Unilateral C1-C2 Vertical Distraction Injuries: Can We Treat Conservatively?

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INTRODUCTION: Traumatic atlantoaxial joint (AAJ) vertical distraction injuries lie on a spectrum of injury involving the craniocervical junction. Isolated injuries can be unstable, requiring surgical stabilization, a highly morbid procedure given C1-2 joint's primary role in cervical spine rotation. Previous authors established normative C1-2 lateral mass values to evaluate for vertical AAJ distraction injuries. However, these studies focus on bilateral AAJ injury, with no data on unilateral or incomplete AAJ injuries. Clinical decision-making regarding these partial injuries is fraught with uncertainty, especially given the possibility of delayed instability. As a result, this study seeks to characterize injury patterns and clinical courses of patients with incomplete or unilateral atlantoaxial joint injuries.

METHODS: After receiving IRB approval, all MRI and CT radiology reads from January 1, 2006 to August 1, 2021 at our Level I Trauma Center were queried for the following terms: edema, disruption, avulsion, tear, distraction, or subluxation and transverse ligament, atlantoaxial joint, or C1-C2 joint, resulting in 2779 studies. Inclusion criteria consisted of age greater than 18 years old, history of recent traumatic injury, and radiographic evidence of unilateral atlantoaxial joint distraction on CT, defined by a unilateral lateral mass index (LMI) >2.6mm. MRI scans were classified based on extent of soft tissue injury. Demographic data and clinical outcomes were obtained by chart review and summarized using descriptive statistics.

RESULTS SECTION: Five patients comprised this study: 3 males and 2 females with an average age of 51 years. Four patients were injured by motor vehicle accident and 1 due to fall from standing height. 3 patients had concomitant orthopedic extremity fractures requiring operative fixation. The average LMI of the involved joint was 4.2 mm versus 2.0 in the contralateral joint. On MRI, 3 patients exhibited bilateral atlantoaxial joint effusions. No patients demonstrated complete injury of associated ligaments. All patients were treated conservatively with a rigid cervical collar. No patients demonstrated late instability at average radiographic follow-up of 876 days.

DISCUSSION: Unilateral or incomplete AAJ vertical distraction injuries lie on a spectrum of injury involving the craniocervical junction and more specifically the C1-2 articulation. MRI is essential to evaluate the ligamentous stabilizers of the craniocervical junction prior to any treatment decisions, but in the absence of an unstable ligamentous injury, incomplete or unilateral vertical distraction injuries can be safely managed conservatively.

SIGNIFICANCE/CLINICAL RELEVANCE: This study is one of few to examine unilateral ligamentous injury between the atlas and axis of the spine. This study shows that in the absence of injury instability, these injuries can successfully be treated non-operatively with successful patient outcomes.

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IMAGES AND TABLES:

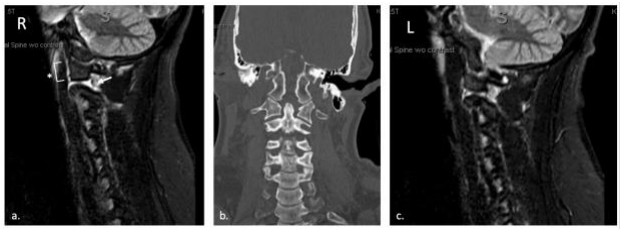

Figure 1: 38yo F involved in MVC w/ R unilateral atlantoaxial joint vertical distraction injury. CT (b) demonstrated R C1-2 lateral mass index of 3.8mm versus 1.8mm in the contralateral. MRI (a & c) demonstrates bilateral atlantoaxial joint effusions and large capsular defect over the R anterior C2 body (bracket) w/ posterior capsular disruption (arrow).

Demographics					CT				MRI			
							Average LMI (mm)		AA STIR Signal		AO STIR	
Pt	Age (yr)	Mechanism	Associated Fracture	Visceral Injury (Y/N)	Laterality	BDI (mm)	Injured	Contralateral	Injured	Contralateral	Signal	Treatment
1	48	MVC	None	Yes	L	10	4.1	2.2	Y	Y	Bilateral	Conservative
2	38	MVC	None	Yes	R	8.9	3.8	1.8	Y	Y	Bilateral	Rigid Collar x6 weeks
3	84	Fall	None	No	R	7.3	3.6	1.5	Y	N	None	Conservative
4	43	MVC	None	No	L	9.4	4.9	2.5	N*	N*	None*	Rigid Collar x6 weeks
5	42	MVC	C1 anterior arch avulsion fx	No	L	7.8	4.6	2.4	Y	Y	Bilateral	Rigid Collar x6 weeks

Table 1: Demographics and injury characteristics. All patients demonstrated an intact tectorial membrane, alar ligaments, and cruciate ligament.
*MRI was obtained 1m delayed from injury.