



Management of the Extremis Trauma Patient : Traumatic Cardiac Arrest, ERT, and REBOA

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Disclosure

- No conflict of interest



Transfer call

- 66/F
- Chief complaint: Changed mental status
- Mechanism of injury: Motorcycle TA
- Drowsy,
V/S 102/66-113/min-30/min-94%
- Local emergency center visit
- Non-contrast chest, brain CT check
- F/U SBP: 66mmHg drop

Transfusion: not available



1

Extremis Trauma Patient

Golden hour

Golden hour



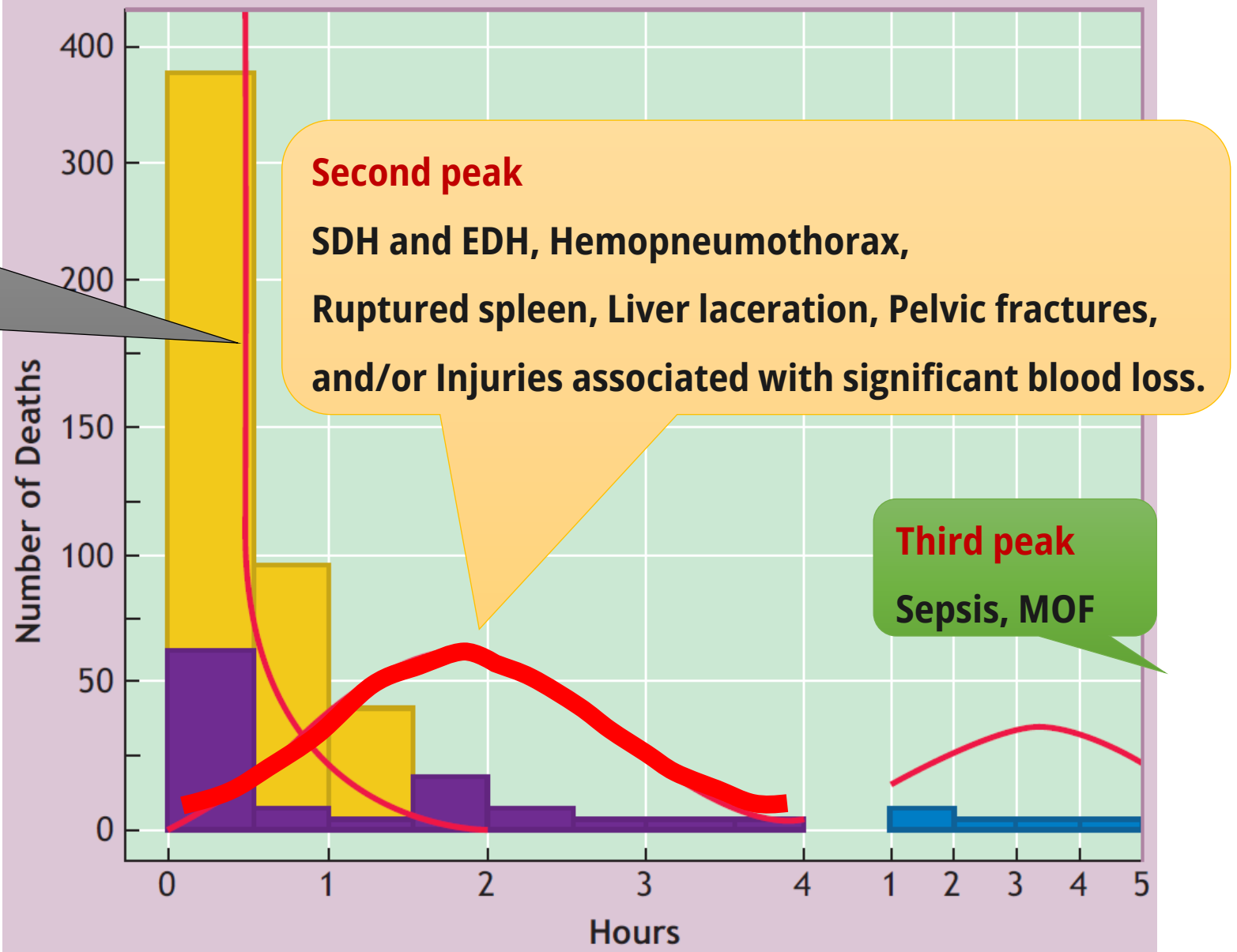
예방 가능한? 외상 사망?

Golden hour !!! What does "PREVENTABLE" mean ?

First peak

Severe brain,
High spinal cord injury,
Rupture of the heart,
Aorta, Large blood vessels

TRIMODAL DEATH DISTRIBUTION



권역외상센터의 추진배경 및 경과

윤 한 덕 | 국립중앙의료원 중앙응급의료센터

Background and progress of regional trauma center development

Han Deok Yoon, MD

National Emergency Medical Center, National Medical Center, Seoul, Korea

We need a trauma center

💀 사회경제적 비용

외상을 포함한 손상은 **사회경제적 비용이 가장 큰 질환군**으로, 특히 젊은 층의 조기 사망으로 인한 미래 소득 손실액이 막대함.

⌚ 골든 아워(Golden Hour)

중증외상 환자의 예후를 결정하는 핵심 요소. 불특정 시간에 발생하는 다발성 손상에 대한 **신속한 다학제적 접근**이 필수적임.

👤 예방가능 사망률의 현실

1999년 기준 **50.4%**에 달했던 예방가능 사망률. 이는 적절한 의료 체계 부재 시 절반 이상의 외상 환자가 살 수 있음에도 사망함을 의미.

🏢 시스템의 한계

현대 의료 체계의 세분화로 인해 민간 의료기관이 자발적으로 외상 전담 체계를 구축하기 어려우며, **정부 차원의 집중 지원**이 필요함.

국내 임상진료지침



HOME



LOGIN



JOIN



SITE MAP



ABOUT US

KoMGi
임상진료지침 정보센터
Korean Medical Guideline Information center

임상진료지침

알림마당

임상진료지침
정보센터 소개

진료지침의
개발과 평가 방법

관련 사이트

국내 임상진료지침

Home > 임상진료지침 > 국내 임상진료지침

* 기본정보

진료지침명	외상 표준진료지침
개발조직명	대한외상학회
개발참여자	개발위원: 이강현, 김오현, 유병철, 이길재, 조재우, 최미영, 황정주 실무위원: 고승제, 권준식, 김마루, 김성엽, 김오현, 마대성 , 박찬용, 유병철, 윤정호, 이경학, 이길재, 장성욱 , 조영권, 정우진, 정필영, 최강국, 황정주 자문위원: 한호성(분당서울대병원 외과), 조현민 (부산대병원), 이재길(신촌세브란스병원), 오종건(고대구로병원), 이정남(가천대길병원), 조항주(의정부성모병원), 배금석(원주세브란스병원), 이국종(아주대병원), 서보라(목포한국병원), 김승민(을지대병원), 김정철(전남대병원), 경규혁(울산대병원), 최석호(단국대병원), 김효윤(안동병원), 문성근(원광대병원), 이무섭(충북대병원), 이민구(제주한라병원), 박진영(경북대병원), 이진석(국립중앙의료원)
개발일자	시작일 : 2017-05-01 - 완료일 : 2018-02-28

외상팀과 활성화를 위한 생리학적 기준

외상 시스템 및 운영

KQ# 1.1. 외상환자의 치료에 있어 외상팀이 미리 구성되어 있어야 하는가?

권고(Recommendation)

1. 중증 외상환자를 치료하기 위하여 미리 조직된 외상팀을 구성해야 하며 팀원의 전문화된 외상 교육 이수를 권고한다(1C).
2. 팀 활성화는 의료 기관의 규모에 따라 적절한 시간 내에 응대하여야 한다(1C).

KQ# 1.3. 외상팀 활성화를 위한 적절한 생리학적 기준은 어떠한가?

권고(Recommendation)

외상팀 활성화를 위한 생리학적 기준은 아래와 같다(1B).

호흡수 <10회/분 또는 >30회/분

수축기 혈압 <90mmHg

심박수 >100bpm

글래스고 혼수 척도 (GCS, Glasgow coma scale) <13

난치성 쇼크 또는 심정지 환자에서의 소생술

소생 개흉술과 REBOA

KQ# 4.1. 외상환자에서 응급실 내 소생개흉술(Resuscitative thoracotomy)의 유용성은 무엇인가?

권고(Recommendation)

관통손상 환자 중 응급실 내원 당시 쇼크 상태 또는 생존징후가 있는 심정지 상태 환자에게 응급실내 소생개흉술을 권고한다(1B).

REBOA(Resuscitative Endovascular Balloon Occlusion of Aorta)는 소생술의 한 방법으로 풍선(balloon)을 이용하여 대동맥을 폐쇄하여 차단 하부의 출혈량을 감소시키고 뇌와 심장으로의 혈액의 흐름을 재분배함으로써 뇌, 심장 혈류량을 일시적으로 증가시키는 손상통제술의 한 방법이다. 5년간 REBOA를 시행 받은 76명의 외상환자 중 심폐소생술을 시행 받은 11명을 포함하여 수축기 혈압 40~91mmHg인 환자를 분석한 연구에서 24시간 생존은 46명(61%), 생존 퇴원은 35명(46%)으로, 처치가 늦어지지 않도록 내원 시부터 평균 60분 이내에 시작하여 심정지가 오기 전에 REBOA를 시행하는 것이 도움이 되고, 수축기 혈압을 90mmHg 정도로 유지하는 대동맥의 부분폐쇄(partial occlusion)를 30분 이내로 시행하는 것이 혈액학적으로 안정을 시킴으로써 생존율을 증가시킨다고 보고하고

한국의 외상 사망률 감소

Preventable Trauma Death Rate in Korea

전국 평균 사망률 하락 추세

● 예방가능 사망률 (%)



전국 예방가능 외상사망률은 2015년 이후 꾸준한 하락세를 보이며 2023년 **사상 첫 한 자릿수 (9.1%)**를 기록했습니다. 이는 권역외상센터의 성공적 안착을 시사합니다.

🏆 최저 사망률 (최우수 권역)

6.4%

경기 / 인천

▼ 전국 평균 대비 -2.7%p

서울

7.8%

대전 / 충청 / 강원 / 세종

7.9%

2021년 대비 최대 개선폭 (-8.1%p)

부산 / 대구 / 울산 / 경상

11.4%

광주 / 전라 / 제주 (최고)

14.3%

Adult emergency resuscitative thoracotomy: A Western Trauma Association clinical decisions algorithm

Ronald Tesoriero, MD, FACS, Raul Coimbra, MD, PhD, FACS, Walter L. Biffl, MD, FACS, Clay Cothren Burlew, MD, FACS, Chasen A. Croft, MD, Charles Fox, MD, FACS, Jennifer L. Hartwell, MD, Natasha Keric, MD, Manuel Lorenzo, MD, MBA, FACS, FCCM, Matthew J. Martin, MD, FACS, Gregory A. Magee, MD, MSc, Laura J. Moore, MD, FACS, Alica R. Privette, MD, FACS, Morgan Schellenberg, MD, FACS, Kevin M. Schuster, MD, MPH, FACS, Jordan A. Weinberg, MD, and Deborah M. Stein, MD, MPH, FACS, FCCM, San Francisco, California

KEY WORDS: Resuscitative thoracotomy; algorithm; traumatic arrest; hemorrhagic shock; Western Trauma Association.

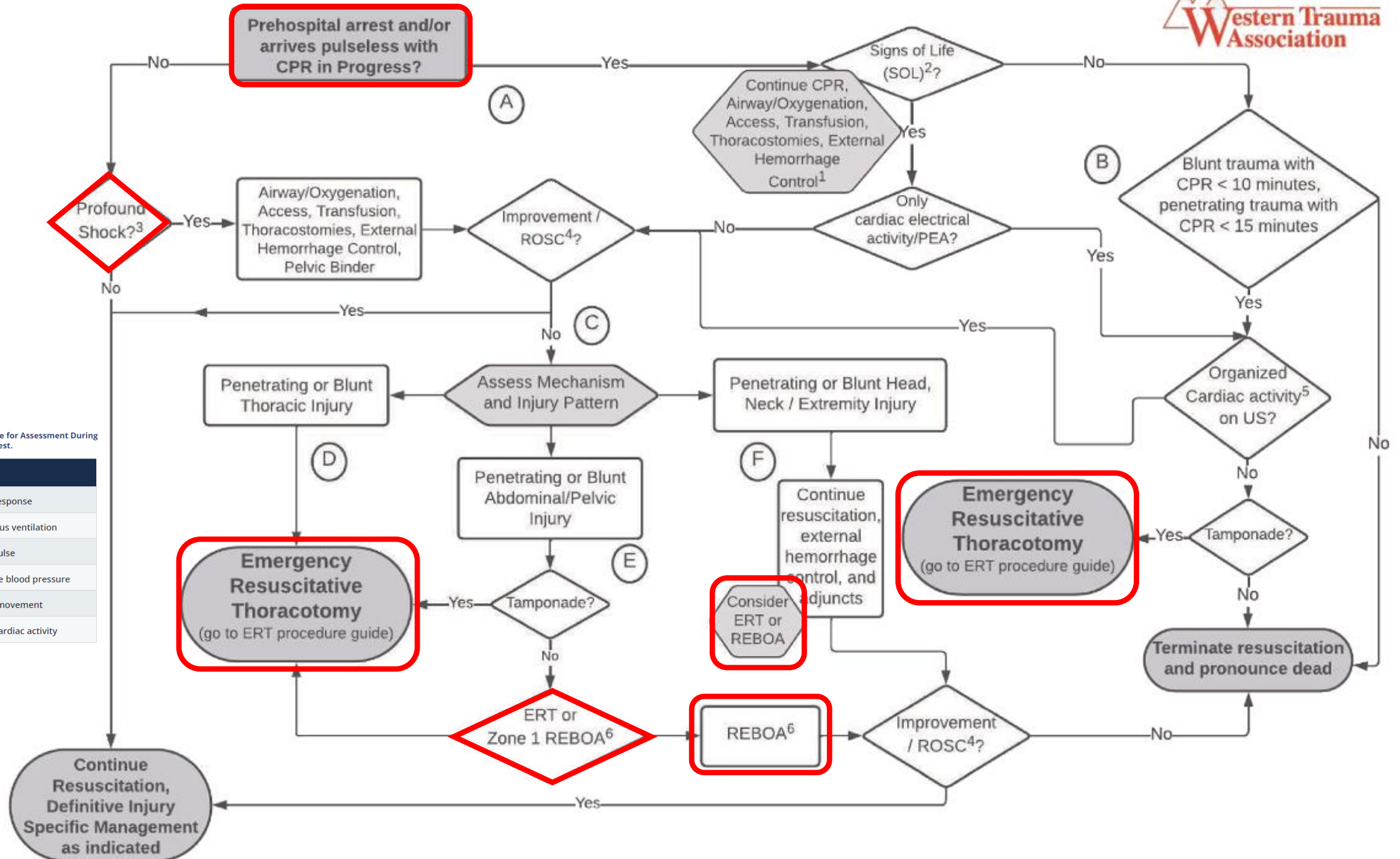


Table 6-8: Signs of Life for Assessment During Traumatic Cardiac Arrest.

SIGN
Pupillary response
Spontaneous ventilation
Palpable pulse
Measurable blood pressure
Extremity movement
Electrical cardiac activity



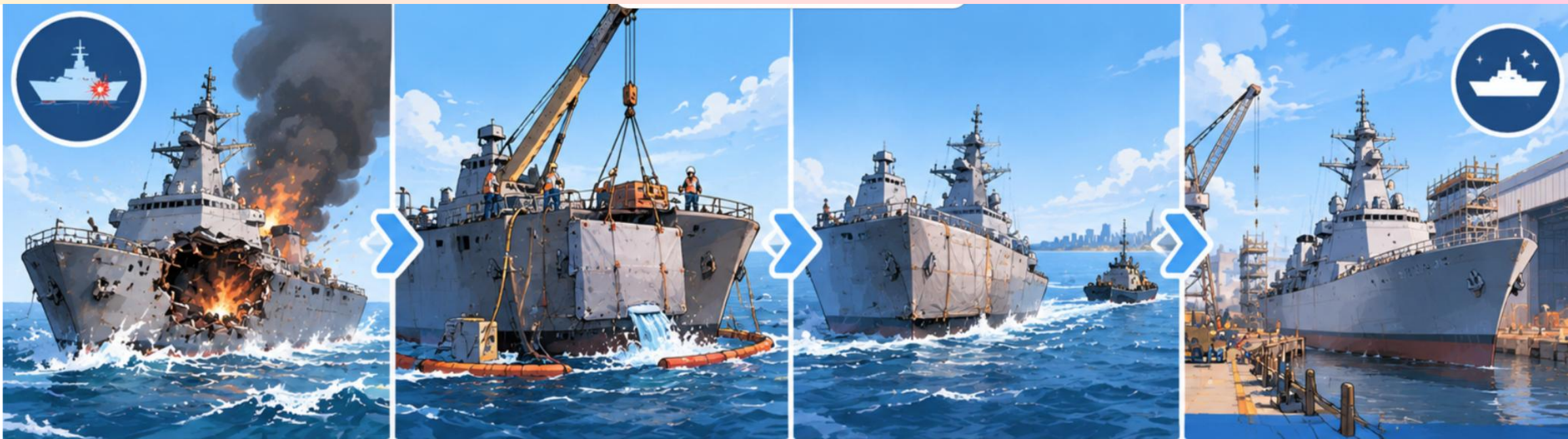
2

Damage Control Surgery (DCS) for TCA

Resuscitative thoracotomy
for Traumatic Cardiorespiratory Arrest

외상손상통제술의 의미

Damage Control Surgery



AI 활용 이미지

Traumatic Circulatory Arrest(TCA)

- Major Causes of TCA
 - Hemorrhagic shock / Hypovolemia (Circulation)
 - Hypoxemia (Airway / Breathing)
 - Tension pneumothorax (Breathing / Circulation)
 - Cardiac tamponade (Circulation)

■ Table 6-8: Signs of Life for Assessment During Traumatic Cardiac Arrest.

SIGN
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Palpable pulse
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Electrical cardiac activity

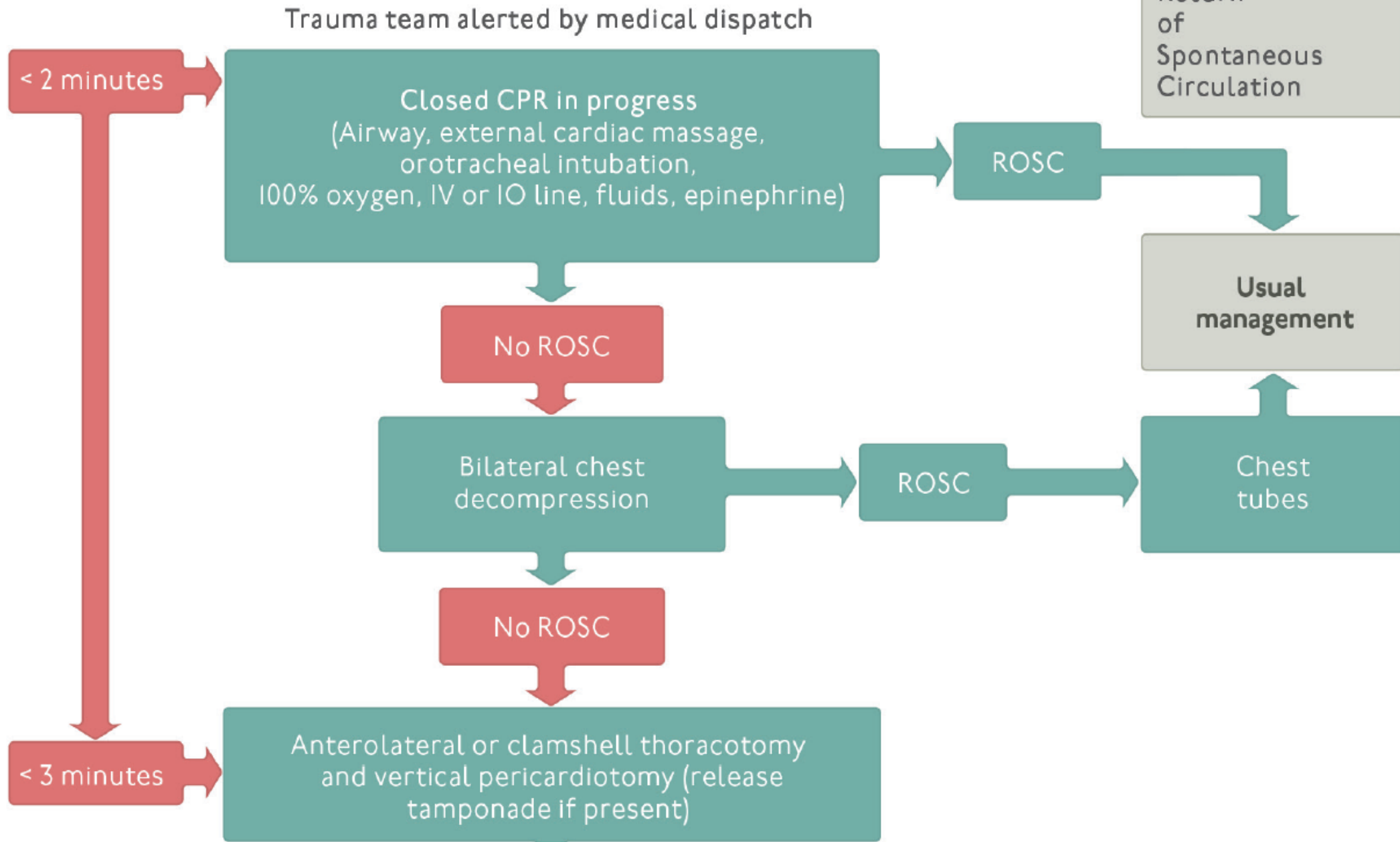
Traumatic Circulatory Arrest(TCA)

- Immediate Interventions
 - Secure airway
 - Provide 100% oxygen
 - Control external hemorrhage
 - Rapid blood/fluid resuscitation
 - Bilateral chest decompression

Traumatic circulatory arrest (penetrating or blunt) with no pulse

**Operating room
with
surgeon present
mandatory**

ROSC =
Return
of
Spontaneous
Circulation



An evidence-based approach to patient selection for emergency department thoracotomy: A practice management guideline from the Eastern Association for the Surgery of Trauma

Population:

Strongly recommend

**Conditionally
recommend**

Against EDT

1. Patients presenting pulseless to the emergency department with signs of life after penetrating thoracic injury
2. Patients presenting pulseless to the emergency department without signs of life after penetrating thoracic injury
3. Patients presenting pulseless to the emergency department with signs of life after penetrating extrathoracic injury
4. Patients presenting pulseless to the emergency department without signs of life after penetrating extrathoracic injury
5. Patients presenting pulseless to the emergency department with signs of life after blunt injury
6. Patients presenting pulseless to the emergency department without signs of life after blunt injury

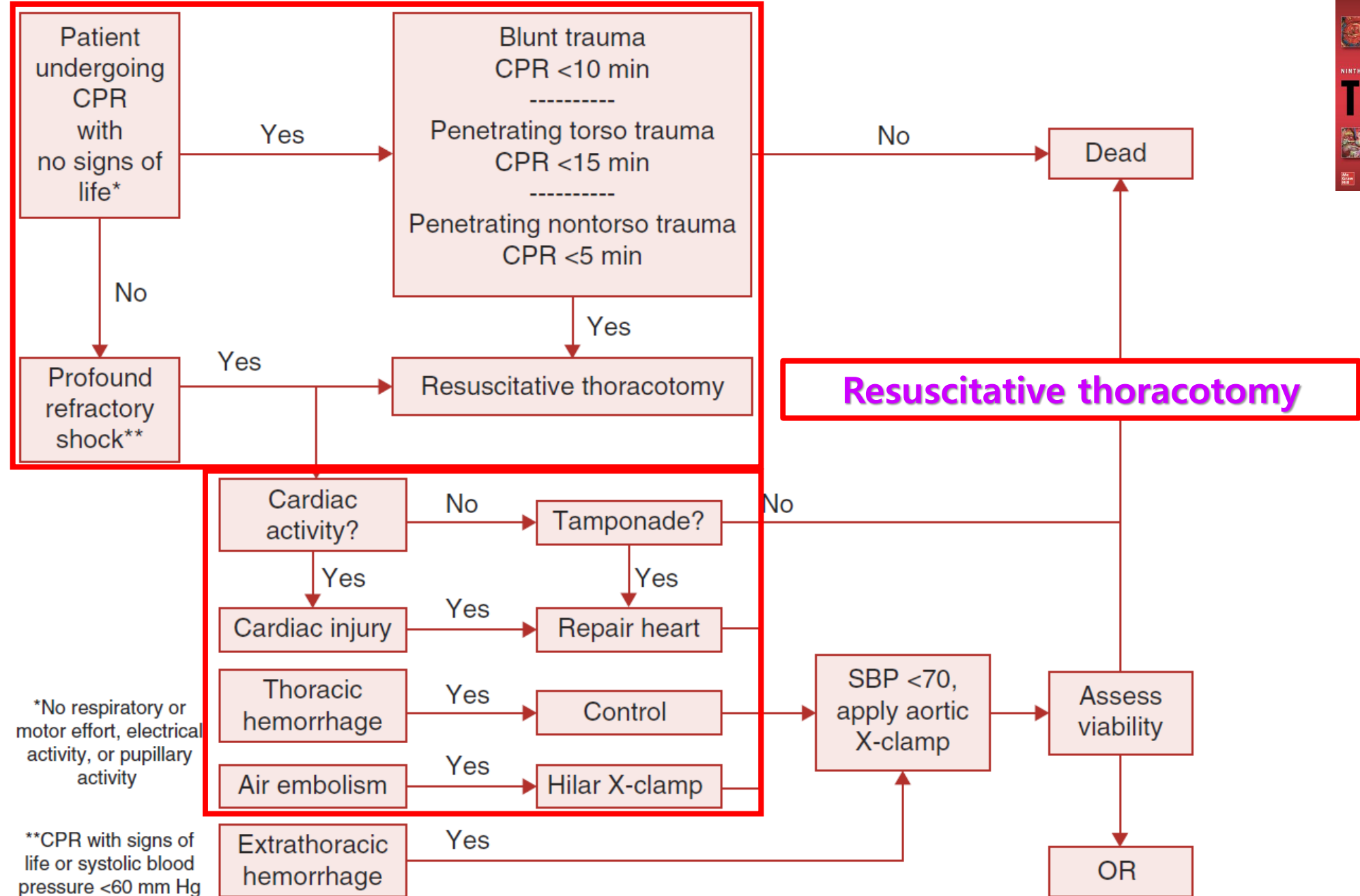


FIGURE 17-1 Algorithm directing the use of resuscitative thoracotomy in the multiply injured trauma patient. CPR, cardiopulmonary resuscitation; OR, operating room; X-clamp, cross-clamp.

Traumatic Circulatory Arrest(TCA)

- If ROSC Occurs
 - ➡ Continue definitive trauma resuscitation
- If No ROSC, consider: Resuscitative Thoracotomy(RT)
 - based on institutional policy,
available surgical expertise,
resource availability
- Particularly relevant in penetrating trauma

Traumatic Circulatory Arrest(TCA)

■ Table 6-8: Signs of Life for Assessment During Traumatic Cardiac Arrest.

- Functional survival is unlikely when:
 - CPR > 10 min after blunt trauma
 - CPR > 15 min after penetrating trauma
 - Ultrasound shows:
 - No cardiac tamponade
 - No cardiac motion
- Electrical activity only (PEA without cardiac movement)

SIGN
Pupillary response
Spontaneous ventilation
Palpable pulse
Measurable blood pressure
Extremity movement
Electrical cardiac activity

Aims of resuscitative thoracotomy(RT)

- To relieve cardiac tamponade
- To perform open cardiac massage
- To control life-threatening intrathoracic hemorrhage
- To control air embolism or bronchopleural fistula
- To occlude the thoracic aorta
(to improve cerebral and coronary circulation &
decrease intra-abdominal and pelvic hemorrhage)

Advanced prehospital care



- Scoop and Run vs. Stay and Play

Minimize scene time: Platinum 10 minutes

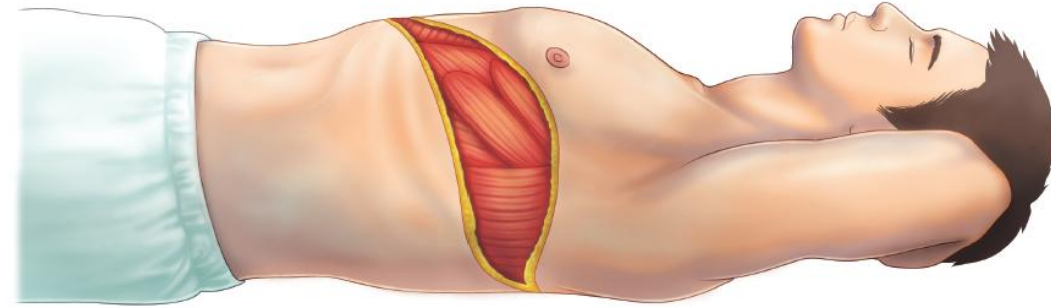
- If prolonged transport time ???
- Resuscitative thoracotomy on scene



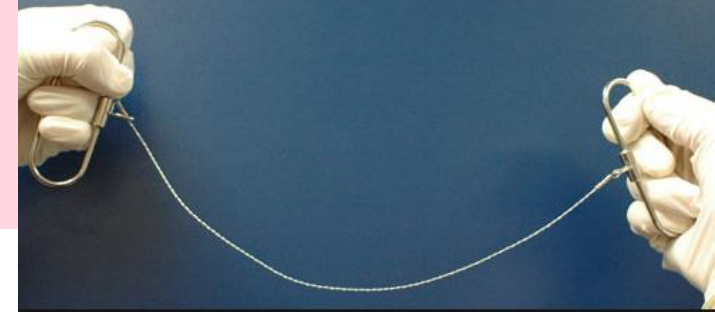


Operative technique 1

- Intubation: selective right, left lung is deflated
- Sedation and muscle relaxant
- Prep/draping should not delay procedure
- Position: towel under left posterior chest, arm above the head
- Supine anterolateral thoracotomy
- Left sided approach: used in all patients in traumatic arrest and with injuries to the left chest
- Right first: not arrested, with profound hypotension d/t Rt. injuries



Operative technique 2

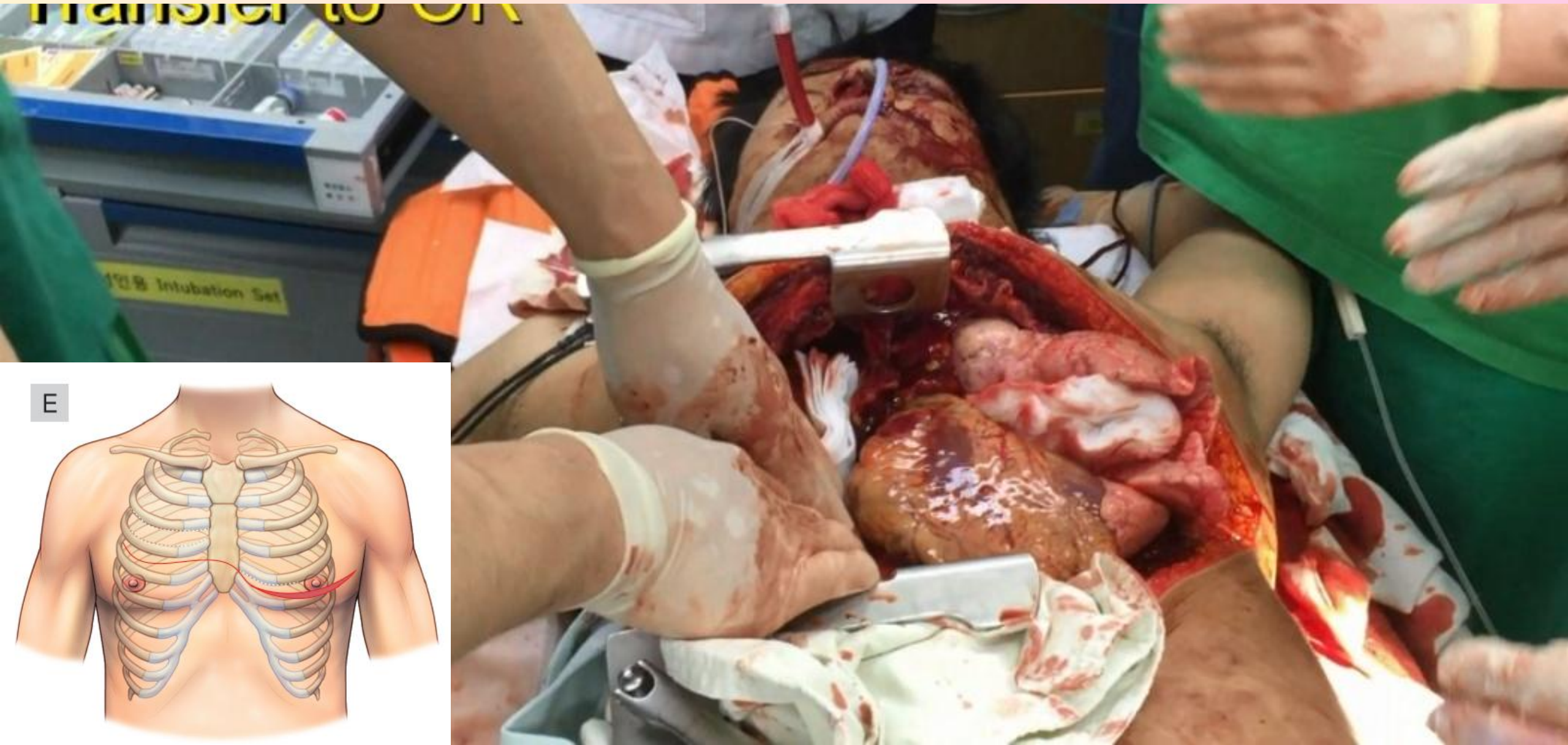


- Skin incision: 5th (4th) ICS → from border of the sternum to mid-axillary line
- Intercostal muscle: incised with a combination of scalpel, heavy scissors and blunt dissection
- Depth: take care not to lacerate the lung
- Insert the rib spreaders between the ribs and open
- Sternum division by Gigli saw or large trauma shears
- Caution during division of the sternum - Clipping/ligation of IMA



소생개흉술 술기

Clamshell thoracotomy



E

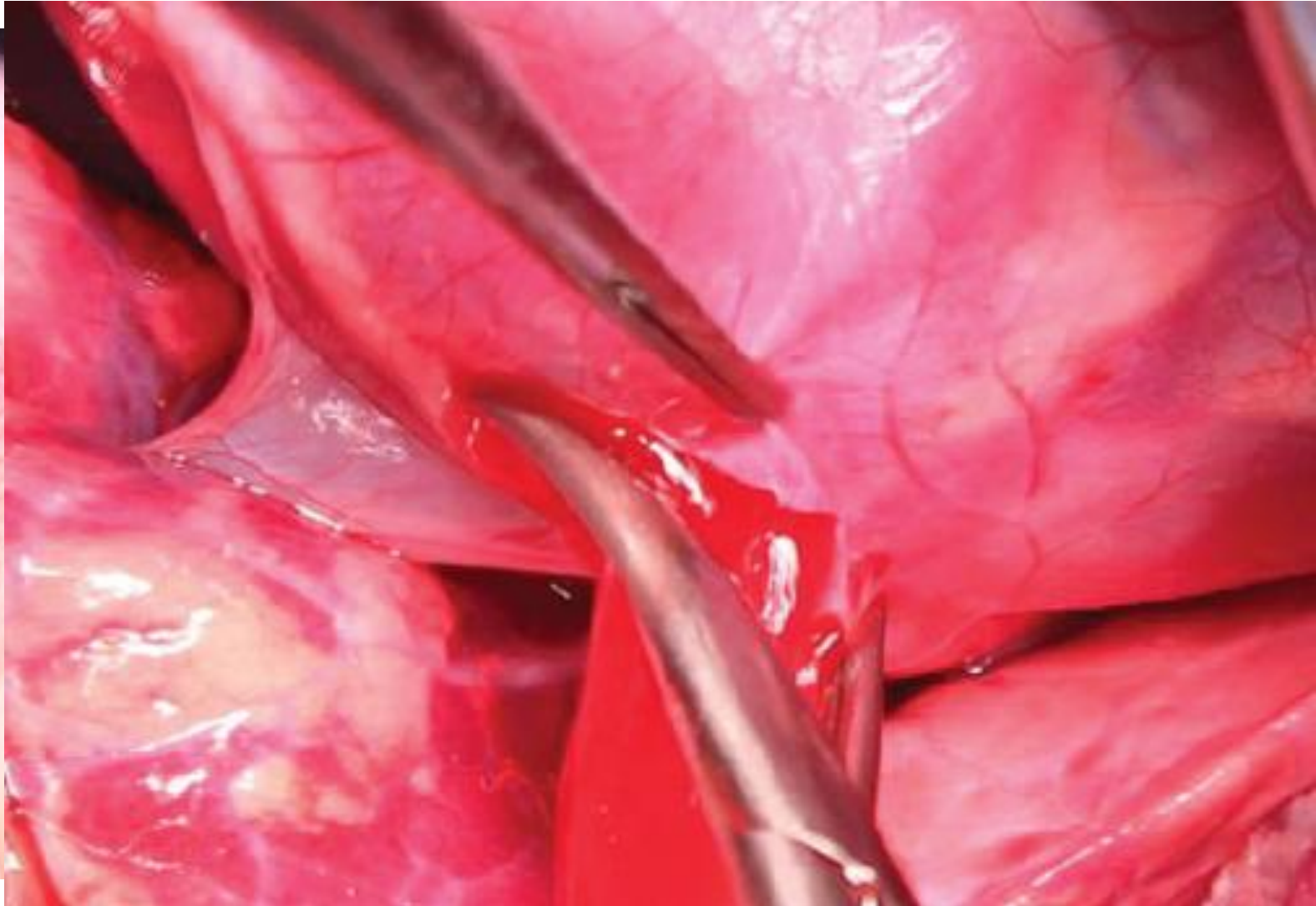


Resuscitative Thoracotomy

Trauma Center
Yonsei University Hospital
Sung Wook, Chang

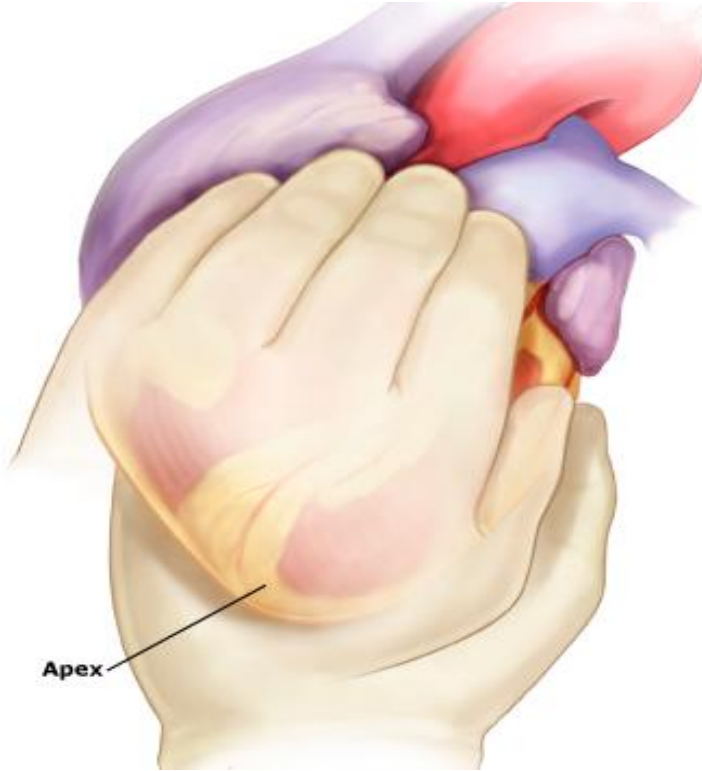
심장눌림증 해결

Relief of tamponade by open pericardiotomy



개흉심장마사지

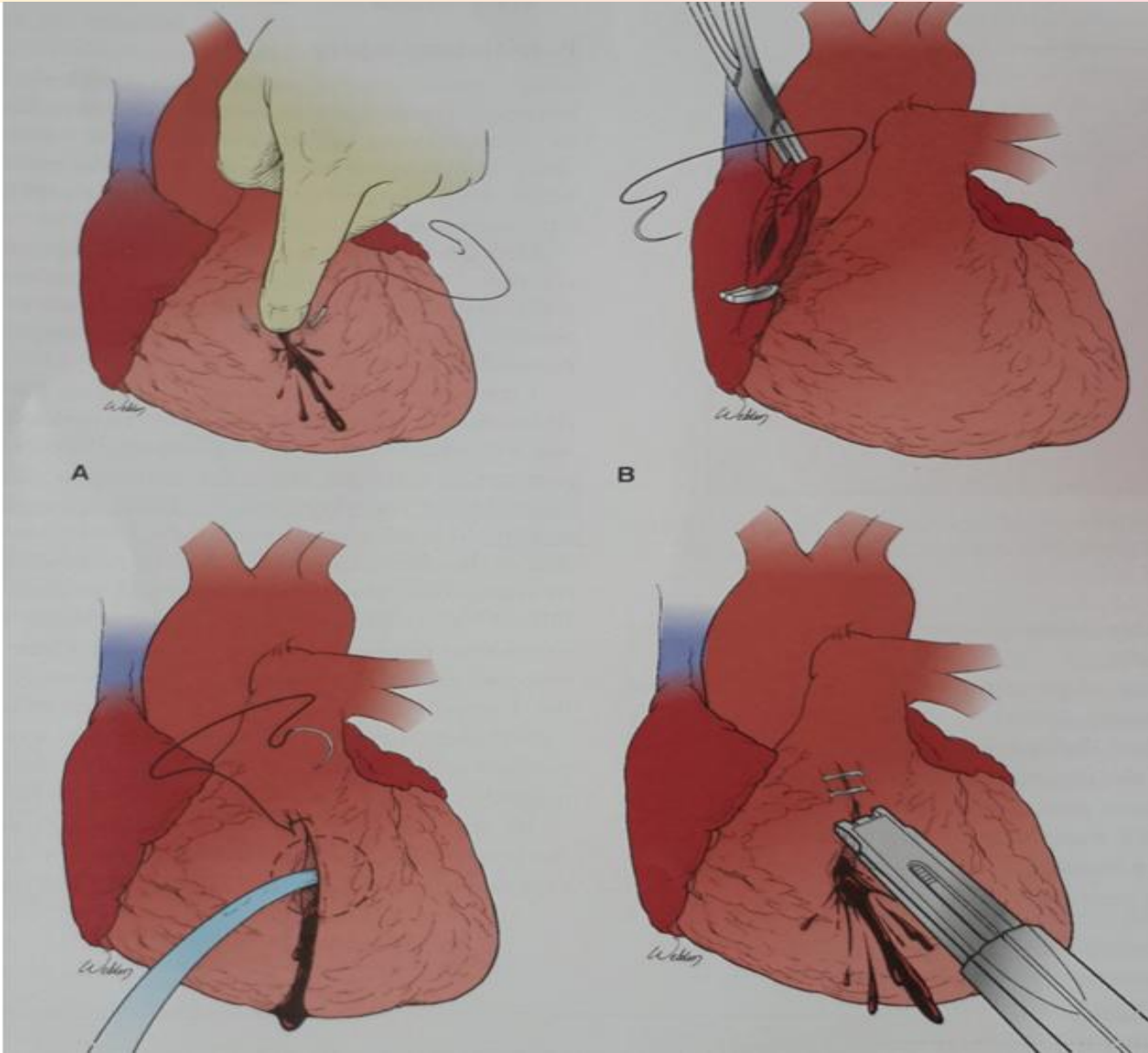
Open cardiac massage



Reach up to 60% (ejection fraction)

심장손상에 대한 손상통제술

Temporary management of cardiac injury





3

REBOA for TCA

Resuscitative Endovascular Balloon
Occlusion of the Aorta

대량 출혈-시간이 답인가?

Massive bleeding and golden hour

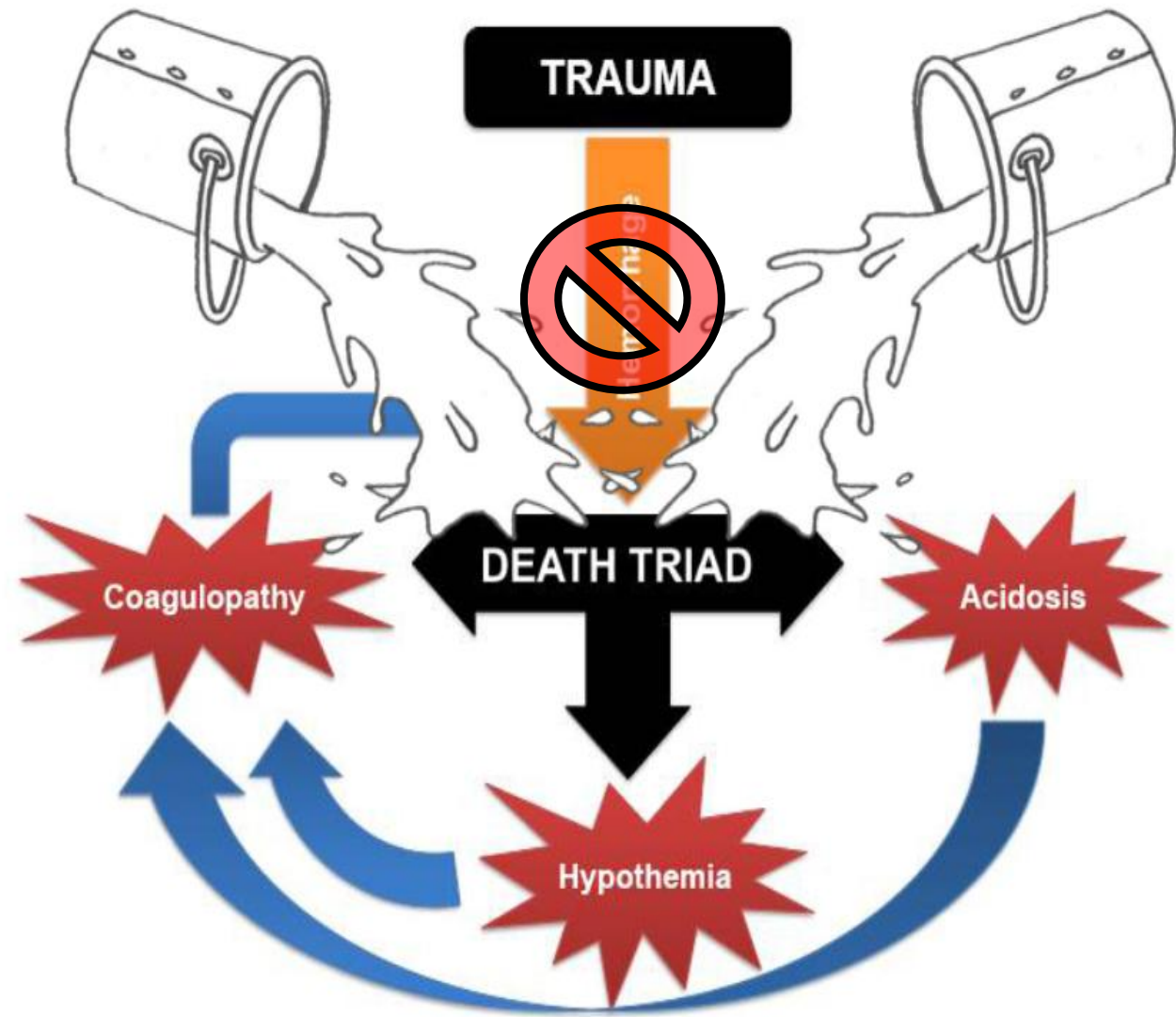
1 mL/sec

→ 60 mL/min

→ 3600 mL/hour

Terrible hemorrhage !!!

Lethal triad & Damage Control Surgery



RT-ACC

Resuscitative **T**horacotomy followed by **A**ortic **C**ross **C**lamping
: To **increase perfusion** to the **heart** and **brain**
To **reduce subdiaphragmatic bleeding**

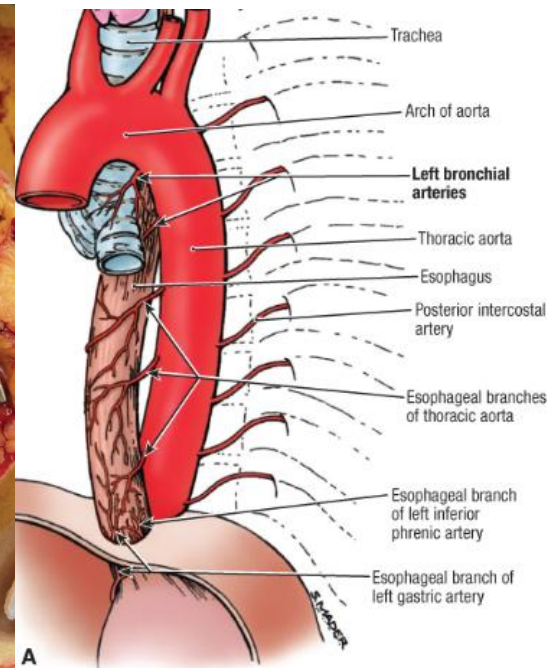
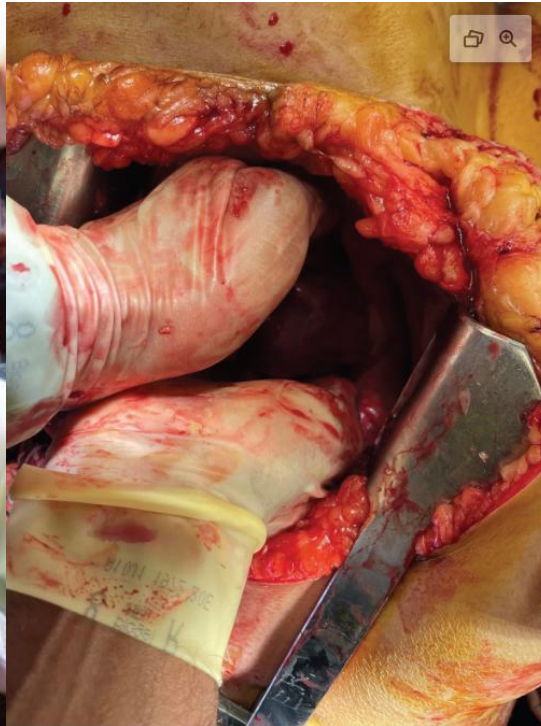
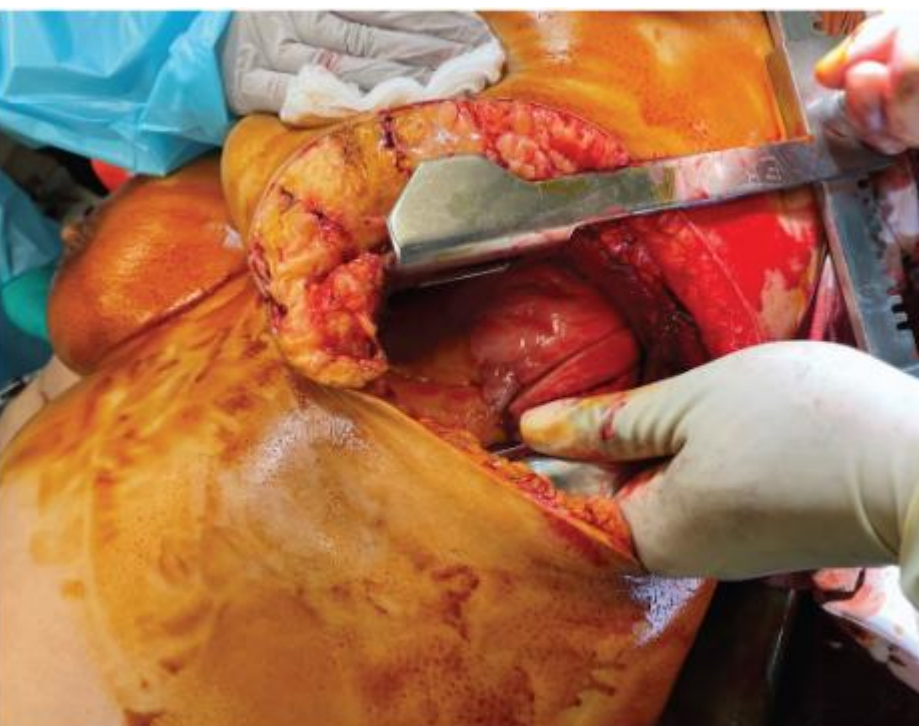
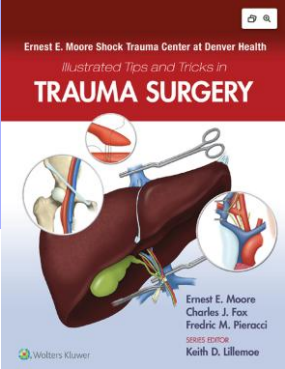
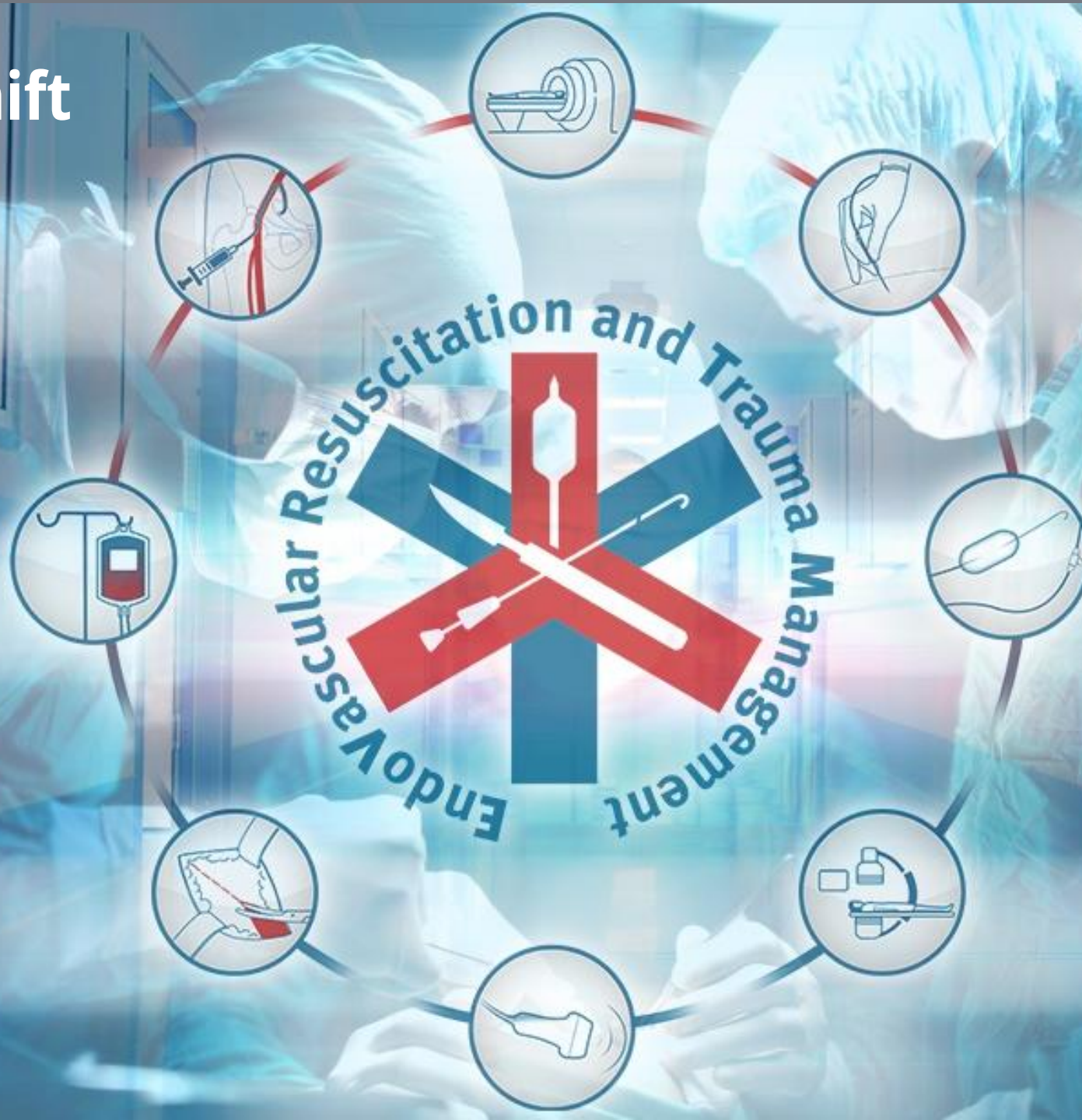


Figure 1.9 The descending thoracic aorta is immediately anterior to the spine (A), and should be clamped just above the diaphragm (B).

Paradigm shift



Initial assessment for trauma care

KEY POINTS

- The goal of the initial assessment is the rapid identification and treatment of life-threatening injuries.
- Structured handoffs from EMS improve communication to the trauma team.
- The resuscitation bay should contain all instruments and equipment required in a major trauma.
- Trauma team composition should have sufficient personnel to both assess and treat the severely injured.
- The team leader should be the most senior person on the team with an understanding of injury.
- Coordination of care by the team leader is crucial to successful trauma assessments and resuscitation.

- The initial assessment should follow the standard primary and secondary survey algorithms as outlined in Advanced Trauma Life Support (ATLS).
- Patients who arrive in shock require even more rapid assessment and treatment by the most senior personnel.
- Initiating the resuscitation with intraosseous access can be lifesaving in patients in shock.
- Early arterial access for subsequent resuscitative endovascular balloon occlusion of the aorta (REBOA) deployment should be considered for patients presenting with subdiaphragmatic life-threatening hemorrhage.

Necessary equipment

✓ Catheter-based hemorrhage control using REBOA



TABLE 13-1: Necessary Ancillary Equipment for a Complete Initial Assessment

Universal tray: hemostats/clamps, retractors (ie, self-retaining, army/navy), pick-ups, needle drivers.

Head and neck: suture material for scalp wounds, intracranial pressure catheters, scopes and light sources for eye and naso-/oropharynx exam, cervical collars.

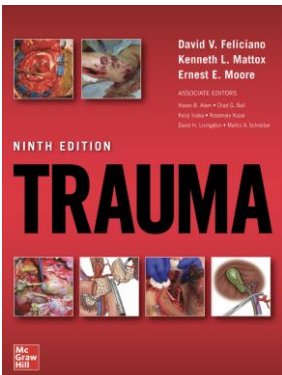
Airway: preassembled airway kit/box. These can be constructed with input from the airway team but should include endotracheal tubes (various sizes), stylets, capnography, and traditional laryngoscopes. Video laryngoscopes, difficult airway devices (bougies, intubating laryngeal mask airway) tracheostomy tubes, ventilator availability, arterial blood gas kits.

Chest: chest tubes of various sizes (pediatric through adult), chest drainage system, chest tube and thoracotomy instrument tray (see below).

Abdominal and pelvis: ultrasound, diagnostic peritoneal lavage kit, nasogastric tube, urethral catheter (temperature sensing if available), pelvic binder (commercial or homemade device).

Extremity: pneumatic tourniquet, Doppler, cast material.

Shock: intravenous pressure bags, blood and fluid warming systems, large-bore central access catheters, arterial access catheters, intraosseous devices, scalpels, thoracotomy equipment, resuscitative endovascular balloon occlusion of the aorta (REBOA) equipment.





Damage control in
Korean folk tale



Damage control in
Korean folk tale

국내에서 사용가능한 장비

REBOA kit: small sized compliant balloon



φ25 / 15 mL



φ30 / 21 mL



φ35 / 28 mL

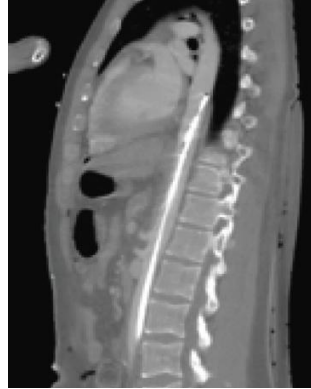


φ40 / 40 mL

The correlation between volume and size of inflated balloon

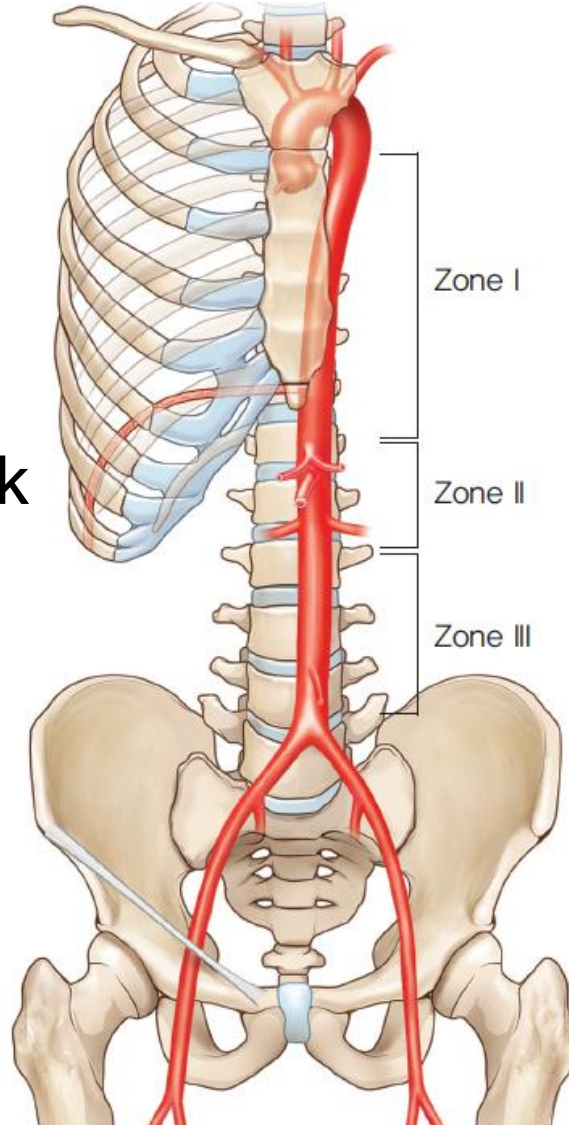
Example: 7 Fr RESCUE Balloon™ (Tokai Medical Products, Aichi, Japan)

Occlusion level of the aorta (REBOA zone)



Zone 2: from the celiac trunk
to lowest renal a.

→ No occlusion



Zone 1: from left subclavian a.
to celiac trunk

→ Abdominal
or truncal hemorrhage

Zone 3: from the lowest renal a.
to aortic bifurcation

→ Pelvic hemorrhage



Advantages of REBOA procedure

Resuscitative Endovascular Balloon Occlusion of the Aorta

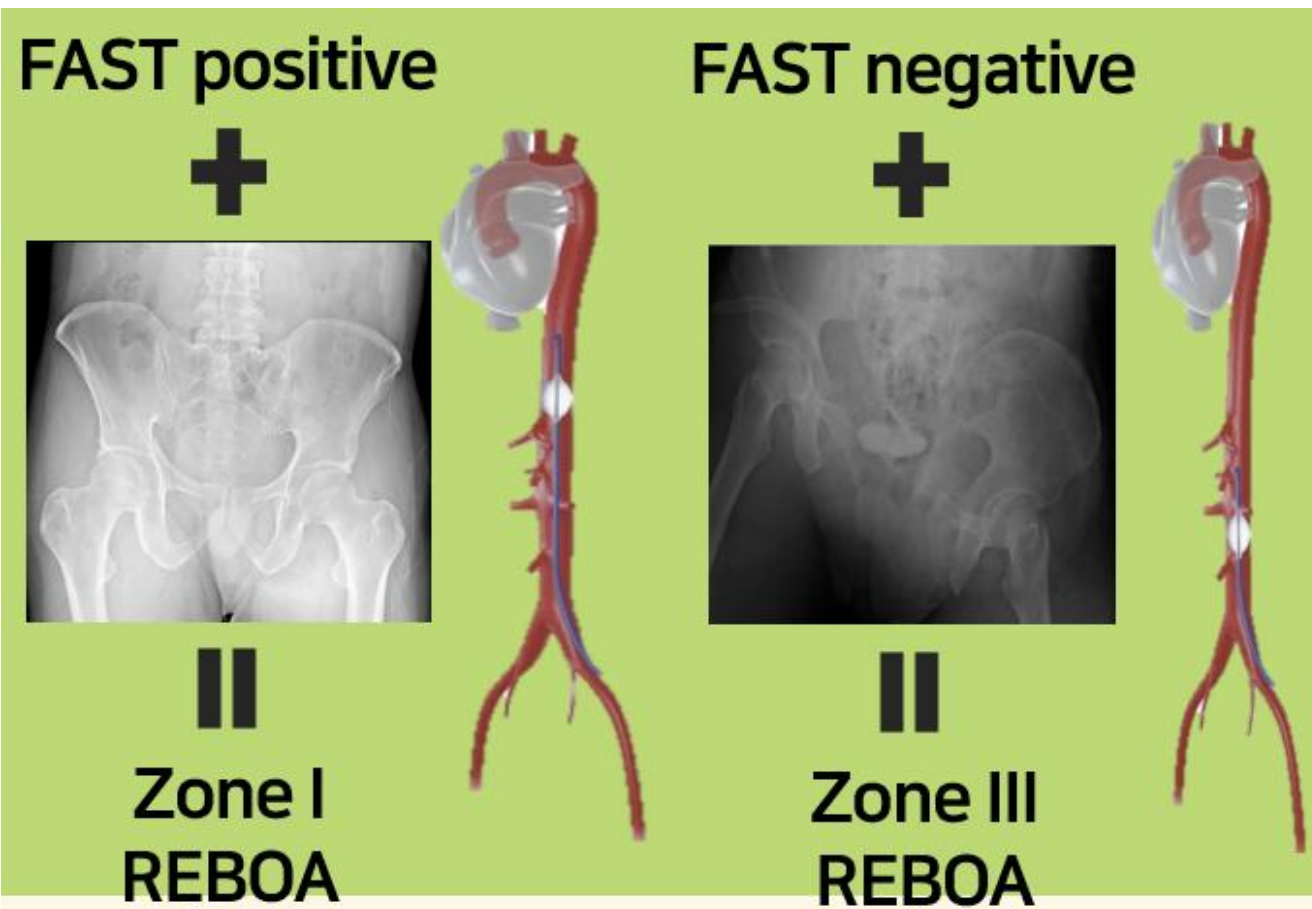
- Less invasive than resuscitative thoracotomy followed by ACC
- Different occlusion levels depending on hemorrhage focus
- All treatment strategies: complete/partial/intermittent occlusion
 - avoid organ ischemia
- Below the inflated balloon
 - decreased the active bleeding
 - permitted circulation by partial occlusion



Resuscitative Endovascular
Balloon Occlusion of the Aorta
(REBOA)

Joint statement from the American College of Surgeons Committee on Trauma (ACS COT) and the American College of Emergency Physicians (ACEP) regarding the clinical use of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA)

Brenner M, et al. Trauma Surg Acute Care Open 2018;3:1-3.



INDICATIONS FOR REBOA

- ▶ REBOA is indicated for traumatic life-threatening hemorrhage below the diaphragm in patients in hemorrhagic shock who are unresponsive or transiently responsive to resuscitation.
- ▶ REBOA is indicated for patients arriving in arrest from injury due to presumed life-threatening hemorrhage below the diaphragm. No evidence exists for the recommended duration of arrest and use of REBOA but should be used within the same time period as would resuscitative thoracotomy.
- ▶ The balloon catheter may be inflated at the distal thoracic aorta (Zone 1) for control of severe intra-abdominal or retroperitoneal hemorrhage, or those with traumatic arrest.
- ▶ The balloon catheter may be inflated at the distal abdominal aorta (Zone 3) for patients with severe pelvic, junctional, or proximal lower extremity hemorrhage.

Clinical use of REBOA in the U.S.A, 2019

- No high-grade evidence defining the specific indications
- A multidisciplinary team-based approach, systems of care
- Early common femoral arterial access and continuous BP monitoring
- Zone 1: control of intra-abdominal or retroperitoneal hemorrhage
- Zone 3: severe isolated pelvic, junctional, or proximal lower extremity hemorrhage not amenable to a tourniquet
- Zone 3 REBOA may be tolerated for longer periods of time
- Partial or intermittent occlusion strategies

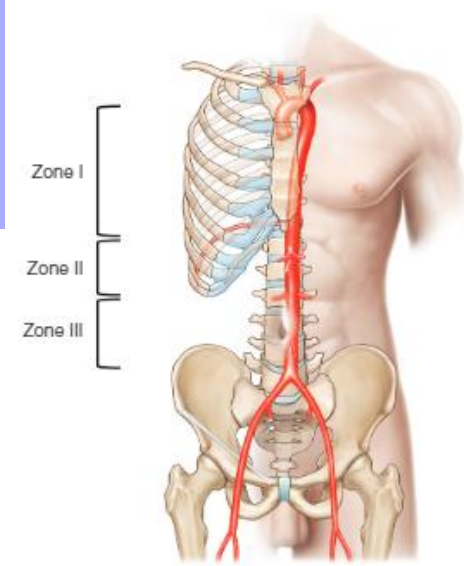
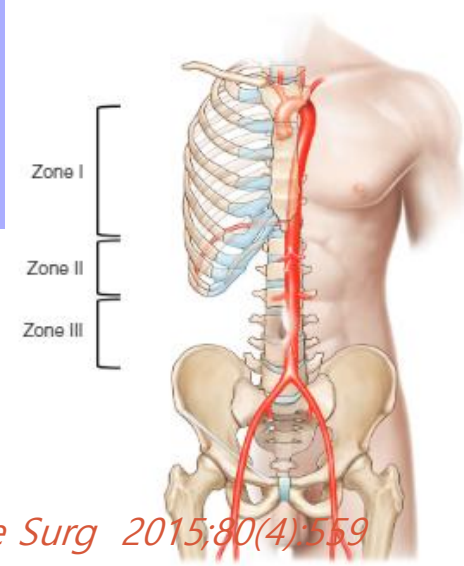


Table 2 Partial REBOA rollout collaborative institutional algorithms for REBOA patient selection

Institution	Data sources cited	Trigger for early CFA access	Contraindications to REBOA	Criteria for REBOA patient selection
Ernest E Moore Shock Trauma Center at Denver Health (Denver, Colorado)	No	▶ SBP <100: 5Fr. ▶ SBP <90: 7Fr. ▶ SBP <80: REBOA.	▶ Active thoracic bleeding.	▶ SBP <80 and cavitory triage.
Grady Memorial Hospital (Atlanta, Georgia)	No	▶ Concern for truncal hemorrhage. ▶ SBP <90, received 2 units of blood product, or transient transponder.	▶ Not specified.	▶ SBP <90. ▶ Transient responder to resuscitation. ▶ Non-responder to 2 units of blood. ▶ Traumatic cardiac arrest.
Grant Medical Center (Columbus, Ohio)	No	▶ SBP <90. ▶ Transient responder. ▶ Profound, refractory shock. ▶ OHCA with ROSC.	▶ Not specified.	▶ SBP <90 with inadequate response to resuscitation. ▶ Profoundly hypotensive. ▶ Hypovolemic cardiac arrest and not beyond salvage.
University of Maryland Shock Trauma Center (Baltimore, Maryland)	No	▶ None specified.	▶ Not specified.	▶ Persistently hypotensive or transient responder. ▶ Low suspicion for aortic injury. ▶ Evidence of vascular continuity from CFA to thoracic aorta. ▶ Attending trauma surgeon or intensivist discretion.
St Michael's Hospital (Toronto, Ontario)	Yes	▶ Pelvic fracture. ▶ Positive FAST and SBP <90.	▶ Not specified.	▶ Traumatic arrest for abdominal/pelvic/junctional hemorrhage provided reversible cause suspected. ▶ SBP <90 and transient or non-responder with positive abdominal FAST or pelvic X-ray (blunt) or abdominal/pelvic/junctional injury (penetrating).
University Medical Center New Orleans (New Orleans, Louisiana)	Yes	▶ SBP <90 and partial or non-responder.	▶ Blunt: possible aortic injury on CXR. ▶ Penetrating: possible supradiaphragmatic or cardiac injury.	▶ Blunt: SBP <90 and partial or non-responder. ▶ Penetrating: SBP <90 and truncal/lower extremity injury (in OR). ▶ In OR: SBP <90, transient responder, profound refractory shock, or prehospital CPR with ROSC.
Vanderbilt University Medical Center (Nashville, Tennessee)	No	▶ SBP <80 with a pulse.	▶ Thoracic aortic injury.	▶ Transient or non-responder.

General recommendations



- Door-to-primary surgery time $\leq$ 60 minutes
if, surgery time $\geq$ 60 minutes could worsen in-hospital mortality

Inoue J et al. J Trauma Acute Care Surg. 2015;80(4):559

- A median time from ED arrival to balloon inflation: 20 minutes

Saito N et al. J Trauma Acute Care Surg. 2015;78(5):897; discussion 904

- The mean aortic occlusion time: 18 – 21 minutes

Brenner ML et al. J Trauma Acute Care Surg. 2013;75(3):506

- Ideal time $\leq$ 40 minutes

Saito N et al. J Trauma Acute Care Surg. 2015;78(5):897; discussion 904

if, occlusion time $\geq$ 40 minutes: without significant procedure
-related complications

Qasim Z et al. Resuscitation. 2015;95:275

- Systolic BP at the ED $\leq$ 80 mmHg

Inoue J et al. J Trauma Acute Care Surg. 2015;80(4):559

Pelvic bleeding

Coccolini et al. *World Journal of Emergency Surgery* (2017) 12:5
DOI 10.1186/s13017-017-0117-6

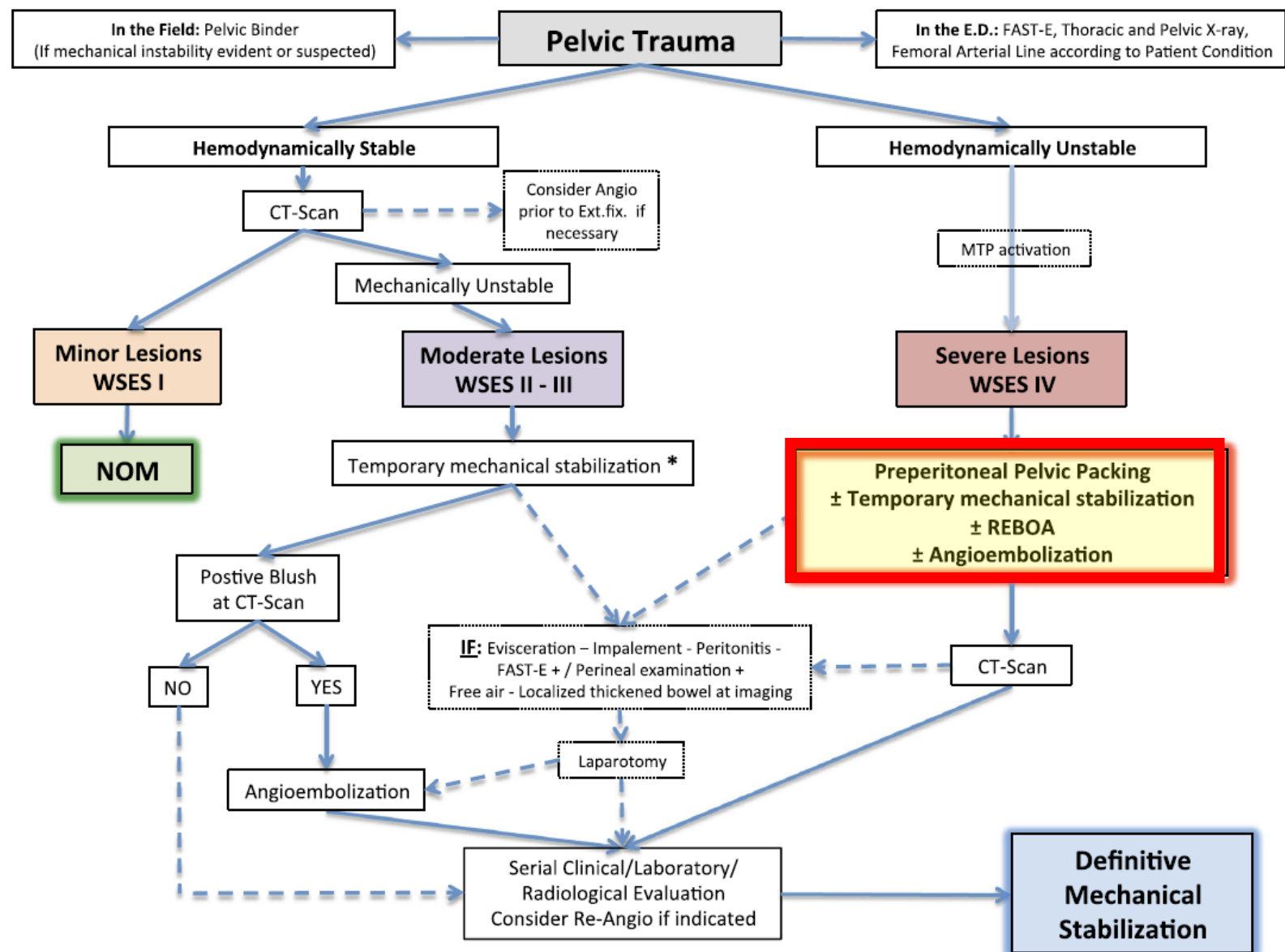
World Journal of
Emergency Surgery

Open Access



Pelvic trauma: WSES classification and guidelines

Federico Coccolini^{1*}, Philip F. Stahel², Giulia Montori¹, Walter Biffi³, Tal M Horer⁴, Fausto Catena⁵, Yoram Kluger⁶, Ernest E. Moore⁷, Andrew B. Peitzman⁸, Rao Ivatury⁹, Raul Coimbra¹⁰, Gustavo Pereira Fraga¹¹, Bruno Pereira¹¹, Sandro Rizoli¹², Andrew Kirkpatrick¹³, Ari Leppaniemi¹⁴, Roberto Manfredi¹, Stefano Magnone¹, Osvaldo Chiara¹⁵, Leonardo Solaini¹, Marco Ceresoli¹, Niccolò Allievi¹, Catherine Arvieux¹⁶, George Velmahos¹⁷, Zsolt Balogh¹⁸, Noel Naidoo¹⁹, Dieter Weber²⁰, Fikri Abu-Zidan²¹, Massimo Sartelli²² and Luca Ansaloni¹



Retroperitoneal bleeding

Coccolini et al. World Journal of Emergency Surgery (2019) 14:54
https://doi.org/10.1186/s13017-019-0274-x

World Journal of
Emergency Surgery

REVIEW

Open Access



Kidney and uro-trauma: WSES-AAST guidelines

Federico Coccolini^{1*}, Ernest E. Moore², Yoram Kluger³, Walter Biffi⁴, Ari Leppaniemi⁵, Yosuke Matsumura⁶, Fernando Kim⁷, Andrew B. Peitzman⁸, Gustavo P. Fraga⁹, Massimo Sartelli¹⁰, Luca Ansaloni¹¹, Goran Augustin¹², Andrew Kirkpatrick¹³, Fikri Abu-Zidan¹⁴, Imitiaz Wani¹⁵, Dieter Weber¹⁶, Emmanouil Pikoulis¹⁷, Martha Larrea¹⁸, Catherine Arvieux¹⁹, Vassil Manchev²⁰, Viktor Reva²¹, Raul Coimbra²², Vladimir Khokha²³, Alain Chichom Mefire²⁴, Carlos Ordonez²⁵, Massimo Chiarugi¹, Fernando Machado²⁶, Boris Sakakushev²⁷, Junichi Matsumoto²⁸, Ron Maier²⁹, Isidoro di Carlo³⁰, Fausto Catena³¹ and WSES-AAST Expert Panel

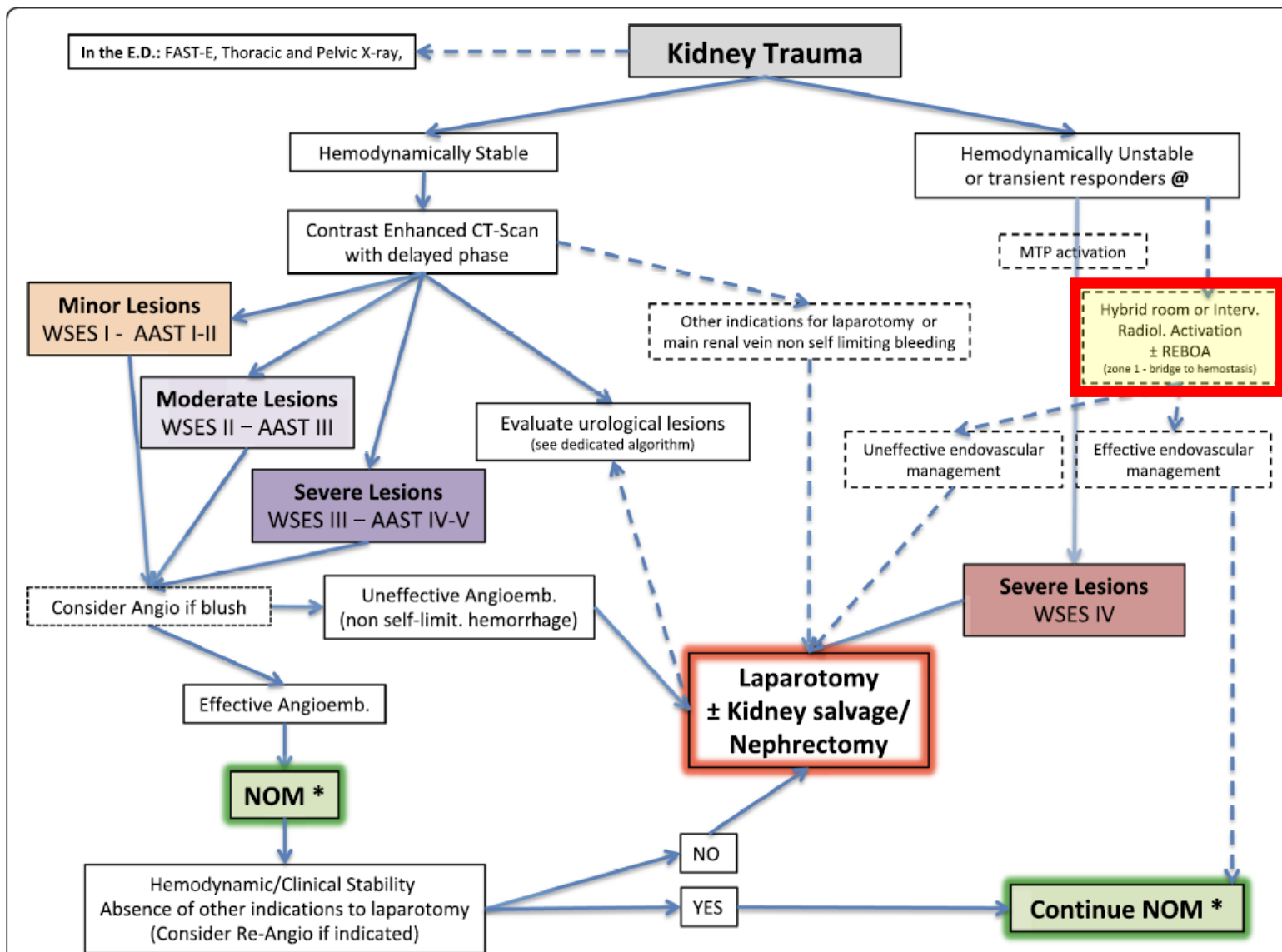


Fig. 3 Kidney trauma management algorithm

Intraabdominal bleeding

Coccolini et al. World Journal of Emergency Surgery (2020) 15:24
https://doi.org/10.1186/s13017-020-00302-7

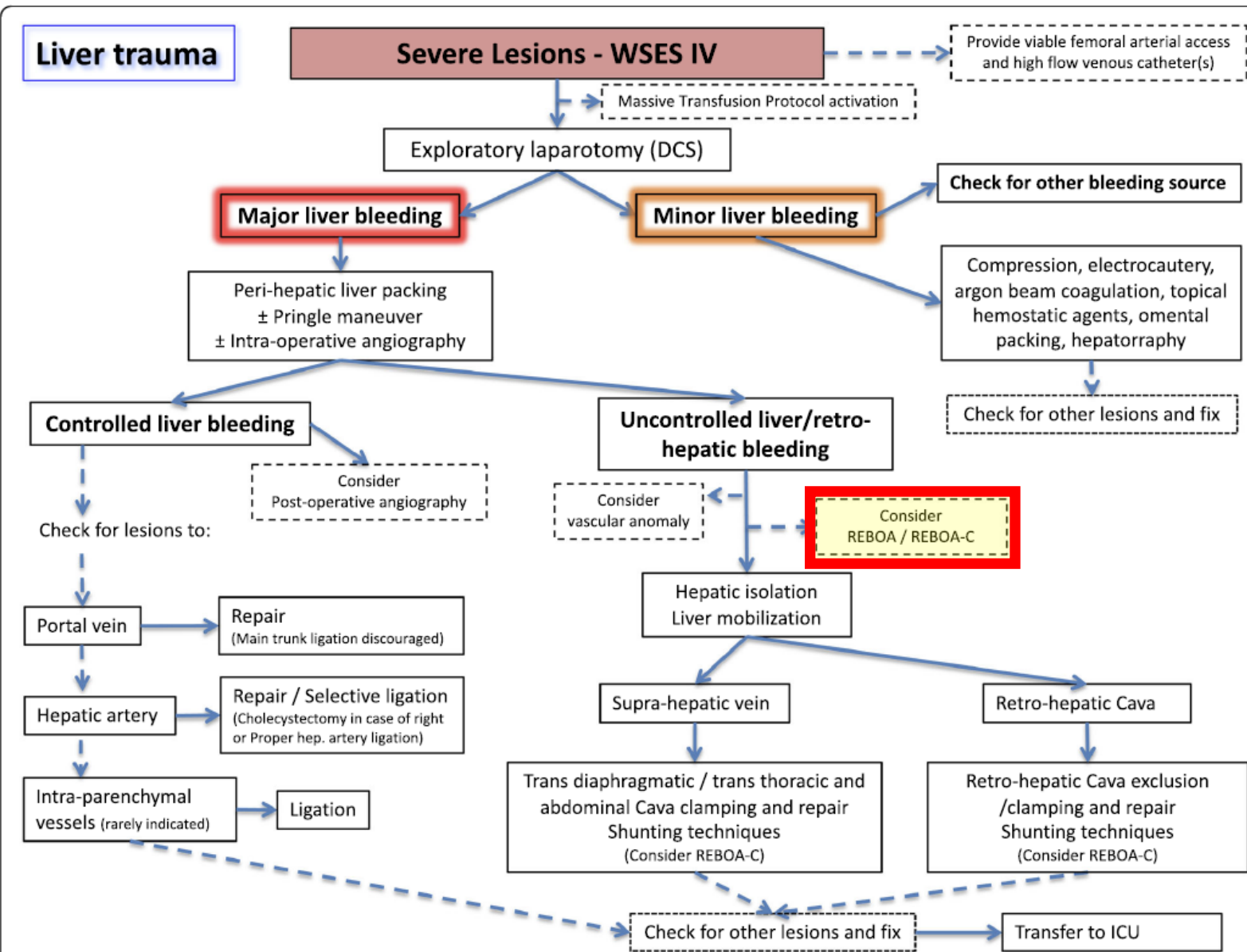
World Journal of
Emergency Surgery

REVIEW

Open Access

Liver trauma: WSES 2020 guidelines

Federico Coccolini^{1*}, Raul Coimbra², Carlos Ordonez³, Yoram Kluger⁴, Felipe Vega⁵, Ernest E. Moore⁶, Walt Biffi⁷, Andrew Peitzman⁸, Tal Horer^{9,36}, Fikri M. Abu-Zidan¹⁰, Massimo Sartelli¹¹, Gustavo P. Fraga¹², Enrico Cicuttin¹, Luca Ansaloni¹³, Michael W. Parra¹⁴, Mauricio Millán³, Nicola DeAngelis¹⁵, Kenji Inaba¹⁶, George Velmahos¹⁷, Ron Maier¹⁸, Vladimir Khokha¹⁹, Boris Sakakushev²⁰, Goran Augustin²¹, Salomone di Saverio²², Emanuel Pikoulis²³, Mircea Chirica²⁴, Viktor Reva²⁵, Ari Leppaniemi²⁶, Vassil Manchev²⁷, Massimo Chiarugi¹, Dimitrios Damaskos²⁸, Dieter Weber²⁹, Neil Parry³⁰, Zaza Demetrashvili³¹, Ian Civil³², Lena Napolitano³³, Davide Corbella³⁴, Fausto Catena³⁵ and the WSES expert panel



Original Research Article

The American Journal of Surgery 224 (2022) 125–130

Gaining or wasting time? Influence of time to operating room on mortality after temporary hemostasis using resuscitative endovascular balloon occlusion of the aorta



Ryo Yamamoto^{a,b,*}, Abdul Alarhayem^c, Mark T. Muir^b, Donald H. Jenkins^b, Brian J. Eastridge^b, Mark L. Shapiro^d, Ramon F. Cestero^b

Methods: Using the 2016–2017 ACS-TQIP database, patients were divided based on the transfer time to OR: ≤ 1 h (early) and >1 h (delayed). In each group, patients who underwent REBOA in emergency department (ED-REBOA) were matched with those without REBOA (non-REBOA) using propensity scores, and survival to discharge was compared.

Results: Among 163,453 patients, 114 and 138 patients (38 and 46 ED-REBOA) were included in the early and delayed groups, respectively. Survival to discharge was comparable between ED-REBOA and non-REBOA patients in the early group (39.5% vs. 48.7%, $p = 0.35$), whereas it was higher in ED-REBOA patients in the delayed group (39.1% vs. 12.0%, $p < 0.01$).

Conclusions: Patients with delayed transfer to OR >1 h benefited from REBOA.



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

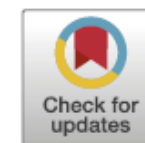
The American Journal of Surgery

journal homepage: www.americanjournalofsurgery.com



The American Journal of Surgery 220 (2020) 1485e1491

Delays in Surgical Intervention and Temporary Hemostasis Using Resuscitative Endovascular Balloon Occlusion of the aorta (REBOA): Influence of Time to Operating Room on Mortality



Ryo Yamamoto ^{a, b, *}, Ramon F. Cestero ^b, Mark T. Muir ^b, Donald H. Jenkins ^b, Brian J. Eastridge ^b, Tomohiro Funabiki ^c, Junichi Sasaki ^a

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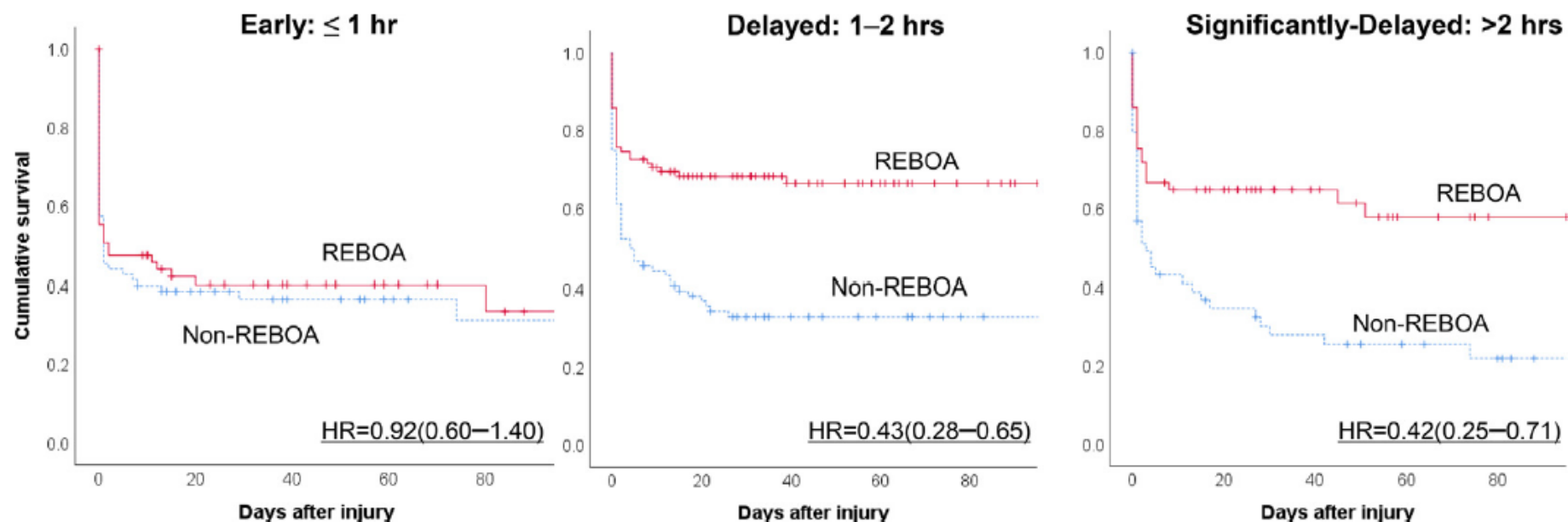
^c Department of Trauma and Emergency Surgery, Saiseikai Yokohamashi Tobu Hospital, 3-6-1 Shimosueyoshi, Tsurumiku, Yokohama, Kanagawa, 230-8765, Japan

Table 3

Transfer time to OR and effectiveness of REBOA.

Three subgroups based on the transfer time to the OR after hospital arrival

	REBOA	no REBOA	P value	OR	95% CI
Early: within 1 h					
Survival to discharge	26(39.4%)	26(33.8%)	0.49	1.28	0.64–2.53
Survival at 28 days	27(40.9%)	29(37.7%)	0.69	1.15	0.58–2.25
Hospital-free days to day 90 (days)	17 ± 28	15 ± 26	0.40		
Delayed: 1–2 h					
Survival to discharge	66(66.0%)	30(33.0%)	<0.001	3.95	2.16–7.21
Survival at 28 days	68(68.0%)	30(33.0%)	<0.001	4.32	2.36–7.92
Hospital-free days to day 90 (days)	29 ± 30	13 ± 24	<0.001		
Significantly-delayed: greater than 2 h					
Survival to discharge	34(59.6%)	15(27.3%)	0.001	3.94	1.78–8.73
Survival at 28 days	37(64.9%)	20(36.4%)	0.003	3.24	1.49–7.01
Hospital-free days to day 90 (days)	25 ± 30	17 ± 55	0.02		

**Fig. 2.** Kaplan-Meier plots of survival curves for patients treated with REBOA and without REBOA in each subgroup. REBOA use was significantly associated with reduced mortality

The utilization of resuscitative endovascular balloon occlusion of the aorta: preparation, technique, and the implementation of a novel approach to stabilizing hemorrhage

Dong Hun Kim¹, Sung Wook Chang², Junichi Matsumoto³

¹Department of Surgery, ²Department of Thoracic and Cardiovascular Surgery, Trauma Center, Dankook University Hospital, Cheonan, Korea; ³Department of Emergency and Critical Care Medicine, Saint-Marianna University School of Medicine, Kawasaki, Japan
Contributions: (I) Conception and design: SW Chang; (II) Administrative support: SW Chang; (III) Provision of study materials or patients: DH Kim; (IV) Collection and assembly of data: SW Chang, DH Kim; (V) Data analysis and interpretation: All authors; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.
Correspondence to: Sung Wook Chang, MD. Department of Thoracic and Cardiovascular Surgery, Trauma Center, Dankook University Hospital, 201 Manghyangro, Dongnam-gu, Cheonan-si, Chungcheongnam-do 31116, Korea. Email: changsw3@naver.com.

J Thorac Dis 2018;10(9):5550-5559

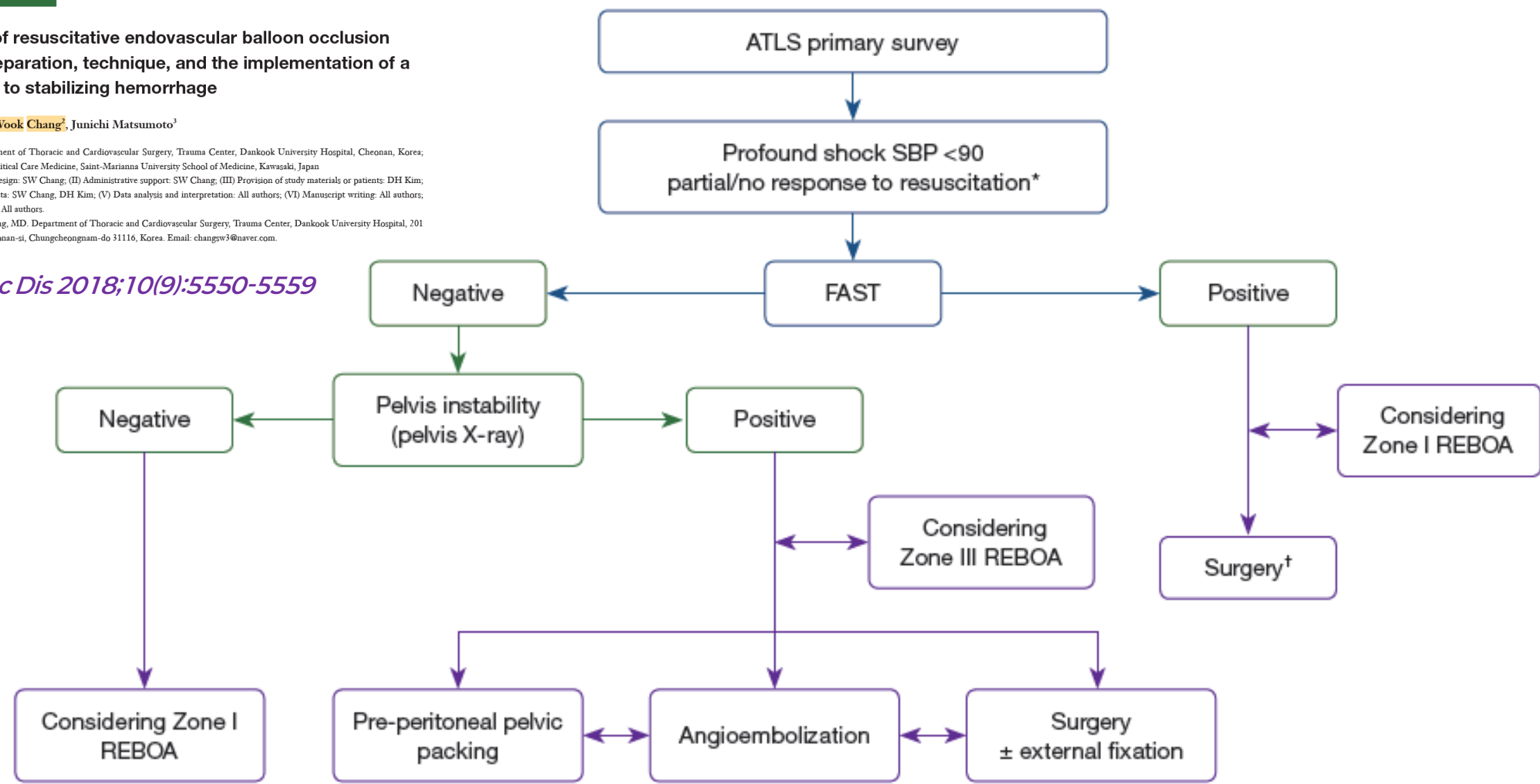


Figure 2 Dankook University Hospital trauma center algorithm for REBOA use in hemorrhagic shock. *, early transfusion in resuscitation room and no possible aortic injury by chest radiography; †, door-to incision time less than 30 minutes. ATLS, advanced trauma life support; SBP, systolic blood pressure; FAST, focused assessment with sonography for trauma; REBOA, resuscitative endovascular balloon occlusion of the aorta.

After occlusion, what should I do?

- Not a definitive method, but a **bridging procedure**
- **REBOA followed by damage control intervention**
 - Transarterial embolization
 - Crash laparotomy
 - Pelvic stabilization
- **Cooperation** for damage control intervention or definitive treatment
 - Trauma surgeon, Emergency physicians, Orthopedic surgeons...
- **Communication** with trauma surgeons, balloon holder and anesthesiologists - Deflation vs. Inflation, Volume vs. vasopressor

All staffs -trauma surgeons,
anesthesiologists, interventionists,
nurses and technicians

Complications-ischemia and reperfusion

- Acute kidney injury: incidence rates ranging from 5.6% to 46%
- Lower limb compartment syndrome incidence rate at 4.3%
- Prolonged hypoperfusion → hyperkalemia, acidosis, and coagulopathy
- ARDS or ALI at 2.6%, pneumonia at 6.1%, and MOF at 6.1%
- Bacteremia at 2.7%
- Sepsis or septic shock at 6.1%
- Surgical site infection (3.3%), severe sepsis(3.2%), enteric fistulas

Trauma Surgery & Acute Care Open 2024;9:e001267. doi: 10.1136/tsaco-2023-001267

DuBose RJ, Morrison J, Brenner M, et al. AORTA Registry 7F vs 11-12 F access. JEVTM 2019;3

Chien C-Y et al. Am J Surg 2023;225:414-9.

Bukur M et al. Shock 2021;55:24-32.

죽을 환자는 없다.

REBOA application in patient with impending cardiac arrest



Transfer call

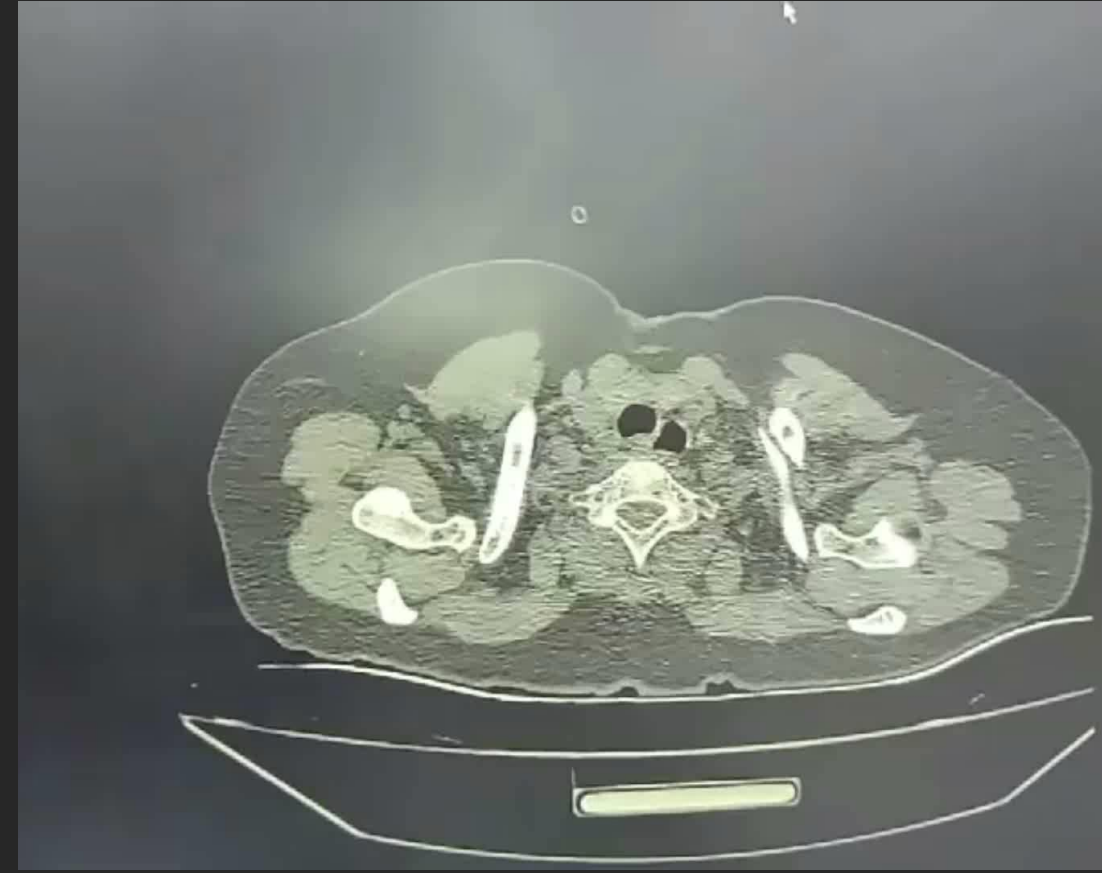
- 66/F
- Chief complaint: Changed mental status
- Mechanism of injury: Motorcycle TA
- Drowsy,
V/S 102/66-113/min-30/min-94%
- Local emergency center visit
- Non-contrast chest, brain CT check
- F/U SBP: 66mmHg drop

Transfusion: nonavailable

2021년 9월 13일 월요일



오후 12:43



66세 여자 오토바이 TA sbp 66
intubation mental drowsy...

혈압이 안오르는데.. 피가없습니다.
40분 걸리는데 바로 쏴다고합니다.
외상팀 준비 부탁드립니다.

[등록번호] [Redacted] [Sex/Age] F/66Y4M
[생년월일] [Redacted] [입원일] 20210913 [진료과] ER

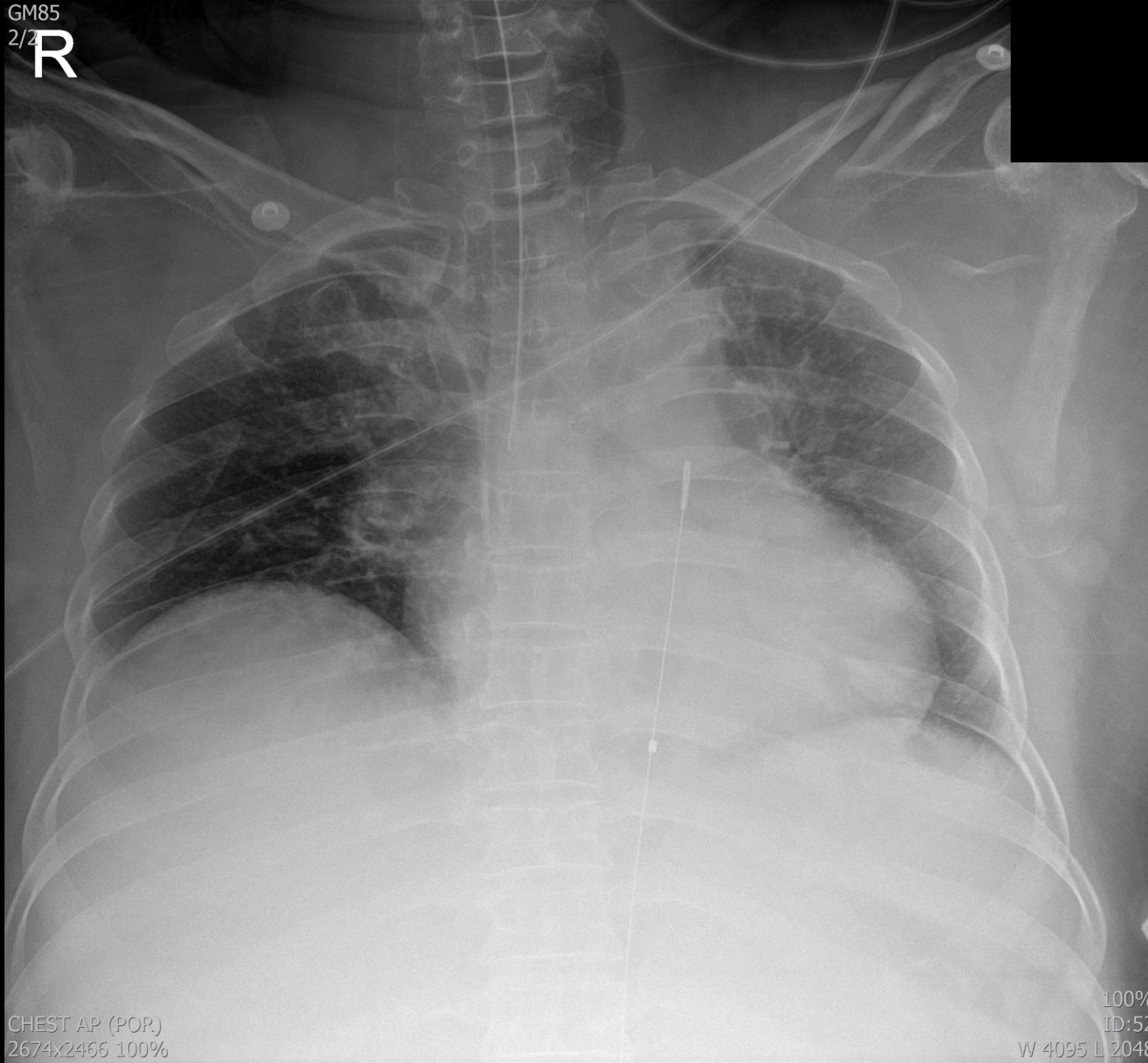
간호 기록지

날짜	시간	Focus	D(간호사정및 평가 진술문)/A(간호계획및 중재 진술문)/R(반응)	입력자
20210913	1301	외상팀 사전대기 호출	D 중증 외상환자 전원의뢰 옴 A CS Pf. 장성욱 호출함 R - D - A 외상팀 수술 중으로 Back up 팀 GS Pf. 윤정석 & Pf. 조한철 호출함 R -	[Redacted]
20210913	1325	외상팀 사전대기	D - A GS Pf. 윤정석 & Pf. 조한철 외상소생구역에 도착하여 사전대기 중임. R -	[Redacted]
20210913	1330	외상팀 사전대기	D - A CS Pf. 장성욱 외상소생구역에 도착하여 사전대기 중임 R -	[Redacted]

내원수단 및 경로	기타 구급차 / 외부에서 전원 외상센터경유: Y	정보제공자 : 119 대원
내원당시 환자상태	혈압 : -1/-1 mmHg 맥박 : 101 회/min 호흡 : -1 회/min 체온 : 36.0 °C	
	P/R Right : 6/F Left : 6/F (P=Prompt, S=Sluggish, F=Fixed, C=Closed)	
	내원시 Sedative : N LOC: 해당없 (- : 없음, + : 있음) 키: Bwt : kg	
	의식상태 : Unresponsive GCS: E 1 M 1 V 9	

20210913	1346 MTP	D -	
		A GS pf.윤정석 ET1 활성화함	
		R -	
20210913	1346 외상팀 활성화	D -	
		A trauma team 활성화 함 by Dr.임규태	
20210913	1353 REBOA	D V/S 53/37-108-18	
		A CS Pf.장성욱 REBOA sheath 7Fr. 삽입함 REBOA series f/u함.	
		R -	
20210913	1354 REBOA	D -	
		A CS Pf.장성욱 REBOA ballooning 10ml 시행함	

GM85
2/2
R



CHEST AP (POR.)
2674x2466 100%

100%
ID:52
W 4095 L 2048

20210913	1355 REBOA	D	-	
		A	CS Pf.장성욱 REBOA ballooning 5ml추가하여 총 15ml 시행함.	
		R	-	
20210913	1355 이형수혈	D	-	
		A	이형수혈 0+ PRC 3-2 T/F 시작함	
20210913	1356 혈액학적 감시	D		
		A	24 MIN (Massive hemoperitoneum)	행함
		R	13:46 Activation and MTP	
			13:53 Arterial access	
20210913	1400 e-FAST	D		
		A	13:54 REBOA	
		R	14:10 Transfer to OR	
20210913	1400 수술 전 간호	D	on call OP 예정임	
		A	GS pf.윤정석 수술적 치료 필요성 설명 후 수술, 전신마취 동의서 받음 장신구, 속옷 제거 확인함.	
20210913	1410 입원 및 수술	D	V/S 95/58-104-ambu-36.5	
		A	CS Pf.장성욱 동행하에 PRC 3 units T/F 하며, monitor 적용하여, O2 15L/min ambu-bagging 하며 OR 감. Ceftriaxone skin test 시행하였고, 결과 확인 후 투여해야 함 인계함.	

보고일 2021-09-13

※ 항목더블 클릭 => 그래프

결과명	결과	단위	참고
CBC&Diff(6종)			
WBC	3.66	▼ x10E3/ μ l	4 -
RBC	0.76	▼ x10E6/ μ l	4 -
Hb	2.2	▼ g/dL	12
Hct		%	36
Hct	7.2	▼ %	36
MCV	94.7	fL	79
MCH	28.9	pg	26 - 32
MCHC	30.6	▼ g/dL	32
Platelet	45	▼ x10E3/ μ l	130
CBC Diff count			
Neutrophil %	70.7	%	42.
Lympho %	24.9	%	20.
Mono %	4.1	%	1.7
Eosinophil %	0.3	▼ %	1.0 - 4.0
Basophil %	0.0	%	0.0 - 1.0

보고일 2021-09-13

※ 항목더블 클릭 => 그래프

결과명	결과	단위	참고치
PT			
PT	24.6	▲ sec	10.3 - 13.1
INR	2.20	▲	0.8 - 1.2
aPTT	68.4	▲ sec	24 - 37
D-dimer	16488	▲ ng/mL	0 - 250
Ionized calcium...	0.88	▼ mmol/L	1.05 - 1.35
Glucose(POCT)	165	▲ mg/dL	60 - 95
Lactate (POCT)	12.1	▲ mmol/L	0.5 - 2
pH(POCT)	7.050	▼ pH	7.35 - 7.45
pCO2,(POCT)	48.3	▲ mmHg	32 - 45

*CARE PLAN

Palpable pulsation on femoral a.

NIBP 53/27 check

FAST: Massive hemoperitoneum(전 병원 Abdominopelvic CT 없음)

13:53 7 Fr sheath insertion via Rt. common femoral a.

Ultrasound – guided(–)

Seldinger technique, palpation, 1st attempt

13:54 Balloon insertion. guidewire position check(–)

Balloon position check: Zone I ==> 10cc inflation, position – good by X – ray

13:55 5cc inflation total 15cc ==> NIBP 87/57

14:00 BP 92/54 HR 100 total 15cc

14:10 transfer to OR

14:42 BP 154/77 HR 103 3cc deflation total 12cc

14:45 BP 102/52 HR 104 2cc deflation total 10cc

14:47 BP 101/52 HR 103 3cc deflation total 7cc

14:49 BP 111/57 HR 101 2cc deflation total 5cc

14:51 BP 102/63 HR 106 , bleeding control done

==> slowly full deflation

14:54 BP 132/66 HR 96 full deflation done

prn) Chest CT recheck (d/t motion artifact)

*Goal

recovery

작성자: 장성욱



교수서명: 장성욱





The role of REBOA in patients in traumatic cardiac arrest subsequent to hemorrhagic shock: a scoping review

S. A. S. Slot¹ · S. E. van Oostendorp^{1,2} · L. J. Schoonmade³ · L. M. G. Geeraedts¹

Received: 17 August 2022 / Accepted: 21 October 2022 / Published online: 6 November 2022

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Methods This scoping review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews (PRISMA-ScR) Statement. PubMed, EMBASE.com and the Web of Science Core Collection were searched. Articles were included if they reported any data on patients that underwent REBOA and were in TCA. Of the included articles, data regarding SBP, ROSC and survival were extracted and summarized.

Results Of 854 identified studies, 26 articles met criteria for inclusion. These identified a total of 785 patients in TCA that received REBOA (presumably less because of potential overlap in patients). This review shows REBOA elevates mean SBP in patients in TCA. The achievement of ROSC after REBOA deployment ranged from 18.2% to 67.7%. Survival to discharge ranged from 3.5% to 12.1%.

Conclusion Overall, weak evidence is available on the use of REBOA in patients in TCA. This review, limited by selection bias, indicates that REBOA elevates SBP and may benefit ROSC and potentially survival to discharge in patients in TCA. Extensive further research is necessary to further clarify the role of REBOA during TCA.

죽은 환자는 없다. 우리에게서는 죽어가는 환자만 있을 뿐이다.

REBOA application during LUCAS chest compression



- Primary survey with resuscitation and transfer immediately

오후 12:58

오후 12:59

오후 1:10

오후 1:22

오후 1:33

송부서류등	lab 동봉
이송구급차	
담당의사소견 기 타	상기 환자는 11시경 경운기에 깔리는 사고로 분원 응급실 내원하였습니다. 분원에서 시행한 FAST상 상기 소견이며, hypovolemic shock 의심되어 PRC, FFP T/F 및 NSS hydration 하였습니다. further evaluation & Tx. 위해 전원하오니 고전선처 바랍니다. 감사합니다. - 이하야백 -

환자 진료정보 공개 동의서

충청남도서산의료원에 진료받은 본인의 진료정보(환자정보, 진료기록 등)를 의료법 제26조 제2항에 따라 의료기관으로 제공받는 것에 동의합니다.

20 년 월 일
(서명 또는 인)

(환자와의 관계 :)

동의자

■ 동의서에 본인 대신 대리인이 서명할 경우 그 사유를 명시

☐ 환자의 신체, 정신적 장애로 인하여 약정 내용에 대하여 이해하지 못함

☐ 미성년자로서 약정 내용에 대하여 이해하지 못함

☐ 설명하는 것이 환자의 신身に 중대한 나쁜 영향을 미칠 것이 명백함

☐ 설명하는 것이 환자의 신身に 중대한 나쁜 영향을 미칠 것이 명백함

☐ 응급상황으로 본인에게 중의를 받기 위하여

☐ 기타 :

오후 1:19

12:38 Blunt trauma

Hemoperitoneum by FAST

MRF c hemothorax by CXR

Dr. Heli activation



12:38 Blunt trauma

Hemoperitoneum by FAST
MRF c hemothorax by CXR
Dr. Heli activation

13:10 Landing zone

Transport to Trauma center
Transfusion: PRC,FFP 2 units

13:22 Arrest



12:38 Blunt trauma
Hemoperitoneum by FAST
MRF c hemothorax by CXR
Dr. Heli activation

13:10 Landing zone
Transport to Trauma center
Transfusion: PRC,FFP 2 units
13:22 Arrest

13:43 Presented to trauma bay
Bilateral C-thoracostomy
13:43 MTP protocol activation

Traumatic circulatory arrest (penetrating or blunt) with no pulse

Operating room
with
surgeon present
mandatory

< 2 minutes

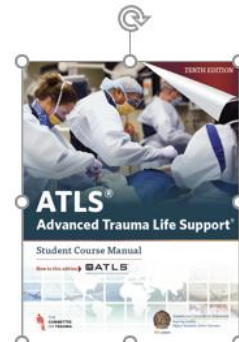
Trauma team alerted by medical dispatch

Closed CPR in progress
(Airway, external cardiac massage,
orotracheal intubation,
100% oxygen, IV or IO line, fluids, epinephrine)

No ROSC

Bilateral chest
decompression

ROSC



20210719 1343 1. 내원
R V/S : unchecked
GCS : E1M1Ve
P/S&L/R : 5/F=5/F

20210719 1343 ET1 D -

A ET1 처방함 by GS pf 조한철 (PRC 3pint)

R -

20210719 1344 심정지 D LUCAS 적용하여 CPR 중임

A Dr. 유경원 처방 하에 WEPIN 1A 3분마다 IV 시작함

R -

20210719 1344 혈액준비 D -

A blood prep) PRC 10, FFP 10

R -

20210719 1345 심정지 D -

A Lt closed thoracostomy 시행함 by CS pf 장성욱
3 bottle 연결함

R air bubbling 잘 되는 상태임

20210719 1345 이형수혈 D -

A GS pf 조한철 처방 하에 이형수혈 시작함

R V/S : CPR 중임

20210719 1346 심정지 D -

A Rt closed thoracostomy 시행함 by CS pf 장성욱
3 bottle 연결함

R fresh blood 배액됨
air bubbling 잘 되는 상태임

12:38 Blunt trauma

Hemoperitoneum by FAST
MRF c hemothorax by CXR
Dr. Heli activation

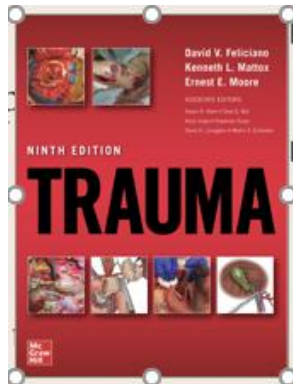
13:10 Landing zone

Transport to Trauma center
Transfusion: PRC,FFP 2 units

13:22 Arrest

13:43 Presented to trauma bay
Bilateral C-thoracostomy

13:43 MTP protocol activation



- Initiating the resuscitation with intraosseous access can be lifesaving in patients in shock.

- Early arterial access for subsequent resuscitative endovascular balloon occlusion of the aorta (REBOA) deployment should be considered for patients presenting with subdiaphragmatic life-threatening hemorrhage.

13:48 Sono-guided vascular access
via Rt. common femoral a.

12:38 Blunt trauma
Hemoperitoneum by FAST
MRF c hemothorax by CXR
Dr. Heli activation

13:10 Landing zone
Transport to Trauma center
Transfusion: PRC, FFP 2 units
13:22 Arrest

13:43 Presented to trauma bay
Bilateral C-thoracostomy
13:43 MTP protocol activation

Traumatic circulatory arrest (penetrating or blunt) with no pulse

Operating room
with
surgeon present
mandatory

Trauma team alerted by medical dispatch

< 2 minutes

Closed CPR in progress
(Airway, external cardiac massage,
orotracheal intubation,
100% oxygen, IV or IO line, fluids, epinephrine)

No ROSC

Bilateral chest
decompression

ROSC

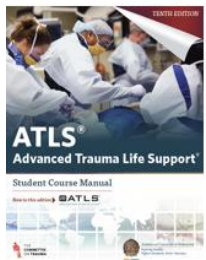
No ROSC

Anterolateral or clamshell thoracotomy
and vertical pericardiotomy (release
tamponade if present)

< 3 minutes

13:48 Sono-guided vascular access
via Rt. common femoral a.

13:50 Zone I REBOA
Total occlusion
20 mL inflation







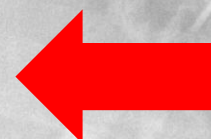
C-thoracostomy



C-thoracostomy



REBOA balloon



20210719	1348 e-FAST	D -	
	A e-FAST checked by GS pf 조한철		
	R -		
20210719	1348 혈액학적 감시	D -	
	A Rt femoral 7Fr sheath 삽입함 by CS Dr. 장성욱		
	R ABP : unchecked CPR 중임		
20210719	1349 REBOA	D -	
	A REBOA 시행 결정함 by CS pf 장성욱		
	R -		
20210719	1350 REBOA	D -	
	A REBOA balloon 20ml 시행함 by GS pf 김동훈		
	R CPR 중임		
20210719	1356 심정지	D -	
	A Dr. 유경원 처방 하에 WEPIN 1A IV 추가로 투여함		
	R -		
20210719	1357 ROSC	D -	
	A ROSC 확인함 by Dr. 유경원 V/S checked		
	R V/S : 144/71-98-22-36.0 ETCO2 : 10mmHg		
20210719	1400 A-line	D Rt femoral 7Fr sheath에 REBOA 시행된 상태로 A-line kit monitoring 불가능한 상태임	

12:38 Blunt trauma
Hemoperitoneum by FAST
MRF c hemothorax by CXR
Dr. Heli activation

13:10 Landing zone
Transport to Trauma center
Transfusion: PRC,FFP 2 units
13:22 Arrest

13:43 Presented to trauma bay
Bilateral C-thoracostomy
13:43 MTP protocol activation

13:48 Sono-guided vascular access
via Rt. common femoral a.

13:57 ROSC
BP: 144/71 mmHg
EtCO2: 10mmHg

13:50 Zone I REBOA
Total occlusion
20 mL inflation

12:38 Blunt trauma
Hemoperitoneum by FAST
MRF c hemothorax by CXR
Dr. Heli activation

13:10 Landing zone
Transport to Trauma center
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13:48 Sono-guided vascular access
via Rt. common femoral a.

14:10 Transfer to OR

13:57 ROSC
BP: 144/71 mmHg
EtCO2: 10mmHg

13:50 Zone I REBOA
Total occlusion
20 mL inflation

12:38 Blunt trauma
Hemoperitoneum by FAST
MRF c hemothorax by CXR
Dr. Heli activation

13:10 Landing zone
Transport to Trauma center
Transfusion: PRC,FFP 2 units
13:22 Arrest

13:43 Presented to trauma bay
Bilateral C-thoracostomy
13:43 MTP protocol activation

27 minutes summary

1. CPR d/t traumatic cardiorespiratory arrest
2. Bilateral closed thoracostomy
3. REBOA under LUCAS compression
4. Transfer to OR

13:48 Sono-guided vascular access
via Rt. common femoral a.

14:10 Transfer to OR

13:57 ROSC
BP: 144/71 mmHg
EtCO2: 10mmHg

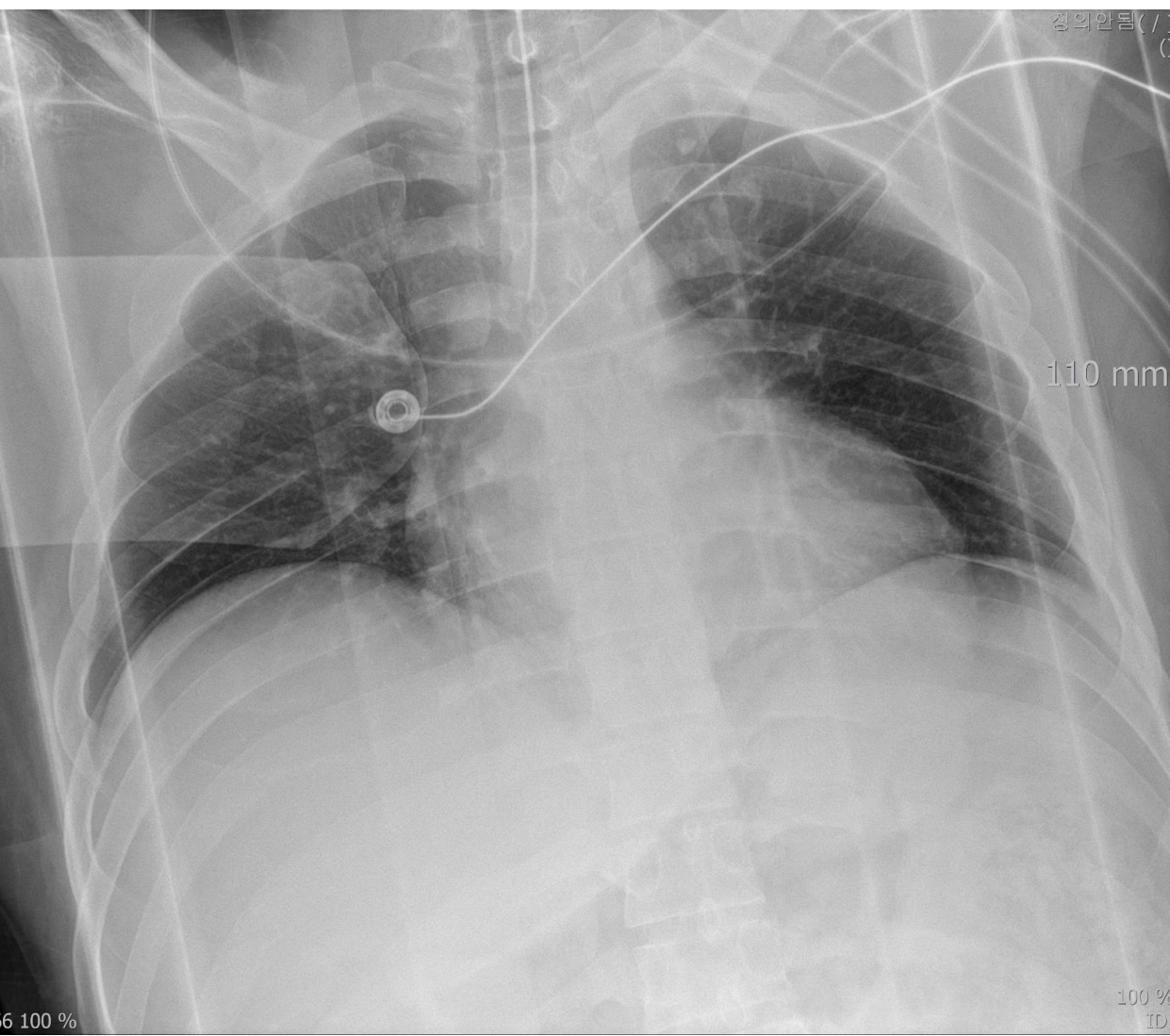
13:50 Zone I REBOA
Total occlusion
20 mL inflation

두가지 모두 사용할 수도 있다.

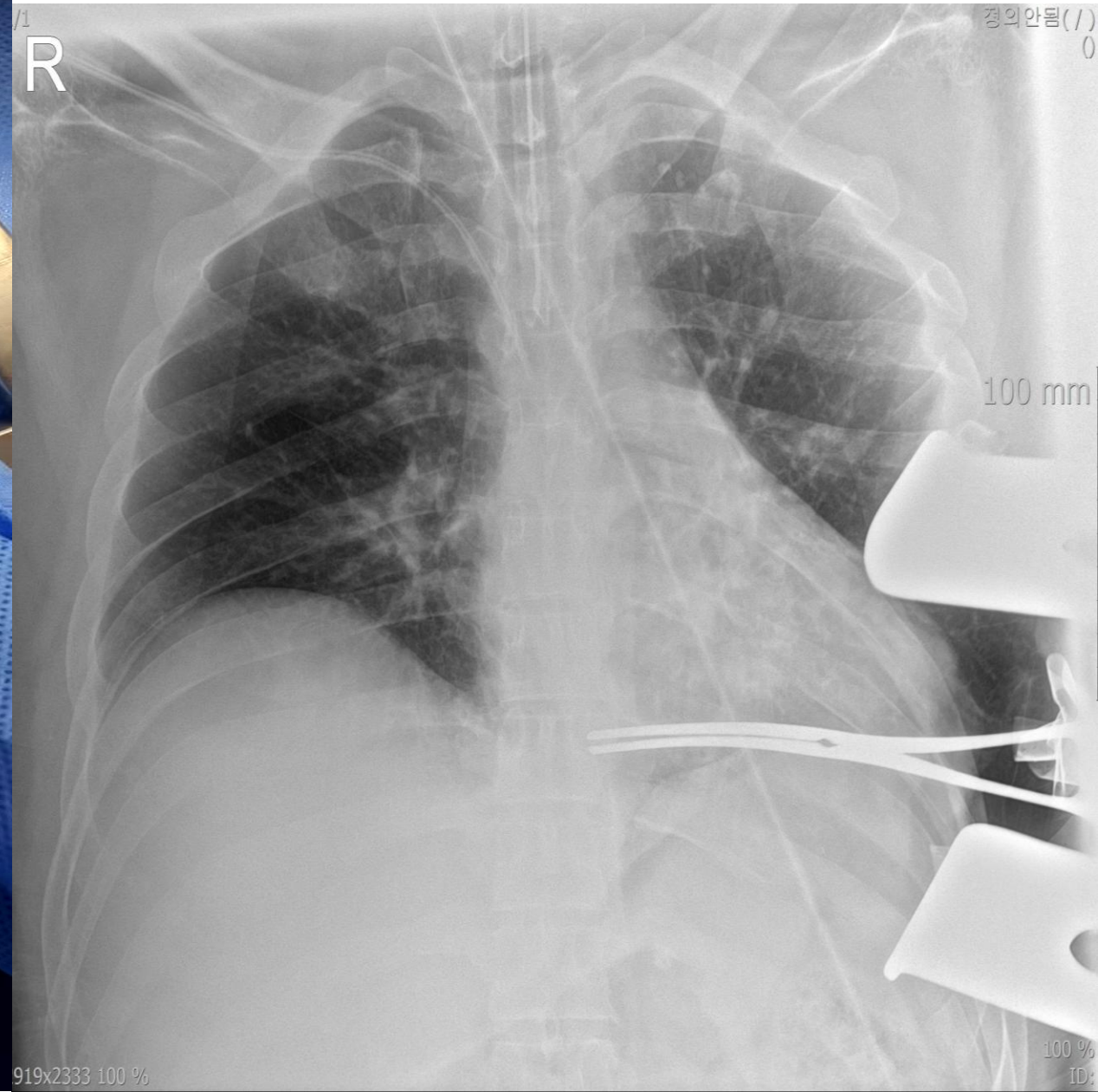
RT-ACC followed by REBOA



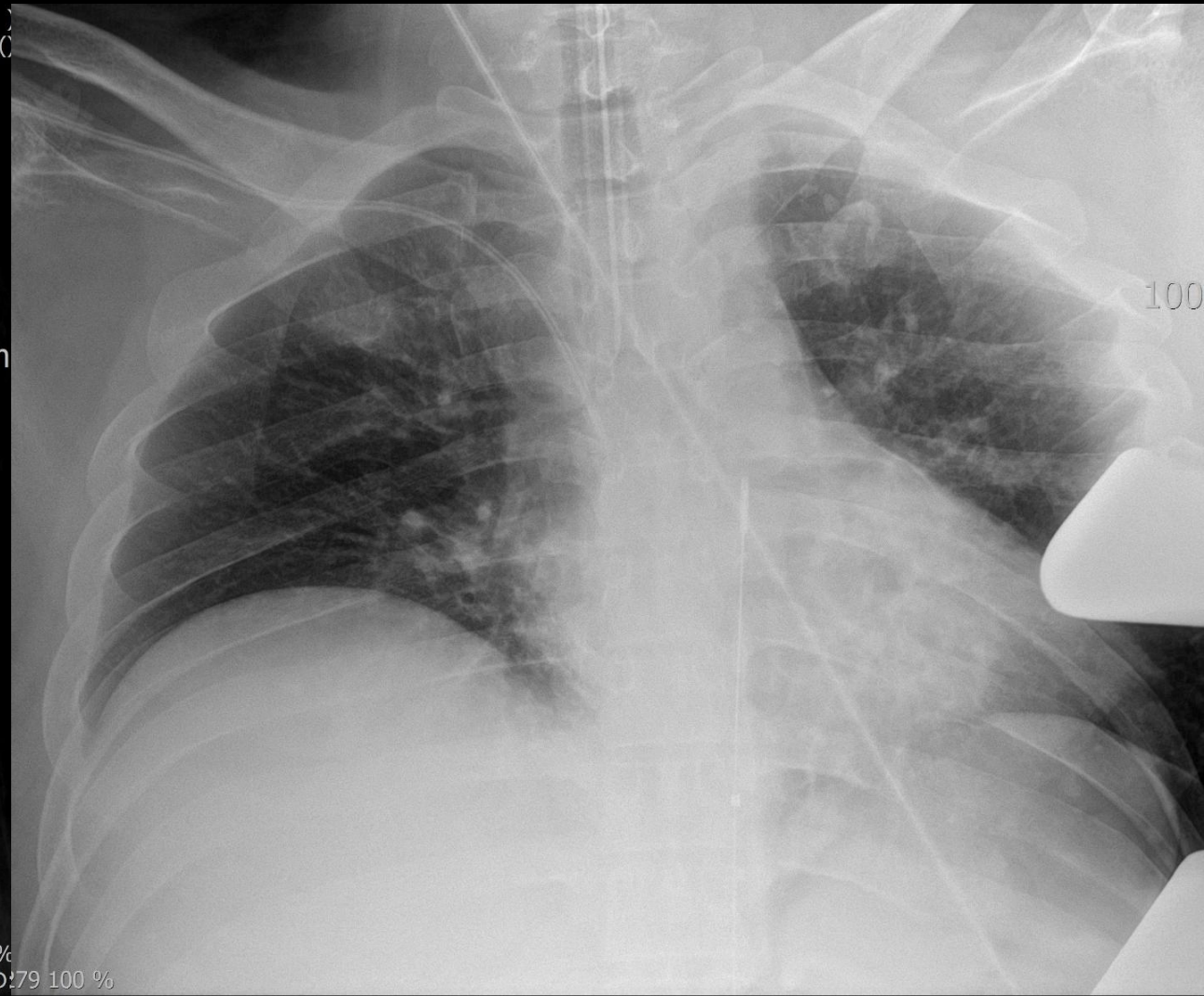
Case 3. 41/M, Crashed by forklift, prehospital CPR: 10 min

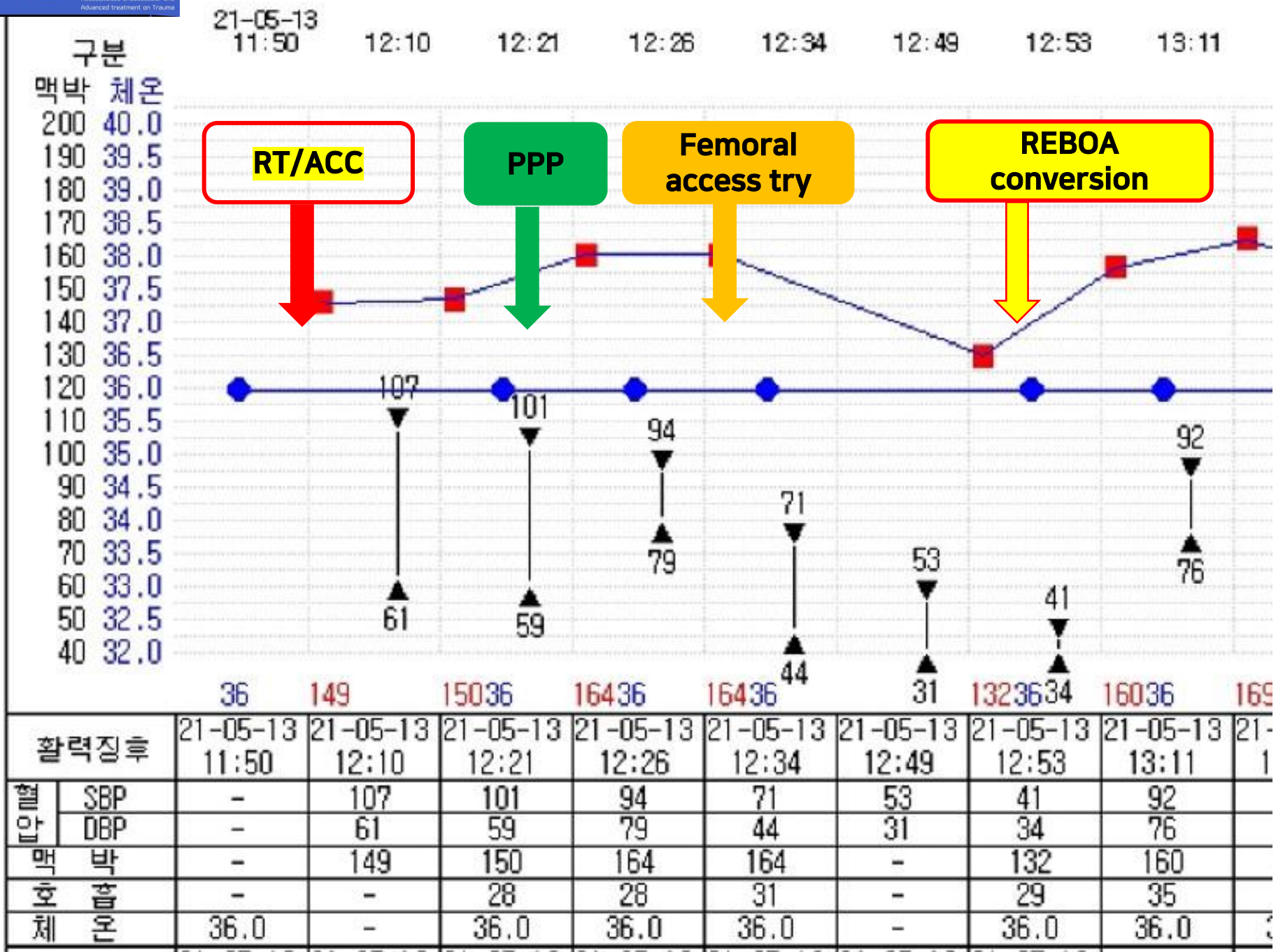


RT-ACC(aorta cross clamping)



ROSC, PPP and change to REBOA

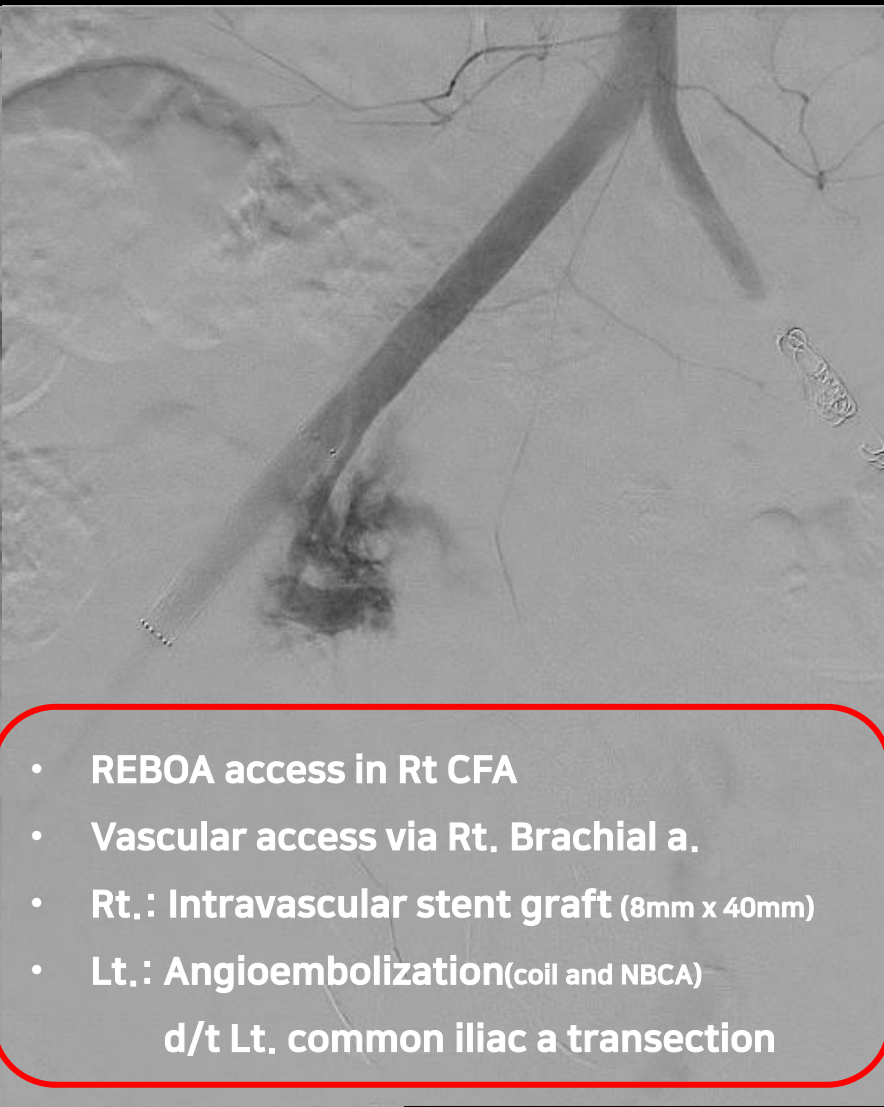




Initial CT and TAE



Initial CT and TAE



- REBOA access in Rt CFA
- Vascular access via Rt. Brachial a.
- Rt.: Intravascular stent graft (8mm x 40mm)
- Lt.: Angioembolization (coil and NBCA)
d/t Lt. common iliac a transection



NBCA 50% 3ea
 Concerto coil 8mm *30cm 1ea

What is Trauma?

Trauma care system
to reduce DEATH in TRAUMA pts

변화와 성장은 우리의 한계점에서 이루어진다.

What is Trauma?

우리가 변화하지 않는다면, 외상 진료의 발전기회는 없을 것입니다.

2021년 2월

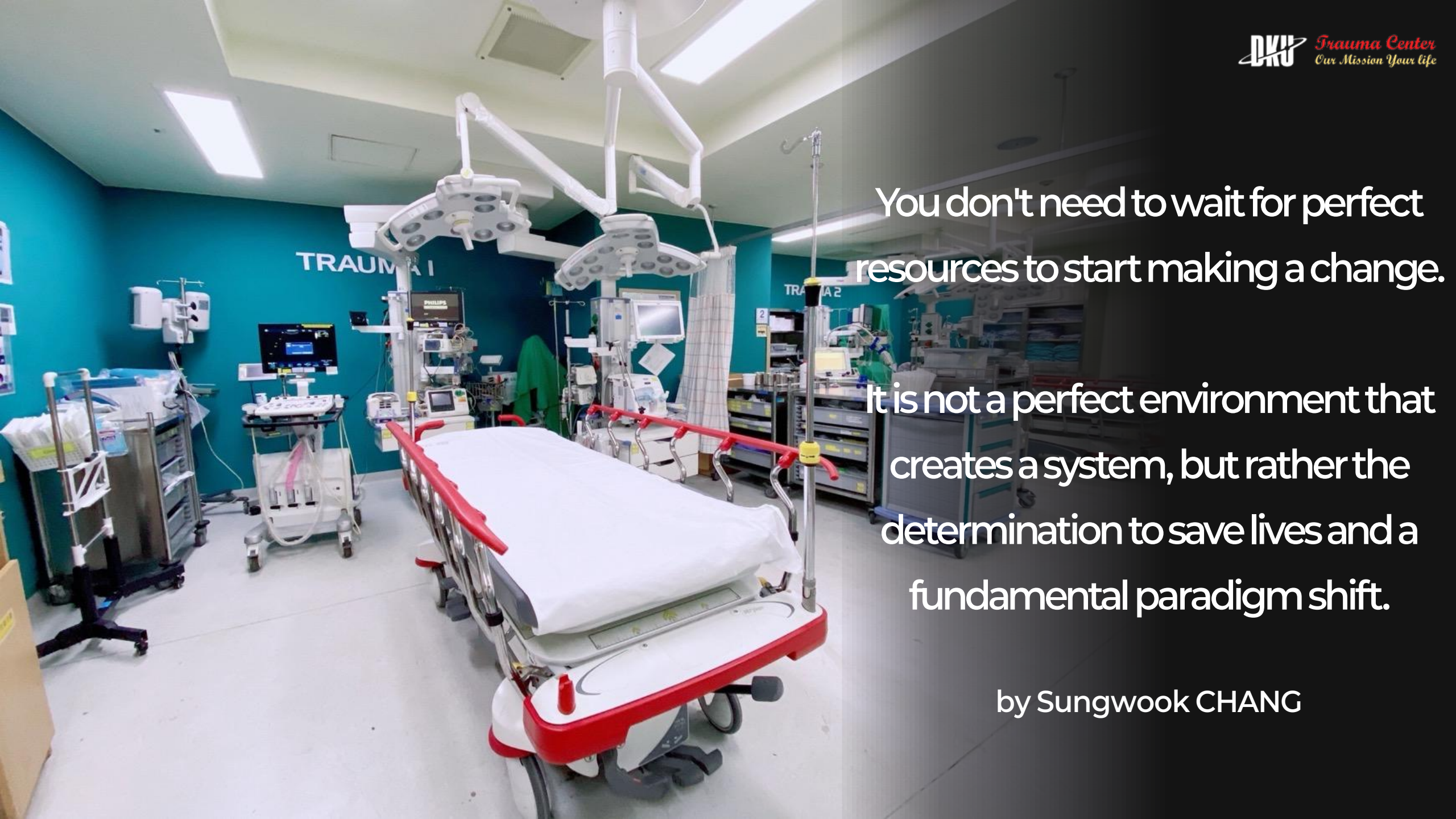
장 성 욱

역자서문

Reverse Letter Preface

The Art of EndoVascular hybrid Trauma and bleeding Management



A photograph of a hospital trauma room. The room has teal-colored walls and a white ceiling with recessed lights. In the center, there is a gurney with a white sheet and red handrails. Above the gurney, there are two large, adjustable surgical lights. To the left of the gurney, there is a medical cart with various equipment, including a monitor and a Philips ultrasound machine. In the background, there are more medical carts and equipment, and the words "TRAUMA 1" and "TRAUMA 2" are visible on the wall.

You don't need to wait for perfect resources to start making a change.

It is not a perfect environment that creates a system, but rather the determination to save lives and a fundamental paradigm shift.

by Sungwook CHANG

“I’m fine.”

...just my trauma-center face

Kakao talk



E-mail: changsw3@naver.com