Combined Minimally Invasive Supraciliary and Transfacial Approach for Large Tumors with Skull Base and Sinonasal Involvement

Pal Barzo[1], Zsolt Zador[3], Mihaly Bodosi[1], Zsolt Bella[2], Daniel Jambor[2], Bela Fulop[1], Jeno Czigner[2]

BACKGROUND: **Tumors invading both the anterior skull base and the sinonasal area have traditionally been accessed via largely invasive open craniofacial approaches. Minimally invasive extended endoscopic endonasal approaches have recently become increasingly available but have anatomical limitations and require incremental experience and thus high patient volume. Our objective was to assess the applicability of a novel combination of the minimally invasive supraciliary incision and the limited maxillofacial osteotomy as a combined surgical approach for large tumors invading both the anterior skull base and the sinonasal area.**

METHODS: **The well-established technique of supraciliary incision with a 2.5 × 3.0-cm craniotomy was combined for the first time with limited facial translocation approach.**

RESULTS: **This series involves 11 cases (female/male ratio 4:7; ranging in age from 6 to 61 years). Intracranial tumor propagation with intranasal and ethmoidal extension was detected in all patients. The pathologic diagnoses included adenocarcinomas, esthesioneuroblastoma, rhabdomyosarcoma, sinonasal papilloma, meningioma, and neurofibroma. The postoperative approach-related mortality rate was zero. No case of cerebrospinal fluid leak was detected. The 3-year survival rate was 70%.**

CONCLUSIONS: **The limited transfacial approach in combination with a supraciliary extension is associated with minimal mortality and morbidity and facilitates gross total tumor removal. We highly recommend this approach for the surgical treatment of large tumors invading both the anterior skull base and the sinonasal area, especially for those being out of indication for extended endoscopic endonasal surgery.**

INTRODUCTION

The treatment of sinonasal tumors involving the frontobasal area together with the nasal cavity and/or paranasal sinuses represents a major challenge because of the proximity of vital anatomical structures. During the past 50 years, the surgical techniques recommended for the treatment of these oncologically complex diseases have undergone considerable evolution. Inspired by the disappointing results of radiotherapy, in 1954 Smith et al.[1] were the first to introduce a combined transcranial (i.e., transbasal) and transfacial approach for the resection of sinonasal tumors, subsequently reporting a series of successful operations by using the elaborated procedure.[2] Since then, surgical resection remained the cornerstone of therapy, with a combination of transfacial and transcranial approaches for tumors invading both the sinonasal area and the anterior skull base. The general aim of the combined surgery is to achieve a tumor-free margin, i.e., an en bloc resection, together with a better scope and thus safer operative conditions for the resection of the intracranial extension. To satisfy these criteria, a number of strategies have been developed to access this region, weighing the advantage of a wide exposure in association with an extensive facial decomposition[3,4] against the disadvantage of a narrower access with, however, significantly less cosmetic disfigurement.[5]

The extension of these tumors into the cranial vault, similarly to primary tumors of the anterior skull base, traditionally has been

Key words
- Craniofacial surgery
- Eyebrow incision
- Minimally invasive
- Sinonasal tumors
- Skull base tumors

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
EEA: Extended endonasal approach

From the Departments of [1]Neurosurgery, Faculty of Medicine, and [2]Otorhinolaryngology and Head and Neck Surgery, Albert Szent-Györgyi Clinical Center, University of Szeged, Szeged, Hungary; and [3]Department of Neurosurgery, Salford Royal NHS Foundation Trust, Salford, United Kingdom

To whom correspondence should be addressed: Pal Barzo, M.D., Ph.D., D.Sc. [E-mail: pbarzo@yahoo.com]

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approached through pterional, subfrontal, or bifrontal craniotomy. These techniques are often complicated by iatrogenic injury induced by the extensive craniotomy and soft-tissue manipulation. In the effort to avoid the aforementioned complications, Donald H. Wilson introduced the idea of keyhole surgery.[6] Subsequently, van Lindert et al.[7] further developed this concept and introduced the supraciliary exposure (i.e., through eyebrow incision), a minimally invasive modification of the subfrontal approach originally proposed for the surgical treatment of aneurysms. This approach, however, provides an excellent exposure of the anterior fossa as well as the supra- and retrosellar regions, making it a suitable technique to access not only aneurysms but also frontobasal, suprasellar, or parasellar tumors,[8] and, as we propose, the intracranial extension of sinonasal tumors.

In the present report, a new combination of the limited transfacial approach and the minimally invasive eyebrow incision is described as an efficient and safe technique for the resection of tumors invading both the anterior fossa and the sinonasal area. Our series of 11 patients demonstrate minimal mortality and morbidity with excellent cosmetic outcomes.

Table 1. Clinical and Demographic Characteristics of the Patients

	Patient										
Characteristic	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Age, years	44	49	32	17	58	61	72	21	7	6	41
Sex	Male	Female	Female	Female	Male	Male	Female	Male	Male	Male	Male
Hospital stay, days	7	9	11	9	8	10	10	6	9	13	9
Reoperation*	+	–	–	–	–	–	–	+	–	+	–
Histology	AC	M	ENB	NPAC	lg-AC	SNUC	M	NF	RMS	m-SP	CCRCC
Extension											
Intracranial	+	+	+	+	+	+	+	+	+	+	+
Intradural	+	+	+	+	+	+	+	–	+	–	–
Intranasal	+	+	+	+	+	+	+	+	+	+	+
Ethmoid sinus	+	+	+	+	+	+	+	+	+	+	+
Frontal sinus	+	+	+	+	+	+	+	–	–	+	+
Maxillary sinus	–	–	+	+	+	+	+	+	+	+	+
Sphenoid sinus	+	–	–	+	+	+	+	+	+	+	+
Retromaxillary	–	–	–	+	–	+	–	+	+	–	–
Other regional	orb.	orb.	orb.	c.s., orb.	orb.	orb.	c.s., orb.	clival	c.s., orb.	orb.	orb.
Intraoperative hemorrhage	–	–	–	–	–	+	–	+	–	–	–
Tissue glue use	–	+	–	+	–	+	–	–	–	+	–
Postoperative CSF leak	–	–	–	–	–	–	–	–	–	–	–
Postoperative hemorrhage	–	–	–	–	–	–	–	–	–	+	–
Survival	3 months, died	6.5 years, died†	6 months, died	8 years, alive	7 years, alive	2.5 years, died	10 years, alive	3.5 years, alive	5 years, alive	3 years, alive	1.5 years, alive
Postoperative radiotherapy	–	+	–	+	+	+	+	+	+	+	+
Duration of surgery, hours	3	3.5	4	4.5	1.5	4	2	1.5	3	2	1.5
Resection	Subtotal	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total

AC, adenocarcinoma; M, meningioma; ENB, esthesioneuroblastoma; NPAC, nasopharyngeal papillary adenocarcinoma; lg-, low-grade; SNUC, sinonasal undifferentiated carcinoma; NF, neurofibroma; RMS, rhabdomyosarcoma; m-SP, malignant sinonasal (Schneiderian) papilloma; CCRCC, clear cell renal cell carcinoma; orb., orbital; c.s., cavernous sinus; CSF, cerebrospinal fluid.
*Primary surgery in another institute.
†Unrelated cause of death.