





**Progress In Resuscitation And Endovascular Trauma Management (EVTM)**  
**With Catheter Based Treatments Including REBOA And Other Devices:**  
**What Is Partial And Intermittent REBOA And What Is Their Value**

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**Conflict of Interest**



None relevant  
**"No ego, just good science, care and collaboration"**




**The EVTM Concept**

Concept focused on using endovascular and hybrid tools for resuscitation and bleeding control

- Embolization
- Stentgrafts
- Resuscitative Endovascular Balloon Occlusion Aorta (REBOA)
- Modern bleeding treatment Strategies/ imaging
- Multidisciplinary work

- Vascular access (AABCDE)
- CTA (<10-15min) - Dedicated protocol
- Angio table / C-Arm / Hybrid suite
- Adjunct techniques / hybrid procedures
- Endo might help / avoid opening new cavity

Does NOT replace open surgery!



Top Stent Manual 2017; Hörer et al 2009-2018; EVTM textbook 2019 Springer; Landmark articles EVTm 2021

**The EVTM Concept**

Resuscitative endovascular balloon occlusion of the aorta (REBOA) and endovascular resuscitation and trauma management (EVTM): a paradigm shift regarding hemodynamic instability



Tal Hörer<sup>1</sup>

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3 Shook, 2020 Feb 19; doi: 10.1053/j.ajem.2020.02.01219; Online ahead of print

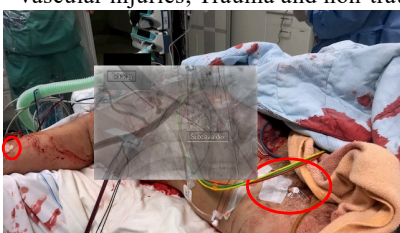


**Endovascular Resuscitation and Trauma Management (EVTM) – Practical Aspects and Implementation**

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Top Stent Manual 2017; Hörer et al 2009; EVTm textbook Springer 2019; DSC 2020/2023; ESVS Vascular trauma in war 2023

**Paradigm shift in hemodynamic instability, vascular injuries; Trauma and non-trauma**

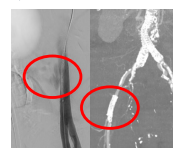




Hörer T 2009-; EVTm textbook Springer 2019, DSC manual 2020, Cocolini et al 2017; Landmark EVTm articles 2021

**EVTM progress (some examples)**

- EVTM 9th Symposium
- 10<sup>th</sup> year workshops
- rAAA/rTAA/rIA
- BTAI
- Bleeding control tools (i.e iatrogenic)
- PPH
- Endovascular thrombectomy
- REBOA (aortic balloon)

**Catheter Based Treatments**



**And much more endo and hybrid solutions..**

**9<sup>th</sup> EVTM Symposium**  
 10<sup>th</sup> bi-annually WORKSHOPS  
 10<sup>th</sup> EVTM Pan-Am in the us 2025/6  
[EVTM – YouTube](#)

**We know that we can treat 100% rAAA with EVAR (15y data!)**

Table 3. Mortality	Mors tabula	24 hours	Mortality	Mortality 30 days	Mortality 90 days	Mortality 1 year
All patients (148), n (%)	-	31 (21)	53 (36)	59 (40)	67 (45)	-
Previous aortic surgery (26), n (%)	0 (0)	2 (8)	7 (27)	8 (31)	9 (35)	-
AI rAAA (104), n (%)	13 (13)	19 (18)	29 (28)	34 (33)	41 (39)	-
rAAA-AD y rAAI, n (%)	6 (15)	11 (27)	13 (32)	18 (44)	21 (51)	-
rAAA-AD y rAAI, n (%)	7 (21)	8 (23)	10 (28)	16 (45)	20 (52)	-
rAAA infrarenal (85), n (%)	10 (12)	14 (16)	20 (24)	24 (28)	31 (36)	-
rAAA suprarenal (15), n (%)	3 (20)	5 (33)	7 (47)	8 (53)	9 (60)	-
rAAA thoracoabdominal (4), n (%)	0 (0)	0 (0)	2 (50)	2 (50)	2 (50)	-

**Value? Minimal invasive!**

Complete Replacement of Open Repair for Ruptured Abdominal Aortic Aneurysms by Endovascular Aneurysm Repair  
 A True Center for Choice Experience  
 A 12-year experience of endovascular repair of ruptured Abdominal Aortic Aneurysms (rAAA)

**EndoVascular and hybrid tools for hemodynamic stabilization and treatment- Endografts TBAI**

**Value? Minimal invasive!**

**atf**  
 aortic trauma foundation

Outcomes and practice patterns of medical management of blunt thoracic aortic injury from the Aortic Trauma Foundation global registry

**EndoVascular and hybrid tools for hemodynamic stabilization and treatment-Endografts**

**Value? Minimal invasive!**

Contemporary management and time to revascularization in upper extremity arterial injury

Landmark articles on EVTM

**Vascular access- Endograft Example endo (EVTM) can help...!**

**Value? Minimal invasive!**

- Iatrogenic injury; EVAR
- SBP 38mmHg; Distal access; 20 min total op time

**CFA endograft iatrogenic injuries: Our data 6 year 20 patients**

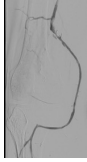
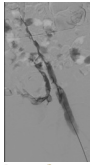

**Value? Minimal invasive, elegant**

Primary Intervention	Extent of Iatrogenic Injury		
	ITA	CFA	SEA
EVAR	1	2	0
PTA	1	2	0
Aortic repair	2	4	1
Intervascular angiography	0	1	1
Catheter dilation	0	0	1
Other (thrombolysis of 1 patient)	0	1	0
<b>Major morbidity</b>			
Closure device failure at access-site	4	9	2
Pseudoaneurysm	0	4	0
<b>Site of vascular access for repair</b>			
SEA ipsilateral side	0	4	0
CFA contralateral side	4	9	3
<b>Type of endograft</b>			
BeGraft	1	14	4
Viabahn	0	0	0
<b>Endovascular instability (%)</b>	4 (100)	1 (21.1)	1 (13.3)
<b>Median time to next graft deployment in patients (range)</b>	4 (4-10)	16 (12-24)	8 (12-40)
<b>Technical success (%)</b>	2 (100)	12 (100)	1 (100)
<b>30-day mortality (%)</b>	0 (0)	0 (0)	0 (0)
<b>30-day mortality (%)</b>	1 (25)	2 (14.3)	1 (100)
<b>1-year mortality (%)</b>	1 (25)	3 (21.4)	0 (0)
<b>30-day limb amputation</b>	0	0	0

Manuscript

## Endovascular embolectomy/thrombectomy

- Lower leg acute ischemia
- Organ ischemia
- Venous thrombosis
- Fistula thrombosis
- Bypass acute thrombosis
- Iliac limb occlusion

With or without thrombolysis  
**Effective, short treatment/restor flow time**

Value? Minimal invasive!

### Technical Considerations for the Use of REBOA in the Management of Placenta Accreta Spectrum

*Alfonso José Nieto-Cabrera<sup>1</sup>, Francisco Rodríguez-Cortés<sup>2</sup>, A. Dorelita<sup>3</sup>, Adrián Ceballos-Aguilar<sup>4</sup>, Juan Pablo Cordero<sup>5</sup>, Ugo Maria Negro-Gallego<sup>6</sup>, Shyam Ganesh Subramanian Das<sup>7</sup> and Adriana Weiss Brayer<sup>8</sup>*

**Resuscitative endovascular balloon occlusion of the aorta (REBOA) as an adjunct treatment in life-threatening postpartum hemorrhage: Fourteen years' experience from a single Norwegian center**



### Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) as a strategy for postpartum haemorrhage management: A narrative review

*Yusuf Alshaykh<sup>1</sup>, Muzahid Hussain<sup>2</sup>, Muzahid Hussain<sup>3</sup>, Muzahid Hussain<sup>4</sup>, Muzahid Hussain<sup>5</sup>, Muzahid Hussain<sup>6</sup>, Muzahid Hussain<sup>7</sup>, Muzahid Hussain<sup>8</sup>, Muzahid Hussain<sup>9</sup>, Muzahid Hussain<sup>10</sup>*

## Post Partum Hemorrhage (PPH)

PPH 1st mortality in non-developed countries

## EndoShunting?



### Vascular Trauma

#### Cross-Limb Vascular Shunting for Traumatic Popliteal Artery Injury

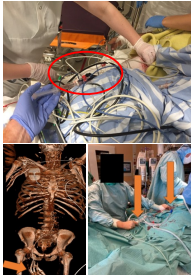
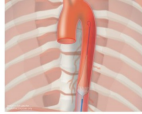

*Ben Hesse, Robert F. Giamberini, Brock Reynolds, Trevor Strimling, Matthew Pinsky, Matthew Pinsky, and Franklin Franklin. Surgical Methods and Biomechanical Response. Artery.*

**Optimization of Volume Flow Rates when Using Endovascular Shunting Technique: An Experimental Study in Different Bench Flow Circuits**

*Arash Mirzaei<sup>1</sup>, David Rodriguez<sup>2</sup>, Marco Vignatiello<sup>3</sup>, Carlos Rojas<sup>4</sup>, Ali Rezaei<sup>5</sup>*



## Balloons (REBOA) if needed (pREBOA in focus!)

- More focus on correct use
- Partial REBOA**
- Mitigate Ischemia/reperfusion
- Correct patient
- Correct team
- Correct indications
- (REBOA is just a tool!)
- In military use/development

## Should REBOA be used in Trauma?

### Should

**Resuscitative endovascular balloon occlusion of the aorta (REBOA) in patients with major trauma and uncontrolled haemorrhagic shock: a systematic review with meta-analysis**

*Yusuf Alshaykh<sup>1</sup>, Muzahid Hussain<sup>2</sup>, Muzahid Hussain<sup>3</sup>, Muzahid Hussain<sup>4</sup>, Muzahid Hussain<sup>5</sup>, Muzahid Hussain<sup>6</sup>, Muzahid Hussain<sup>7</sup>, Muzahid Hussain<sup>8</sup>, Muzahid Hussain<sup>9</sup>, Muzahid Hussain<sup>10</sup>*

### Not

**Emergency Department Resuscitative Endovascular Balloon Occlusion of the Aorta in Trauma Patients With Exsanguinating Hemorrhage: The UK-REBOA Randomized Clinical Trial**

*Arash Mirzaei<sup>1</sup>, David Rodriguez<sup>2</sup>, Marco Vignatiello<sup>3</sup>, Carlos Rojas<sup>4</sup>, Ali Rezaei<sup>5</sup>*

### Zone 1 Endovascular Balloon Occlusion of the Aorta vs Resuscitative Thoracotomy for Patient Resuscitation After Severe Hemorrhagic Shock

*Alain L. Chelly<sup>1</sup>, Navin Vignatharaj<sup>2</sup>, Ernest C. Moore<sup>3</sup>, Joseph Dumas<sup>4</sup>, Megan L. Brewer<sup>5</sup>, Arghav Basu<sup>6</sup>, J. Aaron O'Brien Study Group*




## Value of pREBOA?

Vol. 8, No. 2, 2024, pp. 49–57  
DOI: <https://doi.org/10.26676/jevtrm.25486>

### The Fog has not Lifted: No Reduction in Complications for Partial REBOA in the AAST AORTA Registry

*Micaela Gomez<sup>1,2</sup>, Elizabeth Wood<sup>1</sup>, Juhi Saxena<sup>3</sup>, Lucas P. Neff<sup>4</sup>, Maximilian Peter Forssten<sup>5,6</sup>, Austin Johnson<sup>7</sup>, Timothy K. Williams<sup>8</sup>, Marcelo Ribeiro Jr<sup>9,10</sup>, Bellal Joseph<sup>2,11</sup>, Joseph DuBoise<sup>12</sup> and Shahin Mohseni<sup>2,13</sup>*

Surgeon. 2024 Feb;22(1):37–42. doi: 10.1016/j.surge.2023.08.001. Epub 2023 Aug 30.

**International registry on aortic balloon occlusion in major trauma: Partial inflation does not improve outcomes in abdominal trauma**

*Miguel Barrios<sup>1</sup>, David McCreevy<sup>2</sup>, Bai Mi Zhou<sup>3</sup>, Mansoor Khan<sup>4</sup>, Mickey Dudkiewicz<sup>5</sup>, Boris Kessel<sup>6</sup>, ABC Trauma Registry research group*

### Value of REBOA in CPR/bridge to ECMO?

- Cardiac CPR exterm morbidity/mortality (survival 10%)
- REBOA as temporary perfusion enhancement (CNS, Heart)
- Many experimental studies showd some benefit
- Several clinical studies
- **Awaiting clinical results!**

Shock. 2021;Oct 1:5662-647-654. doi: 10.1097/SHOCK.0000000000001087.  
**End-tidal Carbon Dioxide as an Indicator of Partial REBOA and Distal Organ Metabolism in Normovolemic and Hemorrhagic Shock in Anesthetized Pigs.**  
 Saha D, Ghaemmaghami A, Jansen J, et al. *Shock*. 2021;Oct 1:5662-647-654. doi: 10.1097/SHOCK.0000000000001087.  
**STUDY PROTOCOL**  
**REBOARREST, resuscitative endovascular balloon occlusion of the aorta in non-traumatic out-of-hospital cardiac arrest: a study protocol for a randomised, parallel group, clinical multicentre trial**  
 Hester J, et al. *BMJ Open*. 2021;15(12):e026888. doi: 10.1136/bmjopen-2021-026888.



### EVTM- Whats the value?

- Endovascular and hybrid less invasive
- Less infections/Morbidity/Mortality(?)
- Shorter bleeding control time(?)
- Can be done with local anesthesia
- Can be converted to open surgery
- REBOA /pREBOA role? Trauma/nTrauma

More evidence and refined guidelines needed

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