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CASE REPORT

Transnasal Endoscopic Removal of Malformation of the Odontoid Process in a Patient with Craniovertebral Anomaly

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ABSTRACT

The endoscopic endonasal approach is emerging as a feasible alternative to the transoral route for the resection of the odontoid process, when the latter produces a compression of the brainstem and cervicomedullary junction. This type of approach has some advantages, such as excellent prevertebral exposure of the craniovertebral junction in patients with small oral cavities and the possibility to avoid the use of mouth retractors. A report of two patients with a diagnosis of craniovertebral anomaly—basilar invagination into foramen magnum, suffering from an extreme posterior tilt of the odontoid process causing severe anterior compression of the cervicomedullary junction, is presented to stress the potential of this technique to the endoscopic rhinologist. Transnasal endoscopic removal of the odontoid process was performed and resolution of the ventral compression was achieved. This report demonstrates that, in selected cases, a multidisciplinary team approach can help our patients.

Keywords: Transnasal endoscopic approach, Odontoidectomy, Basilar invagination, Brainstem compression.

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INTRODUCTION

Craniovertebral anomalies represents one of the most common pathological bony abnormalities encountered by pediatric neurosurgeons and orthopedicians which includes sometimes a basilar invagination of the upper cervical vertebrae into the foramen magnum with variable degree of occipitalization of the atlas. In a minority of cases, it is complicated by irreducible ventral compressive pathological features due to a severely retroflexed and malformed odontoid process.[1] In the presence of ventral brainstem compression, the most widely used anterior approach to the cervicomedullary junction via the atlantoaxial region is the transoral route,[2,3] but this approach can prove difficult for a number of reasons: (i) A deep and narrow surgical field depending on the dimensions of the oral cavity of the patient; (ii) the possibility of splitting of the soft/hard palate in the case of lesions located cranially to the palatal plane, causing a possible deglutition dysfunction; (iii) the possibility of prolonged postoperative intubation due to massive edema caused by oral retraction. Nevertheless, in recent years, based on a dissection study by Alfieri et al,[4] Kassam et al[5] have developed a new anterior transnasal approach for resection of the odontoid process in the case of severe brainstem and cervicomedullary junction compression in adult patients. Herein, my personal experience is reported in two cases of transnasal endoscopic removal of the odontoid process affected by basilar invagination with severe cervicomedullary junction ventral compression.

CASE REPORT

A 12-year-old female patient presented at our service, with complaint of tilting of neck (torticollis) to right side present since birth; but progressively increasing with severe restriction of neck movements since last 2 to 3 months. She also had a complaint of weakness of right upper extremity since last 1 to 2 months. A neurology examination revealed a reduced (grade III) power in the right upper extremity with grade V power in the left upper extremity and an ankle clonus on the right side (hyper-reflexia due to an upper motor neuron lesion). MRI cervical spine revealed a marked basilar invagination of the cervical spine into the foramen magnum with platybasia, partial fusion of the anterior portion of C1 with the cranial base (occipitalization of the atlas) and a severe posterior tilt of the odontoid process causing a severe ventral compression of the cervicomedullary junction (Figs 1A to C).

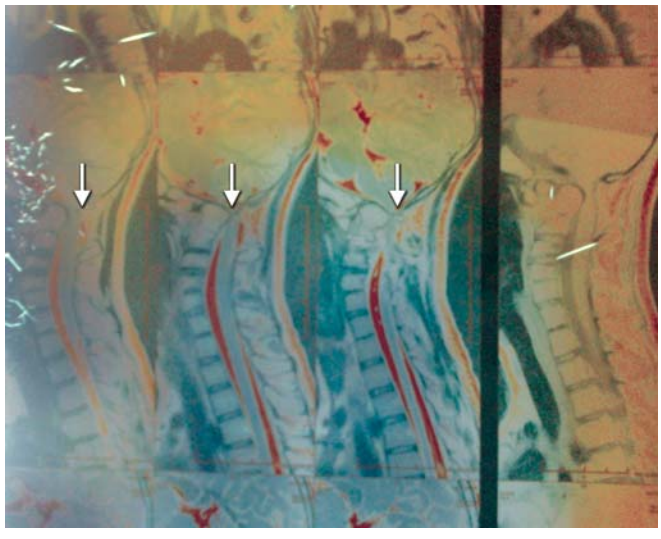

Fig. 1A: Preoperative MRI T2W sagittal view showing a malformed odontoid process causing ventral compression at the foramen magnum level (white arrows)

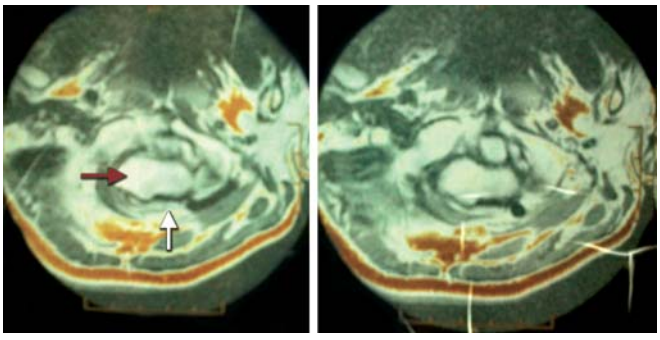

Fig. 1B: Preoperative MRI T2W axial cuts showing a severely compressed cervicomedullary junction (white arrow) by the malformed odontoid process (red arrow)

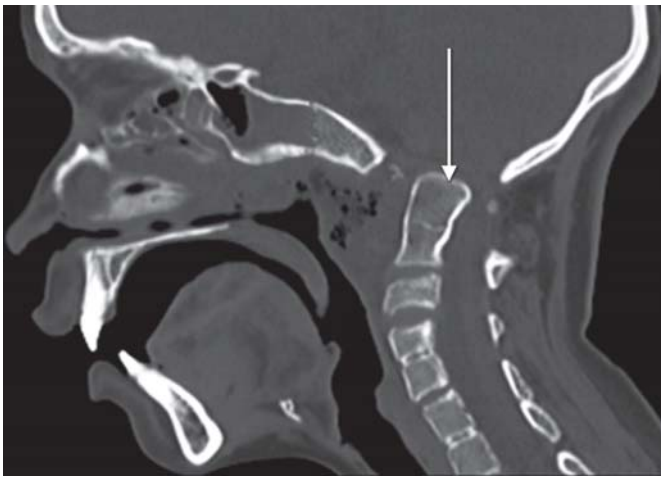

Fig. 1C: Preoperative CT sagittal view bone cuts showing a malformed odontoid process (arrow) projecting into the foramen magnum

The patient was planned for a transnasal endoscopic removal of the odontoid process. A 0° endoscope with an irrigated sheath was introduced into the right nasal fossa and the common landmarks were visualized; posteriorly the choana and rhinopharynx, cranially the anterior wall of the sphenoid sinus, caudally the soft palate and laterally the ostium of the Eustachian tubes were recognized, to correctly delimit the surgical field. To achieve a better and wide angle view, the rostral portion of the nasal septum was removed. Two flexible catheters were introduced into both nostrils and withdrawn from the oropharynx to push down the soft palate; thus giving the surgeon a wide surgical field to improve navigation. An inverted U-shaped incision was kept in the mucosa of the nasopharynx setting following limits: Superiorly at the level of the inferior edge of the sphenoid sinus and laterally at the ostium of the tubes. The inferiorly based mucosal flap was gently rebated in the oropharynx and thus the muscular prevertebral fascia was clearly exposed, consisting in longus capitis and longus colli muscles. These were dissected and partially sectioned to expose the lower end of clivus, atlanto-occipital membrane and the anterior arch of C1. In the case reported herewith, a partial fusion of the anterior arch of the atlas with the occipital bone was present and hence always taking the clival region as the superior surgical limit, the anterior arch of C1 was drilled in the midline (the central 20 mm; being laterally limited by the vertebral arteries on either side) to expose the odontoid process; at this point, the lateral limits of drilling were represented by the occipital condyles and the atlanto-occipital joints that should be preserved. The complete visualization of the cranial portion of the odontoid process was not possible due to presence of an accessory ossicle at the lower end of clivus which was drilled decompressing the anterior margin of the foramen magnum. Now once the whole body of the odontoid was exposed, it was drilled at its base at the level of the lower edge of the body of C1. The drilling was progressively and cranially until the odontoid was reduced to a thin bone cap, adhering to the underlying dura mater and now piecemeal resected. At the end of the surgical maneuvers, the mucosal flap was rebated in the nasopharynx and fibrin glue and absorbable packing was placed in the nasopharynx.

In the immediate postoperative period, the patient wore a rigid cervical collar and hospitalization was uneventful; a postoperative CT scan revealed complete removal of the posteriorly tilted part of the odontoid process and the anterior arch of C1, partial resection of the lower clival region (accessory ossicle) and resolution of the ventral compression of the cervicomedullary junction (Fig. 2).

The patient was discharged on the 10th postoperative day with advice to continue to wear a cervical collar postoperatively. She had complete neurological recovery.

The second patient, a 45-year-old female with similar presenting neurological complaints precipitated by a fall, had on imaging, besides a basilar invagination with a retroverted odontoid; a rotation of the cervical spine

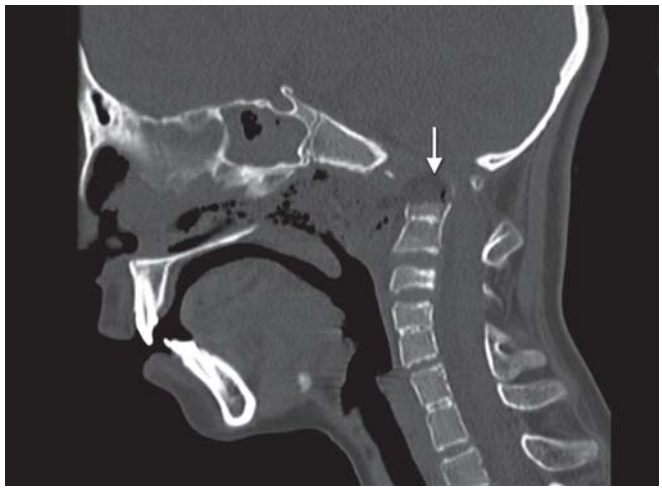

Fig. 2: Postoperative CT sagittal view bone cuts showing the odontoid process drilled away (arrow) thus, decreasing the overcrowding at the foramen magnum

Fig. 3: 3D reconstruction CT image showing differential position of C1 and C2 vertebrae

(Fig. 3) which made the complete access to the offending part of the odontoid a challenge (Fig. 4).

DISCUSSION

In some patients, craniovertebral anomaly could be associated with ventral brainstem compression, resulting in many neurological dysfunctions. In these cases, multistep surgery may be required, including posterior cranial fossa decompression and an anterior approach to the ventral craniocervical junction.[6]

The traditional transoral approach for resection of the odontoid process provides the most direct route to the ventral craniocervical junction, without injury to the major neurovascular structures.[4,7,8] However, this kind of surgical technique presents some disadvantages: (i) Splitting of the soft and hard palate (that can lead to dysphonia and deglutition problems due to velopharyngeal insufficiency), when an additional rostral and clivus exposure is needed; (ii) tongue swelling and ischemic necrosis, as a result of prolonged compression; (iii) risk of damaging teeth with retractors; (iv) the possible addition of tracheostomy, to avoid postoperative problems derived from airway swelling and upper airway obstruction, and gastrostomy or nasal feeding incumbent with prolonged hospitalization.[9-11]

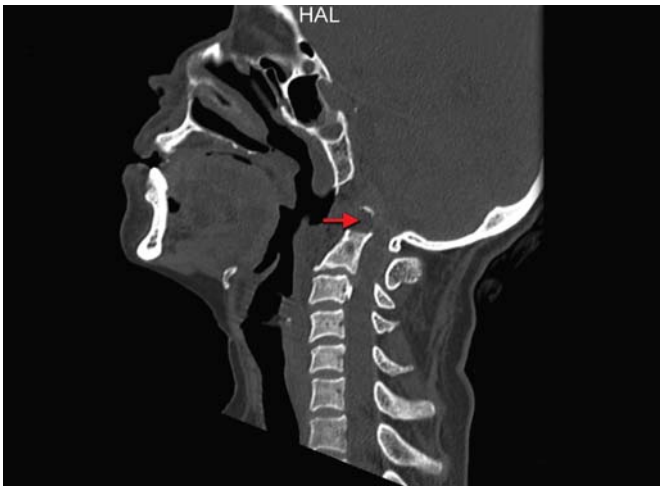

Fig. 4: Postoperative CT of second patient with red arrow showing the removed offending part of the odontoid process

The introduction of the endoscopic endonasal approach to the ventral craniocervical junction results from years of experience and improvements with this technique in skull base surgical practice.[4,5] The use of an endoscope for the anterior approach, when compared with the nonendoscopic technique, offers many surgical advantages, such as a wide panoramic view and the opportunity of placing the optical lens close to the surgical target. It also allows exploration into the narrow surgical anatomy and to obtain angled views to the anatomical corners.[4] The endoscopic transnasal approach provides excellent prevertebral exposure of the craniovertebral junction in patients with small oral cavities, such as those with craniofacial abnormalities, and unlimited surgical access to the rostral midline craniocervical junction; however, it permits less access up to C2 than the transoral approach and is limited by the patient's nasal anatomy[4,6,8] and rotation of the cervical spine on its own axis which if present may make the access to it more difficult. Other advantages of the endonasal route are: The surgical corridor is now above the hard palate, and avoids splitting this structure; the use of mouth retractors is no longer necessary, which eliminates oral trauma with all the related complications. Also, the defect created by this approach should not be exposed to the same degree of bacterial contamination from the oral cavity and oropharynx.[5]

Furthermore, its our contention that an anterior endoscopic approach to the offending part of the odontoid at the foramen magnum can adequately decompress the ventral cervicomedullary junction without creating craniovertebral instability; thus obviating the need for a posterior fixation. However, there are no references in the literature to this concept and we will need to do more cases to support this hypothesis.

CONCLUSION

An endonasal endoscopic approach to the odontoid process provides an excellent surgical route, with many advantages when compared to the transoral approach, potentially avoiding serious intraoperative and postoperative complications.

Although, further experience will be needed to improve the endoscopic transnasal approach to the ventral craniocervical junction, this minimally invasive technique should be considered an important alternative to the transoral route in selected cases, because of its advantages perioperatively and in follow-up.

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