

Cranio-facial Approaches to Anterior and Middle Cranial Fossa Skull Base Tumors

THESIS

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CONTENTS

	Page
▪ Introduction and Aim of the Work	1
▪ Review of Literature:	3
□ Anatomy	3
□ Pathology	25
□ Diagnosis	40
□ Management	51
▪ Patients and Methods	128
▪ Results	133
▪ Case Presentation	159
▪ Discussion	176
▪ Summary and conclusion	203
▪ References	207
▪ Arabic Summary	

LIST OF FIGURES

No.	Title	Page
1	The endocranial and exocranial surfaces of anterior and middle cranial fossa	4
2	The exocrine surface of skull base (anteroinferior view and lateral view)	5
3	The structures in relation to the middle fossa	6
4	superior view of middle fossa floor	7
5	Orbital relationship	8
6	Superior orbital fissure and structure in the superior compartment of orbit	9
7	Anatomical relationship of the sphenoid sinus	10
8	Lateral relationship of the sphenoid sinus to the cavernous sinus	11
9	Carotid sulcus relationship of the sphenoid sinus	11
10	Relationship of the sphenoid sinus (optic strut, optic canal and optico-carotid recess)	12
11	Relationship of the pituitary gland and diaphragma sellae	14
12	Cavernous sinus- Meckel's cave Relationship and oculomotor cistern	14
13	Dural rings in relation to clinoidal segment of ICA	16
14	Cranial nerves in relation to the cavernous sinus	17
15	Trigeminal nerve relation to the cavernous sinus and middle fossa floor	17
16	View of the right cavernous sinus with triangle identification. The anterior clinoid process was removed, exposing the clinoidal triangle (1). The outer layer of the dura has been peeled away, exposing the supratrochlear (2), infratrochlear (4), anteromedial middle fossa (5), and anterolateral middle fossa (6) triangles. The oculomotor triangle (3) is delimited in the smaller picture. The cranial nerve (CN) IV is running parallel to the tentorial artery. D. Dur., distal dural; O.N., optic nerve; I.C.A., internal carotid artery; Post. Clin. Pr., posterior clinoid process.	18
17	Cavernous sinus and middle fossa triangles	19
18	Internal carotid artery and its branches	20
19	Internal carotid artery (petrous and cavernous segment and branches)	21
20	Internal carotid artery (Supraclinoidal part)	23
21	Anatomy of the nose and paranasal sinuses	24
22	WHO grades of meningiomas (Grade I, Grade II and grade III)	27
23	Microscopic picture of schwannomas and neurofibroma	30
24	Microscopic picture of chordoma and chondrosarcoma	31
25	Microscopic picture and EM picture of olfactory neuroblastoma	37
26	Histological features of juvenile nasopharyngeal angiofibroma	39

No.	Title	Page
27	A case of cavernous sinus meningioma. CT revealed tumor extension into superior orbital fissure while MRI delineated tumor extension and angiography demonstrated narrowing of intracavernous carotid	44
28	A case of giant schwannoma extending into middle cranial fossa	45
29	MRI and CT brain revealed large chondrosarcoma involving middle fossa with extensive bone destruction	46
30	A case of angiofibroma with intracranial extension	47
31	A case of giant esthesioneuroblastoma with intracranial extension	48
32	A case of giant squamous cell carcinoma with intracranial extension	50
33	Example of intraoperative cranial nerve monitoring –image guided electrode insertion	54
34	Example of image guided resection of olfactory neuroblastoma	55
35	Extent of exposure provided by the transbasal approach	62
36	Level one transbasal approach	62
37	Level two transbasal approach	63
38	Level three transbasal approach	63
39	Anatomical view of extent of basal exposure	63
40	Head position and different lines of incision	66
41	Elevation of vascularized precranial flap and supraorbital craniotomy	67
42	Osteotomy of the orbital bar without violation of the medial canthal ligament	68
43	Osteotomy modification to spare the olfactory nerve	69
44	Anatomical picture after full exposure of transbasal approach	70
45	Dural closure and reconstruction	71
46	Technique of subfacial dissection for protection of frontal branch of facial nerve	77
47	Cutting and mobilization of zygoma and elevation of temporalis muscle	78
48	Orbito-frontal craniotomy	78
49	Single piece fronto-orbito-zygomatic exposure	79
50	Extradural drilling of lesser wing of sphenoid and anatomical view after full exposure	80
51	Extradural drilling of anterior clinoid and exposure of extradural optic nerve and anatomical view after full exposure	81
52	Extradural dissection of middle fossa dura and exposure of lateral cavernous sinus	82
53	Intradural dissection and tumor dissection from lateral wall of the cavernous sinus	83
54	Preauricular Infratemporal Fossa incision and draw of exposure extent	87
55	Facial nerve preservation and surgical field after excision of rhabdomyosarcoma by preauricular Infratemporal Fossa approach	88
56	Extent of exposure provided by the transfacial approach	89
57	Lateral Rhinotomy incision and facial degloving exposure	90

No.	Title	Page
58	Anatomical view of the extent of exposure provided by transmaxillary osteotomies	92
59	Steps of craniotomy in the modified frontal–nasal–orbital approach	102
60	The craniotomy can be modified to involve orbitozygomatic osteotomy	102
61	Steps of closure in the modified frontal–nasal–orbital approach	105
62	Steps of eyebrow craniotomy	107
63	Extent of exposure provided by the transsphenoidal approach	116
64	The view in standard endoscopic transsphenoidal approach	119
65	Extended endoscopic transsphenoidal approach to anterior skull base	120
66	Anatomical view of extended endoscopic transsphenoidal approach to anterior skull base	121
67	An endoscopic view of the surgical dural defect (delineated with black arrows) after an endoscopic transcribriiform approach for excision of an esthesioneuroblastoma	122
68	Reconstruction using only graft, fat and fibrin glue	123
69	Age distribution of patients	134
70	Sex distribution in relation to the pathology	138
71	Pathology in relation to different groups	139
72	Clinical presentation	140
73	Tumor extent in different groups based on pre-operative imaging	141
74	Pathology of recurrent lesions	144
75	Tumor excision (Extent) in different groups	148
76	Tumor excision (Extent) in relationship to cavernous sinus involvement	149
77	Tumor excision (Extent) in different pathologies	150
78	Tumor excision (Extent) in recurrent tumors	152
79	Surgical morbidity in different groups	153
80	Postoperative Imaging: Extent of removal	156
81	Postoperative clinical outcome (KPS)	157
82	Postoperative visual outcome	158
83	Postoperative outcome of ocular motility	158
84	Case Number 1: preoperative imaging	160
85	Case Number 1: postoperative imaging	160
86	Case Number 3: preoperative imaging	162
87	Case Number 3: postoperative imaging	162
88	Case Number 5: preoperative imaging	164
89	Case Number 5: postoperative imaging	164
90	Case Number 5: postoperative imaging	165
91	Case Number 7: preoperative imaging	166
92	Case Number 7: postoperative imaging	167
93	Case Number 10: preoperative imaging	168
94	Case Number 10: postoperative imaging	169
95	Case Number 12: preoperative imaging	171

No.	Title	Page
96	Case Number 12: postoperative imaging	171
97	Case Number 15: preoperative imaging	173
98	Case Number 15: postoperative imaging	173
99	Case Number 19: preoperative imaging	174
100	Case Number 19: intra-operative imaging	175
101	Case Number 12: postoperative imaging	175

LIST OF TABLES

No.	Title	Page
1	The origin of skull base tumors	25
2	Hyams histopathological grading system	38
3	Fisch system for the grading of juvenile nasopharyngeal angiofibroma	39
4	Modified TNM staging system of esthesioneuroblastoma based on CT and MRI imaging	49
5	Nomenclature of Transbasal Approaches Reported in the Literature Categorized According to Proposed classification of transbasal approaches	61
6	Types of skull base lesions in 41 patients done with transbasal approach	65
7	Complications following the traditional and extended transbasal approach for skull base lesions	73
8	Surgical complications involving 16 patients	100
9	Summary of Surgical Approaches Used for Excision of Multi-compartmental Anterior Skull Base Tumors	104
10	Anatomic structures that can be exposed via the supraorbital subfrontal approach	109
11	Endoscopic cranial base corridors, approaches, and targets	114
12	Endoscopic endonasal approached in relation to pathology	115
13	Percentage of complications resulting from the microscopic transsphenoidal technique versus endoscopic pituitary surgery	125
14	Approaches used in the 3 groups	130
15	Karnofsky performance scale	
16	Age distribution of patients in the various groups	133
17	Sex distribution of patients in the various groups	134
18	Age distribution in relation to pathology	135
19	Mean age distribution in relation to pathology	136
20	Sex distribution in relation to the pathology	137
21	Pathology in relation to different groups	138
22	Clinical presentation in different groups	140
23	Tumor extent in different groups based on pre-operative imaging	141
24	Tumor extent in different groups based on pre-operative imaging	142
25	Pre-operative management; surgical excision (incidence)	142
26	Pre-operative management; surgical excision (approach)	143
27	Pathology of recurrent lesions	143
28	Pre-operative management; Radiotherapy	144
29	Pre-operative management; Radiotherapy in relation to pathology	145
30	Pre-operative management; Chemotherapy	146
31	Tumor excision (extra-dural versus combined extra and intra-dural) in different groups	147
32	Tumor excision (Extent) in different groups	147

No.	Title	Page
33	Tumor excision (Extent) in relationship to cavernous sinus involvement:	148
34	Tumor excision (Extent) in different pathologies	149
35	Tumor excision (Extent) in recurrent tumors	151
36	Surgical morbidity in different groups	152
37	Postoperative adjuvant treatment	153
38	Postoperative adjuvant treatment in different pathology	154
39	Postoperative Imaging: Extent of removal	155
40	Postoperative clinical outcome (KPS)	156
41	Postoperative visual outcome	157
42	Postoperative outcome of ocular motility	158

LIST OF ABBREVIATIONS

ACF	Anterior cranial fossa
ACA	Anterior cerebral artery
ACP	Anterior clinoid process
AChA	Anterior choroidal artery
AE	Arcuate eminence
Angio.	Angiography
B	Biopsy
BA	Basilar artery
BAERs	Brainstem auditory evoked potentials
C	Clivus
CPA	Cerebellopontine angle
COZ	Cranio-orbitozygomatic
CS	Cavernous sinus
CSF	Cerebrospinal fluid
CPc	clival portion of the carotid protuberance
CPs	sellar portion of the carotid protuberance
CT	Computerized tomography
D	Debulking
DCL	Disturbed conscious level
EAC	External auditory canal
ED	Extradural
ED/ID	Extra/intradural
ES	Ethmoid sinus
FW	Flexner–Wintersteiner
GG	Geniculate ganglion
GSPN	Greater superficial petrosal nerve
GTR	Gross total resection
H/A	Headache
HW	Homer–Wright
IAC	Internal auditory canal
ICA	Internal carotid artery
ICP	Intracranial pressure
ID	Intradural
IOM	Intra-operative cranial nerve monitoring
IT	Infratemporal fossa
JNA	Juvenile nasopharyngeal angiofibroma
KPS	Karnofsky performance scale

LSC	Lateral semicircular canal
MCA	Middle cerebral artery
MCF	Middle cranial fossa
MEP	Motor evoked potentials
Mi	Middle
MRA	Magnetic resonance angiography
MRI	Magnetic resonance imaging
MRV	Magnetic resonance venography
MS	Maxillary sinus
NF1	Neurofibromatosis-1
NF2	Neurofibromatosis-2
NO	Nasal obstruction
OCR	Optico-carotid recess
ON	Optic nerve
OP	Optic protuberance
OphthA	ophthalmic artery
PB	Petrous bone
PC	Prepontine cistern
PCA	Posterior cerebral artery
PCoA	Posterior communicating artery
PCP	Posterior clinoid process
PF	Parapharyngeal fossa
PS	Planum sphenoidale
S	Sella
SC	Suprasellar cistern
SCC	semicircular canal
SCA	Superior cerebellar artery
SPECT	Single photon emission computerized tomography
SS	Sphenoid sinus
SSEP	Somatosensory evoked potentials
TS	Tuberculum sellae
WHO	World health organization
Xe-CT	Xenon CT

INTRODUCTION

Skull base tumors are by definition tumors that arise from or are located in the bony structures at the base of the skull. They may originate from a variety of extracranial or intracranial tissues, or directly from the skull base. The usual extracranial sources include area such as the paranasal sinuses, nasopharynx, and surrounding connective tissues whose tumors secondarily invade the skull base. The intracranial sources include basal meningiomas, pituitary tumors, and metastatic tumors that erode into the base of the skull. Osteosarcomas, chordomas and chondrosarcomas are tumors that originate directly from the skull base (*Britz W G and Johnson F, 2000*).

Several advances have occurred that have significantly altered the management of these tumors. Newer imaging techniques have led to improved delineation of the tumors regarding the size and the extent and its relationships with adjacent critical structures, thus aiding in the preoperative evaluation and surgical planning. This information is largely obtained from preoperative imaging investigations, which are typically magnetic resonance imaging (MRI), x-ray, computed tomography (CT), digital x-ray angiography and magnetic resonance angiography (MRA). The operating surgeon therefore requires all modalities in order to obtain the most complete information on the internal anatomy. The surgeon must mentally combine the information from the different modalities to appreciate the interrelationships of the different structures. The surgeon must also mentally reconstruct the three-dimensional (3D) relationships of structures from the 2D slices, which can be time consuming and occasionally misleading (*Gandhe J A et al, 1994*).

Craniofacial approaches have been the standard surgical treatment for resection of such tumors. Advances in surgical techniques have resulted in the development of multiple different approaches that often involve a multidisciplinary team including neurosurgeons, plastic surgeons, maxillofacial surgeons, and otolaryngologists. The

different approaches are used to obtain access to and exposure of skull base tumors in different locations, based on preoperative imaging studies and surgical planning. There are 3 standard approaches to access such tumors: transbasal, transfacial, and transsphenoidal and each of them provide various angles and degrees of access along the skull base. Advancement in neuroanesthesia and surgical aids as the microscope has allowed for improved surgical technique, and more feasibility for radical tumor resection (*Liu K J et al, 2003*). What are still not clear are the indications for the various procedures and the degree to which radical removal should be undertaken. We still must individualize and decide about the course of therapy after considering all the factors presented by any patient (*Long D M, 1996*).

In making decision, close cooperation between the neurosurgeon and head and neck surgeon is essential. No specific radiological criteria for preoperative selection of any approach. The only absolute criteria of the need for craniotomy were thought to be cribriform plate involvement, dural enhancement suggesting dural invasion, or frank intradural extension of tumor. The criteria generally used for a transfacial approach were invasion of the floor of the maxillary sinus, invasion of the base of the nasal septum, involvement of the soft tissues of the face, and orbital involvement requiring orbital exenteration (*McCutcheon IE, 1996*).

Although these approaches provide wide exposure for radical tumor removal and improvement of oncological outcome and survival, there is a high incidence of postoperative morbidity (*Lawton MT, et al, 1995*). Operative morbidity includes high risk of postoperative cerebrospinal fluid (CSF) leakage, meningitis, intracranial infections and neurological sequelae. The recent advances in cranial base reconstruction provide us with more predictable, functional, and aesthetic results, which have helped to reduce postoperative morbidity rates. To date, many studies have reported the clinical outcomes of anterior cranial base surgery but only a few have focused on the risk factors for postoperative complications (*Nibu K, et al, 1998*). When the decision is to do combined approach, the transcranial approach
