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Operative Techniques in

Neurosurgery

Transoral Approach to the Ventral Craniocervical Border

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The transoral approach to the ventral craniocervical border is the most direct route for decompression of irreducible extradural pathology. These procedures encompass the transpalatal, transoropharyngeal, and median mandibulotomy with glossotomy. We share the senior author's (AHM) experience with 693 patients treated via the transoropharyngeal-transpalatal route. Since 1977 the procedure has evolved into a safe and direct approach, associated with minimum morbidity and mortality rates. With this technique, 97% of patients require craniocervical stabilization, which is now performed at the same surgical setting as the transoral procedure.
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The relevant diagnostic imaging for abnormalities at the craniocervical junction consists of plain radiographs of the region, including skull and cervical spine X-rays and dynamic studies in the flexed and extended positions to assess stability and the need for possible reduction.[1] The cervical spine radiograph should include the mandible so the relationship of the craniovertebral border to the hard palate and its accessibility can be judged. In patients with normal anatomy (eg, patients with rheumatoid arthritis or tumors affecting the craniocervical border), the configuration of the clivus is normal, that is, almost vertical. Thus, with a transoral approach, elevation of the soft palate suffices to provide anterior exposure of the craniocervical junction. In patients with congenital abnormalities associated with hypoplasia of the clivus and an upper cervical spine that has "ascended," the clivus tends to become almost horizontal. Consequently, the soft and hard palates must be sectioned.[2]

Computed tomography (CT) of the craniovertebral junction (CVJ) is an integral part of the assessment of bony pathology. Conventional CT is further augmented by 3-dimensional CT reconstructions. This modality shows the location of the occipital condyles, the lateral atlantal and axial masses, and the odontoid process. In congenital abnormalities, the odontoid process is actually smaller than is typical in adults because of segmentation abnormalities.

Magnetic resonance imaging (MRI) is a mainstay of the neurodiagnostic armamentarium. T1- and T2-weighted midsagittal MRIs should be in both the flexed and extended positions. This modality provides information about the neural structures and their relationship to the osseous abnormality and vascularity. Magnetic resonance angiography has been performed when neurological dysfunction cannot be explained fully. It is obtained with patients in rotation, flexed, and extended positions to identify vascular occlusions that can appear when the patient changes position.

Assessment of Nutritional Status

This issue is particularly important in patients who have had difficulty with swallowing and failure to thrive. It is also important in patients with advanced rheumatoid arthritis, atlantoaxial dislocation, or rheumatoid vertical migration that compresses the brain stem. Preoperative nutritional support is mandatory before operative intervention. Failure to do so results in wound dehiscence and nonfusion.

Dental Hygiene

Dental hygiene is addressed to remove causes of bacterial contamination, such as dental caries, pyorrhea, and gingivitis, in the operative field. Dental guards are applied to protect the upper and lower dentition during surgery. The guards are made from a transparent material and are fairly thin. They should be available during the procedure.

Assessment of Comorbidities

Abnormalities of cranial nerves IX, X, and XII can cause brain stem dysfunction. It then becomes necessary to perform pulmonary function studies and to assess for sleep apnea. Significant

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loss of vagal, hypoglossal, and glossopharyngeal nerve function mandates a tracheostomy before proceeding with surgery. Likewise, assessment of cardiac status is crucial.

Oropharyngeal Cultures

Oropharyngeal cultures are obtained 3 to 4 days before surgical intervention. The cultures are obtained from the oropharynx and nasal passages. No antibiotics are instituted if normal nasal flora is present. As a precaution, Nystatin rinses and Peridex gargles are performed 3 times a day before the procedure (for 4 days). Twice a day before the surgery, mupirocin nasal ointment is used in the nasal passages.

Preoperative Traction

Skeletal traction is usually applied through an MRI-compatible crown halo device to assess the "reducibility of the lesion." The crown halo traction is instituted 4 days before planned anterior and posterior surgical procedures for the craniocervical junction. If a lesion is reducible, dorsal fixation is performed.[1] If it is irreducible, both ventral and dorsal procedures are required.[3]

Crown halo traction is performed under mild intravenous sedation and topical and local anesthesia. The patient is placed supine with a pad underneath the shoulders and head. The crown halo is positioned just at the equator of the cranium. Pins placed above that plane have a tendency to pull out, or the entire crown falls off. Hence, it is important to place the frontal pins at least 2.5 cm above the supraorbital margin.

A retromastoid pin is placed on either side. In an adult, four pins are used, two on either side. The fixating cups hold the crown halo in position, and the patient is asked to close the eyelids. The pin entry sites are cleansed with 10% PVP-iodine, and the pin entry points are infiltrated with 0.5% xylocaine solution with 1:200,000 epinephrine. The pins are tightened diagonally and sequentially to a total of 8 lbs of pressure for a normal adult. The pins are fixed in this position with a hex nut control, and a handle is attached to the crown halo for traction.

In a child between the ages of 4 to 6 years of age, six- to eight-pin fixation is used. The maximum tightening pressure for a 4-year-old is 4 lbs. At 6 years of age, four to six pins are used with the torque pressure of 5 to 6 lbs. In young children, the traction is performed under general anesthesia.

The patient is nursed in an intensive care setting. The cervical traction is maintained with mild elevation of the head (about 15 to 20 degrees above the chest). Cervical traction in an adult is initiated at 6 lbs and gradually increased to 9 lbs by the end of the first day. Lateral radiographs are obtained to assess reduction. In an adult, the maximum traction is 15 lbs, which is applied over 2 days. During this time the patient is nursed supine with "logrolling" allowed to 30 degrees to either side. At the end of 48 hours, an MRI is performed with the patient in cervical traction to assess the osseous-neural relationships and reduction. In a 4- to 5-year-old child, the traction is initiated at 4 lbs weight and cannot exceed 7 to 8 lbs.

A similar procedure is performed in patients with a congenital abnormality or tumor who will be undergo an anterior transoral-transpalatopharyngeal resection. In that situation, the crown halo is placed intraoperatively.

Operative Technique of Transoral-Transpalatopharyngeal Approach to the Ventral Craniocervical Border

The transoral-transpalatopharyngeal route to the craniocervical border is a safe and direct approach to this region.[1,4,5] Between 1977 and 2004 the senior author used this technique for 693 patients. The associated infection rate was less than 1%. A dorsal occipitocervical fusion was necessary in all patients.

Indications

The ventral transoral-transpalatopharyngeal route to the craniocervical border is indicated in irreducible ventral bony abnormalities associated with bony compression of the cervicomedullary junction. This approach is reserved for extradural bony and soft tissue masses and a few intracranial intradural tumors. Elevation of the soft palate allows exposure of the inferior third of the clivus (in a patient with normal clival anatomy). However, in congenital pathological states associated with basioccipital hypoplasia, a foreshortened clivus is oriented more horizontally than vertically. Consequently, resection of the inferior portion of the posterior hard palate is needed to gain exposure. In this manner, the upper portion of the clivus can be visualized. The inferior extent of the exposure, which is limited by the amount of depression of the tongue, is the C2-C3 interspace (Fig. 1).

A median glossotomy allows caudal exposure to the vertebral body of C4. The lateral extent of this exposure is between the condylar canals of the hypoglossal nerve (18 mm to either side of midline), the Eustachian tubes, and the vertebral artery before it enters the intradural space. When a tumor such as a chordoma has created the dissection, the exposure may extend as far laterally as the medial aspect of the jugular foramen. By this time, reduction of a bony lesion has already been attempted and the patient is recognized as having an irreducible ventral bony abnormality (Fig. 2A).

The ability to open the mouth and the space between the incisor teeth must be at least 3 cm. Achieving this opening is facilitated by the use of paralyzing agents during the general anesthetic. Preoperative antibiotics consist of 1 g of penicillin G started 2 hours before the procedure begins.

Operative Procedure

In the operating theater, the patient's cervical collar is maintained around the neck as a precaution during intubation, maneuvers, and positioning. Topical and regional anesthesia is administered before fiberoptic oral endotracheal intubation is performed while the patient is awake. Next, general anesthesia is induced. The patient is positioned supine, and the crown halo traction is placed if it was not already applied preoperatively. The patient is then positioned supine on the operating table with the head resting on a Mayfield headrest in mild extension with cervical traction at 7 lbs (4-5 lbs weight in a child) (Figs. 2B,C).

With sutures and adhesive tape, the oral endotracheal tube