TRANSNASAL ENDOSCOPIC SURGERY TO ORBITAL AND SINO-ORBITAL LESIONS

Thesis

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Abstract

The results of this study confirm the value, efficacy, and safety of transnasal endoscopic Sino-orbital surgery. The technique can achieve favorable removal and remission rates with very low morbidity. Endonasal Endoscopic sino-orbital surgery is a minimal invasive alternative to traditional transconjunctival, external frontoethmoidectomy, or lateral rhinotomy approaches to the orbital and sino-orbital lesions. The technique's minimally invasive nature makes it very attractive for selected patients, as it has the potential to minimize the morbidity associated with other extensive approaches. Long-term control data and prospective analysis of surgical series are required to strengthen these conclusions and to extend the approach to totally remove orbital and sino-orbital lesions. The endoscopic endonasal approach for orbital and sino-orbital lesions is a minimally invasive surgery which offers a panoramic view of the orbital contents with increased illumination and magnifications. Such visualization provides a potential for more complete tumor removal with preservation of eye function and very low rate of complication. Finally we still need time to increase our skills and experience to master this approach and to improve our results. We feel that the advantages of the endoscopic approach will make this technique the favored approach for future treatment of skull base tumors.

Keywords:

Transnasal endoscopic surgery

Sino-orbital surgery

بسم الله الرحمن الرحيم

"وَلَوْلا فَضْلُ اللهِ عَلَيْكَ وَرَحْمَتُهُ لَهَمَّتْ طَائِفَةٌ مِنْهُمْ أَنْ يُضِلُّوكَ وَمَا يُضِلُّون إِلا أَنْفُسَهُمْ وَمَا يَضُرُّونَكَ مِنْ شَئٍ وَأَنْزَلَ اللهُ عَلَيْكَ الْكِتَابَ وَالْحِكْمَةَ وَعَلَّمَكَ مَا لَمْ تَكُنْ تَعْلَمْ وَكَانَ فَضْلُ اللهِ عَلَيْكَ عَظِيْماً"

صدق الله العظيم
((الآية ١١٣: سورة النساء))

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INTRODUCTION

Rationale and Background

Anatomically, the paranasal sinuses are in close proximity to the orbits and the optic nerves **(Hudgins, 1993)**. The orbit is related superiorly to frontal and ethmoidal sinuses, inferiorly to maxillary sinus and ethmoidal cells and medially to the lateral wall of the nose, ethmoidal infundibulum, ethmoid and sphenoid sinuses **(Lund, 1997).** The course of the optic nerve is adjacent to the sphenoid sinus in most of the cases and in only 3% are in contact with the posterior ethmoidal sinus **(Delano et al., 1996).**

Many sinonasal lesions may extend to the orbit like: orbital complications of acute bacterial sinusitis, gross polyposis, fungal sinusitis, sinonasal tumours, frontoethmoidal mucoceles and pyoceles (**Benninger and Marks, 1995**; **Karakurum et al., 2005; Batra and Lanza, 2005 and Saetti et al., 2005)** .

There are orbital lesions that may be medially placed or occupying the orbital apex with intimate relation to the paranasal sinuses like: orbital tumors, subperiosteal or extraperiosteal abcess, idiopathic orbital inflammatory, Grave`s opthalmopathy and optic nerve oedema in pseudotumor cerebri. Some of these lesions, as orbital tumors, may extend to involve sinonasal region (**Lund, 1997; Sethi and Lau,1997 and Darsaut et al.,2001)**.

Traditionally, the frontoethmoidal mucoceles and osteomas were managed via an external frontoethmoidectomy and lateral rhinotomy

or even craniofacial approach if greater access is required **(Cousins et al.,1987 and Kennedy et al.,1989)** whereas malignant tumors involving sinonasal region and extending to the orbit were managed via the craniofacial approach which allows thorough exposure and excellent access but carries high incidence of postoperative morbidity **(Cheesman et al., 1986).**

The external approaches to orbital lesions included transfrontal craniotomy, external ethmoidectomy, transantral transethmoid, lateral orbitotomy, postero-lateral orbitotomy, transorbital, transcranial, lateral facial and sublabial transnasal approaches. These traditional external surgical approaches offer excellent exposure of the orbital contents that help complete excision of the lesion with less incidence of damage of intraocular muscles, vessels or nerves. On the other hand they require either craniotomy and/or external incisions resulting in postoperative morbidity and scars **(Stewart et al., 1988; Lund, 1997; Carta et al., 1998 and Darsaut et al., 2001).**

Recently, the transnasal endoscopic approach for the orbit was introduced by **Kennedy et al., 1990** and **Michel et al., 1991.** This approach proved to be effective with less morbidity **(Metson et al., 1995; Kuppersmith et al.,1997; Luxenberger et al., 1998; Tsirbas et al., 2005 and Karaki et al., 2006).**

The endoscopic approach to the orbit allows for excellent visualization and improved access to the medial orbital wall. This approach can be used to access difficult surgical areas as orbital apex. More instruments can be used through the relatively capacious

paranasal sinuses. Further advantages include avoidance of external scars, a reduced number of complications, rapid recovery time and improved patient acceptance and compliance **(Vaseghi et al., 2003 and Tsirbas et al., 2005).**

The limitations of the endoscopic approach include intraconal lesions at the orbital apex, primary tumors of the globe, conjunctiva, eyelids and lacrimal system which are better managed by open approaches. Vascular tumors constitute another difficulty as bleeding may be more difficult to control endoscopically. Endoscopic approach needs combined experience of the team of otolaryngologists and ophthalmologists (**Vaseghi et al., 2003; Batra and Lanza,2005 and Tsirbas et al., 2005)** .

AIM OF THE WORK

The aim of this work is to evaluate the endonasal endoscopic approach in the diagnosis and treatment of sino-orbital and medially placed orbital lesions.

REVIEW OF LITERATURE

Review of Literature

I- Anatomy

A)Endoscopic anatomy of paranasal sinuses

The anatomy of the paranasal sinuses is complex and varies greatly between human subjects **(Stammberger, 1991).**

The ethmoid sinus is commonly referred to as “the labyrinth” due to its complexity and intersubject variability. Fortunately, several rhinologists and surgeons have reduced the complex ethmoidal labyrinth of the adult into a series of lamellae on the basis of embryologic precursors. These lamellae are obliquely oriented and lie parallel. With experience, these structures are relatively easy to recognize during surgery and are invaluable in maintaining orientation in ethmoid procedures **(Stammberger, 1991).**

The first lamella is the uncinate process; the second lamella corresponds to the ethmoidal bulla; the third is the basal or ground lamella of the middle turbinate; and the fourth is the lamella of the superior turbinate. The basal lamella of the middle turbinate is especially important, as it divides the anterior and posterior ethmoids.

The frontal, maxillary, and anterior ethmoids arise from, and therefore drain into, the middle meatus. The posterior ethmoid cells arise from, and therefore drain into, the superior and supreme meati, while the sphenoid sinus drains into the sphenoethmoid recess. The lamellae are relatively constant features between human subjects, making intraoperative recognition important. They can help the surgeon maintain anatomic orientation when operating within the labyrinth of the ethmoid sinus **(Wang et al. 1994**).

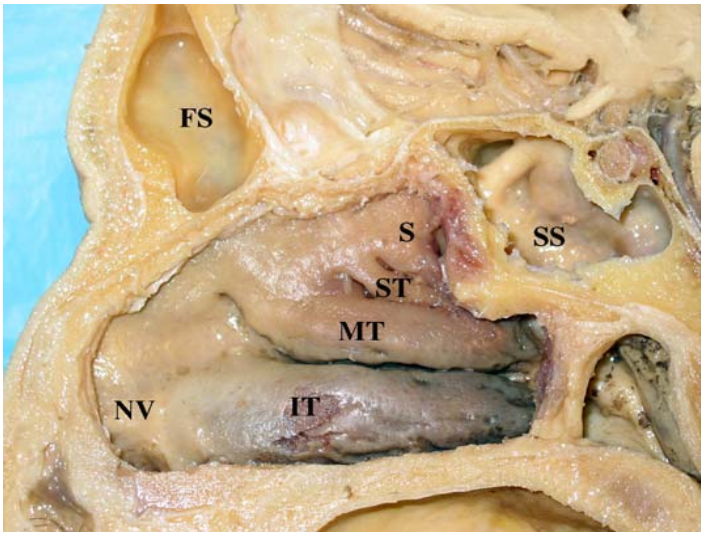

Fig. 1 : Endonasal sagittal view. Each nasal turbinate has a corresponding meatal space located immediately below. FS, frontal sinus; IT, inferior turbinate; MT, middle turbinate; NV, nasal vestibule; S, supreme turbinate; SS, sphenoid sinus; ST, superior turbinate **(Burkat & Lemke,2005).**

Anterior Ethmoid

On anterior rhinoscopy, a prominence can be easily appreciated at and just anterior to the middle turbinate's insertion into the lateral nasal wall. This region was designated the agger nasi, taken from the Latin *agger*, meaning mound or eminence, and *nasi*, meaning nose. This mound or eminence is a very consistent feature on nasal examination. In many but not all cases, the agger nasi region is pneumatized by an anterior ethmoid cell, referred to as the agger nasi cell. This cell usually takes its origin from the superior aspect of the infundibulum or the frontal recess region **(Ritter, 1973).**

The agger nasi cell is bordered anteriorly by the frontal process of the maxilla, superiorly by the frontal recess/sinus, anterolaterally by the nasal bones, inferomedially by the uncinate process of the ethmoid bone, and inferolaterally by the lacrimal bone. The intimate relationship of the cell to

the lacrimal bone readily explains the finding of epiphora in selected patients with sinus disease.

The agger nasi can also be important in frontal sinusitis and its treatment. The superior aspect of the cell serves as the anteromedial floor of the frontal sinus and a significant portion of the anterior border of the frontal recess. This is relevant for understanding the pathophysiology of frontal sinusitis and the surgical treatment of the frontal sinus. The agger nasi can pneumatize inferomedially to pneumatize the uncinate process. In a small percentage of patients, the pneumatization can be significant, and bulla formation of the uncinate may occur **(Kennedy & Zinreich, 1988 and Bolger et al., 1990).**

Uncinate Process

The uncinate process is most easily appreciated by viewing a sagittal gross anatomic specimen after deflecting the middle turbinate superiorly. This ethmoid structure is nearly sagittally oriented, nearly paralleling the ethmoidal bulla. It is approximately 3 to 4 mm wide and 1.5 to 2 cm in length. Through most of its course, its posterior margin is free as it has no bony attachments. The hiatus semilunaris lies directly behind the posterior margin of the uncinate.

Anteriorly and superiorly, it attaches to the ethmoidal crest of the maxillae, just inferior to the lateral attachment of the anterior aspect of the middle turbinate and agger nasi. Directly inferior to this, it fuses with the posterior aspect of the lacrimal bone. Its anterior inferior aspect does not have a bony attachment. Posteriorly and inferiorly, the uncinate attaches to the ethmoidal process of the inferior turbinate bone. The attachment here is thick, and the uncinate often splits or widens in this region to fuse with the

stouter inferior turbinate bone. At its posterior and superior limit, the uncinate also gives off a small bony projection to attach to the lamina perpendicularis of the palatine bone. **(Stammberger, 1991 and Stammberger et al., 1995).**

The uncinate has no bony attachment anterior and posterior to its attachment to the inferior turbinate bone. Here, the lateral nasal wall is made not of bone but rather middle meatal mucosa, a small layer of intervening connective tissue, and sinus mucosa. These areas are referred to as the anterior and posterior fontanelles.

The posterior fontanelle is much larger and more distinct than its anterior counterpart. An opening into the maxillary sinus, the accessory ostium, can often be seen here and can be mistaken for the natural maxillary sinus ostia. Accessory ostia are frequently encountered in the posterior fontanelle region, occurring in approximately 20 to 25% of patients. **(Kennedy et al., 2001)**

Returning to its superior aspect, the uncinate projects posterior and superior to the middle turbinate attachment and most commonly bends laterally to insert on the lamina papyracea of the orbit. Inferior and lateral to this portion of the uncinate lies the superior aspect of the infundibular air space, the recessus terminalis. Superior and medial to this portion of the uncinate (most commonly) lies the floor of the frontal recess. Alternatively, the uncinate can attach centrally to the skull base or medially to the superior aspect of the vertical lamella of the middle turbinate near the turbinate's insertion to the cribriform plate. **(Onishi, 1981 and Stammberger, 1991)**

It can also fuse with an anterior ethmoid cell, such as the agger nasi. **Stammberger** highlights that the superior portion of the uncinate can divide

to attach to the lamina papyracea, skull base, and middle turbinate **(Stammberger, 1991)**

The uncinate process forms the anteromedial boundary of the ethmoidal infundibulum. For most of its course, the uncinate is a three-layer structure, comprising nasal or middle meatal mucosa on its anteromedial aspect, ethmoid bone, and infundibular mucosa on its more posterolateral aspect. The most common orientation of the uncinate to the lateral wall and lamina papyracea is approximately 140°; however, there is a significant amount of variability. **(Yousem, 1993)**

The uncinate can be displaced laterally against the orbit, as commonly occurs in maxillary sinus hypoplasia, or it can be displaced medially, as commonly occurs in cases with extensive polypoid disease within the infundibulum. In select cases, the uncinate is displaced medially to such an extent that it recurves on itself and has been misinterpreted as a duplication of the middle turbinate. Additionally, in a small percentage of cases, the uncinate process can be pneumatized. (**Kennedy &Zinreich, 1988** and **Bolger et al., 1990)**

An appreciation of uncinate variability is important. If lateral displacement of the uncinate with accompanying atelectasis of the infundibulum is not appreciated during infundibulotomy incision, inadvertent orbital injury can occur. (**Bolger &Kennedy**, **1992).**