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A review of 59 consecutive patients with lesions of the anterior cranial base operated on using the subcranial approach

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SUMMARY. Introduction: **Lesions of the anterior cranial fossa are still a challenge for the surgeon. Since Joram Raveh introduced the concept of a subcranial approach in 1978 it has been used in the treatment of lesions extending into the anterior cranial fossa. Our experience with the subcranial approach during the past 8 years at Turku University Central Hospital is described.** Patients: **Fifty-nine consecutive patients underwent surgery using the subcranial approach for treating various benign and malignant neoplasms, for repair of frontobasal-midfacial fractures, and for repair of cerebrospinal fluid leaks.** Methods: **Patient records were retrospectively reviewed, with special focus on surgical technique, early outcome, and complications.** Results: **Nineteen of the patients were operated on because of combined fronto-naso-orbital and skull base fractures, 37 were tumour cases, and 3 patients required surgical repair for cerebrospinal fluid leakage. Significant complications consisted of two cases of meningitis. However, they were successfully treated with antibiotics. The most common late complaint was olfactory nerve dysfunction (44), other late complications such as diplopia (4), enophthalmos (2), scar tissue in the nasal cavity (2), and trigeminal nerve dysfunction (2) were also encountered.** Conclusion: **The subcranial approach affords exposure to the orbital, sphenoethmoidal, and clivus regions, as well as to the nasal and paranasal cavities. On the basis of this review, it is concluded that it is a safe and effective approach for treating lesions involving the anterior skull base.** © **2006 European Association for Cranio-Maxillofacial Surgery**

Keywords: **anterior skull base; subcranial approach; surgical approaches; skull base tumour; cerebrospinal fluid fistula; craniofacial fracture**

INTRODUCTION

Lesions of the nasal cavity, paranasal sinuses and orbit that extend into the anterior cranial fossa pose a technical challenge from the perspective of both resection and the avoidance of complications. However, the development of surgical approaches to the skull base has improved the treatment of tumours, traumatic injuries and cerebrospinal fluid (CSF) leakage (*Raveh* et al., 1988a, b, 1995; *Fliss* et al., 1999; *Aitasalo* and *Grenman*, 2004; *Hendryk* et al., 2004).

The concept of a subcranial approach to the entire anterior skull base from the roof of the ethmoidal labyrinth to the clivus and, laterally, to the orbital roofs, was first introduced in 1978 by Raveh for the treatment of trauma to the anterior skull base (*Raveh* and *Vuillemin*, 1988a), and for correction of craniofacial anomalies (*Raveh* and *Vuillemin*, 1988b). It was also adapted for the removal of skull-base tumours (*Raveh* et al., 1995).

The subcranial approach provides several advantages. It affords exposure to the orbital, sphenoethmoidal, and clival regions, as well as to the nasal and paranasal cavities. Furthermore, the procedure allows intradural and extradural tumour removal, repair of fractures with dural tears, optic nerve decompression, and repair of CSF leakage. The subcranial approach is performed with minimal frontal lobe manipulation, and external facial incisions can be avoided (*Raveh* et al., 1995; *Fliss* et al., 1999; *Kellman* and *Marentette*, 2001; *Hendryk* et al., 2004).

In this report our experience with the subcranial approach in 59 consecutive patients during the past 8 years is described.

PATIENTS AND METHODS

Fifty-nine patients undergoing surgery using the subcranial approach at this institution between March 1996 and January 2004 were included in this study. The patients underwent treatment of various neoplasms originating in the nasal cavity, nasopharynx, paranasal sinuses, orbit, or meninges, as well as repair of complex craniofacial trauma and/or CSF leakage. All patients with a malignant tumour underwent preoperative evaluation by a combined team, including a head and neck surgeon and an oncologist. A plastic surgeon and a neurosurgeon were included in the team when needed. Preoperative radiological evaluation consisted of non-contrast computed tomography (CT) in case of trauma and CSF leakage, or contrast enhancement CT scans in tumour cases. Patients with large tumours or tumours with intracranial invasion were evaluated with

both contrast enhancement CT and magnetic resonance imaging (MRI). Neuroangiography was performed when appropriate. A combination of the broad-spectrum antibiotics, cefuroxime and metronidazole, were used perioperatively. During the operation, patients were under general endotracheal anaesthesia. All surgical procedures were performed by a senior surgeon (KA), with or without the presence of a neurosurgeon and/or a plastic surgeon.

Surgical technique

A bicoronal flap was raised, extending laterally to the supra-auricular areas. Some of the trauma patients were approached through lacerations of the craniofacial skin if possible. The supraperiosteal flap was elevated over the supraorbital ridges and glabella, and extended superficially to the temporalis fascia. The supraorbital nerves and vessels were dissected from the supraorbital notches. The orbit was entered, and the anterior ethmoidal arteries were coagulated.

Osteotomies of the anterior, or anterior and posterior frontal sinus walls were performed along with the nasal bony frame, part of the medial and superior walls of the orbit, and a segment of the superior nasal septum. The osteotomized fronto-naso-orbital segment was removed and stored. Sometimes it was possible to remove frontal and orbital bone segments using fracture lines in trauma cases. Depending on the site of the lesion, bilateral ethmoidectomies or spheno-ethmoidectomies were performed. Thus, a wide exposure of the subcranial area was achieved. Extirpation of the tumour, repair of the frontobasal fractures and of the dural defects was achieved. If the tumour extended infero-laterally, an additional infratemporal fossa approach was used. Furthermore, in cases of tumours involving the

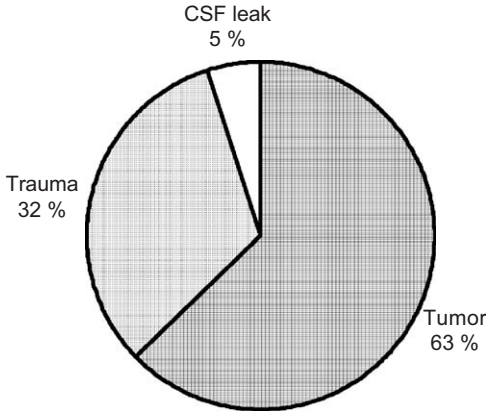

Fig. 1 – Distribution of cases ($n = 59$) in whom the subcranial approach was applied in the years 1996 to 2004 at Turku University Central Hospital.

Table 1 – Tumour diagnoses made in 37 patients

	Number of cases
Benign	
Angiofibroma	4
Angioma	1
Cholesterol granuloma	1
Encephalocoele	1
Fibrous dysplasia	3
Inverted papilloma	1
Meningioma	1
Pseudotumour of orbit	1
Schwannoma	3
Total	16
Malignant	
Adenocarcinoma	2
Adenoid cystic carcinoma	4
Carcinoid tumour	1
Chordoma	1
Aesthesioneuroblastoma	3
Malignant meningioma	1
Melanoma	1
Sarcoma	3
Squamous cell carcinoma	4
Transitional cell carcinoma	1
Total	21

Fig. 2 – (a) Preoperative coronal MRI of a patient (62 years old) with an adenoid cystic carcinoma in the region of nasopharynx and paranasal sinuses. (b) Same, postoperative coronal MRI scan showing absence of tumour and a defect of naso-orbito-ethmoidal complex.