Surgical approaches to sellar and supra sellar regions

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What are we are dealing with???

Sellar neoplasms	***Supra sellar neoplasms***	***Non neoplastic lesions***
•Pituitary adenoma/ carcinoma •Craniopharyngioma •Sarcoma •Granular cell tumor	•Meningioma •Hypothalamic/ Optic glioma •Chordoma •Dermoid/ Epidermoid/ Teratoma/ Germinoma •Lipoma •Melanoma •Paraganglioma •Gangliocytoma •Chondroma •Hemangioblastoma •Olfactory neuroblastoma •Lympho proliferative disorders •Tumors of skeletal origin	•Ratkhes cleft cyst •Mucocoeles •Arachnoid cyst •Aneurysms •Inflammatory lesions •Abscesses •Sarcoidosis •Histiocytosis •Lymphocytic hypophysitis

Surgical approaches

Extra cranial	***Trans cranial***
A. Trans sphenoidal	***A. Intra dural***
- sublabial trans sphenoidal	- sub frontal
- trans- nasal, trans- septal, trans-sphenoidal	- pterional
- trans maxillary trans ethmoido-sphenoidal	- orbito zygomatic
- fronto orbital external trans ethmoidal	- sub temporal
B. Endoscopic endonasal	***B. Extra dural:*** Orbito zygomatic

Trans nasal aproaches

- Indications:
  1. For most pituitary tumors
  2. Craniopharyngiomas and other lesions which are primarily sellar
  3. Ratkhe's cleft cyst
  4. Apoplexy
- Contraindications:
  1. Infection / sinusitis
  2. Tumor having predominant supra/ para sellar invasion
  3. Bare carotids
  4. Conchal sella

Anatomical aspects

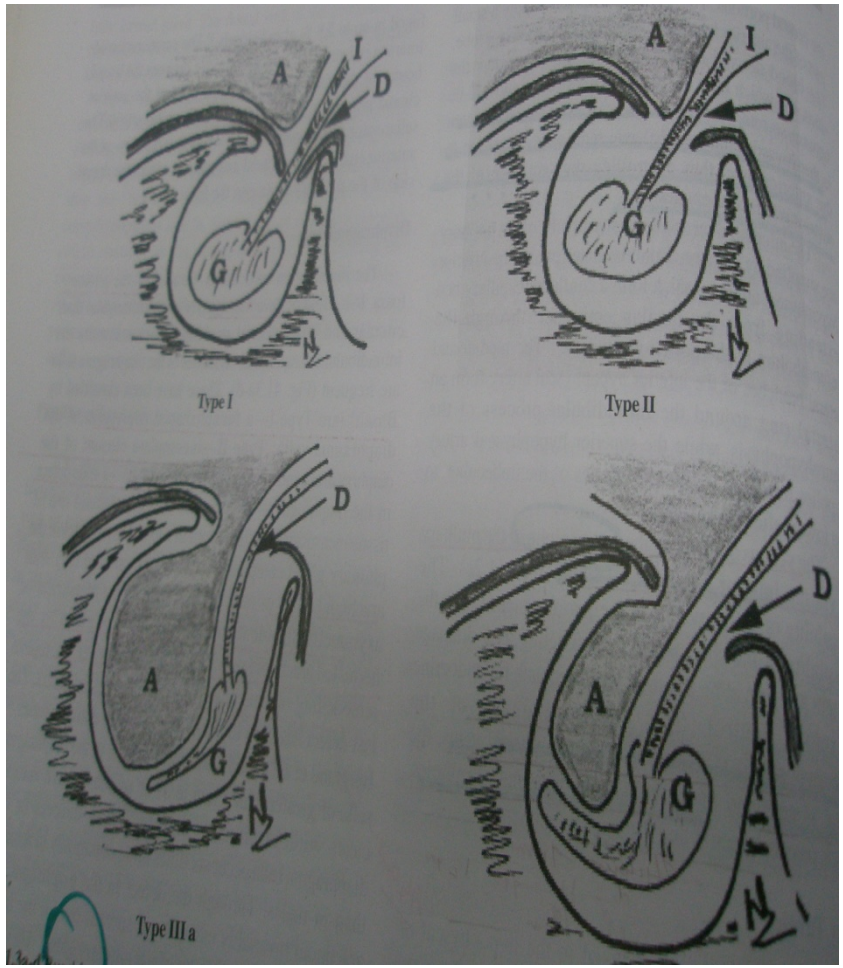
- Pituitary gland is housed in the sella
- Depth of 10 to 12 mm
- Width of 10- 15mm

Sphenoid Sinus

- Sphenoid sinus
- 46% of times septum away from midline
- Hamberger classification:
  - conchal
  - pre sellar
  - sellar
- Carotids bulge into supero lateral walls in 71%
- Separated by thin bone in 96%
- Inter carotid distance usually 10-12 mm

Diaphragma sellae

- Diaphragma sella:
- Busch classification
  - type I
  - type II
  - type III a,b,c

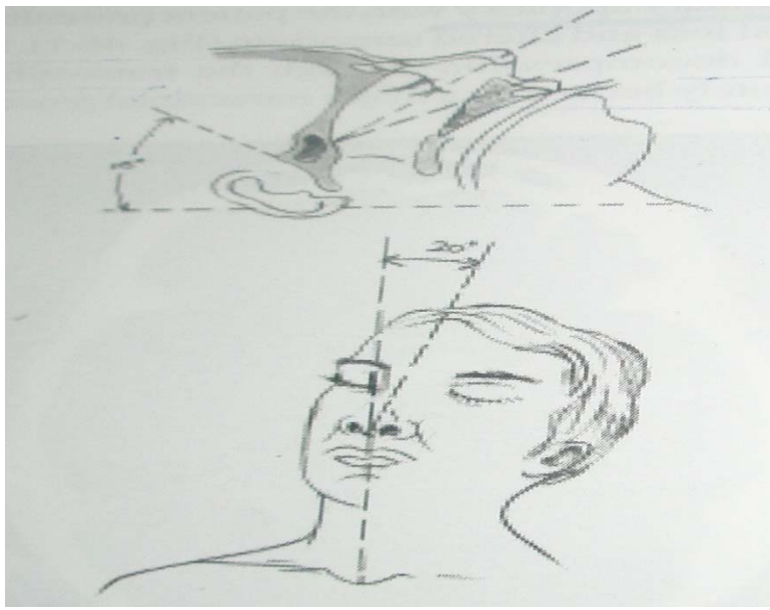


Preoperative evaluation

- X-Ray skull
- NCCT head with thin coronal cuts
- MRI brain
- Complete hormone evaluation
- Nasal swab

Positioning

- Either horse shoe or plain head rest
- Neck flexed by 15 degrees and tilted to opposite side by 15- 20 degrees
- Confirm with an image intensifier
- Clean and drape
- Prepare thigh



Techniques and incision

- Routes: 1. Trans nasal – Direct endonasal

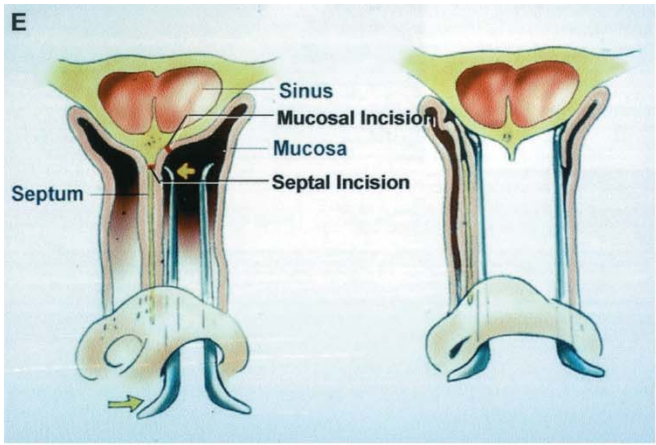
  Anterior mucosal incision

  2. Sub labial

Introduction of speculum

- Septum broken and hardy's speculum introduced

- Perpendicular plate seen which is removed to enter sphenoid sinus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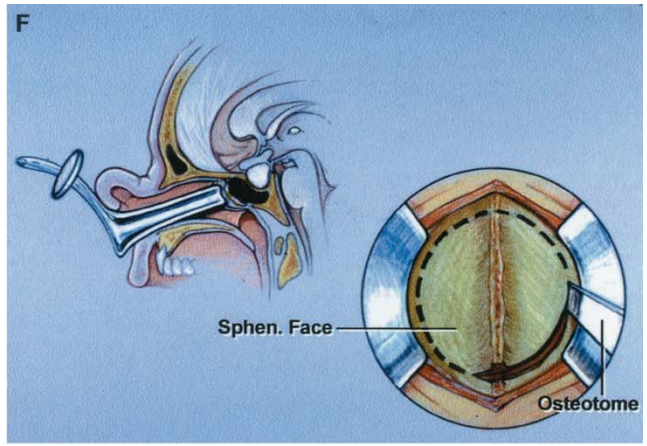
Sinus
Mucosal Incision
Mucosa
Septal Incision
Septum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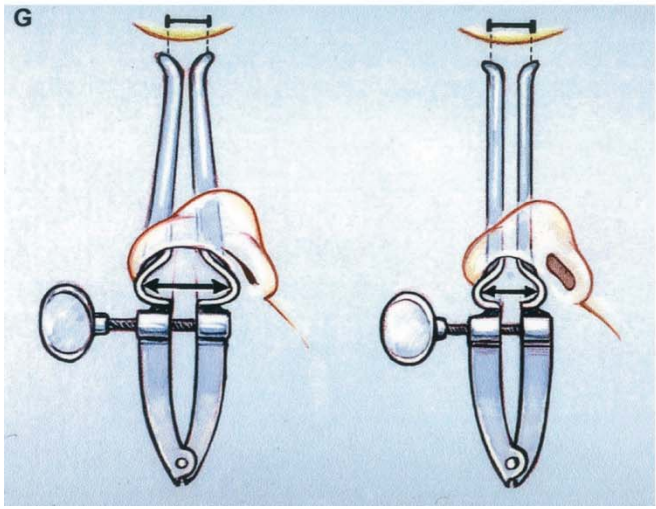
Sphen. Face
Osteotome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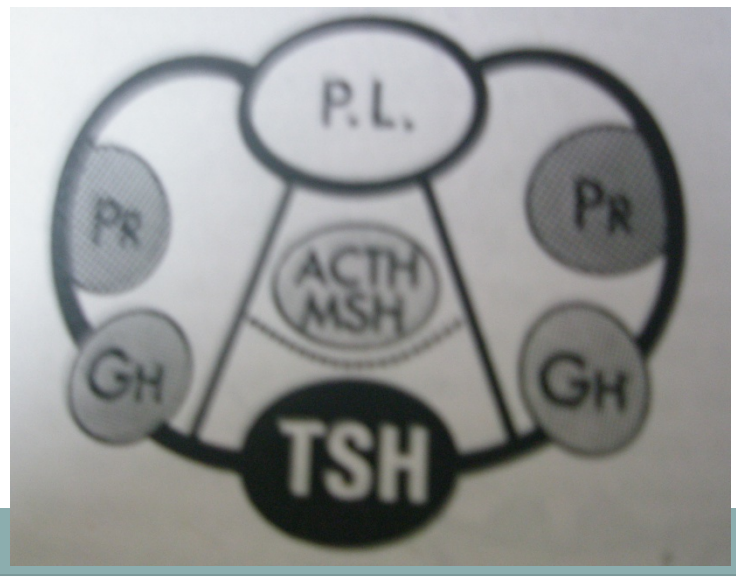
In the sinus

- Mucosa stripped off
- Position confirmed by an image intensifier
- Floor of sella then opened

•Dura opened cruciate

•Tumor decompression from posterior, lateral margins and finally anteriorly

- In micro adenomas transverse incision may have to be made on pituitary
- Confirm completion
- Closure:-pack if CSF leak has occurred
- SLTS incision closed
- Nasal packs introduced



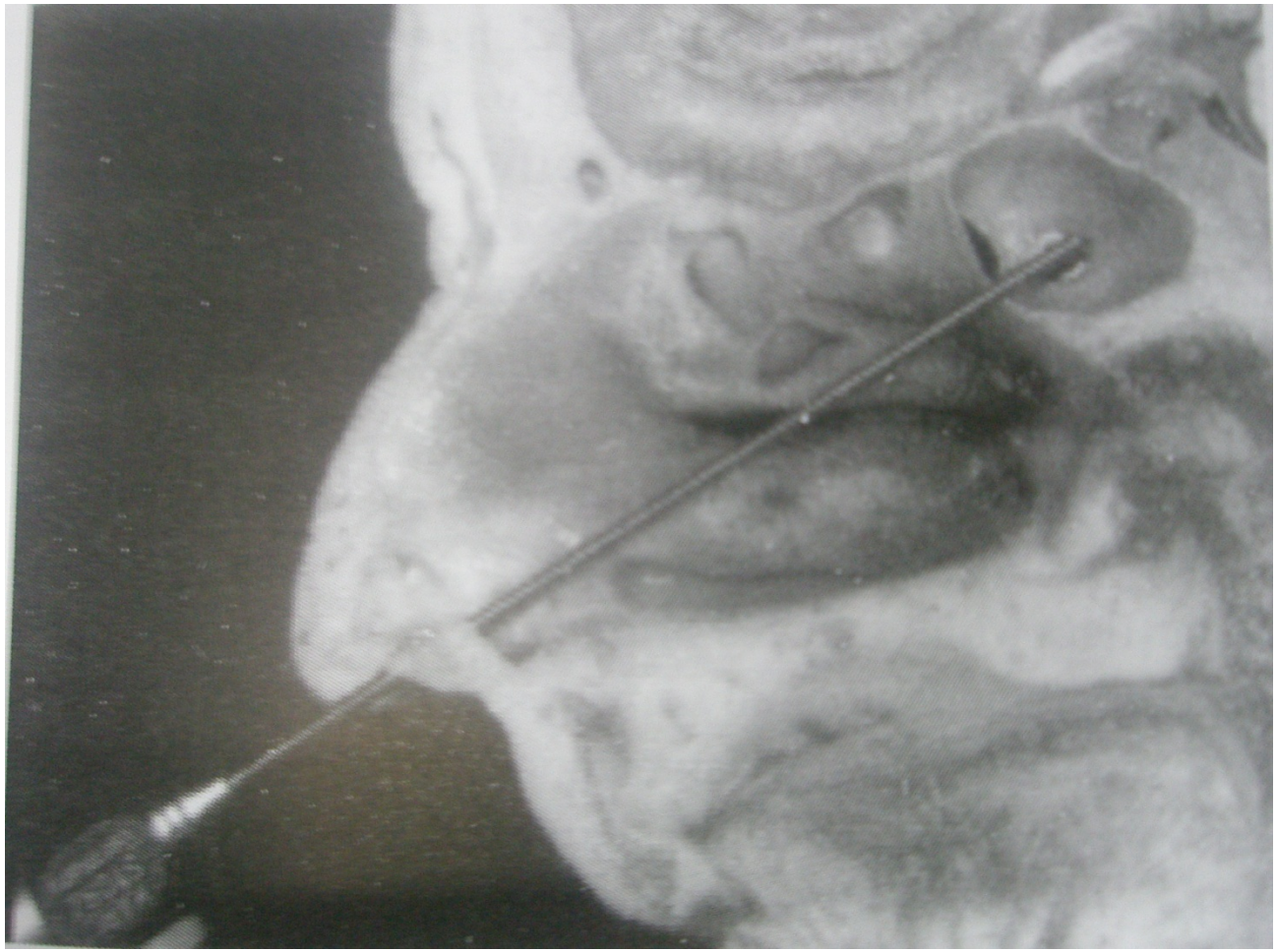
Neuro navigation and MRI

- Wide spread acceptance
- Navigational devices offer a more real time imaging
- Care regarding registration errors
- Obviates the need for repeated X- Rays
- Intra operative MRI for completion of surgery

Complications

- Septal perforation
- Deviated nasal septum
- Nasal blockage, crusting
- Hormonal
- CSF rhinorrhoea
- Apoplexy
- Residual tumor
- Hypoosmia
- Gingival numbness

Endoscopic endo nasal approach



Endoscopic endo nasal approach

- Pioneered in 1963 by Gerard Guiot
- Advantages:
  1. Nasal part of procedure simpler
  2. Wider angle of operation
  3. More safer as all structures are visualized
  4. Less traumatic
  5. Less time consuming in experienced hands
- Disadvantages:
  1. Two dimensional image
  2. Skill and training
  3. Blood can blur vision

Pertinent sino nasal anatomy

- Opening of various sinuses
- Approach through area between middle turbinate and septum
- Posterior septal artery
- Surgical landmarks are the nasopharynx and the middle turbinate

Surgical procedure

- Endoscopes with 0, 30 and 70 degree angles
- Positioning: Torso elevated by 20 degrees
- Neck neutral- for sella
- Flexion for clival region
- Extension for anteriorly place lesions
- Head rotated by 20 degrees towards the surgeon

Surgical approaches

- Para septal
- Middle meatal
- Middle turbinectomy

Technique

- Endoscope inserted at an angle of 25 degrees
- Inferior margin of middle turbinate identified
- 1 to 1.5 cm sphenoidotomy performed
- Coagulation of postero lateral septal artery
- Once inside sphenoid sinus, mucosa not stripped
- Carotid and cavernous sinus protuberances identified laterally, tuberculum sella and optic protuberances rostrally
- Sella opened
- Dura opened cruciate
- Tumor resection with curette and suction
- Packing of sella if intraoperative CSF leak

Extended approach for anteriorly placed lesions

- Head 15 degree extension
- Procedure carried out similar for pituitary
- Further rostral removal of posterior ethmoids
- This itself devascularizes most of tumors
- Bony removal by drill or rongeurs
- Tumor de- bulking from central to posterior
- Main problem is CSF leak
- Adequate packing necessary

Complications

- Hypothalamic damage
- CSF leak
- Meningitis
- Vascular injury
- Visual loss
- Hormonal
- Septal perforation
- Mucosal atrophy
- Nasal crusting
- Mucocoeles

Trans ethmoidal approach

- Indications same as that for trans sphenoidal approach
- Advantages:
  1. Shortest route to sella
  2. View not restricted by speculum
  3. No need for image intensifier
  4. Reoperations for recurrences easy
- Disadvantages:
  1. Scar
  2. Lateral to medial approach- midline can be missed

- Head flexed by 30 degrees and turned to right by 15 degrees
- Both nostrils are packed
- Eyes protected
- Curvilinear incision medial to the eye 1- 1.5cm
- Skin and orbicularis retracted
- Periosteum separated and bone exposed
- Laminae papyracea opened up preserving the lacrimal duct
- Operating microscope
- Ethmoid sinus mucosa stripped
- Identify the keel of sphenoid sinus wall
- Midline verified by passing long forceps through nostril

- Further opening of sellar floor and tumor removal and closure carried out similar to trans sphenoidal approach
- Complications
  1. Lacrimal duct avulsion
  2. Do not enter ant cranial fossa
  3. Care while removing the mucosa from superior aspect of ethmoid sinus
  4. Stay in midline
  5. Rest complications similar to TNTS

Sub frontal approach

- One of the most widely used approaches
- Advantages:
  1. Direct view of all vital structures
  2. Excellent anatomical orientation
  3. Multiple corridors for removal of extensions
  4. Intra sellar extension accessible through the inter optic corridor
- Disadvantages:
  1. Frontal sinuses opened up
  2. Anosmia
  3. Frontal lobe retraction
  4. Difficulty in a prefixed chiasm

Pertinent Supra sellar anatomy

- Optic canal
- Intracranial optic nerve 15 mm diameter
- Arteries – ICA giving rise to ophthalmic, posterior communicating and the anteriorly choroidal arteries
- ICA bifurcation

Optic chiasm

- Chiasm can be : Normal

  Pre fixed

  Post fixed

Cisternal anatomy

- Carotid cistern
- Chiasmatic cistern
- Lamina terminalis cistern
- Inter peduncular cistern

Positioning

- Trunk elevated by 20 degrees
- Head extended by 45 degrees, neutral position
- Horse shoe or three point fixation

Incision

- Bi coronal skin incision or frontal skin flap or pterional skin incision

- Frontal craniotomy performed either unilateral or bilateral

- If bilateral, sagittal sinus is ligated and cut
- Craniotomy flush with superior orbital margin
- Pack frontal sinus

- Frontal lobe retracted
- Olfactory tract dissected to the chiasm and protected
- Often necessary to open the Sylvian fissure
- For meningiomas early control of posterior ethmoidal branches reduces vascular supply

Various corridors

- Inter optic corridor: for long optic nerves with tumor lying between the nerves

- Lamina terminalis corridor: Posterior extension of tumor, prefixed chiasm

- Push the tumor through lamina terminalis and remove via inter optic corridor

- Drilling of plannum sphenoidale if prefixed chiasm
- In case of craniopharyngioma and meningioma, optic chiasm elevated
- Tuberculum sellae tumor push the nerves outward and backward
- Tumors arising from the anterior clinoid process compress the ipsilateral optic nerve before going to opposite side
- Tumors may engulf the nerve an vessels requiring careful dissection
- Preserve all perforating branches
- Identify pituitary stalk
- Plain of cleavage for hypothalamus.
- No pulling of tumor
- Meticulous closure

- Complications:
  1. Skin necrosis, facial paresis orbital swelling
  2. Rhinorrhoea, meningitis
  3. Pneumo- cephalus
  4. Anosmia
  5. Frontal contusion
  6. Perforator avulsions
  7. Vasospasm
  8. Direct neural injury
  9. Pituitary deficiency

Trans Sylvian approach

- Supine on horse shoe or three pin fixation
- Head elevated by 20 degrees
- Head turned to opposite side by 15 degrees and extended by another 20 degrees so that malar prominence is the highest
- Side of procedure by lateral extension of tumor and pre operative deficits

- Pterional skin flap
- Care taken to preserve the facial nerve branches and superficial temporal artery
- Standard bone flap raised
- Sphenoid ridge drilled out
- Dura opened in curvilinear fashion
- Further technique proceeds either through trans Sylvian or sub frontal route
- Arachnoid opened in Sylvian fissure to let out the CSF and frontal lobe retracted
- Carotid cistern opened and major vessels identified

- Tumor will be seen by this time
- Various corridors used:
- Inter optic, optico- carotid, carotico tentorial, lamina terminalis, between the carotid bifurcation
- In cases of cystic tumors, decompressed, capsule coagulated
- When chiasm is pre fixed, lamina terminalis or between carotid and chiasm
- Perforators separated carefully
- Drilling of tuberculum sellae for view if sella
- Hemostasis and meticulous closure

- Advantages of addition of orbitozygomatic extension
  1. Short and direct surgical access to deep seated lesions
  2. Offers low basal approach to the anterior and middle fossae with minimal retraction of frontal and temporal lobes
  3. Allows access through multiple routes
  4. Larger exposure for specially posteriorly located lesions
  5. Early interception of tumors blood vessels good cosmetic reconstruction

- Complications:
  1. Facial paresis, skin flap necrosis
  2. Opening of frontal sinus
  3. Anosmia
  4. Lobar retraction
  5. Perforator injury
  6. Pituitary damage
  7. Neural injury

Anterior Inter hemispheric approach

- For supra sellar lesions lying predominantly above the chiasm
- Head fixed on three pin fixation or horse shoe head rest
- Head extended by 15 to 20 degrees and tilted to right for the frontal lobe to fall
- Approach through a bi coronal skin flap and a para sagittal craniotomy
- Dissection of anterior inter hemispheric fissure done as low as possible to reach the pathology
- The paired ICA's are identified as the emerge out

Thank you