Anterior Skull Base Surgery—Our Experience

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Anterior skull base surgery is now an accepted treatment modality for many lesions involving the anterior skull base including the pituitary region. This paper deals with a fifteen year experience over various approaches to the anterior skull base, and thereby trying to rationalize the appropriate approach for the tumours in different anatomical situations. Relevant literature has also been reviewed.

Key words

Anterior skull base; Approach.

INTRODUCTION

Throughout most of modern medical history the cranial base was regarded as surgically unapproachable because of anatomic complexity and vital importance of structures within its boundaries (Nuss and Janecka 1993).

Skull base surgery now is a multi disciplinary approach where the Otolaryngologist has a major role to play along with the Neurosurgeon, Neuroradiologist, Neuropsychiatrist and the Speech pathologist. With incremental advances having been made in the fields of Anaesthesiology and Biomedical Engineering, the introduction of various sophisticated screening and monitoring systems have made this specially much safer and rewarding in recent times.

Skull base surgery has conceptually been divided into Anterior, Lateral, Middle and Posterior. Posterior and Middle cranial surgery is associated with a high mortality whereas anterior skull base surgery carries a higher morbidity. Various approaches have been advocated by different

surgeons for the many pathologies involving the anterior skull base. However a definitive approach to this region is not very well documented in this part of the country.

This paper deals with our experience in exploring the anterior skull base and also highlights the preferred approach for various pathologies.

MATERIALS AND METHODS

Since 1980 to 1995 December we have performed 85 cases of anterior skull base surgery by adopting different approaches for various pathological states. The approaches and the histopathological lesion are depicted in Table I and Table II. Few of the benign lesions like giant frontal mucocele were subjected to anterior approach because of the lack of nasal endoscope facility at that time. Patients were subjected to CT, MRI, DSA and Diagnostic nasal endoscopy in addition to routine investigation whenever necessary. The patients were further examined by the senior authors of the Otolaryngology Group and the Neurosurgery Group. Neurosurgical help was sought wherever bitemporal craniotomy was adopted. Anterior skull base dura was explored from the facial side by the otolaryngologist alone in some cases.

RESULTS

This paper discusses an experience garnered over 85 cases of anterior skull base surgery involving various approaches.

25 patients in this series underwent craniofacial resection of their tumours for lesions ranging from olfactory nueroblastomas to squamous cell

Fig-1

Post operative photograph of a patient undergone craniofacial resection, showing 1- Lateral rhinotomy incision, 2- Bicoronal craniotomy incision

malignancy (Fig.1). 21 patients survived the surgical procedure. There were 4 deaths, three

Fig-2a

Pre operative - C T scan of angiofibroma

due to cerebral edema and one due to a cardiac arrest. On a five year follow up there were 12 patients alive.

All the 22 cases of Juvenile Angiofibroma excepting 2 cases were selected for transcervical-Transmandibular-transpalatal approach because of their radiological evidence of involvement of anterior skull base (Fig.2a, b & c). Whereas other 2 cases were approached via bitemporal craniotomy in addition to transcervical-transmandibular-transpalatal approach to clamp the internal carotid artery above the ophthalmic artery to control bleeding from internal carotid

Fig-2b

Intra operative photograph showing the exposure of the mass via the transcervical-transmandibular-transpalatal approach (Fig.4). All the cases are surviving with no evidence of recurrence.

Trans-oro-septo-sphenoidal approach was adopted for all the cases of pituitary adenomas

Fig-2c

Post operative CT scan of the same patient

which presented with classical features of acromegally. Post operative CSF leak was seen in 7 cases, but resolved spontaneously.

Midfacial degloving were performed in 2 cases who were presented with proptosis, blurring of vision, nasal obstruction, and blood stained nasal discharge. Anterior naso-frontal-ethmoidal area with orbital involvement were seen in both the cases of mesenchymal chondrosarcoma and

Fig-3a

D.S.A. showing vascular supply from the internal carotid artery (ICA) and external carotid artery (ECA)

Fig-3b

Intra operative photograph showing clipping of the internal carotid artery (ICA) above the ophthalmic artery via the craniotomy approach.

traumatic bone cyst of ethmoid. In both the cases, enblock tumour removal was achieved (Fig.4).

Fig-4

Showing midfacial degloving approach to the tumour

Inverted papilloma with severe dysplasia and ossifying fibroma cases were approached via medial maxillectomy (Fig.5). Operating microscope (ZEISS) was used simultaneously for tumour clearance from the ethmoidal roof.

Fig-5

Medial maxillectomy approach for exposing septal ossifying fibroma involving the anterior cranial fossa

Anterior cranial fossa dura was exposed completely in these cases from the ethmoidal roof to the sphenoid. CSF leak was seen in two cases which were sealed with abdominal fat along with BIPP nasal pack.

DISCUSSION

Surgical techniques for combining the facial and cranial approaches were first described by Dandy (1941). Smith et al (1954), reported their experiences in the treatment of frontal sinus cancer using these techniques. Terz et al

published their experience with the use of craniofacial disassembly techniques in the management of tumours extending till the pterygoid fossa (Terz et al 1969).

The anterior skull base is often infiltrated by various benign and malignant neoplasms. In the present series extranasopharyngeal angiofibroma was the commonest among the benign whereas squamous cell carcinoma and esthesioneuroblastoma are the commonest amongst the malignant tumours. Most of these lesions will erode the cribriform plate, sellar and the parasellar regions to involve the cavernous sinus. Orbital cavity involvement is normally through the ethmoid labyrinth. In all our cases excepting one intracranial extension through the cribriform plate was noted but this remained extradural.

Radical surgery for malignant growth of fronto ethmoidal region, in the post war era produced cure rates no higher than 25 to 35 percent. Orthovoltage radiation along resulted in even lower cure rates at 10 to 30 percent. However the overall survival rate of the malignant growth of the antro ethmoidal area has improved tremendously to reach between 39 to 76% after adapting to the anterior skull base surgery (Osguthorpe and Patil 1995).

Symptoms caused by cranial base lesions can range from a minor headache to major disturbance of CNS function. Unfortunately however most anterior skull base lesions are insidious in onset and cause few symptoms till they reach an advanced stage (Nuss and Janecka 1993). Clinical presentation can be divided into nasal, ophthalmological, neurological and otological. The commonest symptoms encountered were epistaxis, nasal block, proptosis, blurring of vision, blindness, ophthalmoplegia, headache, vomiting, fever, earblock and deafness.

The diagnosis is made by the presence of a soft tissue mass in the antero superior part of the nasal cavity and by histopathological examination.

However investigations like high resolution CT scan, MRI, DSA and nasal endoscopy are required to know the extension. Histologic diagnosis may be obtained by, biopsy and a transnasal or transorbital aspiration cytology in some cases (Osguthorpe and Patil 1995). Ophthalmic and Neurosurgical evaluation are a must before complete tumour exenteration.

Various surgical approaches were adopted in our series to explore the anterior cranial fossa. The anterior skull base may be involve by the primary tumour from the ethmoid or by the tumour extension from different part of the nasal cavity and nasopharynx. Because of this surgical decision to adopt a suitable approach for complete tumour removal from anterior skull base may become difficult. The authors prefer to

Fig-6b

Showing tumour situation suitable for midfacial degloving excellent approach for benign or malignant smaller lesions (Fig.6b) that do not abut anteriorly into the nasofrontal angles or frontal sinuses or laterally into the orbits (Osguthorpe and Patil 1995). Angiofibroma with intracranial extension

Fig-6a

Showing tumour situation suitable for lateral rhinotomy approach with anterior craniofacial resection

follow a certain criteria in selecting the appropriate approach, which is shown in table III. The surgical principles governing facial surgery include the placement of incisions along junctions of anatomic units and flap mobilisation in subperiosteal or subfascial planes (Nuss et al 1991). Neoplasms confined to the anterosuperior sinonasal area can be exenterated by a lateral rhinotomy approach (Fig. 6a). A gull wing incision to the lateral rhinotomy allows good frontal sinus access (Biller et al 1989). Nasal translocation procedures offer excellent extirpation of disease involving both sinonasal areas. The midfacial degloving approach is an

Fig-6c

Showing tumour situation suitable for transcervical-transmandibular-transpalatal approach of Biller

through the cribriform plate with minimal to moderate anterolateral extension can be adequately removed by the transcervical, trans mandibular transpalatal approach of Biller (Fig. 6c) for vascular control Angiofibromas with vascular supply from the internal carotid is approached better by a bifrontal craniotomy with ligation of vascular feeders. Balloon obliteration of internal carotid artery may also be done to avoid the craniotomy. But the authors feel that bifrontal craniotomy has definite advantages where arterial

ligation as well as intracranial extension of the angiofibroma can be tackled in the same sitting. Benign tumours involving the cribriform plate with minimal extension to the orbit may be approached better by a medial maxillectomy and the complementary use of the microscope. Squamous

Table I
Depicting the various approaches to the anterior skull base

Approach	Number of patients
Transcervical Transmandibular Transpalatal (Billers)	24
Transoro-septal Trans sphenoidal	26
Anterior Craniofacial resection	25
Midfacial degloving	2
Medial maxillectomy with operative microscope	8
n= 85	

Table II
Depicting the histology of tumours

Hystological types	Number
Olfactory neuroblastoma	5
Squamous cell carcinoma	12
Undifferentiated carcinoma	1
Giant frontoethmoidal mucocoele	1
Giant cell reparative granuloma	1
Recurrent myxoma of fronto ethmoidal complex	1
Ossifying fibroma	2
Aspergilloma P.N.S.	1
Angiofibroma	22
Chromophobe adenoma (pituitary)	21
Adenocystic carcinoma of P.N.S.	9
Pleomorphic adenoma involving the nasopharynx	1
Mesenchymal Chondrosarcoma	1
Traumatic bone cyst of ethmoid	1
Inverted papilloma with malignant Changes	6
85	

cell carcinomas and esthesioneuroblastomas involving the cribriform plate should be approached by the craniofacial approach. Pituitary

Table III
Showing the preferred approach in different anatomical situation involving anterior skull base

Site	Approach
1. Antero-superior sino nasal area	1. Lateral rhinotomy
2. Antero-superior sino nasal area and frontal sinus	2. Lateral rhinotomy with linch extension
3. Superior sino-nasal are on both sides	3. Midfacial degloving with nasal translocation
4. Angiofibroma with intracranial extension through cribriform plate with minimal to moderate anterolateral extension	4. Trans-cervical trans mandibular trans palatal approach of Biller
5. Benign tumour involving cribriform plate with minimal extension to orbit	5. Medial maxillectomy approach with complimentary use of microscope
6. Squamous cell carcinoma or olfactory neuroblastoma involving cribriform plate	6. Anterior craniofacial resection
7. Pituitary adenoma with minimal parasellar extension	7. Transoro-septosphenoidal approach

tumours like adenomas with minimal parasellar extension may be adequately removed via the trans oro-septosphenoidal approach.

While the benefits of cranial base surgery are heartening, these procedures are not without potential complications. Documented complications are meningitis, epidural and subdural brain abscess and osteomyelitis of the skull. CSF leaks, diabetes insipidus hemiplegia, meningocele and pneumatocele have also been reported. With increasing experience the skull base surgeon can recognize factors predisposing to complications early and thereby plan prophylactic measures (Hazarika et al 1986, 1990). However curative therapy may now be offered for many patients with primary or recurrent disease of the anterior skull base and surgical resection can be considered as a primary treatment modality for many cranial base lesions which previously would

have been considered inoperable (Nuss and Janecka 1993; Schramm et al 1979).

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