

**Comparison of Methods of Halo Vest Application: A Biomechanical Study***Mark L. Prasarn, MD<sup>1</sup>; Caleb J. Behrend, MD<sup>2</sup>; MaryBeth Horodyski, PhD<sup>3</sup>;**Rex A. Marco, MD<sup>1</sup>; Glenn R. Rechtine, MD<sup>2</sup>;**<sup>1</sup>University of Texas, Houston, Texas, USA;**<sup>2</sup>University of Rochester, Rochester, New York, USA;**<sup>3</sup>University of Florida, Gainesville, Florida, USA*

**Purpose:** It is a well-accepted tenet that spinal motion should be minimized when managing an unstable cervical spine fracture. Such injuries are oftentimes managed temporarily, or even definitively, with a halo vest. We sought to determine the best method to minimize motion of an unstable upper cervical spine injury during the application of a halo vest.

**Methods:** Unstable C1-C2 injuries were surgically created in 5 fresh, lightly embalmed human cadaver specimens. An electromagnetic motion analysis device (Liberty; Polhemus, Colchester, VT) was used to assess the amount of angular and linear motion at the injured C1-C2 segment. These sensors were rigidly affixed to the occiput and the lamina of C2. Measurements were recorded during the application of a halo vest using either the log-roll maneuver, or torso elevation of the cadaver. All trials were performed by a fellowship-trained spine surgeon.

**Results:** There were no differences in anterior-posterior displacement or flexion-extension with the two techniques. The log-roll maneuver resulted in more motion in axial rotation, lateral bending, medial-lateral translation, and axial displacement. This was statistically significant for axial rotation ( $P = 0.04$ ) and medial-lateral translation ( $P = 0.02$ ), and approached significance for lateral bending ( $P = 0.06$ ). There was almost twice the motion in each of these planes when using the log-roll technique (Table 1).

**Conclusion:** There can be significant motion at an unstable upper cervical spine injury during the application of a halo vest. This undesirable motion can potentially result in secondary neurologic injury. Using the torso-elevation technique results in less unwanted motion, and may be a safer method to apply a halo vest than the log-roll maneuver. We propose a new method for application of the halo vest that results in less motion at an unstable upper cervical spine injury, possibly resulting in improved protection of the spinal cord.

Table 1

Technique		F/E	AR	LB	ML	AX	AP
Log-roll	Mean	16.21	20.89	15.48	19.99	18.41	22.53
	Std. Deviation	3.65	5.85	5.86	15.95	17.44	10.24
	N	15	15	15	15	15	15
Torso-elevation	Mean	17.39	11.40	8.72	11.22	12.31	19.67
	Std. Deviation	4.77	3.03	3.11	9.14	7.81	10.33
	N	15	15	15	15	15	15
Total	Mean	16.80	16.14	12.10	15.60	15.36	21.10
	Std. Deviation	4.22	6.65	5.75	13.53	13.63	10.21
	N	30	30	30	30	30	30

F/E = flexion-extension, AR = axial rotation, LB = lateral bending, ML = medial-lateral translation, AX = axial displacement, AP = anterior-posterior translation.

- The FDA has not cleared this drug and/or medical device for the use described in this presentation (i.e., the drug or medical device is being discussed for an “off label” use). For full information, refer to page 600.