

# ER-REBOA Patient Selection, the Procedure, and Outcomes

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## Disclosures

- Speaking Consultant with Prytime Medical

## Outline

- I. Indications
- II. Contraindications
- III. Procedure
- IV. Trouble Shooting
- V. Post Occlusion Management
- VI. Pitfalls

## Mechanism of Injury



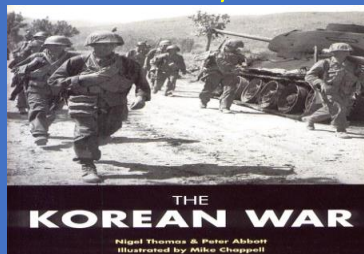
## Mechanism of Injury



We're # 1



## History

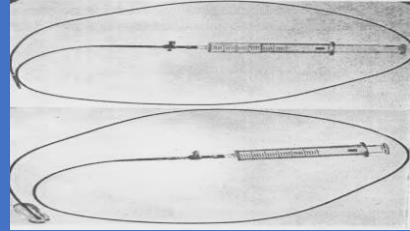


## History

- 1954
  - Lieutenant Colonel Carl W. Hughes
  - 10 fr. Catheter with 20 cc balloon
  - "Arbitrarily" utilized after 10 units of blood if no bp obtained
  - Attempted in three patients



## History



## History

- 1976



- Ann Ledgerwood



## History

- Journal of Trauma
  - The Role of Thoracic Aortic Occlusion for Massive Hemoperitoneum
    - 40 patients: 11-immediate laparotomy; 29 thoracotomy then laparotomy
    - Six of the first group survived secondary to thoracotomy while 22 of the 29 showed bp improvement
    - Conclusion
  - The Role of Thoracic Aortic Occlusion for Massive Hemoperitoneum.
    - Ledgerwood AM, Kazmers M, Lucas CE.
    - J Trauma. 1976 Aug;16(08):610-5.

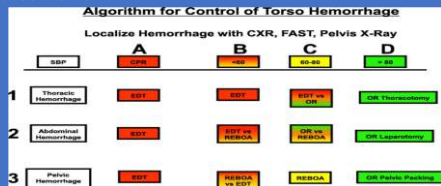
## History

- Thoracotomy results
  - 4-33% survival
  - 18-33% in penetrating trauma
- 2000
  - Rhee
  - 24 studies involving 4600 patients over the last 25 yrs
  - 7.4% survival rate overall

## History

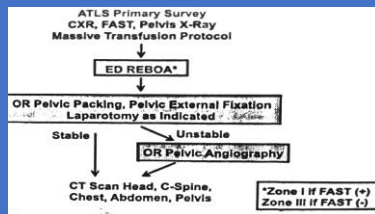
- History
  - Gupta, 1989
    - 21 consecutive patients with penetrating abdominal trauma treated with intra-aortic balloon occlusion
    - 3 groups evaluated: no bp, bp < 80 torr systolic, bp < 80 torr during prep for laparotomy
    - Results: no survivors in group 1, 3 of 6 in group two, and 4 of 10 in group three

### Indications

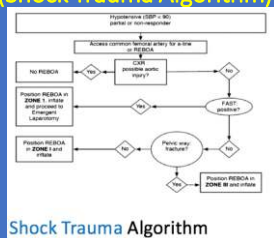


J Trauma Acute Care Surg. 2016 May;78(5):1054-8. doi: 10.1097/TA.0000000000000978.  
 The role of REBOA in the control of exsanguinating torso hemorrhage.  
 Biff WL, Fox CJ, Moore EE.

### Indications



### Indications (Shock Trauma Algorithm)



### Indications

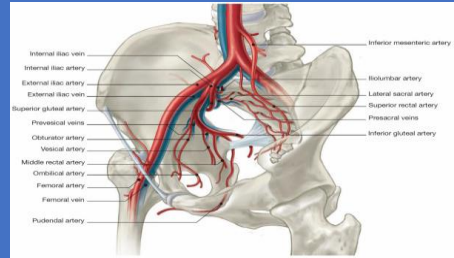
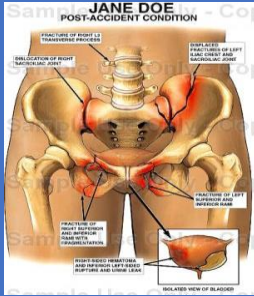
- SBP <90 mmHg
- Presence of trauma with concern for abdominal, pelvic, or lower extremity hemorrhage
- Absence of widened mediastinum on cxr
- If these criteria are met, proceeds at the very least with obtaining access

### Indications

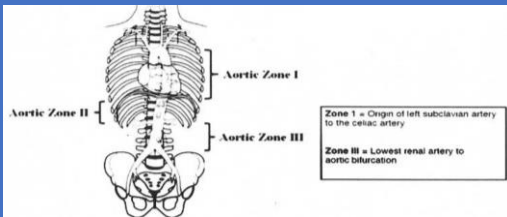
- Access
  - 7 fr sheath in the CFA
  - U/S guidance recommended
  - No catheters in SFA
  - Placement needs to be within 2 inches of the inguinal ligament to avoid going to low

### Contraindications

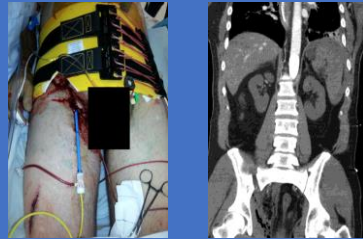
- Widened Mediastinum
  - Impact on thoracic aorta trauma is unknown



### Hemorrhage Control



### Hemorrhage Control



### Procedure

- Measure, Mark, Insert
  - Initially only a 12 fr sheath was used followed by placement of a large balloon catheter requiring arterial repair afterwards
  - Insert 7 fr sheath into the femoral artery within 2 cm of the inguinal ligament
    - (u/s guidance is recommended)
  - Determine appropriate zone
    - Zone I is at or above the diaphragm
      - Used in event of positive FAST
      - "P" at the sternal notch
    - Zone III is at the level of the umbilicus
      - Used with negative FAST and presence of pelvic fracture
      - "P" at the xiphoid process

### Procedure

- Inflation volume:
  - "5 or 8 - don't overinflate" (5 or 8 cc's)
  - Zone 1 insertion depth = 46 cm
  - Zone 3 insertion depth = 27 cm

## Procedure

- This 6 steps of REBOA are ME-FIIS pronounced "ME-FIZZ"
- Measure – measure distance
- Evacuate – evacuate the balloon
- Flush – flush the arterial line
- Insert – insert the catheter
- Inflate – inflate the balloon
- Secure – secure the catheter

## Procedure

- Flush arterial line port with saline
- Ensure proper wave form upon insertion of catheter
- Insert to desired measurement dependent on desired zone
- Check position with portable x-ray
- Slowly inflate balloon until see a rise in bp then stop immediately
  - 5 cc's in zone III
  - 8 cc's in zone I
- Secure catheter in position
  - Catheter fastener
  - Suture
  - Ioban
  - Kerlex
- Mobilize to OR or IR

## Pitfalls

- Do not leave inflated > 30 min
- Do not expect tactile sensation for balloon filling
- Catheter should slide easily, if any resistance, could be creating a dissection
- Avoid in patients with a widened mediastinum

## Conclusions

- REBOA is a safe and effective tool when used correctly for the correct indications
- Utilizing algorithms and protocols will help identify those most likely to benefit
- Do not place in patients with a widened mediastinum
- Do not leave inflated for > 30 minutes
- Flush arterial line prior to use
- Do not force if it does not go easily
- Safe implementation of a REBOA program should be well thought out and involve multiple departments

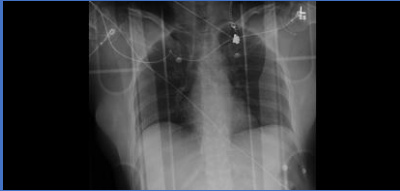
## ER-REBOA CASE REVIEWS

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## CASE 1

- 52 yof s/p auto vs pedestrian hypotensive at the scene with gcs of 9 at the scene improved to 14 at the scene with bp 110/65 on arrival

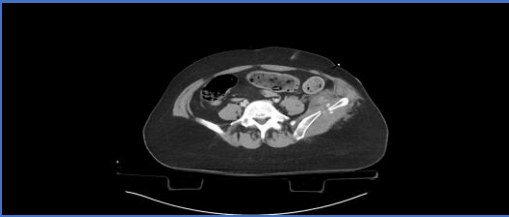
CASE 1



CASE 1



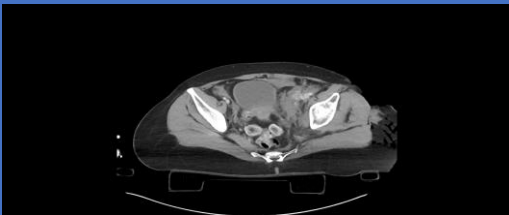
CASE 1



CASE 1



CASE 1



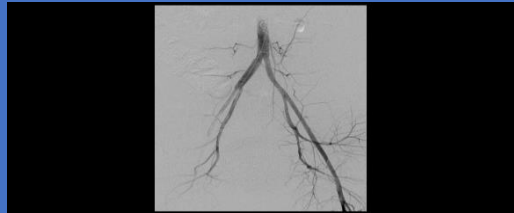
CASE 1

- After returning from CT bp drops to 70/40
- Next Steps:
  - Transfuse?
  - Binder?
  - OR?
  - REBOA?
    - Zone?

## CASE 1



## CASE 1



## CASE 1

- Negative A-gram
- REBOA and sheath removed

## CASE 2

- 26 yo female presents as pedestrian vs. MVC. Intubated upon arrival. Pressure 53/30 on arrival. GCS 7.

## CASE 2



## CASE 2



## CASE 2

- Positive FAST
- Next Steps
  - Transfuse?
  - TXA?
  - Binder?
  - OR?
  - IR?
  - ICU?
  - REBOA?
    - Zone?

## CASE 2



## CASE 2

- REBOA placed at zone 1
  - Ex lap=large nonexpanding rp hematoma stable, abtherra
  - REBOA withdrawn
  - A-gram neg via same sheath(intraop)
  - Abd larger-blood under abtherra
  - Next step?

## CASE 2

- Replaced REBOA
  - enlarging rp hematoma
  - medial visceral rotation of rt colon, right nephrectomy performed
- REBOA removed

## CASE 3

- 34 y/o M trauma alert s/p high-speed MVC. Pt was restrained driver, ran into a metal telephone pole; extensive vehicle damage; + LOC; b/l leg entrapment needing extrication. On arrival, pt was in moderate respiratory distress, hypotensive and tachycardic, GCS14. Pt complaining of severe dyspnea, LLE and LUE pain; worsened with movement and palpation; improved with narcotics. Pt's mental status was beginning to decline and was in respiratory failure, pt was intubated without complications.

## CASE 3





## CASE 3



## CASE 3

- FAST Negative
- Next Steps?
  - Binder?
  - CT?
  - IR?
  - OR?
  - REBOA?
    - Zone?

## CASE 3



## CASE 3

- Patient to OR
  - EX-LAP
  - Pre-Peritoneal Packing
  - Repair of left hemidiaphragm

## CASE 4

- 73 y/o M presents to ORMC after MVC. Patient was driving and struck on driver side by another vehicle. He was HDS. Complaining of pain in left hip and left chest, 10/10, worse with movement, non-radiating and located on left chest, left lower extremity, and left abdomen. GCS of 15 on presentation.

## CASE 4



## CASE 4



## CASE 4

- Negative FAST
- Drops BP to 80/40 mmHg
- Next step?
  - OR
  - Binder
  - IR
  - REBOA

## CASE 4

- Stabilizes with one unit of PRBC's
- Contraindication for REBOA
- Thoracic Aorta Injury
- Left acetabulum fx
- To ICU
  - BP control
  - Ortho consultation

## CASE 5

- 26 F who presents to ORMC ED as trauma alert restrained driver s/p MVC vs pole, with heavy entrapment for 30 mins. Became hypotensive; she was agitated for EMS w/ a GCS of 4 on arrival to TB. She was tachycardic to 140s.

## CASE 5



## CASE 5



## CASE 5

- FAST Positive
- Next Steps
  - TXA?
  - MTP?
  - Binder?
  - OR?
  - IR?
  - REBOA?
    - Zone?



## CASE 6

- 34 y/o F presents to ORMC as a trauma alert s/p falling off the back of a motor cycle. +LOC. Per EMS, pt was GCS 15 and HDS on scene and en route; they placed a traction splint on her LLE due to an obvious Left femur deformity. On presentation to the trauma bay, pt was HDS with a GCS of 15 complaining of LLE pain.



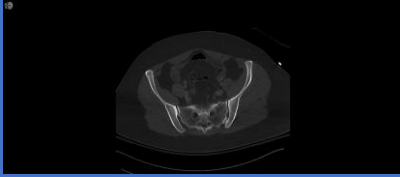
## CASE 6



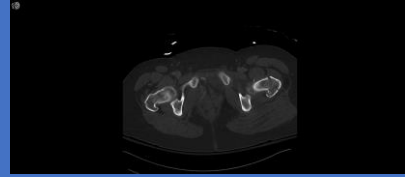
## CASE 6



## CASE 6



## CASE 6



## Case 6



## CASE 6

- Patient became hypotensive and unresponsive to IVF, 2 units of emergency release given with transient response
- Negative FAST
- Next Steps
  - Binder?
  - IR?
  - OR?
  - REBOA?
    - ZONE?

## CASE 7

- 46F restrained driver s/p driver's side T-bone MVC with airbag deployment. Per ED resident patient arrived GCS 14, tachycardic, tachypneic, and diaphoretic with a seatbelt sign.

## CASE 7



## CASE 7



## CASE 7

- FAST NEGATIVE
- NEXT STEP?
  - Binder?
  - OR?
  - IR?
  - REBOA?
    - Zone?

## CASE 8

- Unknown age male trauma alert s/p pedestrian vs auto at high rate of speed. Patient brought in GCS 3 PEA. ACLS was initiated. The patient was a difficult intubation. He was successfully intubated with the glide-e-scope. The patient received ROSC. He has obvious trauma to the head, chest, and all 4 extremities. Bilateral chest tubes were placed. A central line and a-line were placed. MTP initiated

## CASE 8



## CASE 8



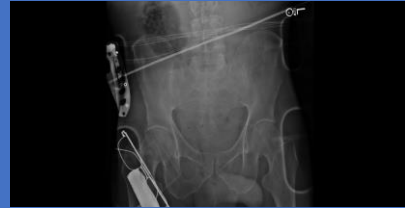
## CASE 8

- FAST Positive
- Hypotensive with BP 60/40 mmHg
- Next step?
  - Binder?
  - OR?
    - EXLAP
    - Pre-Peritoneal Packing
  - IR?
  - Thoracotomy?
  - REBOA?
    - Zone?

## CASE 9

- 61 yom trauma alert arrived to ORMC after being struck by a car at 40mph. The patient was confused on scene. He was less confused on arrival to ORMC answering basic questions about his name, birthdate, and medical history. He was given two liters of NS and then two units of blood but remained persistently hypotensive.

## CASE 9



## CASE 9



## CASE 9

- FAST Positive
- Next Step
  - OR?
  - IR?
  - ICU?

## CASE 9

- Arrests in OR
- ROSC after brief period of CPR
- Next step
  - Aorta Cross Clamp
  - REBOA?
    - Zone?
  - Laparotomy?

## CASE 10

- 45 y/o F trauma alert transfer after moped vs bus earlier this morning. Coded in field/at outside facility with ROSC. Intubated and transferred to ORMC for further management. On arrival, bilateral chest tubes placed, and central venous access obtained. Became hypotensive, requiring blood transfusions and vasopressors.

## CASE 10



## CASE 10

- Positive FAST
- Plan?
  - OR?
  - IR?
  - ICU?
  - Binder?
  - Cross Clamp?
  - REBOA?
    - ZONE?

## CASE 11

- 29 yof presents to ORMC as a Trauma alert s/p MCC. Patient arrived and was agitated, and anxious. Initial evaluation revealed that the patient had an open book pelvic, and a vaginal laceration. The patient then became hypotensive and HD unstable. The patient then underwent RSI for air way protection. A right subclavian CVC and a left femoral A Line were emergently placed.

## CASE 11



## CASE 11



## CASE 11

- FAST Negative
- Next Step
  - Binder?
  - Preperitoneal Packing?
  - IR?
  - REBOA?
    - Zone?

## CASE 11



## CASE 12

- 33 yom restrained driver in HOC with brief LOC, HD stable initially but dropped to 80/45 mm Hg and open femur fracture
- Intermittently responsive to fluid boluses

## CASE 12



## CASE 12



## CASE 12

- Negative FAST
- Next Step?
  - PRBC?
  - Ex Laparotomy?
  - IR?
  - OR?
  - REBOA?
    - Zone?

## NONTRAUMA CASES

- Complicated Placental Issues
  - Accreta
  - Increta
- 3 Cases
- 2 after MTP initiated
- 1 with cardiac arrest during procedure
- 1 prophylactic placement after c-section
  - 100 cc ebl
  - No transfusions
  - D/C'd Post op day 2
- Now incorporated into institutional protocol



## NONTRAUMA CASES

- 50's yom 3 weeks s/p whipple
- Presents with hypotension, tachycardia
- ER-REBOA placed in zone I
- SMA bleed
- Pt stabilized and repaired
- Currently on med surg floor

## Conclusions

ER REBOA is not the Holy Grail

It is a helpful tool for hemorrhage control and improvement in bp

Recognizing the indications, contraindications, and proper planning for implementation are paramount to its success

Its benefits may be far reaching well beyond the world of trauma as we continue to look at potential uses.

Thank You