# Management of Simultaneous Traumatic Brain and Aortic Injury

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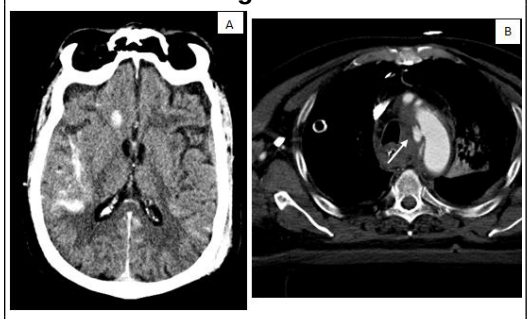
## Introduction

Simultaneous traumatic brain injury (TBI) and aortic injury (AI) has been considered "unsurvivable" for many years because treatments such as sedation and blood pressure goals conflict for these two conditions. Additionally, surgical interventions for AI often require full anticoagulation, which is contra-indicated in TBI patients. For these reasons and due to the relative rarity of AI/TBI, little data are available to guide treating physicians.

**Figure 1**




Computed tomography of TBI and AI

## Methods

A retrospective review was performed on all simultaneous TBI and AI cases from 2000 to 2012 at a level I trauma center. Patient demographics, imaging studies, interventions, and outcomes were analyzed. TBI/AI cases treated with endovascular stenting were studied to determine trends in procedure timing, use of anticoagulation, and neurological outcome.

## Results

Thirty-three patients with TBI and AI were identified over a 12 year period. Median patient age was 44 years (range 16-83), and overall mortality after imaging diagnosis was 46%. All surviving patients were awake and neurologically functional at discharge. Patients who died had a higher injury severity scale (ISS) score (p=0.006). Severe TBI (p=0.045) or hemodynamic instability (p=0.015) upon arrival to the hospital were also correlated with increased mortality. Thirty-three percent of AI/TBI patients underwent endovascular stenting (n=11), and seven of these patients received intravenous anticoagulation at the time of surgery. Six of these seven anticoagulation treated patients had no significant progression on postoperative brain computed tomography, and one patient died of hemodynamic instability prior to further imaging.

**Table 1: Results**

| | | Died | Total | Percent | |
|---|---|---|---|---|---|
| Total | | 15 | 33 | 45.5 | |
| Age<40 | | 6 | 14 | 42.9 | p=0.93 |
| Age>40 | | 8 | 18 | 44.4 | |
| Male | | 9 | 22 | 40.9 | p=0.46 |
| Female | | 6 | 11 | 54.5 | |
| Hemodynamic Status | | | | | |
| | Shock | 14 | 24 | 58.3 | p=0.015 |
| | Stable | 1 | 9 | 11.1 | |
| GCS | | | | | |
| | Mild/Moderate | 4 | 15 | 26.7 | p=0.045 |
| | Severe | 11 | 18 | 61.1 | |
| Type of Aortic injury | | | | | |
| | Dissection | 3 | 6 | 50.0 | p=0.69 |
| | Pseudoaneurysm | 9 | 18 | 50.0 | |
| | Transsection/Extravasation | 3 | 9 | 33.3 | |
| CV Surgery | | | | | |
| | Endovascular repair | 3 | 11 | 27.3 | p=0.24 |
| | Open repair | 1 | 3 | 33.3 | |
| | No open or endovascular intervention | 11 | 19 | 57.9 | |
| ISS | | | | | |
| | 26-45 | 5 | 19 | 26.3 | p=0.015 |
| | 46-65 | 6 | 10 | 60.0 | |
| | 66-75 | 4 | 4 | 100.0 | |
| ISS | | Mean | Median | | |
| | Alive | 42 | 41 | | p=0.006 |
| | Dead | 54 | 50 | | |

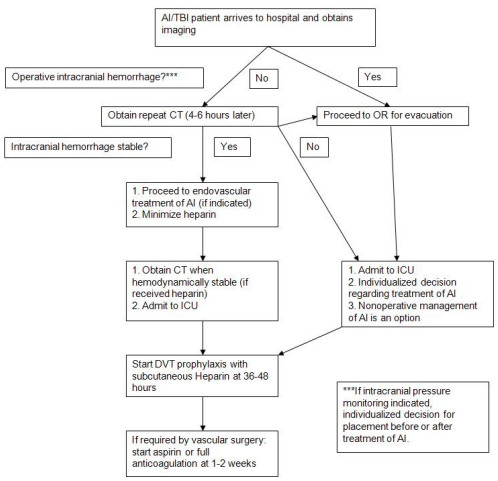
**Table 2: Endovascular Treatment of AI**

| Patient | Days from Injury to Stent | Heparin Dose | Intracranial Lesion | Progression on CT | Outcome |
|---|---|---|---|---|---|
| 1 | 1 | 3000 Units Heparin IV | SAH, SDH | None | Alive |
| 2 | 0 | 7000 Units Heparin IV | Contusion | 7 Petechial hemorrhage | Alive |
| 3 | 4 | 1000 Units Heparin IV | Contusions, IVH | None | Alive |
| 4 | 1 | 5000 Units Heparin IV | SDH | None | Alive |
| 5 | 0 | None | Contusion | None | Alive |
| 6 | 0 | None | SAH | Dead (No CT done) | Dead |
| 7 | 0 | 3000 Units Heparin IV | Contusions, SAH, SDH | None | Alive |
| 8 | 2 | None | SAH, SDH | None | Alive |
| 9 | 1 | 10,000 Units Heparin IV | Contusion, IVH | Dead (No CT done) | Dead |
| 10 | 0 | 4000 Units Heparin IV | Contusion, SAH | None | Alive |
| 11 | 1 | None | SAH | Dead (No CT done) | Dead |

## Conclusions

Simultaneous TBI and AI is a rare condition with a historically poor prognosis. However, our results suggest that many patients can survive with good quality of life. Technological advances such as endovascular aortic stenting may improve patient outcome, and anticoagulation is not absolutely contraindicated after TBI.

**Figure 2**




Algorhythm for treatment of TBI and AI

## Learning Objectives

By the conclusion of this session, participants should be able to 1) understand the prognosis of simulatenous traumatic brain and aortic injury and 2) be aware of treatment strategies for these conditions.

## References

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