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Case Presentation Morbidity and Mortality Conference

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Case Presentation

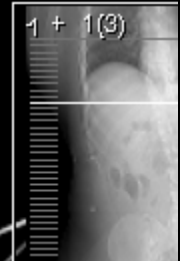
- 53 year old male bus driver had a syncopal episode and found down unresponsive.
- Brought to emergency room by EMS
- Initial vitals SBP – 70, HR 120s
- Patient regained consciousness and complained of left flank pain radiating to left groin.
- Patient was aggressively resuscitated and a CT scan of the abdomen was performed.

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Case Presentation

Laboratory values:

- Arterial blood gas - 7.3/27/150/99.6/18/-7.8
- Lactate – 4.7 Hgb / Hct – 9.5 / 30

Emergent surgical consultation obtained.

- Physical Exam:
 - Patient was in extremis – pale, diaphoretic, tachypnic
 - Diffusely distended abdomen.

Patient was taken to OR for exploration.

Operative Course

- Giant retroperitoneal hematoma extending from the inguinal ligament to diaphragm with hemoperitoneum
- Size of hematoma precluded proximal vascular control outside the hematoma.
- Entered the hematoma and proximal control was attempted by compressing aorta against the spine
- Left sided medial visceral rotation was performed
- Aorta was clamped proximal to a widely ruptured iliac artery aneurysm.
- A distal clamp was placed on the iliac artery

Operative Course

- By this time, patient lost signs of life
 - Coarse v.fib on the monitor.
- Resuscitation including antero-lateral thoracotomy with open cardiac massage failed to revive the patient.
- Intra-operatively, patient received 13 units of pRBCs.

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Ruptured Abdominal Aortic Aneurysm

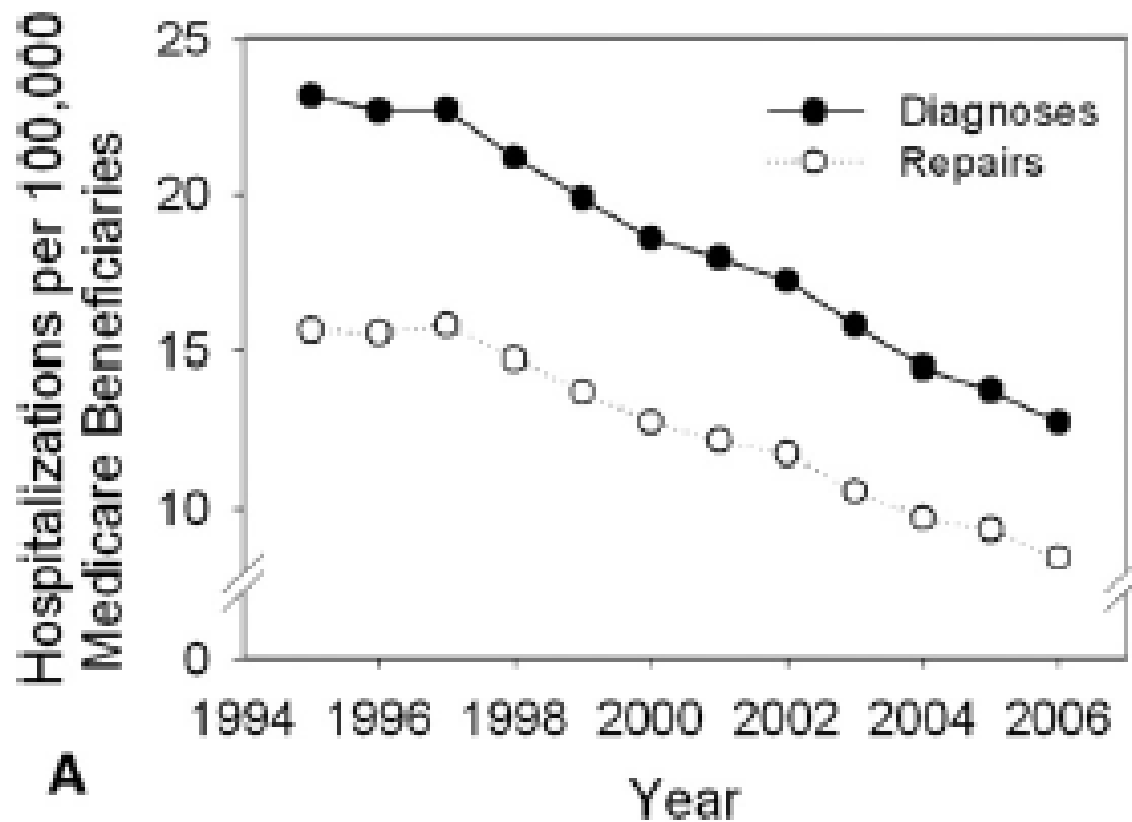
Ravi Dhanisetty, MD

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Ruptured AAA: Background

- Sudden, unheralded event
- 13th leading cause of death
- Usually fatal (70-80%).
 - Only 50% present to hospital alive.
- Emergent repair of ruptured aneurysms
 - Staggering mortality of up to 50%
 - 10 X that of elective repair.

Ruptured AAA: Incidence



Risk Factors for Developing Aneurysms

- **Age** – peak prevalence of 6% at 80-85 y.o.
- **Male Gender** – 4 - 5 x more common.
- **Smoking** – 8x compared to non-smokers
- **Family history** and
 - History of **inguinal hernia**
- **Diabetes and female gender** – negative risk factors.

Rupture Risk of Stable Asymptomatic AAA

Greatest Diameter (cm)	Annual Rupture Risk (%)
3.0–5.5	0.6
5.6–5.9	5–10
6.0–6.9	10–20
7.0–7.9	20–30
>8.0	30–50

- Elective repair - > 5.5 cm. Growth > 0.5 cm/ 6mo
- Biannual surveillance

Risk Factors for Rupture of AAA

<i>Risk Factors</i>	<i>Low Risk</i>	<i>High Risk</i>
Diameter	< 5 cm	> 6 cm
Expansion	< 0.3 cm /yr	> 0.6 cm / yr
Hypertension	None	Poorly Controlled
Smoking / COPD	None / Mild	Steroid Dependent
Family History	None	Positive

Natural History

Retrospective review

56 patients with
ruptured AAA and
no surgical
intervention.

Once decision made
not to operate:

- Minimal fluids
- Average survival
– 10 hours
- 87% alive at 2
hrs.

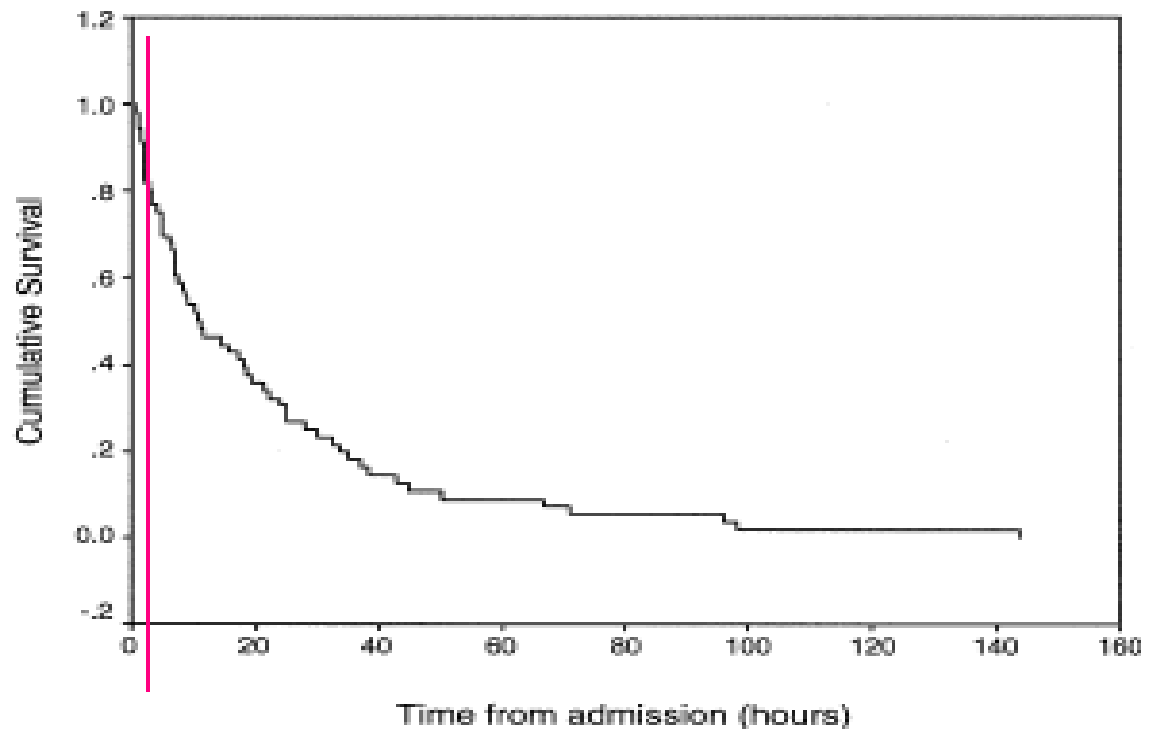


Fig 2. Survival curve shows cumulative survival after admission.

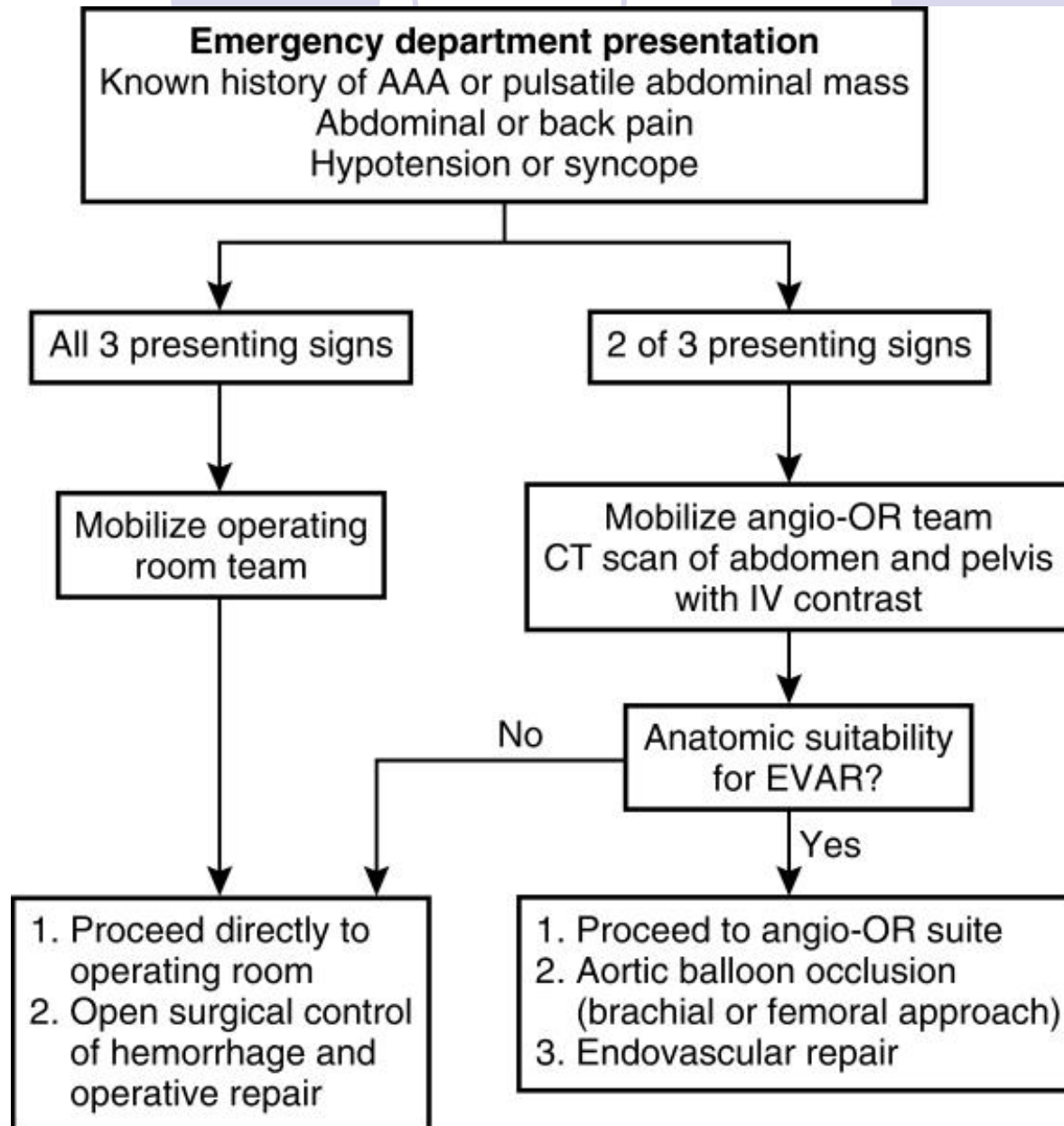
Presentation & Initial Management

Two distinct groups (based on hypotension)

- Hypotension \pm known history of AAA or pulsatile mass
 - Free intra-peritoneal rupture

- No hypotension, or responsive to initial resuscitation
 - Contained / Retro-peritoneal rupture

Presentation & Initial Management



Presentation and Initial Management

- Patient should be immediately transferred to operating room and all other tests performed there
- Hypotensive resuscitation may be considered
 - level I rapid transfusion system and auto-transfusion device are a must.
- Prep and drape patient prior to induction of anesthesia.

Surgical Management

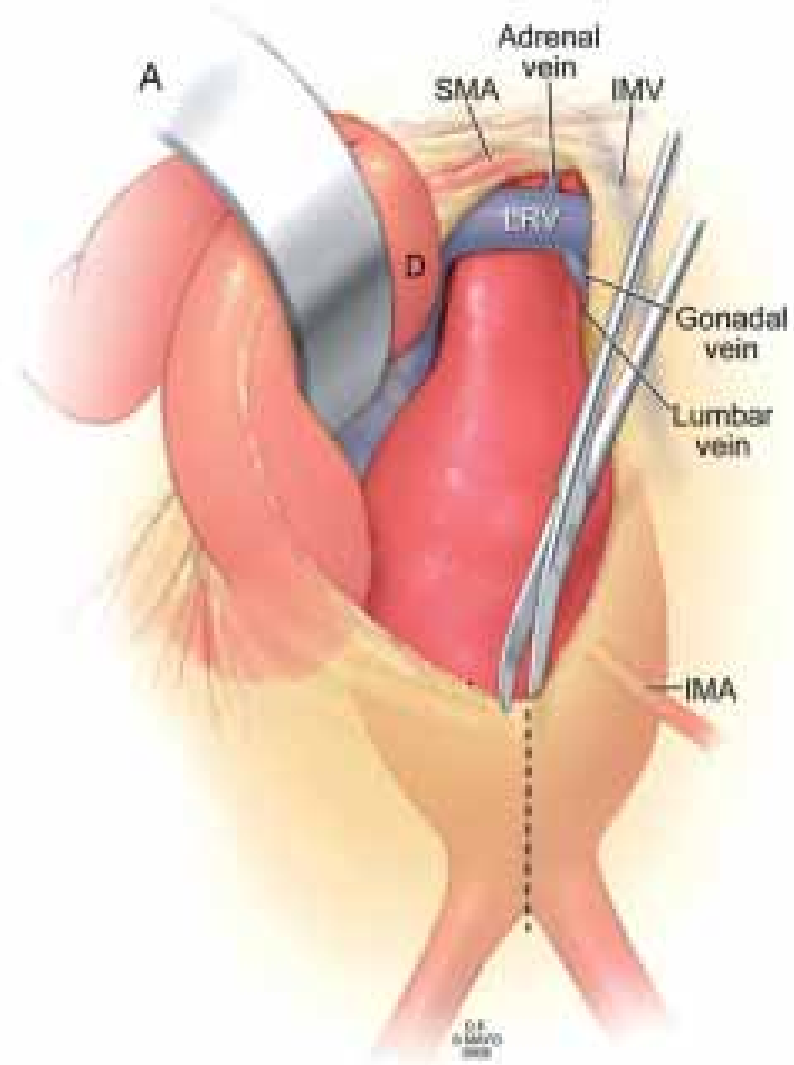
Most important step – ***control of hemorrhage by proximal aortic occlusion:***

- Supra-celiac occlusion or clamping
- Control of aorta within the hematoma
- Rarely – antero-lateral thoracotomy with aortic clamping if patient arrests prior to incision.

Anatomy

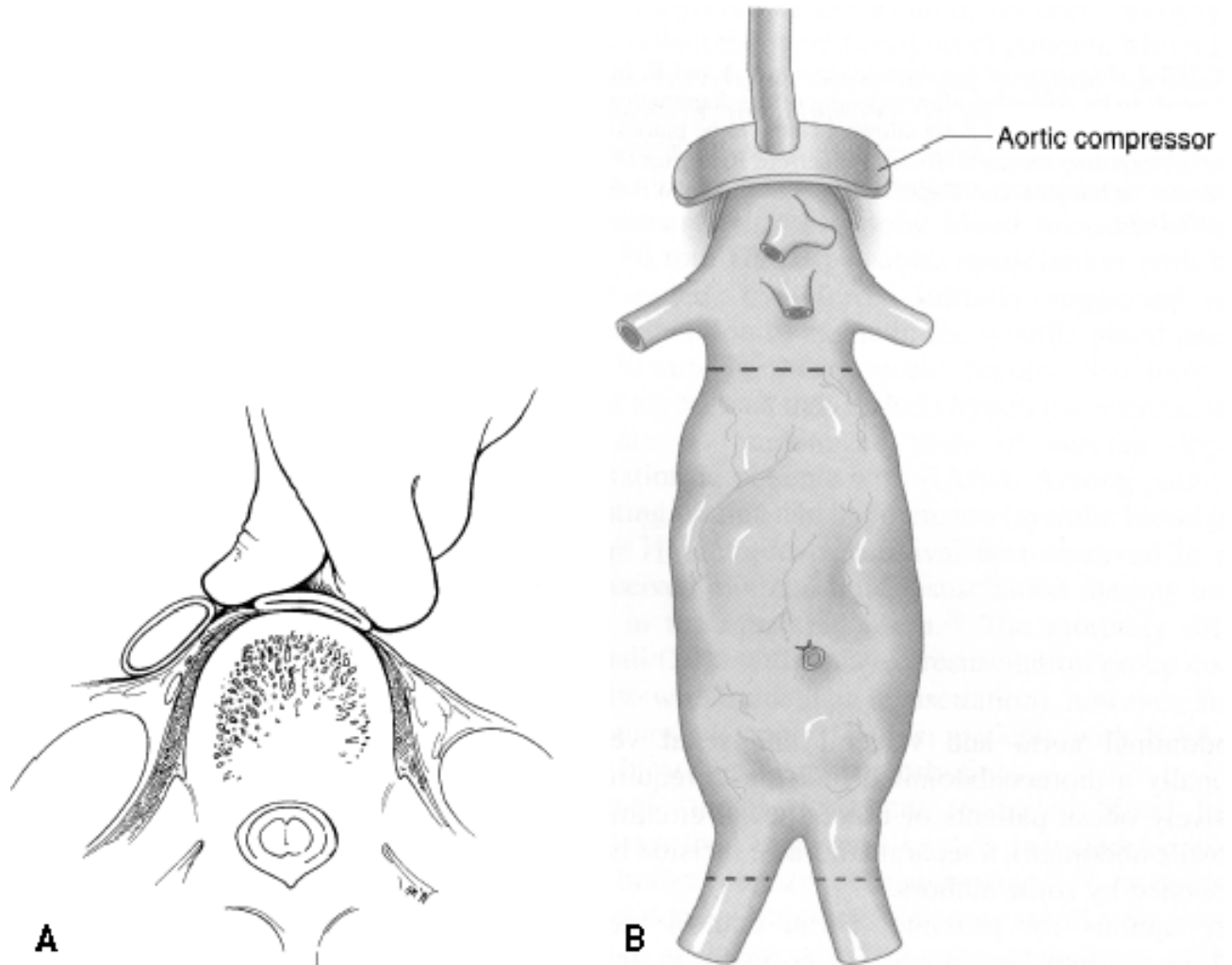
WHY NOT INFRA-RENAL ??

- Hematoma obscuring veins
- Venous anomalies

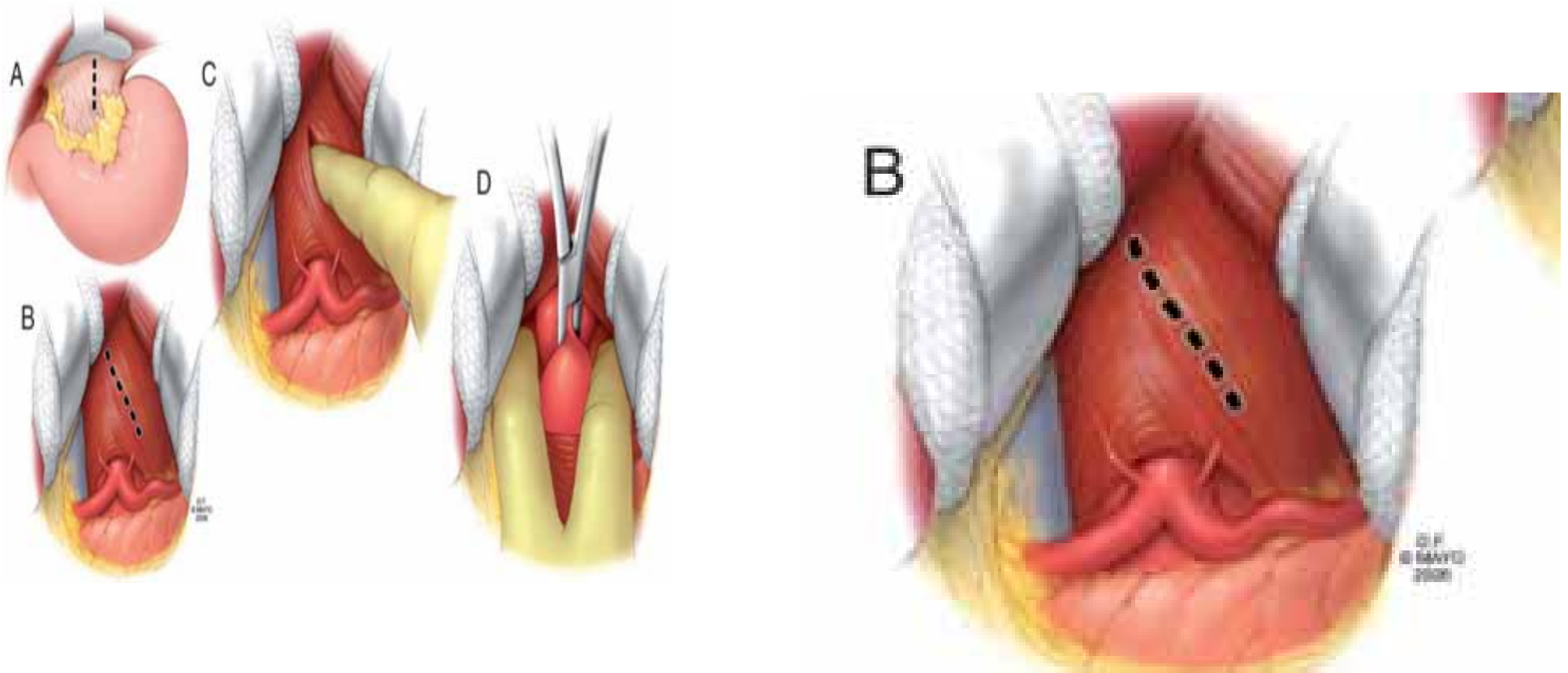


Manual compression of the supra-celiac aorta against the spine

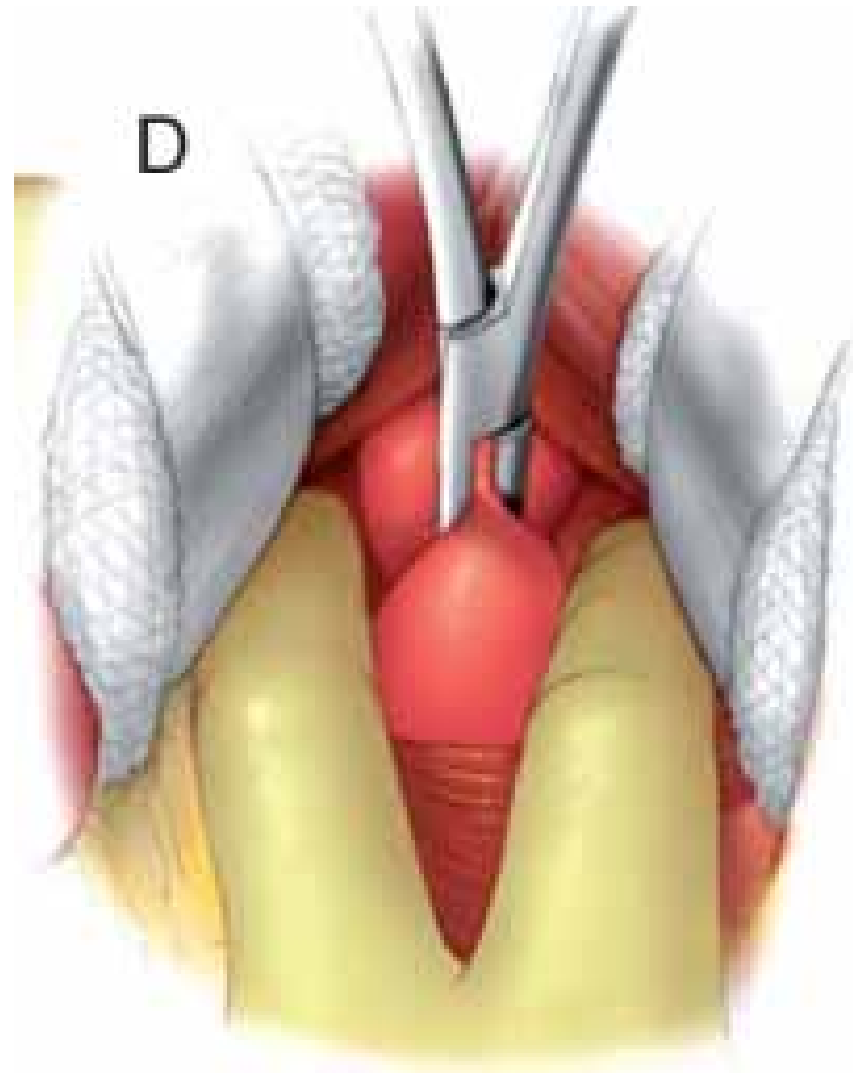
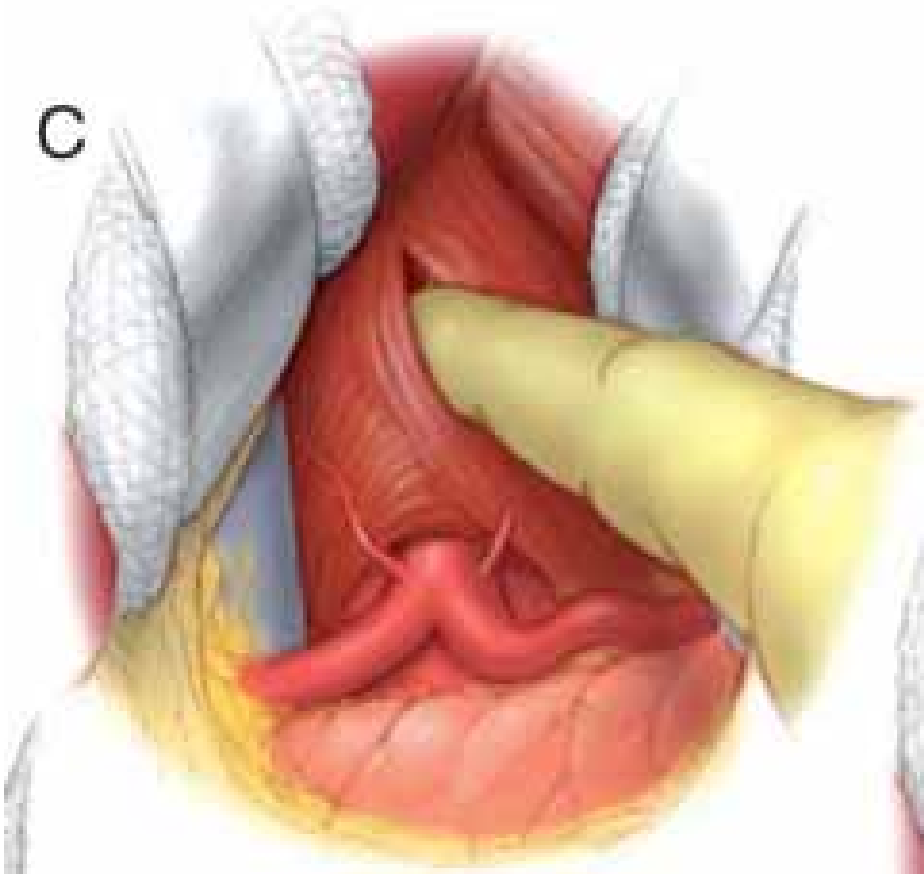
- Temporary control of supra-celiac aorta.



Supra-Celiac Control of Aorta



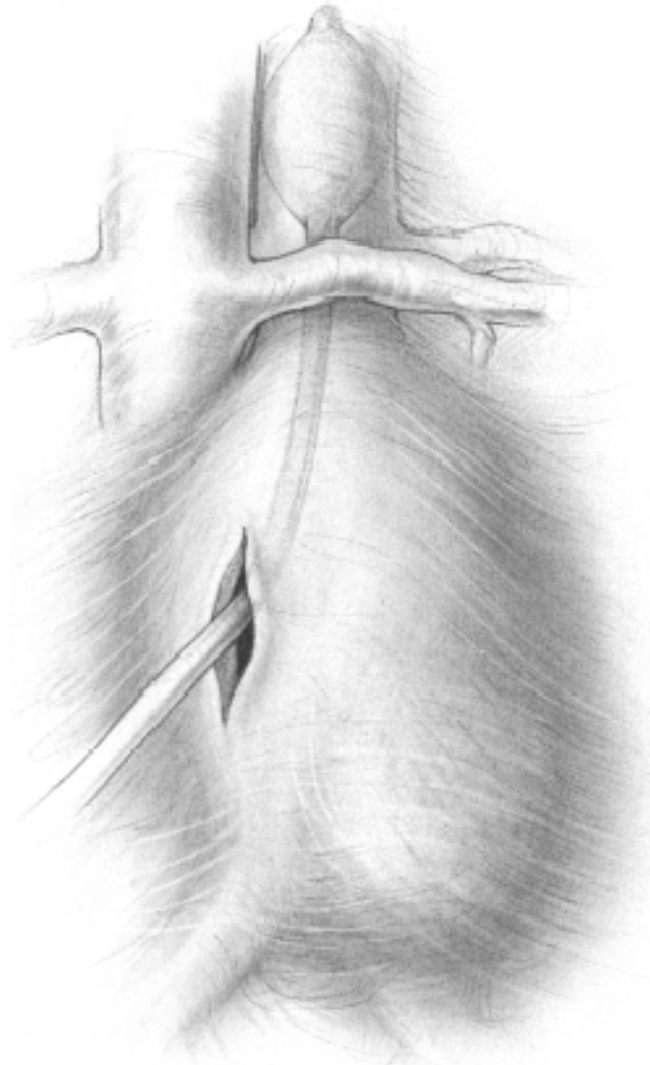
Supra-Celiac Control of Aorta



- Veith FJ, et al: Surg Gynecol Obstet., 1980.

Proximal Control from within the Ruptured Aneurysm

- In the case of an uncontained rupture, a foley catheter can be inflated in the supra-renal aorta to gain rapid proximal control.



Surgical Management

- Once proximal control is achieved
 - Further dissection can be carried to expose infra-renal portion of aorta to move cross clamp to infra-renal location
 - Distal control of iliacs – most commonly from within the aneurysm lumen.
 - Repair of aneurysm with prosthetic graft.

Complications

- Bleeding

- Secondary to injury to adjacent veins:

- Infra-renal aorta is a large artery surrounded by veins

- Lower Extremity Ischemia

- Cross clamping, embolization, distal anastomosis.

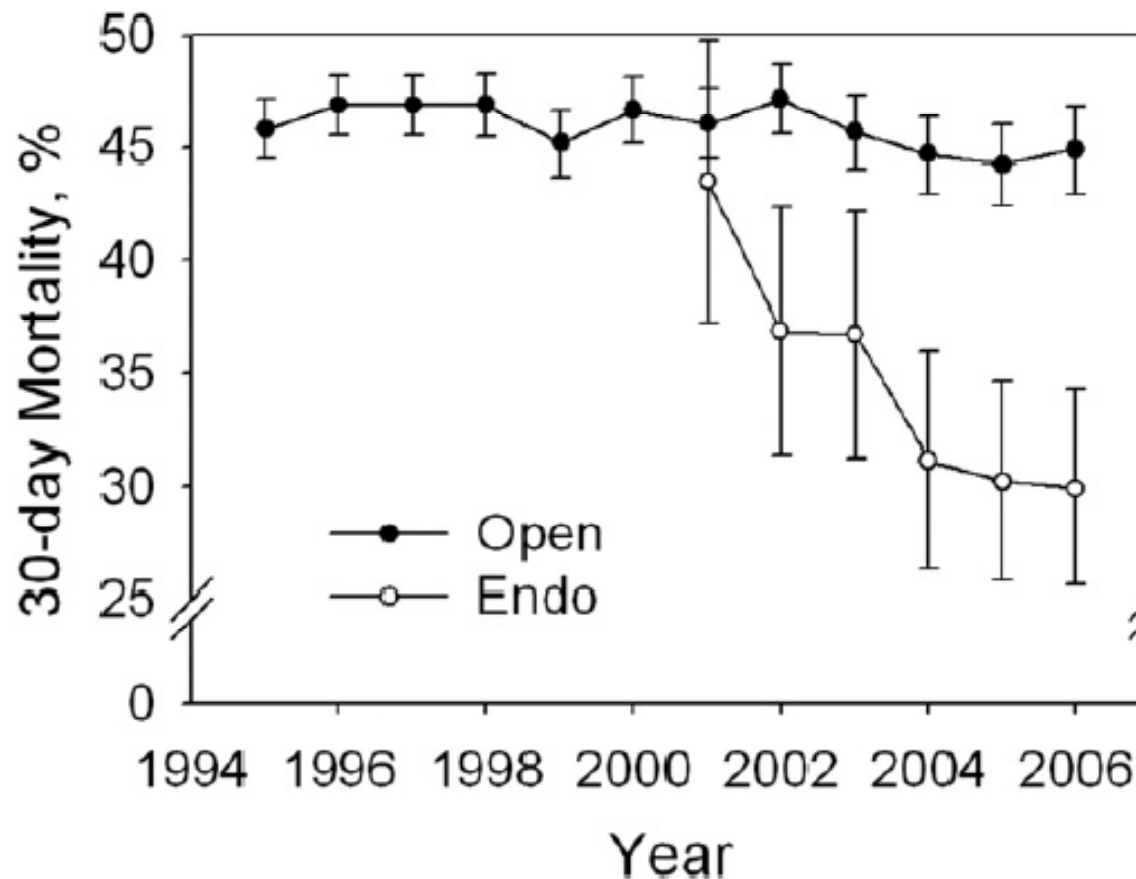
- Intestinal Ischemia (40%)

- Mortality in up to 80% of patients

- Abdominal Compartment Syndrome

Recent Outcomes. www.downstatesurgery.org

30 Day Mortality after Ruptured AAA Repair



• Mureebee et al. JVS 2008.

Prognostic Score to Predict Outcome

- Edinburgh Ruptured Aneurysm Score (ERAS)
 - Hemoglobin level 9 g/dL
 - GCS of < 15
 - Blood pressure of less than 90 mm Hg
- Prospective evaluation with 111 patients and compared to other scoring systems (HI, GAS, POSSUM)
- ERAS – only one to accurately stratify peri-operative risk

Prognostic Score to Predict Outcome

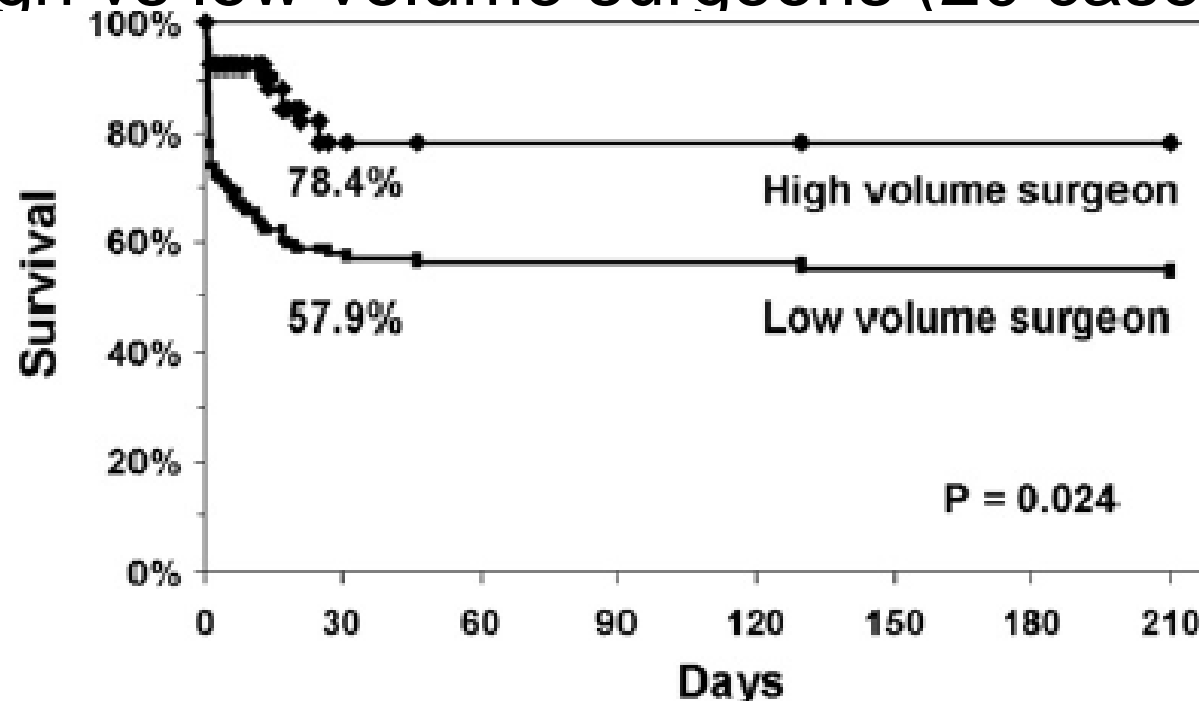
Table VI. Distribution and mortality rates in 84 patients according to Edinburgh Ruptured Aneurysm Score

<i>Edinburgh Ruptured Aneurysm Score</i>	≤ 1	2	3
Patients, No. (%)	46 (55)	27 (32)	11 (13)
Deaths, No. (%)	12 (26)	16 (59)	9 (82)

Other Factors Affecting Outcome

Retrospective review of 213 patients that underwent open repair of ruptured AAA at a tertiary referral center.

High vs low volume surgeons (20 cases/year)



Cho et al. JVS 2008

Other Factors Affecting Outcome

Table III. Factors associated with in-hospital mortality
(Cox proportional hazard model)

<i>Variable</i>	<i>Hazard ratio</i>	<i>95% Confidence interval</i>	<i>P value</i>
Surgeon's annual AAA volume ≥ 20	0.280	0.093, 0.841	.023
Age	1.076	1.016, 1.139	.012
Intestinal ischemia	4.342	1.720, 10.961	.002

Screening

- Consensus Statement in 2004 based on 6 prospective randomized studies.
 - Screening general population for AAA
 - High compliance
 - Decreased AAA related mortality (up to 68%)
 - Decrease rupture rate (49%)

Screening Recommendations

- All men aged 60 to 85 years
 - Women aged 60 to 85 years with cardiovascular risk factors
 - Men and women older than 50 years with a family history of AAA.
-
- Aortic diameter less than 3 cm, no further testing
 - AAA 3 to 4 cm in diameter, yearly ultrasound examination
 - AAA 4 to 4.5 cm in diameter, ultrasound examination every 6 months
 - AAA greater than 4.5 cm in diameter, referral to a vascular specialist.

Conclusion

- Ruptured AAA continues to be a highly lethal problem.
- Successful outcomes depend on establishing correct diagnosis and rapid surgical control of hemorrhage.
- Screening, early detection of aneurysm and elective repair remains most likely way to reduce aneurysm-related death.

Questions

- Which one of the following is associated with poor outcome in a patient undergoing repair of rAAA?
 - a. Peri-operative cardiac arrest
 - b. Intestinal ischemia
 - c. Age > 80
 - d. Initial blood pressure < 90 mm Hg
 - e. All of the above

- Risk factors associated with development of AAA include:
 - a. Smoking
 - b. Age
 - c. Family history
 - d. All of the above

Questions

- Screening is recommended in all of the patients except:
 - a. 75 year old male with history of hypertension
 - b. 65 year old female with history of MI
 - c. 54 year old male with family history of AAA
 - d. 75 year old male with aortic diameter of 2.8 cm on a CT scan a year ago.
- Peri-operative complications of repair of ruptured AAA include all of the following except.
 - a. Myocardial Infarction
 - b. Bleeding
 - c. Intestinal ischemia
 - d. Lower extremity ischemia
 - e. None of the above

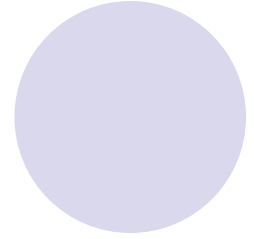
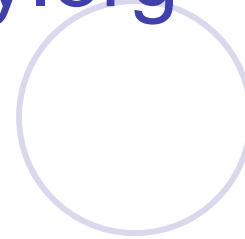
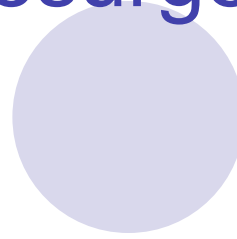
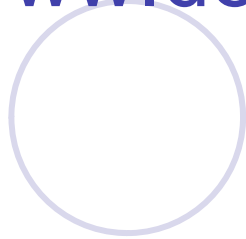
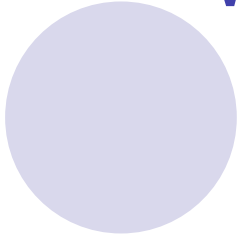
Questions

- Initial evaluation of a hypotensive patient with suspected ruptured AAA include:
 - a. Rapid assessment and transport to operating room
 - b. Aggressive resuscitation with fluid and pressors
 - c. CT scan with iv contrast
 - d. None of the above.

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Other Factors Affecting Outcome

Table III. Effect of patient demographic and comorbid variables on rAAA mortality rate

	<i>Factor</i>	<i>n</i>	<i>Mortality rate (%)</i>	<i>P*</i>
Gender	Female	108	51.9 ± 4.8	0.33
	Male	419	46.3 ± 2.4	
Race†	White	494	48.2 ± 2.3	0.24
	Black	28	35.7 ± 9.2	
Hypertension	Yes	135	33.3 ± 4.1	<0.0001
	No	392	52.3 ± 2.5	
Diabetes	Yes	30	26.7 ± 8.2	0.023
	No	497	48.7 ± 2.2	
COPD	Yes	115	36.5 ± 4.5	0.008
	No	412	50.5 ± 2.5	
Smoker	Yes	10	30.0 ± 15.3	0.35
	No	517	47.8 ± 2.2	
Cardiac disease	Yes	80	37.5 ± 5.4	0.07
	No	447	49.2 ± 2.4	
Renal disease	Yes	9	44.4 ± 17.6	0.99
	No	518	47.5 ± 2.2	

Other Factors Affecting Outcome: Surgeon Volume

Table V. Effect of surgeon volume on rAAA mortality rate

<i>Class</i>	<i>n*</i>	<i>Mortality rate (%)</i>	<i>LOS (days)</i>	<i>Charge (\$)</i>	<i>Age (yr)</i>	<i>Medical complexity score</i>
Low	315	50.8 ± 2.8	11.7 ± 0.8	27,362 ± 1283	72.1 ± 0.5	3.19 ± 0.06
Medium	121	47.1 ± 4.6	11.6 ± 1.0	28,575 ± 1748	72.1 ± 0.8	3.22 ± 0.09
High	91	36.3 ± 5.1	12.4 ± 1.8	23,740 ± 2356	71.3 ± 0.9	3.08 ± 0.10
<i>P</i>		0.05†	0.46‡	0.018‡	0.49‡	0.39‡

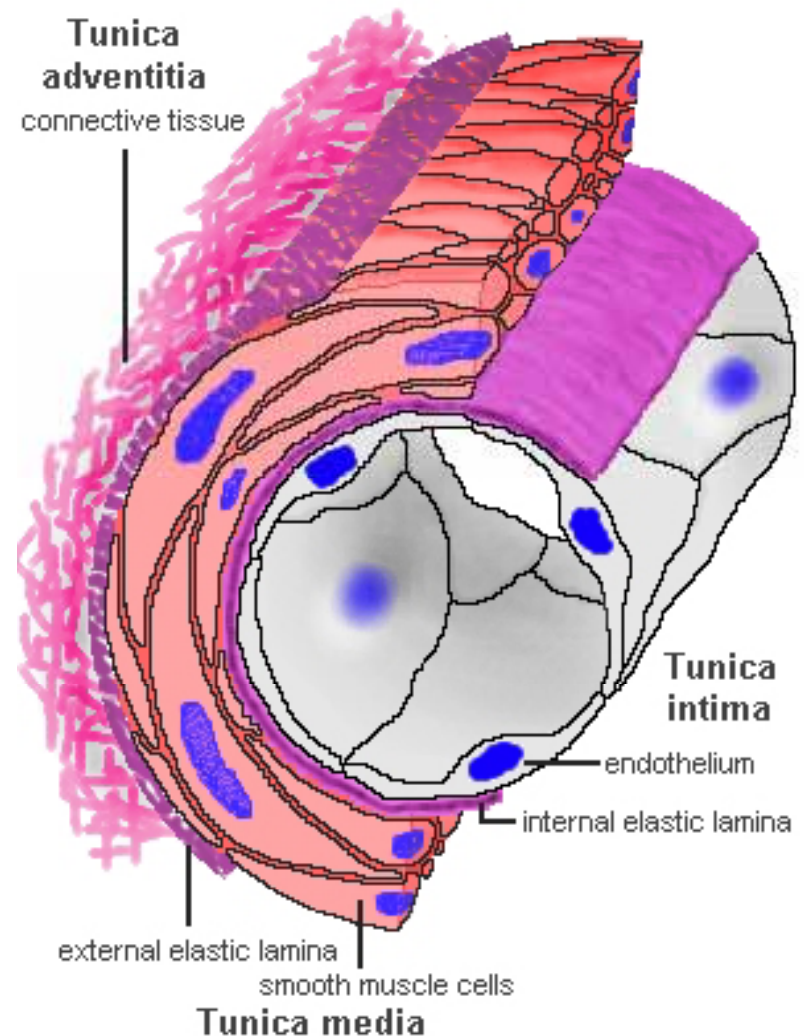
*Surgeon class is based on 1 to 4 (n = 199 surgeons), 5 to 9 (n = 20), or 10 or more (n = 7) rAAA repairs per surgeon. n represents the number of patients per surgeon class.

Pathogenesis

- Most are degenerative:
 - Interaction of multiple factors is responsible for destruction of media of the aortic wall leading to aneurysm.
 - The balance of aortic wall remodeling favors elastin and collagen degradation.

Components of Aortic Wall

- Elastin and collagen are major structural components and act in complementary fashion.
- Elastin in media
 - Not synthesized in aorta with half-life of 40 – 70 yrs.
 - Load-bearing and elastic recoil
- Collagen in adventitia
 - Tensile strength and structural integrity.



Pathophysiology: Aneurysm Formation

- Histology: aneurysm wall thin and marked decrease in the amount of elastin and collagen.
- Elastin degradation / fragmentation: aneurysmal formation, elongation, and tortuosity
- Collagen degradation: aneurysmal rupture
- Primarily by proteolytic enzymes
 - Either over expression or decreased expression of protease inhibitor (alpha –1 antitrypsin or tissue inhibitors of MMP (TIMPs)).

Pathophysiology: enlargement.

- Laplace's Law:

- $T \text{ (tangential stress)} = P \text{ (tangential pressure)} \times R / \delta$

- Size and hypertension are important risk factors in the rate of enlargement.