



VNVDVA  
Hội Bệnh Mạch Máu Việt Nam  
Viet Nam Vascular Disease Association

# HỘI NGHỊ KHOA HỌC TOÀN QUỐC LẦN THỨ I HỘI BỆNH MẠCH MÁU VIỆT NAM

Ninh Bình, ngày 04-06 tháng 03 năm 2022

*Bệnh mạch máu*  
ĐIỂM ĐẾN CỦA CÁC CHUYÊN NGÀNH

## Abdominal Compartment Syndrome following Ruptured Abdominal Aortic Aneurysms: Diagnosis and Interventions

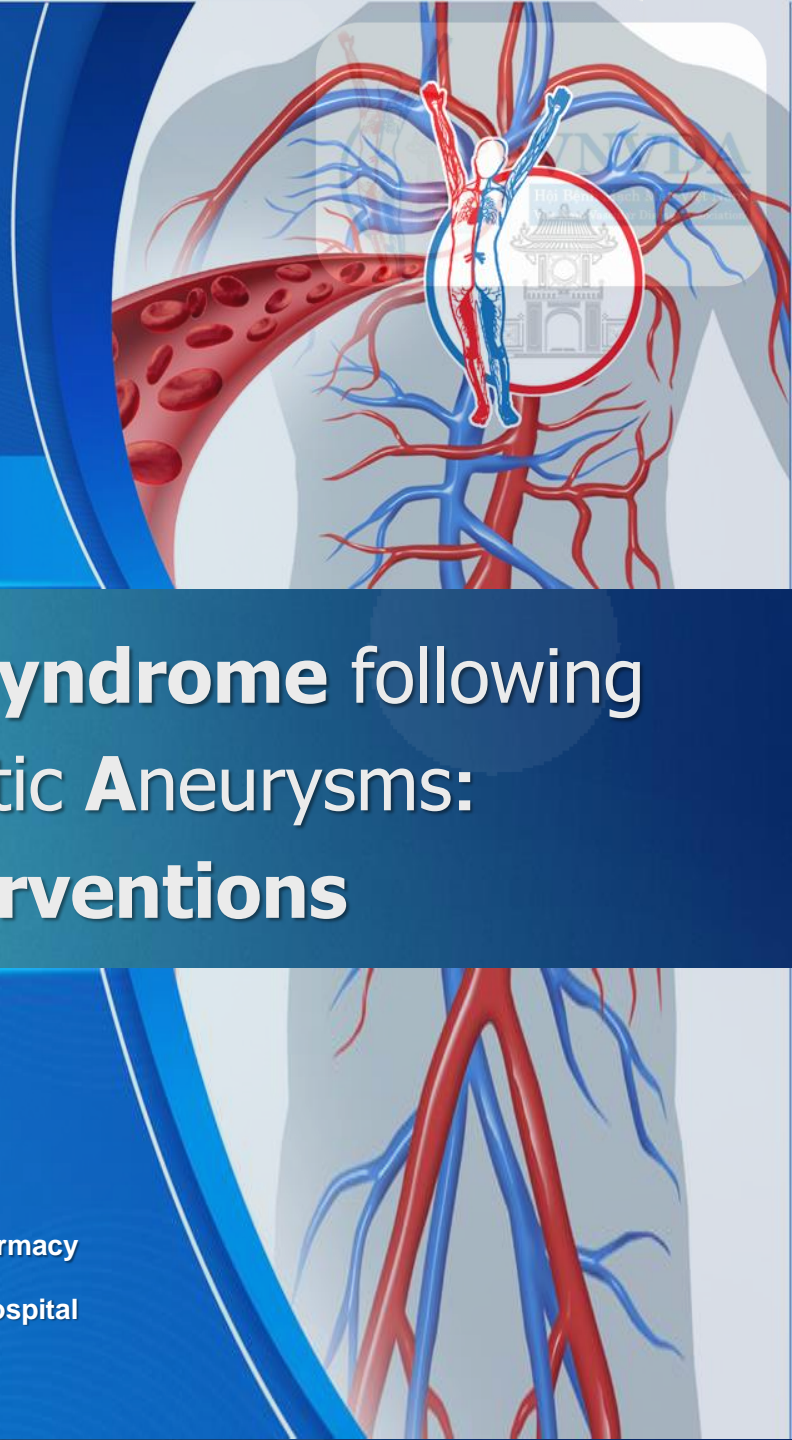
NGUYEN HOANG DINH – LE QUAN ANH TUAN

BUI DUC AN VINH\* – LE QUANG THUAN

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Hue Central Hospital

**NINH BINH, 3/2022**



# Clinical case



- A 61-year-old man
- Complained an aching pain in left abdomen which was severe at times
- Admitted to **University Medical Center Ho Chi Minh City**
  - 12 hours since initial diagnosis (*Covid blockage, provincial transport*)
  - Pale skin, cold hands and feet
  - BP: ~ 90/50 mmHg, Hct ~ 17%

# Clinical case

- Ruptured abdominal aortic aneurysm
- Left accessory renal artery (d = 2mm)  
arise from the aneurysm
- **Hematoma** in retroperitoneal  
space → push left kidney anteriorly



# RUPTURED ABDOMINAL AORTIC ANEURYSM (rAAA)



- Acute haemorrhage from the AAA outside the true aortic wall with the presence of retroperitoneal and/or intraperitoneal blood (Wanhainen et al., 2019)

Ann Vasc Dis Vol. 12, No. 3; 2019; pp 323–328

Online July 25, 2019  
doi: 10.3400/avd.ra.19-00074

➤ *Review Article* ◀

## **Operative Strategy of Ruptured Abdominal Aortic Aneurysms and Management of Postoperative Complications**

Hiroyuki Ito, MD, PhD



## SOCIETY FOR VASCULAR SURGERY<sup>®</sup> DOCUMENT

### The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm

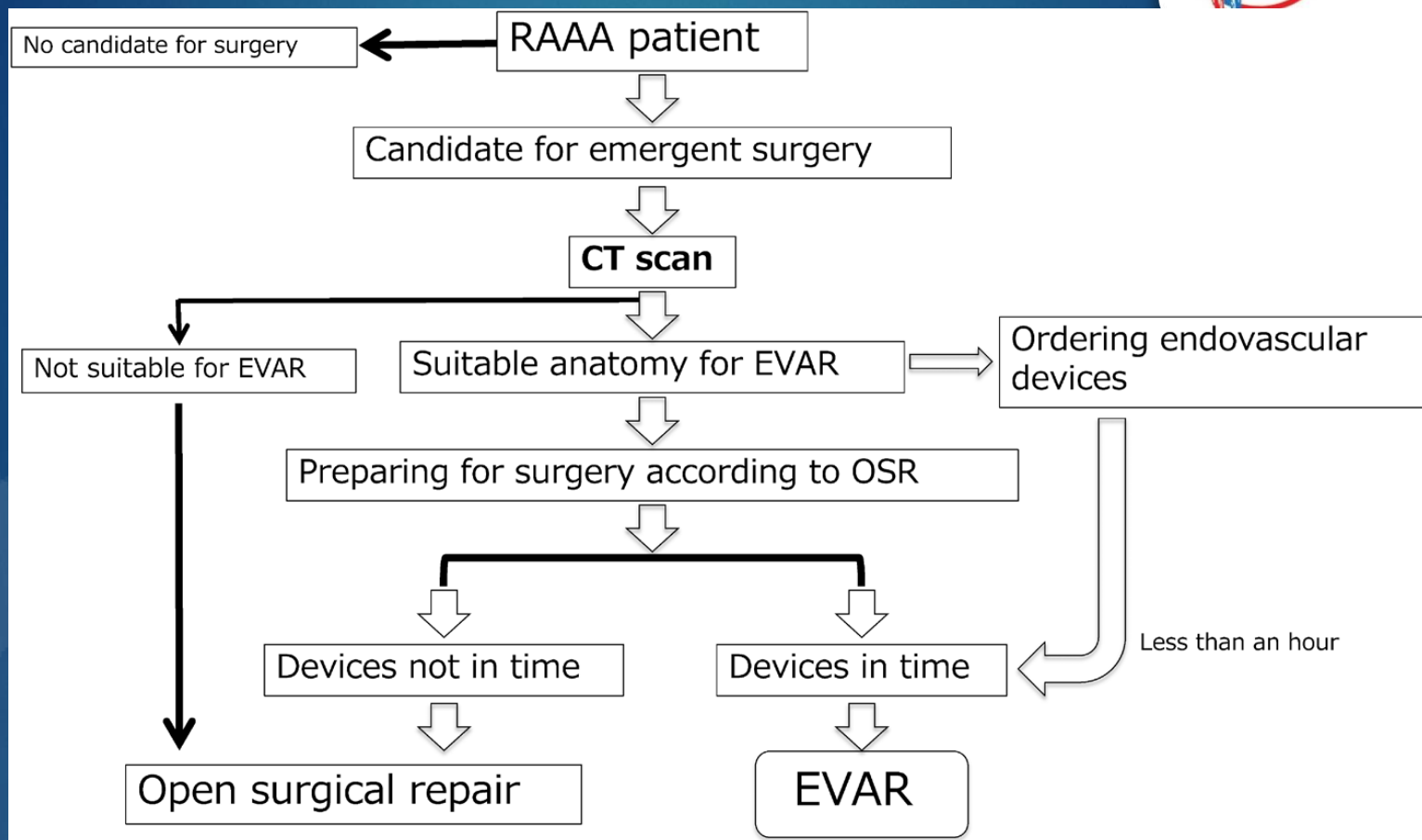


Elliot L. Chaikof, MD, PhD,<sup>a</sup> Ronald L. Dalman, MD,<sup>b</sup> Mark K. Eskandari, MD,<sup>c</sup> Benjamin M. Jackson, MD,<sup>d</sup> W. Anthony Lee, MD,<sup>e</sup> M. Ashraf Mansour, MD,<sup>f</sup> Tara M. Mastracci, MD,<sup>g</sup> Matthew Mell, MD,<sup>b</sup> M. Hassan Murad, MD, MPH,<sup>h</sup> Louis L. Nguyen, MD, MBA, MPH,<sup>i</sup> Gustavo S. Oderich, MD,<sup>j</sup> Madhukar S. Patel, MD, MBA, ScM,<sup>a,k</sup> Marc L. Schermerhorn, MD, MPH,<sup>a</sup> and Benjamin W. Starnes, MD,<sup>i</sup>  
*Boston, Mass; Palo Alto, Calif; Chicago, Ill; Philadelphia, Pa; Boca Raton, Fla; Grand Rapids, Mich; London, United Kingdom; Rochester, Minn; and Seattle, Wash*

If it is anatomically feasible, we recommend EVAR over open repair for treatment of a ruptured AAA.

Level of recommendation	1 (Strong)
Quality of evidence	C (Low)

Chaikof E. L., Dalman R. L., Eskandari M. K., et al. (2018), "The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm", *J Vasc Surg*, 67(1), 2-77 e2.



# Surgery vs EVAR – ESVS 2019

Eur J Vasc Endovasc Surg (2019) 57, 8–93

## Editor's Choice — European Society for Vascular Surgery (ESVS) 2019 Clinical Practice Guidelines on the Management of Abdominal Aorto-iliac Artery Aneurysms

Anders Wanhainen <sup>a,i,\*</sup>, Fabio Verzini <sup>a,j</sup>, Isabelle Van Herzele <sup>a</sup>, Eric Allaire <sup>a</sup>, Matthew Bown <sup>a</sup>, Tina Cohnert <sup>a</sup>, Florian Dick <sup>a</sup>, Joost van Herwaarden <sup>a</sup>, Christos Karkos <sup>a</sup>, Mark Koelemay <sup>a</sup>, Tilo Kölbel <sup>a</sup>, Ian Loftus <sup>a</sup>, Kevin Mani <sup>a</sup>, Germano Melissano <sup>a</sup>, Janet Powell <sup>a</sup>, Zoltán Szeberin <sup>a</sup>



- Recent analysis of a database 2003 - 2013 (514 EVAR, 651 OSR) suggested EVAR associated with lower in hospital morbidity than surgery
- **3 years:** compared with open repair, an EVAR for suspected rAAA associated with
  - survival advantage, a gain in quality adjusted life years, similar levels of reintervention
  - Reduced costs, cost effective

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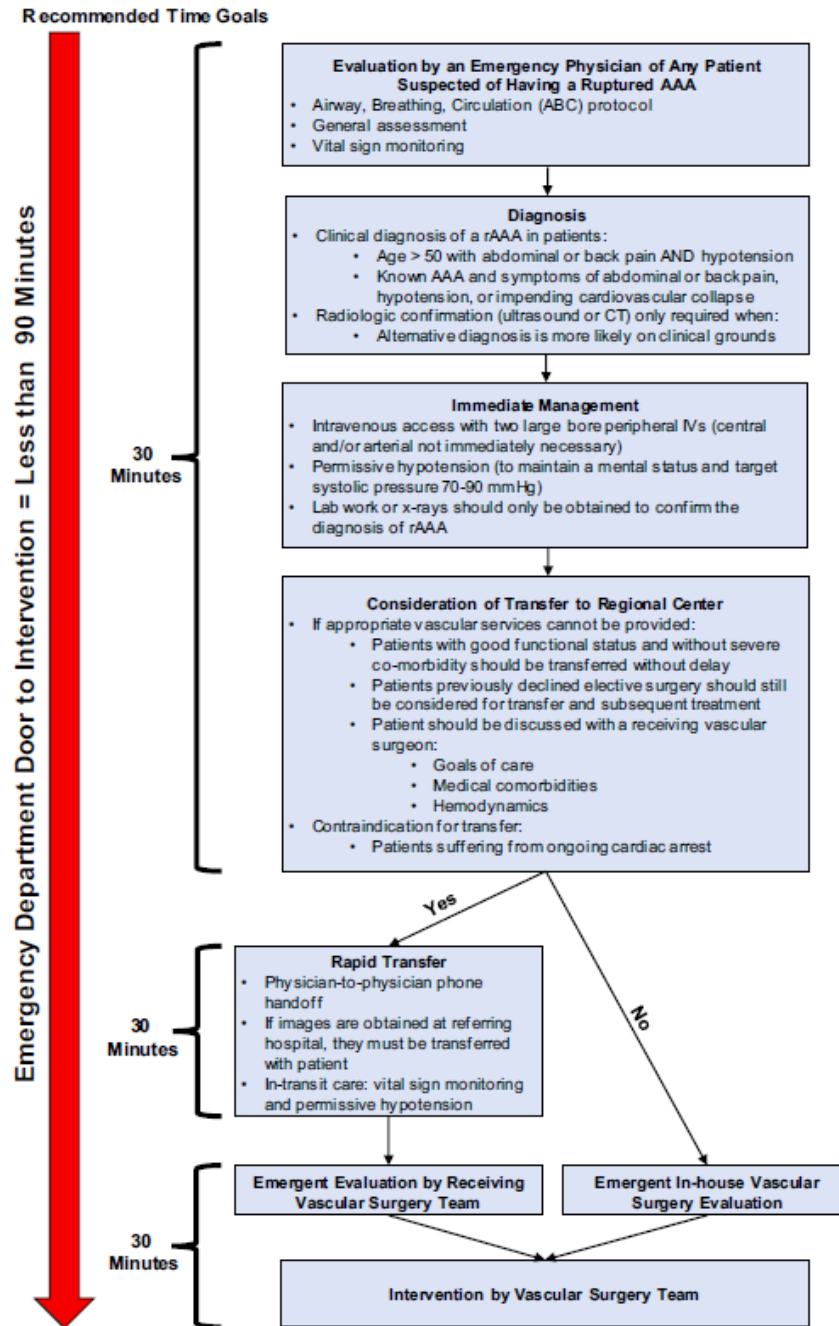
- A large study including >10,000 rAAA, of whom 1126 underwent EVAR: the peri-operative mortality was 33.8% after EVAR and 47.7% after OSR (p < 0.001)
- **> 4 years:** EVAR for rAAA is associated with lower peri-operative and long-term mortality
  - The increasing adoption of EVAR for rAAA is associated with an **overall decrease in mortality** of patients hospitalised for rAAA



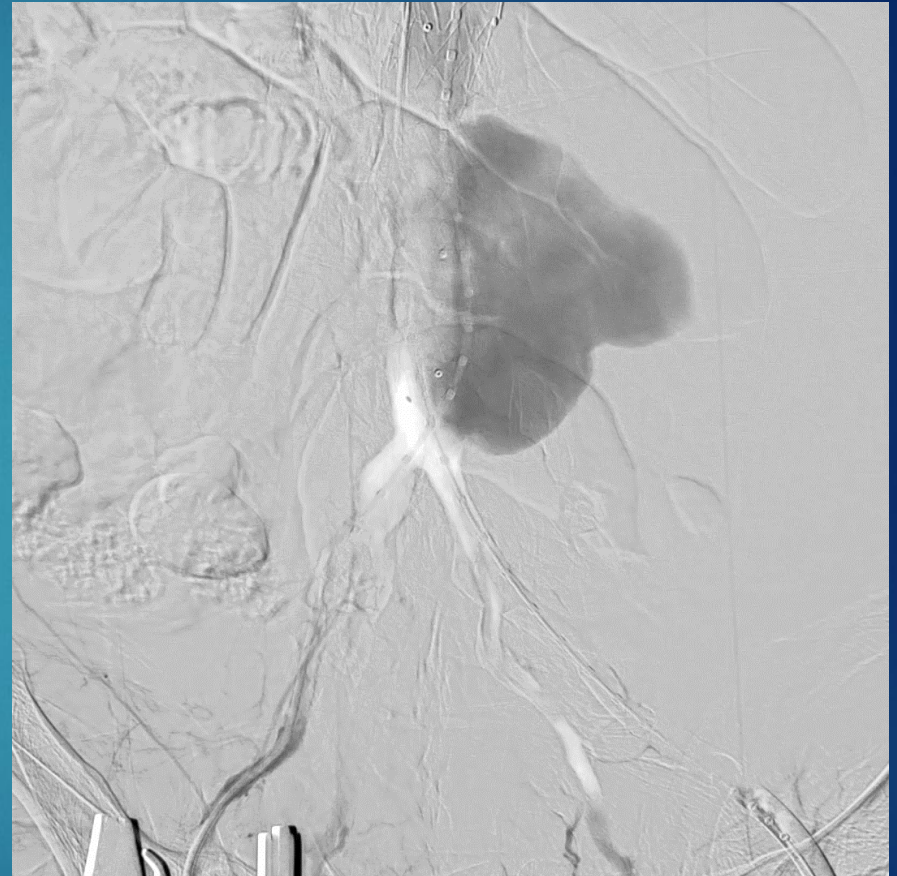
# Suspected Ruptured Abdominal Aortic Aneurysm (rAAA) Algorithm



Chaikof E. L., Dalman R. L., Eskandari M. K., et al. (2018), "The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm", J Vasc Surg, 67(1), 2-77 e2.

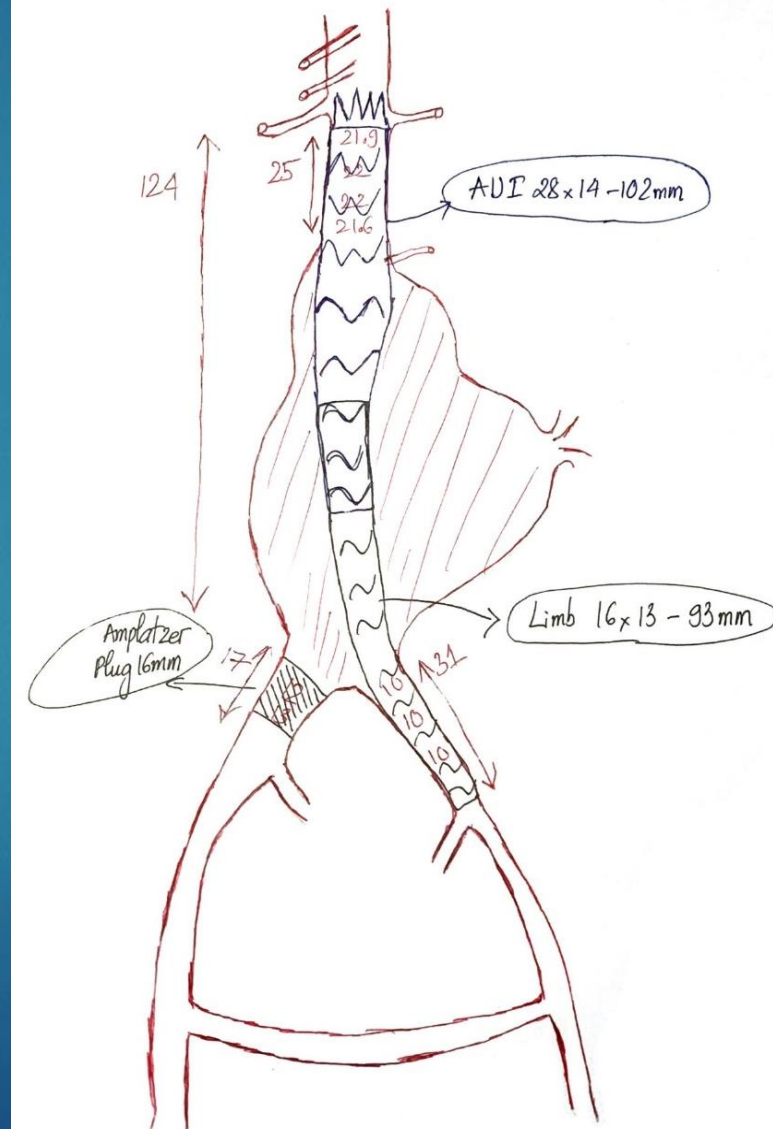


# Clinical case: Intra-Intervention



# Clinical case - Plan

- Stentgraft 28/14/102 at the level of Right Renal Aa.
- Stentgraft 16/13/93 into Left Common iliac Aa.
- Endoleak: additional cuff 28/28/49
- Amplatzer 16mm in Right Common Iliac Aa.
- Femoro-femoral bypass graft





# Clinical case: Intra-Intervention



- **Plug Amplatzer deployment**



- **Final angiogram**



# Clinical case: Post-Intervention



■ Axial CT Scan

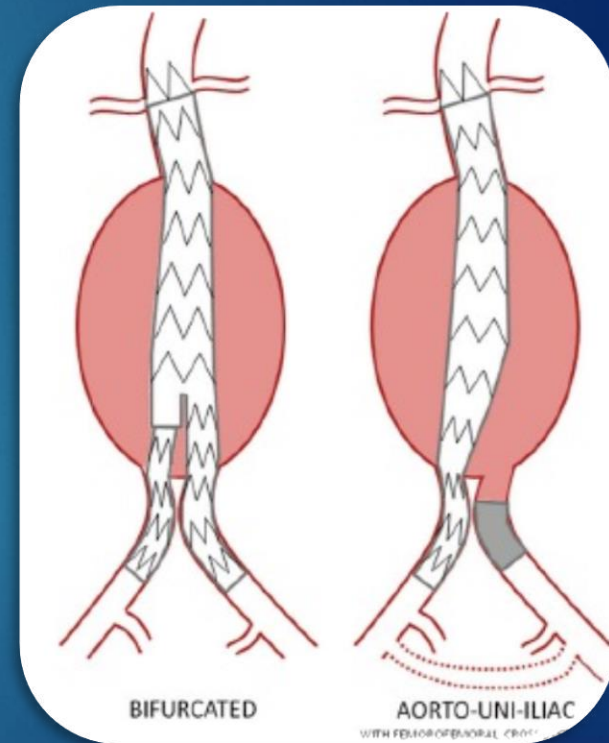


■ 3D Reconstruction

# Aorto-Uni-iliac stent (AUi) or Mod-Ular Bifurcation stent (MUB) ?



- Expertise and preference of the operator, stent graft availability, aneurysm anatomy & haemodynamic status
- Outcomes of EVAR in rAAA comparing AUi vs MUB are debated
- Single centre reports suggested bifurcated stent associated with lower mortality than AUi (Karkos et al., 2014), (Gupta et al., 2017)
- **IMPROVE trial** graft infection rates are lower with MUB devices (Powell et al., 2018)



# AUI or MUB (?)



## Outcomes After Use of Aortouniiliac Endoprosthesis Versus Modular or Unibody Bifurcated Endoprostheses for Endovascular Repair of Ruptured Abdominal Aortic Aneurysms

Vascular and Endovascular Surgery  
1-6  
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sagepub.com/journalsPermissions.nav  
DOI: 10.1177/1538574417703562  
journals.sagepub.com/home/ves  
SAGE

Prateek K. Gupta, MD<sup>1,2</sup>, Kelly Kempe, MD<sup>1,2,3</sup>,  
Reshma Brahmhatt, MD<sup>1,2</sup>, Himani Gupta, MD<sup>2</sup>,  
Jorge Montes, MD<sup>4</sup>, R. Armour Forse, MD<sup>4</sup>,  
Shaun M. Stickley, MD<sup>1,3</sup>, and Michael J. Rohrer, MD<sup>1,2</sup>

	AUI	MUB
<b>Pros</b>	<ul style="list-style-type: none"><li>Easier and quicker, higher eligibility rate</li><li>Requires fewer stent grafts in stock</li></ul>	<ul style="list-style-type: none"><li>More anatomically suited</li></ul>
<b>Cons</b>	<ul style="list-style-type: none"><li>Requires an extraanatomical femoro-femoral graft</li><li>Disadvantages of an extraanatomical bypass plus the fact that local anaesthesia may have to be converted to general anaesthesia</li></ul>	<ul style="list-style-type: none"><li>Avoids a femoro-femoral bypass time taken to cannulate the contralateral stump</li><li>Any delay in excluding the aneurysm may have a negative impact on survival</li></ul>

# Clinical case: follow-up



- Adrenaline, Noradrenaline
- Maintained sBP  $\sim$  90 mmHg
- Blood transfusion: 12 UI of packed red blood cells
- Hct 15  $\rightarrow$  27%
- **Intra-Abdominal Pressure** (IAP) Monitoring: indirectly via Urinary bladder
- Echo: Peritoneal effusion



## Clinical case: A few minute later



- Anuria
- Abdominal tenderness
- **Bladder pressure ~ 28-29 mmHg**
- Abdominal circumference: 103 -> 104 cm
- Echo: Peritoneal effusion (x 1,5) & hematoma in the left retroperitoneum

# Clinical case



- **ACS diagnosed** → **Indication for decompressive laparotomy**
- **Aim:** decompression of the abdomen to prevent multiple organ failure
- **Not to do:** do not intervene the hematoma if it is unnecessary
- May not close the abdomen at time

# Clinical case: Laparotomy



- Long median incision
- **periotoneal cavity:** 700ml old, red and unclotted blood
- **Organs:** perfused pink small intestine, gas in the large intestine, pulse in the mesenteric arteries
- **Hematoma** in the left retroperitoneum, size  $\sim 5 \times 10$ cm, pulseless
- Left the **incision open**, drainage, covered with plastic drapes

# Abdominal Compartment Syndrome

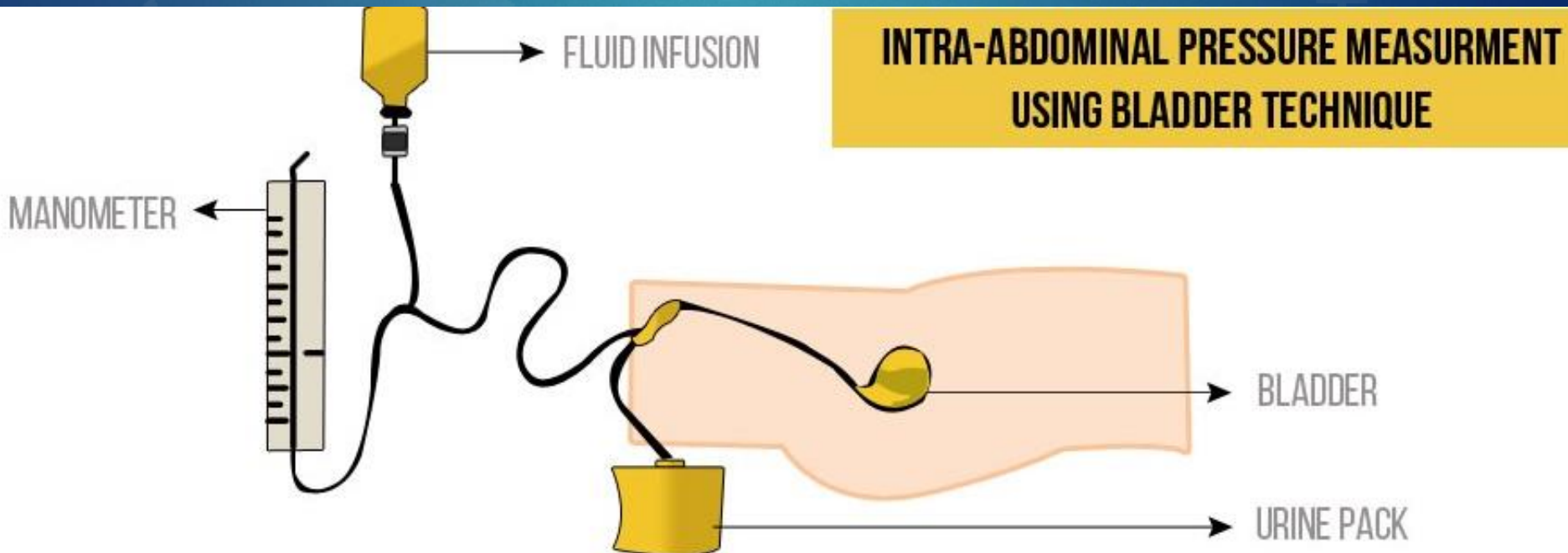


- Intra-abdominal pressure (**IAP**)
- Intra-abdominal hypertension (**IAH**):  $IAP > 12 \text{ mmHg}$
- Abdominal compartment syndrome (**ACS**):  $IAP > 20 \text{ mmHg}$   
associated with a **new organ** dysfunction or failure



# IAP measurement

- Indirect assessment of IAP by bladder pressure
- 50-100ml saline into bladder
- **Gold standard**



# ACS following rAAA treatment



- The development of ACS has been documented after both open repair and EVAR of rAAA
- **(Rubenstein, 2015)** ACS developed more frequently in **open repair** than in EVAR (**34%** vs **21%**)

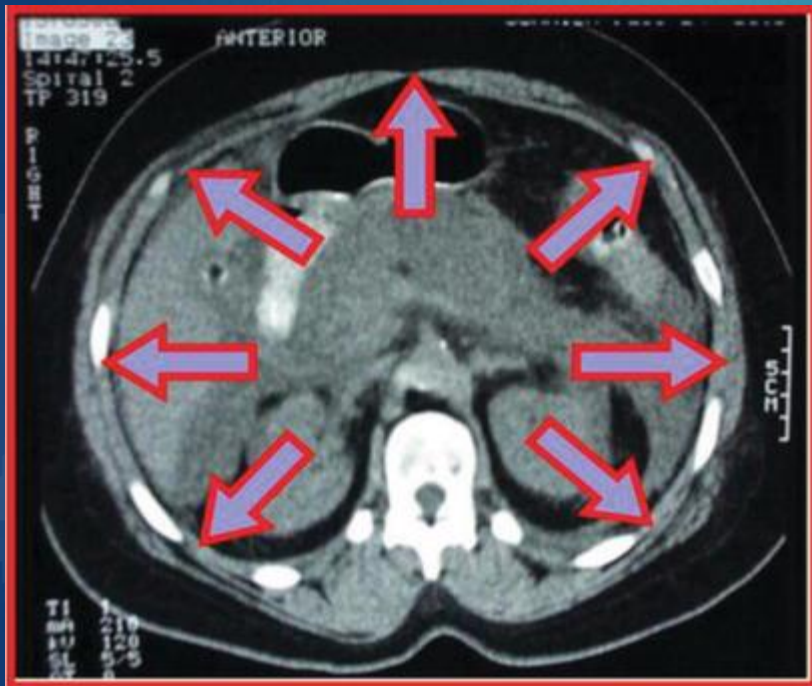
# Risk factors for IAH



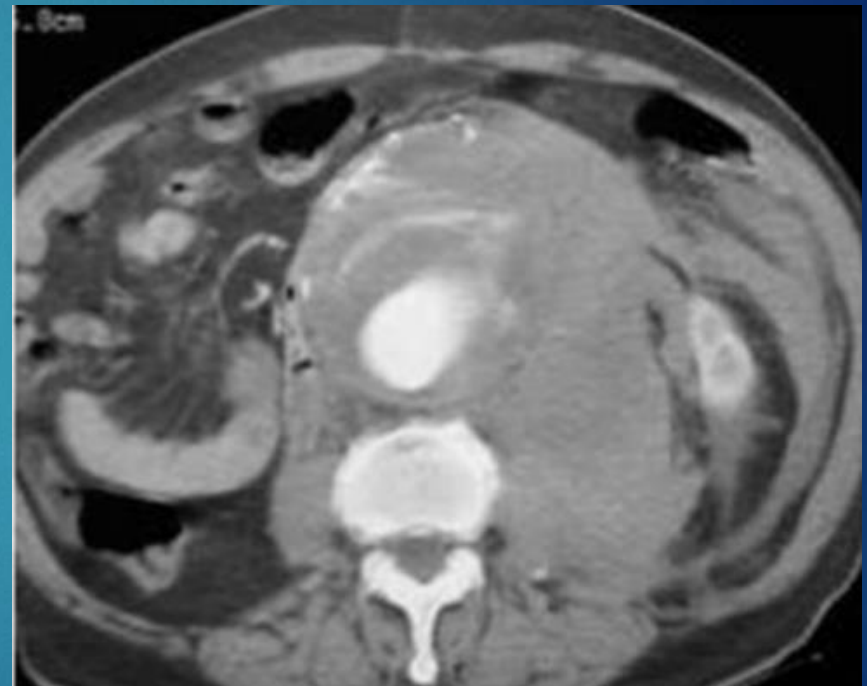
## ESVS 2019

- Use of Aortic Occlusion Balloon
- Severe coagulopathy
- Massive transfusion requirements
- Pre-operative loss of consciousness
- Low pre-operative BP
- The emergency conversion of MUB to AUI devies

# rAAA increases IAP



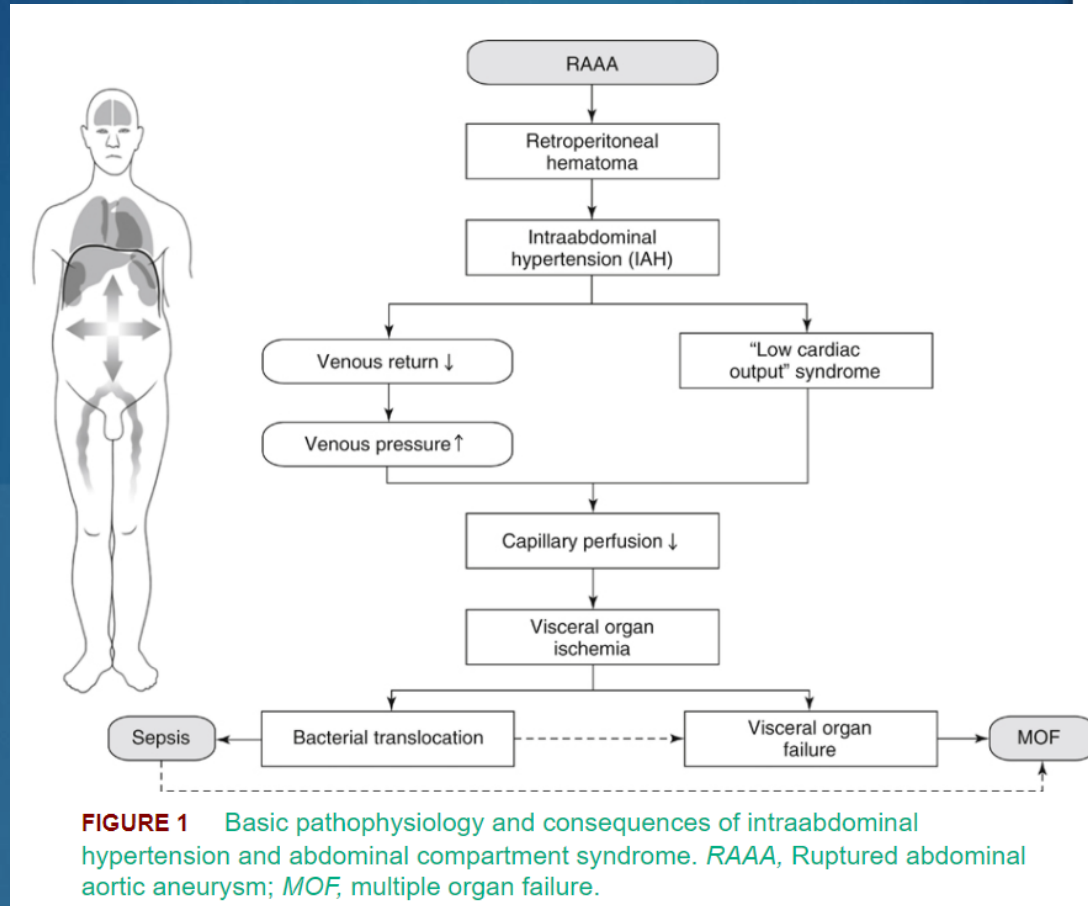
■ IAP



■ rAAA



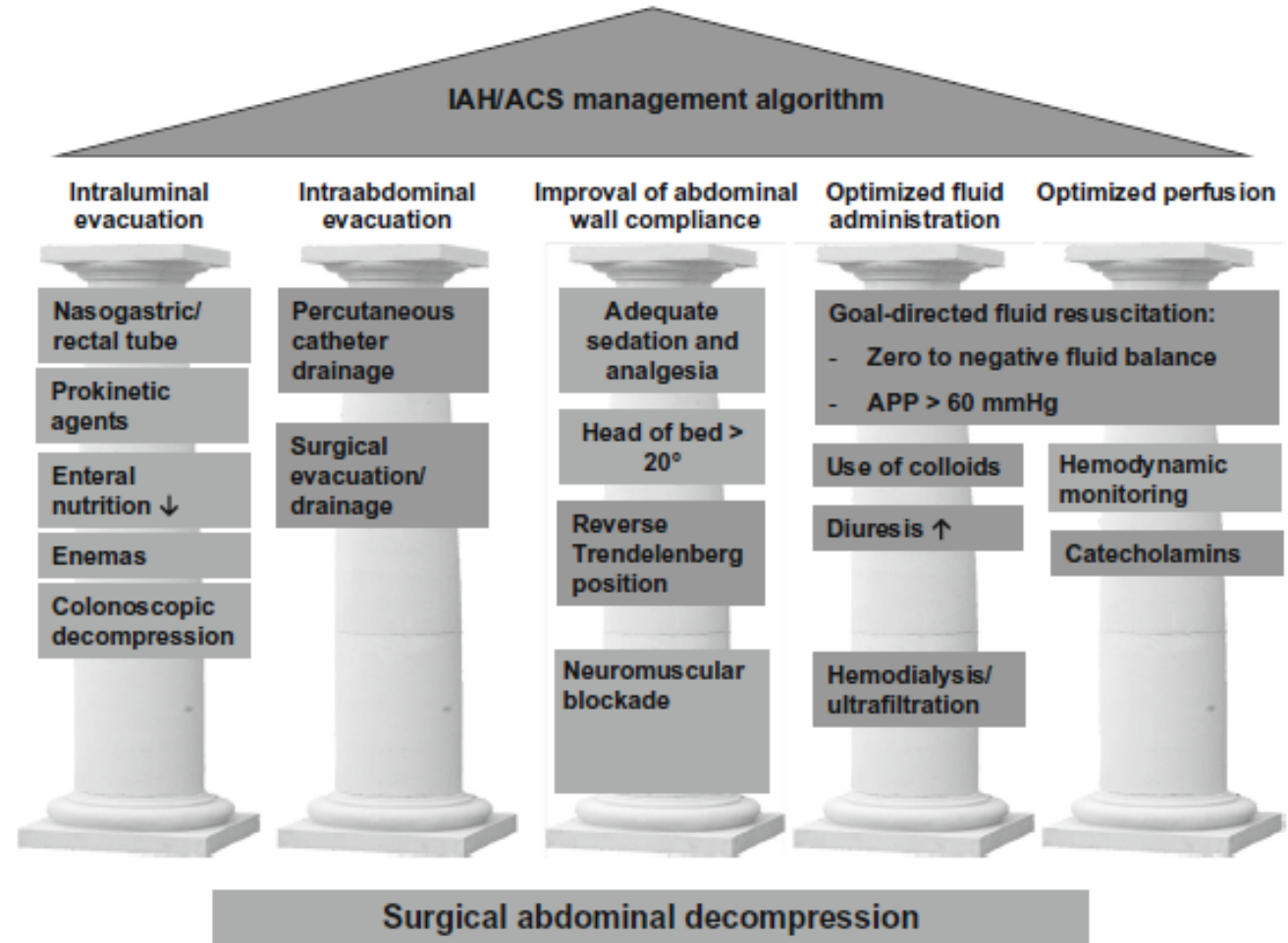
# Complications of ACS



- The postoperative deaths are related to multiple organ failure that could be explained by a misdiagnosis or a delayed diagnosis of an occurring ACS

# Decompressive Laparotomy

**Fig. 4** Intensive care unit (ICU) management algorithm to treat intraabdominal hypertension and the acute abdominal compartment syndrome, respectively. Therapy is based on five major columns. In case of clinical escalation, surgical decompression is the most effective therapeutic approach to cope with this emergency situation



Hecker A., Hecker B., Hecker M., et al. (2016), "Acute abdominal compartment syndrome: current diagnostic and therapeutic options", *Langenbecks Arch Surg*, 401(1), 15-24.

# Decompressive Laparotomy



**Table 5.3. Summary of medical treatment options for intra-abdominal hypertension/abdominal compartment syndrome.**

Improve abdominal wall compliance	Pain relief (epidural anaesthesia) Avoid morphine Neuromuscular blockade (may reduce IAP by 50%)
Evacuate intra-luminal/abdominal content	Nasogastric decompression Paracentesis (seldom feasible)
Correct positive fluid balance	Avoid over resuscitation and crystalloids Whole blood and colloids (20% albumin) Diuretics (furosemide) Renal replacement therapy if indicated
Organ support	Optimize ventilation (PEEP) Vasopressors (APP > 60 mmHg)

IAH = intra-abdominal hypertension; ACS = abdominal compartment syndrome; IAP = intra-abdominal pressure; PEEP = positive end expiratory pressure; APP = abdominal perfusion pressure.

# Decompressive Laparotomy



## Recommendation 72

In the presence of abdominal compartment syndrome after open or endovascular treatment of ruptured abdominal aortic aneurysm, decompressive laparotomy is recommended

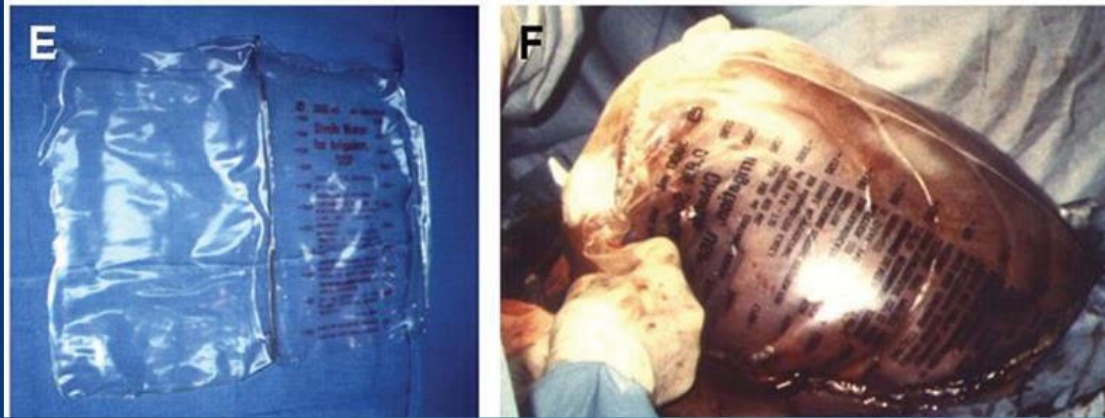
Class	Level	References
I	B	[466,467,450,382,459,464]

Wanhainen A., et al. (2019), "Editor's Choice - ESVS 2019 Clinical Practice Guidelines on the Management of Abdominal Aorto-iliac Artery Aneurysms", *Eur J Vasc Endovasc Surg*

Fernandez L. G. (2016), "Management of the open abdomen: clinical recommendations for the trauma/acute care surgeon and general surgeon", *Int Wound J*



# TEMPORARY ABDOMINAL CLOSURE



Fernandez L. G. (2016), "Management of the open abdomen: clinical recommendations for the trauma/acute care surgeon and general surgeon", *Int Wound J*, 13 Suppl 3, 25-34.

- Early abdominal closure is difficult & can cause ACS recurrence



**Our patient:** after decompressive surgery



# Clinical case – abdominal closure

## 6<sup>th</sup> day

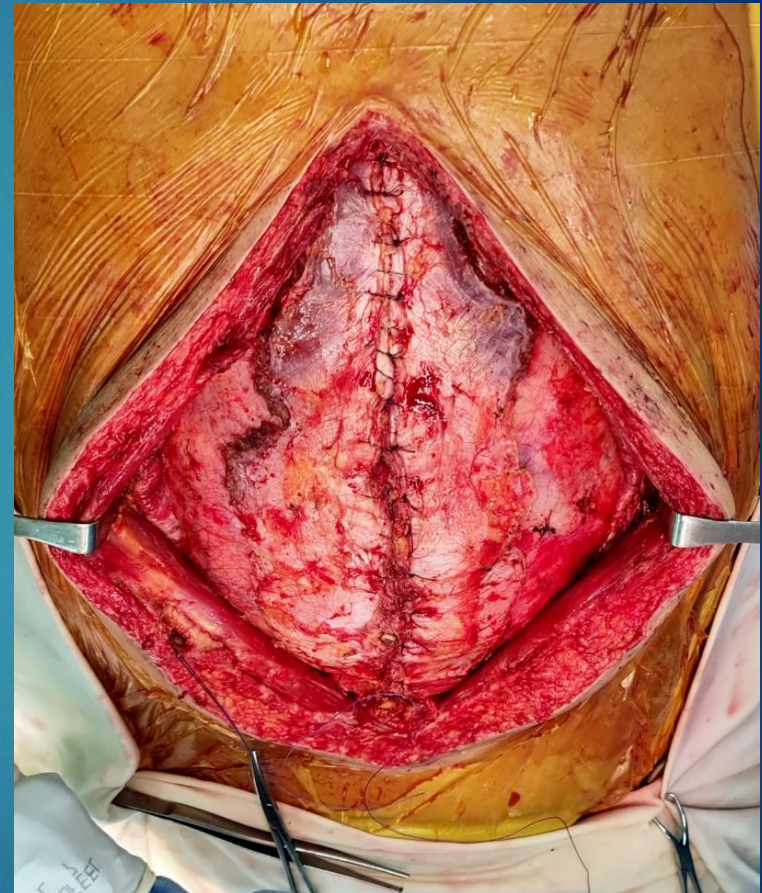


- **Evaluation:** no lesions in peritoneal organs
- **Component separation:** separated the **posterior of rectus sheath** on both side, freed the **transverse abdominal muscle**
- **Primary fascial closure**, assisted with **Mesh** reinforced
- Coved with **Vacuum – Assisted Closure** (P=80mmHg, continuous mode)

# TEMPORARY ABDOMINAL CLOSURE



Fig. 5. Components separation closure. Note the release incisions in the aponeurosis of the external oblique muscles allowing midline mobilization.



**Our patient:** fascia closure at 6<sup>th</sup> day



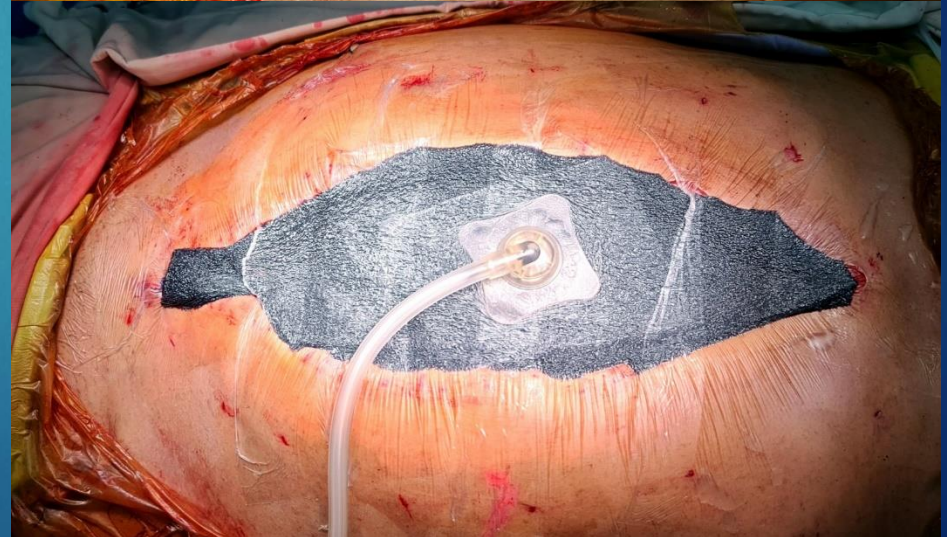
# TEMPORARY ABDOMINAL CLOSURE

## Recommendation 73

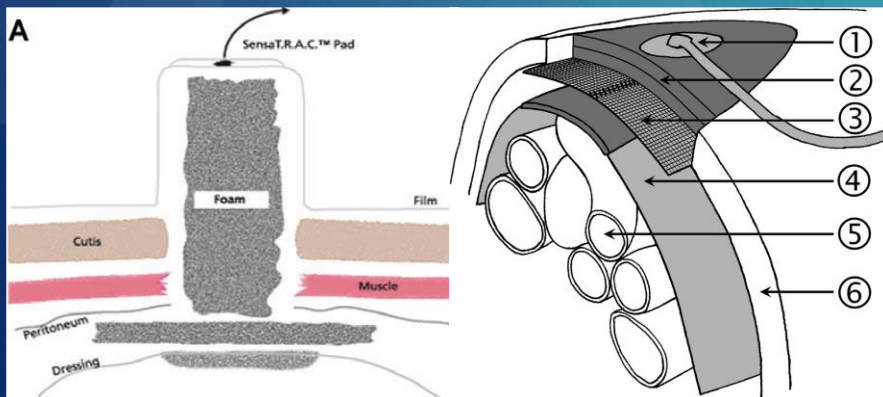
In the management of open abdomen following decompression for abdominal compartment syndrome after open or endovascular treatment of ruptured abdominal aortic aneurysm, vacuum assisted closure system should be considered

Class	Level	References
Ila	C	[466,459,464]

Wanhainen A., et al. (2019), "Editor's Choice - ESVS 2019 Clinical Practice Guidelines on the Management of Abdominal Aorto-iliac Artery Aneurysms", *Eur J Vasc Endovasc Surg*



**Our patient**



# Abdominal closure



- performed after confirming improved circulatory dynamics and alleviated intestinal edema, may be performed within a few days after the laparotomy, or has to wait > 1 week
- Decisions should be made carefully as to when the patient is ready for abdominal closure as too early abdominal closure can cause ACS recurrence and intraperitoneal infections (*Ito Hiroyuki. 2019*)
- Abdominal fascia may be closed using temporary closure devices such as (vacs, meshes, and zippers), after 5 to 7 days after the compartment pressures and swelling have decreased.



# Clinical case – 1 month PostOpt



- **Total closure – 27<sup>th</sup> day**



- **Discharge – 1 month postsurgery**

# Conclusions



- **rAAA managements and interventions**
  - **SALVAGE!!!**, hemodynamic stabilization
  - Surgery versus EVAR, AUI versus MUB
- **ACS precaution**
  - Bladder pressure measurement
- **ACS management followed recent recommendations**
  - Decompressive laparotomy
  - Multispecialty teams
  - Temporary abdomen closure → Total closure

# Post test Q/A



## Which of the following statements is true about ACS following rAAA?

- A. Cathetering the abdomen is the only way to diagnose ACS
- B. ACS need no more than ICU management
- C. Decompressive laparotomy is important in ACS treatment
- D. Decompressive laparotomy requires a complete wash-out of the hematoma

# Post test Q/A



- A. Cathetering the abdomen is the only way to diagnose ACS
- B. ACS need no more than ICU management
- C. **Decompressive laparotomy is important in ACS treatment**
- D. Decompressive laparotomy requires a complete wash-out of the hematoma





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## HỘI BỆNH MẠCH MÁU VIỆT NAM

Ninh Bình, ngày 04-06 tháng 03 năm 2022

*Bệnh mạch máu*

**ĐIỂM ĐẾN CỦA CÁC CHUYÊN NGÀNH**

# THANK YOU!

