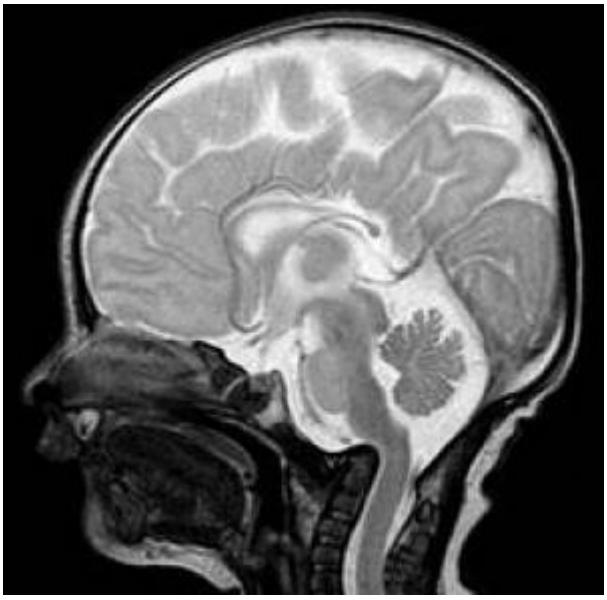
Basilar invagination



- Anterior transarticular crossing screw fixation for reducible atlantoaxial dislocation with basilar invagination: a radiological feasibility study
- In Reply: The Rocker Technique for Atlantoaxial Dislocation With or Without Basilar Invagination: A Prospective Observational Study
- Letter: The Rocker Technique for Atlantoaxial Dislocation With or Without Basilar Invagination: A Prospective Observational Study
- Posterior extradural transpedicular monolateral odontoidectomy (PETMO): a technical note
- Commentary: Bilateral High-Riding Persistent First Cervical Intersegmental Arteries in a Case of Klippel-Feil Syndrome: The Technique of Vertebral Artery Mobilization for C1-C2 Reduction and Fusion for Atlantoaxial Dislocation and Basilar Invagination: 2-Dimensional Operative Video
- Cranio-cervical conundrum; Enigmatic complete atlanto-occipital assimilation with Chairi I malformation
- Pediatric Halo Use: Indications, Application, and Potential Complications
- Surgical Treatment of Basilar Invagination without Evident Atlantoaxial Instability (Type B) - A Systematic Review

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The terms basilar impression and basilar invagination are often used interchangeably in the literature: historically, basilar invagination (AKA cranial settling) denoted upward indentation of skull base usually due to acquired softening of bone, often associated with atlanto-occipital fusion, while basilar impression implied normal bone. Making a distinction seems pointless (the abbreviation (BI) will be used for either). Common feature: upward displacement of the upper cervical spine (including odontoid process, AKA cranial migration of the odontoid) through the foramen magnum into the posterior fossa.

Platybasia: flattening of the skull base. Originally assessed on plain x-rays (which are subject to error due to skull rotation or difficulty identifying landmarks), now more commonly evaluated on CT or MRI. May or may not be associated with BI, and may occur in association with craniofacial abnormalities, Chiari malformation, Paget's disease…

Epidemiology

Basilar invagination is a relatively rare condition in which the upper portion of the second cervical vertebra migrates upward and posteriorly into the intracranial space. It can be associated with a number of other conditions such as rheumatoid arthritis, Chiari malformation, syringomyelia, C1-2 instability, or congenital abnormalities.

Classification

see Basilar invagination classification

Clinical features

Patients generally become symptomatic when the displaced vertebral segment causes sufficient pressure on the upper spinal cord or lower portion of the brainstem. The most common symptoms include headache, dizziness, swallowing problems, numbness/tingling in the extremities, and paralysis. Symptoms can become worse with flexion of the head, which even further drapes the spinal cord over the upper portion of C2.

Conditions associated with BI

1. congenital conditions (BI is the most common congenital anomaly of the craniocervical junction, it is often accompanied by other anomalies [1)].

a) Down syndrome

b) Klippel-Feil syndrome

c) Chiari malformation in a series of 100 patients, 92 had BI [2)].

d) Syringomyelia

2. Acquired conditions

a) see Basilar impression in rheumatoid arthritis

b) post-traumatic

3. conditions with BI associated with softening of bone include [3)]

a) Paget’s disease

b) Osteogenesis imperfecta: patients have blue discolored sclera and early hearing loss and due to a genetic defect that causes defective Type 1 collagen. Bones are weak (”brittle-bone dis- ease”). Autosomal dominant inheritance. There are 4 common types of OI and some uncommon ones

c) Osteomalacia

d) Rickets

e) Hyperparathyroidism

Diagnosis

see Basilar invagination diagnosis

Differential diagnosis

Basilar impression occurs when parts of the cervical (neck) vertebrae enter the hole in the skull base (foramen magnum).

Basilar invagination is the same problem, except that it’s caused by softening in the bones at the skull base.

Cranial settling occurs when the bone at the top of the neck on which the skull rotates (dens) extends into the foramen magnum.

Treatment

see Basilar invagination treatment.

Systematic literature reviews

A systematic literature review was performed to identify clinical or radiological studies that expressed the amount of odontoid violation above Chamberlain´s line in patients that harbor Basilar invagination diagnosis. In addition, a metanalysis was performed to evaluate normal subjects' values of Chamberlain's line violation (CLV).

Twenty-three studies were included (13 radiological and 10 clinical). Most of them used CT and / or MRI. Eight different cutoff values were used to measure dislocated odontoid apexes above Chamberlain's line regardless of the radiological modality. The described mean measured amount of CLV was 3.95 mm (median of 5, ranging from 0 to 9 mm). In the metanalysis, eight studies (1233 patients) with a normal sample population, a mean normal CLV of -0.63 mm (below the line) (95% IC -0.8; 1.18 mm, random effects model) was reported

Different values were found in the assessed studies used for CLV in BI diagnosis. This variability is especially important for type B BI, since type A BI has other craniocervical diagnostic parameters. Considering the results obtained in this metanalysis, any dens violation above 1.18 mm should be diagnosed as BI [4)]

Case series

Basilar invagination case series.

Case reports

Basilar invagination case reports.

References

1)
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2)
Menezes AH. Primary craniovertebral anomalies and the hindbrain herniation syndrome (Chiari I): data base analysis. Pediatr Neurosurg. 1995; 23:260–269
3)
Jacobson G, Bleeker HH. Pseudosubluxation of the Axis in Children. Am J Roentgenol. 1959; 82:472–481
4)
Joaquim AF, Evangelista Santos Barcelos AC, Daniel JW, Botelho RV. Chamberlain´s line violation in Basilar Invagination patients compared to normal subjects - A systematic literature review and metanalysis. World Neurosurg. 2023 Feb 21:S1878-8750(23)00205-X. doi: 10.1016/j.wneu.2023.02.057. Epub ahead of print. PMID: 36822399.