

Original Article

## Plain roentgenographic and CT scan morphometric analysis of the anterior atlantodens interval (AADI) and posterior atlantodens interval (PADI) in the Indian population

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### ABSTRACT

**Background:** The anterior atlantodental interval (AADI) and posterior atlantodental interval (PADI) on X-ray and computed tomography (CT) studies can both be used to gauge the risk and/or presence of neurological compression.

**Methods:** This retrospective observational study was conducted at a tertiary care center in 116 patients with head injuries additionally warranting routine cervical X-ray and CT examinations.

**Results:** The AADI averaged  $1.36 \pm 0.45$  mm (X-ray) and  $1.393 \pm 0.47$  mm (CT), while the mean PADI was  $18.04 \pm 2.44$  mm (X-ray), and  $18.07 \pm 2.43$  mm (CT). Notably, 93.96% of the total subjects had AADI below 2 mm. Further, 6.8% of patients with  $PADI \leq 14$  mm had no neurological deficits.

**Conclusion:** No significant differences were observed for X-ray versus CT studies, measuring AADI and PADI. Therefore, X-rays should continue to prove reliable for assessing craniovertebral junction anatomy in emergency settings. Of interest, the normal upper limit of AADI on sagittal CT reconstructions should now be changed to 2 mm from the previously accepted upper limit of 3 mm.

**Keywords:** Atlantodens interval, Cervical spine, Morphometry

### INTRODUCTION

An anterior atlantodental interval (AADI) of more than 10 mm is clinically significant as it suggests transverse ligament rupture and the normal upper limit of normal in adults is 3 mm.<sup>[3]</sup> The lower limit of normal value of posterior atlantodental interval (PADI) in adults is 14 mm. Here, we evaluated/compared the baseline ranges for AADI and PADI utilizing X-rays versus computed tomography (CT) scans in an Indian head-trauma population.

### MATERIALS AND METHODS

There were 116 patients with head injuries who underwent cervical X-rays and CT scans in this study. Films were independently evaluated by two orthopedic surgeons who similarly measured

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AADI and PADI on plain radiographs versus CT scans [Figure 1]. All these patients with head injuries had normal cervical anatomy on imaging.

## RESULTS

AADI ranged from  $1.36 \pm 0.45$  mm on X-rays to  $1.393 \pm 0.47$  mm on CT scans, while PADI varied from  $18.04 \pm 2.44$  mm on X-rays to  $18.07 \pm 2.43$  mm on CT scans [Figures 2 and 3]. We found 109 (93.96%) subjects with AADI below 2 mm, and 8 (6.8%) subjects with PADI below 14 mm who were clinically asymptomatic [Table 1]. Using the Mann–Whitney test, the difference between the male and female values was statistically significant while the difference between the parameters as measured on X-ray and CT scan was not statistically significant.

## DISCUSSION

The values of AADI and PADI obtained in the present study differed significantly from the previously published values based on standard plain radiographs. We found that the differences in measurements of AADI and PADI made on X-ray and CT scans were not statistically significant.

Therefore, X-rays are reliable for assessing the CVJ anatomy in emergency scenarios, especially where CT scans are not available.

Rojas *et al.*<sup>[5]</sup> found that the normal values for the craniocervical relationships on MDCT were significantly different from the accepted ranges of normal on plain radiographs and 95% of patients had a BDI <8.5 mm on MDCT versus 12 mm on data from plain radiographs.

Chen *et al.* studied the AADI in a normal Chinese population using CT;<sup>[2]</sup> the AADI was  $1.83 \pm 0.46$  mm (0.9–3.4 mm) in males and  $1.63 \pm 0.43$  mm (0.5–3.2 mm) in females.

Liu *et al.*<sup>[4]</sup> studying AADI using MDCT found that AADI was 0.85–3.12 mm in those 18–39 years of age, 0.71–2.55 mm those 40–59-years-old, and 0.00–2.37 mm in those over 60 years of age, that is, MDCT AADI linearly decreased with increasing age.

Boden *et al.*<sup>[1]</sup> concluded that the most important predictor of the potential for neurological recovery after

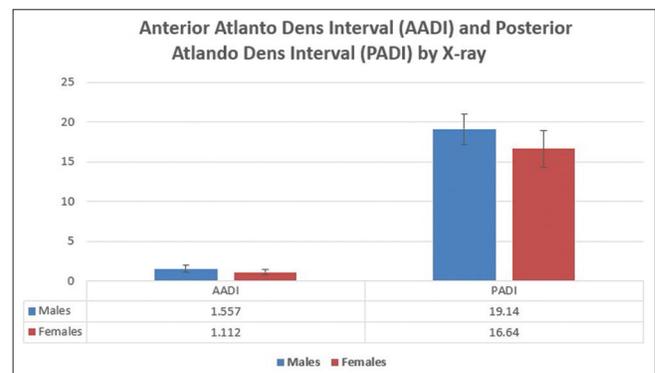
**Table 1:** Ranges of AADI, PADI in this study.

Range	Average	Minimum	Maximum
AADI (CT)	1.393	0.631	2.91
PADI (CT)	18.07	12.098	23.91
AADI (X-ray)	1.36	0.618	2.671
PADI (X-ray)	18.04	12.889	23.91

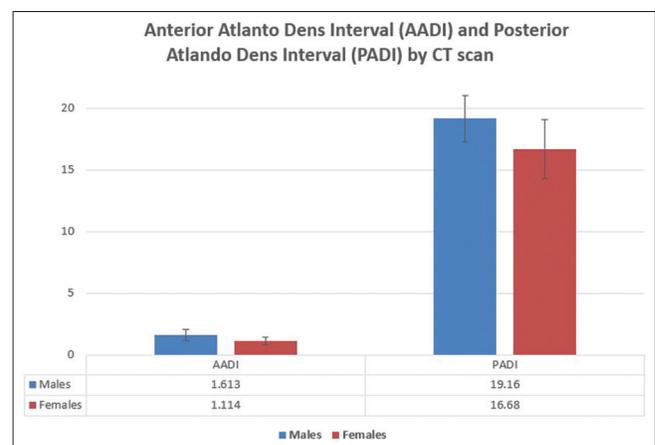
AADI: Anterior atlantodental interval, PADI: Posterior atlantodental interval, CT: Computed tomography. All values in millimeters



**Figure 1:** Sagittal computed tomography showing atlantodens interval.



**Figure 2:** Values for atlantodens interval on X-ray.



**Figure 3:** Values for atlantodens interval on computed tomography scan.

the surgery was the preoperative posterior atlanto-odontoid interval.

## CONCLUSION

We found the normal upper limit of AADI on sagittal CT scans was 2 mm versus the previously accepted 3 mm. Further, there can be patients with a PADI below 14 mm who have no neurological symptoms.

## Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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## Conflicts of interest

There are no conflicts of interest.

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