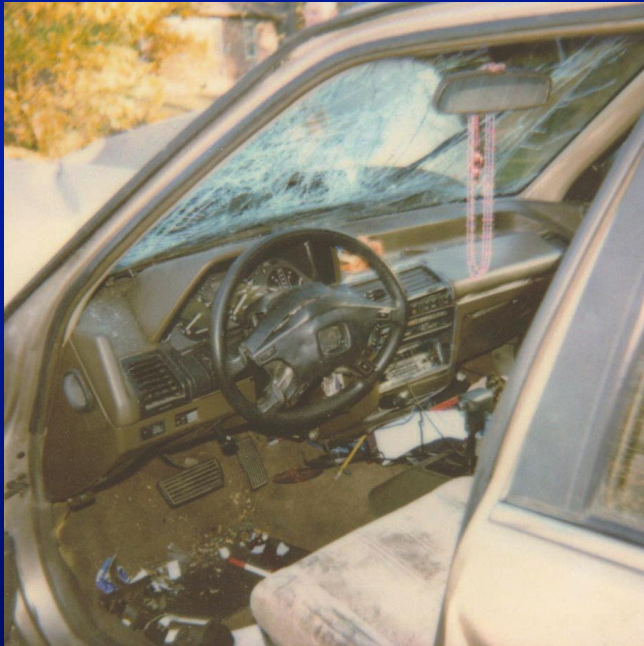


Advances in Treatment of Traumatic Aortic Transection



Himanshu J. Patel MD

University of Michigan Medical Center

Author Disclosures

- Consulting fees from WL Gore Inc.

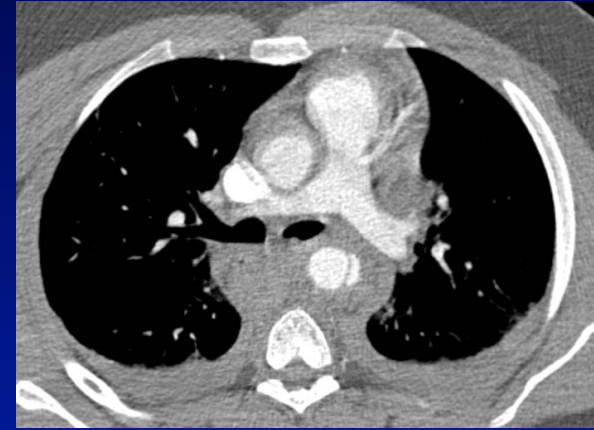
“There is no disease more conducive to clinical humility than aneurysm of the aorta”



Sir William Osler

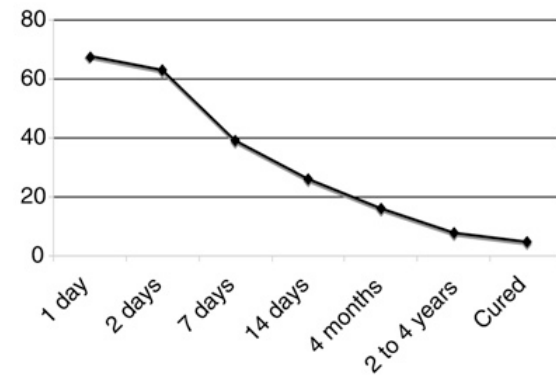
Natural History

- Pioneering work described natural history of untreated blunt thoracic aortic injury
 - Initial mortality rate at 24 hours was 34%
- Classic teaching of early aortic repair



Survival Times of Hospitalized Patients

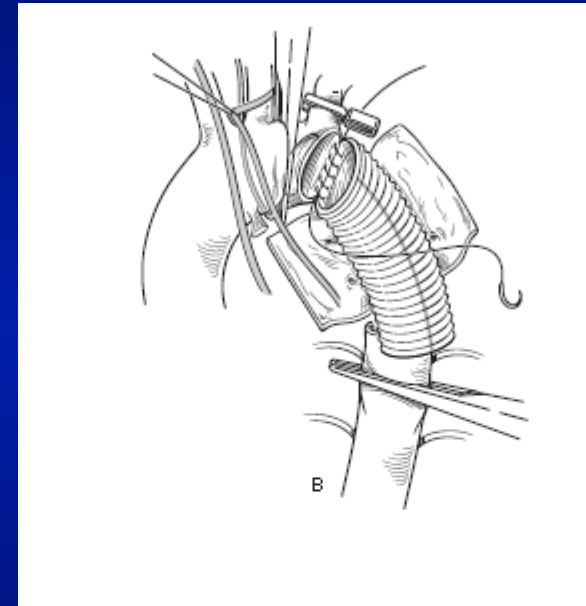
Time	Survival Total (%)
1 day	12 (32)
2 days	2 (5)
7 days	9 (24)
14 days	5 (13)
4 months	4 (10)
2 - 4 years	4 (10)
Cured	2 (5)



Parmley, et al. 1958

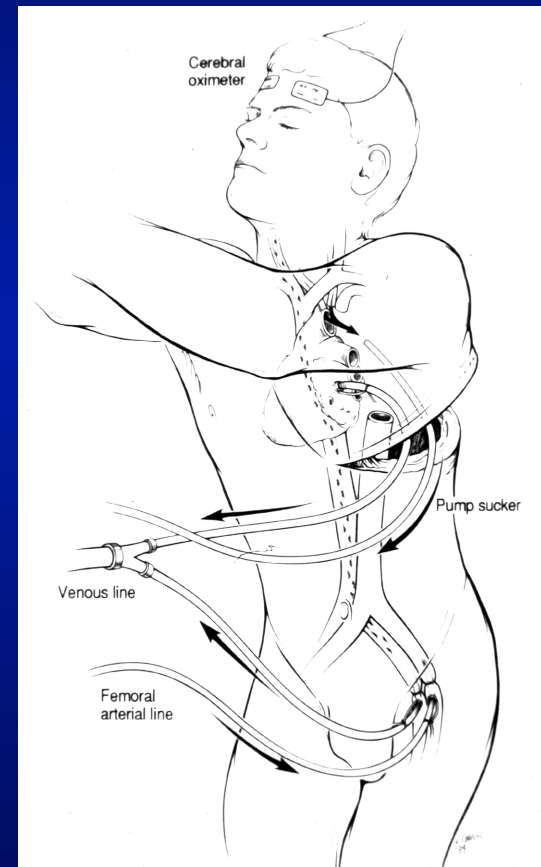
Prospective AAST-1 Study (1997)

- Immediate repair in 207 of 274 patients
- 31% mortality rate with 63% of deaths attributable to aortic rupture
- Paraplegia rate of 9%



Contemporary Natural History

- Akins et. al. (1981) challenged dogma of immediate repair
- Recent autopsy study (242 patients) suggests
 - 57% dead at scene
 - 37% died in 1st 4 hours
 - 6% died thereafter



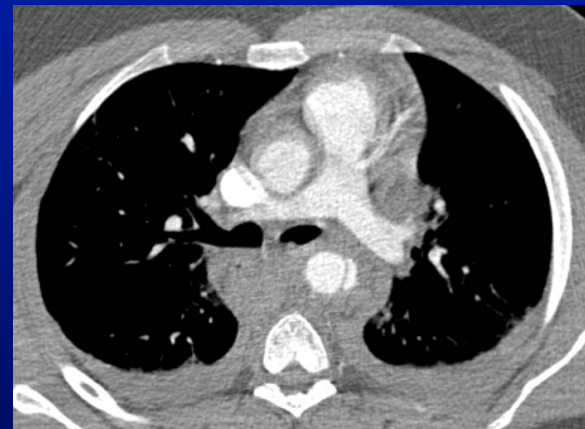
Emerging Paradigm Shifts

- Prospective study:
 - CT for early diagnosis
 - Prompt BP control eliminates rupture risk
 - Treat other life threatening injuries—e.g. closed head injury
 - Validated the concept of selective delayed repair

Prospective Study of Blunt Aortic Injury Helical CT is Diagnostic and Antihypertensive Therapy Reduces Rupture

Timothy C. Fabian, MD,* Kimberly A. Davis, MD,* Morris L. Gavant, MD,† Martin A. Croce, MD,* Sherry M. Melton, MD,* Joe H. Patton, Jr., MD,* Constance K. Haan, MD,* Darryl S. Weiman, MD,* and James W. Pate, MD*

From the Departments of Surgery and Radiology,† University of Tennessee, Memphis, Tennessee*



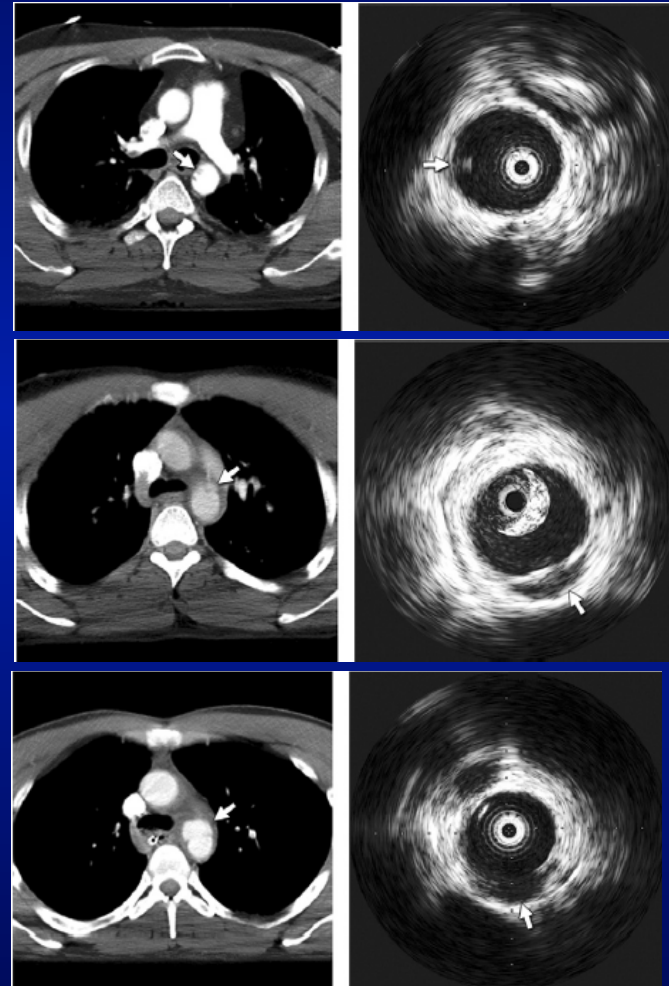
Are All Injuries Lethal?

- Sensitivity of CT scans
- Classification schema of Azzizadeh et. al.



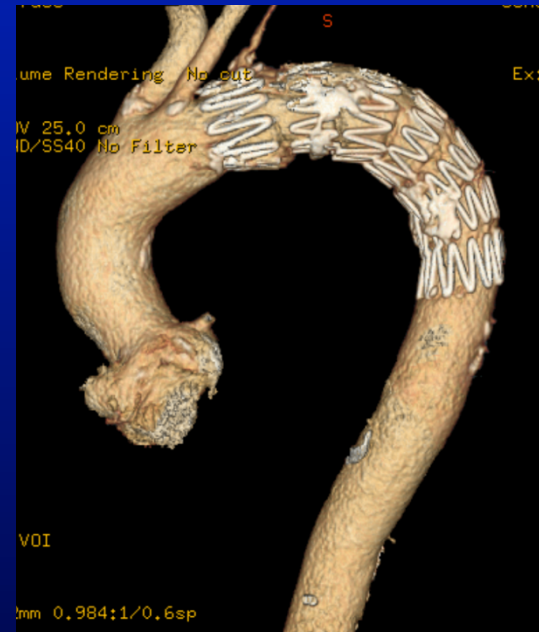
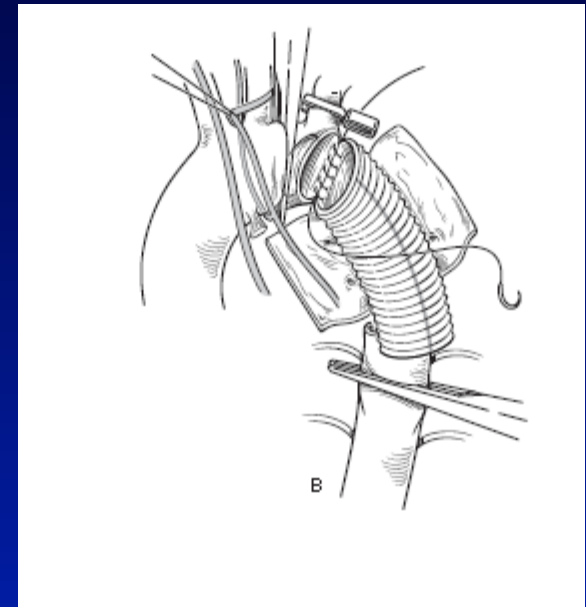
Extent of Injury Determines Therapy

- Grade 1—Intimal injury usually heals
- Grade 2—Intramural hematoma usually heals
- Grade 3—Pseudoaneurysm needs repair



Therapeutic Options

- Open descending aortic repair
 - Thoracotomy
 - Single lung ventilation
 - Extracorporeal support with heparin use
- Thoracic endovascular repair



Prospective AAST-2 Study (2007)

- Increased utilization of selective delayed management in 198 patients
 - Improved survival
 - No impact of associated injury

The Journal of TRAUMA® Injury, Infection, and Critical Care

Operative Repair or Endovascular Stent Graft in Blunt Traumatic Thoracic Aortic Injuries: Results of an American Association for the Surgery of Trauma Multicenter Study

Demetrios Demetriades, MD, PhD, FACS, George C. Velmahos, MD, Thomas M. Scalea, MD, Gregory J. Jurkovich, MD, Riyad Karmy-Jones, MD, Pedro G. Teixeira, MD, Mark R. Hemmila, MD, James V. O'Connor, MD, Mark O. McKenney, MD, Forrest O. Moore, MD, Jason London, MD, Michael J. Singh, MD, Edward Lineen, MD, Konstantinos Spaniolas, MD, Marius Keel, MD, Michael Sugrue, MD, Wendy L. Wahl, MD, Jonathan Hill, MD, Mathew J. Wall, MD, Ernest E. Moore, MD, Daniel Margulies, MD, Valerie Malka, MD, and Linda S. Chan, PhD

Prospective AAST Trial-2 (2007)

- Increased utilization of TEVAR in patients
 - Improved early survival
 - No difference in LOS, ICU stay, ventilator days or systemic complications
 - Reduction in transfusion requirements

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<u>Type of Repair</u>	<u>N</u>	<u>%</u>
Open	68	35
Clamp and Sew	11	6
Bypass	57	30
Endovascular	125	65
Total	193	

Prospective AAST Trial-2 (2007)

- Device related complications seen in 20% (n=25):
 - 9 of 25 required 2nd TEVAR procedure
 - 6 of 25 required open repair
 - Endograft collapse, branch vessel coverage, access vessel rupture

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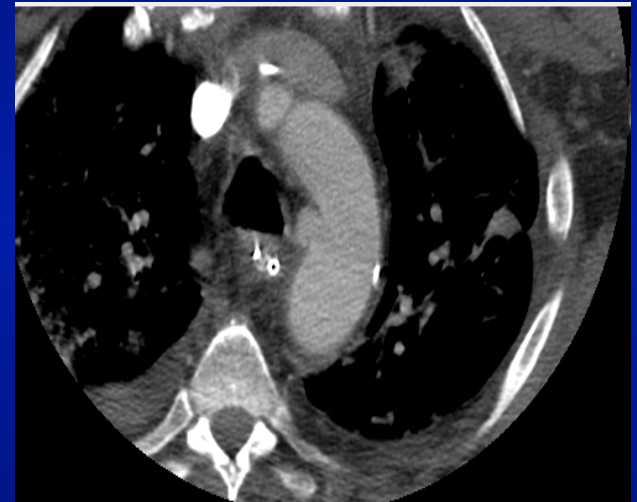
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Late Results of Repair of BTAI

- 109 patients treated from 1992-2010
- Selective delayed management in 72% treated since 1997
- TEVAR in 42% treated since 2002
 - Anatomical features considered high risk for rupture AND not open surgery candidate
 - Complete disruption
 - Lateral pseudoaneurysm
 - Age over 60 years

Early Outcomes

- Early mortality (either in-hospital or 30-day)
 - 5 patients (4.6%) all who had open repair
- Stroke 2.8%
- Spinal cord ischemia 1.8%
- Permanent dialysis 1.8%



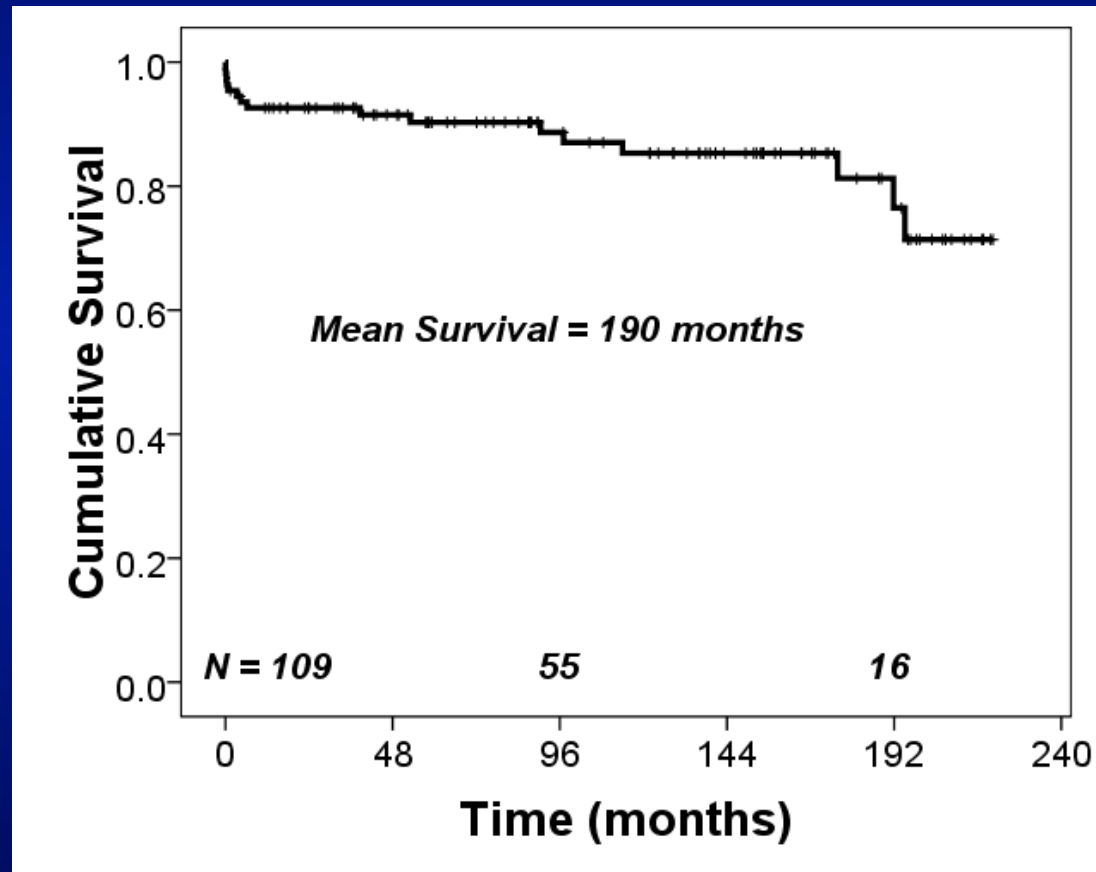
Early Morbidity

- Composite outcome of early mortality, stroke, paraplegia or dialysis dependent renal failure

- | <u>Independent Predictors</u> | <u>OR</u> | <u>p Value</u> |
|-------------------------------|-----------|----------------|
| Age > 60 years | 8.4 | 0.015 |
| Creatinine | 7.9 | 0.017 |
| Postoperative sepsis | 9.6 | 0.021 |

- Repair type not predictive ($p = 0.4$)

Survival Analysis---Entire Cohort



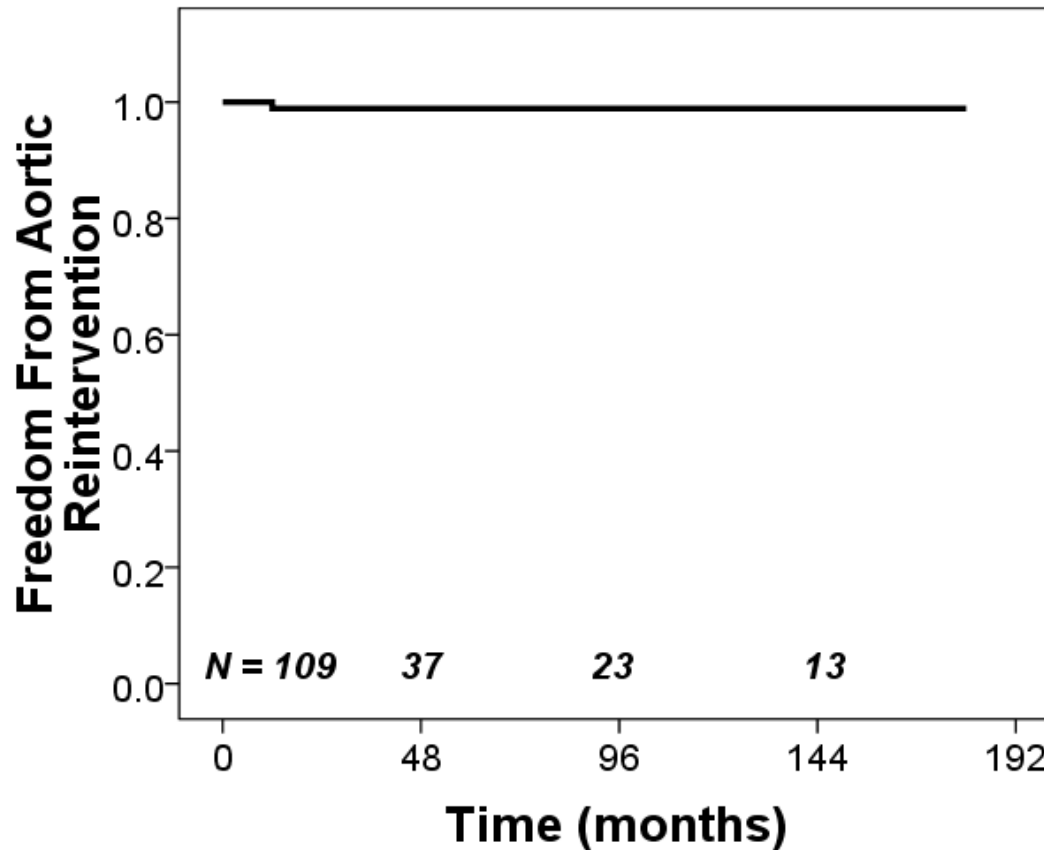
- 15 year Survival
81.3%

Late Mortality

<u>Independent Predictors</u>	<u>HR</u>	<u>p Value</u>
Age > 60 years	4.1	0.01
Creatinine	9.1	<0.001
Postoperative SCI	20.6	<0.001

- Repair type not predictive ($p = 0.7$)

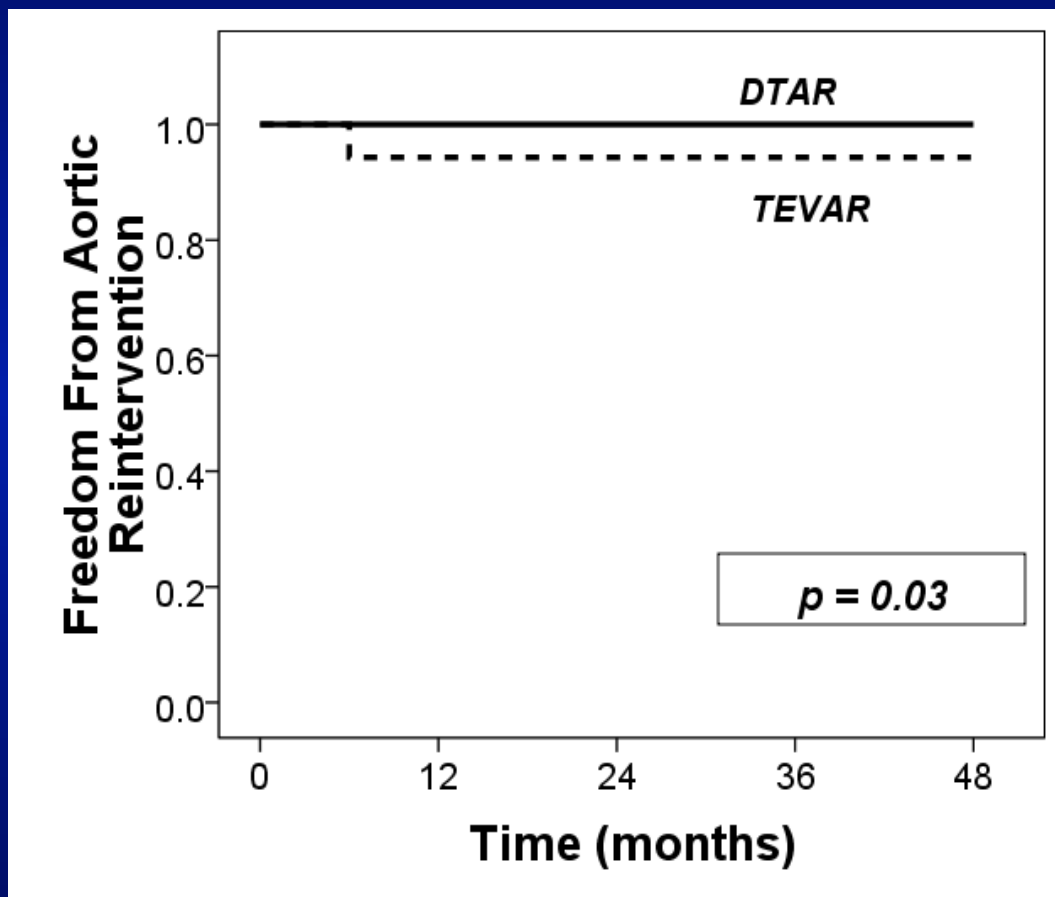
Late Aortic Reoperation—Entire Cohort



- 15 Year Freedom

99.1%

Late Aortic Reoperation



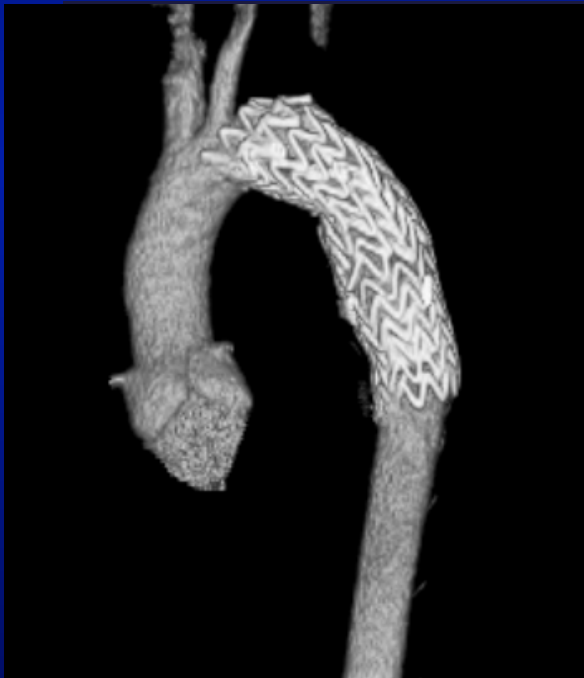
4 Year Freedom

- *DTAR*: 100%
- *TEVAR*: 94%

$p=0.03$

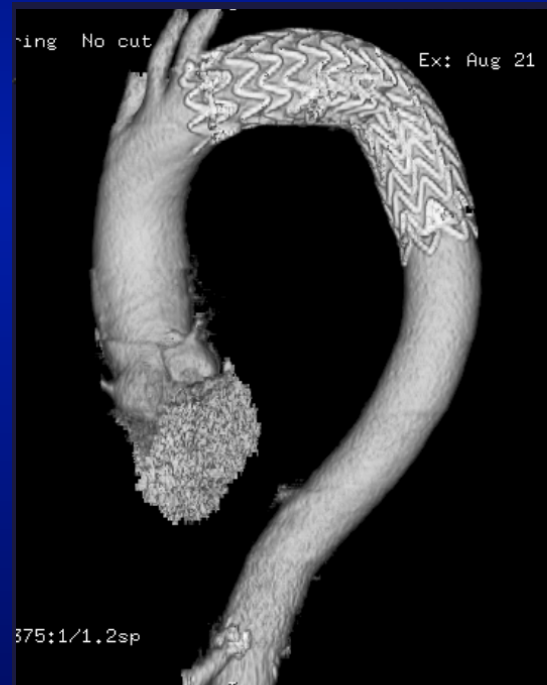
Early Pitfalls in TEVAR for BTAI

- Beware the gothic arch and bird-beak in the young trauma patient



•21 yr old

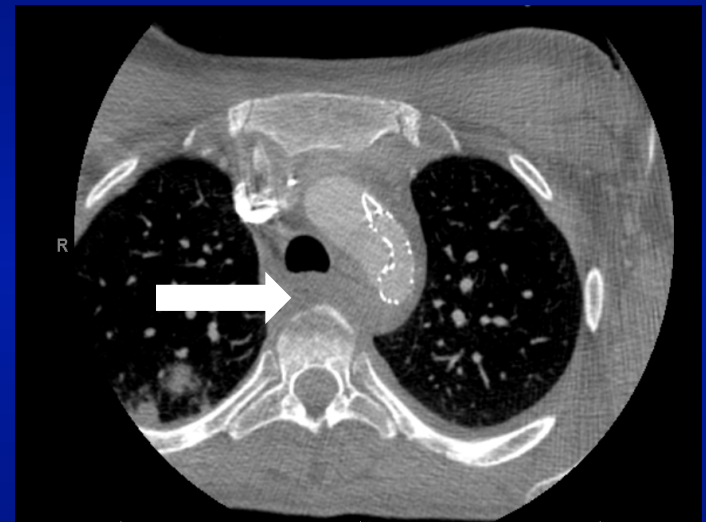
Vs.



•71 yr old

Early Pitfalls in TEVAR for BTAI

- Volume resuscitation increases aortic diameter by at least 10%
 - Oversizing of endografts may predispose to endograft collapse
- Remember circle of Willis
 - Pre-TEVAR left carotid to left subclavian arterial bypass should be considered



Late Pitfalls in TEVAR for BTAI

- Aortic diameter grows by up to 1 cm from 20-80 years of age
- Many young patients will not return for follow-up imaging required for TEVAR
 - Imaging follow-up in our study was 50 months vs. 104 months obtained for primary endpoint of vital status from SSDI

Summary

1. Repair for BTAI can be performed with excellent early and late results—gold standard remains open repair.
2. With careful selection of candidates for TEVAR, factors other than treatment strategy may impact late survival.
3. Risk for re-intervention remains higher in the TEVAR subset thus providing strong motivation to develop devices tailored to this pathology.