The Incidence of Vascular Injuries in Patients with Negative Cervical Computed Tomography (CT) Following Blunt Trauma

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Background

- Blunt trauma of the cervical spine most commonly occurs in patients after high-speed motor vehicle collisions or falls.
- The incidence of vascular injury, of the vertebral and carotid arteries, associated with cervical spine fractures is reported as high as 30%, and it occasionally represent a life-threatening emergency that requires prompt detection and treatment to prevent devastating ischemic complications.[1]
- The original Denver criteria mandated CT angiography screening for any patients with C1– C3 fracture, cervical spine fractures that enter the foramen transversarium, and cervical fracture subluxations.[2]
- The expanded criteria, which is more widely used, included nonfracture indications.[3]
- However, there is a scarcity of evidence to support the use of that criteria, particularly in patients with absence of abnormal findings on cervical CT, including fractures, dislocation, or malalignment.[4]

Objectives

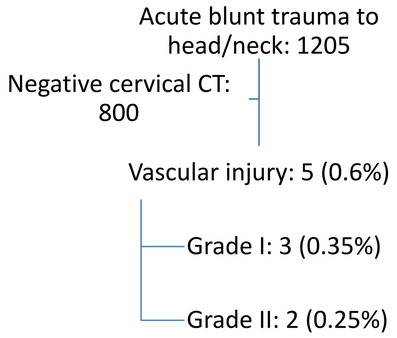
- In this study, we aimed to study the incidence of vascular injury in patients with blunt cervical trauma and negative cervical CT.
- The study hypothesis was that in patients with negative cervical CT, the incidence of vascular injury of grade 2 or higher on CTA is less than 5%.

Methods

- We conducted a retrospective analysis of a prospectively maintained database, to identify patients with cervical blunt trauma who sustained cervical vascular injury in the absence of cervical fracture.
- All blunt trauma patients above the age of 18 years, who presented to our level 1 trauma center as tiers 1, 2, and 3 injuries between January 2020 and December 2022 were reviewed.
- Inclusion criteria included concurrent CT cervical spine and CTA. Patients with no available cervical CT and CTA, non concurrent or positive cervical CT for fracture were also excluded.
- The data collected included patient characteristics (eg. age, gender), trauma details (eg. mechanism, tier), and imaging details (CT and CTA findings).
- The sample size required for this study was calculated using the formula: n = (Z^2 * P * (1 - P)) / E^2. Assuming a 99% confidence interval, we used the following values: Z (Z-score for a 99% confidence interval) = 2.326, P (proportion) = 0.05, and E (margin of error) = 2%.
- Based on these parameters, the calculated sample size (N) was 791.
- Institutional Review Board (IRB) approval was obtained prior to the beginning of the study.

Results

- A total of 9632 patients presented with acute trauma to our hospital between January 2020 and December 2022.
- Of those, 1205 (12.5%) with blunt trauma to the head and neck received both cervical CT and CTA, and 800 (66.4%) had negative cervical CT, with no signs of fractures, dislocations, or malalignment.
- Among those 800 patients, only 5 patients (**0.6%**; 2 females and 3 males, mean age 44.2 years) had vascular injury on cervical CTA:
  - 3 patients had grade 1 injury
  - 2 had grade 2 injury



Discussion and Conclusion

- The risk of cervical vascular injury following cervical blunt trauma is up to 11%, however, when cervical fracture is present, the risk could be up to 30%.[5]
- In this study, the incidence of cervical arterial injury, including vertebral and carotid arteries, following blunt cervical trauma with negative cervical CT was 0.6%, and none of those patients had an injury higher than grade 2.
- This indicates that the use of CTA in patient no signs of cervical fracture on images is generally not indicated and should be tailored based on the patient's presentation.
- In those patients, the mechanism of vascular injury is likely to result from excessive shearing forces occurring during extreme flexion and extension, such as in a whiplash injury with rapid acceleration and deceleration,

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