REBOA

Barely in the Trauma Bay…already in the Battlefield

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Disclosures

- No financial disclosures
- Opinions herein are mine and do not represent those of SOST, AFSOC, or the DOD

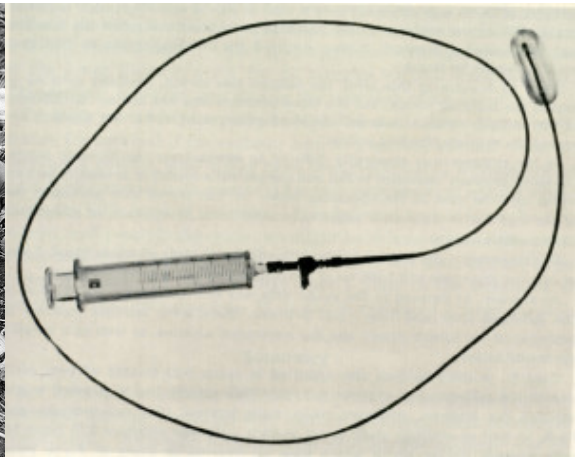
Overview

- REBOA Background
- Indications and Limitations of REBOA
- REBOA cases from downrange
- How far forward should REBOA go?

REBOA Background

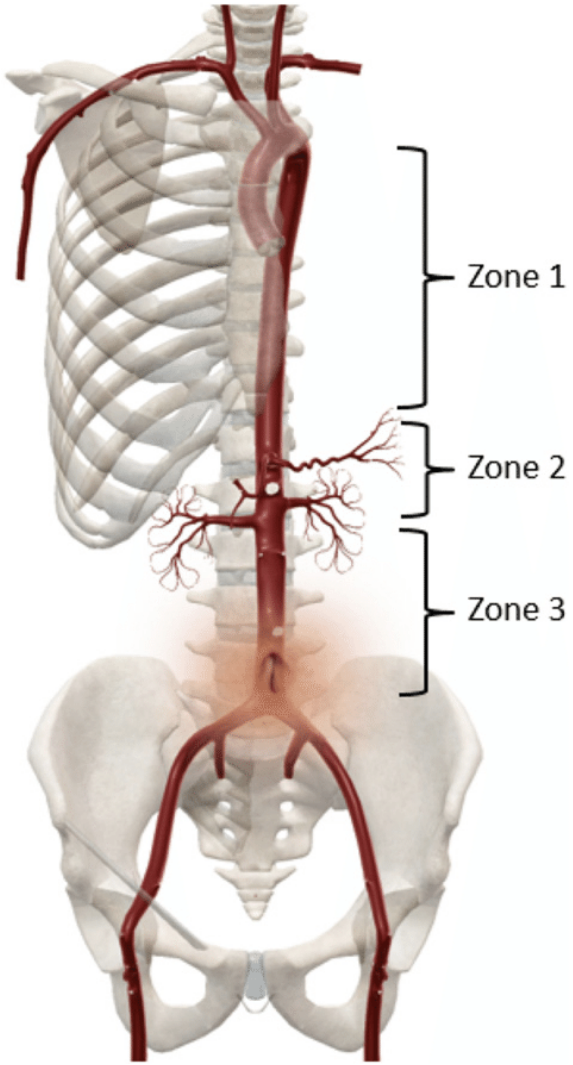
REBOA's Debut

- LTC Carl W. Hughes
  - 3 cases
  - "temporized situation"
- 1986
  - 23 cases
  - "improved blood pressure"
- 2000s
  - Porcine models re-address



Procedure

- Determine appropriate occlusion Zone
  - Measure catheter insertion length
- Common Femoral Artery access
  - Cut Down vs US-guided
- 7Fr Sheath Placement
- Advancement of Catheter
- Inflation of Balloon
  - Radiographic confirmation
- Removal of Sheath/Catheter
  - Post-removal Fluoroscopy



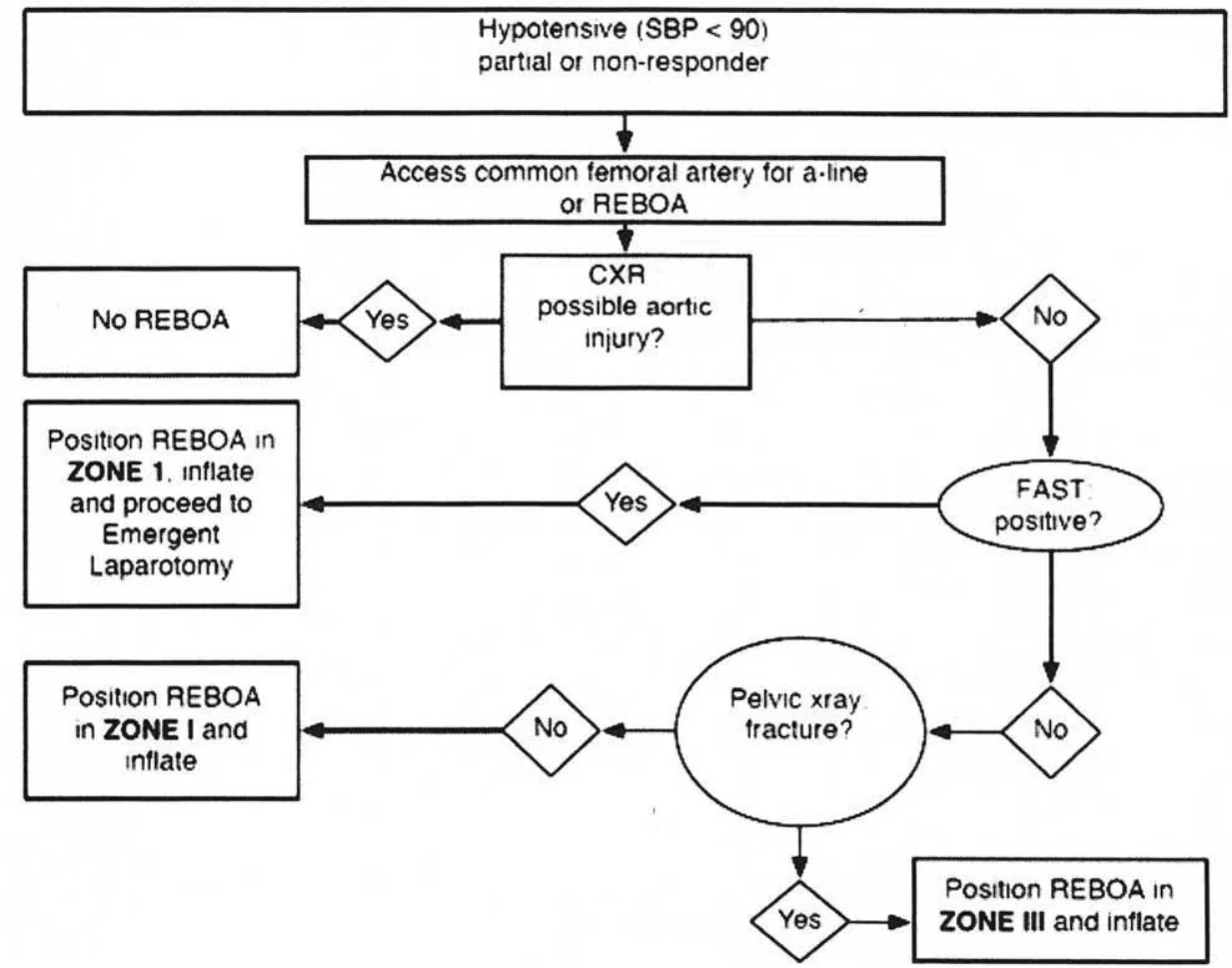
Data in Medical Centers

- 2015 US: REBOA vs Thoracotomy at two trauma centers
  - Fewer early deaths, improved survival
- 2015 Japan: REBOA complications
  - 12.5% limb amputations
- 2016 Japan: REBOA vs without REBOA
  - Mortality higher with REBOA
- 2016 US: REBOA vs Thoracotomy via registry (8 centers)
  - No statistically significant difference in mortality
- 2017 Japan: Traumatic vs non-traumatic REBOA
  - Higher mortality in traumatic REBOA

Indications and Limitations of REBOA

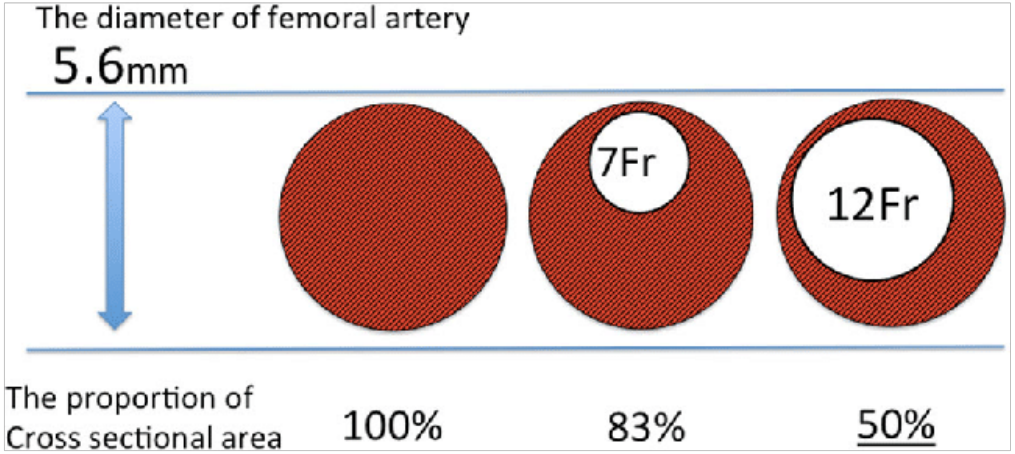
Indications

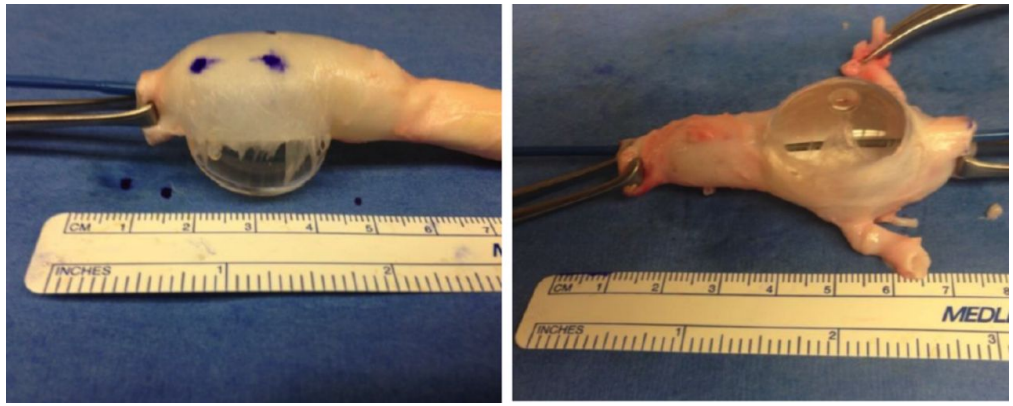
- Blunt/Penetrating Trauma
  - Abdomen/Pelvis
- Non-compressible hemorrhage
- Hypotensive
- Surgical Access*



Limitations/Complications

- CFA Access
  - Rate Limiting step
  - Dissection, pseudoaneurysms, hematoma, thrombi
- Zone 2 occlusion
- Aortic Injury/Rupture
- Prolonged Occlusion
  - Spinal Cord Ischemia
  - Organ ischemia

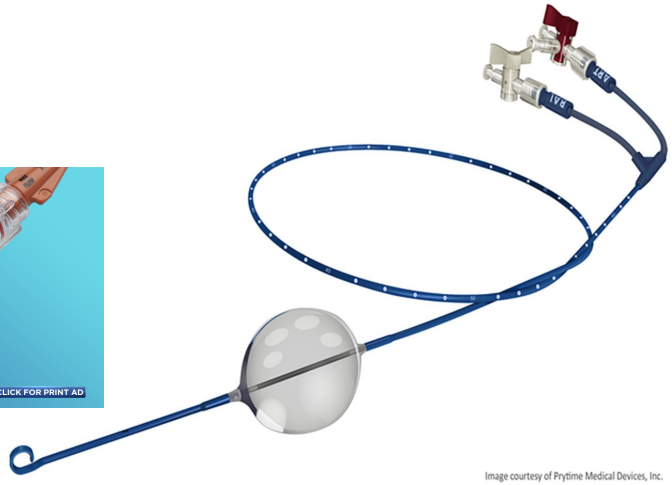




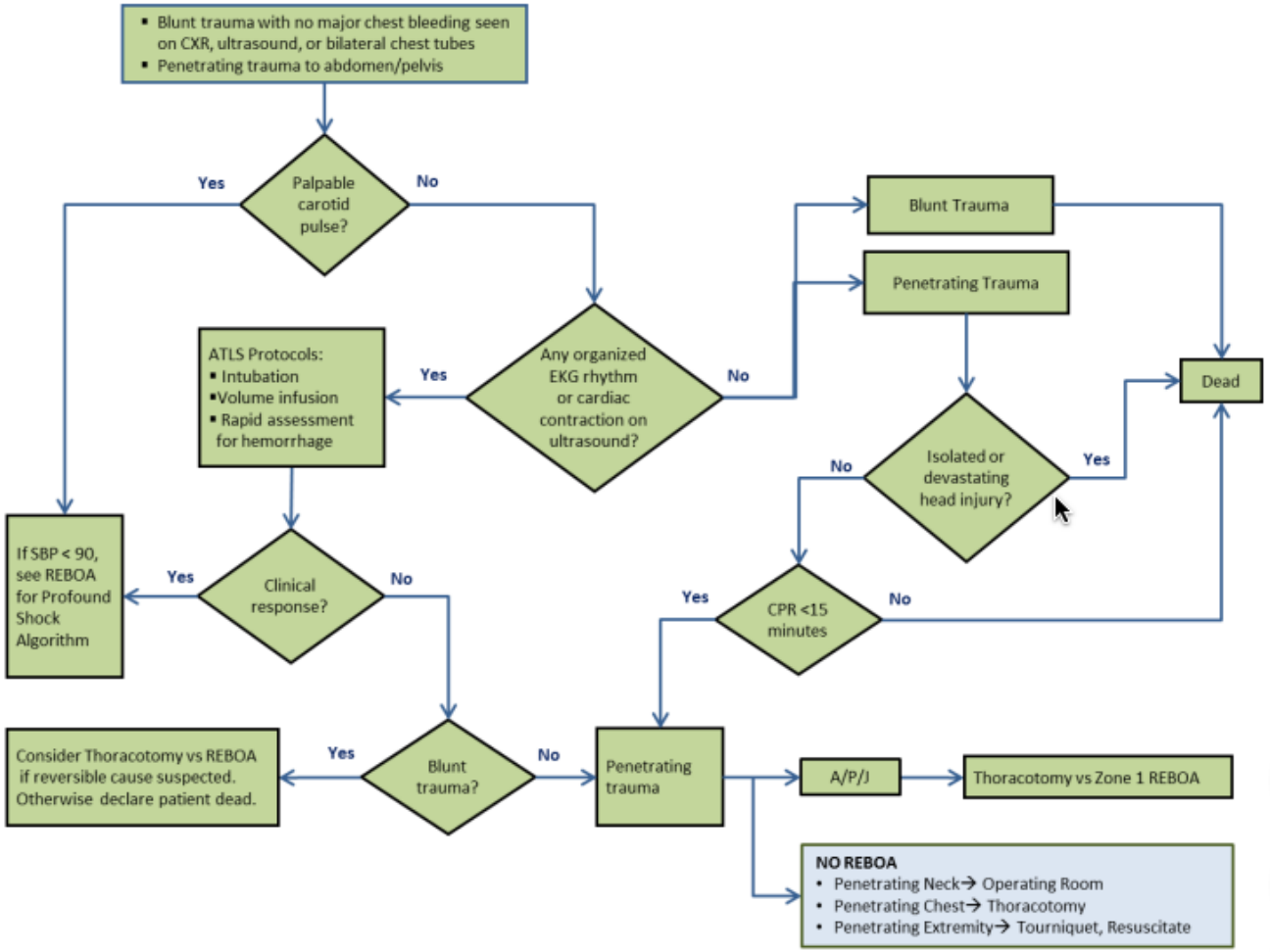
Downrange REBOA

REBOA Procedure Downrange

- **Proactive** vs Reactive
- Early use of REBOA
- Determining candidates
  - Blood Product Use
  - Limited resources
- Limited Radiology
- Monitoring/Transfers
- Ultrasound's Role
- Compass Centurion pressure transducer



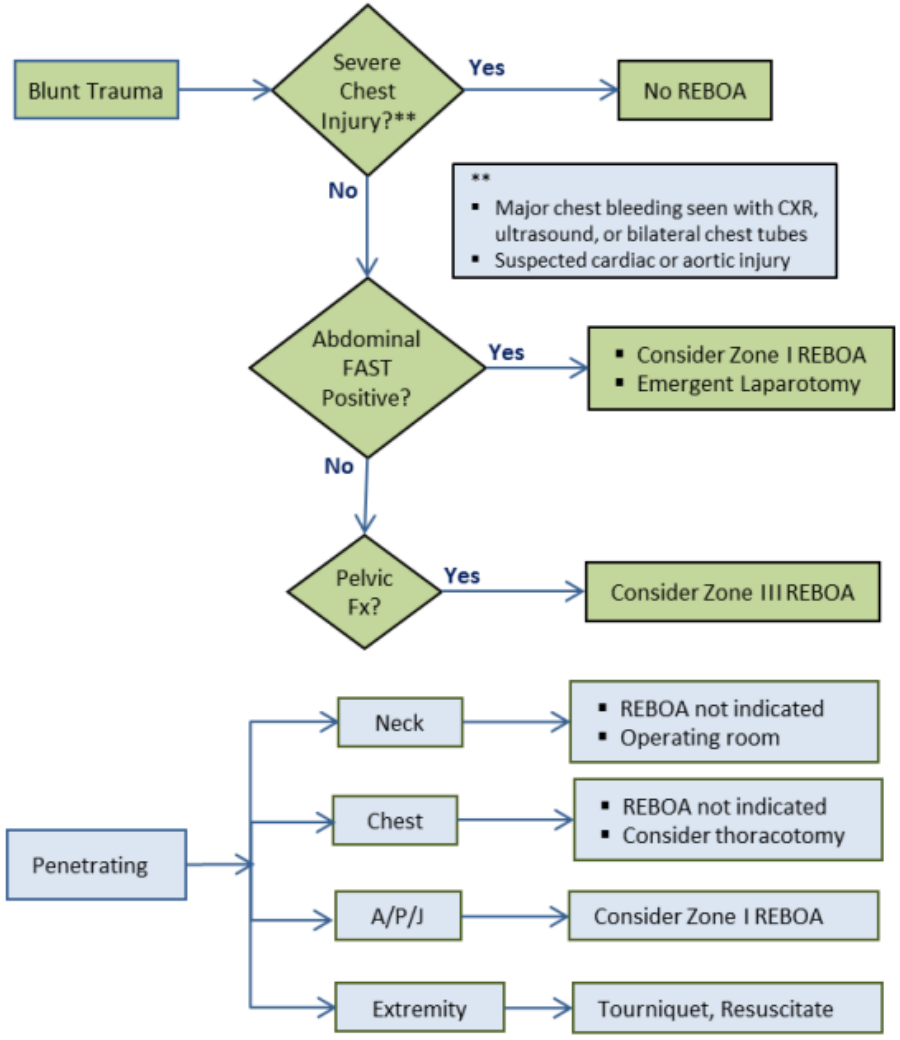
APPENDIX A: TRAUMATIC ARREST ALGORITHM FOR REBOA



REBOA: Resuscitative Endovascular Balloon Occlusion of the Aorta; CXR: Chest X-Ray; EFAST: Extended Focused Assessment with Sonography for Trauma; ATLS: Advanced Trauma Life Support; EKG: Electrocardiogram; SBP: Systolic Blood Pressure; CPR: Cardiopulmonary Resuscitation; A/P/J: Abdomen/Pelvis/ Junctional Lower Extremity.

APPENDIX B: ALGORITHM FOR THE USE OF REBOA FOR PROFOUND SHOCK

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



SOST Practice

- Hypotensive (<80 SBP)
- Abdominal or pelvic injuries
- E-FAST to rule out chest trauma
  - Alt: Bilateral chest tubes
- **Immediate** IV/IO access, femoral a-line access
  - **Rate limiting step**
- 2u whole blood, TXA, antibiotics

- Low threshold to upsize to 7fr sheath
- + E-FAST → Zone 1 (external landmarks)
- Pelvic fx or junctional bleed → Zone 3

REBOA placed during MASCAL by EM doc

- Situation: 12pt MASCAL
- Patient: 25yo transabdominal GSW (20 min post-injury)
  - 98/59, 127, 84%, 18, GCS 14
  - Wounds L Flank, RLQ w evisceration
  - FAST +
- Whole Blood Transfusion initiated
- A-line placed by US
- BP 60s, HR 140s
  - Upsized to 7fr, zone 1 REBOA
- OR Results: Large volume hemoperitoneum
  - Multiple root of mesentery injuries, 10x small bowel injuries, R colon injury
- Balloon time: 34 min
- Blood Products: 7U WB
- Vitals on Transfer: 127/62, 109
- “Having an competent ER doc is invaluable”

SOST Experience

- **20 REBOAs** - all male combatants
- All explosive wounds or gunshot wounds

Data Point	Mean	Range
Time from Injury	44min	15-90min
Initial GCS	10	7-15
Initial SBP	70mmHg	50-90mmHg
Initial HR	129	110-153
Rise in BP with occlusion	57mmHg	30-142mmHg
Occlusion time	21min	7-34min
Blood Products used	10U	2-21U

- Placed primarily by EM: 6
- Placed primarily by Surgeon: 14

SOST Experience

Zone 1 n=17

- Mean depth 47cm (range 44-55)
- Mean volume 14ml (range 6-27)

Zone 3 n=3

- Mean depth 26cm (range 23-30)
- Mean volume 8m

- No catheter related complications*
- 1 balloon failure

Unique Advantage to the Military

- Rapid normalization of vitals
- Rapid hemorrhage control
- Less blood product usage (**88 walking blood drives over 18 mo**)
- Single surgeon – rapidly dry operative field
- MASCAL (75x over 18 mo)
  - EM docs place REBOA during MASCALs

- REBOA preserves precious resources, saves time, **saves lives in the combat setting**

How far Forward should REBOA go?

ACS/ACEP Joint Statement on REBOA

- Acute care surgeon access
- Mitigate complication risk
  - Balloon occlusion time
  - Leaving sheath in place
- Transferring with REBOA
  - NOT recommended
- Military
  - Attend formal course prior to deployment
  - EM physicians must work in conjunction with surgeon

Finding the “Sweet Spot” for REBOA

- Pre-hospital REBOA
  - British EMS system
  - Battlefield?
- Austere surgical teams
  - Training/Competency
  - Blood available
- Does not extend Golden Hour
  - Communicate this with GFC!
- Future
  - Intermittent/Partial Flow?
  - REBOA in place, deflated?

Conclusion

REBOA Take-Aways

- Proactive tool vs reactive efforts
- Understand complications and mitigate risks
- Work in conjunction with a surgeon
- Less Blood Product use
- Frees up resources
- Life-saving tool downrange; limited data on long-term outcomes
- Only as forward as surgical capability

Questions?

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