REBOA - Real World

Lena M. Napolitano, MD
REBOA: ESSENTIAL!!!!!
REBOA: ESSENTIAL!

REBOA is an adjunct to provide early hemorrhage control.

REBOA provides early aortic occlusion to transiently stabilize patients to undergo definitive hemorrhage control.
REBOA: ESSENTIAL!

- Need for the technique – patient population
- Established technique already in use
- National/International & Military guidelines
- National Protocols
- Institutional Protocols
- Already adopted in clinical use
Hemorrhagic Shock
Major cause of trauma mortality (40% civilian/military)
Leading cause of potentially preventable death in trauma
87% due to Noncompressible Torso Hemorrhage

Impact of Hemorrhage on Trauma Outcome:
An Overview
of Epidemiology, Clinical Presentations, and Therapeutic Considerations
David S. Kauvar, MD, Rolf Lefering, PhD, and Charles E. Wade, PhD

REBOA: ESSENTIAL!

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- National Protocols
- Institutional Protocols
- Already adopted in clinical use
Ruptured AAA
Increased Survival with REBOA

Log rank test comparing groups
Three groups significantly different (p=0.0022)
Significant difference between pre and post (p=0.0054)
Significant difference between evar and open in post-protocol era (p=0.0063)
REBOA: ESSENTIAL!

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1. **Goal.** Review background, explain rationale, establish indications, itemize resources, and describe technique for Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) as an interventional capability for control of hemorrhagic shock in the setting of uncontrolled truncal and extremity bleeding in surgically capable theater facilities. This Clinical Practice Guideline has been substantially adapted from the Stannard, Eliason, and Rasmussen 2011 publication in the Journal of Trauma.

2. **Background.** Truncal hemorrhage is the leading cause of preventable death on the battlefield. Balloon occlusion as a resuscitative adjunct is not a new or novel intervention.

TRAUMATIC ARREST ALGORITHM

Trauma with Loss of Vitals

- Blunt → Organized Rhythm on EKG or FAST → YES
  Thoracotomy vs. REBOA I
- Penetrating → CPR ≤15 min → YES
  - Neck → OR
  - Chest → Thoracotomy
  - A/P/E* → Thoracotomy vs. REBOA I

Pulse → NO
- Profound Shock Algorithm (Fig 2)

*Abdomen/Pelvis/Extremity; REBOA I=Placement of aortic balloon in the thoracic aorta (2-8 cm above the xyphoid)
ALGORITHM FOR THE MANAGEMENT OF PROFOUND SHOCK

SBP <90 with Transient or No Response
CPR pre-hospital with ROSC

Blunt

Cardiac or Aortic Injury?

NO

YES

No REBOA

Pelvic Fx

+ FAST

NO

YES

Consider REBOA I

NO

Consider REBOA III

Penetrating

Neck

NO REBOA

Chest

NO REBOA

A/P/E*

Consider REBOA I

*Abdomen/Pelvis/Extremity; ROSC, Return of Spontaneous Circulation; REBOA I
Placement of aortic balloon in the thoracic aorta (2-8 cm above the xyphoid); REBOA III
Placement of aortic balloon directly above the aortic bifurcation (1-2 cm above the umbilicus)
# JOINT TRAUMA SYSTEM CLINICAL PRACTICE GUIDELINE (JTS CPG)

## Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) for Hemorrhagic Shock (CPG ID: 38)

Reviews the range of accepted management approaches to profound shock and post-traumatic cardiac arrest and establishes indications for considering REBOA as a hemorrhage control adjunct.

## Contributors

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First Publication Date: 16 Jun 2014  
Publication Date: 09 June 2017  
Supersedes CPG dated 16 Jun 2014

Opinions, interpretations, conclusions, and recommendations are those of the authors and are not necessarily endorsed by the Services or DoD.
APPENDIX A: TRAUMATIC ARREST ALGORITHM FOR REBOA

- Blunt trauma with no major chest bleeding seen on CXR, ultrasound, or bilateral chest tubes
- Penetrating trauma to abdomen/pelvis

Pulmpable carotid pulse?

- Yes
- No

ATLS Protocols:
- Intubation
- Volume infusion
- Rapid assessment for hemorrhage

Clinical response?

- Yes
- No

If SBP < 90, see REBOA for Profound Shock Algorithm

CPR < 1.5 minutes

- Yes
- No

Any organized EKG rhythm or cardiac contraction on ultrasound?

- Yes
- No

Blunt Trauma

- Penetrating Trauma

Isolated or devastating head injury?

- Yes
- No

Dead

A/P/I

Thoracotomy vs. Zone 1 REBOA

NO REBOA
- Penetrating Neck → Operating Room
- Penetrating Chest → Thoracotomy
- Penetrating Extremity → Tourniquet, Resuscitate

Blunt trauma?

- Yes
- No

Penetrating trauma

Consider Thoracotomy vs REBOA if reversible cause suspected, otherwise declare patient dead.
APPENDIX B: ALGORITHM FOR THE USE OF REBOA FOR PROFOUND SHOCK

SBP<90 with Transient or No Response to initial ATLS resuscitation

- Blunt Trauma
  - Severe Chest Injury??
    - Yes
      - No REBOA
    - No
      - Abdominal FAST Positive?
        - Yes
          - Consider Zone 1 REBOA
          - Emergent Laparotomy
        - No
          - Pelvic Fx?
            - Yes
              - Consider Zone III REBOA
            - No
              - Penetrating
                - Neck
                  - REBOA not indicated
                  - Operating room
                - Chest
                  - REBOA not indicated
                  - Consider thoracotomy
                - A/P/I
                  - Consider Zone I REBOA
                - Extremity
                  - Tourniquet, Resuscitate

**
- Major chest bleeding seen with CXR, ultrasound, or bilateral chest tubes
- Suspected cardiac or aortic injury
The European guideline on management of major bleeding and coagulopathy following trauma: 4th Edition

- REBOA has been used in patients in end-stage shock following blunt and penetrating trauma together with embolisation of the vascular bed in the pelvis. Descriptions of REBOA are few and there are no published trials. Some combined approaches are reported and the technology is evolving [331]. These techniques can be combined with a consecutive laparotomy if deemed necessary [337].
- REBOA may decrease the high mortality rate observed in patients with major pelvic injuries who have undergone laparotomy as the primary intervention, however non-therapeutic laparotomy should be avoided [341]. Time to pelvic embolisation for haemodynamically unstable pelvic fractures may affect survival [331, 342].

Rossaint R et al. Critical Care 2016;20:100
REBOA: ESSENTIAL!

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Management of Pelvic Fracture with Hemodynamic Instability

45th Annual Western Trauma Association Meeting March 1-6, 2015
Pelvic Fx Hemorrhage

- Mean 9.4 u PRBCs
- Median time to angio 286 min
- **Median time to hemostasis with embolization was 344 min**
- In a trauma center with robust resources
Expanded from zoomed area of Davis algorithm. Decisions will be based on local resources.

- **Consider pelvic wrap**
- **Positive FAST or DPA?**
  - NO
  - **Pelvic Stabilization**
    - **Remains hemodynamically unstable?**
      - YES
      - **Angio/Embo**
      - NO
      - **ReBOA**
    - NO
      - **Preperitoneal Packing, consider external fixation**
  - NO
    - **To OR for exploration, external fixation, consider ReBOA**

- NO
  - **To ICU**
Western Trauma Association Critical Decisions in Trauma: Management of pelvic fracture with hemodynamic instability—2016 updates

Thai Lan N. Tran, MD, Karen J. Brasel, MD, PhD, Riyad Karmy-Jones, MD, Susan Rowell, MD, Martin A. Schreiber, MD, David V. Shatz, MD, Roxie M. Albrecht, MD, Mitchell J. Cohen, MD, Marc A. DeMoya, MD, Walter L. Biffl, MD, Ernest E. Moore, MD, and Nicholas Namias, MD. Miami, Florida

Figure 1. Management of pelvic fracture with hemodynamic instability.
Western Trauma Association (WTA) Algorithm

For exsanguinating pelvic hemorrhage from blunt trauma:

- **REBOA** (Zone III, above aortic bifurcation) is less invasive than resuscitative thoracotomy
- **REBOA** is more effective at aortic control than thoracotomy with aortic compression
- **REBOA** is quicker to perform than resuscitative thoracotomy
- **REBOA** is easier to control, i.e. intermittent balloon deflation to provide perfusion
Partial REBOA

Radial Arterial MAP (mmHg)

Operative Time (min)

Total Occlusion (8 mins)
Partial Occlusion (20 mins)

Hemostasis achieved / REBOA completely deflated

REBOA insertion (3 minutes 10 secs)

ICU
REBOA: ESSENTIAL!

- Need for the technique – patient population
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- Already adopted in clinical use
Maryland Shock Trauma Center Protocol

Hypotensive (SBP < 90) partial or non-responder

Access common femoral artery for a-line or REBOA

No REBOA

CXR possible aortic injury?

Yes

Position REBOA in ZONE 1, inflate and proceed to Emergent Laparotomy

No

Position REBOA in ZONE I and inflate

FAST: positive?

Yes

Pelvic xray fracture?

No

Position REBOA in ZONE III and inflate

No

Yes
REBOA

- Must have a protocol
- REBOA kit
- ED & OR
- Educate

University of Michigan
Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) as Adjunct for Hemorrhagic Shock

Similar to resuscitative thoracotomy with aortic clamping for traumatic arrest due to hemorrhage, REBOA is used for temporary aortic occlusion. REBOA supports proximal aortic pressure and minimizes hemorrhage until hemorrhage control and hemostasis are obtained. REBOA can be used instead of resuscitative thoracotomy in hemorrhagic shock.

REBOA Steps:
1. Arterial access and Sheath Placement
   a. Ultrasound-guided femoral arterial access with Micropuncture kit (21 gauge needle, 4 or 5 French catheter and dilator, 0.018 inch guidewire)
   b. Or Femoral arterial cut-down, proximal/distal control for direct puncture
   c. Upsize to 14-French Introducer Sheath using Amplatz guidewire (0.035 in)
   d. Confirm Amplatz guidewire position in proximal aorta – digital radiography
2. Balloon selection and positioning
   a. Cook Medical CODA Balloon 14 Fr (32-40mm diameter, 120cm length)
   b. Compliant, low-atmospheric, high volume balloons
3. Balloon inflation
   a. Use the minimal pressure to gain wall apposition, to prevent aortic injury.
   b. 30-60cc syringe – fill with NS or ½ NS/Contrast for visualization
   c. All attempts should be made to minimize the time of balloon inflation
4. Balloon deflation
   a. Intermittent deflation of REBOA can be used to optimize visceral perfusion, goal SBP > 90 mm Hg
5. Sheath removal – Primary arterial repair needed after 14Fr sheath removal

REBOA INTRA-AORTIC PLACEMENT
The placement of the balloon is determined by the location of the injury and ongoing hemorrhage:

- Zone 1 Descending Thoracic Aorta (origin of left subclavian artery to celiac artery) is used for truncal hemorrhage control
- Zone 2 Para-Visceral Aorta (celiac artery to lowest renal artery): NO-OCCLUSION ZONE
- Zone 3 Infra-renal Aorta (lowest renal artery to aortic bifurcation) for pelvic hemorrhage and junctional bleeding.
REBOA

- Must have a protocol
- REBOA kit
- Readily available
- ED & OR
- Educate
REBOA
Resuscitative Endovascular Balloon Occlusion of the Aorta

- 11 blade – Disposable
- 30cc syringe
- 100ml bag .9NS
- Bag Decanter 10-102
- Conray 50ml
- Micropuncture Introducer Set 21g/4fr/0.018 G47946
- Cordis Avanti 7fr Introducer sheath kit 402-607A
- Central Venous Catheter Set G01916
- ER-REBOA Catheter ER7232A
- 0 Silk #678
- Arrow 5fr Catheter Clamp with Fastener

Nursing Instructions:
1. Call Radiology 8-3636 or page 2465 for stat digital XRAY films of Chest/Abdomen.
2. Open all of the above items.
3. Decant Conray & .9NS – May use just .9NS or 1:1 Conray with .9NS
4. Replace Reboia kit with backup kit from POD III service lead office, between OR 18 and OR 19.

Call Rochelle Crow 4-2531 or email rkraus@med.umich.edu to replenish.
Consider inclusion of quick insertion guide in your REBOA kit.
REBOA

- Royal London Hospital
ENDOVASCULAR SKILLS FOR TRAUMA AND RESUSCITATIVE SURGERY (ESTARS™) COURSE:
Curriculum Development, Content Validation, and Program Assessment

Funding through Contract No FA8052-11C-0035 under BAA 11-01-HPW heading: Aerospace Medicine, Clinical Research, Human Performance Research, and Expeditionary Medicine

Jonathan L. Eliason MD, Lena M. Napolitano MD, Brent Stansfield PhD, Todd E. Rasmussen MD

Clinical Research Division, Lackland Airforce Base, San Antonio, TX
Endovascular Skills for Trauma and Resuscitative Surgery course: Curriculum development, content validation, and program assessment

Carole Y. Villamaria, MD, Jonathan L. Eliason, MD, Lena M. Napolitano, MD, R. Brent Stansfield, PhD, Jerry R. Spencer, BS, and Todd E. Rasmussen, MD, Ann Arbor, Michigan
ESTARS

Injury of Iliac artery

Arterial hemorrhage
ESTARS

REBOA Balloon Occlusion for Hemorrhage Control
ESTARS

Iliac artery temporary vascular shunt placement
After proximal control of hemorrhage by REBOA
Students were able to achieve first 3 steps of REBOA in 2 minutes (vascular access, balloon positioning, inflation)
Complex Pelvic Fractures
Complex Pelvic Fractures
The role of REBOA in the control of exsanguinating torso hemorrhage

Walter L. Biffl, MD, Charles J. Fox, MD, and Ernest E. Moore, MD, Denver, Colorado

Algorithm for Control of Torso Hemorrhage

Localize Hemorrhage with CXR, FAST, Pelvis X-Ray

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<tr>
<td></td>
<td>SBP</td>
<td>CPR</td>
<td>&lt;60</td>
<td>&gt; 80</td>
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1. Thoracic Hemorrhage
   - EDT
   - EDT vs OR
   - OR Thoracotomy

2. Abdominal Hemorrhage
   - EDT
   - EDT vs REBOA
   - OR vs REBOA
   - OR Laparotomy

3. Pelvic Hemorrhage
   - EDT
   - REBOA vs EDT
   - REBOA
   - OR Pelvic Packing
DHMC Algorithm: Management of Patient with Unstable Pelvic Fractures and Severe Hemorrhagic Shock

ATLS Primary Survey
CXR, FAST, Pelvis X-Ray
Massive Transfusion Protocol

↓

ED REBOA*

↓

OR Pelvic Packing, Pelvic External Fixation
Laparotomy as Indicated

Stable

↓

Unstable

↓

OR Pelvic Angiography

CT Scan Head, C-Spine,
Chest, Abdomen, Pelvis

*Zone I if FAST (+)
Zone III if FAST (-)

Figure 3. Revised Denver Health Medical Center (DHMC) algorithm for the management of hemodynamically unstable patients with mechanically unstable pelvic fractures. ATLS, advanced trauma life support.
Figure 4. (A) Plain x-ray in ED demonstrating REBOA balloon inflated in REBOA Zone III. (B) Patient with pelvic binding device secured and REBOA catheter in place in left common femoral artery.
60 yo F
MVC
Unstable pelvic fx
CT with traumatic lumbar hernia, right CFA injury
Tx to Level I
SBP 50mm
REBOA Left CFA
OR for pelvic packing and ExFix Pelvis, pelvic arteriography in OR, vascular repair

Figure 6. Repair of right common femoral artery. Anterior external fixation device is in place, REBOA has been removed, and the left common femoral artery has been repaired.
Exsanguinating pelvis: Occlude the aorta
From: Moore, Ernest MD [Ernest.Moore@dhha.org]
Sent: Friday, December 11, 2015 5:26 PM
To: Napolitano, Lena (Lena)
Subject:

Your education in San Antonio saved this officers life; 44 mag x 7, no BP on arrival
Best regards

The Denver Health email system has made the following annotations
Revolutionary surgical procedure saves life of Denver police officer

Doctors at Denver Health use new method for Officer Tony Lopez Jr.
Denver Police officer Tony Lopez Jr. takes first steps after traffic stop shooting

Shot Denver Police officer Tony Lopez, Jr., released from Denver Health

12/11 Admit
12/31 D/C
CASE #1
Case #1

- 20 yo male
- Motorcycle crash at high speed
- GCS 15, neurologically intact
- SBP 90/60, HR 120
- Arterial oxygen saturation 99%
- Pelvis unstable by physical exam
- FAST exam negative
Case #1

- Hemostatic resuscitation initiated
- Initially transient responder
- Placed femoral arterial line - micropuncture
- Non-responder
- BP 75/60, HR 130
- REBOA deployed in ED
- To IR for Pelvic angioembolization
- Arterial oxygen saturation 90%
- Endotracheal intubation AFTER Reboa
Case #2
Prehospital / Trauma Bay

- 31 yo M, found in middle of a road after being hit by a car at 55mph, ped struck
- At scene, hypotensive, tachycardic, GCS 4
- BMV, O₂ sat 100%, intubated
- Access: IO x 1, IV x 1, MTP 1:1:1
- HR 120, palpable femoral pulse, sat 100%
- Femoral arterial line, femoral venous cordis
- pH 6.9, lac 7.9, HCO₃ 11
Resuscitation Bay
Resuscitation Bay
To OR for Ex-lap

- After transfer to OR bed, sudden loss of BP, ACLS 30 seconds
- REBOA inflated Zone 1
- SBP 70 increased to SBP 110
- Ex-lap
  - No solid organ injury
  - Mesenteric arterial hemorrhage, vascular ligation
- REBOA moved to Zone 3 for pelvic bleeding
- Pelvic Preperitoneal packing (IR not ready)
ER–REBOA – ZONE 1
B/L internal iliac artery embolization
ICU – Critical REBOA Adjuncts

- Continued **hemostatic resuscitation**
  - Hypothermia: 33°C -> 37°C
  - Acidosis: pH 6.9 -> 7.4, HCO₃ 11->24
  - 1:1:1 blood products, minimal crystalloid
- Coagulopathy
  - TXA
  - Rotem
  - Calcium
ROTEM

Extem

Fibtem

Aptem

Arrival

Post-IR
Ex-lap #2

- 2L intraperitoneal blood evacuated
- Bleeding from mesenteric defect controlled
- Packs removed, no ongoing bleeding
- Pelvic ex-fix (Ortho)
- Abthera Abc VAC
Head CT
Brain Scan / Gift of Life

Donated heart and liver to in-house recipients
Prehospital REBOA

- London’s Air Ambulance Crew
- 1st used in UK by Royal London Hospital
- 2 yrs later…
- Modified technique for prehospital use

Balloons surgery stops fatal bleeding at roadside

By Smitha Mundasad
Health reporter, BBC News

16 June 2014 Last updated at 22:11 ET
World’s first pre-hospital REBOA performed

Monday 16th June 2014

- World’s first pre-hospital REBOA carried out by London’s Air Ambulance
- Pioneering new technique to prevent trauma patients bleeding to death
- Control of severe pelvic haemorrhage, an injury most commonly associated with cycling incidents and falls from height
- 2 years of development with The Royal London Hospital
- Boris, “stunning advances in medical care are helping people survive serious injury in London”

We have performed the world’s first roadside balloon surgery to control internal bleeding. Use of pre-hospital Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA), a technique used first in the UK at The Royal London Hospital, to control haemorrhage in trauma patients is a ground breaking move by London’s Air Ambulance.
Prehospital REBOA

- 32yo M fell 15 meters on concrete, catastrophic internal hemorrhage due to pelvic fractures.
- He was treated by the Physician-Paramedic team with insertion of a REBOA balloon catheter at the scene to control likely fatal exsanguination.
- He survived transfer to hospital, emergency angioembolization and subsequent surgery.
- He was discharged neurologically normal after 52 days and went on to make a full recovery.

Prehospital REBOA

- Team arrived 34 min after injury
- **No BP, HR 130**
- Intubation
- Resuscitation
- 6u PRBCs
- TXA, splint pelvis
- Closest trauma ctr 30 minutes
- **REBOA 7 Fr**
Balloon catheter with guide-wire in situ

REBOA balloon at terminal aorta
Field REBOA
Resuscitative Endovascular Balloon Occlusion of Aorta

EMCrit Podcast 121 – REBOA
Exsanguinating Torso Hemorrhage

- The most appropriate means of prompt torso hemorrhage control must be tailored to the clinical situation.
- Trauma surgeons should have expertise with all approaches:
  - Resuscitative thoracotomy
  - Trauma laparotomy
  - REBOA
REBOA: ESSENTIAL!
Resuscitative Endovascular Balloon Occlusion of the Aorta: Indications, Outcomes, and Training

Lena M. Napolitano, MD, FCCP, MCCM

KEYWORDS
- Resuscitative endovascular balloon occlusion of aorta
- Hemorrhagic shock
- Aortic occlusion
- Aortic balloon
- Noncompressible torso hemorrhage
- Resuscitative thoracotomy

KEY POINTS
- Resuscitative endovascular balloon occlusion of aorta (REBOA) is an adjunct to trauma hemorrhage control; it provides early aortic occlusion to improve blood pressure and stabilization without the need for definitive vascular control.
Endovascular / REBOA Trauma Education:

- National Standardized education and training
- Competency-based education
- Take a Course!

REBOA Implementation:

- Get examples of REBOA protocols / kits from others

REBOA Module to be added to ASSET and ATOM ACS Courses soon
Current opinion on catheter-based hemorrhage control in trauma patients

John B. Holcomb, MD, Erin E. Fox, PhD, Thomas M. Scalea, MD, Lena M. Napolitano, MD, Rondel Albarado, MD, Brijesh Gill, MD, Brian J. Dunkin, MD, Andrew W. Kirkpatrick, MD, Bryan A. Cotton, MD, Kenji Inaba, MD, Joseph J. DuBose, MD, Alan M. Cohen, MD, Ali Azizzadeh, MD, Megan Brenner, MD, Mitchell J. Cohen, MD, Charles E. Wade, PhD, Alan B. Lumsden, MD, Richard Andrassy, MD, Peter M. Rhee, MD, MPH, Barbara L. Bass, MD, Kenneth L. Mattox, MD, L.D. Britt, MD, A. Brent Eastman, MD, David B. Hoyt, MD, Todd E. Rasmussen, MD, and the Catheter-Based Hemorrhage Control Study Group, Houston, Texas

COMPETENCY AND CREDENTIALING IN CATHETER-BASED HEMORRHAGE CONTROL

At present, no common standard for competency/credentialing exists for endovascular interventions for catheter-based hemorrhage control, but we must work toward this goal for the future, being certain to include the trauma and acute care surgeons in the provider group.
First Endovascular Hemorrhage Control Course at American College of Surgeons Clinical Congress 2015
### SSC10 Endovascular Approaches to Hemorrhage Control and Resuscitation: Integrating BEST™ and ESTARS™

**Fellow $995 | Non-Fellow $1,150 | RAS $500 | Non-RAS $580 (2016)**

**Session Code:** SSC10  
**Title:** Endovascular Approaches to Hemorrhage Control and Resuscitation - Integrating BEST™ and ESTARS™  
**Date and Time of Session:** Tuesday, October 18: 9:00 am - 4:30 pm  
**Location:** Washington DC Convention Center - Room: 149  
**Description:** This course is the integration of two published training courses Basic Endovascular Skills for Trauma (BEST™) and Endovascular Skills for Trauma and Resuscitative Surgery (ESTARS™) designed to familiarize physicians with the basic endovascular techniques required to perform the maneuver referred to as resuscitative endovascular balloon occlusion of the aorta (REBOA). Preclinical translational investigations have noted the physiologic benefits of REBOA for abdominal and pelvic hemorrhage and shock. Recent case reports and multi-institutional trials have demonstrated safe and effective control of hemorrhage using REBOA in patients with life-threatening hemorrhage below the diaphragm. This skill set can be performed safely in the resuscitation suite using X-ray, or in the operating room using fluoroscopy. The advent of the hybrid operating room coupled with the potential benefits of endovascular techniques in the setting of trauma will likely result in an increasing number of patients being diagnosed and treated with catheter-based interventions. Basic pelvic angiography will be also discussed and demonstrated as a potential bridge from REBOA to definitive hemorrhage control.  
**CME Credit Hours:** 6  
**Webcast Package Available:** No  
**Audio Package Available:** No
SC10 | Basic Endovascular Skills for Trauma (BEST™) Workshop
4 credits, Verification Level III
Tuesday, October 24; 1:00–5:15 pm
Chair: Megan L. Brenner, MD, FACS, Baltimore, MD
Co-Chair: Joseph J. DuBose, MD, FACS, Davis, CA
Fellow $425 | Non-Fellow $500 | RAS $225 | Non-RAS $300 (2017)

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<tr>
<td>Title:</td>
<td>Basic Endovascular Skills for Trauma (BEST™) Workshop</td>
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<tr>
<td>Date and Time of Session:</td>
<td>Tuesday, October 24; 1:00 pm - 5:15 pm</td>
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<td>Location:</td>
<td>San Diego Convention Center - Room: 18</td>
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<td>Description:</td>
<td>The utilization of endovascular techniques for vascular control in the bleeding injured patient requires understanding of indications and contraindications of the procedure as well as a hands-on experience utilizing the required devices. Recent case reports have demonstrated safe and effective temporary control of hemorrhage using Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) in trauma patients with life-threatening hemorrhage below the diaphragm. The BEST™ Workshop uses simulation models and is intended to serve as an introduction to REBOA and lays the foundation for more in-depth training at the BEST™ Course.</td>
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**Target Audience**

This course is designed for practitioners seeking to develop or improve their understanding and skills for Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA).

**Course Objectives**

- To demonstrate indications for REBOA
- To demonstrate access and closure of the common femoral artery
- To demonstrate tools required for REBOA
- To demonstrate technique of REBOA

**Course Agenda**

- Welcome/Registration and Pre-Test
- Introduction, History of REBOA, and Translational Research
- Indications for REBOA, Clinical Applications
- Technique of REBOA: CODA and ER-REBOA
- Simulator Lab
- Cadaver Lab
- Post-Test, Wrap-up Discussion