Transnasal vs Transoral Odontoidectomy in Basilar Impression Associated with Congenital Craniovertebral Junction Anomalies: A Systematic Review and Meta-Analysis

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Introduction

Basilar Impression (BIm) and group B Basilar Invagination (BI) treatment, usually consists of ventral decompression through odontoidectomy. This review compares surgical and neurological outcomes of transnasal (TnO) and transoral odontoidectomy (ToO) approaches for adult patients with BIm. We also propose a novel algorithm for the approach and management of patients with congenital CVJ anomalies.



	Transnasal	Transoral	p-value
Mean Age (years)	42.3	33.6	0.5
Female Rate (%)	50	25	0.4
Klippel-Feil Syndrome Rate (%)	16.7	12.5	0.9
Syringomyelia Rate (%)	16.7	25	0.7
Chiari Malformation Rate (%)	16.7	50	0.2
Osteogenesis imperfecta Rate (%)	16.7	0	0.2
Rate of Preoperative Increased ADI (%)	50	50	1
Preoperative Neurological Deficit Rate (%)	100	100	1
Motor Strenght Symptoms Rate (%)	67	50	0.6
Sensory Symptoms Rate (%)	67	75	0.8
Lower Cranial Nerve Palsy Rate (%)	33.3	75	0.1
Clinical Myelopathy Rate (%)	50	37.5	0.7



A. On the left, a diagram of normal craniometric angles is shown. The Welcher's angle (Wa) (i.e., skull base angle) is drawn in blue between the Wackenheim line (black line) and the anterior fossa axis line (blue arrow). As well, Boogaard's angle (Ba) is shown in red formed by the Wackenheim line (black line) and Mc Rae line (red line). Foramen magnum angle (FMA) is drawn in yellow and is formed between McRae's and Chamberlain's lines, with normal values around 6 degrees. The atlantodental interval (ADI) is encircled (black circle) and shows the preserved distance. On the right, a sagittal head CT scan of a patient with a normal CVJ configuration is shown. The Klaus Height Index is shown by the red dotted line, which measures the distance from the tip of the dens to the Twining line (dotted black line) (i.e., tuberculum- torcula line). The nasopalatine line (NPL) is shown to reach C2 dens bellow the anterior C1 arch.

Methods

A systematic review was performed in Medline, Embase, and Scopus databases for studies involving adult patients with BI associated with CVJ congenital anomalies requiring odontoidectomy. Studies with fewer than 30 days followup, neurologic sequelae secondary to a different cause, acquired BI, and approaches different than transoral and transnasal odontoidectomy were excluded. Preoperative and postoperative data were evaluated, and P values below 0.05 were considered significant. The next figure shows the prisma flowchart used for the review. Demographic features and preoperative conditions of patients in transnasal and transoral groups. ADI, Atlantodental Interval.





Results

Nine articles with 14 patients were examined, six undergoing TnO and eight ToO. No significant differences in demographic variables or preoperative neurological status were documented between the groups. Postoperatively, persistent neurologic deficits were documented in 38% of the ToO group versus none in the TnO group (p=0.01). The C1 anterior arch was resected in 83% of TnO cases versus 25% in ToO cases. After odontoidectomy, all the occipito-cervical (OC) fixation required an additional posterior fossa decompression in the ToO group compared to 17% in TnO, where most of the OC fixation cases were without posterior fossa decompression (p=0.03)

The BI treatment proposed flowchart. After a BI diagnosis, the stability status must be elucidated (i.e., ADI). In unstable BI, a posterior fixation is required and would depend on the reducibility of the entity for the requirement of a previous ventral decompression. In stable entities, an upfront ventral decompression is indicated. In short, Klaus height index cases, the transnasal approach should be favored. An upfront odontoidectomy is also indicated when there is a presence of soft tissue pannus in non-congenital BI.

	Transnasal	Transoral	p-value
Postoperative Neurologic Deficit Rate (%)	0	37.5	0.01*
Oropalatopharyngeal Complications Rate (%)	0	12.5	0.2
C1 Arch Resection Rate (%)	83.3	25	0.03*
Complete Dens Resection Rate (%)	83.3	62.5	0.4
Complication Rate (%)	16.7	12.5	0.6
Additional Surgical Procedure Rate (%)	83.3	100	0.2
OC Fixation Rate Without Posterior Fossa Decompression (%)	66.7	0	<0.01*
OC Fixation With Posterior Fossa Decompression (%)	16.7	75	0.03*

Postoperative neurological outcomes, C1 and C2 resection, complication, and additional procedure rates. OC, Occipitocervical. *, statistically significant.



TnO in BIm associated with congenital CVJ anomalies have lower rates of persistent neurologic deficit and lower rates for additional decompression through posterior approaches than the ToO approach. The indications and the best posterior fixation modalities in this setting remain unclear.

