The Alar Ligaments: A Cadaveric and Radiologic Comparison Study

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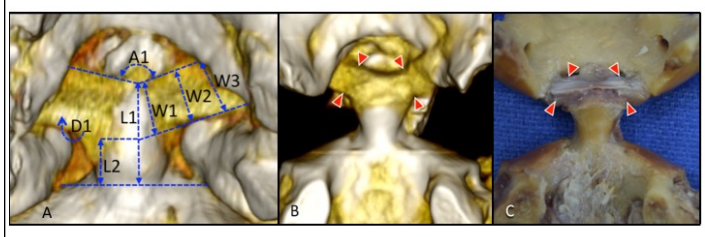
Introduction

A precise anatomical description of the alar ligaments is important to better understand their biomechanical and pathological implications. Although there are several studies regarding their anatomy, the literature is inconsistent. To our knowledge there are no reports comparing cadaveric morphologic findings with CT images of the alar ligaments.

Methods

Eight sides from four fresh frozen cadaveric specimens were used in this study. Following routine dissection of the craniocervical junction the alar ligaments were exposed. We carried out measurements of the alar ligaments, their position within the CVJ and their relation to the dens and adjacent structures. Fine cut CT of the specimens were performed and the measurements were later compared to the original cadaveric dissections. (Figure 1)

Figure 1



Measurements of the alar ligaments. A. 3D reconstruction of the osseous and ligamentous structures: A1 angle between the ligaments, L1 length of the dens, L2 length from the base of the dens to the ligament insertion, D1 anteroposterior diameter of the alar ligament, W1-W3 Proximal, middle and distal superoinferior diameters of the ligaments. B. 3D reconstruction of the alar ligaments (arrow heads) and associated bony structures. C. Cadaveric dissection of the alar ligaments (arrow heads) in a 68-year-old Caucasian male.

Results

Alar ligaments were attached to the upper half of the lateral surface of the dens and ran laterally to its insertion just medial to the occipital condyle. The ligaments were found to have an ovoid cross-sectional area with a nearly horizontal caudo-cranial trajectory and comparable diameters in both anteroposterior and superoinferior directions between the CT and cadaveric measurements.

Conclusions

There were small but not statistically significant differences in the measurements between the cadaver specimens and the CT images. There was however, a strong correlation between the proximal and distal insertions, as well as the orientation of the fibers that suggests CT images can be an appropriate approach to the study of the anatomical and three-dimensional features of the alar ligaments.

Learning Objectives

By the conclusion of this session, participants should be able to comprehend in detail the anatomy and relationships of the alar ligaments and their morphologic correlation with CT images. Also they should be able to acknowledge the usefulness of CT images as an appropriate approach to the study of the anatomical and three-dimensional features of the alar ligaments. Finally, it should open a window for further studies regarding the biomechanical implications of the alar ligaments in cranio-cervical junction pathologies.

Table 1

	Right Alar ligament		Left Alar ligament	
	Specimen	CT	Specimen	CT
L2	7.15±1.74mm (4.98-9.23)	6.48±1.59mm (5.1-8.7)	8.27±3.33mm (5.89-13.12)	7.08±2.98mm (5.3-11-5)
W1	8.77±1.33mm (6.86-9.93)	8.73±2.04mm (6.6-11.5)	8.9±1.47mm (7.35-10.47)	9.5±1.28mm (8.2-11)
W2	7.18±1.34mm (5.42-8.58)	6.45±0.94mm (5.5-7.6)	7.87±1.28mm (5.97-8.73)	7.4±1.22mm (5.6-8.3)
W3	6.93±1.4mm (4.85-7.78)	8.8±1.49mm (47.2-10.8)	6.94±1.32mm (4.95-7.67)	9.08±0.95mm (8.5-10.5)
D1	6.53±1.18mm (5.11-7.6)	5.58±1.07mm (4.2-6.6)	5.64±1.47mm (4.75-7.82)	5.93±1.35mm (4.4-7.7)

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