



## TRAVMADA

Extracorporeal Membrane Oxygenation (ECMO)(ECLS)

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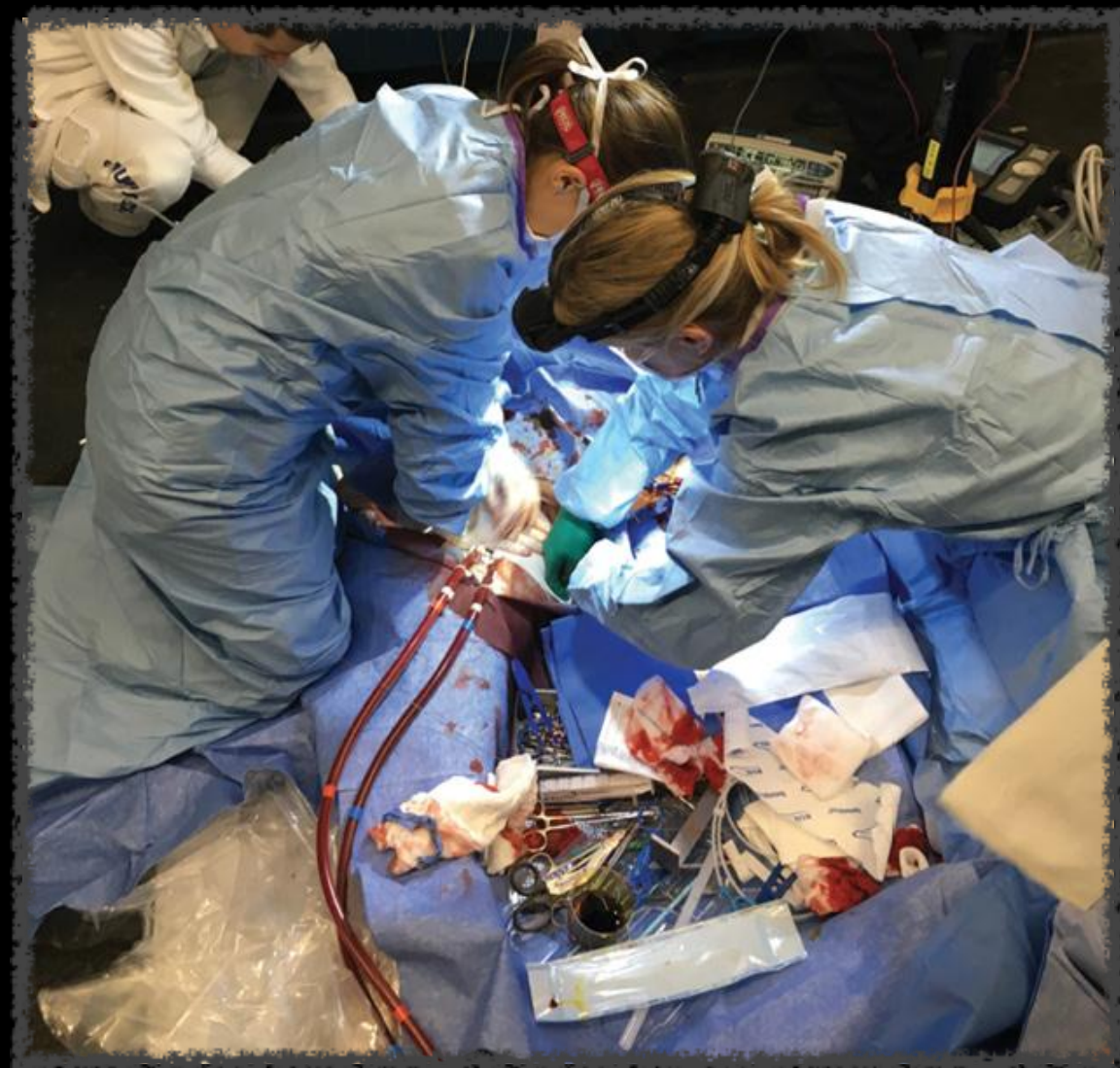
Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA)

Dr. Mustafa SABAK  
Nizip Devlet Hastanesi

## Extracorporeal Membrane Oxygenation (ECMO)







Hastanın

yaşamsal fonksiyonlarını devam ettirilemediği  
durumda, uygun endikasyonlar altında uygulanan  
ve hastayı hayatta tutmayı sağlayan bir tedavi  
yöntemidir.



# Geleneksel Yaklaşım Oldukça Başarısız (ACLS&CPR)

Spontan Dolaşımın Sağlanması (ROSC) – %26.3  
Hastaneden Taburculuk – %9.6

# ECLS Registry Report

International Summary

January, 2019



Extracorporeal Life Support Organization  
2800 Plymouth Road  
Building 300, Room 303  
Ann Arbor, MI 48109

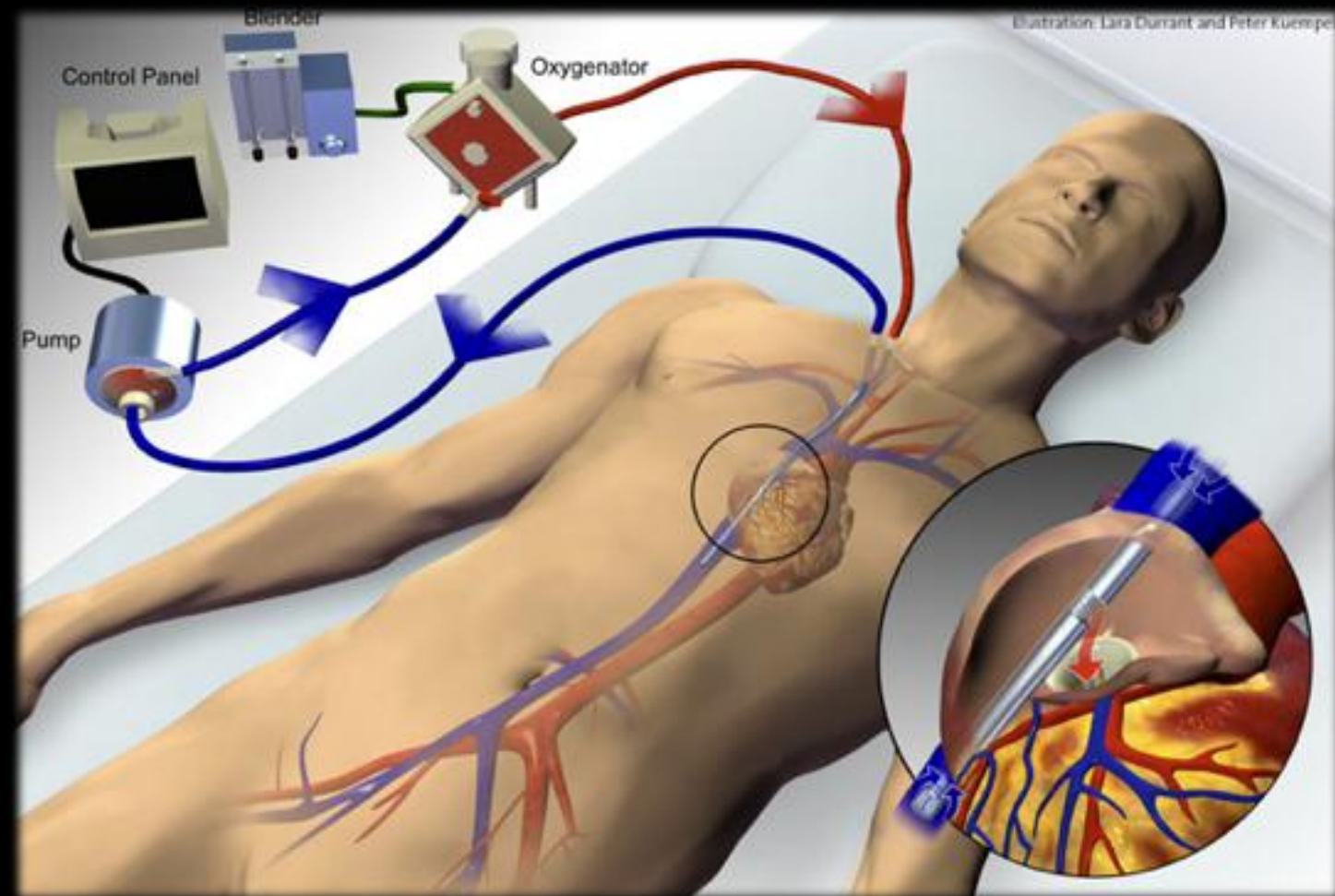
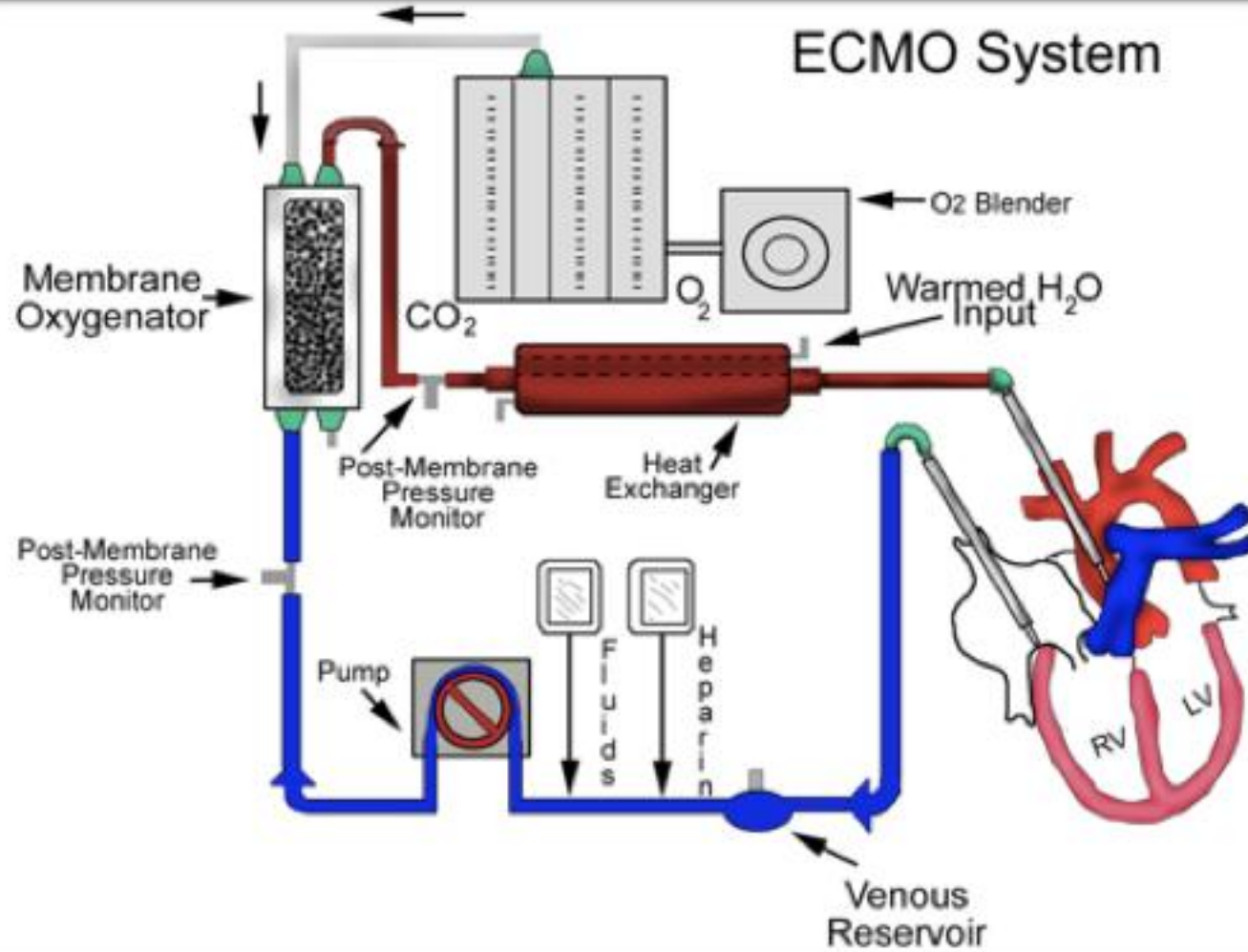
## Overall Outcomes

		Total Runs	Survived ECLS	Survived to DC or Transfer
Neonatal				
Pulmonary		31,591	27,779	87%
Cardiac		8,252	5,684	68%
ECPR		1,864	1,315	70%
Pediatric				
Pulmonary		9,487	6,797	71%
Cardiac		11,377	8,155	71%
ECPR		4,361	2,628	60%
Adult				
Pulmonary		19,482	13,453	69%
Cardiac		19,627	11,628	59%
ECPR		6,190	2,580	41%

## Centers by year



# ECMO System



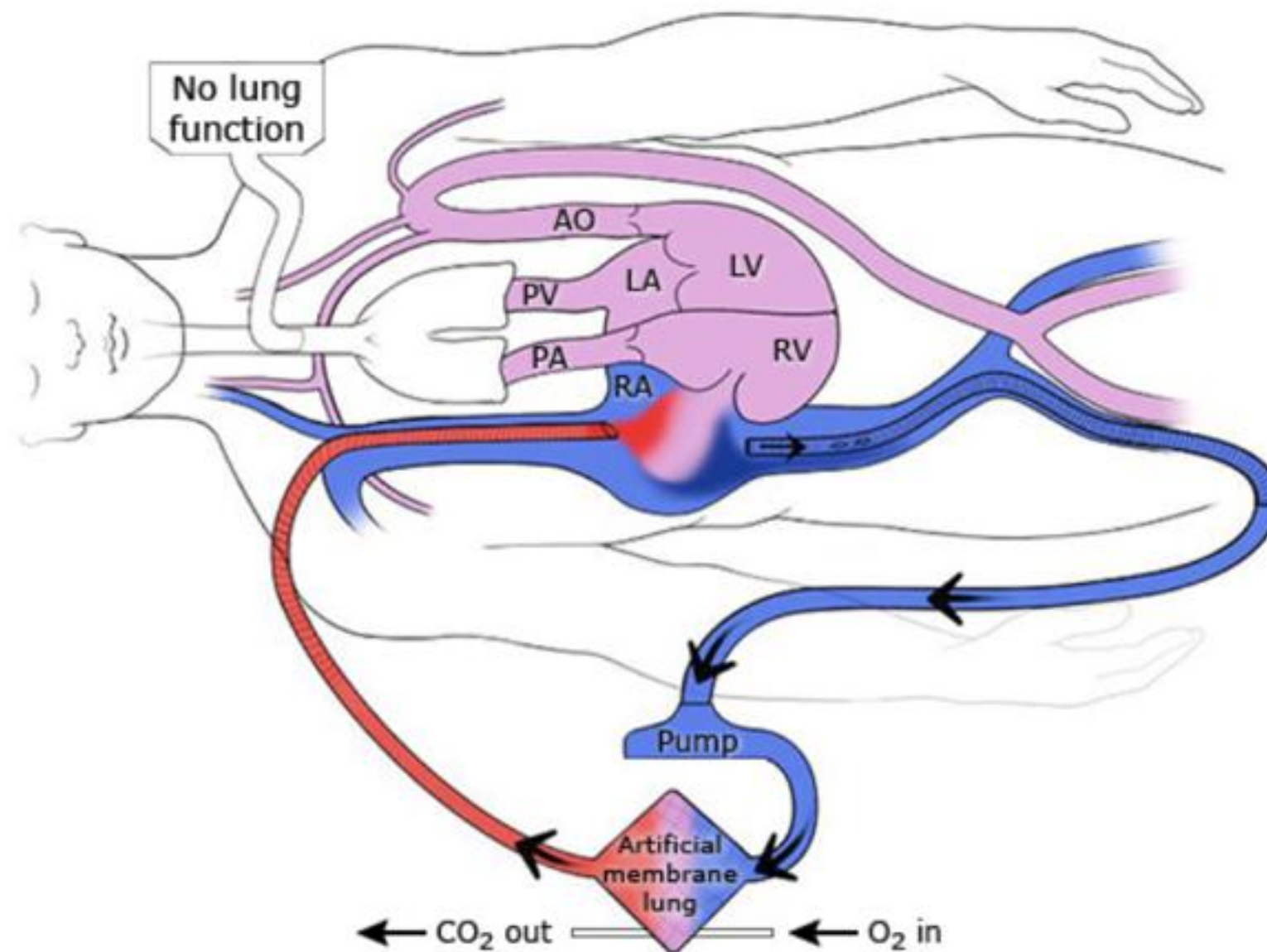


**Venoarteriyal (VA) ECMO**

**Venovenöz (VV) ECMO**

# VV ECMO

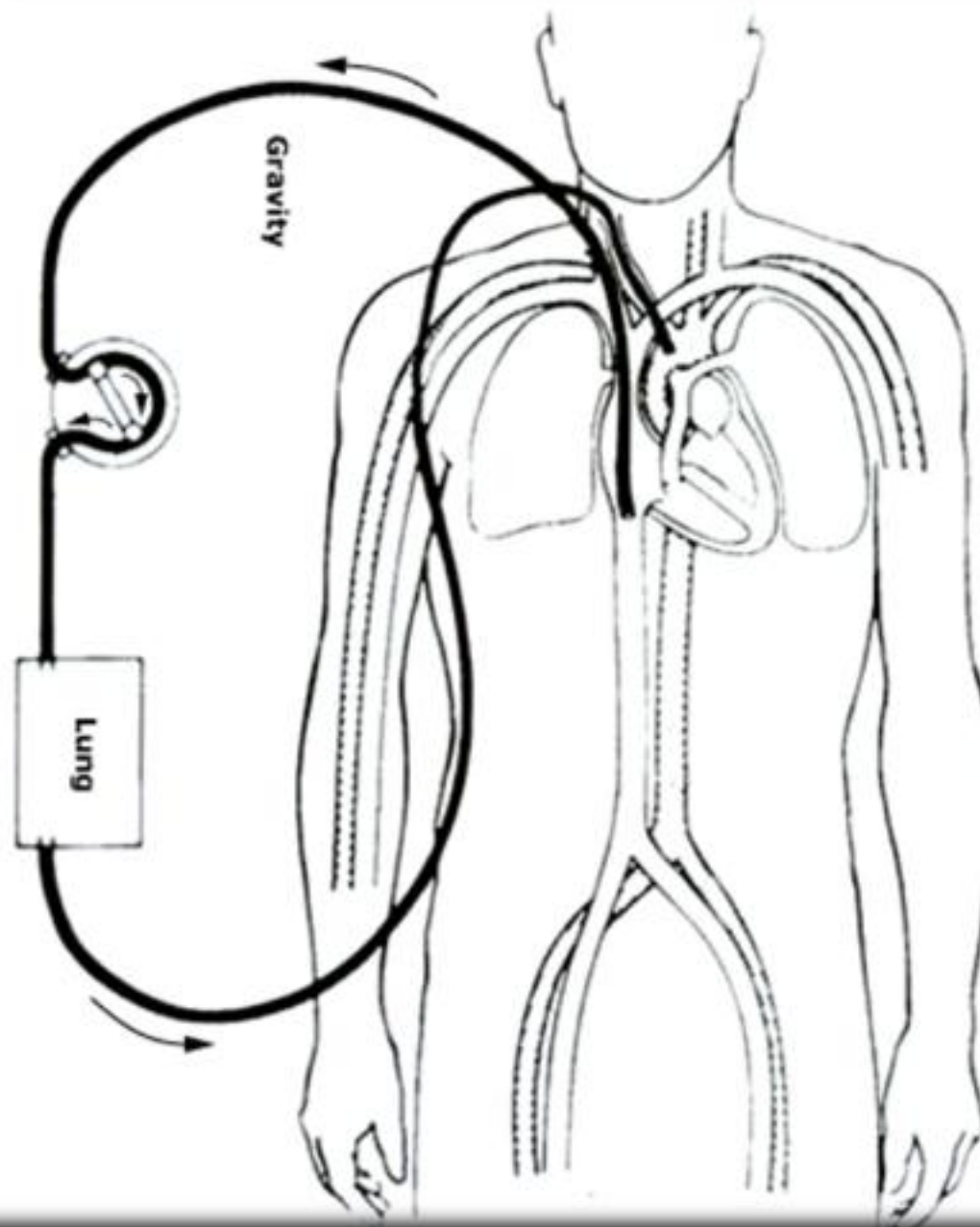
## Venovenous (VV) ECMO for isolated respiratory failure



# AV ECMO

Veno-arterial (VA) ECMO for cardiac and/or respiratory failure

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Literatür

## Extracorporeal membrane oxygenation in severe trauma patients with bleeding shock.

Arlt M<sup>1</sup>, Philipp A, Voelkel S, Rupprecht L, Mueller T, Hilker M, Graf BM, Schmid C.

### + Author information

#### Abstract

**AIM OF THE STUDY:** Death to trauma is caused by disastrous injuries on scene, bleeding shock or acute respiratory failure (ARDS) induced by trauma and massive blood transfusion. Extracorporeal membrane oxygenation (ECMO) can be effective in severe cardiopulmonary failure, but preexisting bleeding is still a contraindication for its use. We report our first experiences in application of initially heparin-free ECMO in severe trauma patients with resistant cardiopulmonary failure and coexisting bleeding shock retrospectively and describe blood coagulation management on ECMO.

**METHODS:** From June 2006 to June 2009 we treated adult trauma patients (n=10, mean age: 32+/-14 years, mean ISS score 73+/-4) with percutaneous veno-venous (v-v) ECMO for pulmonary failure (n=7) and with veno-arterial (v-a) ECMO in cardiopulmonary failure (n=3). Diagnosis included polytrauma (n=9) and open chest trauma (n=1). We used a new miniaturised ECMO device (PLS-Set, MAQUET Cardiopulmonary AG, Hechingen, Germany) and performed initially heparin-free ECMO.

**RESULTS:** Prior to ECMO median oxygenation ratio (OR) was 47 (36-90) mmHg, median paCO(2) was 67 (36-89) mmHg and median norepinephrine demand was 3.0 (1.0-13.5) mg/h. Cardiopulmonary failure was treated effectively with ECMO and systemic gas exchange and blood flow improved rapidly within 2 h on ECMO in all patients (median OR 69 (52-263) mmHg, median paCO(2) 41 (22-85) mmHg. 60% of our patients had recovered completely.

**CONCLUSIONS:** Initially heparin-free ECMO support can improve therapy and outcome even in disastrous trauma patients with coexisting bleeding shock.

## Extracorporeal lung support in trauma patients with severe chest injury and acute lung failure: a 10-year institutional experience.

Ried M, Bein T, Philipp A, Müller T, Graf B, Schmid C, Zonies D, Diez C, Hofmann HS.

### Abstract

**INTRODUCTION:** Severe trauma with concomitant chest injury is frequently associated with acute lung failure (ALF). This report summarizes our experience with extracorporeal lung support (ELS) in thoracic trauma patients treated at the University Medical Center Regensburg.

**METHODS:** A retrospective, observational analysis of prospectively collected data (Regensburg ECMO Registry database) was performed for all consecutive trauma patients with acute pulmonary failure requiring ELS during a 10-year interval.

**RESULTS:** Between April 2002 and April 2012, 52 patients (49 male, three female) with severe thoracic trauma and ALF refractory to conventional therapy required ELS. The mean age was  $32 \pm 14$  years (range, 16 to 72 years). Major traffic accident (73%) was the most common trauma, followed by blast injury (17%), deep fall (8%) and blunt trauma (2%). The mean Injury Severity Score was  $58.9 \pm 10.5$ , the mean lung injury score was  $3.3 \pm 0.6$  and the Sequential Organ Failure Assessment score was  $10.5 \pm 3$ . Twenty-six patients required pumpless extracorporeal lung assist (PECLA) and 26 patients required veno-venous extracorporeal membrane oxygenation (vv-ECMO) for primary post-traumatic respiratory failure. The mean time to ELS support was  $5.2 \pm 7.7$  days (range, <24 hours to 38 days) and the mean ELS duration was  $6.9 \pm 3.6$  days (range, <24 hours to 19 days). In 24 cases (48%) ELS implantation was performed in an external facility, and cannulation was done percutaneously by Seldinger's technique in 98% of patients. Cannula-related complications occurred in 15% of patients (PECLA, 19% (n=5); vv-ECMO, 12% (n=3)). Surgery was performed in 44 patients, with 16 patients under ELS prevention. Eight patients (15%) died during ELS support and three patients (6%) died after ELS weaning. The overall survival rate was 79% compared with the proposed Injury Severity Score-related mortality (59%).

**CONCLUSION:** Pumpless and pump-driven ELS systems are an excellent treatment option in severe thoracic trauma patients with ALF and facilitate survival in an experienced trauma center with an interdisciplinary treatment approach. We encourage the use of vv-ECMO due to reduced complication rates, better oxygenation and best short-term outcome.



## Extracorporeal membrane oxygenation for adult respiratory distress syndrome in trauma patients: A case series and systematic literature review.

Robba C<sup>1</sup>, Ortu A, Bilotta F, Lombardo A, Sekhon MS, Gallo F, Matta BF.

### Author information

### Abstract

**BACKGROUND:** Venovenous extracorporeal membrane oxygenation (vv-ECMO) is an established salvage therapy for severe respiratory failure, and may provide an alternative form of treatment for trauma-induced adult respiratory distress syndrome (ARDS) when conventional treatments have failed. The need for systemic anticoagulation is a relative contraindication for patients with bleeding risks, especially in multitraumatic injury.

**METHODS:** We describe a case series of four trauma patients with ARDS who were managed with ECMO admitted to the neuro critical care unit at Addenbrooke's Hospital, Cambridge (UK), from January 2000 to January 2016. We performed a systematic review of the available literature to investigate the safety and efficacy of vv-ECMO in posttraumatic ARDS, focusing on the use of different anticoagulation strategies and risk of bleeding on patients with multiple injuries.

**RESULTS:** Thirty-one patients were included. A heparin bolus was given in 16 cases. Eleven patients developed complications during treatment with ECMO with three cases of major bleeding. In all documented cases of bleeding a bolus and infusion of heparin was administered, aiming for an activated clotting time (ACT) target longer than 150 seconds. Two patients treated with heparin-free ECMO developed thromboembolic complications. Four patients died, and death was never directly or indirectly related to use of ECMO.

**CONCLUSION:** vv-ECMO can be lifesaving in respiratory failure. Our experience and our literature review suggest that vv-ECMO should be considered as a rescue treatment for the management of severe hypoxemic respiratory failure secondary to ARDS in trauma patients. For patients with a high risk of bleeding, the use of ECMO with no initial anticoagulation could be considered a valid option. For patients with a moderate risk of bleeding, use of a heparin infusion keeping an ACT target shorter than 150 seconds can be appropriate.

**LEVEL OF EVIDENCE:** Therapeutic study, level V.

## Advanced extracorporeal therapy in trauma.

Zonies D<sup>1</sup>, Merkel M.

### Author information

### Abstract

**PURPOSE OF REVIEW:** The purpose is to review the current application of extracorporeal life support (ECLS) in trauma patients. In addition, programmatic development is described.

**RECENT FINDINGS:** ECLS use is increasing among trauma patients. Several recent studies among trauma patients report survival rates of 65-79%. Despite the high bleeding risk, extracorporeal membrane oxygenation (ECMO) may be safely implemented in trauma patients based on a strict protocol-driven policy. Early implementation may improve overall outcomes. Alternative anticoagulants and heparin free periods may be well tolerated in trauma patients at high risk of hemorrhage.

**SUMMARY:** ECMO is becoming a more routine option in severely injured trauma patients that develop severe respiratory failure. Well tolerated implementation and program development is possible among regional trauma centers. Although clinical knowledge gaps exist, ECMO is a promising treatment in this high-risk population.



## **Emergency physician-initiated extracorporeal cardiopulmonary resuscitation.**

Bellezzo JM<sup>1</sup>, Shinar Z, Davis DP, Jaski BE, Chillcott S, Stahovich M, Walker C, Baradarian S, Dembitsky W.

### **Author information**

### **Abstract**

**CONTEXT:** Extracorporeal cardiopulmonary resuscitation (ECPR) refers to emergent percutaneous veno-arterial cardiopulmonary bypass to stabilize and provide temporary support of patients who suffer cardiopulmonary arrest. Initiation of ECPR by emergency physicians with meaningful long-term patient survival has not been demonstrated.

**OBJECTIVE:** To determine whether emergency physicians could successfully incorporate ECPR into the resuscitation of patients who present to the emergency department (ED) with cardiopulmonary collapse refractory to traditional resuscitative efforts.

**DESIGN:** A three-stage algorithm was developed for ED ECPR in patients meeting inclusion/exclusion criteria. We report a case series describing our experience with this algorithm over a 1-year period.

**RESULTS:** 42 patients presented to our ED with cardiopulmonary collapse over the 1-year study period. Of these, 18 patients met inclusion/exclusion criteria for the algorithm. 8 patients were admitted to the hospital after successful ED ECPR and 5 of those patients survived to hospital discharge neurologically intact. 10 patients were not started on bypass support because either their clinical conditions improved or resuscitative efforts were terminated.

**CONCLUSION:** Emergency physicians can successfully incorporate ED ECPR in the resuscitation of patients who suffer acute cardiopulmonary collapse. More studies are necessary to determine the true efficacy of this therapy.



# Hasta Seçimi



ECLS başlama kriteri olarak; potansiyel olarak reversible ve konvansiyonel tedaviye yanıt vermeyen akut ciddi kardiyak ve solunum yetmezliğidir.

- Uygun ventilasyon ayarlarına rağmen ((PaO<sub>2</sub>/FiO<sub>2</sub>) <100 mmHg) hipoksemik solunum yetmezliği
- PCI, transplantasyon, LVAD gibi tedavilere köprü olarak
- Refraktör Şok Tablosu
- Kardiyak Arrest
- Overdoze
- Aritmisi olan hipotermik hastalar v.s.

# Komplikasyonları

*\*Kanama %30-50*

*\*Tromboembolizm %16*

*\*Nörolojik %10*

*\*Kanül ile ilişkili komplikasyonlar %5*

*\*Heparinin indüklediği trombositopeni*

# Take Home Point

- Konvansiyonel tedavilere cevap vermeyen ciddi, potansiyel olarak reversible akut solunum ve kardiyak yetmeliği olan hastalar ECLS için değerlendirilmelidir.
- ECLS>Konvansiyonel tedavi
- Definitif tedavi için köprü
- Nörolojik ve uzun sağkalım açısından iyileştirme sağlamaktadır.
- Acil hekimi tarafından da gerekli donanım ve ekipmanı olan merkezlerde uygulanabilir.



# Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA)





# REBOA



**R E B O A**

Xiphoid  
Umbilicus  
Zone 1  
Zone 2  
Zone 3  
Iliacs

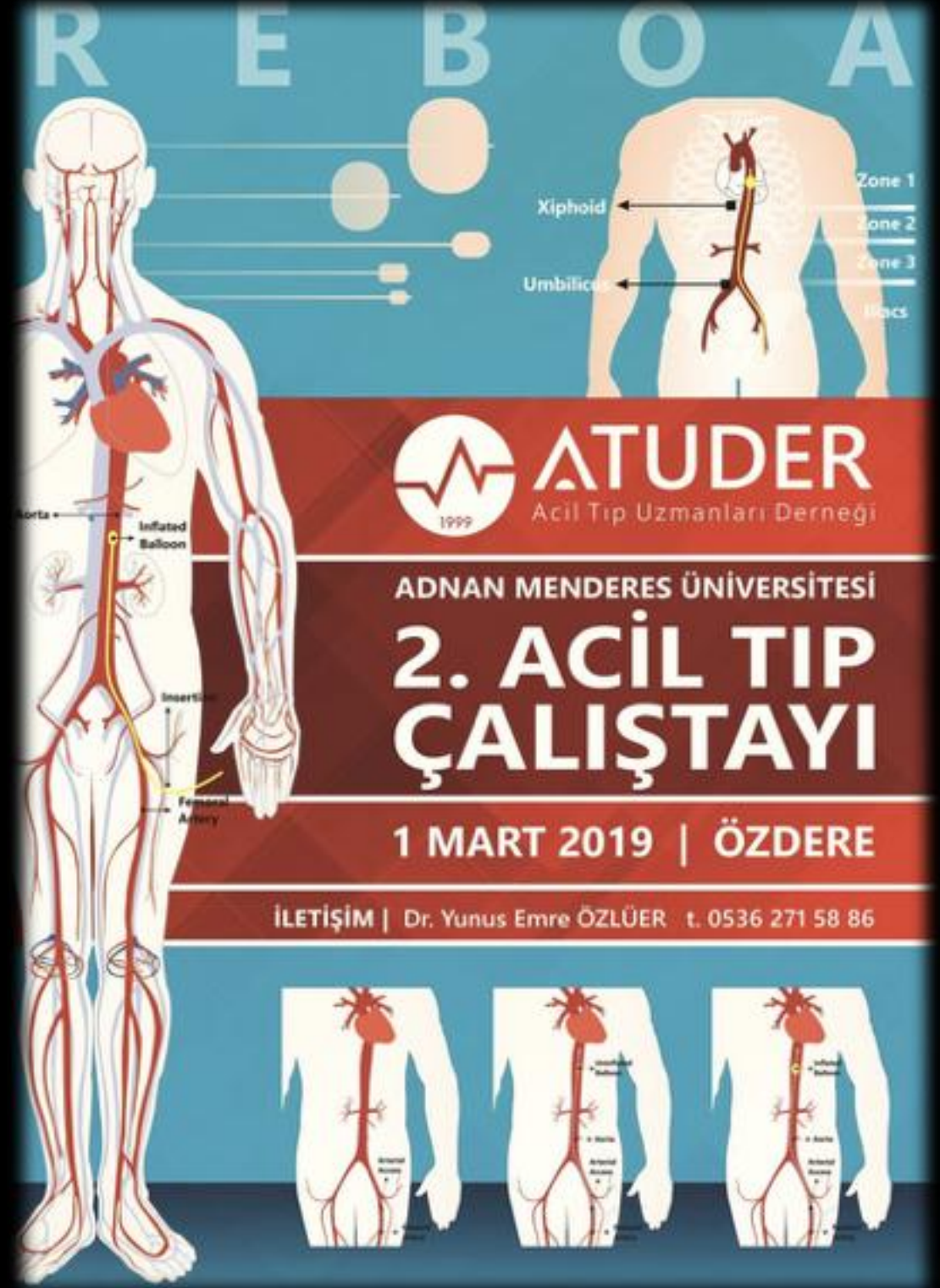
**ATUDER**  
1999  
Acil Tıp Uzmanları Derneği

ADNAN MENDERES ÜNİVERSİTESİ  
**2. ACİL TIP  
ÇALIŞTAYI**

1 MART 2019 | ÖZDERE

İLETİŞİM | Dr. Yunus Emre ÖZLÜER t. 0536 271 58 86

Aorta  
Inflated Balloon  
Insertion  
Femoral Artery







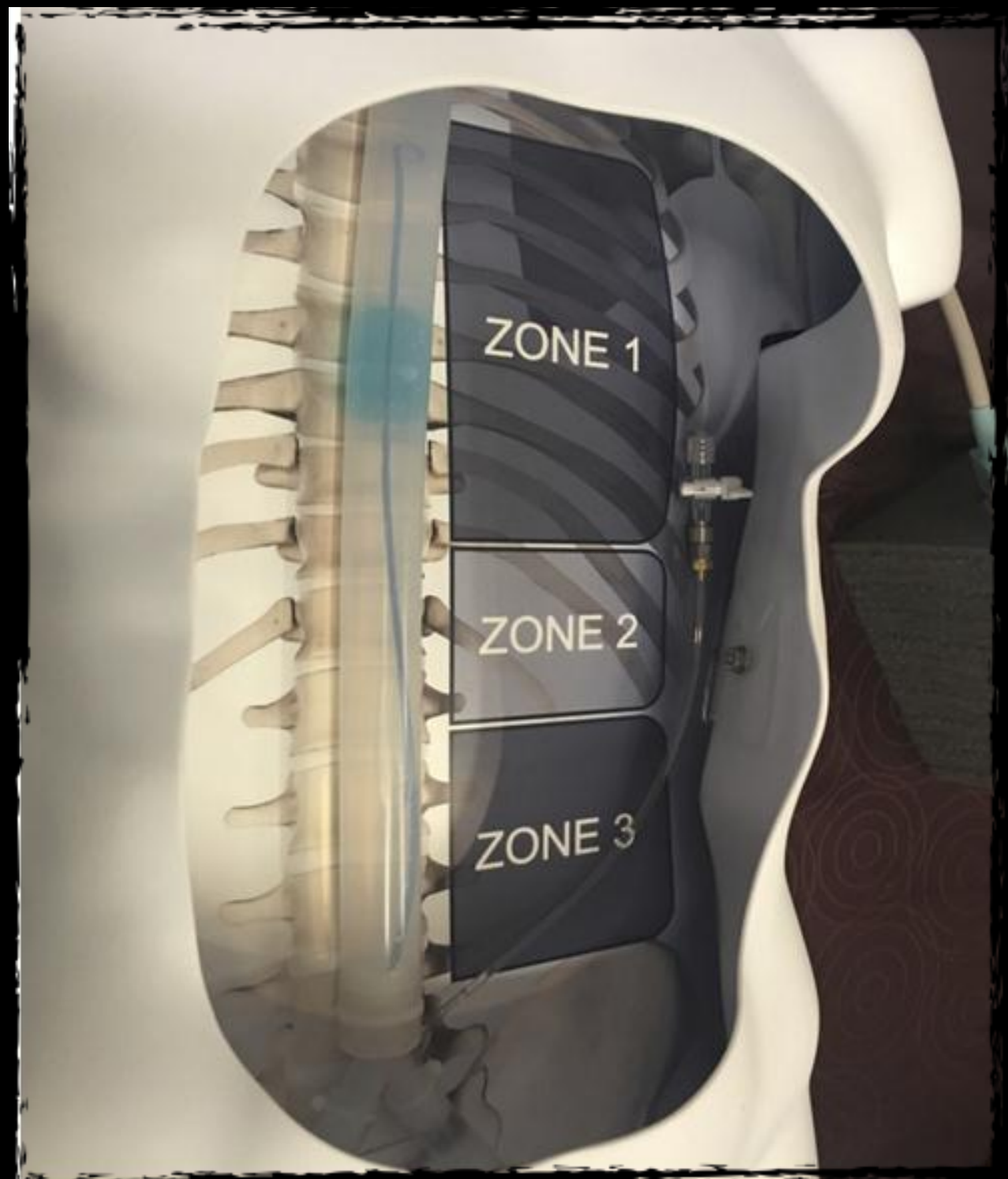
Military Antishock Trousers (MAST)

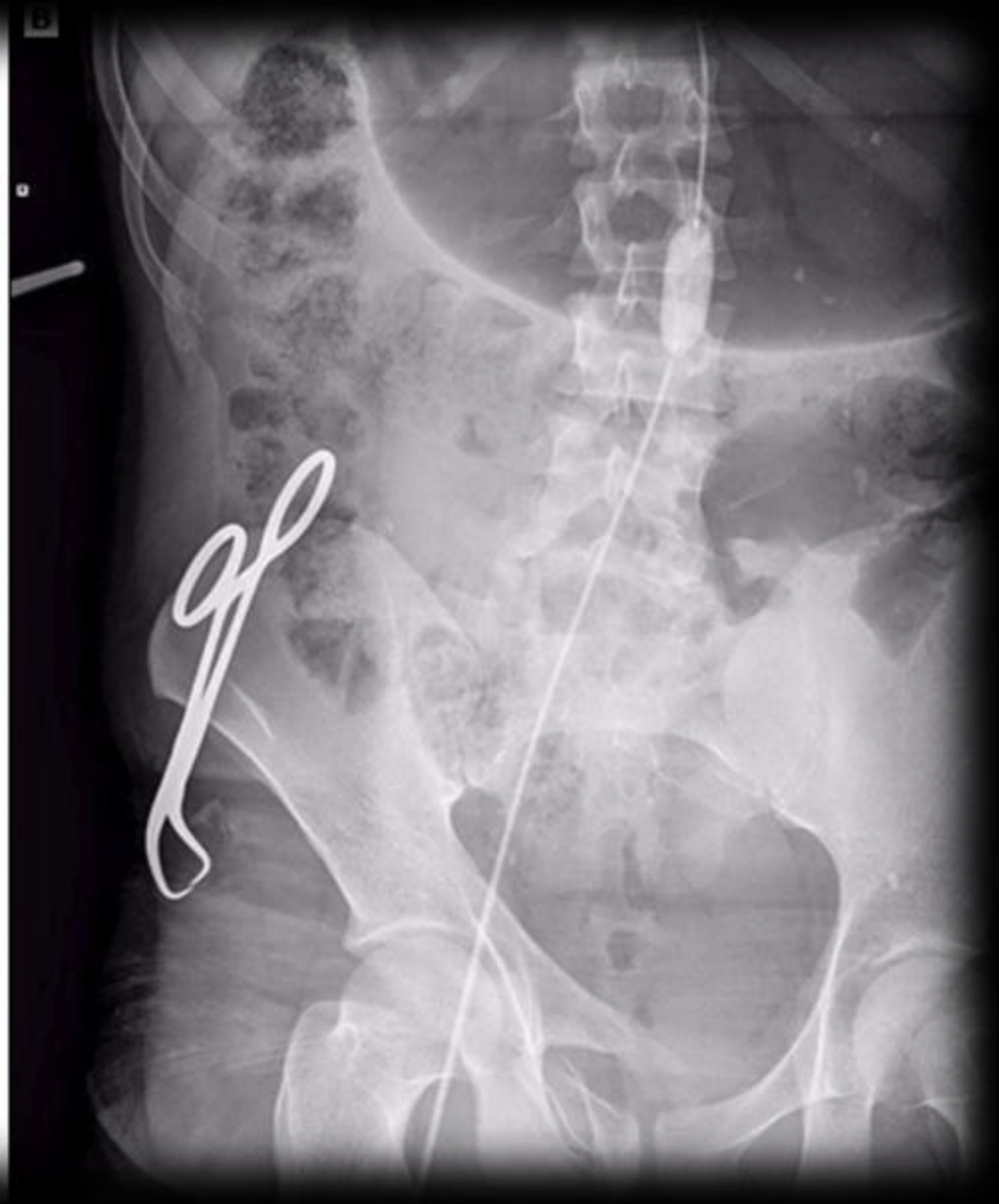














## RECOMMENDATIONS

- Level 1
  - None
- Level 2
  - None
- Level 3
  - Consider early placement of a common femoral artery catheter in the hypotensive trauma patient (SBP < 90 mmHg) to facilitate rapid upsizing to a 7-French sheath to accommodate a REBOA catheter if necessary
  - REBOA should be considered in patients with hemorrhagic shock and the following:
    - Penetrating or blunt abdominopelvic trauma patients who are hypotensive (SBP < 90 mmHg), transient responders to fluid resuscitation, or receiving a Massive Transfusion Protocol (MTP)
    - Positive FAST examination
    - Suspected pelvic or lower extremity trauma with hemorrhage
  - The REBOA device may also be considered for the following alternative Indications:
    - Prophylactic use in women undergoing surgery for abnormal placentation
    - Severe gastrointestinal bleeding

Literatür

## A systematic review of the use of resuscitative endovascular balloon occlusion of the aorta in the management of hemorrhagic shock.

Morrison JJ, Galgon RE, Jansen JO, Cannon JW, Rasmussen TE, Eliason JL.

### Author information

### Erratum in

J Trauma Acute Care Surg. 2016 Mar;80(3):554. Morrison, Jonathan James [corrected to Morrison, Jonathan J]; Jansen, Jan Olaf [corrected to Jansen, Jan O]; Rasmussen, Todd Erik [corrected to Rasmussen, Todd E].

### Abstract

**BACKGROUND:** Torso hemorrhage remains a leading cause of potentially preventable death within trauma, acute care, vascular, and obstetric practice. A proportion of patients exsanguinate before hemorrhage control. Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an adjunct designed to sustain the circulation until definitive hemostasis. A systematic review was conducted to characterize the current clinical use of REBOA and its effect on hemodynamic profile and mortality.

**METHODS:** A systematic review (1946-2015) was conducted using EMBASE and MEDLINE. Original studies on human subjects, published in English language journals, were considered. Articles were included if they reported data on hemodynamic profile and mortality.

**RESULTS:** A total of 83 studies were identified; 41 met criteria for inclusion. Clinical settings included postpartum hemorrhage (5), upper gastrointestinal bleeding (3), pelvic surgery (8), trauma (15), and ruptured aortic aneurysm (10). Of the 857 patients, overall mortality was 423 (49.4%); shock was evident in 643 (75.0%). Pooled analysis demonstrated an increase in mean systolic pressure by 53 mm Hg (95% confidence interval, 44-61 mm Hg) following REBOA use. Data exhibited moderate heterogeneity with an I of 35.5.

**CONCLUSION:** REBOA has been used in a variety of clinical settings to successfully elevate central blood pressure in the setting of shock. Overall, the evidence base is weak with no clear reduction in hemorrhage-related mortality demonstrated. Formal, prospective study is warranted to clarify the role of this adjunct in torso hemorrhage.



## A meta-analysis of resuscitative endovascular balloon occlusion of the aorta (REBOA) or open aortic cross-clamping by resuscitative thoracotomy in non-compressible torso hemorrhage patients.

Manzano Nunez R<sup>1</sup>, Naranjo MP<sup>1</sup>, Foianini E<sup>2</sup>, Ferrada P<sup>3</sup>, Rincon E<sup>1</sup>, García-Perdomo HA<sup>4</sup>, Burbano P<sup>5</sup>, Herrera JP<sup>6</sup>, García AF<sup>4,7</sup>, Ordoñez CA<sup>4,7</sup>.

### Author information

### Abstract

**BACKGROUND:** The objective of this systematic review and meta-analysis was to determine the effect of REBOA, compared to resuscitative thoracotomy, on mortality and among non-compressible torso hemorrhage trauma patients.

**METHODS:** Relevant articles were identified by a literature search in MEDLINE and EMBASE. We included studies involving trauma patients suffering non-compressible torso hemorrhage. Studies were eligible if they evaluated REBOA and compared it to resuscitative thoracotomy. Two investigators independently assessed articles for inclusion and exclusion criteria and selected studies for final analysis. We conducted meta-analysis using random effect models.

**RESULTS:** We included three studies in our systematic review. These studies included a total of 1276 patients. An initial analysis found that although lower in REBOA-treated patients, the odds of mortality did not differ between the compared groups (OR 0.42; 95% CI 0.17-1.03). Sensitivity analysis showed that the risk of mortality was significantly lower among patients who underwent REBOA, compared to those who underwent resuscitative thoracotomy (RT) (RR 0.81; 95% CI 0.68-0.97).

**CONCLUSION:** Our meta-analysis, mainly from observational data, suggests a positive effect of REBOA on mortality among non-compressible torso hemorrhage patients. However, these results deserve further investigation.

# Resuscitative Endovascular Balloon Occlusion of the Aorta Using a Low-Profile Device is Easy and Safe for Emergency Physicians in Cases of Life-Threatening Hemorrhage

Takahiro Shoji, Takehiko Tarui, Takashi Igarashi, Yuki Mochida, Hiroyuki Morinaga, Yasuhiko Miyakuni, Yoshitaka Inoue, Yasuhiko Kaita, Hiroshi Miyauchi, Yoshihiro Yamaguchi

*Journal of Emergency Medicine* 2018, 54 (4): 410-418

**BACKGROUND:** Bleeding from hemorrhagic shock can be immediately controlled by blocking the proximal part of the hemorrhagic point using either resuscitative thoracotomy for aortic cross-clamping or insertion of a large-caliber (10-14Fr) resuscitative endovascular balloon occlusion of the aorta (REBOA) device via the femoral artery. However, such methods are very invasive and have various complications. With recent progress in endovascular treatment, a low-profile REBOA device (7Fr) has been developed.

**OBJECTIVE:** The objective of this study was to report our experience of this low-profile REBOA device and to evaluate the usefulness of emergency physician-operated REBOA in life-threatening hemorrhagic shock.

**METHODS:** Ten patients with refractory hemorrhagic shock underwent REBOA using this device via the femoral artery. All REBOA procedures were performed by emergency physicians. The success rate of the insertion, vital signs, and REBOA-related complications were evaluated.

**RESULTS:** Median age was 54 years (interquartile range 33-78 years). The causes of hemorrhagic shock were trauma (n = 4; 1 blunt and 3 penetrating), ruptured abdominal aortic aneurysm (n = 3), and obstetric hemorrhage (n = 3). Two patients had cardiopulmonary arrest upon arrival. REBOA procedure was successful in all patients, and all became hemodynamically stable to undergo definitive interventions after REBOA. There were no REBOA-related complications. The mortality rate within 24 h and 30 days was 40%.

**CONCLUSIONS:** This REBOA device was useful for emergency physicians in life-threatening hemorrhagic shock because of its ease in handling and low invasiveness.



# Resuscitative endovascular balloon occlusion of the aorta performed by emergency physicians for traumatic hemorrhagic shock: a case series from Japanese emergency rooms

Ryota Sato, Akira Kuriyama, Rei Takaesu, Nobuhiro Miyamae, Wataru Iwanaga, Hayato Tokuda, Takehiro Umemura

*Critical Care: the Official Journal of the Critical Care Forum 2018 April 21, 22 (1): 103*

**BACKGROUND:** Resuscitative endovascular balloon occlusion of the aorta (REBOA), which has been increasingly used for the management of hemorrhagic shock, is a less invasive strategy for the management of patients with very severe hemorrhage. However, its effectiveness remains controversial.

**METHODS:** This retrospective case series included trauma patients who underwent REBOA for hemorrhagic shock due to trauma in four Japanese tertiary care emergency centers from January 2013 to March 2017. Patients in cardiac arrest at the time of REBOA and those who underwent REBOA for nontraumatic causes during the study period were excluded.

**RESULTS:** A total of 24 patients underwent REBOA during the study period. The median age was 52 years (interquartile range (IQR) 36.5-62.5), 17 (70.8%) of the patients were male, and 23 (95.8%) had blunt trauma. The 24-h survival was 50% (n=12), and the in-hospital survival rate was 41.7% (10/24). In all cases, REBOA was performed in emergency rooms by emergency physicians without fluoroscopic guidance. Complications of REBOA were mesenteric ischemia (n=1, 4.2%), ischemia of the lower extremities (n=1, 4.2%), and placement of REBOA in thoracic aortic injury (n=3, 12.5%).

**CONCLUSIONS:** REBOA can be an effective and feasible tool for controlling massive hemorrhage due to trauma. However, caution should be exercised regarding complications including placement of REBOA in aortic injury and limb ischemia in cases where REBOA is performed in an emergency department setting with minimal or no support from trauma surgeons.



# Resuscitative Endovascular Balloon Occlusion of the Aorta and Resuscitative Thoracotomy in Select Patients with Hemorrhagic Shock: Early Results from the American Association for the Surgery of Trauma's Aortic Occlusion in Resuscitation for Trauma and Acute Care Surgery Registry.

Brenner M<sup>1</sup>, Inaba K<sup>2</sup>, Aiolfi A<sup>2</sup>, DuBose J<sup>3</sup>, Fabian T<sup>4</sup>, Bee T<sup>4</sup>, Holcomb JB<sup>5</sup>, Moore L<sup>5</sup>, Skarupa D<sup>6</sup>, Scalea TM<sup>3</sup>; AAST AORTA Study Group.

+ Collaborators (39)

+ Author information

## Erratum in

Correction. [J Am Coll Surg. 2018]

## Abstract

**BACKGROUND:** Aortic occlusion is a potentially valuable tool for early resuscitation in patients nearing extremis or in arrest from severe hemorrhage.

**STUDY DESIGN:** The American Association for the Surgery of Trauma's Aortic Occlusion in Resuscitation for Trauma and Acute Care Surgery registry identified trauma patients without penetrating thoracic injury undergoing aortic occlusion at the level of the descending thoracic aorta (resuscitative thoracotomy [RT] or zone 1 resuscitative endovascular balloon occlusion of the aorta [REBOA]) in the emergency department (ED). Survival outcomes relative to the timing of CPR need and admission hemodynamic status were examined.

**RESULTS:** Two hundred and eighty-five patients were included: 81.8% were males, with injury due to penetrating mechanisms in 41.4%; median age was 35.0 years (interquartile range 29 years) and median Injury Severity Score was 34.0 (interquartile range 18). Resuscitative thoracotomy was used in 71%, and zone 1 REBOA in 29%. Overall survival beyond the ED was 50% (RT 44%, REBOA 63%;  $p = 0.004$ ) and survival to discharge was 5% (RT 2.5%, REBOA 9.6%;  $p = 0.023$ ). Discharge Glasgow Coma Scale score was 15 in 85% of survivors. Prehospital CPR was required in 60% of patients with a survival beyond the ED of 37% and survival to discharge of 3% (all  $p > 0.05$ ). Patients who did not require any CPR before had a survival beyond the ED of 70% (RT 48%, REBOA 93%;  $p < 0.001$ ) and survival to discharge of 13% (RT 3.4%, REBOA 22.2%,  $p = 0.048$ ). If aortic occlusion patients did not require CPR but presented with hypotension (systolic blood pressure  $<90$  mmHg; 9% [65% RT; 35% REBOA]), they achieved survival beyond the ED in 65% ( $p = 0.009$ ) and survival to discharge of 15% (RT 0%, REBOA 44%;  $p = 0.008$ ).

**CONCLUSIONS:** Overall, REBOA can confer a survival benefit over RT, particularly in patients not requiring CPR. Considerable additional study is required to definitively recommend REBOA for specific subsets of injured patients.

J Trauma Acute Care Surg. 2015 May;78(5):1054-8. doi: 10.1097/TA.0000000000000609.

## The role of REBOA in the control of exsanguinating torso hemorrhage.

Biffi WL<sup>1</sup>, Fox CJ, Moore EE.

 Author information

### Abstract

The management of patients with exsanguinating torso hemorrhage (requiring resuscitative thoracotomy for control of the aorta) have been controversial. We submit that broad acceptance of REBOA is necessary. We propose an agenda for research questions that we feel can help clarify the role of REBOA in modern trauma care in a variety of trauma settings.

Sistolik basıncı <80 mmHg

Nabız alınan

Abdominal ve Pelvik kanaması olan hastalar için

gözönünde bulundurulması gerektiği vurgulanmaktadır.

occasional use of  
endovascular balloon  
occlusion (REBOA) in  
civilian and military are  
of historical  
as well as a set of

## Traumatic intra-abdominal hemorrhage control: has current technology tipped the balance toward a role for prehospital intervention?

Chaudery M<sup>1</sup>, Clark J, Wilson MH, Bew D, Yang GZ, Darzi A.

### + Author information

### Abstract

**BACKGROUND:** The identification and control of traumatic hemorrhage from the torso remains a major challenge and carries a significant mortality despite the reduction of transfer times. This review examines the current technologies that are available for abdominal hemorrhage control within the prehospital setting and evaluates their effectiveness.

**METHODS:** A systematic search of online databases was undertaken. Where appropriate, evidence was highlighted using the Oxford levels of clinical evidence. The primary outcome assessed was mortality, and secondary outcomes included blood loss and complications associated with each technique.

**RESULTS:** Of 89 studies, 34 met the inclusion criteria, of which 29 were preclinical in vivo trials and 5 were clinical. Techniques were subdivided into mechanical compression, endovascular control, and energy-based hemostatic devices. Gas insufflation and manual pressure techniques had no associated mortalities. There was one mortality with high intensity focused ultrasound. The intra-abdominal infiltration of foam treatment had 64% and the resuscitative endovascular balloon occlusion of the aorta had 74% mortality risk reduction. In the majority of cases, morbidity and blood loss associated with each interventional procedure were less than their respective controls.

**CONCLUSION:** Mortality from traumatic intra-abdominal hemorrhage could be reduced through early intervention at the scene by emerging technology. Manual pressure or the resuscitative endovascular balloon occlusion of the aorta techniques have demonstrated clinical effectiveness for the control of major vessel bleeding, although complications need to be carefully considered before advocating clinical use. At present, fast transfer to the trauma center remains paramount.





J Spec Oper Med. Spring 2017;17(1):1-8.

## **A Modern Case Series of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) in an Out-of-Hospital, Combat Casualty Care Setting.**

Manley JD, Mitchell BJ, DuBose JJ, Rasmussen TE.

### **Abstract**

**BACKGROUND:** Resuscitative endovascular balloon occlusion of the aorta (REBOA) is used to mitigate bleeding and sustain central aortic pressure in the setting of shock. The ER-REBOA™ catheter is a new REBOA technology, previously reported only in the setting of civilian trauma and injury care. The use of REBOA in an out-of-hospital setting has not been reported, to our knowledge.

**METHODS:** We present a case series of wartime injured patients cared for by a US Air Force Special Operations Surgical Team at an austere location fewer than 3km (5-10 minutes' transport) from point of injury and 2 hours from the next highest environment of care—a Role 2 equivalent.

**RESULTS:** In a 2-month period, four patients presented with torso gunshot or fragmentation wounds, hemoperitoneum, and class IV shock. Hand-held ultrasound was used to diagnose hemoperitoneum and facilitate 7Fr femoral sheath access. ER-REBOA balloons were positioned and inflated in the aorta (zone 1 [n = 3] and zone 3 [n = 1]) without radiography. In all cases, REBOA resulted in immediate normalization of blood pressure and allowed induction of anesthesia, initiation of whole-blood transfusion, damage control laparotomy, and attainment of surgical hemostasis (range of inflation time, 18-65 minutes). There were no access- or REBOA-related complications and all patients survived to achieve transport to the next echelon of care in stable condition.

**CONCLUSION:** To our knowledge, this is the first series to demonstrate the feasibility and effectiveness of REBOA in modern combat casualty care and the first to describe use of the ER-REBOA catheter. Use of this device by nonsurgeons and surgeons not specially trained in vascular surgery in the out-of-hospital setting is useful as a stabilizing and damage control adjunct, allowing time for resuscitation, laparotomy, and surgical hemostasis.



# Olası Endikasyonları

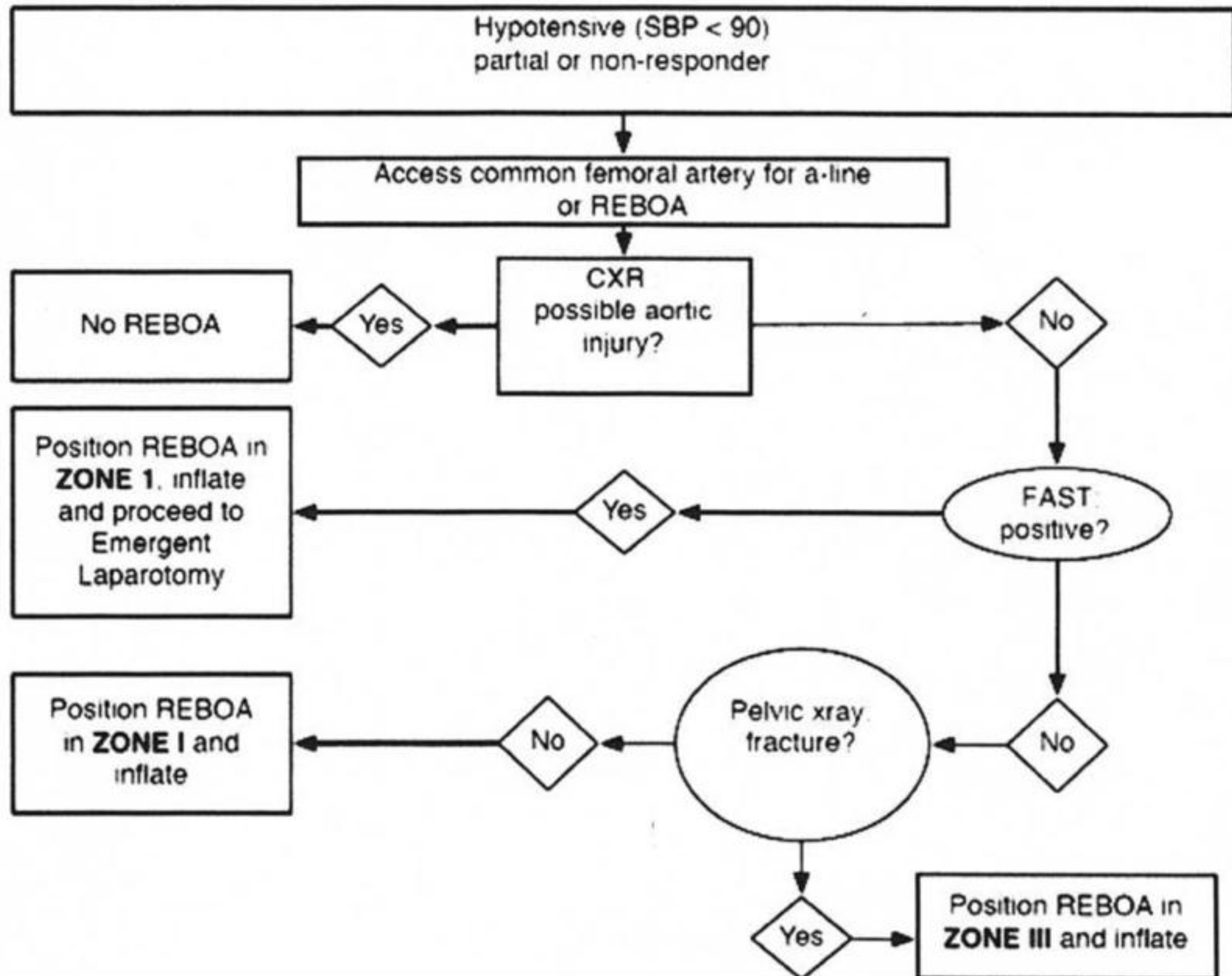
Hangi hasta grubu???

- ★ **Sistolik basıncı <80 mmHg**
- ★ **Nabız alınan Abdominal ve Pelvik kanama**

Dolayısı ile olası endikasyonları:

- \*Şok tablosunda olan **abdominal** travma- **ZERO I REBOA**
- \*Şok tablosunda olan **pelvik** travma-**ZERO III REBOA**
- \*Hemorajik şok riski olan **torso travması** olan hastalardır.

# Shock Trauma Center Protocol



# Kontrendikasyonlar

- \* Resusitatif torakotomi için uygun olmayan hastalarda REBOA düşünülmemelidir.
- \* Ayrıca penetran torasik travma veya toraks hemorajisi olan hastalara da REBOA uygulanmamalıdır.



# Komplikasyonlar

- REBOA ile ilgili risk yeteri kadar belirtilmiştir.
- Bu zamana kadar bildirilmiş herhangi bir otopsi raporu mevcut değil.
- Vasküler girişim alanında **arter yada aort yaralanması**
- Balon yada sheathe bağlı **tromboembolik komplikasyonlar (%4.3)**
- **End-organ yetmezliği** bildirilmiştir.

# Take Home Point

- Kanamanın azaltılması açısından fırsat penceresi sunabilir.
- REBOA daha az invazivdir ve kardiyovasküler kollaps olmadan önce uygulanabilir.
- Sistolik basıncı  $<80$  mmHg olan ve nabız alınan abdominal ve pelvik kanaması olan hastalar için REBOA'nın göz önünde bulundurulabileceği vurgulanmaktadır.
- REBOA'yı uygulamak için ideal zamanı, balon inflasyon süresindeki toleransı ve bu prosedürden faydalanabilecek uygun hastalarını tam olarak belirlemek için **daha fazla çalışmaya ihtiyaç vardır.**



## “Teşekkürler”

