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Transclival injury after routine transnasal rhinological surgery

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ABSTRACT

Objectives: Routine transnasal rhinological procedures are widely practiced and are considered as safe, in general. Skull base lesions occur in less than 1% of procedures and typically involve the anterior or middle cranial fossa, while clivus lesions have not been well documented. Here we present a series of three patients with iatrogenic transclival lesions after routine transnasal rhinological procedures.
Patients and methods: Three patients with penetrating clivus injuries after routine transnasal rhinological procedures were identified. All patients had undergone transnasal rhinological surgery at other hospitals and two of them were referred for emergency treatment. Patients were managed within an interdisciplinary context.
Results: There were two women and one man. Mean age at surgery was 35 years. All operations had been performed under general anaesthesia. In only one instance, perforation of the clivus had been noticed during surgery by the ENT physician, while it went unnoticed in the other two patients. In one patient, no intracranial injury occurred secondary to the clivus fracture, while two patients had extensive brainstem lesions. The first patient survived without deficits, but one patient succumbed to the brainstem injury and the other remained with severe deficits. Risk factors including anatomical variants or distorted morphology were present in all patients.
Conclusion: Transnasal rhinological procedures can result in penetrating clivus injuries, which may not be noticed during surgery, but which can result in permanent morbidity or mortality. These lesions are obviously very rare and their true incidence remains unknown.

1. Introduction

Endonasal surgery including septorhinoplasty and sinus surgery are widely practiced and are considered, in general, as safe procedures [1,2]. Despite the multifold advances, however, achieved in the last decades, surgical complications are still a major issue and can have a negative impact on the outcome of surgery [1–3]. In general, complications in endonasal surgery have been divided into minor or major complications [4–6]. A feared complication is perforation of the skull base resulting in rhinorrhea.

In rare instances, iatrogenic skull base lesions can be associated with injury of intracranial structures like the frontal lobe, intracranial vessels such as the internal carotid artery or the anterior cerebral artery, or cranial nerves like the optic or the olfactory nerve [7–12]. Such injuries of the skull base during rhinological surgery occur mainly in the anterior or in the central skull base [13].

Iatrogenic penetration of the clivus during routine rhinological or maxillofacial procedures appears to be exceptional. Here, we describe three patients with perforating injuries of the clivus secondary to such procedures. Two of them suffered severe injury to the brainstem.

2. Materials and methods

Over a 10-year period, three patients with penetrating clivus injuries after routine rhinological procedures were identified. All patients had undergone surgery at other hospitals after having given informed consent. Two of them were referred for emergency treatment. Patients underwent both CT and MRI imaging to detect the site of lesion.

3. Results

There were two women, and one man. Age at surgery ranged between 18 and 67 years (mean age 35). Procedures performed

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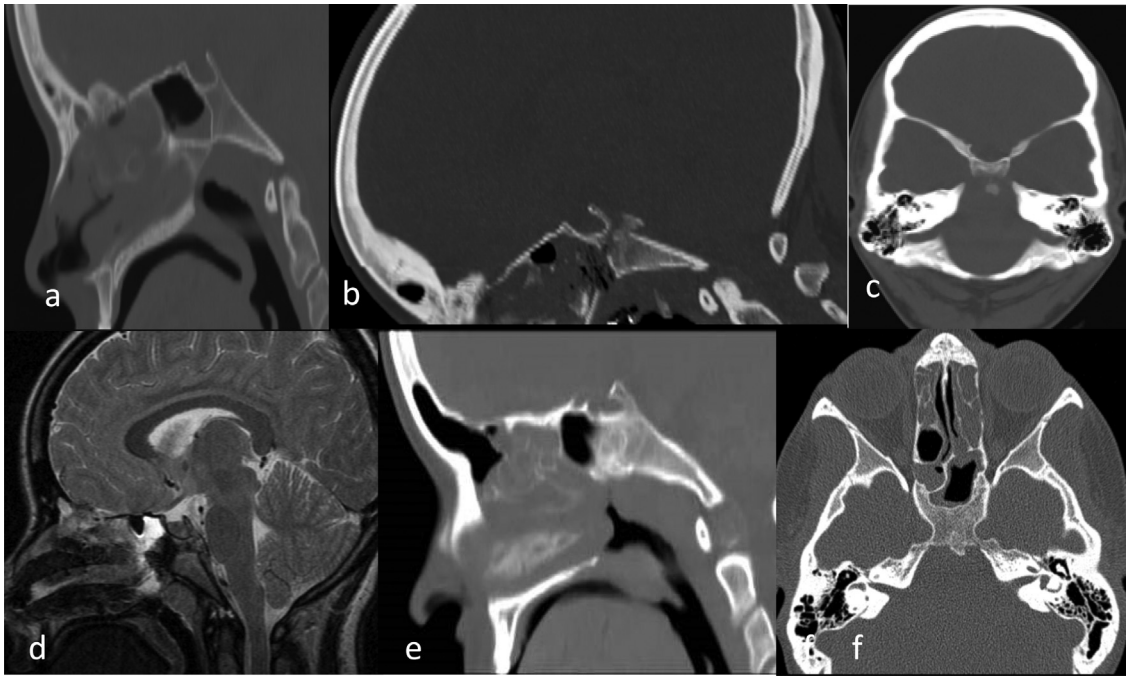

Fig. 1. Case 1. (a) Craniofacial CT before surgery shows pansinusitis involving the sphenoid sinus; note the caudal extension of the sinus to the clivus. (b) CT performed directly after surgery shows the perforating fracture through the clivus (c) and dislocation of a bone fragment behind the clivus. (d) Cranial MRI (sagittal T2-weighted sequences) shows the fracture canal, without injury to the brainstem; note the close position of the basilar artery to the fracture. (e) CT of the skull 6 months after surgery shows healing of the fracture, (f) with a bony "spicule" behind the clivus.

were septorhinoplasty, endoscopic sinus surgery, and closure of a CSF fistula after tumour removal. All operations had been performed under general anaesthesia. Only in one instance, the perforation of the clivus was noticed during the operation by the ENT surgeon. The instrument which was used in this case was a rongeur. While bony fracture injuries occurred in two cases, the most devastating result was noted in a patient with osseous destruction of the clivus by a chordoma. Two patients suffered severe brainstem lesions, which resulted in persistent disability in one patient and in prolonged coma with subsequent death after pneumonia in the other patient.

3.1. Case illustrations

3.1.1. Case 1

An 18-year-old woman suffered from chronic headache, difficulty breathing, and recurrent bronchitis. Craniofacial CT showed chronic pansinusitis with nasal septum deviation (Fig. 1a). She was admitted for septorhinoplasty and sinus surgery in the ENT department at a local hospital.

Surgery was performed under general anaesthesia guided by endoscopy and navigation. During resection of the mucosa in the sphenoidal sinus, the surgeon suspected that the posterior wall of the sphenoidal sinus was accidentally penetrated with the rongeur. A sudden loss of resistance was noted but without CSF flow or hemorrhage. The defect in the mucosa was closed using fibrin coated sponge. A cranial CT performed immediately after surgery showed a lesion of the clivus with a dislocated bone fragment directly posterior to the clivus (Fig. 1b,c). MRI confirmed penetration of the clivus but without involvement of the brainstem and the basilar artery (Fig. 1d).

The patient had no complaints postoperatively. She was referred to our hospital for further observation and treatment. There was no CSF leak in the following period and she was discharged 12 days after surgery. At follow-up, 6 months after surgery she had no neurological deficits. Follow-up CT showed osseous healing of the clival fracture (Fig. 1e,f).

3.1.2. Case 2

A 20-year-old man with severe congenital hypotrophy of the right facial skeleton (Goldenhar syndrome) and a history of several facial surgeries suffered from difficulty with nasal breathing and recurrent sinusitis. CT showed marked osseous deformity and a nasal septum deviation. He was admitted to a local hospital for septorhinoplasty.

Surgery was performed under general anaesthesia without navigation. While the surgeon reported a regular operation without remarkable events, the anaesthesiologist noted sudden and severe intraoperative bradycardia lasting for a few minutes. After the operation, the patient did not wake up. An emergency cranial CT showed a longish subarachnoid and intrapontine haemorrhagic lesion. Additionally, a bony defect in the clivus was demonstrated. A cranial MRI one day after surgery showed a canal perforating through the clivus transversing the right aspect of the pons reaching the fourth ventricle.

Postoperatively, the patient could not be extubated and tracheostomy was performed seven days after surgery. A ventriculo-peritoneal shunt was placed eight days after operation because of developing hydrocephalus. Nasal CSF discharge was noted 10 days later. The clival defect then was closed with a septal flap by endoscopic surgery. The patient was sent to rehabilitation with a hemiparesis on the left side, severe ataxia, severe dysphagia, and severe dysarthria. One year after surgery he was wheelchair-bound, with persistent severe neurological deficits.

3.1.3. Case 3

A 67-year-old woman had a known history of clivus chordoma. She had undergone partial resection of the tumor through a transnasal approach three years earlier. After surgery, proton beam radiotherapy of the residual tumor was administered.