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Case Report

Nasopharynx paraganglioma with extension in the clivus

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Summary

Paraganglioma is a rare benign tumor arising from the sympathetic nervous system. Here we describe an exceptional case of a paraganglioma located in the nasopharynx with an extension through the clivus up to the dura. Atypically, no contact with any major vessels was found.

A radical resection of the mass was performed by an anterior transmaxillary approach through a Le Fort I osteotomy. One year follow up reveals no signs of local or distant recurrence. No cosmetic changes can be observed after the surgery and nasal and masticatory functions are unmodified.

We review the clinical presentation, workup of paraganglioma, as well as the surgical approaches to the clivus.

Keywords: Paraganglioma; clivus; nasopharynx; Le Fort I osteotomy.

Introduction

Paragangliomas, also known as glomus tumors, are rare tumors arising from the sympathetic nervous system.

Paraganglioma location parallels the anatomy of the sympathetic ganglion chains. Glenner and Grimley [7] classified paraganglioma into two main groups: adrenal (i.e. pheochromocytoma) and extra-adrenal. While pheochromocytoma usually secrete catecholamines, extra-adrenal paraganglioma are rarely functional. The extra-adrenal sites were further divided into branchiomeric, intravagal, aorticosympathetic, and visceroautonomic sites. The branchiomeric sites are described anatomically as aorticopulmonary, coronary, intercarotid, jugulotympanic, laryngeal, nasal, orbital, pulmonary, and subclavian [7]. Branchiomeric and intravagal paraganglioma are located in the head and neck, usually stain negative for chromaffin and are rarely functional. Aorticosympathetic paraganglioma are found along the length of the aorta and include the organ of Zuckerkandl. The viscero-autonomic group occurs in visceral organs such as the bladder. Aorticosympathetic and visceroautonomic paraganglioma tend to be chromaffin-positive and are frequently functional [15].

An incidence of paraganglioma of 2.1 cases per million inhabitants per year was found in the Swedish Cancer Registry [18]. About 80% of paraganglioma are adrenal pheochromocytoma and the remaining 20% are extra-adrenal [18, 20], most frequently within the abdomen (85%), followed by the thorax (12%) and the head and neck (3%) [11]. While the true incidence of head and neck paraganglioma is unknown, the most frequent location is the carotid body, followed by the vagus, the jugulare, and the tympanic ''glomus'' [12]. Much rarer locations of head and neck paraganglioma include the larynx and the nasal cavity [14].

Here we describe an exceptional case of paraganglioma located in the nasopharynx with an extension into the clivus, without any contact with major vessels. The tumor was removed by an anterior transmaxillary approach through a Le Fort I osteotomy.

Case report

A 44 years old man, presented with recurrent epistaxis, mostly on the right side for the last 2 years. He was otherwise in good health and his medical history was unremarkable. Rhinoscopic examination revealed a reddish mass obstructing the nasopharynx. The remaining physical

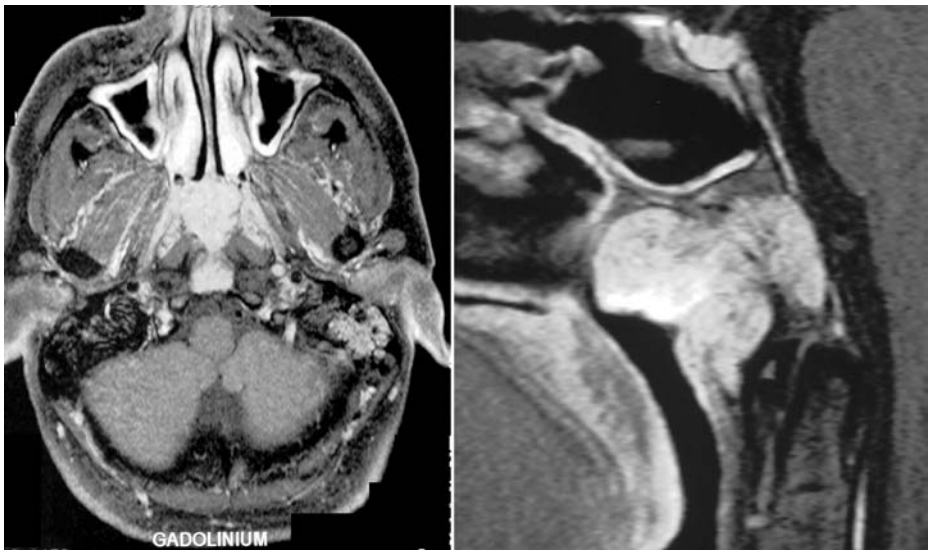

Fig. 1. T1 weighted transverse and sagittal MRI scan after gadolinium perfusion demonstrating the retro pharyngeal mass infiltrating the clivus and entering into contact with the dura. The mass is homogenously enhanced by contrast perfusion

examination, including head and neck, neurological and ophthalmological evaluations were unremarkable. His heart rate was 80 per minute and his blood pressure 130/90 mmHg.

Radiological investigation by CT-Scan and MRI demonstrated a retronasopharyngeal mass extending from below the sphenoid sinus, involving the clivus with destruction of the anterior cortica and infiltration of the clivus spongiosa. The posterior cortica was eroded but still present (Fig. 1). No direct contact of the mass with either carotid arteries was observed. The mass enhanced homogeneously with contrast infusion. The MRI sequences showed that the lesion contained numerous vessels characterized by flow void images. A bilateral Eustachian tube dysfunction was suspected because of the presence of a small amount of fluid in both middle ear cavities and mastoid. An MRI angiography with arterial and venous phases did not reveal any abnormality or contact between the nasopharyngeal mass and the carotid arteries or jugular veins.

Thoracic and abdominal CT-scans were negative, as were 24 hours urinary metanephrin levels. A moderate elevation of 24 hours urinary noradrenalin (602 nmol; normal < 498 nmol) was found, but urinary adrenaline or dopamine levels were normal.

Two transnasal biopsies of the mass were obtained, and the microscopic examination revealed a neuro-endocrine tumor, most probably a paraganglioma. Most cells contained eosinophilic cytoplasm, with almost no visible mitosis. Immunohistochemical stains were negative for common leucocyte antigen, melanoma antigen, S-100 protein, CD31, CD34, CD68, and vasoactive intestinal peptide. Slight positivity was found for low molecular weight cytokeratins and strong positivity was found for neuron-specific enolase, synaptophysin, and chromogranin.

It was decided to resect the tumor through a transmaxillary approach by means of a Le Fort I osteotomy. The operation was performed by a multidisciplinary team consisting of a maxillofacial surgeon (MR), an ENT surgeon (PD) and neurosurgeons (PB; NdT). A circumvestibular incision was made from the anterior part of the zygomatico-alveolar crest to the anterior nasal spine, just above the level of the root apices on both sides. By stopping the soft-tissue incision anterior to the zygomatico-alveolar crest, and undermining posteriorly to the pterygomaxillary junction, one provides a maximal blood supply from the buccal side to both the bone and soft tissues. The periosteum was elevated and reflected superiorly from the anterior and lateral maxillary walls and the infra-orbital nerves were exposed on both sides. Two 1.5 mm thick titanium miniplates in L and Y shapes (Synthes) were adjusted to the anterior and lateral maxillary buttresses and fixation holes were drilled prior to the osteotomy to insure a perfect reposition later on. The plates were removed and a horizontal osteotomy was performed with a reciprocal saw following the classical Le Fort I fracture trajectory (Fig. 2). The mucoperiosteum was elevated off the nasal floor and the inferior limit of the nasal septum on both sides. A nasal septal osteotome was used to sever the nasal septum from the maxilla and a

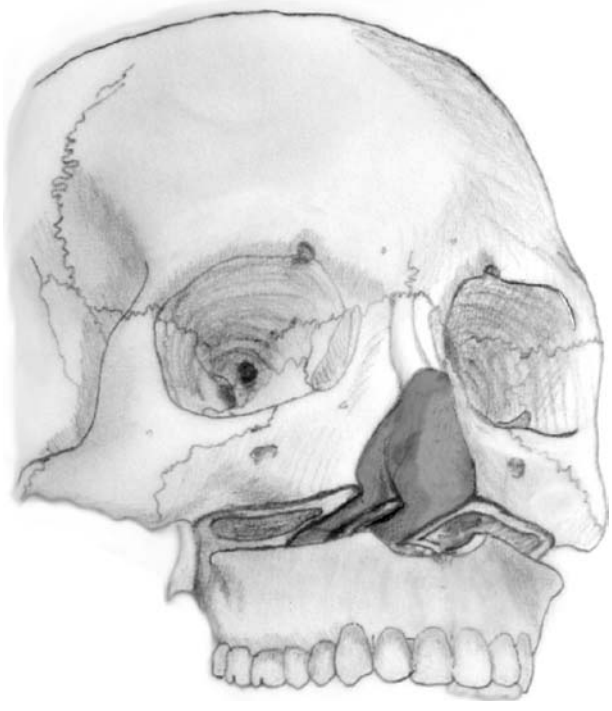

Fig. 2. Drawing showing the classical Le Fort I osteotomy trajectory with mobilization of the palatine plate (inspired with permission from a drawing by M.T. Lawton)

straight osteotome to cut the lateral nasal walls posteriorly to about the first molar area.

The maxilla was then down-fractured using Tessier's small expansion forceps. A total mobilization of the palatine plate was accomplished separating the tuberosity from the pterygoid plates on both sides, taking care not to injure the palatines arteries. The nasopharyngeal mucosa was incised around the choanal aperture and reflected laterally, allowing an unobstructed view of the nasopharynx. A radical tumor resection was undertaken. During surgery the mass was solid and moderate bleeding was encountered. Laterally, some of the remaining clivus bone was drilled out to ensure correct visualization. After excision of the tumor, the dura was exposed and appeared free of tumor infiltration and no cerebrospinal fluid was seen. Upon completion of the resection, the cavity was packed with an abdominal adipose graft covered with fascia lata, which was tacked by a few sutures to the nasopharyngeal mucosa edges and further secured with fibrin glue. The retractors were relaxed. The maxilla was repositioned without temporary maxillomandibular fixation but the teeth were maintained in good occlusion during the positioning of the preformed mini-plates and their fixation in the prepared holes with sixteen 6 mm long and 1.5 mm diameter titanium screws. The dental occlusion was again checked and the gingivobuccal mucosa sutured. The diagnosis of paraganglioma was confirmed by histopathological examination of the resected tumor (Fig. 3).

On discharge, 6 days after surgery, the patient did not complain of malocclusion, nasal regurgitation, or voice changes. The cosmetic result was excellent. The evaluation by the maxillofacial surgeon and an orthopantomogram revealed normal occlusion. Fibroscopic evaluation showed healing of pharyngeal mucosa and normal velopharyngeal closure.

At 6 month following surgery the patient had no complaints. On maxillo-facial examination the facial profile aspect is unchanged. The facial sensitivity and mobility are normal. The maximal mouth opening is of 47 mm with no lateral deviation and 4 mm overbite. Protrusion is of 10 mm and laterotrusion is of 6 mm on both sides. The occlusion is class I on both sides.

Control MRI at 3 and 6 months after surgery showed no signs of recurrence.

The whole body pentetreotide scintigraphy 1 year after surgery does not show any recurrence or metastatic dissemination (Fig. 4).

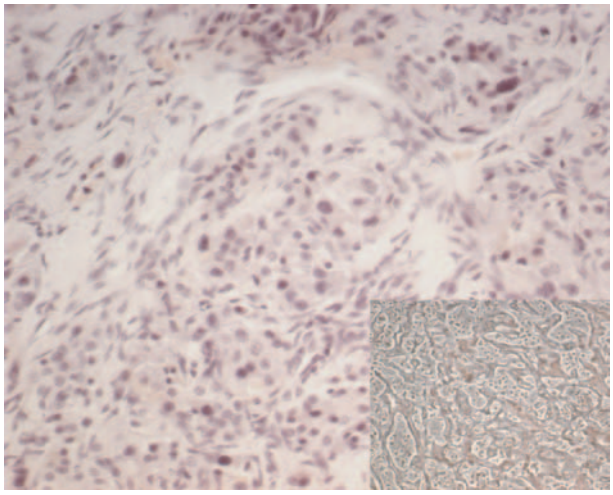

Fig. 3. Hematoxylin and eosin staining of the tumor showing a typical "zelballen" architecture of tumor cells (×200). The inset is a Gomeri staining showing tumor cell lobules surrounded by reticulin fibers (×200)

Discussion

Paragangliomas are painless, usually well-vascularized tumors which grow slowly. The term glomus tumor, frequently used in the otolaryngological literature, is to be proscribed because it is employed for completely unrelated skin glomus tumors, also called glomangioma [5]. Originally, paraganglioma were believed to arise from blood vessel pericytes, similarly to skin glomus tumors, a theory that has been refuted [7].

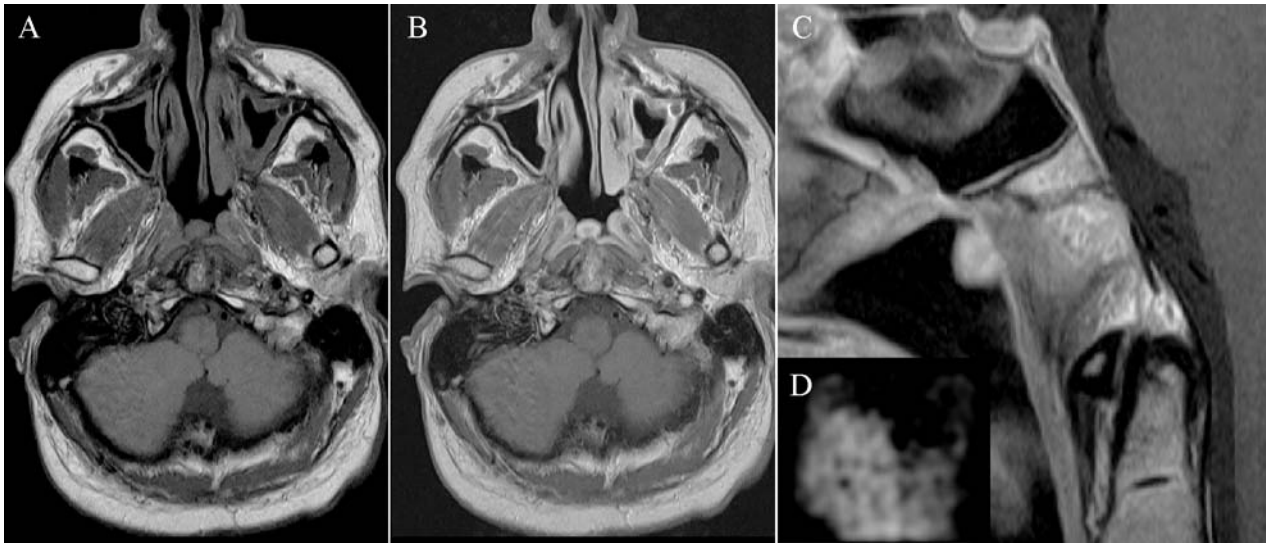

Fig. 4. T1 weighted transverse and sagittal MRI without (A) and after gadolinium perfusion (B, C) showing complete resection as confirmed by the pentetreotide scintigraphy of the head (D). The little contrast enhancement on the retropharyngeal mucosa is scarr tissue as confirmed by endoscopic biopsy

Generally, clinical manifestations are related to a mass effect, impinging on surrounding vessels or nerves. For example, carotid paraganglioma can cause vascular stenosis and thus result in stroke, but most often large carotid body tumors compress surrounding cranial nerves, mainly the vagus and the hypoglossal. Other base of skull paragangliomas commonly present with hearing loss, pulsatile tinnitus or dizziness. Various combinations of palsies of cranial nerves occur when the jugular foramen is involved. Some massive lesions may induce brain stem compression syndromes with ataxia and hydrocephalus.

Occasionally patients present with hypertension due to catecholamine secretion or with carcinoid-like syndrome, characterized by bronchoconstriction, abdominal pain, explosive diarrhoea, violent headaches, cutaneous flushing, hypertension, hepatomegaly, and hyperglycemia due to serotonin and kallikrein release [6]. It is of surgical relevance to remember that tumor manipulation might induce histamine and bradykinin release causing hypotension and bronchoconstriction [8]. The presentation of a paraganglioma with epistaxis as sole manifestation is very rare [14].

Preoperative evaluation of paraganglioma is based on CT-scan and MRI imaging. CT-scan better delineates bone erosion and an arterial flow patterns, demonstrated by rapid sequential scanning after contrast infusion, and is supposed to be characteristic of paraganglioma [13]. On T1-weighted MR, paraganglioma appears as a well-defined hypointense mass with areas of signal void (flow voids) and on T2-weighted MR, a typical ''salt and pepper'' pattern is seen [16]. The presence of somatostatin receptors in paraganglioma has been used recently for radionuclear imaging. Pentetreotide, a radiolabelled octreotide, has been shown to exhibit high sensitivity (above 90%) for paragangliomas bigger than 1 cm [9, 19]. The specificity is a little lower because other neuroendocrine tumors also exhibit somatostatin receptors. Pentetreotide scintigraphy has been found useful for postoperative scanning, as performed in our patient, as well as for evaluating family members of patients with familial paraganglioma (see infra) [9, 19].

The majority of paraganglioma are solitary lesions, but in about 10% of cases they present as multiple tumors, confined to the head and neck or associated with adrenal or extra-adrenal paragangliomas. Paraganglioma can also be associated with well known multi-tumor syndromes, such as multiple endocrine neoplasia type 2b (medullary thyroid carcinoma, hyperparathyroidism, and pheochromocytoma), von Hippel-Lindau disease, neurofibromatosis type I, and Carney's syndrome (paragangliomas, gastric leiomyosarcoma, and pulmonary chondroma) [2].

While initial estimates of familial paraganglioma were variable, recent data show that 35% of head and neck paraganglioma have a hereditary basis [4]. The genes responsible have been localized to chromosomal region 11q (see [2] for a recent review).

Paraganglioma are benign tumors. The prognosis depends on the extent of the surgical resection. Therefore it is mandatory to choose a surgical approach that would allow the best exposure, ensuring radical resection of the tumor while preventing postoperative morbidity and complications.

Three types of approaches are classically described to expose the clivus: transcranial, latero-transcervical, and anterior approaches. Transcranial approaches, either subfrontal or subtemporal or through the posterior fossa, are commonly used for intradural non-midline lesions close to the clivus. In the context of this extradural midline lesion anterior to the brain stem, the transcranial approaches are not appropriate. An exclusively extradural approach is preferred to reduce the risk of cerebrospinal liquid leakage and meningitis. In addition, exposure of midline structures requires extensive cerebral retraction with associated risks of severe complications. Lateral transcervical approaches have the advantage of minimizing infectious problems because the retropharyngeal route used avoids opening the aerodigestive tract. The lower third of the clivus and the lateral cervical spine are adequately exposed, while the dorsal and medial part of the clivus are difficult to reach without risking lower cranial nerve or carotid artery injury.

Anterior approaches are considered to be superior to lateral approaches because they provide a good exposure in the midline and are associated with decreased risk of damage to major vessels and cranial nerves. The transsphenoidal approach to the cranial base is limited by the pyriform fossa and the bony nasal cavity. It provides access only to the planum sphenoidale and upper third of the clivus. We use this approach for sphenoid and pituitary lesions. Transoral direct approach to the clivus exposes the lower clivus and the cranio-cervical junction. A number of modifications have been made to the technique to improve cranial access to the clivus by splitting the palate or dividing the mandible. Even with those improvements the exposure of the most cranial part of the clivus is limited.

Transfacial approaches with facial skin incisions or midface degloving procedure followed by various osteotomies of the facial bones have been reported. These procedures

provide an excellent exposure to the complete clivus. The transmaxillary osteotomy following the Le Fort I fracture line with downward displacement of the maxilla provides a wide exposure to the posterior nasopharynx from the sphenoid sinus down to the clivus and to the anterior part of the foramen magnum [1, 3]. It allowed us to preserve the mucosa of the nasal septum and floor, thereby maintaining nasal function. No facial incision was necessary, the vestibular incision being sufficient. Proper technique permits preservation of tooth vitality and lacrimal drainage. To minimize the risk of nasopharyngeal insufficiency, we filled the bone defect in the clivus with abdominal fat and covered it with fascia lata.

If needed, the exposure can be extended downwards by splitting the palate and by rotating it laterally [17]. This manoeuvre increases the cranio-caudal exposure while restricting the lateral view. To increase the cranio-caudal exposition without impairing the lateral exposure, Kyoshima *et al.* [10] recently proposed to extend the osteotomy upwards by associating it with a naso-maxillary osteotomy. This approach has the advantage of reaching the clivus and the upper cervical spine by a submucosal route without sectioning the mucosa of the oropharynx. Preserving the soft palate also decreases the risk of velopharyngeal insufficiency.

Paraganglioma are rare benign well vascularized tumors originating from the sympathetic nervous system. Because these tumors are sometimes multicentric and secretory a preoperative workup has to include pentetreotide scintigraphy and blood metanephrine levels. Surgery is the favoured curative modality and should use an approach allowing excellent exposure with minimal risks of morbidity.

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Comments

The authors present a rare case of a retropharyngeal midline paraganglioma (glomus tumour) with extension into the clivus. The tumour was successfully removed via a transfacial approach. This is indeed a rare case, and it is of some interest for the reader of Acta Neurochirurgica. The discussion and review of the literature highlight the characteristics of the entity well.

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Duesseldorf

The manuscript deals with a case report of a paraganglioma of the skull base operated interdisciplinarily. The procedure involved three specialities, which is our idea of skull base surgery today.

The approach appears worth a description, since it really provides an excellent view of the epipharynx.

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