Trends and predictors of computed tomography angiography utilization for cervical spine fractures in the emergency department from 2010 to 2022: A national database analysis

Rahul H. Jayaram, BS[a], Albert H. Lee, MSE[a], Kevin Girardi, BS[a], Anshu Jonnalagadda, BS[a], Ajay Malhotra, MD[b],Jonathan N. Grauer, MD[c]
[a]Yale School of Medicine, New Haven, CT, USA
[b]Department of Radiology and Biomedical Imaging, Yale School of Medicine, New Haven, CT, USA
[c]Department of Orthopaedics and Rehabilitation, Yale School of Medicine, New Haven, CT, USA

Disclosures: Rahul H. Jayaram (N), Albert H. Lee (N), Kevin Girardi (N), Anshu Jonnalagadda (N), Ajay Malhotra (N); Jonathan N. Grauer (North American Spine Society Past Board Member; North American Spine Society Journal Editor-in-chief; Journal of the American Academy of Orthopaedic Surgeons Deputy Editor)

Abstract body using the following format: abstract information must not appear on or outside the margins. Abstracts must be created in a Word document formatted to 8.5" x 11" (21.59cm x 27.94cm) with the following margin settings: Top & Bottom 0.75 inch (1.91cm); Left & Right 0.75 inch (1.91cm). Font should be 10 points for the Title and 8 points for all authors, institutions, disclosures, and body sections. Times New Roman is the only font approved for use. (If noting a brand name of a product you used, please do not list the city, state or country.)

INTRODUCTION: Screening for blunt cerebrovascular injury (BCVI) in cervical trauma patients has become increasingly routine due to the risk of vertebral artery injury and posterior circulation stroke. Many trauma centers now employ CTA protocols for acutely traumatized patients with cervical fractures, though concerns persist about potential overuse. Prior studies on CTA trends and predictors in cervical fracture patients have been limited by sample size and regional focus. The current study aimed to evaluate national computed tomography angiography (CTA) use trends and identify predictors of use for emergency department (ED) patients with cervical spine fractures.

METHODS: Patients presenting to the ED with acute cervical fractures were identified from the 2010-2022 M170 PearlDiver administrative database. CTA use on the day of presentation was identified. Annual numeric and proportional CTA utilization in this patient population was assessed. Multivariate analyses were performed to evaluate predictors of CTA use that were clinical (age, sex, Elixhauser Comorbidity Index [ECI]), non-clinical (insurance type, geographic region), and anatomic fracture location ([C1-C2], subaxial [C3-C7], other).

RESULTS SECTION: Among 183,756 patients, CTA was utilized for 24,831 (13.51%). Utilization increased from 5.82% in 2010 to 23.92% in 2022 ($p < 0.001$). Independent predictors of CTA included younger age (per decade decrease, OR 1.02), male sex (OR 1.14), higher ECI (relative to ECI 0: ECI 1-2, OR 1.20; ECI 3-4, OR 1.32; ECI ≥5, OR 1.36), insurance type (relative to Medicare: Commercial, OR 1.41; Medicaid, OR 1.49), geographic region (relative to West: South, OR 1.06; Midwest, OR 1.22), and upper cervical injury (relative to subaxial, OR 1.52).

DISCUSSION: CTA use in ED cervical fracture patients rose over four-fold from 2010 to 2022. There were several clinical factors associated with the use of CTA in cervical fracture patients. There were also notable differences in nonclinical factors associated with CTA utilization. These findings suggest that factors unrelated to injury severity or clinical presentation may influence the decision to perform CTA.

SIGNIFICANCE/CLINICAL RELEVANCE: While clinical and anatomic factors predicted CTA use, the influence of non-clinical factors underscores the lack of standardized screening and supports more evidence-based protocols for BCVI evaluation in cervical fractures.

IMAGES AND TABLES:

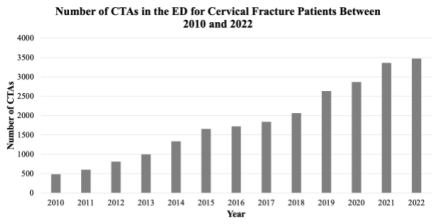

Figure 1: Total annual number of CTAs performed in the ED for cervical fracture patients from the years 2010 to 2022.

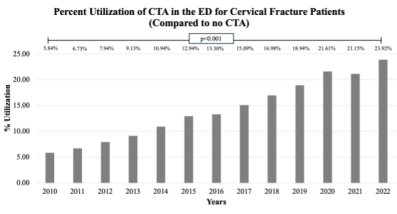

Figure 2: Annual proportional utilization of CTA in the ED for cervical fracture patients compared to not undergoing CTA from the years 2010 to 2022. **Chi*-squared test $p<0.05$, referent=2010

Table 1: Characteristics of Cervical Fracture ED Patients (Univariate)

Variable	All Patients	Without CTA	With CTA	p-value
Total	183,758	158,925 (86.49%)	24,833 (13.51%)	
Age (mean ± SD)	62.76 ± 17.84	63.44 ± 17.52	58.43 ± 19.23	**<0.001**
Sex				**<0.001**
Female	89,023 (48.45%)	78,150 (49.17%)	10,873 (43.79%)	
Male	94,733 (51.55%)	80,775 (50.83%)	13,958 (56.21%)	
ECI (mean ± SD)	5.77 ± 4.43	5.81 ± 4.44	5.46 ± 4.33	**<0.001**
0	15,649 (8.52%)	13,496 (8.49%)	2,153 (8.67%)	
1 to 2	35,479(19.31%)	30,222 (19.02%)	5,257(21.17%)	
3 to 4	34,062 (18.54%)	29,237 (18.40%)	4,825 (19.42%)	
≥ 5	15,219 (8.28%)	13,137 (8.27%)	2,082 (8.38%)	
Plan				**<0.001**
Commercial	107,707 (58.61%)	91,884 (57.82%)	15,820 (62.91%)	
Medicare	66,283 (25.19%)	41,887 (26.36%)	4,355 (17.54%)	
Medicaid	14,883 (8.10%)	12,279 (7.73%)	2,590 (10.43%)	
Region				**<0.001**
West	26,912 (14.65%)	23,437 (14.75%)	3,473 (13.99%)	
Northeast	33,474 (18.22%)	29,221 (18.39%)	4,255 (17.14%)	
South	69,821 (38.00%)	60,687 (38.19%)	9,136 (36.79%)	
Midwest	52,388 (28.50%)	44,569 (28.04%)	7,797 (31.40%)	
Fracture Type				**<0.001**
Upper Cervical	75,935 (41.32%)	63,256 (39.80%)	12,679 (51.06%)	
Subaxial	77,031 (41.91%)	66,145 (41.63%)	10,886 (43.84%)	
Other	30,770 (16.75%)	29,504 (18.56%)	1,266 (5.10%)	

SD, Standard Deviation
ECI, Elixhauser Comorbidity Index
Bold p-value = statistical significance at $p < 0.05$

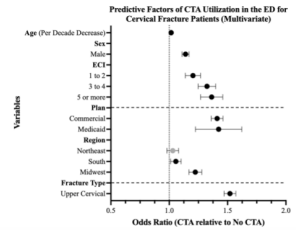

Figure 3: Forest plot with multivariate odds ratios showing independent predictors of undergoing CTA in the ED for cervical fracture patients. Dark dots indicate statistically significant predictors, and gray dots indicate non-significant predictors.