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Surgical Technique of the Supraorbital Key-Hole Craniotomy

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BACKGROUND
The enormous development of microsurgical techniques and instrumentation together with preoperative planning using the excellent preoperative diagnostic facilities available, enables neurosurgeons to treat more complicated diseases through smaller and more specific approaches.

METHODS
The technical details of the supraorbital key-hole craniotomy are described in this article as it has been evolving in our experience for more than 10 years. After an eyebrow skin incision with careful soft tissue dissection and single frontobasal burr-hole trephination, a supraorbital craniotomy is carried out with a diameter of about 1.5 × 2.5 cm. As a real frontolateral approach, the supraorbital craniotomy avoids removal of the orbital rim, the lesser sphenoid wing or the zygomatic arch.

RESULTS AND CONCLUSIONS
The supraorbital craniotomy allows wide intracranial exposure of the deep-seated supra- and parasellar region, according to the concept of key-hole approaches. The limited craniotomy requires minimal brain retraction thus significantly decreasing approach-related morbidity. In addition, the short skin incision within the eyebrow, the careful soft tissue dissection, and the single burr hole trephination result in a pleasing cosmetic outcome. © 2003 Elsevier Science Inc.

KEY WORDS

The first supraorbital, subfrontal approach for resection of a skull base meningioma was reported by Fedor Krause in the first volume of his pioneering work

, published in 1908 [11]. Since then, various authors have been describing different modifications to enhance the exposure offered by the subfrontal route [2,4–7,10,12,14–16,17,18]. However, in his pioneering description, Krause had already realized the essence of the subfrontal supraorbital exposure: the suprasellar anatomic structures are free for surgical dissection from an anterior direction of view and the anterior part of the temporal lobe does not obscure the access to deep-seated areas.

In our institution, we have been using the supraorbital subfrontal approach for more than 10 years. During a 5-year period between January 1997 and December 2001, there were 511 patients suffering from a variety of tumors and vascular lesions within the anterior, middle, and posterior cranial fossa. In this report, we will describe the basic surgical technique of our supraorbital key-hole craniotomy through an eyebrow skin incision.

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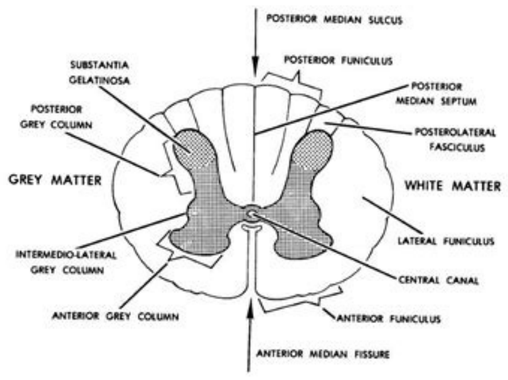
Surgical Technique

PATIENT POSITIONING

The patient is placed supine on the operating table; the head is fixed in a three-pin Mayfield holder. The single pin of the head fixator should be placed in the opposite frontal area to allow free manipulation on the ipsilateral side during the procedure. Positioning of the head requires that the neck be extended with the head above the heart level to facilitate venous drainage during surgery. Thereafter, the head is rotated to the contralateral side, the degree of rotation dependent on the precise location of the lesion. According to the individual pathoanatomical structures, for ipsilateral temporomesial lesions a 15° rotation is sufficient; however, by choosing the correct angle between 30° and 60°, one can also make contralateral lesions visible. Note that right-handed surgeons performing a left-sided craniotomy need more rotation to allow an ergonomic working position. The maneuver of retroflexion supports gravity-related self-retraction of the frontal lobe, but is dependent on the precise anatomic and pathologic situation. Lesions in close proximity to



INTERNAL SURFACE OF CRANIAL BASE

is divided into: **the anterior cranial fossa**
the middle cranial fossa
the posterior cranial fossa

anterior cranial fossa:
1. frontal bone - orbital parts - superior surfaces
2. ethmoidal bone - ***cribriform plate – olfactory n*** *(1st)*
3. sphenoid bone - ***lesser wings***

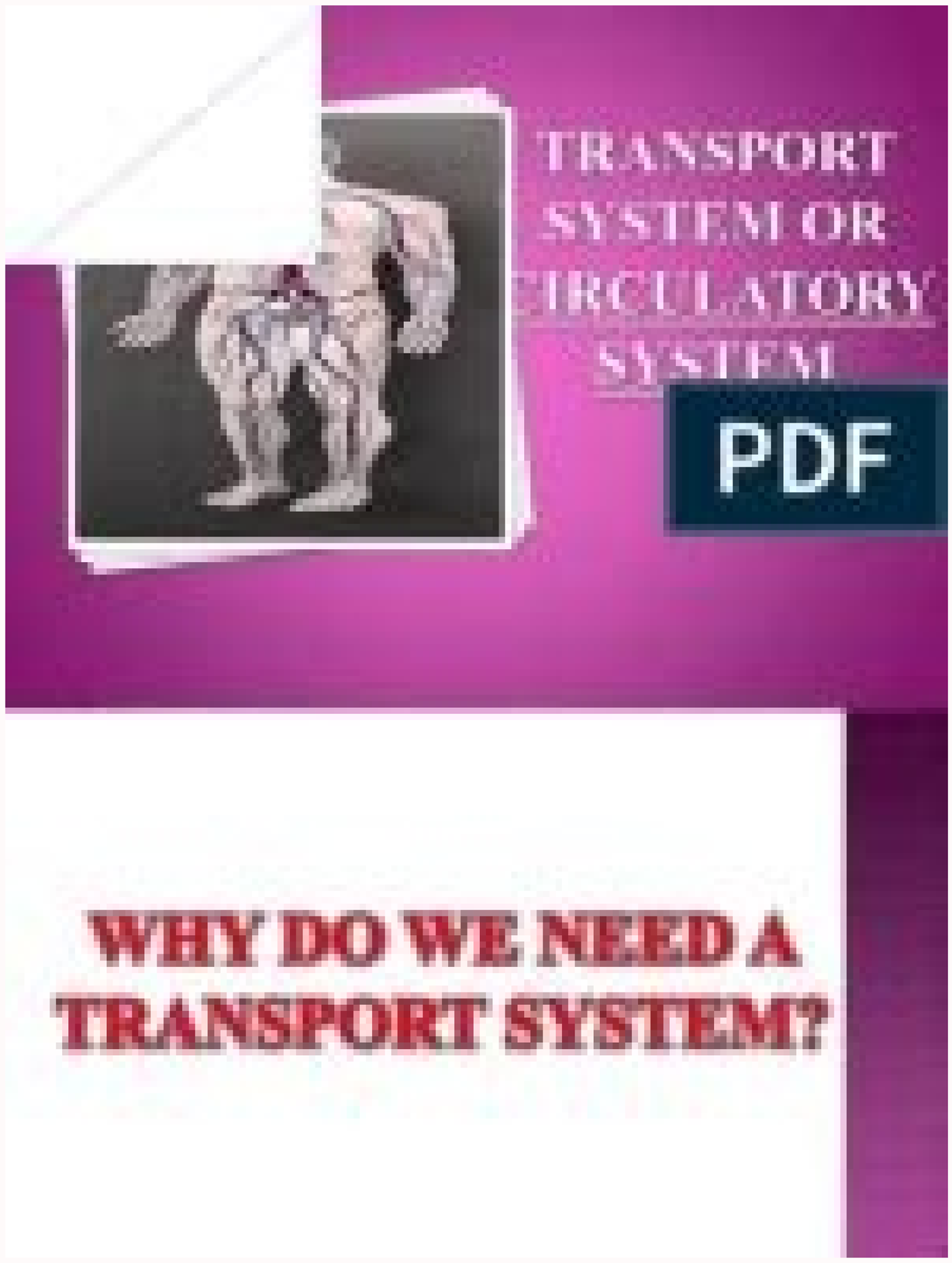
middle cranial fossa:
1. sphenoid bone • ***body*** - ***hypophysial fossa*** ***(hypophysis=pituitary gland)***
- ***optic canal*** - ***optic nerve*** (2nd)
- ophthalmic a.
- ***sulcus chiasmatis (optic chiasm)***
• ***greater wings*** - cerebral surface
foramen rotundum: Maxillary n. (5th/2)
foramen ovale: Mandibular n. (5th/3)
foramen spinosum: middle meningeal a.
superior orbital fissure: Oculomotor n.(3rd)
Trochlear n.(4th)
Abducent n. (6th)
Ophthalmic n.(5th/1)
Sup. ophthalmic v.

2. temporal bone - ***petrous part*** - anterior surface
trigeminal impression
tegmen tympani
carotid canal – internal carotid a.
foramen lacerum - borders: sphenoid,petrous,occipital

posterior cranial fossa:
1. temporal bone -petrous part -***internal acoustic meatus:***
Facial n. (7th)
Vestibulocochlear n. (8th)
- mastoid part - internal surface
2. occipital bone - basilar part - superior surface
- lateral parts - superior surface
- squama - internal surface

jugular foramen - borders: dorsal margin of petrous part
occipital b. - jugular notch
internal jugular v.
Glossopharyngeal n. (9th)
Vagus n. (10th)
Accessory n. (11th)
hypoglossal canal: Hypoglossal n. (12th)

Olfactory Nerve(I)	Optic Nerve(II)
Carries special sensory (small) nerve fibers. Bulb of CN1 sits on cribriform plate of ethmoid bone. Sends fibers into nasal cavity.	Carries special sensory (vision). Both nerves cross at optic chiasm. Exits cranial cavity through optic canal.
Oculomotor Nerve(III)	Trochlear Nerve(IV)
Somatic motor to foot extraocular muscles. Parasympathetic to sphincter pupillae and ciliary muscles. travels through cavernous sinus and exits via superior orbital fissure.	Somatic motor to the superior oblique muscle of the eye CN1r. travels through cavernous sinus and exits via superior orbital fissure.
Trigeminal Nerve(V)	Trigeminal Nerve(V)
Somatic sensory to head, eye. Somatic motor to muscles of mastication. Three divisions: Ti:Ophthalmic nerve V2:Maxillary nerve V3:Mandibular nerve	Ti:Ophthalmic nerve travels through the cavernous sinus and exits via superior orbital fissure supraorbital nerve Sensory only R



Cranial cavity diagram. Cranial cavity quizlet.

This is a model of human (homo sapiens). The cronist and mandãbula were exported from CT data. It was cleaned, adapted and polypinated in Zbrush. In CT data, the upper teeth and the lower teeth were united as a mesh, so I completely reshaded some of the teeth so that the mandhabula could be detached from the cronto and can be printed 3D separately. This 3D model was made as part of my Master's Dissertation in Mother Art, where I am creating an educational resource on evolution for children of secondary education. This model is part of a comparison with a human's cront. Please feel free to download and print. Hope you like it! 1. Presented by: Tarun K. UBHU Cranial Department of Anatomy Cavity 2. Introduction to Cranial Cavity Film The cavity present in the cranium of the chrion is known as the cranial cavity. Containing re -rro, meninges, venous sinuses, all cranial nerves, four petrosal nerves, part of the internal racket and part of the vertebral artist of the special senses. The anterior branch of the menengial artist is found in PTerion and is a prone rupture in extra heemorrhage. 3. Craneiro Fossa 1. The anterior cranial fossa accommodates the anterior wolf of the rebro. 2. The cranial fossa is much broader than the anterior cranial fossa and contain the 2 temporal wolves of the rebro. 3. The cranial fossa is much more shallower and wider than the cranial fossa motion and accommodates the occipital lobes of the 4. Anterior fossa ï½ž boundaries anterior and laterally ï½ž front bone pavement: Frontal bone orbital, Crybriform Plate Etã´Mide, anterior edge of the smaller wings and galli crest later: it pressed the load of the smaller wing of the anterior clinate process and the grooves. Crest galli percussion is a sharp projected on the ethmoid bone in the Mother line, for the From Cerebri Falx. Foamen Cecum pressed the small opening between the galli galli crest The crest of the front bone 5. Fossa Mã © day â â´ boundaries anterolyly â â´ Post Border of the Lesser Wings of Sphenoid, anterior Clinoid Process and Sulcus Chiasmaticus. Subsequently, he pressed superior borders of a petrous part of temporal and dorsum sella. Later, the scaly part of the storm and some part if parietal and larger wings of the spare. Floor: Larger wing of sponso and scams of the temporal bone. In the center, the floor is formed by the Sella Touric of the Space Body. 6. And shared the internal surface of the scaly part of the occipital bone. Parade â - Basilar part, scamping and condylor of the Occipital bone & mastoid â–ª Foamen Magnum forms the central part of the Chã £ o. 7. Duramater ï½ž Duramater is the hardest and thickest membrane in our body. It develops from the mesoderm around the neural tube ï½ž This is conventionally described as two layers: the endosteal layer and the meningal layer. These are closely united, except in certain lines, where they separate to form venous breasts. The outer layer is highly vascular, while the inner layer is more fibrous and has little blood supply. The failure is provided by the Meningeal Mother. ? The anterior cranial fossa by anterior, posterior, and opthalmic meningeal branches of the artist. Cranial fossa Mã © day by meningal mother, meningal accessory and internal caring artist. The cranial fossa pursed by meningal branches of vertebral, dental and finishing artist. 9. ï½ž The duration of the abbody has only a few sensory nerves that are the dental branches of the trigeminal nerve to the durable of the chã £ o have a rich and very sensitive nerve source. 1. The ACF is supplied mainly by the anterior ethmoidal nerve and partially nerve. 2. The MCF is provided by the maxillary nerve in the ant. Half and branches of the mandibular nerve and the trigeminal ganglion. 3. The PCF is mainly supplied by recurring subsidiary of the 1st, Nd Rd 10. Layers of Dura Mater The periosteal endosteal layer covering the inner surface of the skull bones. - It's not continuous with the spinal cord's dura-mater. The meningengeal layer is the hard -Mater, covering the brain - continuous with the hard -mater of the spinal cord. ï - provides tubular sheaths for the cranial nerves. Outside the skull, they merge with the nerve epineurium. 11. Dura Mater 12 folds. Venous Breasts of Duramater. (Vous spaces whose walls are formed of Duramater) - These are ï are an inner lining of endothelium do not have muscles on their walls - they do not have valves - they receive blood from the brain, mening and bones of the skull. Some are also poured by the LCR. They communicate with veins outside the skull through the emissary veins. These communications help to maintain constant blood pressure from venous sinuses. ï - There are 23 venous breasts: paired venous breasts: 8 ï ¶ Non-paired venous branches: 7 13. Introduction of the cavernous sinus - is one of the paired breasts - it is a large venous space situated in the middle cranial fossa on both sides of the body of the sphenoid bone. The floor and the medial and medial walls are formed by the endosteal duramater and the lateral walls are formed by the meningangeal duramater - previously: it extends to the medial end of the ant. Orbital fissure. Later: it extends to the apex of the petrosal temporal bone. 14. Cavernous sinus relations - Superior: optical tract, optical kiasma, olfactory tract, internal carotid artery and previous perforated substance. ï - Lower: forame lacerum and the junction of the body and the larger wing of the sphenoid bone. Medially: cerebri hypophysis and sphenoidal air sinus. ï - laterally: temporalof unco. below laterally : mandibular nerves. previously: upper orbital fissure and the apex of orbit. ? subsequently : apex of the raw temporal petrous and cerebri of the half-brain. 15. structures inside the lateral wall (from above to bottom) twelve occulomotor nerve: in the anterior part of the breast. it is divided into sup. and inf. divisions that leaves the breast passing away the sup. orbital fissure: nerve in the anterior part of the breast superficially crosses to the occulomotor nerve and enters the orbit through its orbital fissure. optic nerves: in the ant. part of the breast. it is divided into lacrimal, frontal and nasociliary nerves. maxillary nerves: leaves the breast passing through the foramen rotundum on its way to the pterigopalatine fossa. . trigeminal ganglion: the ganglion and its hard cave projects in the post. part of the lateral wall of the breast. 16. structures that pass through the medial aspect of the breast press the internal carotid artery with the venous and sympathetic plexus around it. abdominal nerve, inferolaterally to the internal carotid artery. the structures on the lateral wall and on the medial wall are separated from the blood by the endothelium coating. 17. tributaries u input channels press from orbit 1. the superior opthalmic vein 2. a branch of the inferior opthalmic vein u sometimes the vein itself 3. the central vein of the retina can drenar u in the superior dental vein u in the cavernous sinus. 1. medium superficial cerebral vein. 2. Lower cerebral veins of the temporal lobe press the meninges 1. sphenoparietal sinus. 2. the frontal trunk the mesquingue vein can drain u into the pterigoid plexus through the foramen u in the sphenoparietal sinus u cavernous sinus. 18. draining channels or communications into transverse sinus through the superior petrosal sinus.) in respect of internal Vein through inferior petrosal sinus and through a plexus around the internal carotid artery. ¯ÃÂÂ Into Pterygoid plexus of veins through the emissionary veins passing through the foramen ovale, thge foramen lacerum and the emissary sphenoidal foramen. ¯ÃÂÂ Into the facial veinn through the superior opthalmic vein. ¯ÃÂÂ The right and left cavernous sinus communicate with each other through the anterior and posterior intercavernous sinus and through the basilar plexus of veins. ALL THESE COMMUNICATIONS ARE VALVELESS AND BLOOD CAN FLOW THROIUGH THEM IN ANY DIRACTION. 19. FACTORS HELPING EXPULSION OF THE BLOOD FROM THE SINUS ¯ÃÂÂ EXPANSILE PULSATIONS OF THE INTERNAL CAROTID ARTERY WITHIN THE SINUS ¯ÃÂÂ GRAVITY ¯ÃÂÂ POSITION OF THE HEAD 20. SUPERIOR SAGGITAL SINUS ¯ÃÂÂ It occupies the upper convex, attached margin of the falx cerebri. ¯ÃÂÂ It begins anteriorly at the crista galli by the union of tiny meningeal veins. Here it communicates with the veins of the frontal sinus, and occasionaly with the veins of the nose ,through the foramen caecum. ¯ÃÂÂ As the sinus runs upwards and backwards, it becomes progressively larger in size. ¯ÃÂÂ Its triangular in crossection. ¯ÃÂÂ It ends near the internal occipital protuberance by turning to one side, usually the right and becomes continuous with the right transverse sinus. 21. Interior of the sinus shows ¯ÃÂÂ Openings of the superior cerebral veins. ¯ÃÂÂ Openings of the venous lacunae, usually 3 on each side. ¯ÃÂÂ Arachnoid villi and granulations projecting into the lacunae as well as into the sinus. ¯ÃÂÂ Numerous fibrous bands crossing the inferior angle of the sinus. Tributaries From ¯ÃÂÂ Superior cerebral veins which never open into the venous lacunae ¯ÃÂÂ Parietal emissary veins ¯ÃÂÂ Venous lacunae, usually three on each side which first, receive the diploic and 22. TRANSVERSE SINUS ¯ÃÂÂ These are large sinuses in which right one is larger than the left. ¯ÃÂÂ It is situated in the post. Part 1 ssecer ralubidnufni muirenicrebut amsaihc citpo ealles amgarhpaiD :ylroirepuS ÂÂÃ¯ snoitaleR .72 .ydob eht fo sdnalg enircodne rehto ynam fo noiterces eht lortnoc hcihw senomroh fo rebmun secudorp ti esuaceb artsehcro enircodne fo retsam dellac netfO ÂÂÃ¯ . Elcirtnev Dr3 FORO ROOLF EHT EVABA DEHCATTA NA EALLES MARLES MARLES MARHPAIP EALLES EALLES LESYHPOPYH FO CLASE EHT ,EALLES MARHPAID yb defoor shy eht sysof .acrub .acrub .acrub Niarb Eht Fo Eht Ot Noitaler of Detautis Dalg Enircodne llocodne llams â,â▸´)dnalg yratiutip(irberec sisyhpyh .62 .saniv ânieçâ Diotsam eht â—â,ã¯ sesunis diomgis fo seiratubirt .52 .enob fo etalp niht ylno yb Sllec ria diotsam dna murtna diotsam eht morroiretna dearpepes , erehw , enob laropmet eht fo trap diotsam eht sevoorg of â¢ââ SEVUMâ . 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Wolf that surrounds and forms part of the infundibulum. 29. â - The neurohypity develops as a descendant growth of diencefan chã and is linked to hypothare by a neural pathway. Includes: posterior pars: is smaller than ant. LOBE, it's in the mail. Greater ant concavity. Lobe. Infundibular rod: which contains neurais posts of post. Lobe with Hipothallamus. 30. SUPPLY OF GLORDING PITUYING GLORDING A superior hypofiseal artist on each side that provides: 1. ventral part of hypothare 2. Upper part of infundibulum 3. lower infundibulum through a branch LONG SEPARATED CALLED OF ARTION TRABECULUM. An inferior hypophiseal article on each side that is divided into medial and side branches that join each other to form an arterial ring around the posterior lobe and also anatlomosis with superior hypophiseal artist branches. The portal vessels are of great functional importance because they carry the hormones releasing factors from hypothare to the ant. LOBE where they control the secretary of the different glandular squads. 31. DRAINING VOUNTS Short veins emerge in the superphyte of the gland and the loading in the neighboring venous sinuses. The hormone passes the venous blood glue and is taken to their slope. Con © Lulas.

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