



### CCI Measurements: Cspine MRI radiography

Measurement	Definition	Normal	Pathological	Notes
<b>Clival Axial Angle (CXA)</b>	<p>A stress deformity of the brainstem over the odontoid</p> <p><i>The angle formed between a line drawn along the posterior aspect of the lower clivus and the posterior axial line</i></p>	<p>&gt; 145 is normal</p> <p>(150 in flexion to 180 in extension is normal)</p>	<p>&lt; 150 may indicate some brainstem compression</p> <p>&lt; 135 is pathological</p>	<p>Best measured in flexion</p>
<b>Grabb-Oakes Measurement (GO)</b>	<p>Measures whether the odontoid is pressing (like a fulcrum) on brainstem</p> <p><i>Draw a line from basion to posterior inferior edge of C2, and then measure the interval from the line to the dura</i></p>	<p>≤ 6mm is normal</p> <p>&gt;8 mild risk</p>	<p>In the presence of low lying cerebellar tonsils, a Grabb-Oakes measurement <b>≥ 9mm</b> suggests brainstem compression</p>	<p>Best measured in flexion</p>
<b>Harris Measurement - Basion axial interval (BAI)</b>	<p><i>Interval from basion to posterior axial line</i></p>	<p>≤ 9 mm is normal</p>	<p>≥ 12mm represents CCI</p>	<p>Measure the BDI in flexion and extension. The change in BDI = translation, Translation &gt;2 mm is abnormal, (Allowing for error) <b>&gt;4mm = CCI</b></p>



<b>Vertical Harris measurement</b> <b>- Basion Dens Interval (BDI)</b>	Interval from basion to tip of odontoid	5mm is normal	> 10mm is abnormal <b>≥12 mm = CCI</b>	
<b>Powers Ratio (PR)</b>	Determines if the head is moving forward on the upper neck  <i>It's a ratio:          Basion to posterior C1 ring /          opisthion to anterior portion of C1</i>		> 1 is abnormal	

References

- Henderson Sr, F; Henderson Jr, F; Wilson, W; Mark, A; Koby, M; Utility of the Clivo-Axial Angle in Assessing Brainstem Deformity: Pilot study and literature review, *Neurosurg Review* 2018; 41: 149-163
- Grabb PA, Mapstone TB, Oakes WJ (1999) Ventral brain stem compression in pediatric and young adult patients with Chiari I malformations. *Neurosurgery* 44:520–527 discussion 527-528
- Henderson Sr., F; Austin, C; Benzel, E; Bolognese, P, Ellenbogen, R; Francomano, C; Ireton, C; Klinge, P; Koby, M; Long, D; Patel, S; Singman, E; Voermans, N; Neurological and Spinal Manifestations of the Ehlers-Danlos Syndromes; *American Journal of Medical Genetics Part C (Seminars in Medical Genetics)*, 175C:195–211 (2017)
- Elements NCD (2016) Clinical research common data Elements(CDEs): radiological metrics standardization for Craniocervical
- instability. National Institute of Neurological Disorders and Stroke common data element project - approach and methods..*Clin Trials* 9(33):322–329
- Batzdorf U B E, Henderson F. et al (2014) Consensus Statement In Proceedings of CSF Colloquium 2013. In: U B (ed) *Basilar*
- Impression & Hypermobility at the Craniocervical Junction. Chiari Syringomyelia Foundation, Lulu,
- Harris JH Jr, Carson GC, Wagner LK (1994) Radiologic diagnosis of traumatic occipitovertebral dissociation: 1. Normal occipitovertebral relationships on lateral radiographs of supine subjects. *AJR Am J Roentgenol* 162:881–886. <https://doi.org/10.2214/ajr.162.4.8141012>

Approved by Dr. Fraser Henderson, April 12, 2021