

Reliability Assessment of the Biffi Scale for Blunt Traumatic Cerebrovascular Injury as Detected on Computer Tomography Angiography

Paul M. Foreman MD, Christoph J. Griessenauer MD, Kimberly P. Kicielinski MD, Philip G. R. Schmalz MD, Brandon G. Rocque MD, MS, Matthew R. Fusco MD, Joseph C. Sullivan III MD, John P. Deveikis MD, Mark R. Harrigan MD

University of Alabama at Birmingham

Introduction

Blunt traumatic cerebrovascular injury (TCVI) represents structural injury to a vessel due to high-energy trauma. The Biffi Scale is a widely accepted grading scheme for these injuries that was developed using digital subtraction angiography. In recent years, screening computed tomography angiography (CTA) has been used to identify patients with TCVI. The reliability of this scale, using CTA, has not yet been determined.

Table 1. Biffi Scale for traumatic cerebrovascular injury

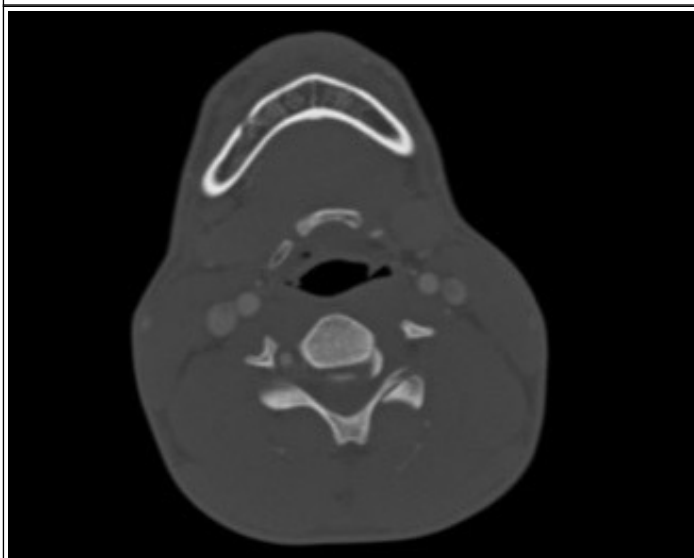
Injury Grade	Description
I	Luminal irregularity or dissection with < 25% luminal narrowing
II	Dissection or intramural hematoma with ≥ 25% luminal narrowing
III	Pseudoaneurysm
IV	Occlusion
V	Transection with free extravasation

Methods

Seven independent raters, including two neurosurgeons, two neuroradiologists, two neurosurgical residents, and one neurosurgical vascular fellow independently reviewed a presenting CTA of the neck performed on 40 patients with confirmed TCVI and assigned a Biffi grade. Ten images were repeated to assess intra-rater reliability, for a total of 50 CTAs. Fleiss's multi-rater kappa and interclass correlation were calculated as a measure of inter-rater reliability. Weighted Cohen's kappa was used to assess intra-rater reliability.



Type III Injury



Type IV Injury

Results

Fleiss's multi-rater kappa was 0.65 (95% CI 0.61 - 0.69), indicating substantial agreement as to the Biffi grade assignment among the seven raters. Interclass correlation was 0.82 demonstrating excellent agreement among the raters. Intra-rater reliability was perfect (weighted Cohen's kappa = 1) in two raters and near perfect (weighted Cohen's kappa > 0.8) in the remaining 5 raters.

Conclusions

Grading of TCVI with CTA using the Biffi Scale is reliable.