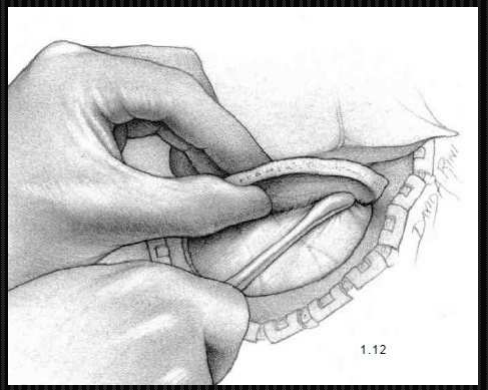
- Most direct access to target
- For cerebral convexity directly centered over the lesion
- Number of burr holes varies
  - Young p/t → *Cosmesis* → **fewer/single**
  - Old p/t → *Adherent Dura* → **multiple**
    - Separation of underlying dura
- Bevel effect

BONE FLAP → Fundamentals

- ***Dural laceration***
  - Turn saw off
  - Remove drill backwards through entry hole
- ***Opened air cells***
  - Obliterate with bone wax
  - Cover with vascularized tissue
  - Frontal sinus mucosa to be removed , ducts obliterated and sinus covered with vascularized pericranial graft

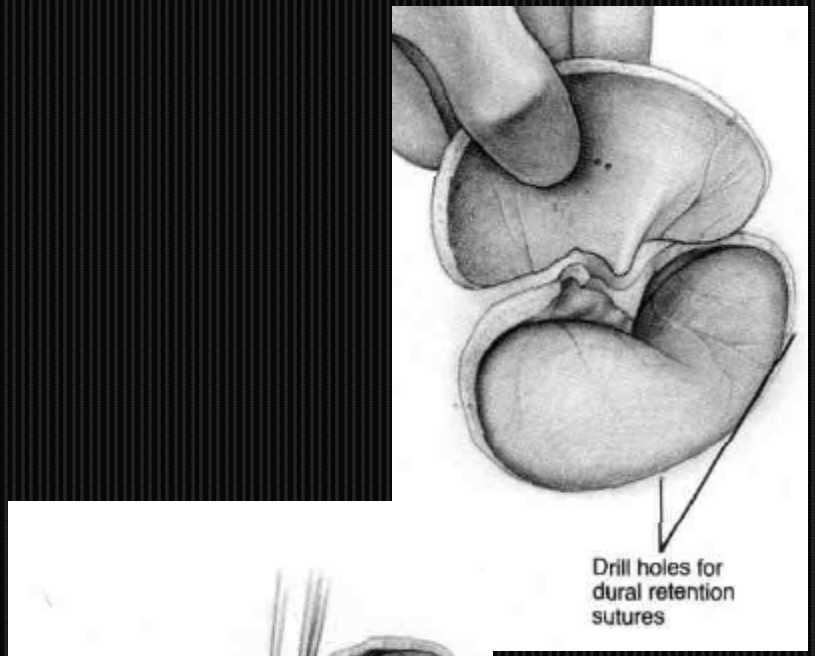
BONE FLAP → Fundamentals

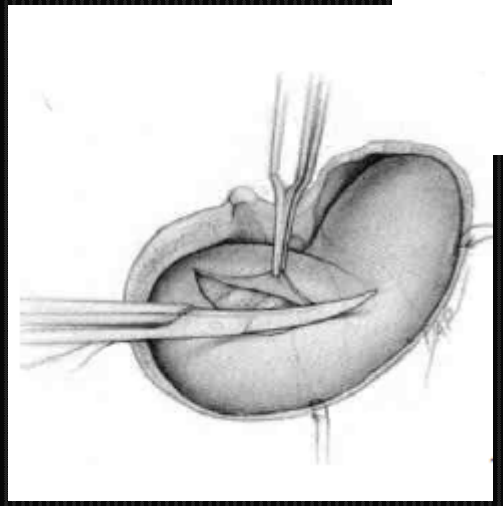
- ***Sinus protection***
  - Proposed bony cuts over the sinuses should be done last
    - Vascularity
    - Dural adherence
  - Cut sinus can be sewn/ tamponaded against bone with gelfoam
- Bone wax for bleeding edges
- Dura gently separated when lifting bone



BONE FLAP → Fundamentals

- Epidural tacking (hitch) sutures to control epidural bleeding *before opening dura*

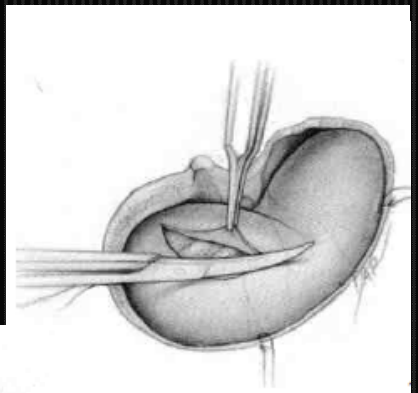


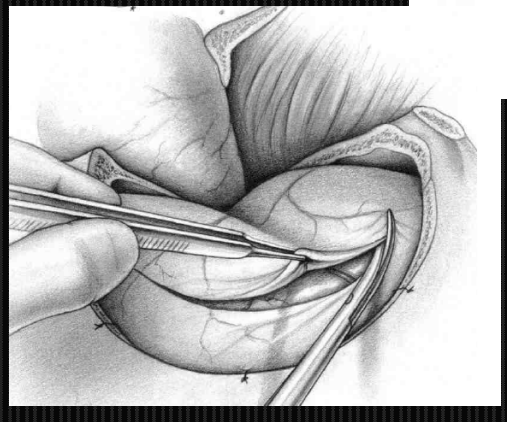


- **Osteoplastic Bone Flap**
  - Blood supply partly retained
  - Better tolerance to infection and post op radiation
  - Frontal , Temporal and Parietal flaps Suspended on temporalis muscle; Occiptal flap on Suboccipital muscle

OPENING OF DURA MATER

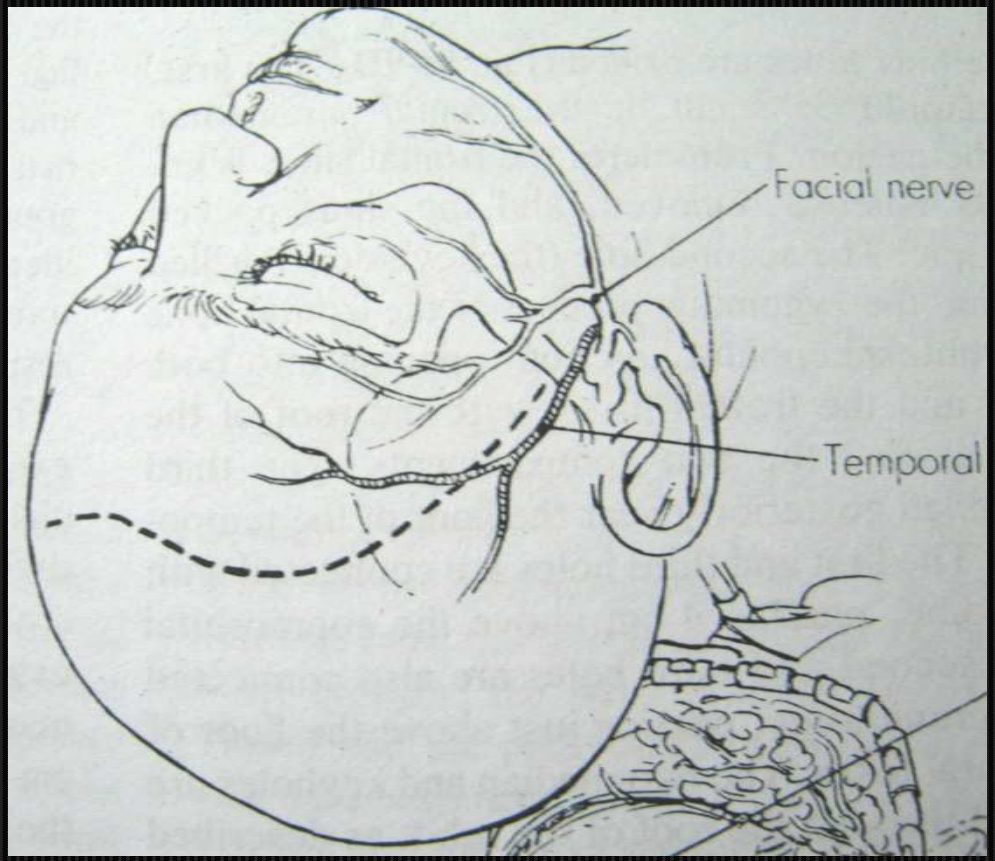
- Tailored to avoid venous channels
- Flap / curved incision with side cuts
- Flap *based towards venous sinus* to *avoid injury to cortical veins*
- Initiated with hook and knife
- Advanced with scissors
- Dural cuff to be left on edges





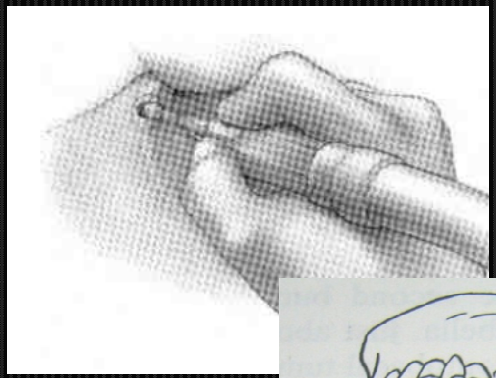
FRONTAL CRANIOTOMY

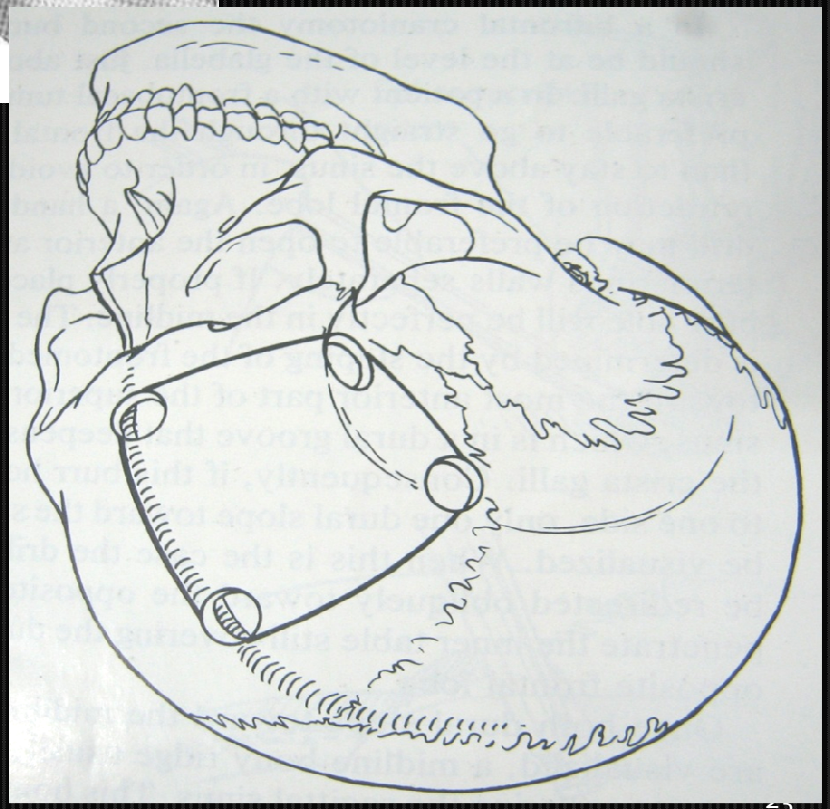
- Frontal lobe, subfrontal approach to anteror skull base, trans cortical access to ventricles
- P/t supine, head turned to opposite side
- Frontal, Hockey stick or 3/4th Soutter Incision



FRONTAL CRANIOTOMY

- "Key Burr Hole" at junction of sphenoid ridge, lateral anterior orbit and posterior edge of zygomatic process of frontal bone

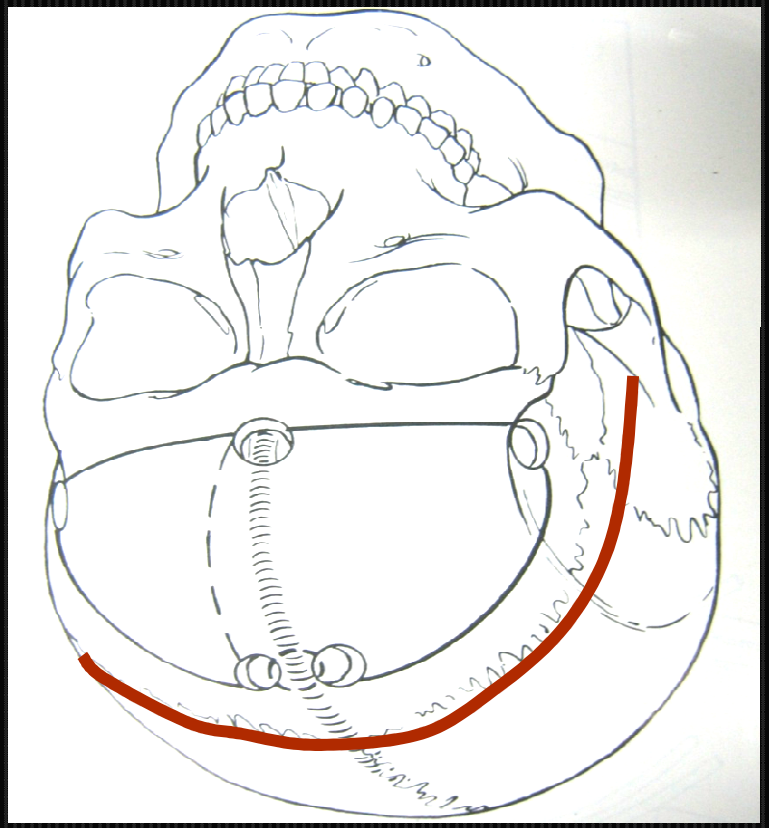




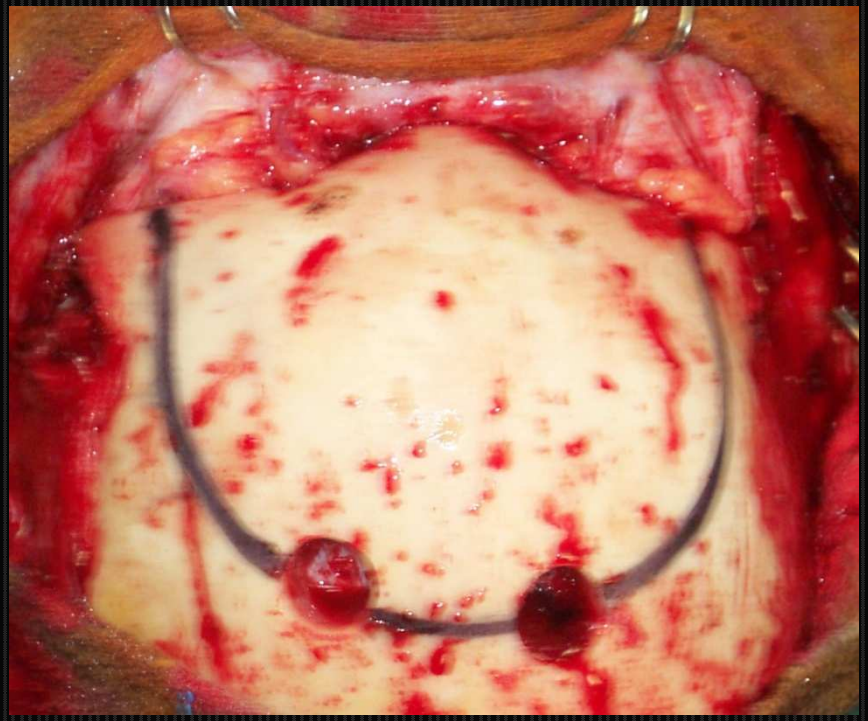
- If orbit breached: bipolar cautery and close with bone wax

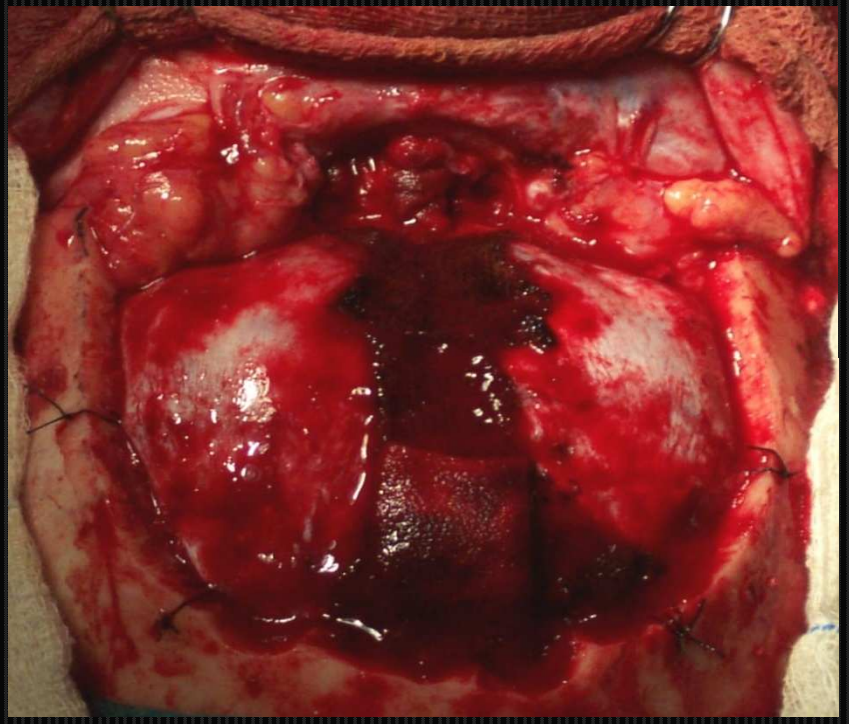
BIFRONTAL CRANIOTOMY

- Anterior Cranial Floor, Sellar Region
- Head supine, turned opposite to surgeon's handedness, vertex lowered
- Bicoronal /Soutter flap



BIFRONTAL CRANIOTOMY

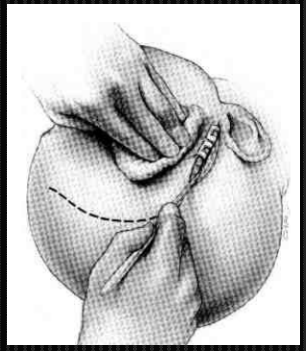




Opened frontal sinus obliterated

FRONTO-TEMPORAL (PTERIONAL) CRANIOTOMY

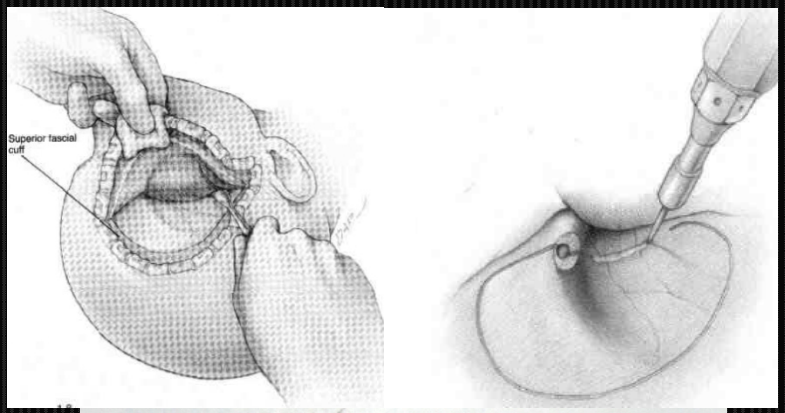
- Popularized by Yasargil
- Most useful for aneurysms of anterior circulation, basilar top, tumors of retro orbital, parasellar and subfrontal areas
- Commonly from *right side*
- Supine, Head elevated and rotated 30° to left
- Skin incision : Fronto temporal

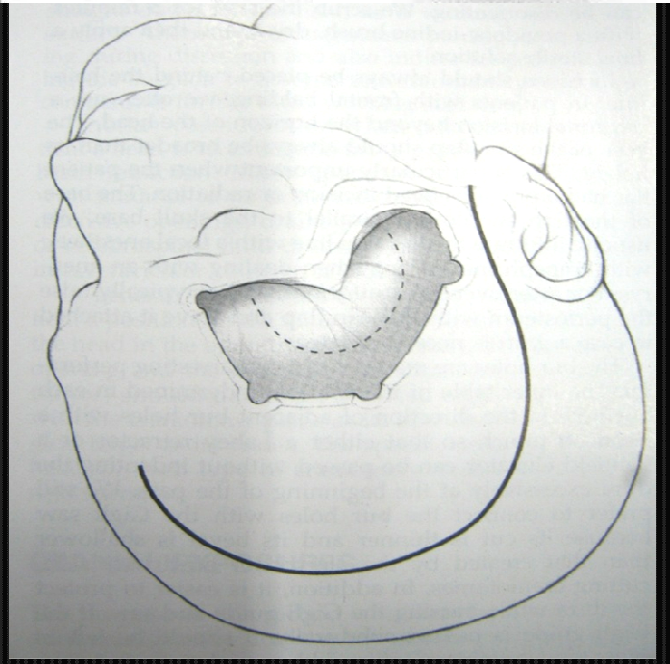


FRONTO-TEMPORAL (PTERIONAL) CRANIOTOMY

- Bone flap centered over the pterion

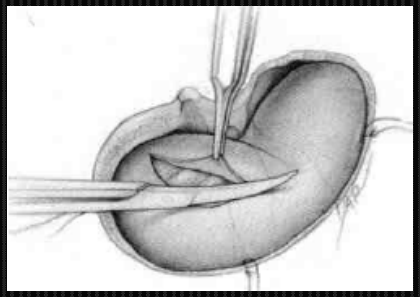
- Key burr hole, frontal burr hole, posterior burr hole, last burr hole just above the zygoma





FRONTO-TEMPORAL (PTERIONAL) CRANIOTOMY

- Further bone may be removed from the inferior temporal squama
- To improve vision, drill the sphenoid ridge
- Dural flap based on the orbit

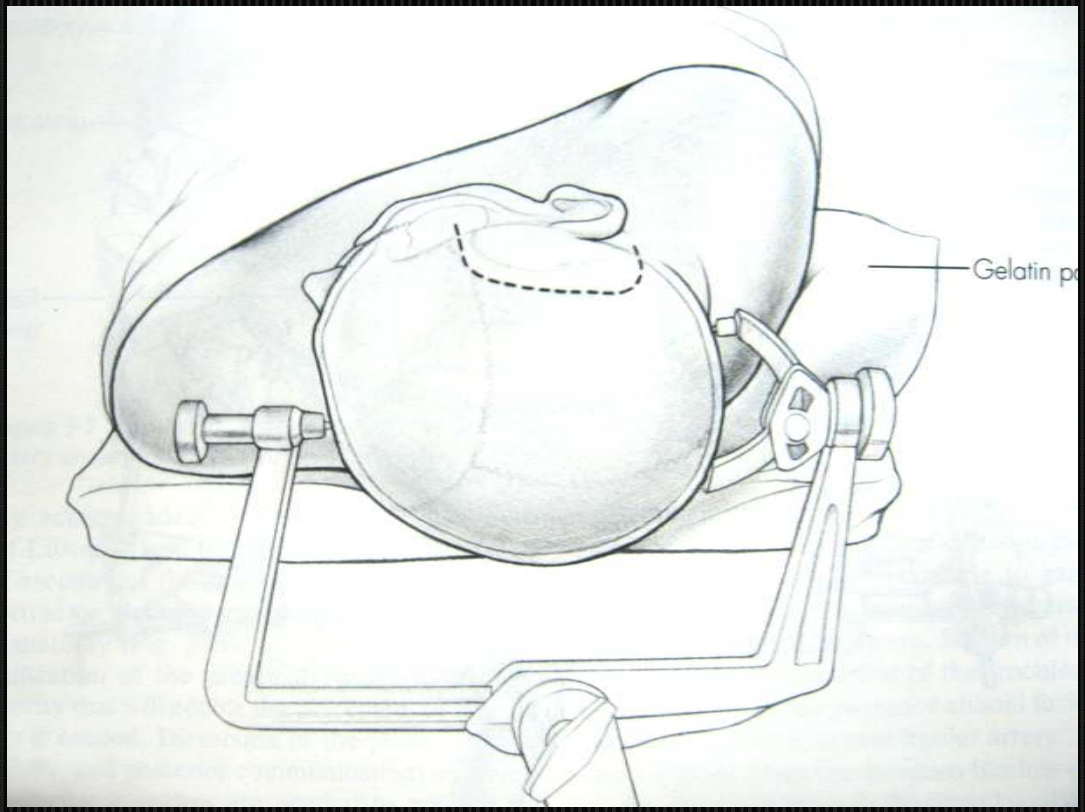


FRONTO-TEMPORAL (PTERIONAL) CRANIOTOMY

- Orbito-zygomatic osteotomy allows for a more lower and anterior approach
- Suited for para-sellar, inter peduncular lesions, basilar aneurysms

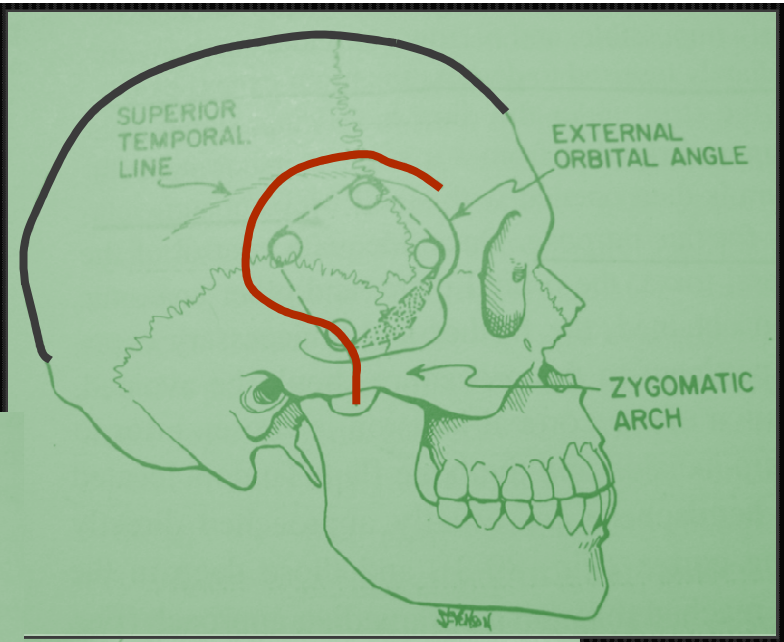
TEMPORAL CRANIOTOMY

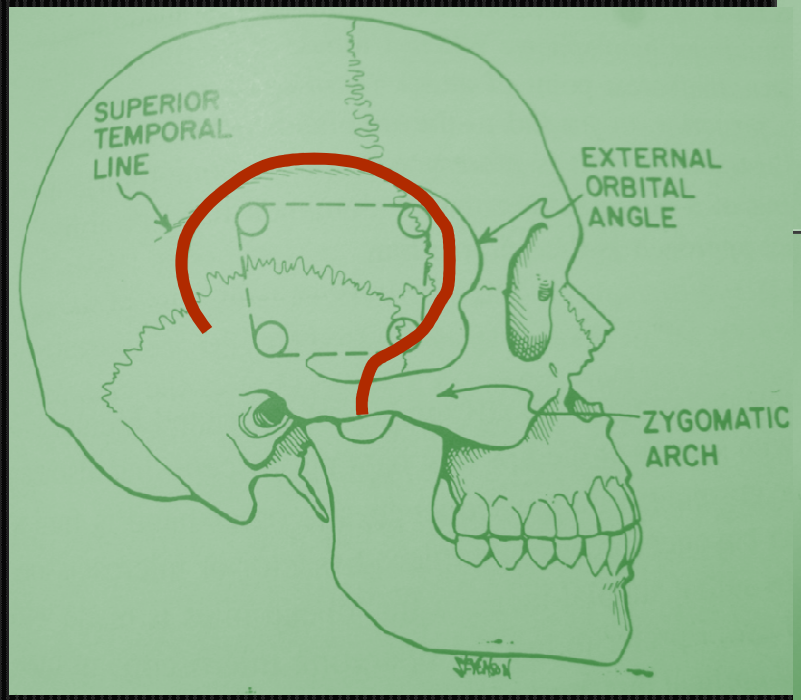
- To approach Anterior and Posterior Temporal Lobe
- Position: Supine with head turned laterally

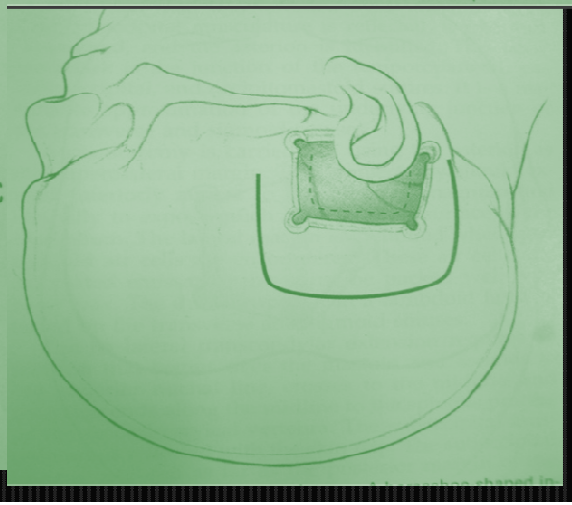


TEMPORAL CRANIOTOMY

- Incision : Question mark/Vertical linear/Inverted U

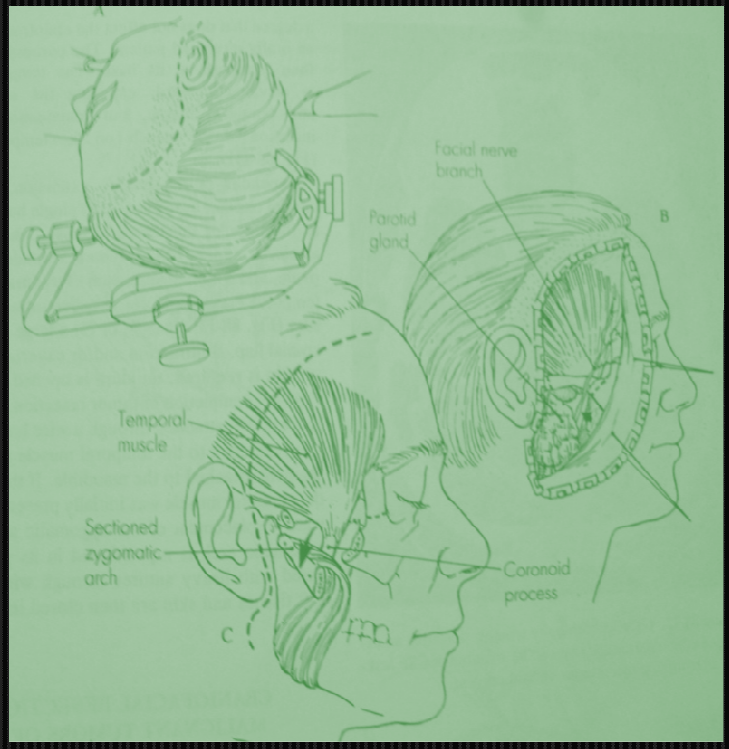






TEMPORAL CRANIOTOMY

- To increase exposure
  - Inferior temporal craniectomy
  - Zygomatic osteotomy
  - Resection of medial petrous tip
  - Zygomatic approach (infra temporal fossa) : angiofibroma, trigeminnal scwannoma

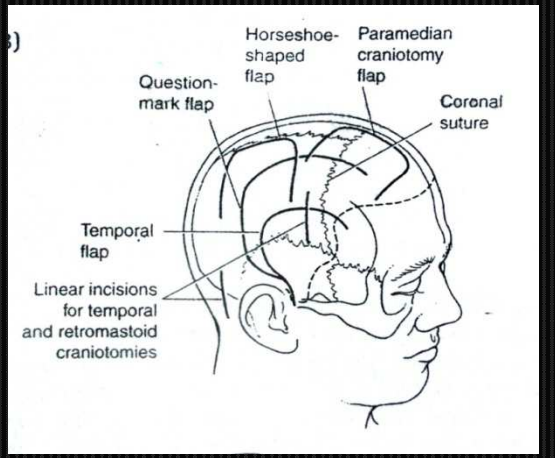


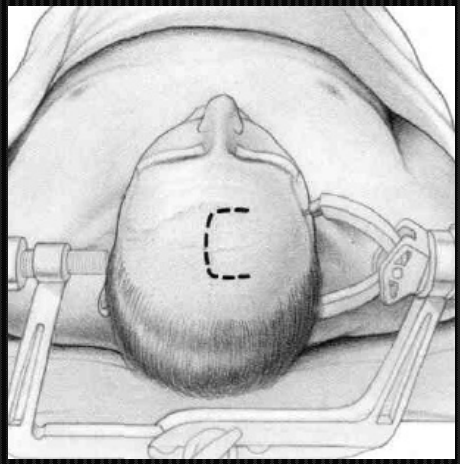
PARIETAL CRANIOTOMY

- Parietal lobe lesions, Transcortical access to trigone
- Supine , head turned contralateral
- Square bone flap

PARASGITTAL CRANIOTOMY

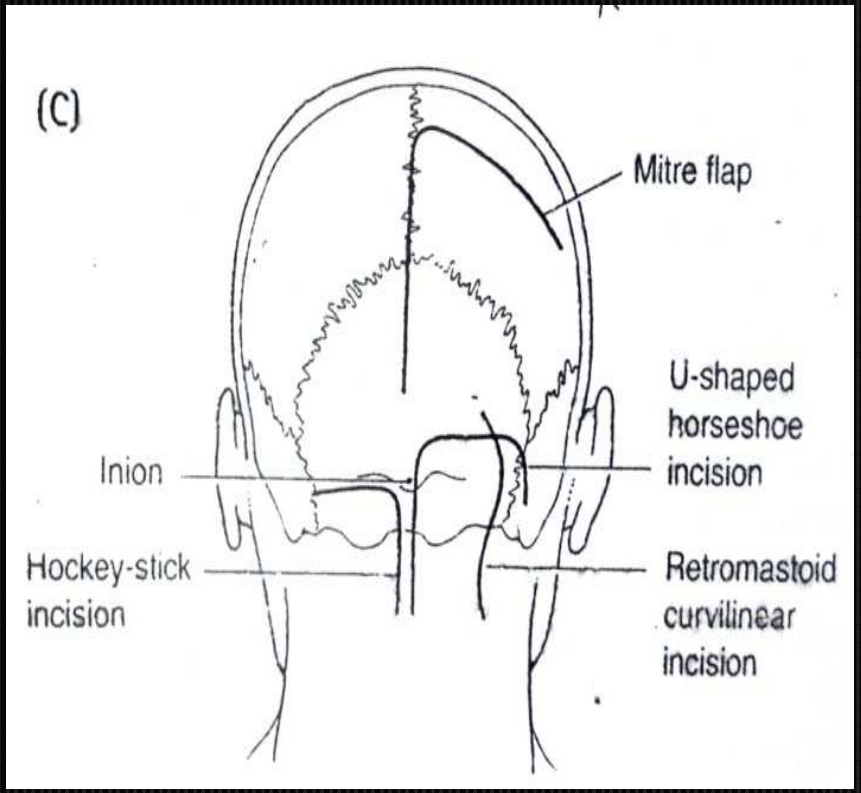
- Interhemispheric/ parasagittal lesions, Transcallosal approach to 3rd ventricle, Pineal region
- Inverted -U (Horse Shoe) / L-shaped incision
- Position
  - Anterior : supine- neck flexed
  - Middle: lateral /semisitting
  - Posterior :lateral/prone
- Burr holes on lateral margins of sagittal sinus
- Dural flap based towards midline



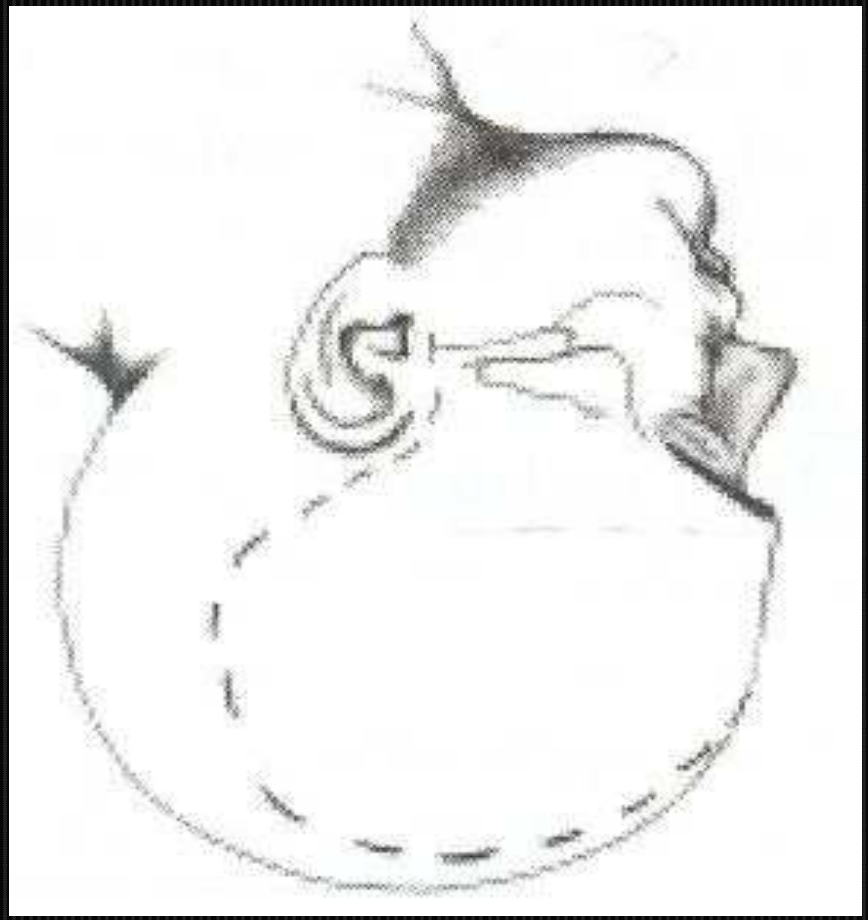


OCCIPITAL CRANIOTOMY

- Prone position
- **Mitre flap**
- Burr holes along sagittal sinus (caudal one adjacent to torcula Herophili), over asterion
- Dural flap based on Superior Sagittal or transverse sinus

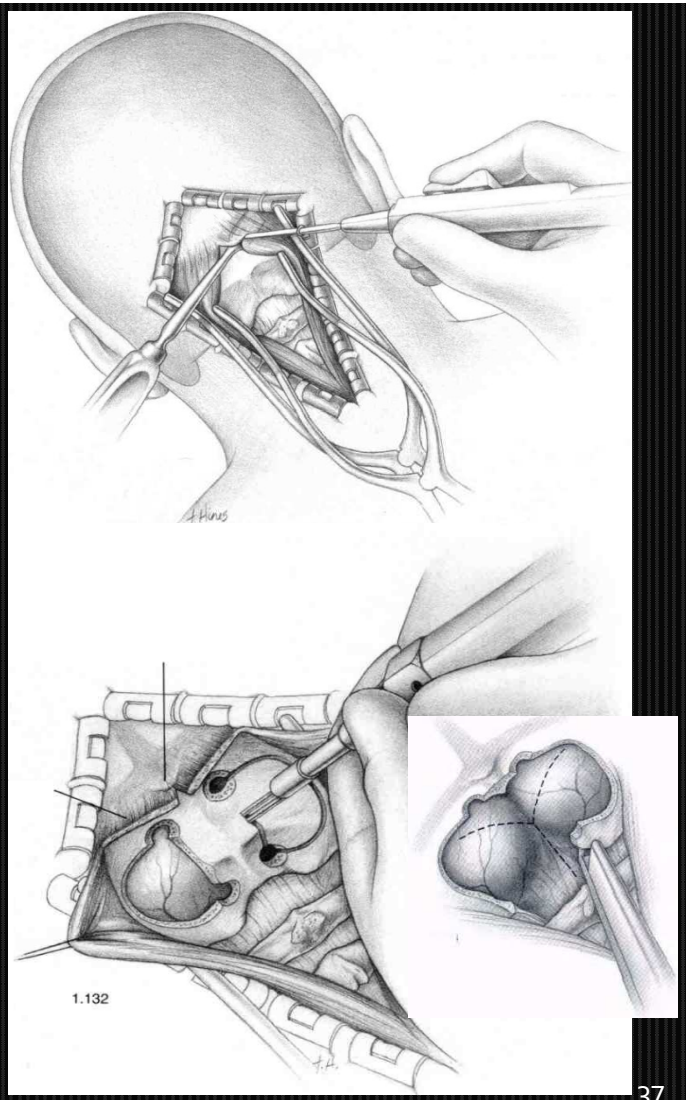


TRAUMA FLAP



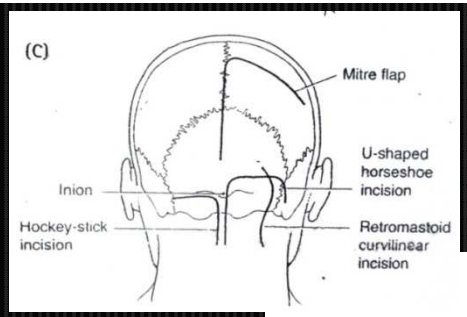
INFRATENTORIAL CRANIOTOMY SUBOCCIPITAL

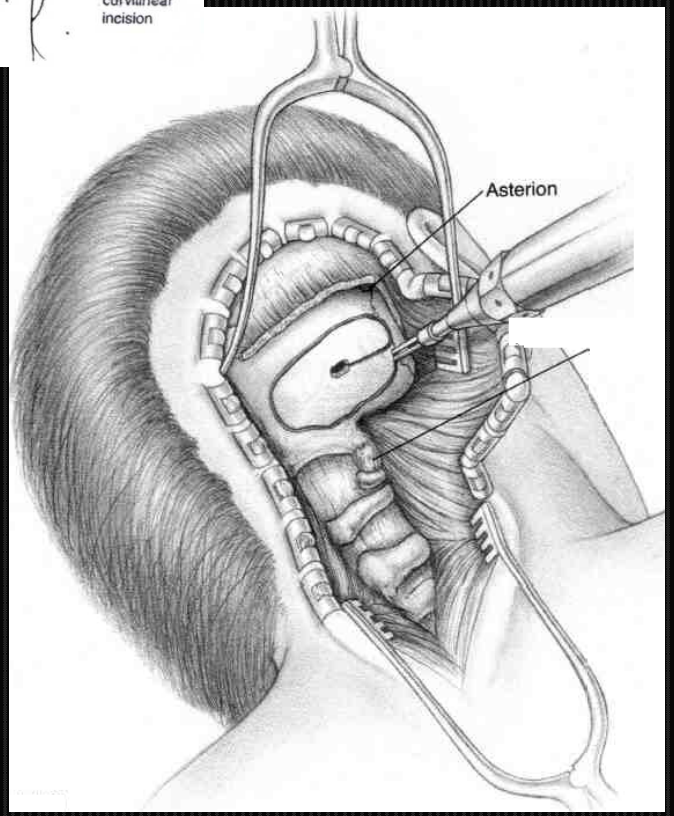
- MIDLINE
  - Vermis, 4th Ventricle, posterior cerebellum
  - Sitting/semisitting/prone /Concorde position
  - Exposure from inion to posterior atlanto –axial membrane
  - Y-shaped dural opening



INFRATENTORIAL CRANIOTOMY: SUBOCCIPITAL

- PARAMEDIAN
  - Unilateral cerebellar, CPA lesions, PICA, AICA aneurysms
  - Paramedian / Hockey Stick incision

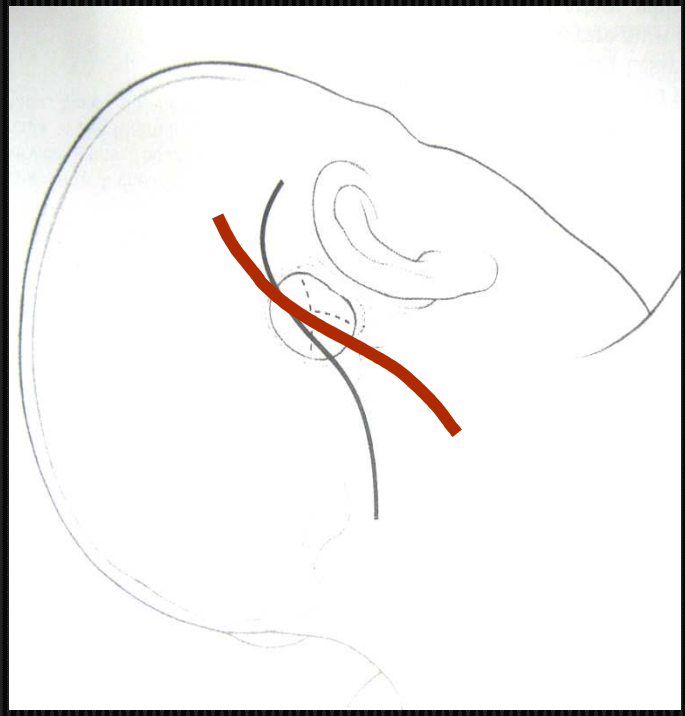




INFRATENTORIAL CRANIOTOMY: RETROMASTOID

- Ideal for CP Angle
- Semisitting/ Lateral Position
- Linear/Curvilinear Incision
- Post op headache reduced if bone flap replaced
- Superiorly upto transverse sinus; laterally upto sigmoid sinus
- Mastoid air cells to be occluded
- Dural opening curvilinear

- Modifications
  - Far lateral
  - Extreme lateral

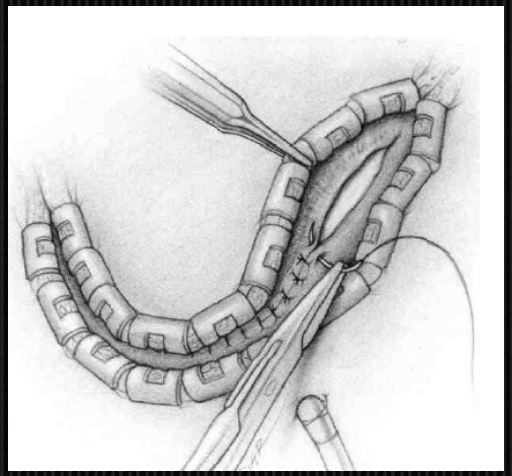


CLOSURE

- Hemostasis
- Sinuses/air cells to be occluded with bone wax
- Watertight dural closure (monofilament)
  - Grafts : periosteum, temporalis fascia, fascia lata, dural substitutes
  - Aspirated CSF to replaced with buffered saline
- Tack up sutures

CLOSURE

- Bone flap secured with mini plates and screws
- Burr holes filled with bone chips, Titanium cover, Silicon plugs
- Temporalis resutured to fascial cuff (esp. anteriorly)
- Suboccipital muscles reapproximated in layers



- Scalp closed in two layers
- Absorbable suture for galea aponeurotica ; non absorbable suture for skin

THANK YOU