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Microsurgical Anatomy and Surgery of the Central Skull Base

in collaboration with Larry Rogers

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Preface

Parkinson's idea of crossing the dura from intradural to epidural space to repair arteriovenous fistulae and aneurysms of the parasellar space (PS) was a revolutionary step toward devising a surgical method for treating these difficult pathologies. Yet, owing to the difficulties and potential complications attendant to cardiac standstill and extracorporeal circulation, the idea was not universally accepted in the surgical community. The application of endovascular techniques, as introduced by Serbinenko, amounted to another major breakthrough in the treatment of these lesions. For a time, the endovascular method brought the development of surgical procedures for parasellar space (PS) lesions to a resounding halt. Combining, however, the results of anatomical studies by Taptas, Parkinson and Glasscock, the concept of opening the PS without manipulating heart function was born. Access could be gained simply by locally and temporarily interrupting internal carotid astery (ICA) flow. When this idea was presented as an alternative for treating PS tumors and vascular lesions at the 7th International Neurosurgical Congress in Munich in 1981, opposition was generalized but not universal. Neurosurgeons demanded proof that such methods afforded successful, safe treatment of PS lesions, that a sizable series of good postoperative results be established.

The presentation of these new anatomical concepts kindled the imaginations of neurosurgeons around the world, but not always to the benefit of their patients. In many cases actions were taken without appreciation of the technical difficulties involved. As neurosurgeons flocked to put theory into practice, poor results occurred. All too often the importance of gaining a full understanding of microsurgical anatomy through long hours of laboratory experience was overlooked. A new skepticism arose, in many instances voiced by nascent PS "experts"! It constituted a very disheartening chapter in the history of central skull base (CSB) surgery. Particularly sad is the fact that countless patients were forced to pay a stiff price for their surgeons' overextending themselves.

The first International Meeting of the Cavernous Sinus was convened in Ljubljana in 1986 to emphasize the importance of mastering a practical knowledge of CSB anatomy and the special surgical techniques required. Undoubtedly that meeting had a large impact on refining and disseminating safe methods of CSB surgery. Its reports were published in *The Cavernous Sinus. A Multidisciplinary Approach to Vascular and Tumorous Lesions*. After 1986, however, it became even more difficult to monitor and assess the numerous publications appearing. Most involved experiences with relatively few clinical cases, authors at times drawing conclusions based on inadequate statistical samples. *Anatomy and Surgery of the Cavernous Sinus*, published in 1989, was devoted to detailed CSB anatomy and its surgical implications. That book sold out within a year, leading to repeated requests for its re-printing, and finally, as experience grew, to update it. This volume is an attempt to describe concepts of CSB anatomy even more fully and to detail practical approaches to various skull base lesions now amenable to surgery. It emphasizes the evolution of surgical thought since the 1989 publication. Key among several changes is that whereas previously most lesions were exposed intradurally, currently we understand that they are ideally accessed by a totally extradural approach. At the present time lesions simultaneously inhabiting intradural and extradural compartments are approached first extradurally, then by opening dura only as a given lesion dictates. This affords maximum protection to intradural structures while allowing full extirpation of many tumors and vascular lesions. Gaining adequate dissection space at the expense of skull base bone (rather than retracting brain) amounts to a crucial advantage in dealing with such lesions. Where opening dura is absolutely required, it must be reconstructed in a watertight manner in order to avoid CSF leakage.

Here the most important vascular lesions and tumors are presented from the surgeon's point of view, and all results are analyzed in detail. The careful reader should be able to determine accurately what currently is possible with surgery and how to go about achieving good results. The current series of vascular lesions and tumors is the result of two decades' continuous experience. We believe it supports our belief that surgery for such lesions is useful, beneficial, and necessary. Continued advancing knowledge will lead to an even superior understanding of normal and pathological CSB anatomy, facilitating additional improvements and refinements.

Nowadays, surgery as therapy remains continuously and increasingly under fire. Surgeons are reminded daily of the unquestionable fact that to operate is not always to cure. Yet patients seek optimum treatment *today*. They require surgeons' care long before "less invasive" treatment modalities have proved their superiority in safety and efficacy. Surgeons will continue to face such patients. As a consequence, each is obliged to continue to improve his methods in order that much more is achieved, until every untoward effect and possible postoperative neurological deficit have been eliminated entirely. With respect to the challenging lesions of the CSB, such will be possible only if surgeons remain prepared to invest still more time and energy to advance anatomical knowledge and surgical skill with the demanding lesions occurring at the CSB. Surgeons must accept that no single treatment is best for long. The history of surgery details a never ending story of change and improvement. Our generation depends on the surgeons of tomorrow to continue to roll back the frontiers of what is possible. One may find satisfaction and pride only as an active participant in the process.

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Contents

Abbreviations

Cranial nerves

ON	Optic nerve
III	Oculomotor nerve
IV	Trochlear nerve
V	Trigeminal nerve
GG	Gasserian ganglion
V_1	Ophthalmic division
V_2	Maxillary division
V_3	Mandibular division
Vm	Motor branch of the trigeminal nerve
VI	Abducens nerve
VII	Facial nerve
VIII	Vestibulocochlear nerve

Internal carotid artery

ICA	Internal carotid artery
(AL)	Anterior loop
(ML)	Medial loop
(LL)	Lateral loop
(PL)	Posterior loop

Other intracranial arteries

ACA	Anterior cerebral artery
ACom	Anterior communicating artery
BA	Basilar artery
CA	Capsular artery
DAs	Dawson's arteries
ILT	Inferolateral trunk
MCA	Middle cerebral artery
MHT	Meningohypophyseal trunk
MMA	Middle meningeal artery
OA	Ophthalmic artery
PCom	Posterior communicating artery
SCA	Superior cerebellar artery
TA	Tentorial artery (Bernasconi-Cassinari)

Other structures

ACP	Anterior clinoid process
APB	Apex of the petrous bone
BS	Brain stem
CSB	Central skull base
DR	Distal (dural) ring
DS	Dorello's space
FL	Foramen lacerum
FO	Foramen ovale
FR	Foramen rotundum
FS	Foramen spinosum
GPN	Greater petrosal nerve
IAC	Inner auditory canal
LM	Liliequst membrane
LPN	Lesser petrosal nerve
LR	Lateral ring
MCF	Middle cranial fossa
MM	Mucous membrane
OC	Optic canal
PB	Pituitary body
PCL	Petroclival ligament
PCP	Posterior clinoid process
PR	Proximal ring
PSt	Pituitary stalk
PV	Petrosal vein
SF	Sylvian fissure
SN	Sympathetic nerve(s)
SOF	Superior orbital fissure
SPS	Superior petrosal sinus
TM	Temporal muscle
TTM	Tensor tympani muscle