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Operative Techniques in
Orthopaedics

Anterior Transoral Resection

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Anterior transoral odontoid resection is a useful surgical treatment for ventral, midline irreducible pathology at the craniocervical junction. With modern imaging and surgical advances, transoral odontoid resection can be safely performed. Evaluation and care of the patient undergoing transoral surgery are reviewed, as are relevant anterior craniocervical anatomy, surgical indications, operative technique and complication avoidance.
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Anterior odontoid resection was first described by Fang and Ong in 1962,[1] when they published their series of patients who underwent the transoral approach for decompression of the spinal cord and brainstem for irreducible compressive atlantoaxial pathology. Nevertheless, given the high complication rate observed in the early experience associated with this procedure, many have avoided surgery via this route. As technology improved, however, and better imaging techniques became available, including improved surgical technique, the use of the operating microscope, frameless stereotaxy, and improved antibiotics, there has been a resurgence in the use of the transoral approach.[2] Through meticulous planning and a detailed understanding of anatomy of the craniovertebral junction, it is possible to perform the procedure in a safe, effective manner to address irreducible pathology at the craniovertebral junction.

Indications

The transoral approach is indicated for ventral midline irreducible extradural pathology at the levels of atlas and the axis (Fig. 1). Most commonly, the procedure is used to decompress the craniovertebral junction when craniovertebral settling is present and for resection of a compressive pannus associated with rheumatoid arthritis. Compression at this junction also can be seen secondary to neoplasms, basilar invagination, other causes of craniovertebral settling, congenital deformities, fibrocartilaginous masses (nonrheumatoid pannus formation) secondary to chronic nonunion, and other soft tissue masses in the region. Some authors have even used the approach for intradural pathology, including meningiomas and schwannomas,[3] and even vascular lesions.[4-6]

Physical Examination

Patients considered for the transoral approach undergo examination of the oral cavity. Ideally, a patient should be able to open his or her mouth greater than 25 mm. This would permit improved visualization of the pathology as well as provide the needed room to access the region surgical instrumentation. Nevertheless, the procedure can be performed in patients with minimal mouth opening with the assistance of various mandibular splitting/osteotomy techniques to increase exposure.[7-10]

The mouth should be inspected for any evidence of infection, including dental caries, periodontal abscesses, and dental root abscesses. Irregularities in the dentition may make retractor placement difficult; thus, authors have advocated gum guards to be fashioned before surgery that accommodate both irregular dentition and standard retractors. Additionally, the temporomandibular joint should be inspected in mouth opening because pathology here could limit mouth opening and subsequently the use of this approach. A detailed neurologic and musculoskeletal examination must be performed.[11]

Surgical Anatomy

A detailed understanding of the cervical anatomy of the craniovertebral junction and detailed imaging is mandatory be-

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Figure 1 T2-weighted sagittal MRI (A) and CT (B) sagittal reconstruction demonstrating an os odontoideum with associated irreducible midline ventral cyst compressing the spinal cord. The cyst has high signal on T2 weighted imaging and may have resulted from chronic instability.

fore undertaking the transoral approach. Below the level of foramen magnum, the oropharynx is well delineated from the prevertebral fascia by an areolar tissue plane. It should be noted that the oropharyngeal mucosa heals very well after surgical incision and repair. In terms of bony landmarks, the most important anatomic structure is the anterior arch and tubercle of C1. Additionally, on each side of the dens is flanked by the longus coli muscle and more laterally the dens if flanked by the longus capitis muscle. The anterior longitudinal ligament then continues caudally at the midline.[11]

It is imperative to know the location of the vertebral arteries when performing this approach. Typically, the vertebral arteries are located 14 mm laterally from the midline at the arch of C1 and approximately 11 mm laterally at the C2-3 junction and at the foramen magnum (Fig. 2). Nevertheless, this can be considerably distorted by pathology such as rotatory subluxation. Typically, however, the anatomic midline can accurately be defined via the position of the anterior longitudinal ligament and longus colli muscle.[12] If anatomic variations are significant (as seen in Down's syndrome) or are anticipated, imaging with fluoroscopy or use of intraoperative frameless stereotaxy are extremely helpful.

Preoperative Work-Up

The preoperative workup for this procedure should include detailed imaging of the cervical spine. This includes both plain films with flexion/extension views and computed tomography (CT) scans with sagittal and coronal reformatting for a detailed understanding of bony anatomy. Magnetic resonance imaging (MRI) is very useful for further imaging any soft-tissue pathology. Because some odontoid lesions consist entirely of soft tissue and others entirely bone, and many with both, both studies should be performed whenever possible. Additionally, detailed bony imaging obtained from CT scan may be useful in planning posterior stabilization procedures.[13,14] Finally, fluoroscopic CT imaging (Iso-C) may also be useful intraoperatively.

Other considerations are the relationship of the hard pallet with the pathology. Although not usually an issue with pannus formation, this is a major issue if using the transoral approach for craniovertebral settling. The ideal candidate for the transoral approach can open his/her mouth widely and extend the neck well to facilitate procedure. Nevertheless, many of these patients have spinal instability limited neck extension and exposure.