Open Retroperitoneal Aortic Approach for Ruptured AAAs Technical Tips, Advantages & Limitations: When is it Better than EVAR and F/EVAR

THE VASCULAR GROUP

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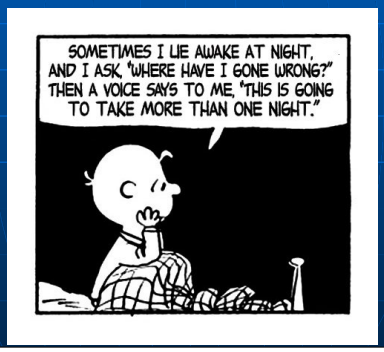
No Disclosures

Recent Improvements in RAAA Care

- Early Recognition
- Permissive hypotension
- PACS Systems
- EVAR for RAAA
- Percutaneous Access
- Safety of Access under Local Anesthesia
- Proximal Balloon Control
- Systems Improvements

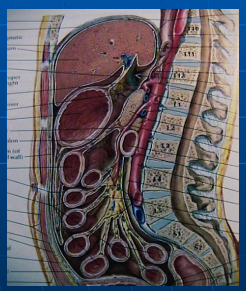
There Are No Easy Cases Anymore Where Did We Go Wrong?

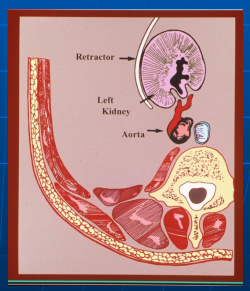


Why Retroperitoneal Approach?

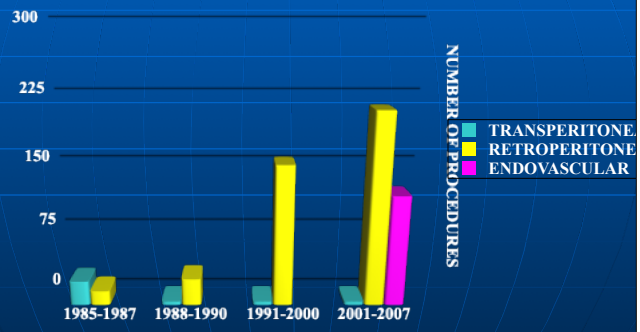
- Most rAAA not amenable to EVAR involve Visceral Vessels
- The Left Retroperitoneal approach gives excellent expeditious approach to Supraceliac Aorta

ANATOMY





EVOLUTION OF OUR RUPTURED AAA EXPERIENCE



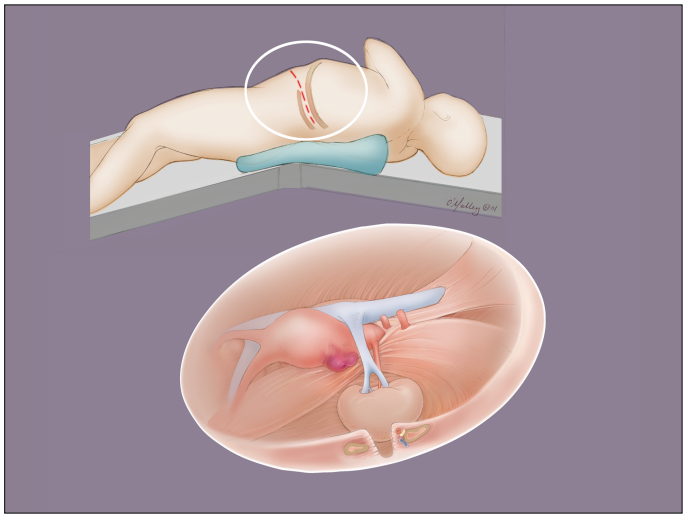
Obligatory Albany Volume Slide

- 1117 Raaa Repairs
- 419 EVAR/TEVAR (18% mortality)
- 512 Retroperitoeal (32% Mortality)
- 186 Transabdominal (41% mortality)
- 30-36/YEAR
- Currently 80% Endo for all comers

(registry numbers-unaudited)

KEY TIPS
Positioning and Preparation

- RIGHT LATERAL DECUPITUS
- ALLEN ARM REST
- BREAK OF TABLE AT ILIAC CREST
- FLEX/ELEVATE LEFT LEG TO RELAX PSOAS
- Have one surgeon scrubbed when patient arrives to room-directing traffic, watching monitor, coordinating care

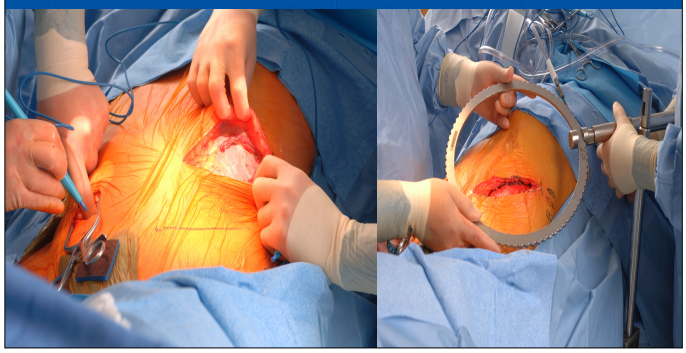


Key Tips
Incision

- 10 th interspace from lateral border of rectus
- Elevate Kidney Medial and Cephalad
- Left Index Finger behind Left Crus
- Compress/Occlude Supra-celiac Aorta
- Place Stable Retraction and Clamp

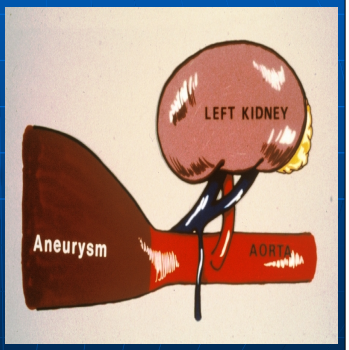
Enter Retroperitoneum
Sweep kidney Anterior
Feel/Incise Left Crus (Beware Lumber Vein Left Renal)
Place Hand to Manually Control Supra-celiac Aorta
Place Retractors
Practice and teach on Elective Procedures

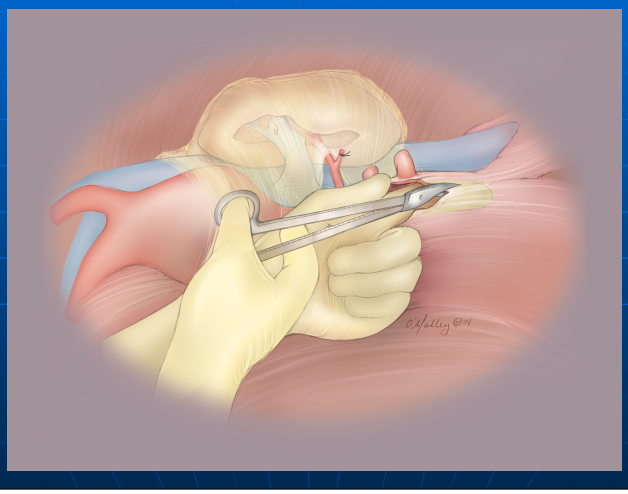
Left Retroperitoneal Incision

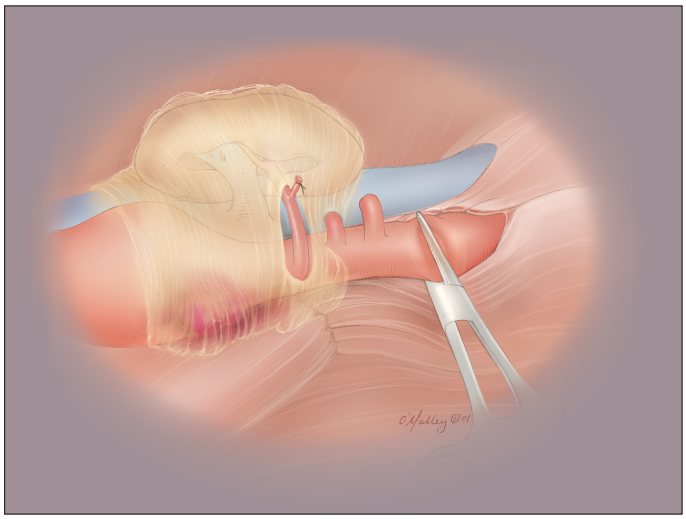


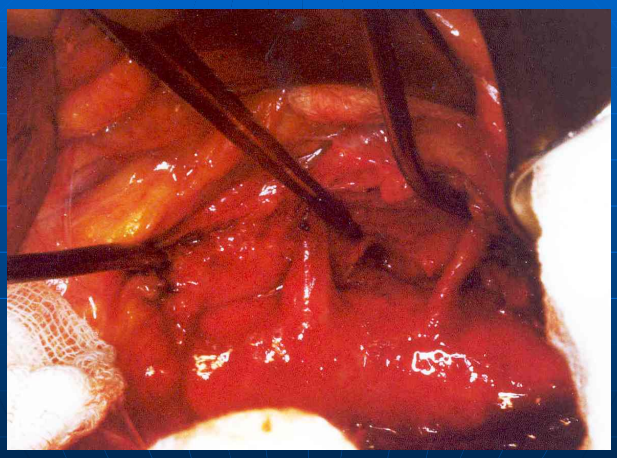
Key Tips: Dissection

- Once left Kidney Elevated
- Three Structures Left Crus, Left Renal, Lumbar Vein
- Ligate Lumbar Branch Of Left Renal Vein
- Left Renal should be Perpendicular to aorta



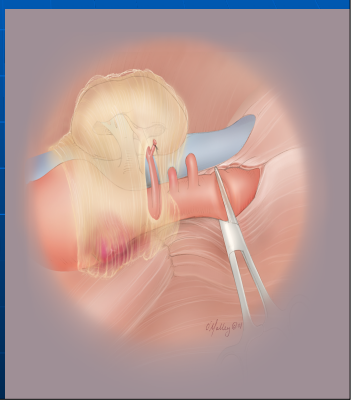




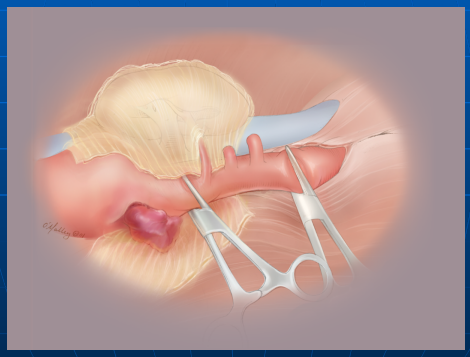


Incising The Left Crus

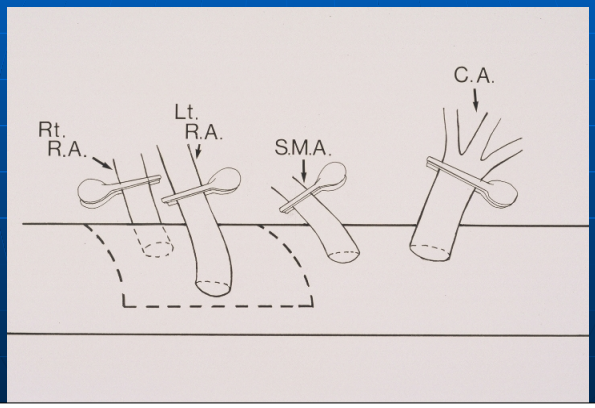
- Allows:
- Exposure of Supraceliac Aorta
- Clamping above or between Renal
- Move Clamp after Patient stabilization in RAAA

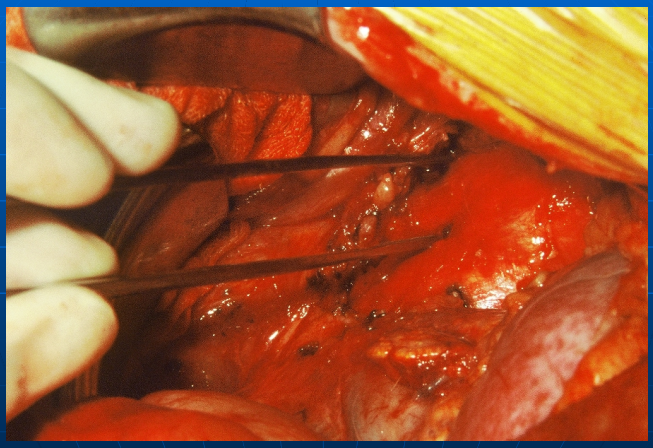


Moving the Clamp Down

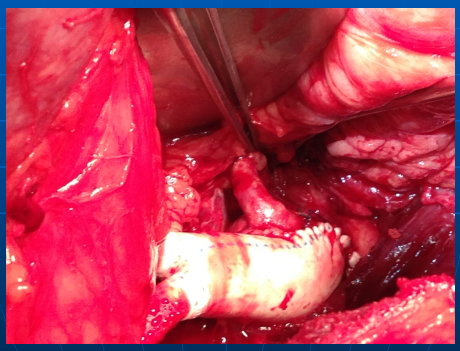


Visceral Exposure From the Left Retroperitoneal Approach





Type 4 TAAA Repair



COMPLICATIONS OF RETROPERITONEAL AORTIC EXPOSURE

Splenic Injury (Retraction)
Ureteral Tear from Traction (Redo)
Vena Cava Injury
Right Iliac Vein Injury
Flank Muscle Diastasis

COMPLICATIONS POSSIBLY MINIMIZED BY RETROPERITONEAL AORTIC EXPOSURE

Aorto-enteric fistula/erosion
Pulmonary Insufficiency
Ileus
Bowel Injury
Pancreatitis

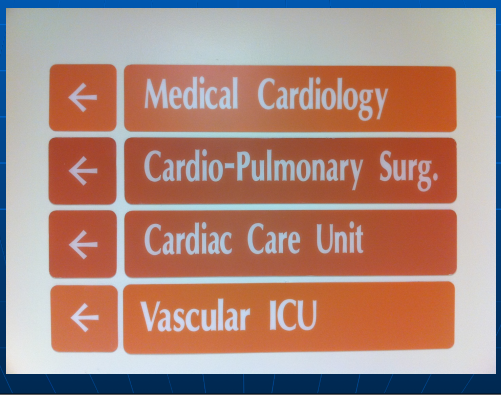
When is it Better Than EVAR?
Not Very Often, but Retro Gives Better Access

- About 20 % of RAAA
- Poor Access from Iliacs or Visceral Vessels
- Not Amenable for Transperitoneal Hostile Abdomen

Not Often, But If You Must Open Retroperitoneal Approach Offers:

- Expeditious Aortic control
- Good Access to Visceral Vessels
- Can Move Clamp Safely
- Must Practice Approach in Elective situations to be Comfortable

The Vascular ICU At Albany Med
You Need A Good Team and Hospital Support



Final Thoughts

- Ruptured AAA is a Systems Problem
- Not Just a "Procedure" Solution
- We (The System) needs to have access to both Skill Sets (Open and EVAR) for optimal results
- EVAR is not the ONLY answer for best results in repair of RAAA

The Institute for Vascular Health & Disease

- Thank You ! darlinr@amc.edu

THANK YOU!

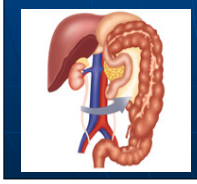
THE VASCULAR GROUP

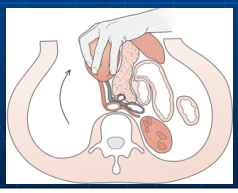
Transabdominal Approaches

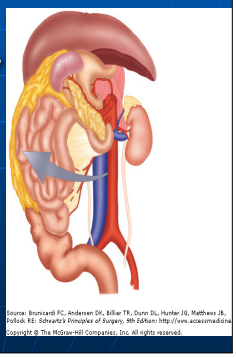
Standard Approach For Infrarenal AAA

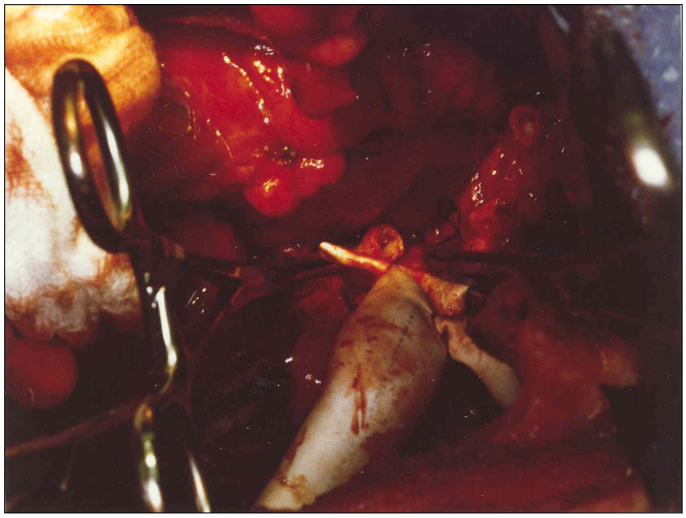
Medial Visceral Rotation for More Cephalid Exposure

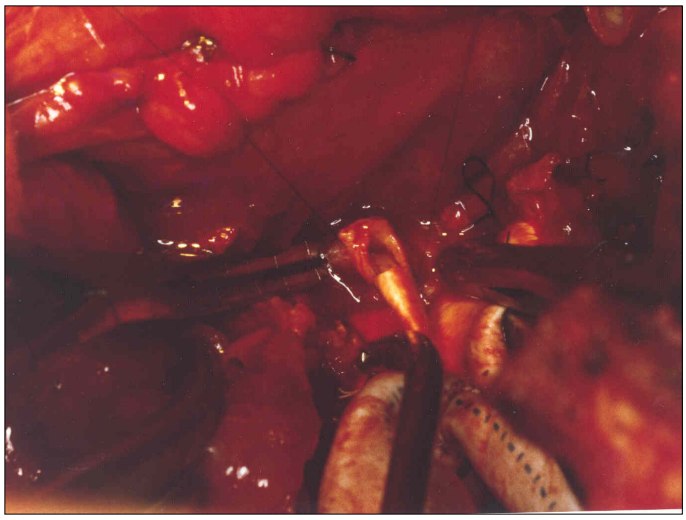
More Bowel Manipulation

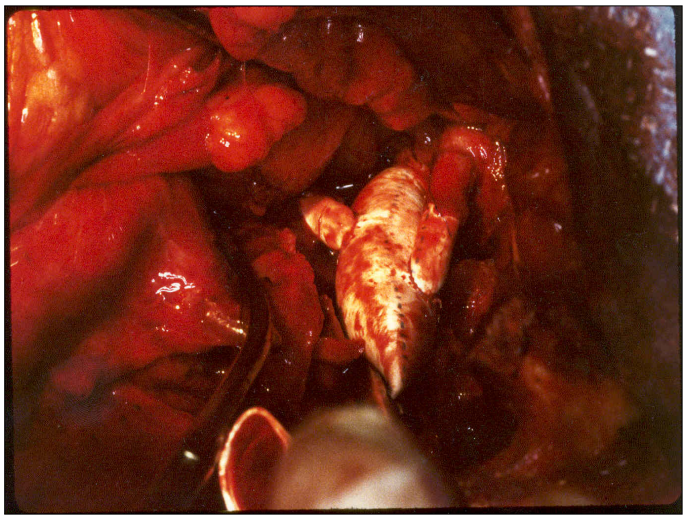






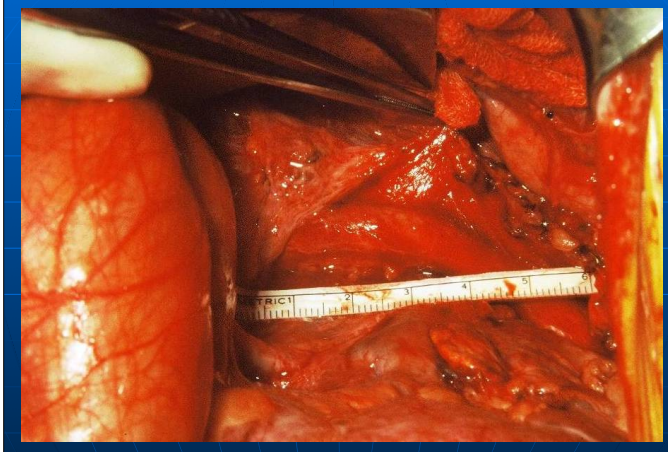


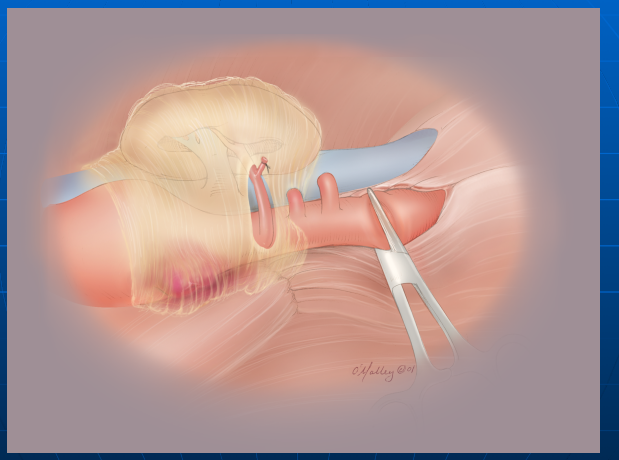


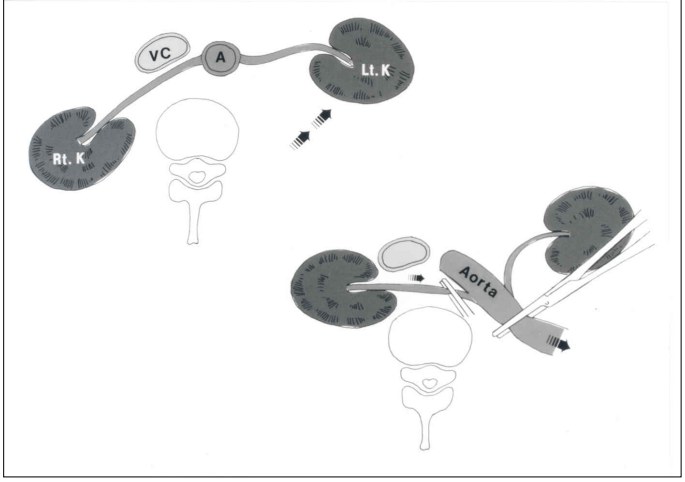


Open Surgery

- Trans vs Retro
- May need experienced backup
- TEE / Cardiac anesthesia
- Auto Transfusion
- Heparin???
- Have one surgeon scrubbed when patient arrives to room-directing traffic,watching monitor, coordinating care







89 Year Old RAAA; HCT 19

Systems Improvements

- Military Anti Shock Trousers (MAST) NO Useful
- Resusitate in field (Higher Mortality) NO Useful
- Scoop and Run (Permissive Hypotension
- Vascular trained Nurses/Staff
- Early transfers/Imaging/PACS systems
- Regionalization to High Volume Vascular Centers

Ruptured AAA Evolution

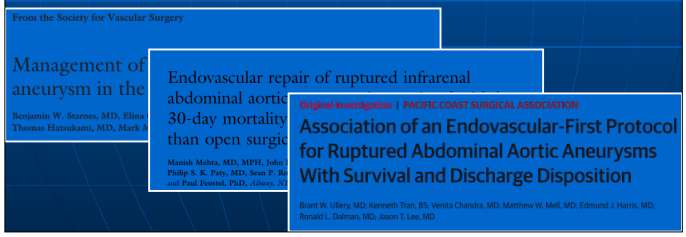
- The treatment of ruptured AAA is evolving
- Over the past decade there has been an increased utilization of EVAR for ruptured AAA

Controversies In RAAA Repair

- EVAR vs Open
- EVAR General vs Local
- Open approaches Retro vs Trans
- Regionalization vs Local care

Background

- Treatment of ruptured abdominal aortic aneurysms (r-AAA) has evolved over the last two decades
- Endovascular aneurysm repair (EVAR) associated with a reduction in short-term morbidity and mortality



Randomized Prospective Trials

- Nottingham 2004
- ECAR 2013
- AJAX 2011
- IMPROVE 2013
- ALL NO Significant Difference between EVAR and OPEN

First Report of RAAA Repair by EVAR

- Frank Veith and Takao Ohki reported 12 cases of RAAA treated by EVAR in 1994
- Larger recent reports of EVAR for RAAA with consistent mortality of 20%
- Reports Have Noted increased use of EVAR for RAAA 5.9-18.9% from 2001 to 2006 now 75%+

MAYO CLINIC

Randomized Prospective Trials

- Nottingham 2004
- Single Center RTC
- 32 Randomized patients
- 30 day Mortality 53% for Both
- Underpowered, under enrolled, high exclusions 15 pts for EVAR

Contemporary Approaches, Controversies and Treatments of Ruptured AAA

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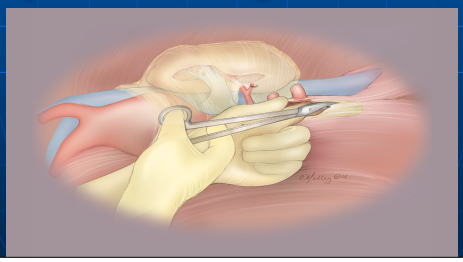
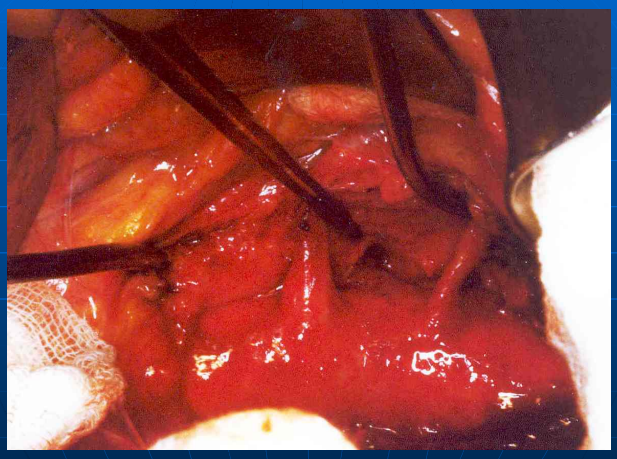
Key Tips
Dissection

- Clamp Iliacs Separately
- Incise left Crus Longitudinally
- Keep Dissection Dry





Randomized Prospective Trials
ECAR

- Randomized Stable Patients
- 107 Patients Randomized
- Mortality 24% to 30% NSD
- EVAR: Less Complications, Lower Use of Resources

Randomized Prospective Trials
AJAX 2011

- Multi Center RTC
- 116 Randomized (of 520 22%)
- Mortality 21% REVAR,25% Open
- Diagnosis Imperfect
- Not all centers proficient at both

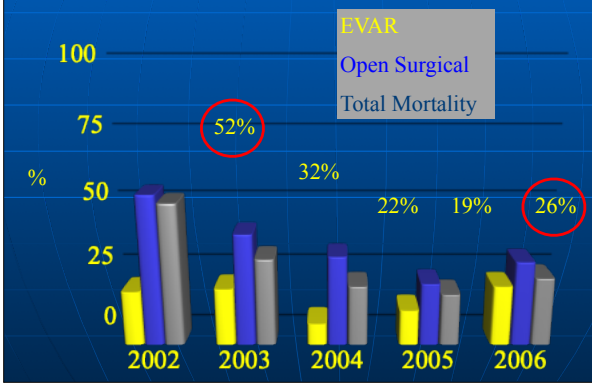
Randomized Prospective Trials
IMPROVE

- 623 Randomized (of 1275,49%)
- Real World Data "Clinical Diagnosis"
- Randomized before CTA
- Pts unsuitable for EVAR done Open(almost Half) Were considered in "EVAR" limb
- Mortality 35%/37%
- Women had better results with EVAR

RCTs Not always the best Answer

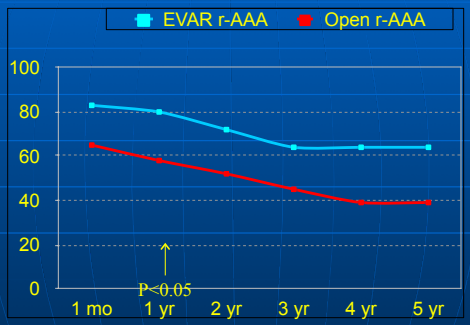
- Strict Selection Criteria
- Too many Exclusions
- Not Applicable to Emergencies
- ? Consecutive patient trials

Ruptured AAA: Operative Mortality



Ruptured AAA: Endovascular vs. Open Surgical Repair

Cumulative Survival



@ Risk						
EVAR	53	45	26	13	4	2
Open	49	32	15	7	4	2

Local vs General for RAAA

KEY TIPS
Positioning

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- ALLEN ARM REST
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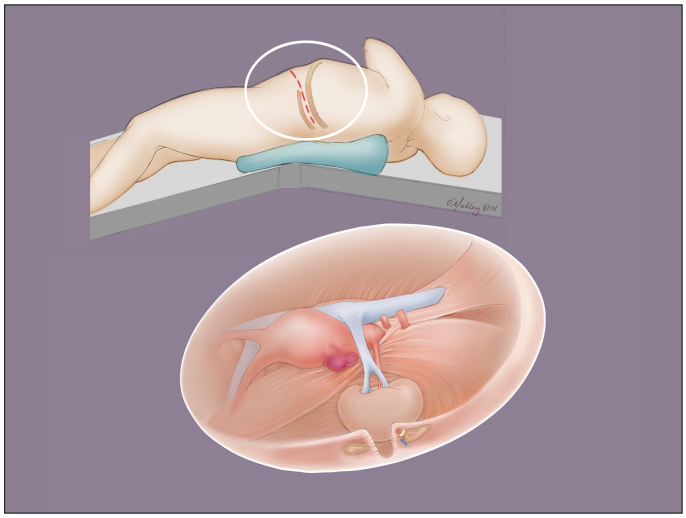

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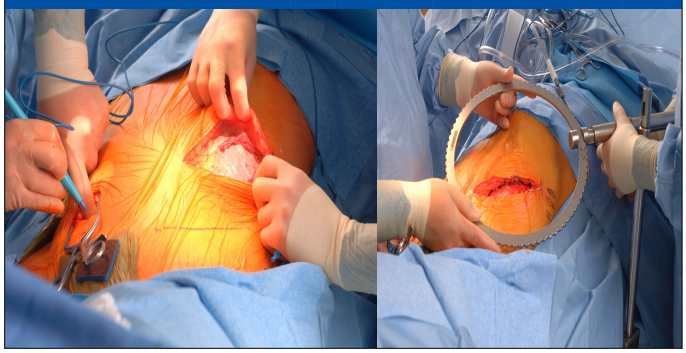
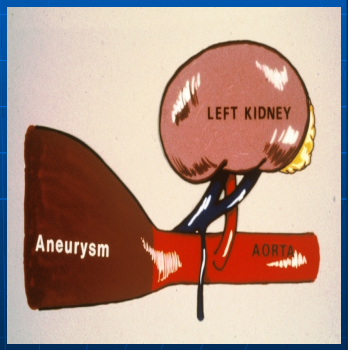
Left Retroperitoneal Incision



Key Tips: Dissection

- Ligate Lumbar Branch Of Left Renal Vein
- Left Renal should be Perpendicular to aorta



Key Tips
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- Incise left Crus Longitudinally
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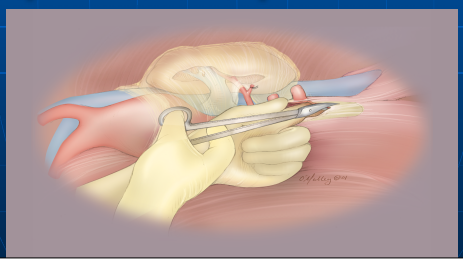
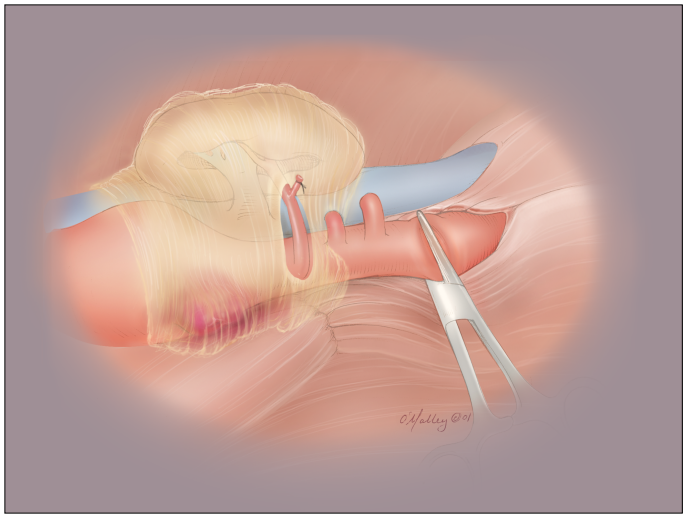
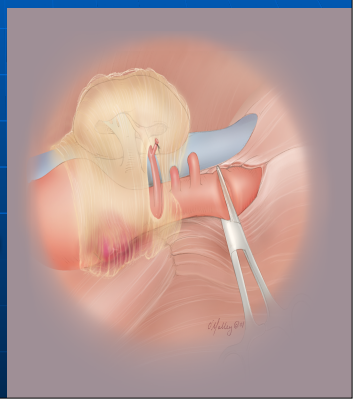




Incising The Left Crus

- Allows:
- Exposure of Supraceliac Aorta
- Clamping above or between Renal
- Move Clamp after Patient stabilization in RAAA



Key Tips
Dissection

- Clamp in Clean area "Landing Zone"
- Isolate SMA/Celiac (if Necessary)
- Heparin 30units/kg
- Clamp Placed Above or between renals or Supra celiac

Decreased mortality with local versus general anesthesia in endovascular aneurysm repair for ruptured abdominal aortic aneurysm in the Vascular Quality Initiative database

Rumi Faizer[1], Eric Weinhandl[2], Selma El Hag[3], Stacey Le Jeune[3], Ioanna Apostolidou[3], Susan M Shafi[3], Cheong J Lee[3], Michael S Rosenberg[3], Amy Reed[3], Christina L Pancoa[1] J VES 2018;1[92-101]

- A total of 3330 patients (77.4% male) met the inclusion criteria (1594 [47.9%] open surgical repair, 226 [6.8%] rEVAR-LA, and 1510 [45.3%] rEVAR-GA). Patients treated with rEVAR-LA compared with rEVAR-GA had decreased intraoperative time, number of intraoperative blood transfusions, intraoperative crystalloid administration, intensive care unit length of stay, and postoperative pulmonary complications. Mortality rates with rEVAR-LA were lower compared with rEVAR-GA at 30 days (15.5% vs 23.3%; adjusted hazard ratio [AHR], 0.70; 95% confidence interval [CI], 0.49-0.99; P = .04) and at 1 year (22.5% vs 32.3%; AHR, 0.71; 95% CI, 0.53-0.96; P = .02). Patients undergoing EVAR who were <75 years old and those without preoperative hypotension had the greatest survival benefit from LA compared with GA (both factors: AHR, 0.14 [95% CI, 0.03-0.57]; single factor: AHR, 0.57 [95% CI, 0.36-0.91]).
- **Conclusions:** This study demonstrates that rEVAR-LA for rAAA may be a safe alternative to rEVAR-GA for certain patients, with lower morbidity and improved mortality. Further prospective study is warranted to confirm mortality benefit in rEVAR-LA for rAAA.

General versus loco-regional anesthesia for endovascular aortic aneurysm repair

Sandra Lee [1] Carolyne You [1] Andrew Kucey [1] Fahad Alam [2] Giuseppe Papia [1] Daryl S Kucey [1] Thomas Forbes [3] Stephen Choi [2] Andrew D Dueck [1] Ahmed Kayssi [1]

- **Objectives:** To evaluate the benefits and harms of general anesthesia compared to loco-regional anesthesia for endovascular aortic aneurysm repair.
- **Selection criteria:** We searched for all randomized controlled trials that assessed the effects of general anesthesia compared to loco-regional anesthesia for endovascular aortic aneurysm repairs.
- **Authors' conclusions:** We did not identify any randomized controlled trials that compared general versus loco-regional anesthesia for endovascular aortic aneurysm repair. There is currently insufficient high-quality evidence to determine the benefits or harms of either anesthetic approach during endovascular aortic aneurysm repair. Well-designed prospective randomized trials with relevant clinical outcomes are needed to adequately address this.

First Albanian Suggestion

Our Current Preference

- Start Femoral access under local
- Once Sheath in position may convert to General anesthesia or continue with Local

rEVAR cannot solve all problems

- What about those who have "Hostile or Unsuitable" necks or poor access?
- Less than 50 % of rAAA fall in the IFU for EVAR
- What about patients with poor access?

Open Surgery

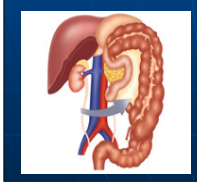
- Trans vs Retro
- May need experienced backup
- TEE / Cardiac anesthesia
- Auto Transfusion
- Heparin???
- Have one surgeon scrubbed when patient arrives to room-directing traffic,watching monitor, coordinating care

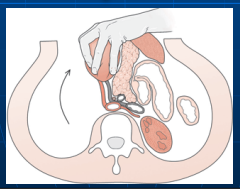
Transabdominal Approaches

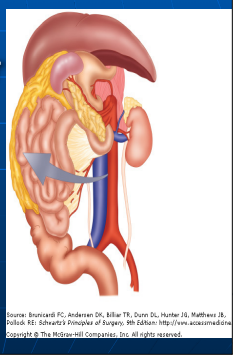
Standard Approach For Infrarenal AAA

Medial Visceral Rotation for More Cephalid Exposure

More Bowel Manipulation



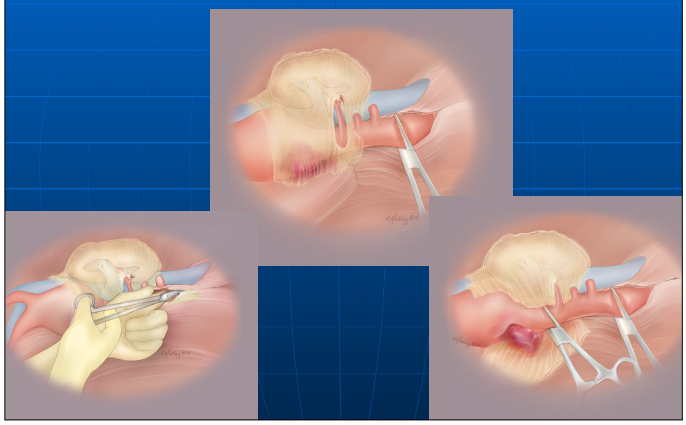




Mortality Of Ruptured AAA Repair

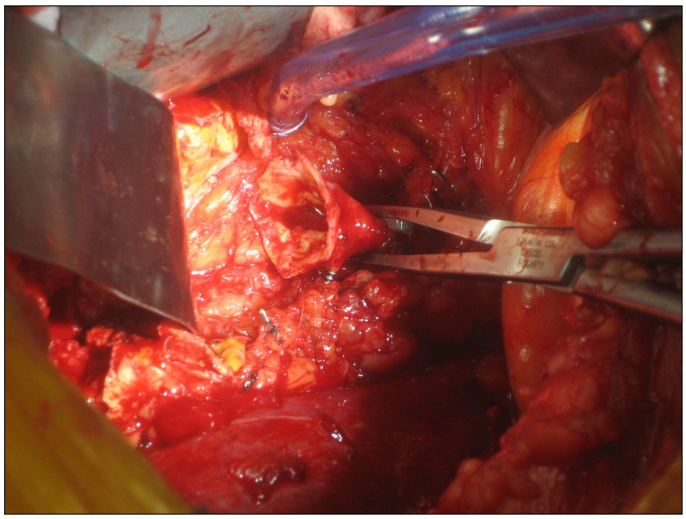
STUDY	YEAR	# pts	Mortality
HOFFMAN	1982	152	38%
OURIEL	1990	243	55%
GLOVICZKI	1992	231	42%
JOHANSEN	1991	186	70%
DARDIK	1998	527	43-59%
HELLER	2000	67,751	46%
ALBANY	2001	202	31%

Open Ruptures Repaired Retro



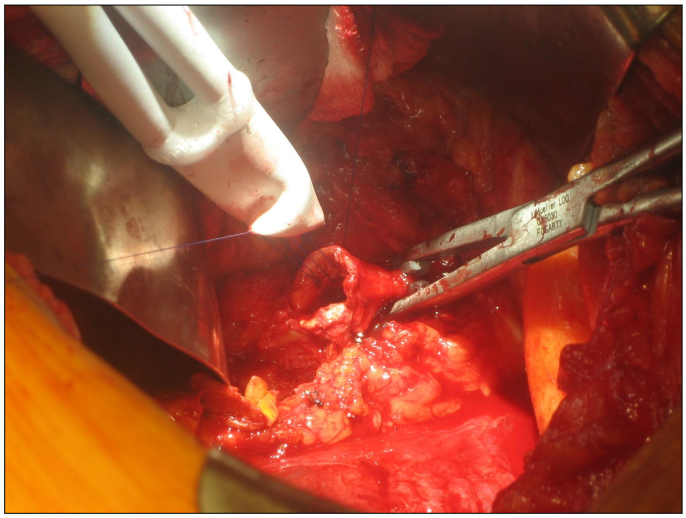
OUR NETWORK

CUTTING EDGE CARE, CLOSE TO HOME



Second Albanian Suggestion

- Aortic Transection minimizes proximal issues (less Pseudoaneurysms, leaks etc)
- Facilitated through Retroperitoneal Approach



Third Albanian Suggestion
Maybe It Is Not The Procedure

- The System
- The Skill Set
- The Infrastructure
- Patient Selection
- Comfort Level
  - Surgeon, Staff, Hospital

The First Call

- Plan & Measurements should be done before the patient reaches the OR
- Minimize Patient Time in ER (less than 60 min)
- Communication, Communication, Communication
  - Transfer Center, EMTs, ER, OR staff, Anesthesia, Angio, ICU (nursing and Attending)
- Make Sure you have the correct Tools/ Grafts/Staff in the OR

Endovascular Repair of Ruptured Aortic Aneurysms
Albany Vascular Institution Experience (2002 – Present)

Established Protocol

Multidisciplinary Approach → Surgeons, ER physicians, Anesthesiologists, OR staff, Radiology technicians

Adequate Equipment →  + Stentgrafts, Wires & Catheters

5 Patients Symptomatic AAA → Simulation: Patients presenting with ruptured AAA

Protocol: Ruptured AAA

ER physician suspects r-AAA

↓

Alerts Vascular Surgery On-Call Team

↓

Hemodynamically Stable SBP ≥ 80 mm Hg

↓

Emergent CTA in ER

Hemodynamically Unstable SBP < 80 mm Hg

↓

OR: Ready for EVAR and Open Surgical Repair

'Surgeon Bias'

The Procedure
Our Approach

- Endo vs Open- Evaluate CTA (hopefully in advance) Helps with Staff and Room
- One surgeon Scrubbed as patient in room
- Aline and prep under local
- Percutaneous bilateral Femoral access under ultrasound guidance under local
- Two Occlusion Balloons on field
- Align Boxes of EVAR in sequence you use them

Procedural Concerns
Our Approach

- Open Main Body as accessing femoral
- Stack boxes of grafts in order of use in room
- Bilateral Access under local
- 12 fr sheath for Balloon Occlusion (hold in place)
- No Heparin
- Cut down at end of case (remove potential concern for blood loss post op)

Peri-Procedural Care

- Staff familiar with RAAA care
- Judicious fluid resuscitation
- Vascular ICU (VICU)
- Monitor Bladder Pressures for Abdominal Compartment Syndrome (BP, Ventilation)
- General Surgery willing to explore for ACS
- Sigmoidoscopy within 24 hours
- Vascular Trained Nurses in ICU and on Floors

ICU Course
Physiology to consider

- Assess Bleeding risk - No heparin, Type II endoleaks, normalize coagulation
- Colon ischemia - early colonoscopy
- Abdominal Compartment Syndrome- Bladder pressures, Respiratory issues (Peak Pressures/Hypotension, decreased U/O

Discharge Planning

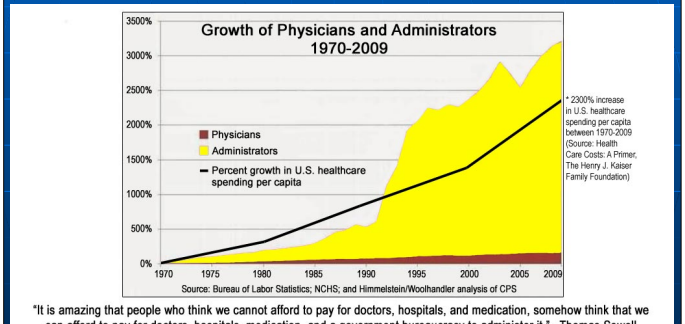
- Discharge Planning starts when procedure ends
- Once on floor-Physical Therapy evaluation
- Social Worker/Discharge Planning
- Evaluate Family Support
- Rehabilitation Planning
- Close follow-up close to home
- Communication

Regionalization of Emergent Vascular Surgery for Patients with Ruptured AAA Improves Outcomes

Courtney J. Warner, Sean P. Roddy, Benjamin B. Chang, Paul B. Kreienberg
Yaron Sternbach, John B. Taggert, Kathleen J. Ozsvath, Chin-Chin Yeh,
Steven C. Stain, R. Clement Darling III

How Hospitals View Physicians

Epidemic Of Administrators



"It is amazing that people who think we cannot afford to pay for doctors, hospitals, and medication, somehow think that we can afford to pay for doctors, hospitals, medication, and a government bureaucracy to administer it." –Thomas Sowell

The Difference Between Vascular and Cardiac

Cardiac

Elective Mortality	< 2%
Emergency Mortality	5-10%

Vascular

Elective Mortality	1-17%
Emergency Mortality	20-70%

Gunshot Wounds: Mortality 10.8%

Results

- Transfer did not influence r-EVAR mortality
  - 20% in rEVAR group presenting to MC
  - 20.1% in rEVAR transferred

	Transfer to MC	Arrival at MC
Lowest SBP<80	34.8%	34.3%
ACLS	5.1%	3.1%
Hgb on arrival	11.1	11.0

- Overall rAAA mortality was 20% lower at the tertiary medical center (27% vs 46%, p<0.001)

Conclusions

- Regionalization of r-AAA to centers equipped for both emergent EVAR and open repair decreased overall mortality by ~20%
- Transfer status did not impact the low mortality of r-EVAR at the tertiary medical center
- Development of treatment algorithms and coordination with community hospitals to expedite triage to specialized centers is critical
- The vast majority of patients will benefit from transfer to an experienced high volume vascular center

Vascular Surgery Is A Team Sport

Everybody plays a vital role (and that role may evolve over time)

The Team includes Nurses (OR, Floor, ICU, Angio, Office), Techs, Anesthesiologists, Cardiology, Endocrine, Neurology, ICU Staff, Discharge Planners Administration, Patients and Families, as well as Vascular Surgeons

Best way to treat an emergency is to prevent it or prepare for it

- Diagnose Quickly
- Educate EMT's, ER and referring Doctors
- Good imaging
- Get to the correct hospital
- Expeditious and safe proximal Aortic control
- Well trained Surgeons and staff (Endo and Open)
- Comprehensive, Multidisciplinary Post procedure care
- Supportive well coordinated Discharge Plan

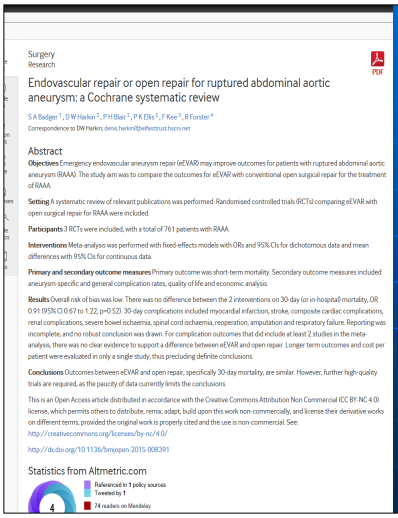
Standard of care for rAAA Requires

- Hospital Infrastructure/Buy-in
- Experienced Vascular surgeons who can do open and EVAR repair
- Early Diagnosis and Expeditious Transfer
- Comprehensive Vascular System
- 24/7 Availability of Staff
- Not only Ability to perform EVAR

Never Get Complacent That you have "Found" the Answer

THANK YOU!

THE VASCULAR GROUP



Surgery
Research

Endovascular repair or open repair for ruptured abdominal aortic aneurysm: a Cochrane systematic review

S A Badger [1], D W Harkin [2], P H Blair [3], P K Ellis [2], F Kee [3], R Forster [4]
Correspondence to DW Harkin; denis.harkin@belfasttrust.hscni.net

Abstract

Objectives Emergency endovascular aneurysm repair (eEVAR) may improve outcomes for patients with ruptured abdominal aortic aneurysm (RAAA). The study aim was to compare the outcomes for eEVAR with conventional open surgical repair for the treatment of RAAA.

Setting A systematic review of relevant publications was performed. Randomised controlled trials (RCTs) comparing eEVAR with open surgical repair for RAAA were included.

Participants 3 RCTs were included, with a total of 761 patients with RAAA.

Interventions Meta-analysis was performed with fixed-effects models with ORs and 95% CIs for dichotomous data and mean differences with 95% CIs for continuous data.

Primary and secondary outcome measures Primary outcome was short-term mortality. Secondary outcome measures included aneurysm-specific and general complication rates, quality of life and economic analysis.

Results Overall risk of bias was low. There was no difference between the 2 interventions on 30 day (or in-hospital) mortality, OR 0.91 (95% CI 0.67 to 1.22, p=0.52). 30-day complications included myocardial infarction, stroke, composite cardiac complications, renal complications, severe bowel ischaemia, spinal cord ischaemia, reoperation, amputation and respiratory failure. Reporting was incomplete, and no robust conclusion was drawn. For complication outcomes that did include at least 2 studies in the meta-analysis, there was no clear evidence to support a difference between eEVAR and open repair. Longer term outcomes and cost per patient were evaluated in only a single study, thus precluding definite conclusions.

Conclusions Outcomes between eEVAR and open repair, specifically 30-day mortality, are similar. However, further high-quality trials are required, as the paucity of data currently limits the conclusions.

http://dx.doi.org/10.1136/bmjopen-2015-008391

Statistics from Altmetric.com

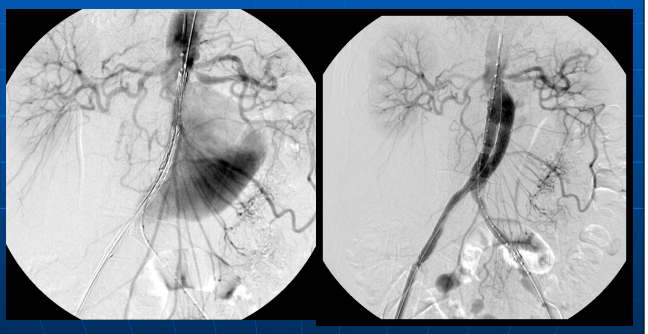
Outcomes between eEVAR and open repair, specifically 30-day mortality, are similar.

Maybe It Is Not The Procedure

- The System
- The Skill Set
- The Infrastructure
- Patient Selection
- Comfort Level
  - Surgeon, Staff, Hospital

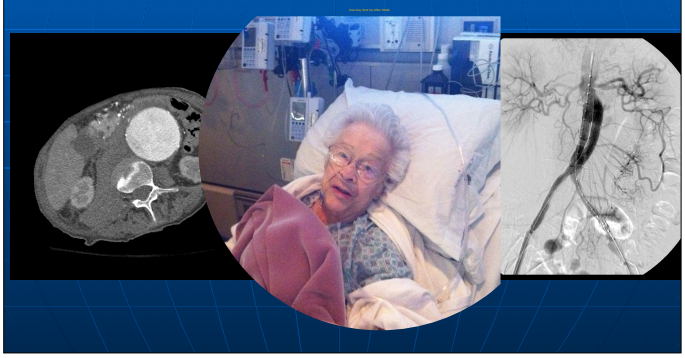
89 Year Old RAAA HCT 19

89 Year Old RAAA Repaired by EVAR



One Day Post Op After RAAA

89 Year Old RAAA HCT 19
Too ill for elective but Ok for a RAAA



The First Call

- Educate your referrals
- Expedite the transfer-Accept All, one number
- Try to evaluate images
- The procedure starts with the plan
- Activate Plan: Notify ER/OR/Staff/ Angio Tech

Key Tips
Dissection

- Clamp in Clean area "Landing Zone"
- Isolate SMA/Celiac (if Necessary)
- Heparin 30units/kg, If Stable
- Clamp Placed Above or between renals or Supra celiac