Predictors of Vertebral and Carotid Artery Dissection during Blunt Trauma: Experience in a Level I Trauma Center

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Introduction

Various studies have sought to identify factors associated with vertebral and carotid artery dissection in a trauma setting [1,2]. However, these models are controversial, and efforts continue to optimize these predictors.

Methods

950 patients, who underwent CT-angiography in Santa Clara Valley Medical Center Emergency Department between 2009-2014, were included in this study. 515 patients were excluded because they were non-trauma cases, or had penetrating injuries.

435 patients were analyzed, who all underwent neck CTA for blunt traumatic injuries. Mechanism of injury was classified as high- and low-impact, based on county guidelines for major and minor trauma. A positive neurological sign included altered mental status (GCS<15 or less than baseline) or focal neurological deficits. Fractures and dissections were radiologically confirmed. Multivariable logistic regression was used to analyze data with SAS v9.4.

Table 1. Population Demographics

N	435
Mean Age +/- SEM	39.70 +/- 0.95
% Female	35.86
% High Impact Injury	54.25
% Low Impact Injury	45.75
% Vertebral Column Fracture	28.51
% Displaced Fracture	50.81
% Carotid Artery Injury	2.07
% Vertebral Artery Injury	3.68
% Neurological Injury	41.38
% Stroke	1.15

Table 2. Patient Differences by Carotid Artery Dissection

	Vertebral Injury	No Vertebral Injury	P-Value
N	16	419	
Mean Age +/- SEM	40.56 +/- 3.91	39.66 +/- 0.97	0.86
% Female	43.75	35.56	0.5
% High Impact Injury	56.25	54.18	0.87
% Vertebral Fracture	75	26.73	***<0.0001***
% Displaced	58.33	50	0.58
% Neurological Injury	81.25	39.86	***0.001***
% Stroke	0	1.2	0.66

Table 3. Patient Differences By Vertebral Artery Dissection

	Vertebral Injury	No Vertebral Injury	P-Value
N	16	419	
Mean Age +/- SEM	40.56 +/- 3.91	39.66 +/- 0.97	0.86
% Female	43.75	35.56	0.5
% High Impact Injury	56.25	54.18	0.87
% Vertebral Fracture	75	26.73	***<0.0001***
% Displaced	58.33	50	0.58
% Neurological Injury	81.25	39.86	***0.001***
% Stroke	0	1.2	0.66

Results

Of 435 patients, 35.86% were female and 54.25% experienced high-impact injuries. 28.51% had vertebral fractures, of which 50.81% were displaced. 41.38% patients had a positive neurologic sign on presentation. 9 (2%) patients were diagnosed with carotid artery dissections, and 16 (3.7%) had vertebral artery dissections [Table 1.]. There were no significant associations between positive neurologic sign, age, sex, mechanism of injury, or vertebral fracture for carotid artery injury (all $p>0.05$). There was a significant difference in the rates of stroke between patients with carotid artery dissection and those without injury ($p<0.05$) [Table 2.].

Positive neurologic signs and vertebral fractures were significant predictors of vertebral artery dissection (OR=5.46, $p<0.01$; OR=8.44, $p<0.001$ respectively). Age, sex, mechanism of injury, or displacement of vertebral fracture were not significant predictors of vertebral artery injury (all $p>0.05$). There were significant differences in rates of vertebral fractures and positive neurologic sign between those with vertebral artery dissection and those without injury (all $p<0.05$) [Table 3.].

Conclusions

These findings from a large cohort of patients with blunt traumatic injury at a single trauma center show that positive neurologic signs and presence of vertebral fractures (displaced or non-displaced) are significant predictors of vertebral artery injuries. This underscores potential avenues to optimize screening tools for such injuries.

Learning Objectives

1) Neurologic deficits is a significant predictor of vertebral artery dissection in a trauma setting.
2) Mechanism of injury (high or low impact) is not an independent predictor of arterial dissection.
3) Vertebral fractures (displaced and non-displaced) are a significant predictor of vertebral artery dissection, while vertebral body dislocation/displacement by itself is not.

References

1) Lockwood MM, Smith GA, Tanenbaum J, Lubelski D, Seicean A, Pace J, Benzel EC, Mroz TE, Steinmetz MP. Screening via CT angiogram after traumatic cervical spine fractures: narrowing imaging to improve cost effectiveness. Experience of a Level I trauma center. J Neurosurg Spine. 2016 Mar;24(3):490-5. doi: 10.3171/2015.6.SPINE15140. PubMed PMID: 26613284.

2) Delgado Almandoz JE, Schaefer PW, Kelly HR, Lev MH, Gonzalez RG, Romero JM. Multidetector CT angiography in the evaluation of acute blunt head and neck trauma: a proposed acute craniocervical trauma scoring system. Radiology. 2010 Jan;254(1):236-44. doi: 10.1148/radiol.09090693. PubMed PMID: 20019135.