Endoscopic Resection of Clival Malignancies

Adam J. Folbe, MD[a,b], Peter F. Svider, MD[a,*], James K. Liu, MD[c,d], Jean Anderson Eloy, MD[c,d,e,f]

KEYWORDS

• Clivus • Clival tumor • Clival lesion • Clival chordoma • Chordoma
• Chondrosarcoma • Endoscopic endonasal approach • Skull base surgery

KEY POINTS

- Managing clival lesions using a minimally invasive approach presents numerous therapeutic challenges because of the close proximity of surrounding critical structures, including the basilar artery, brain stem structures, and cranial nerves.
- In leading skull base centers, the surgical management of clival lesions has evolved considerably from aggressive external approaches to endoscopic endonasal approaches in select cases.
- Although chordomas and chondrosarcomas are the most common clival lesions, a broad differential diagnosis should be considered during evaluation of clival lesions.
- Identification of the vidian nerve intraoperatively is of paramount importance, because finding this structure helps keep the surgeon below the internal carotid artery.

INTRODUCTION

When the tumors appeared at the base of the skull, death usually followed a history of cranial nerve disturbances with pressure symptoms.
— Dr Ernest M. Daland, 1919[1]

Disclosures: None.
Conflicts of Interest: None.
[a] Department of Otolaryngology–Head and Neck Surgery, Wayne State University School of Medicine, 4201 St. Antoine, 5E-UHC, Detroit, MI 48201, USA; [b] Department of Neurosurgery, Wayne State University School of Medicine, 4201 St. Antoine, 5E-UHC, Detroit, MI 48201, USA; [c] Department of Otolaryngology–Head and Neck Surgery, Rutgers New Jersey Medical School, 90 Bergen Street, Suite 8100, Newark, NJ 07103, USA; [d] Department of Neurological Surgery, Center for Skull Base and Pituitary Surgery, Neurological Institute of New Jersey, Rutgers New Jersey Medical School, 90 Bergen Street, Suite 8100, Newark, NJ 07103, USA; [e] Endoscopic Skull Base Surgery Program, Rhinology and Sinus Surgery, Otolaryngology Research, Department of Otolaryngology–Head and Neck Surgery, Rutgers New Jersey Medical School, 90 Bergen Street, Suite 8100, Newark, NJ 07103, USA; [f] Department of Ophthalmology and Visual Science, Rutgers New Jersey Medical School, 90 Bergen Street, Suite 8100, Newark, NJ 07103, USA
* Corresponding author.
E-mail address: psvider@gmail.com

Otolaryngol Clin N Am 50 (2017) 315–329
http://dx.doi.org/10.1016/j.otc.2016.12.008
oto.theclinics.com

Managing clival lesions using a minimally invasive approach presents numerous therapeutic challenges because of the close proximity of surrounding critical structures, including the basilar artery, internal carotid artery, brain stem structures, and the cranial nerves. Discussing his operative technique in *Curetting Tumor at Base of Skull*, Dr C.A. Porter detailed surgical steps in the management of a patient with a chordoma in the early twentieth century:

> *Incision [was] made over [the] growth and colloid like material curetted out with free hemorrhage. [The] curette [was] passed upwards and inwards and large masses of material obtained. The greater part of the base of the skull was denuded and the base bone felt everywhere. Bleeding gradually ceased.*[1]

Surgical management of clival lesions has evolved considerably since then, as endoscopic endonasal approaches now represent the standard of care for many lesions at leading skull base centers.[2–5] Nonetheless, the significant potential for serious neurologic consequences makes an understanding of the complex anatomic relationships encountered exceedingly important. Principles of preoperative workup, surgical preparation, intraoperative management, and postsurgical care are discussed in this article, with illustrative examples of diagnostic imaging and endoscopic anatomy. In addition, the various disorders presenting as clival lesions are discussed.

DIFFERENTIAL DIAGNOSIS OF CLIVAL LESIONS

Although chordomas are the most common clival lesions, they are not the only disorder identified. A differential diagnosis can have implications in terms of patient counseling and prognosis. Surgical resection is the mainstay of treatment of most lesions, and radiation therapy can be considered either as primary therapy among poor surgical candidates or as adjuvant therapy for aggressive or recurrent disease.

Radiologic Characteristics of Clival Lesions

Differentiating factors affecting imaging interpretation are detailed in **Table 1**. Importantly, chordomas usually originate at the midline (**Fig. 1**) whereas chondrosarcomas are more commonly paramedian (**Figs. 2** and **3**). Depending on the primary tumor, metastasis to the clivus usually has lower signal on T2-weighted magnetic resonance (MR), compared with greater signaling from chordomas and chondrosarcomas.[6] Lesions originating from the clivus as well as the nasopharynx tend to elevate the pituitary gland, in contrast with invasive pituitary macroadenoma involving the clivus, which surrounds the pituitary and makes discrete identification of the pituitary difficult.[6]

Chordoma

Developing from cells thought to be remnants of the embryonic notochord, clival chordomas can commonly present with nonspecific symptoms such as pain and headaches. Furthermore, patients may present with abducens nerve (cranial nerve VI) deficits caused by the close proximity of Dorello's canal, trigeminal nerve (cranial nerve V) involvement, and in some cases lower cranial nerve deficits. In more advanced disease, there can also be cerebellopontine angle extension (**Fig. 4**). Analysis of population-based resources such as the Surveillance, Epidemiology, and End Results (SEER) database reveals that chordomas occur predominantly among men more than 40 years of age, and have an incidence of 0.08 per 100,000 people.[7] Younger patients are more likely to have intracranial and clival lesions, and the overall 5-year survival rate has been reported to be 65% to 67.6%,[7] which is significantly