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Neuronavigation-Assisted Transoral-Transpharyngeal Approach for Basilar Invagination

—Two Case Reports—

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Abstract

Two patients presented with congenital basilar invagination manifesting as progressive myelopathy. Both patients underwent surgery using a neuronavigation-assisted transoral-transpharyngeal approach. The Brain-LAB Vector Vision navigation system was used for image guidance. The registration accuracies were 0.9 and 1.3 mm. After decompression, posterior stabilization was performed. Both patients had an uneventful postoperative course. The transoral-transpharyngeal approach with the neuronavigation system provides safe exposure and decompression for basilar invagination.

Key words: basilar invagination, transoral-transpharyngeal approach, neuronavigation

Introduction

The surgical treatment of anterior upper cervical spine and skull base disease remains challenging because of the anatomical complexity and limited surgical accessibility. The transoral pathway provides a direct route to lesions involving the craniocervical junction.[9] The transoral-transpalatopharyngeal approach has been recommended by many surgeons for extradural lesions because it offers decompression between the midclivus and the upper cervical level.[1,2,8,10–12,14] Transoral operations have been used for years to drain retropharyngeal abscesses.[7] The first series using the transoral approach for atlantoaxial abnormalities was reported in 1962.[6] The high rate of morbidity and mortality associated with transoral approaches has decreased with improvements in technology.[4]

Basilar invagination may be primary, occurring as a congenital craniovertebral junction malformation, or secondary to various disorders including osteogenesis imperfecta, osteochondrodysplasias, Arnold-Chiari malformation with or without syringomyelia, and trauma.[3,7,15,16]

Here we describe the use of neuronavigation during the transoral-transpharyngeal approach to treat two patients with basilar invagination, which overcame the difficulties associated with surgical access and the anatomical complexity of the upper cervical spine and skull base.

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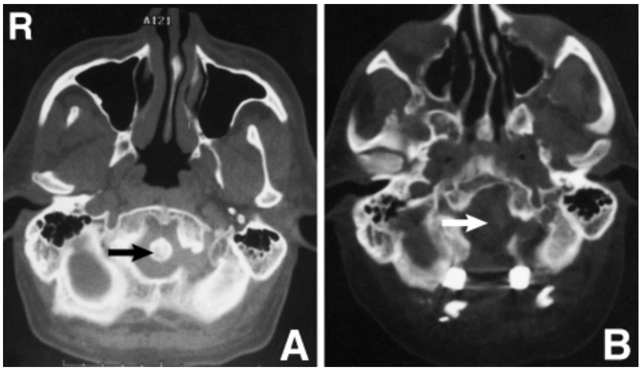

Fig. 1 Case 1. Axial bone window computed tomography scans (A) before (*arrow*) and (B) after odontoidectomy (*arrow*).

Case Reports

Case 1: A 33-year-old male patient presented with neck pain and myelopathy. Craniocervical computed tomography (CT) (Fig. 1A) and magnetic resonance (MR) imaging were performed. The odontoid process height was 2.3 cm, up to the McGregor

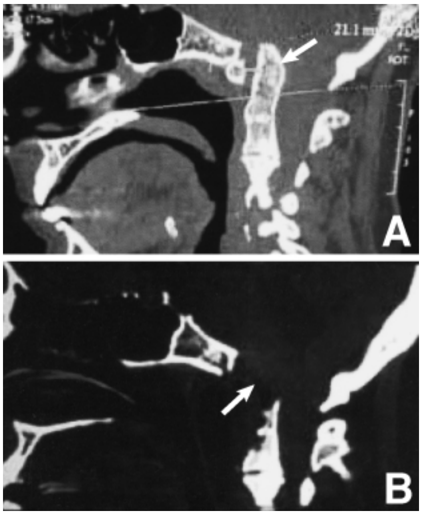

Fig. 2 Case 2. Sagittal bone window computed tomography scans (A) before (*arrow*) and (B) after odontoidectomy (*arrow*).

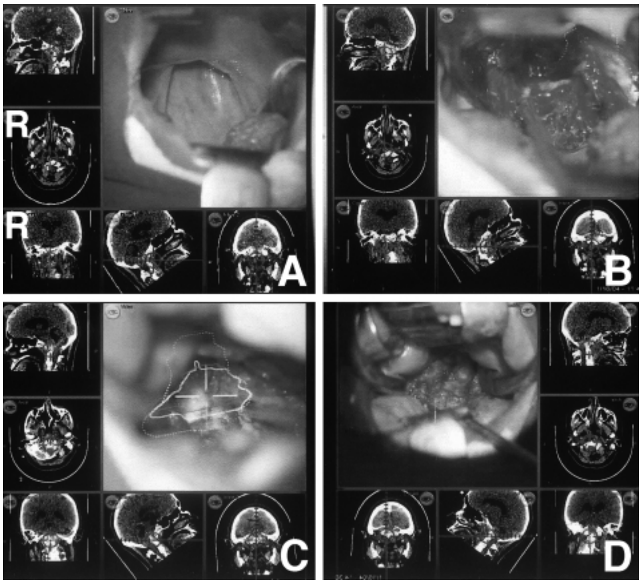

Fig. 3 Case 2. Intraoperative neuronavigation images of the transoral-transpharyngeal approach showing (A) the pharynx wall, (B) exploration of the odontoid bone, (C) navigation focusing on the odontoid process (*green lines*), and (D) decompression with odontoidectomy.

line, which is considered to indicate basilar invagination. Atlantoaxial deformation formed the basilar invagination. The transoral-transpharyngeal approach was used. After orotracheal intubation, the patient's head was fixed in a Mayfield clamp. The Crockard retractor was used for retraction of the mouth and to optimize the exposure of the posterior pharyngeal wall. Registration was performed with the infrared pointer by localizing the marker center (VectorVision II; BrainLAB, Munich, Germany). The registration accuracy was 1.3 mm. The soft plate was incised. Then the sterile pointer was used for determination of the odontoid process, C-1, and C-2. Decompression of the anterior C1–2 complex and odontoidectomy were achieved by drilling with a Midas-Rex (Medtronic, Minn., U.S.A.). After decompression, the pharyngeal wall was closed without using fat. Stabilization was simultaneously performed by the posterior approach. The operation was uneventful, and no neurological deficits occurred after surgery. Postoperative CT demonstrated total decompression of the odontoid process (Fig. 1B). The patient had mediastinitis 10 days after the surgery, but recovered following treatment and was discharged 19 days after the surgery.

Case 2: A 35-year-old female patient presented with headache, neck pain, and hypesthesia of both arms. Craniocervical CT (Fig. 2A) and MR imaging were performed. The odontoid process height was 2.1 cm, up to the McGregor line. The transoral-transpharyngeal approach and same procedures were used as in Case 1 (Fig. 3). The registration accuracy was 0.9 mm. Decompression was performed. The surgery was uneventful with no neurological deficits. Posterior stabilization was performed 3 days after the first operation. Postoperative CT (Fig. 2B) and MR imaging demonstrated total decompression of the odontoid process. The patient was discharged 10 days after the first surgery.

Discussion

The routine transoral-transpharyngeal approach requires a high-speed drill, a Crockard retractor system, an operating microscope, and a flexible oral endotracheal tube.[1,12,13] Various monitoring systems have been recommended including intraoperative fluoroscopy and spinal cord monitoring,[17] the endoscopic transoral approach,[7] and intraoperative MR imaging.[9] Stereolithographic biomodels are advised for patient education, operative planning, and surgical navigation.[5] HALO fixation (HALO Torque screwdriver, Hannover, Germany) has been advised for image-guided transoral procedures.[18] The navigated transoral approach to the cranial base and the craniocervical junction has been used in three patients with chordomas and one patient with rheumatoid atlantoaxial subluxation.[19]

Intraoperative MR imaging[9] and endoscopic transoral surgery[7] are currently advised for efficacy and safety. These technological changes and the use of intraoperatively acquired navigational data to guide placement of spinal instrumentation can eliminate the need for intraoperative fluoroscopy and the risks inherent to radiation.[9] The main advantages of the transoral approach are safety and direct access to the craniocervical junction, shorter operation time, and minimal trauma to the soft tissues, so reducing the risk of complications such as pneumonia, fistula, and airway obstruction.

The present cases illustrate that neuronavigation in the transoral-transpharyngeal approach allows safer and more effective surgery for the treatment of basilar invagination in complex anatomical areas.

References

1) Apuzzo MLJ, Weiss MH, Heiden JS: Transoral exposure of the atlantoaxial region. *Neurosurgery* 3: 201–207, 1978
2) Blaizer CJ, Hadley MN, Spetzler RF: The transoral surgical approach to craniovertebral pathology. *J Neurosci Nurs* 18: 57–62, 1986
3) Botelho RV, Bittencourt LRA, Rotta JM, Tufik S: Polysomnographic respiratory findings in patients with Arnold-Chiari type I malformation and basilar invagination, with or without syringomyelia: preliminary report of a series of cases. *Neurosurg Rev* 23: 151–155, 2000
4) Dorward NL, Alberti O, Velani B, Gerritsen FA, Harkness WFJ, Kitchen ND, Thomas DGT: Postimaging brain distortion: magnitude, correlates, and impact on neuronavigation. *J Neurosurg* 88: 656–662, 1998
5) D'Urso PS, Aksin G, Earwaker JS, Merry GS, Thompson RG, Barker TM, Effeney DJ: Spinal biomodeling. *Spine* 24: 1247–1251, 1999
6) Fang HSY, Ong GB: Direct anterior approach to the upper cervical spine. *J Bone Joint Surg Am* 44A: 1588–1604, 1962
7) Frempong-Boadu AK, Faunce WA, Fessler RG: Endoscopically assisted transoral-transpharyngeal approach to the craniovertebral junction. *Neurosurgery* 51 (5 Suppl): S60–66, 2002
8) Goel A, Phalke U, Cacciola F, Muzumdar D: Surgical management of high cervical disc prolapse associated with basilar invagination — two case reports. *Neurol Med Chir (Tokyo)* 44: 142–145, 2004
9) Kaibara T, Hurlbert RJ, Sutherland GR: Transoral resection of axial lesions augmented by intraoperative magnetic resonance imaging. Report of three cases. *J Neurosurg* 95 (2 Suppl): 239–242, 2001
10) Kawai K, Sasaki T, Yanai A, Teraoka A: High cervical chordoma — case report. *Neurol Med Chir (Tokyo)* 35: 165–167, 1995
11) Kingdom TT, Nockels RP, Kaplan MJ: Transoral-transpharyngeal approach to the craniocervical junction. *Otolaryngol Head Neck Surg* 113: 393–400, 1995
12) Menezes AH, VanGilder JC: Transoral-transpharyngeal approach to the anterior craniocervical junction: Ten-year experience with 72 patients. *J Neurosurg* 69: 895–903, 1988
13) Menezes AH, VanGilder JC, Graf CJ, McDonnell DE: Craniocervical abnormalities: A comprehensive surgical approach. *J Neurosurg* 53: 444–455, 1980
14) Naderi S, Pamir MN: Further cranial settling of the upper cervical spine following odontoidectomy. Report of two cases. *J Neurosurg* 95 (2 Suppl): 246–249, 2001
15) Pasztor E, Vajda J, Piffko P, Horvath M: Transoral surgery for basilar impression. *Surg Neurol* 14: 473–476, 1980
16) Sawin PD, Menezes AH: Basilar invagination in osteogenesis imperfecta and related osteochondrodysplasias: medical and surgical management. *J Neurosurg* 86: 950–960, 1997
17) Selman WR, Spetzler RF, Brown R: The use of intraoperative fluoroscopy and spinal cord monitoring for transoral microsurgical odontoid resection. *Clin Orthop* 154: 51–56, 1981
18) Veres R, Bago A, Fedorcsak I: Early experiences with image-guided transoral surgery for the pathologies of the upper cervical spine. *Spine* 26: 1385–1388, 2001
19) Vougioukas VI, Hubbe U, Schipper J, Spetzger U: Navigated transoral approach to the cranial base and the craniocervical junction: Technical note. *Neurosurgery* 52: 247–251, 2003

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