Case Report

Endoscopic transnasal odontoidectomy using ultrasonic bone curette: Technical case report

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Abstract

A 65-year-old woman, a case of cranio-vertebral junction anomaly, presented with a sudden onset of quadriparesis, dysphagia, and breathing difficulty and required emergency surgery. She underwent image-guided endoscopic transnasal odontoidectomy followed by occipito-cervical decompression and stabilization. She recovered well, with immediate improvement of respiratory function. Burning paresthesias disappeared and the upper limbs function normalized.

Key words: *Cervical spine, craniovertebral junction anomaly, odontoidectomy, skull base, transnasal endoscopy, ultrasonic bone curette*

Introduction

Ventral compression due to craniovertebral junction (CVJ) anomalies has been traditionally accessed through a transoral approach. Since 2002 several anatomic studies emphasized the possibility to access this region through a transnasal corridor.[1-3] In 2005, Kassam's group underlined the feasibility of an endoscopic transnasal odontoidectomy.[4-6] Cooperation between otolaryngologists and neurosurgeons, technological improvements, and design of dedicated instruments greatly contributed to the reproducibility and success of the technique and several case reports yielded highly promising results.[7-14] In 2010, Cappabianca *et al*. highlighted the value of an ultrasonic bone curette (UBC) as an ancillary device in both standard and extended transplanum approaches.[15] In this technical report, we present a patient who underwent emergency image guided endoscopic endonasal decompression of the CVJ by UBC followed by occipito-cervical decompression and stabilization.

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The patient was a 65-year-old woman with a long history of gait disturbances associated with progressive increasing paresthesias of four limbs refractory to all kind of opioid medication and selective serotonin reuptake inhibitors. Because of progressive worsening of symptoms, the patient was referred to the emergency. Magnetic resonance imaging (MRI) and computed tomography (CT) scans demonstrated a severe stenosis of the CVJ [Figure 1b-c].

Due to sudden onset of quadriparesis, absolute dysphagia, and breathing difficulty, a naso-gastric feeding tube was positioned, a tracheostomy was performed, and she was admitted to the Intensive Care Unit for acute respiratory distress. Endoscopic transnasal odontoidectomy followed by occipito-cervical decompression and stabilization was scheduled as an emergency. Intraoperative neurophysiological monitoring was used. Extra-long high-speed microdrill (Anspach Effort, Palm Beach Gardens, FL, USA) and Sonopet Omni Ultrasonic Surgical System (Styker, Inc., Kalamazoo, MI, USA) were adopted. We used two disposable tips: The Payner™ 360 (model N 817-25) [Figure 2a] and the

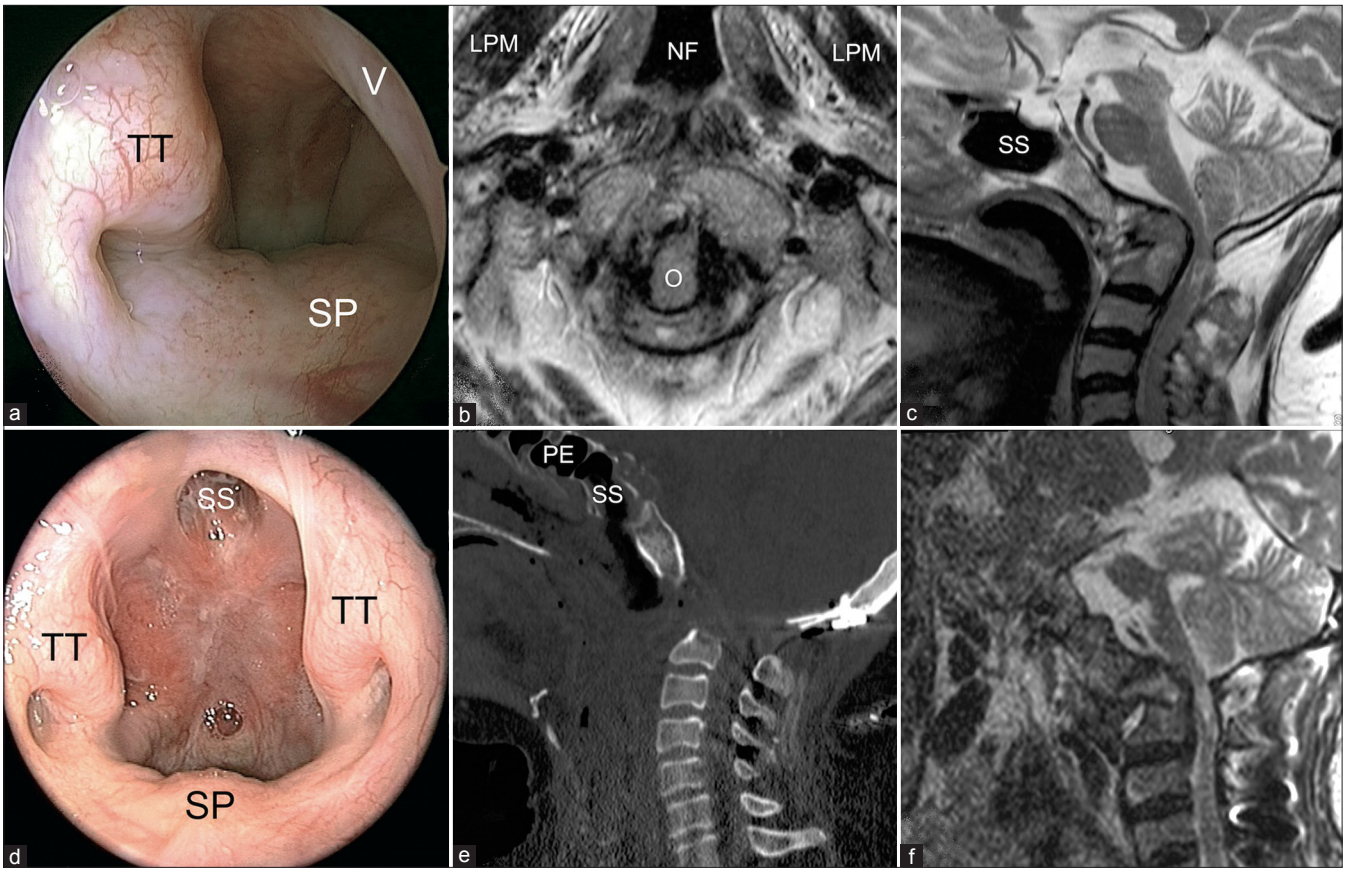

Figure 1: (a) Intraoperative picture showing the posterior portion of the right nasal cavity and the nasopharynx at the beginning of the procedure, (b) axial and, (c) sagittal preoperative MRI show upper cord compression, (d) 1-month postoperative endoscopic control highlights a well-healed nasopharyngeal mucosa and sphenoid sinus opened on its floor, (e) early postoperative sagittal CT reconstruction, and (f) 6-month postoperative MRI show successful odontoidectomy, occipito-cervical decompression and stabilization TT - Torus tubarius; V - Vomer; SP - Soft palate; LPM - Lateral pterygoid muscle; NF - Nasopharynx; O - Odontoid; SS - Sphenoid sinus; PE - Posterior ethmoid

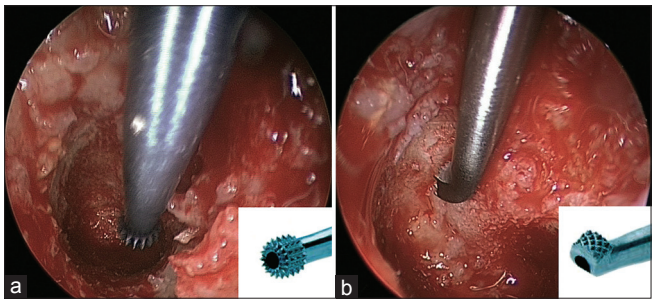

Figure 2: (a) Intraoperative pictures showing ultrasound-assisted odontoidectomy with Payner 360 and (b) Spetzler Claw tips

Spetzler Microclaw™ (model N 808-25) [Figure 2b]. This device allows selective bone emulsification based on longitudinal and torsional oscillation of the tip with a frequency of 25 kHz. CT-MRI fusion image guidance registration was undertaken (BrainLAB AG, Heimstetten, Germany). The ventral aspect of the foramen magnum and the anterior arch of C1 were identified [Figure 3] and drilled away starting from the midline. After image guided confirmation of the odontoid, a 2 mm coarse diamond burr was used to enter its anterior cortex [Figure 4]. The use of the UBC was reserved to removal of the tip of the dens, the base and the interface between the posterior cortex of the dens, and the soft tissues covering the spinal dura.

After surgery the patient was followed in the Intensive Care Unit for 4 days with an improvement of respiratory drive and resolution of upper limbs paresis. Postoperative CT scan and MRI confirmed complete CVJ decompression [Figure 1e-f]. The nasogastric tube and tracheostomy were removed after 2-3 weeks with normal diet intake and normal respiratory function. Paresthesias disappeared within 1 month. The upper limbs function is normalizing. She is actually followed in a rehabilitation center to properly restore the lower limbs function. The patient underwent follow-up nasal endoscopy at 1 and 6 months postoperative period [Figures 1d and 5]. Compared to the preoperative endoscopic view [Figure 1a], the resection of the posterior third of the nasal septum and drilling of the sphenoid floor provided a direct midline exposure of the CVJ area.

Discussion

The endonasal technique provides an inside view of the CVJ and allows a less invasive decompression in

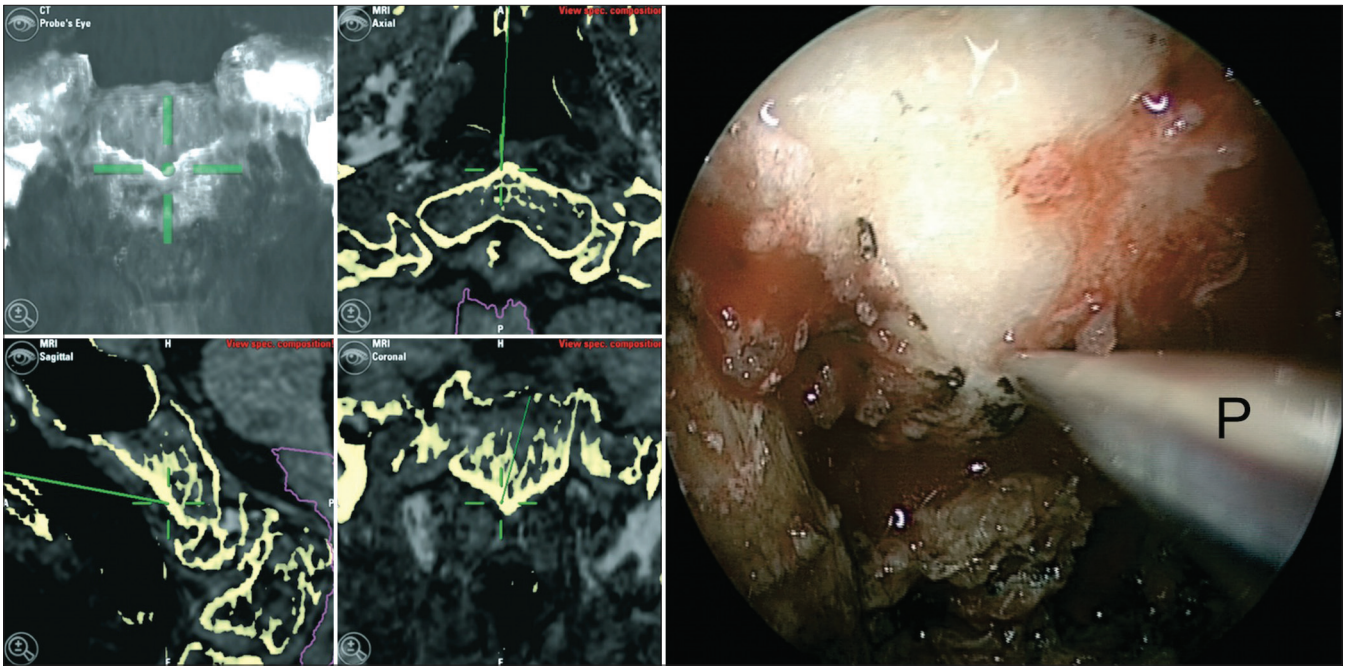

Figure 3: Image guided localization of the midline and corresponding endonasal view. Note the rostro-caudal endonasal route toward the odontoid through the lower clivus P - Probe

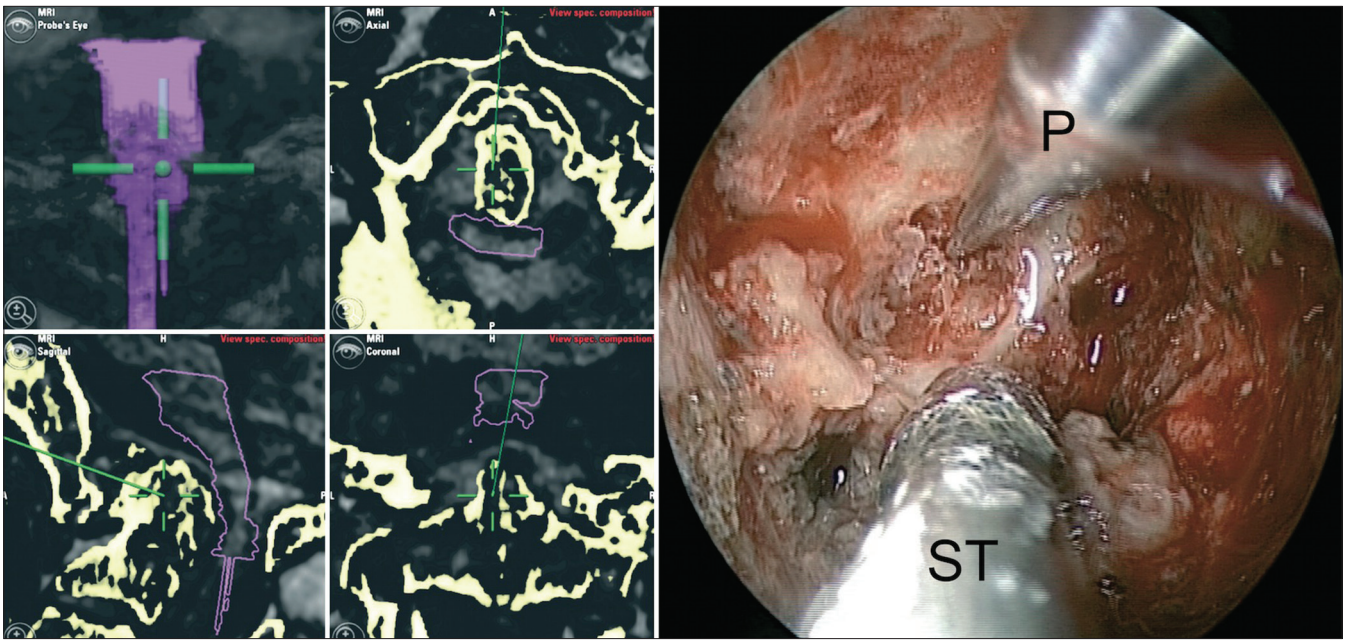

Figure 4: Image guided localization during microdrill-assisted odontoid cavitation and corresponding endonasal view P - Probe; ST - Suction tube

selected cases. The inferior limit of the exposure is underlined by the Kassam's line (aka nasopalatine line).[16] Relative contraindications to the transoral odontoidectomy (i.e., retropharyngeal medialization of internal carotid artery, micrognathia, macroglossia, etc.,) can be addressed with the endonasal approach. Since 2005, surgical experiences reported in the literature underlined the need of dedicated instruments, state-of-the-art endoscopic equipment and image guidance.[4-6,11]

Several factors contribute to the adaptability of the UBC to the transnasal approach to the CVJ: It provides a bone emulsification-irrigation-suction mechanism in single-hand, the thermal damage is minimal, dedicated tips are available, and the cost of the main unit can be shared between different departments of the hospital. This device allows selective bone emulsification based on longitudinal and torsional oscillation with minimal termal damage, which, combined with a meticulous respect for the sphenoid ostia, resulted in complete

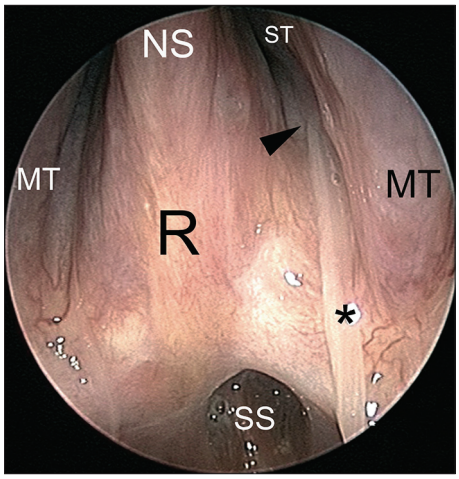

Figure 5: Six-month postoperative endoscopic control. 70-degree view. Complete healing and remucosalization of the residual sphenoid floor. Physiologic mucus drainage (asterisk) from the natural sphenoid ostium (arrow head) to the spheno-ethmoid recess is visible NS - Nasal septum; R - Rostrum; SS - Sphenoid sinus; ST - Superior turbinate; MT - Middle turbinate

healing and remucosalization of the residual sphenoid floor [Figure 5].

A case of supposed UBC vibration-related spinal cord injury has been reported in the literature.[17] We used the UBC in about 10 endoscopic skull base procedures (unpublished data) and we never experienced related complications. The UBC is safe and effective; it contributes to reduce soft tissue manipulation and to optimize the surgical time. Larger series and follow-up validation studies should compare this emerging technique with the transoral approach.

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