

# Four-year Surgical Results for Traumatic Aortic Injury in China Medical University Hospital, Mid-Taiwan

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## Background

Blunt traumatic aortic injury (BTAI) carries a high mortality rate up to 10-30%, especially when combining with brain injury and severe thoraco-abdominal visceral organ injuries. For Grade (Gr) II to IV injuries, urgent thoracic endovascular aortic repair (TEVAR) is mandatory. This study aims at surgical strategy and results in our center.

## Method

From Jan. 2014 to Jan. 2019, all BTAI patients undergoing surgery in China Medical University Hospital were retrospectively reviewed.

### Initial Data

Mechanism of injury	Associated injury
Injury severity score	Glasgow coma scale
Initial/lowest BP	Initial heart rate
Comorbidity	Door to operation time

### Operative Data

Operation time	Number of stents
Tapered stent usage	Diameter of stents
Proximal landing	Distal landing
LSCA coverage	Associated operation

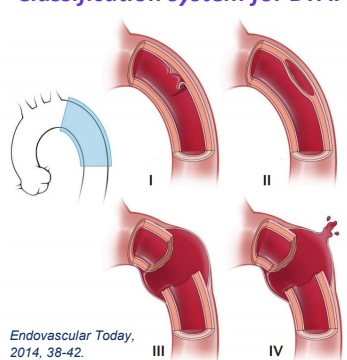
### Post-operative Data

Length of ICU stay	Length of ward stay
Early/late complication	Early/late reintervention
Mortality cause	Operation to mortality time

### Diagnostic Data

Grade of aortic injury	Diagnostic chest X-Ray
Diagnostic CT	CT after operation
Aortic diameter change	False lumen thrombosis

### Classification system for BTAI



**Grade I: intimal tear/flap**  
**Grade II: intramural hematoma**  
**Grade II': AORTIC DISSECTION**  
**Grade III: pseudoaneurysm**  
**Grade IV: rupture**  
**Grade X: PERIAORTIC HEMATOMA**

## Results

### Initial ISS

31 ± 9

### Door to operation time

Mean	2 hour 51min
Max	14 hour 48 min
min	29 min

Fig.1 | Initial injury severity score

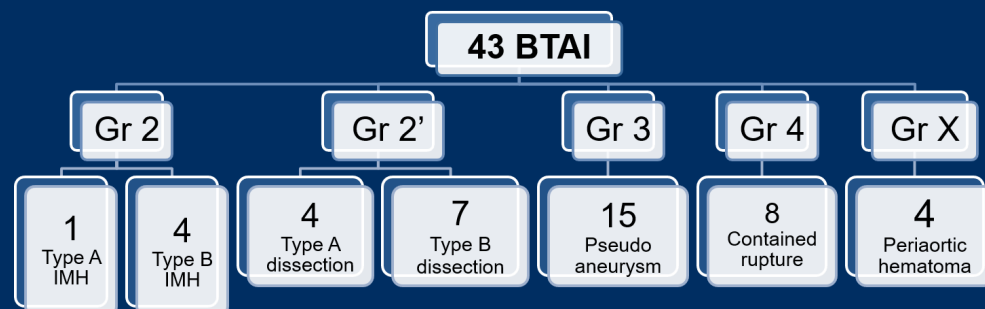


Fig.2 | Classification for BTAI patients

## Results

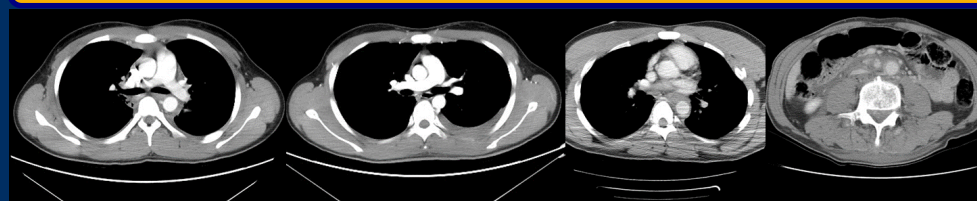


Fig.3 | CT image of periaortic hematoma in the 4 patients

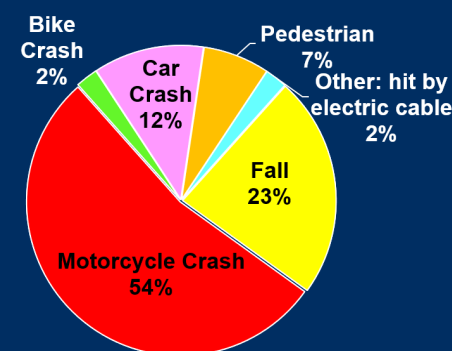


Fig.4 | Mechanism of injury

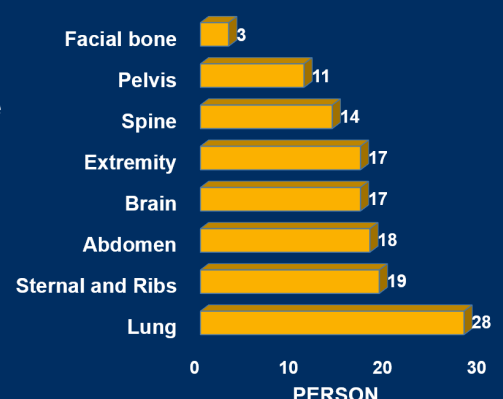


Fig.5 | Associated injury

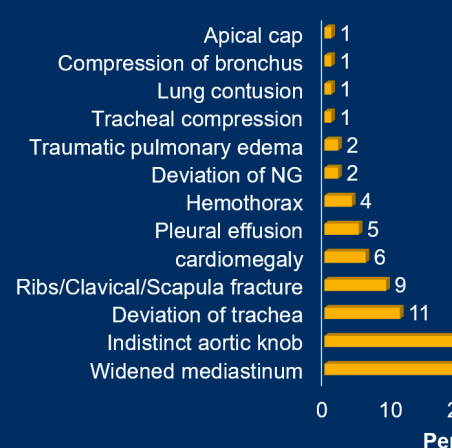


Fig.6 | Diagnostic chest X-ray

Age	52.8 ± 17.6
Male	34 (79.07%)
Comorbidities	
Hypertension	15 (34.88%)
Cigarette	13 (30.23%)
CVA	1 (2.33%)
DM	7 (16.28%)
Medication	
Antiplatelet	2 (4.65%)

Fig.7 | Comorbidities

Grade	Gr 2		Gr 2'		Gr 3	Gr 4	Gr X
	A IMH	B IMH	A AD	B AD			
Mortality no.	1 / 1	1 / 4	3 / 4	2 / 7	2 / 15	4 / 8	0

Fig.8 | Mortality in different TAI groups

Type	Management	Outcome	Cause
A IMH	Z4 TEVAR	mortality	Pre-operative spinal shock, medulla infarction
A AD	Asc. Ao grafting + Z3 TEVAR	MBD in 26 days	-
A AD	Z0 TEVAR	mortality	Severe AR, related to aortic valve entrapment
A AD	Total arch replacement + Z2 TEVAR + LSCA aChimney	mortality	Pre-operative cerebellum infarction
A AD	Asc. stent graft +innominate a. chimney	mortality	True lumen collapse

Fig.9 | Management in patients with type A IMH/AD

A 59y/o male was sent to ED after falling from 2F to 1F. Type A AD, liver laceration, hemoperitoneum and L-spine fracture were found in initial CT image. Abrupt shock accompanying with poor cardiac contraction and pulmonary hemorrhage occurred after Zone 0 TEVAR. Aortography revealed clues of acute severe aortic regurgitation caused by aortic valve entrapment.

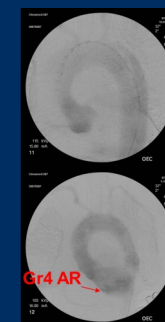


Fig.10 | Aortography of aortic valve entrapment

	BTAI	BAAD
30-day Mortality	13/43 (30.2%)	8.7%
Procedure-related	5/43 (11.6%) *free rupture 3	4.3%
Brain injury	5/43 (11.6%)	4.3%
Lung	1/43 (2.3%) *Tension pneumothorax 1	0
Abdomen	2/43 (4.7%) *Visceral ischemia/ Intra-abdominal bleeding	0
Early complication	7.1% *A AD aortic valve entrapment 1, AKI 2	15.2%
Reintervention	3.3% *RSA to LSA, LSA steal syndrome 1	23.9%

Fig.11 | Surgical results in TAI / acute Type B aortic dissection patients

Grade	Gr 2	Gr 2'	Gr 3	Gr 4	Gr X
	IMH	AD	Pseudo-aneurysm	Contained Rupture	Periaortic hematoma
F/U person	2	6	9	2	3
0a	0	33.3%	0	0	0
I	0	33.3%	0	0	0
IIb	0	16.7%	0	0	0
III	100%	16.7%	100%	100%	100%

Fig.12 | Classification of false lumen thrombosis after follow-up

## Discussion

According to an analysis with 13627 trauma patients in Japan, the mortality rate rose to 27.2% at ISS ≥36, which is consistent with the result of our study. Standard treatment of ascending aortic pathology is open repair, but in some high-risk patients, TEVAR has been used as an alternative. A study in London revealed promising result of 8.3% 30-day mortality in selected Type A AD patients underwent TEVAR, which is satisfying comparing to our results. Novel surgical, hybrid and delicate endovascular strategies should be further developed for better outcome.

## Conclusion

TEVAR for BTAI is always a dilemma in multiple traumatic patients, especially in which combined with brain injury. Besides, the aortic remodeling for Gr III-IV TAI after TEVAR procedure is promising.