CONGRESSO NAZIONALE IRC 2022

TRAUMA: NUOVE EVIDENZE E PERCORSI

AUDITORIUM DELLA TECNICA • ROMA • 14-15 OTTOBRE

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Damage control in Uncompressible torso haemorrage

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IRC Italian Resuscitation Council

Coccolini et al. World Journal of Emergency Surgery (2018) 13:50
https://doi.org/10.1186/s13017-018-0211-4

World Journal of Emergency Surgery

LETTER TO THE EDITOR Open Access

Abdominopelvic trauma: from anatomical to anatomo-physiological classification

Federico Coccolini[1*], Fausto Catena[2], Yoram Kluger[3], Massimo Sartelli[4], Gianluca Baiocchi[5], Luca Ansaloni[1] and Ernest Eugene Moore[6]

Table 1 Liver trauma classification

	WSES grade	AAST	Haemodynamic
Minor	WSES grade I	I–II	Stable
Moderate	WSES grade II	III	Stable
Severe	WSES grade III	IV–V	Stable
	WSES grade IV	Any	Unstable

Table 2 Spleen trauma classification

	WSES class	AAST	Haemodynamic
Minor	WSES I	I–II	Stable
Moderate	WSES II	III	Stable
	WSES III	IV–V	Stable
Severe	WSES IV	I–V	Unstable

Table 3 Kidney trauma classification

	WSES grade	AAST	Haemodynamic
Minor	WSES grade I	I–II	Stable
Moderate	WSES grade II	III or segmental vascular injuries	Stable
Severe	WSES grade III	IV–V or any grade parenchymal lesion with main vessels dissection/occlusion	Stable
	WSES grade IV	Any	Unstable

Table 4 Pelvic ring injuries classification

	WSES grade	Young-Burgees classification	Haemodynamic	Mechanic
Minor	WSES grade I	APC I–LC I	Stable	Stable
Moderate	WSES grade II	LC II/III–APC II/III	Stable	Unstable
	WSES grade III	VS	Stable	Unstable
Severe	WSES grade IV	Any	Unstable	Any

Table 6 Duodeno-pancreatic and extra-hepatic biliary tree lesions

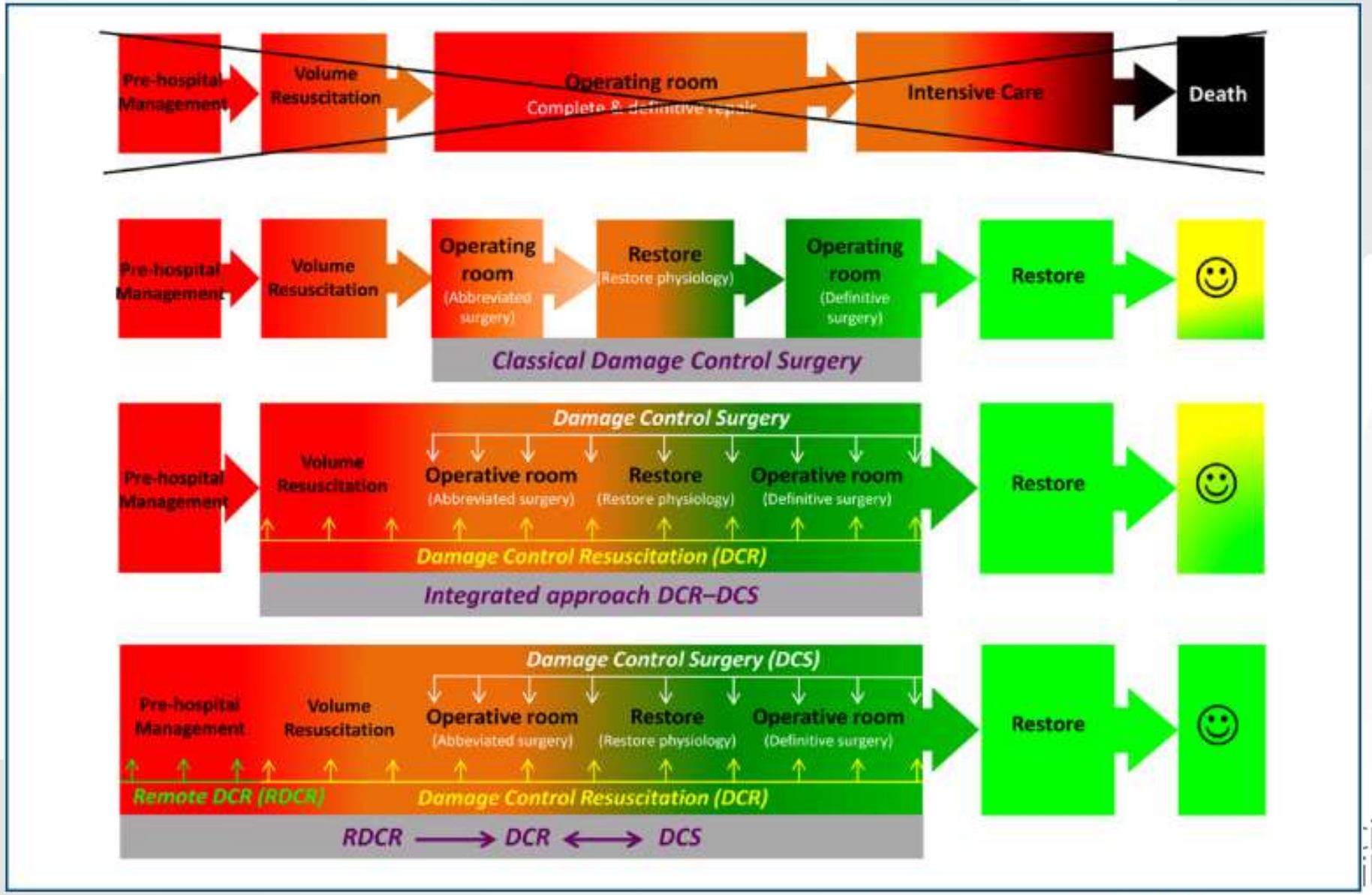
Grade	WSES class	Organ	AAST	Description of injury
Minor	WSES class I	Pancreas	I–II	- Minor contusion without duct injury Superficial laceration without duct injury - Major contusion without duct injury or tissue loss Major laceration without duct injury or tissue loss
		Duodenum	I	- Hematoma involving a single portion of duodenum Laceration: partial thickness, no perforation
		Extrahepatic biliary three	I–II–III	- Gallbladder contusion/hematoma. Portal triad contusion - Partial gallbladder avulsion from liver bed; cystic duct intact. Laceration or perforation of the gallbladder - Complete gallbladder avulsion from liver bed. Cystic duct laceration
Moderate	WSES class II	Pancreas	III	- Distal transection or parenchymal injury with duct injury
		Duodenum	II	- Hematoma involving more than one portion Laceration with disruption of less than 50% of circumference
		Extrahepatic biliary three	IV	Partial or complete right hepatic duct laceration Partial or complete left hepatic duct laceration Partial common hepatic duct laceration (< 50%) Partial common bile duct laceration (< 50%)
Severe	WSES class III	Pancreas	IV–V	- Proximal transection or parenchymal injury involving ampulla - Massive disruption of pancreatic head
		Duodenum	III–IV–V	- Disruption 50–75% of circumference of D2 Disruption 50–100% of circumference of D1, D3, and D4 - Disruption > 75% of circumference of D2 involving ampulla or distal common bile duct - Massive disruption of duodeno-pancreatic complex Devascularization of duodenum
		Extrahepatic biliary three	V	> 50% transection of common hepatic duct > 50% transection of common bile duct Combined right and left hepatic duct injuries Intraduodenal or intrapancreatic bile duct injuries
	WSES class IV	Any	Any	Any degree of lesion with hemodynamic instability

REVIEW

Damage control: Concept and implementation

B. Malgras, B. Prunet, X. Lesaffre, G. Boddaert, S. Travers, P.-J. Cungi, E. Hornez, O. Barbier, H. Lefort, S. Beaume, M. Bignand, J. Cotte, P. Esnault, J.-L. Daban, J. Bordes, E. Meaudre, J.-P. Tourtier, S. Gaujoux, S. Bonnet

Damage control



Liver bleeding

Coccolini et al. World Journal of Emergency Surgery (2018) 13:50
https://doi.org/10.1186/s13017-018-0211-4

World Journal of Emergency Surgery

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Abdominopelvic trauma: from anatomical to anatomo-physiological classification

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Liver injuries

The WSES classification divides hepatic injuries into three degrees considering the AAST-OIS classification and the hemodynamic status (Table 1) [4]:

Minor (WSES class I)
Moderate (WSES class II)
Severe (WSES class III and IV)

Minor hepatic injuries

WSES class I includes hemodynamically stable AAST-OIS grade I–II blunt and penetrating lesions.

Moderate hepatic injuries

WSES class II includes hemodynamically stable AAST-OIS grade III blunt and penetrating lesions.

Severe hepatic injuries

WSES class III includes hemodynamically stable AAST-OIS grade IV–VI blunt and penetrating lesions.

WSES class IV includes hemodynamically unstable AAST-OIS grade I–VI blunt and penetrating lesions.

Table 1 Liver trauma classification

	WSES grade	AAST	Haemodynamic
Minor	WSES grade I	I–II	Stable
Moderate	WSES grade II	III	Stable
Severe	WSES grade III	IV–V	Stable
	WSES grade IV	Any	Unstable

WSES World Society of Emergency Surgery, *AAST* American Association for the Surgery of Trauma

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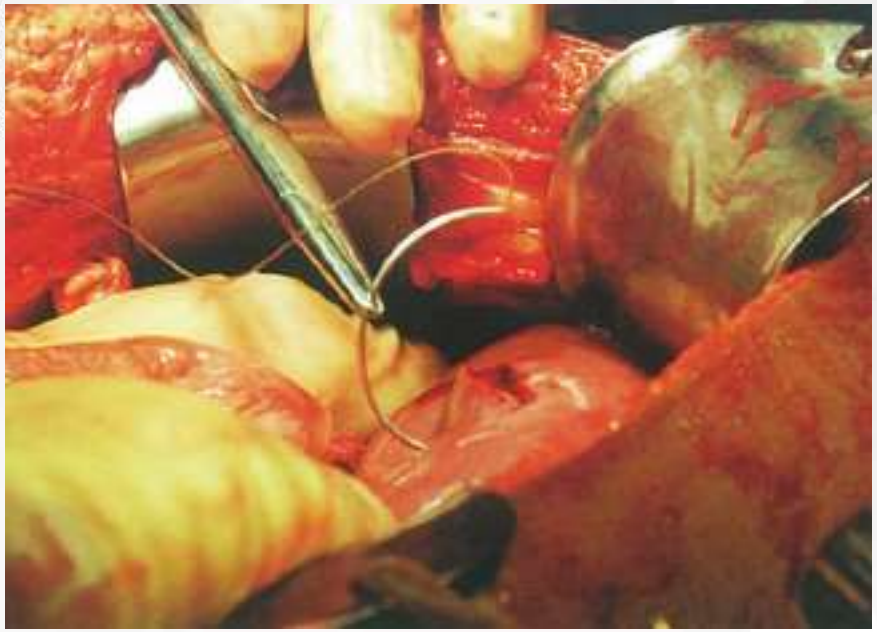
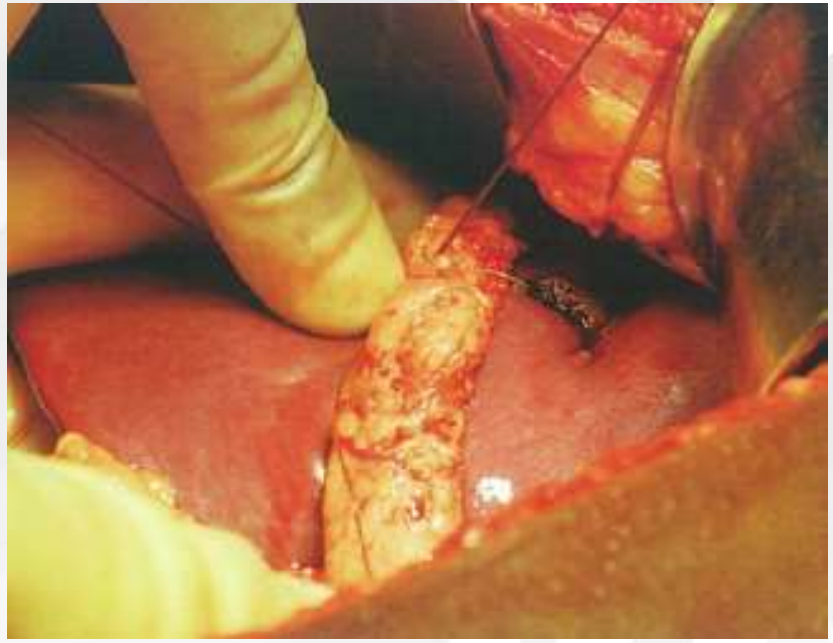
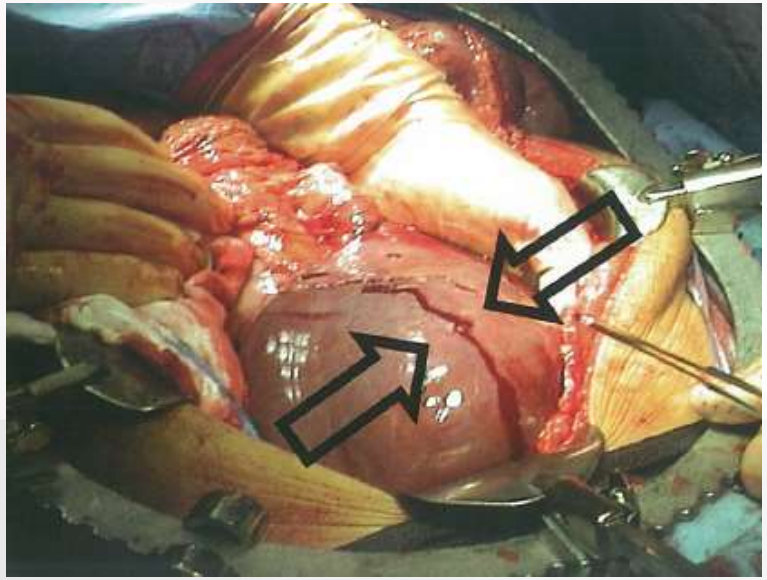
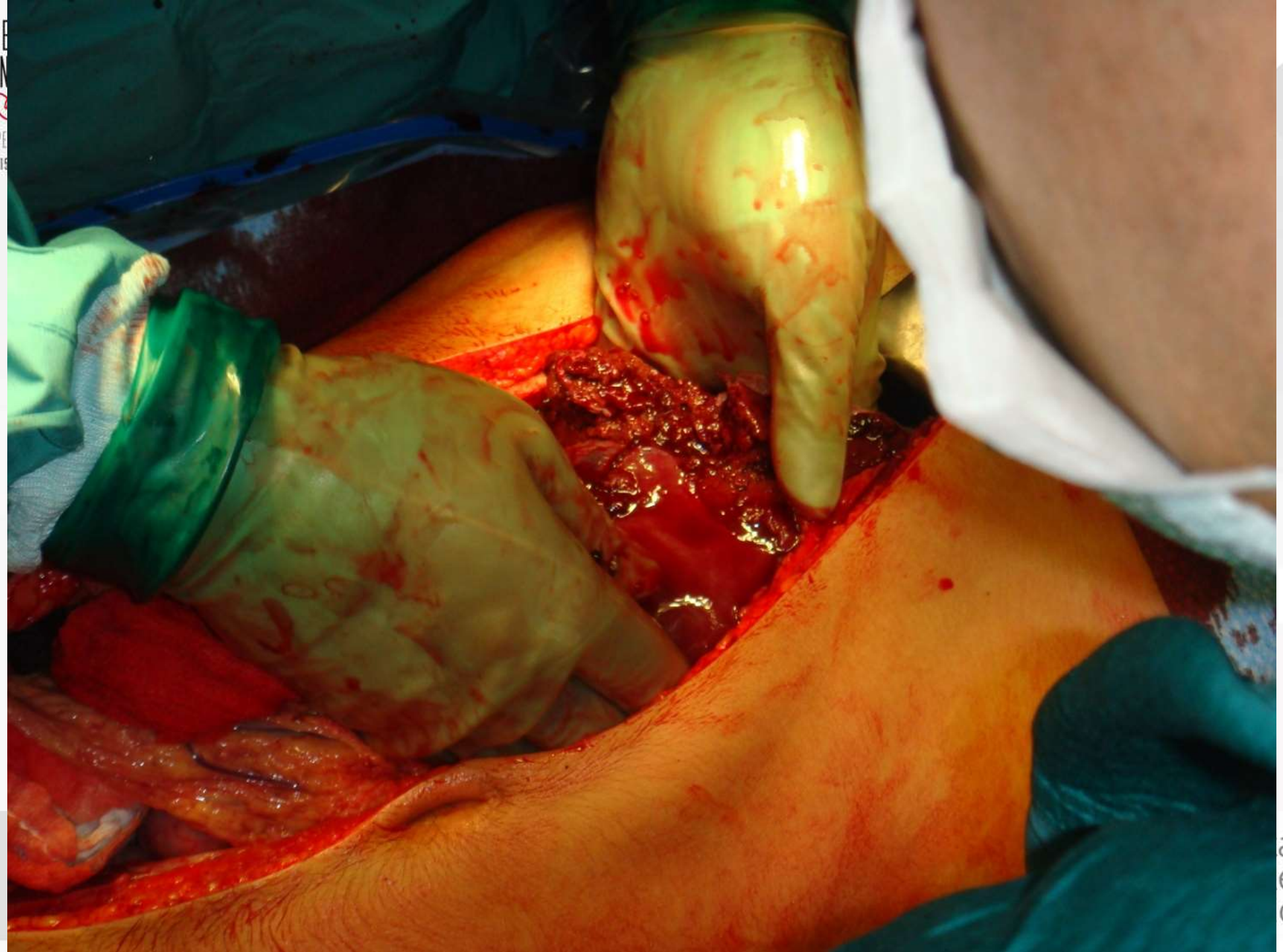
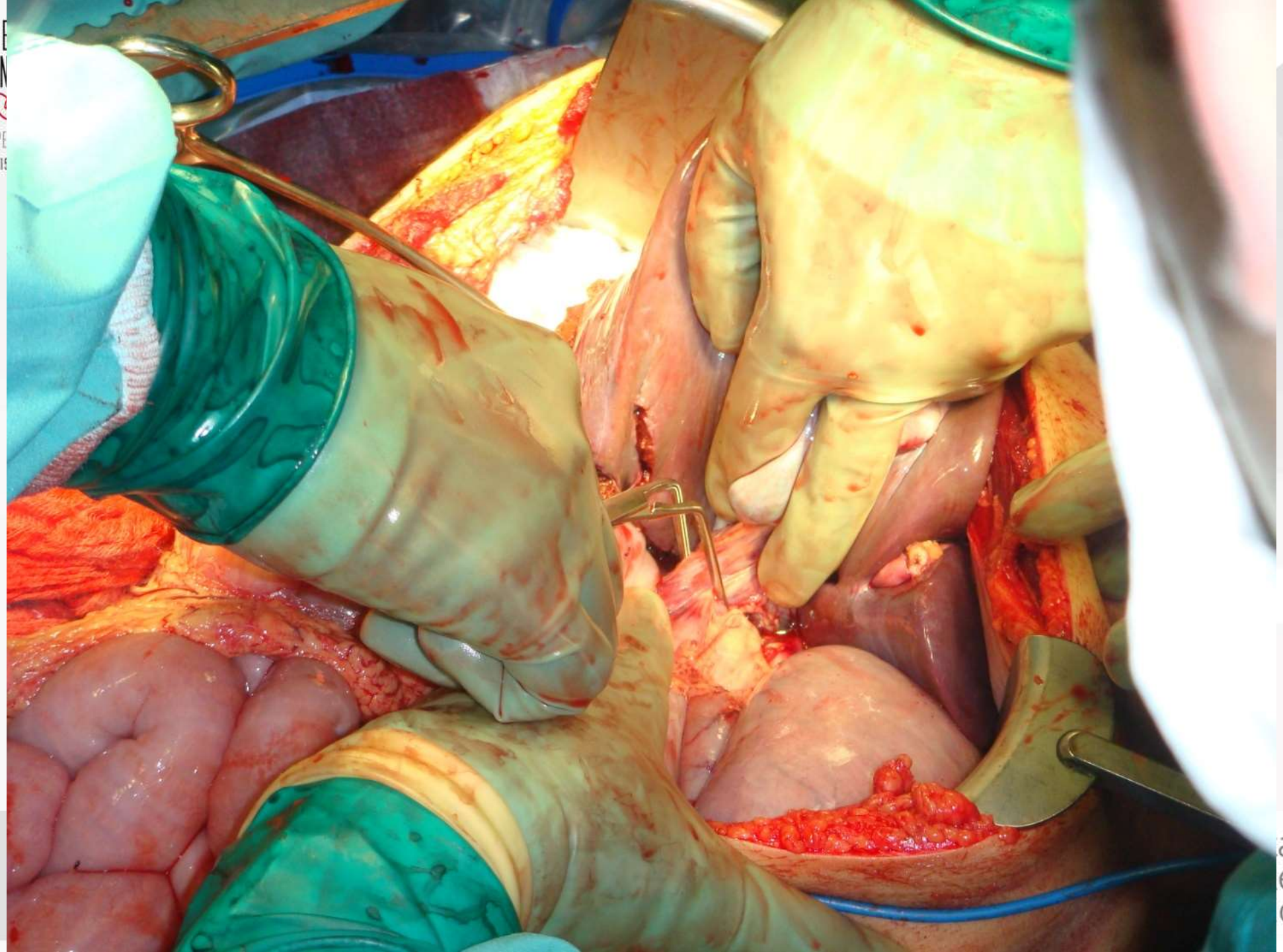
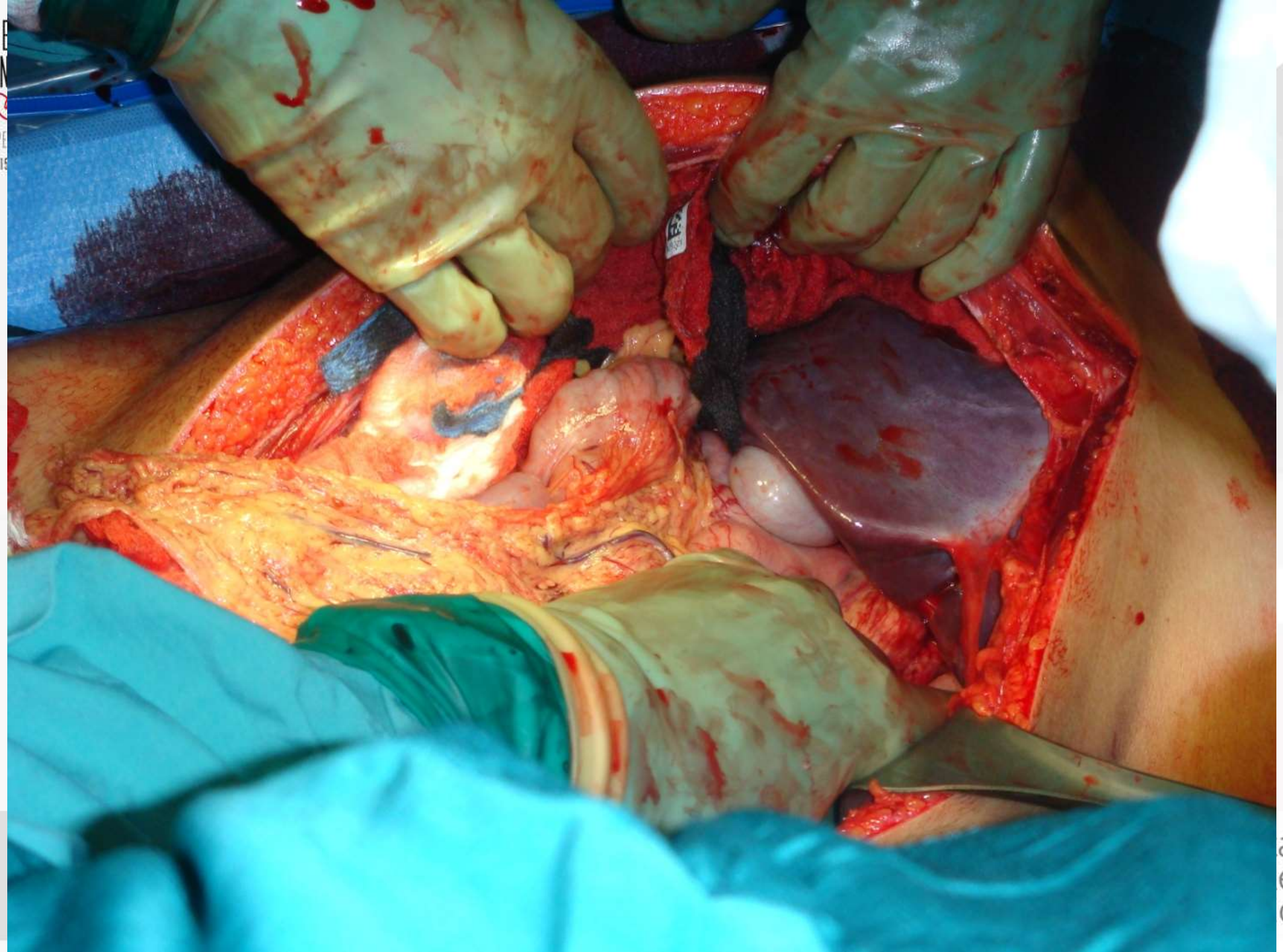












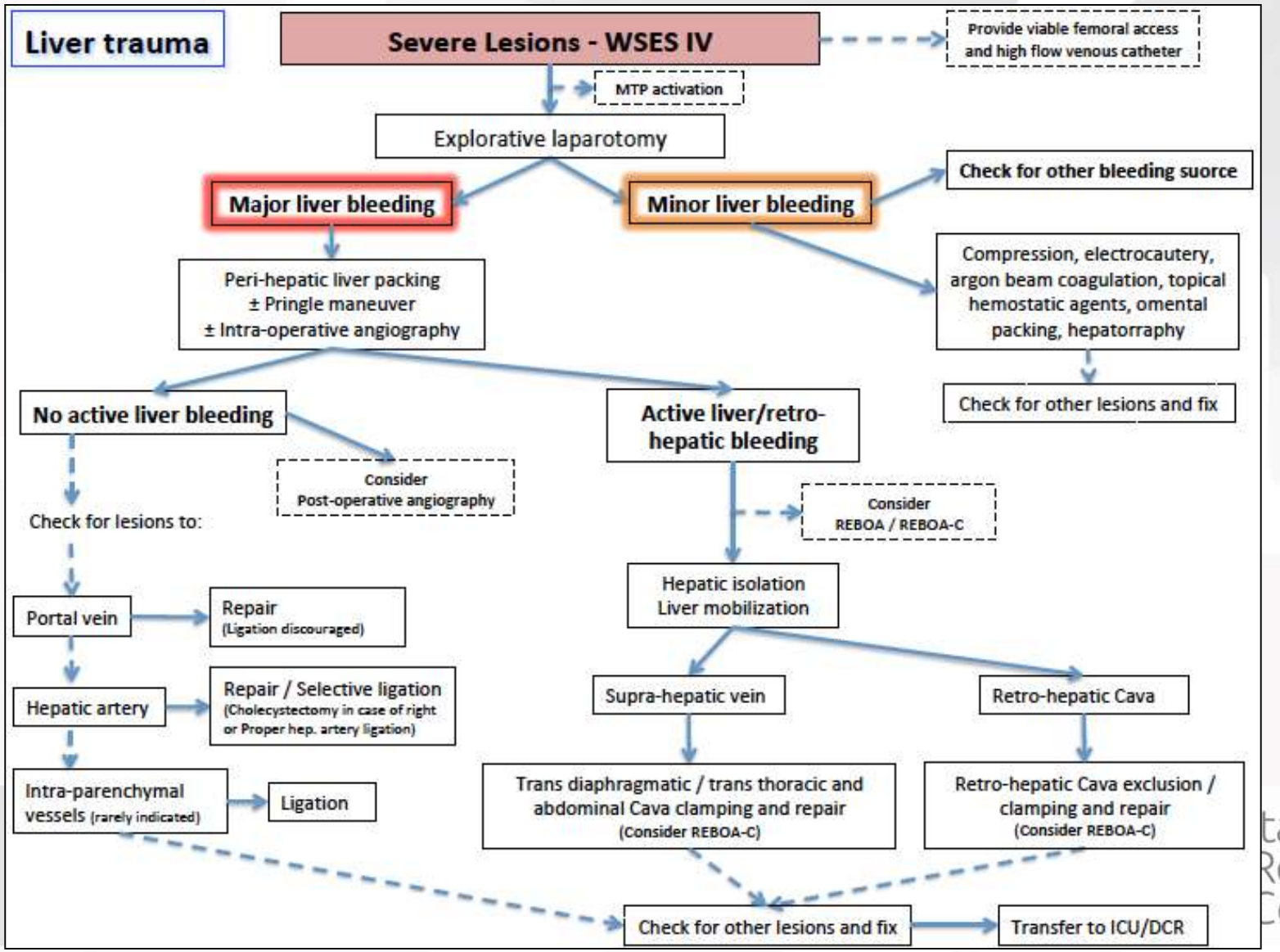
Coccolini et al. World Journal of Emergency Surgery (2016) 11:50
DOI 10.1186/s13017-016-0103-2

World Journal of Emergency Surgery

REVIEW Open Access

WSES classification and guidelines for liver trauma

Federico Coccolini[1*], Fausto Catena[2], Ernest E. Moore[3], Rao Ivatury[4], Walter Biffl[5], Andrew Peitzman[6], Raul Coimbra[7], Sandro Rizoli[8], Yoram Kluger[9], Fikri M. Abu-Zidan[10], Marco Ceresoli[1], Giulia Montori[1], Massimo Sartelli[11], Dieter Weber[12], Gustavo Fraga[13], Noel Naidoo[14], Frederick A. Moore[15], Nicola Zanini[16] and Luca Ansaloni[1]



Pelvic bleeding

J Trauma Acute Care Surg. 2016 May;80(5):717-25. doi: 10.1097/TA.0000000000001034.

Current management of hemorrhage from severe pelvic fractures: Results of an American Association for the Surgery of Trauma multi-institutional trial.

Costantini TW[1], Coimbra R, Holcomb JB, Podbielski JM, Catalano R, Blackburn A, Scalea TM, Stein DM, Williams L, Conflitti J, Keeney S, Suleiman G, Zhou T, Sperry J, Skiada D, Inaba K, Williams BH, Minei JP, Privette A, Mackersie RC, Robinson BR, Moore FO; AAST Pelvic Fracture Study Group.

- 1300 Pelvic Fractures / 11 LI Trauma Centers
- 13 % Arrived in Shock (SBP < 90 mm Hg)
- **Mortality = 32 %**

J Trauma Acute Care Surg 2016

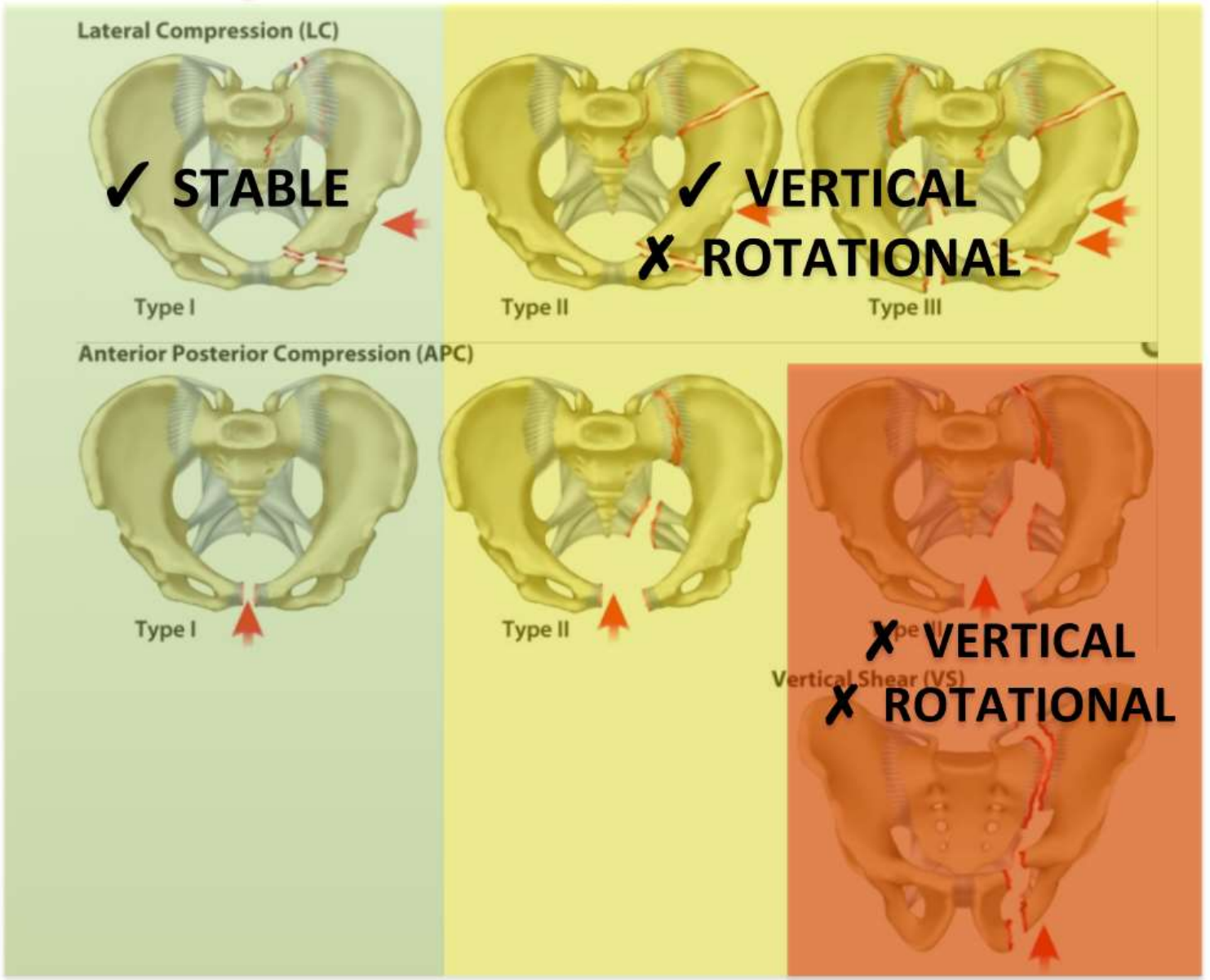
Italian Resuscitation Council

Young Burgess Classification

LC

APC

VS



Abdominopelvic trauma: from anatomical to anatomo-physiological classification

Federico Coccolini[1*], Fausto Catena[2], Yoram Kluger[3], Massimo Sartelli[4], Gianluca Baiocchi[5], Luca Ansaloni[1] and Ernest Eugene Moore[6]

ADDITIONUM DELLA TECNICA • ROMA • 14-15 OTTOBRE

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WSES Pelvic trauma classification

	WSES grade	Young-Burgees classification	Haemodynamic	Mechanic	CT-scan	First-line Treatment
MINOR	WSES grade I	APC I – LC I	Stable	Stable	Yes	NOM
MODERATE	WSES grade II	LC II/III - APC II/III	Stable	Unstable	Yes	Pelvic Binder in the field ± Angioembolization (if blush at CT-scan) OM – Anterior External Fixation *
	WSES grade III	VS - CM	Stable	Unstable	Yes	Pelvic Binder in the field ± Angioembolization (if blush at CT-scan) OM - C-Clamp *
SEVERE	WSES grade IV	Any	Unstable	Any	No	Pelvic Binder in the field Preperitoneal Pelvic Packing ± Mechanical fixation (see over) ± REBOA ± Angioembolization

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

World Journal of Emergency Surgery

REVIEW Open Access

Pelvic trauma: WSES classification and guidelines

Federico Coccolini[1*], Philip F. Stahel[2], Giulia Montori[1], Walter Biffl[3], Tal M Horer[4], Fausto Catena[5], Yoram Kluger[6], Ernest E. Moore[7], Andrew B. Peitzman[8], Rao Ivatury[9], Raul Coimbra[10], Gustavo Pereira Fraga[11], Bruno Pereira[11], Sandro Rizoli[12], Andrew Kirkpatrick[13], Ari Leppaniemi[14], Roberto Manfredi[1], Stefano Magnone[1], Osvaldo Chiara[15], Leonardo Solaini[1], Marco Ceresoli[1], Niccolò Allievi[1], Catherine Arvieux[16], George Velmahos[17], Zsolt Balogh[18], Noel Naidoo[19], Dieter Weber[20], Fikri Abu-Zidan[21], Massimo Sartelli[22] and Luca Ansaloni[1]

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YOUNG - BURGESS CLASSIFICATION

24 Hour Transfusion (Units)

LC			APC		VS	CM
I	II	III	II	III		
2.4	2.8	5.7	6.4	20.4	7.8	7.1

Burgess, J Trauma 1990

Pelvic Fracture Hemorrhage

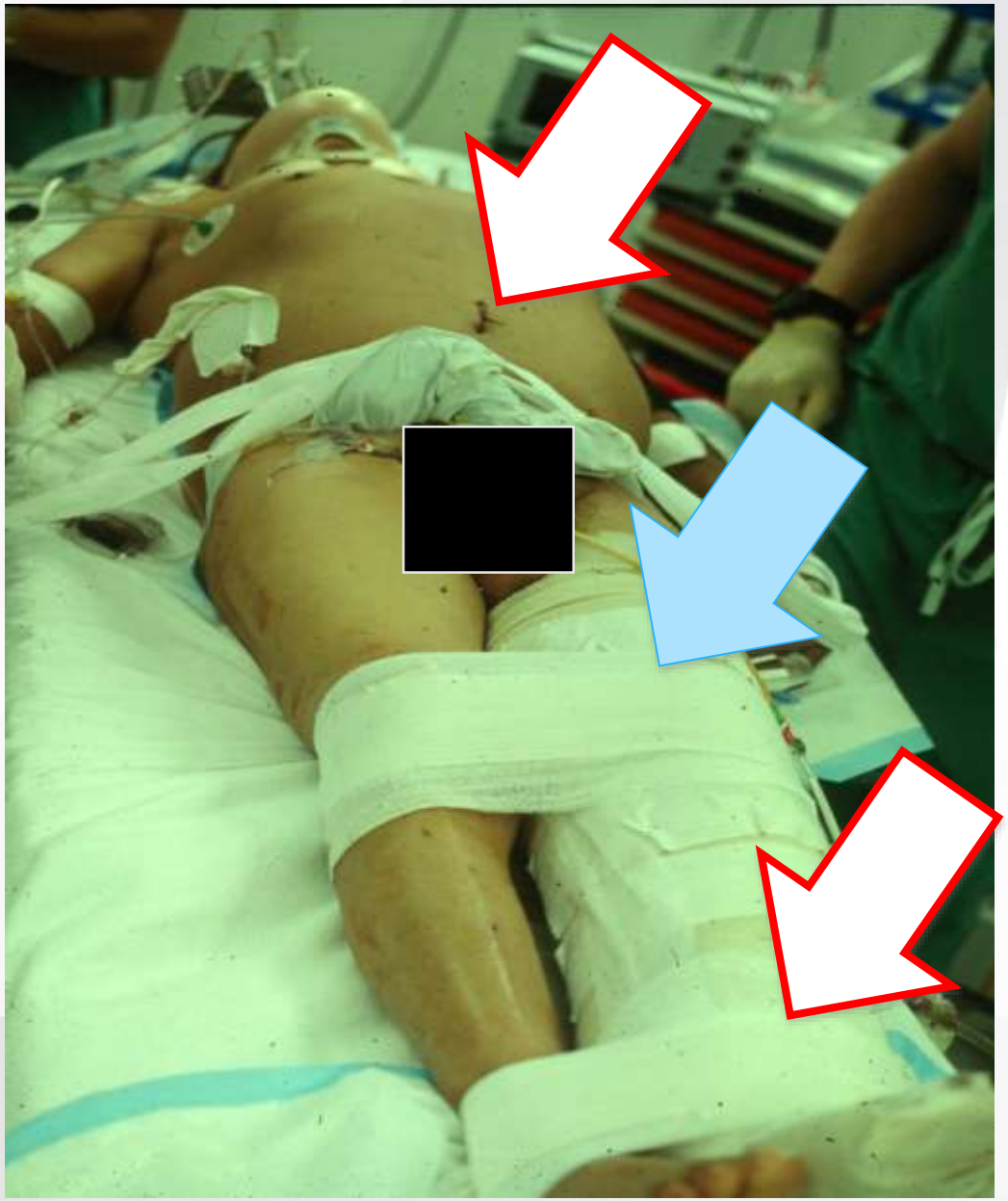
85% - Extravasation from Fractures/Veins

11% - Extravasation from Arteries

Conclusion : Reposition Pelvic Fractures

Huittimen & Slatis, Surgery 1973

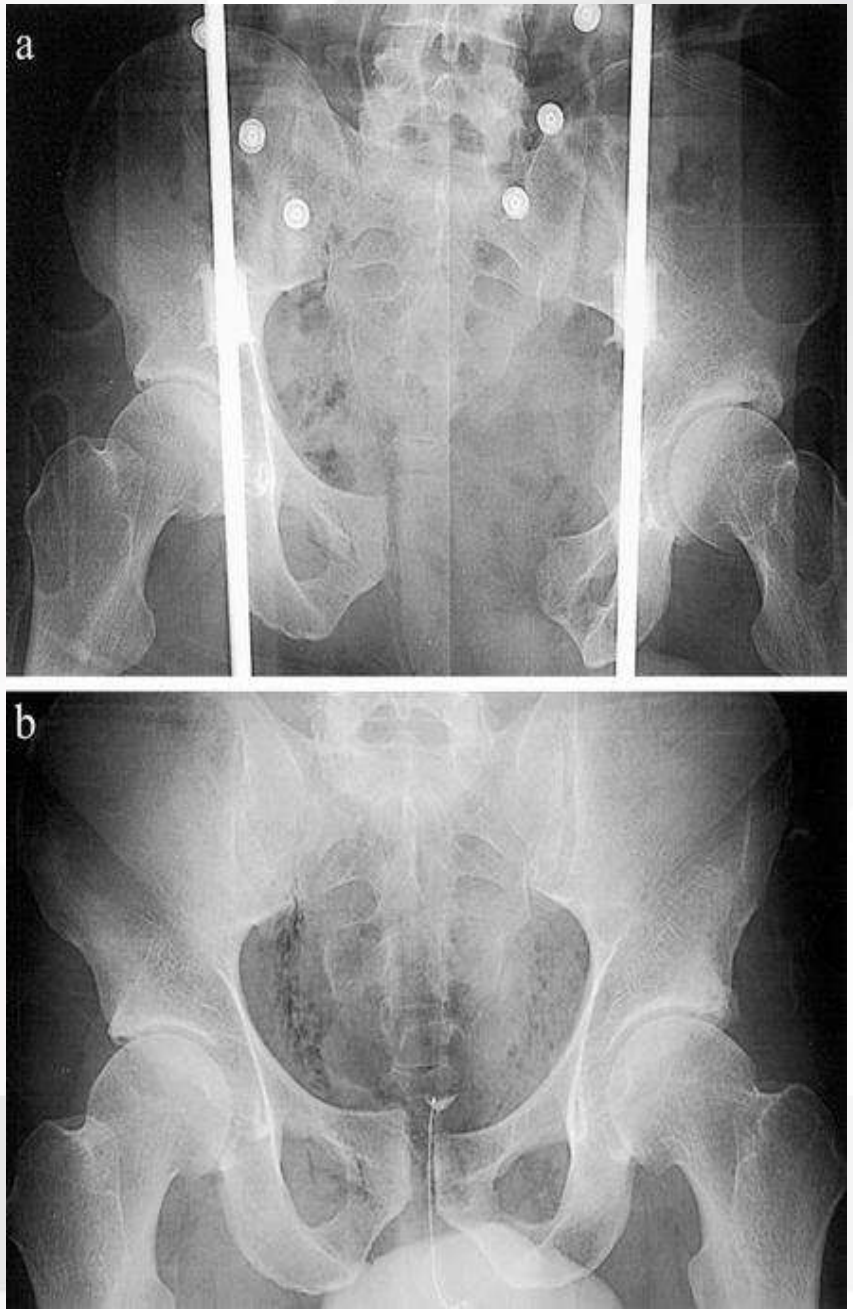
CIRCUMFERENTIAL SHEET



CIRCUMFERENTIAL SHEET

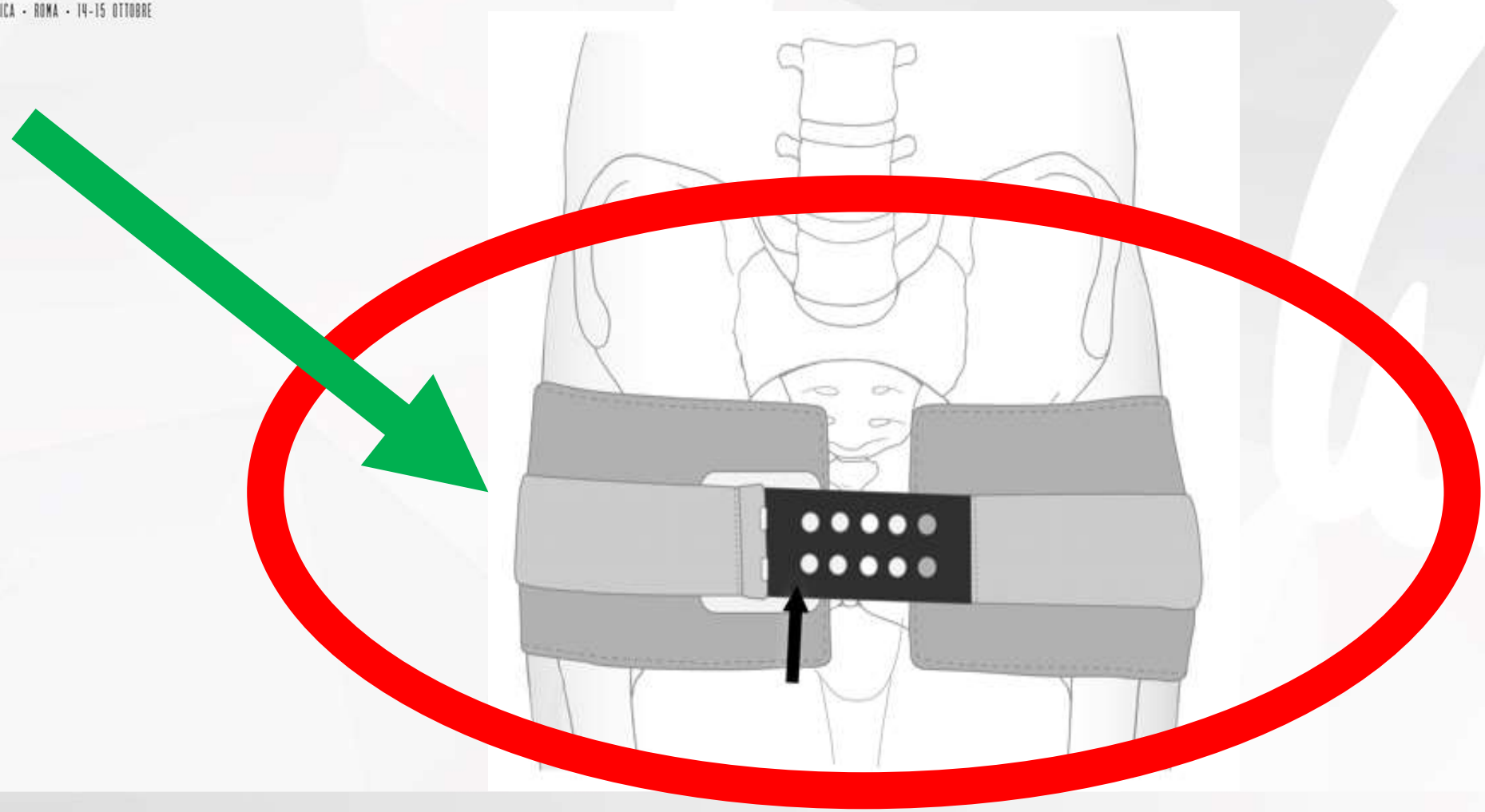
Before

After



Simpson, J Trauma 2002

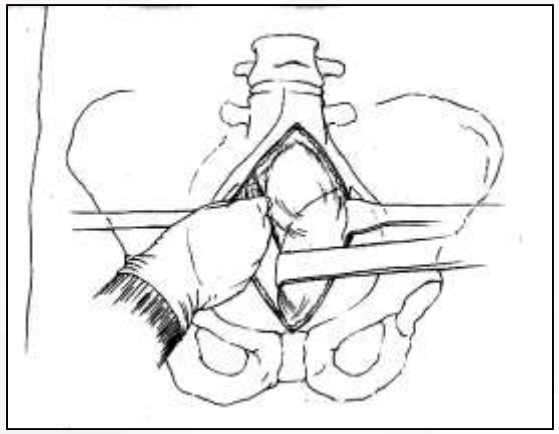
PELVIC STABILIZATION



Hak et al. J Am Acad Orthop Surg 2009; 17:447

Technique

6-8 cm Suprapubic Incision → Divide Midline Fascia → Leave Peritoneum Intact

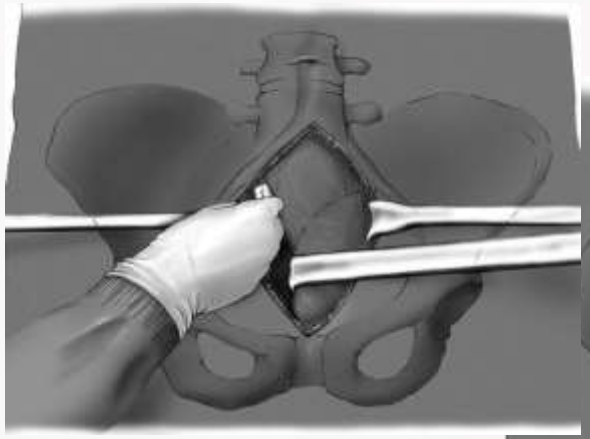


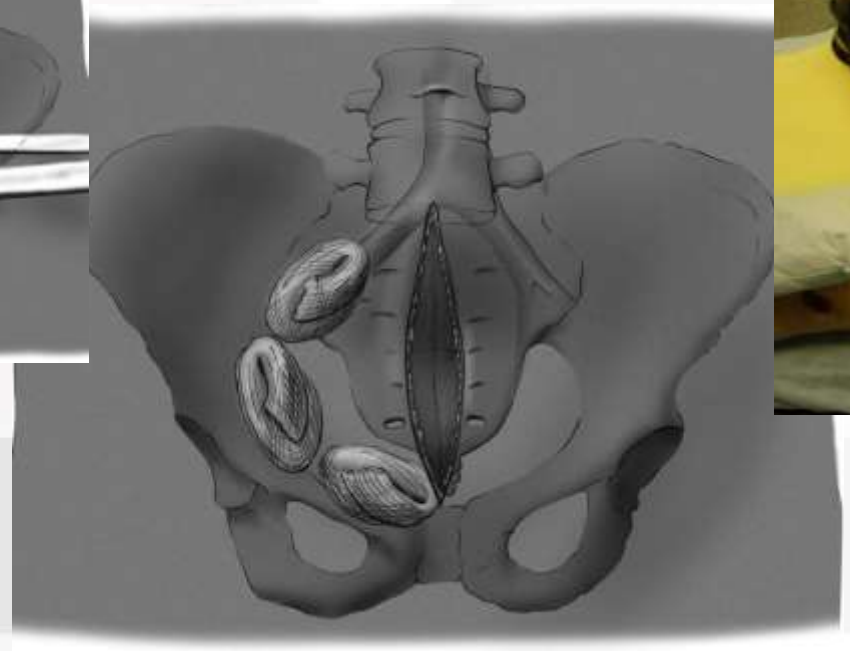
Smith et al. J Trauma 2005; 59:1510

Technique

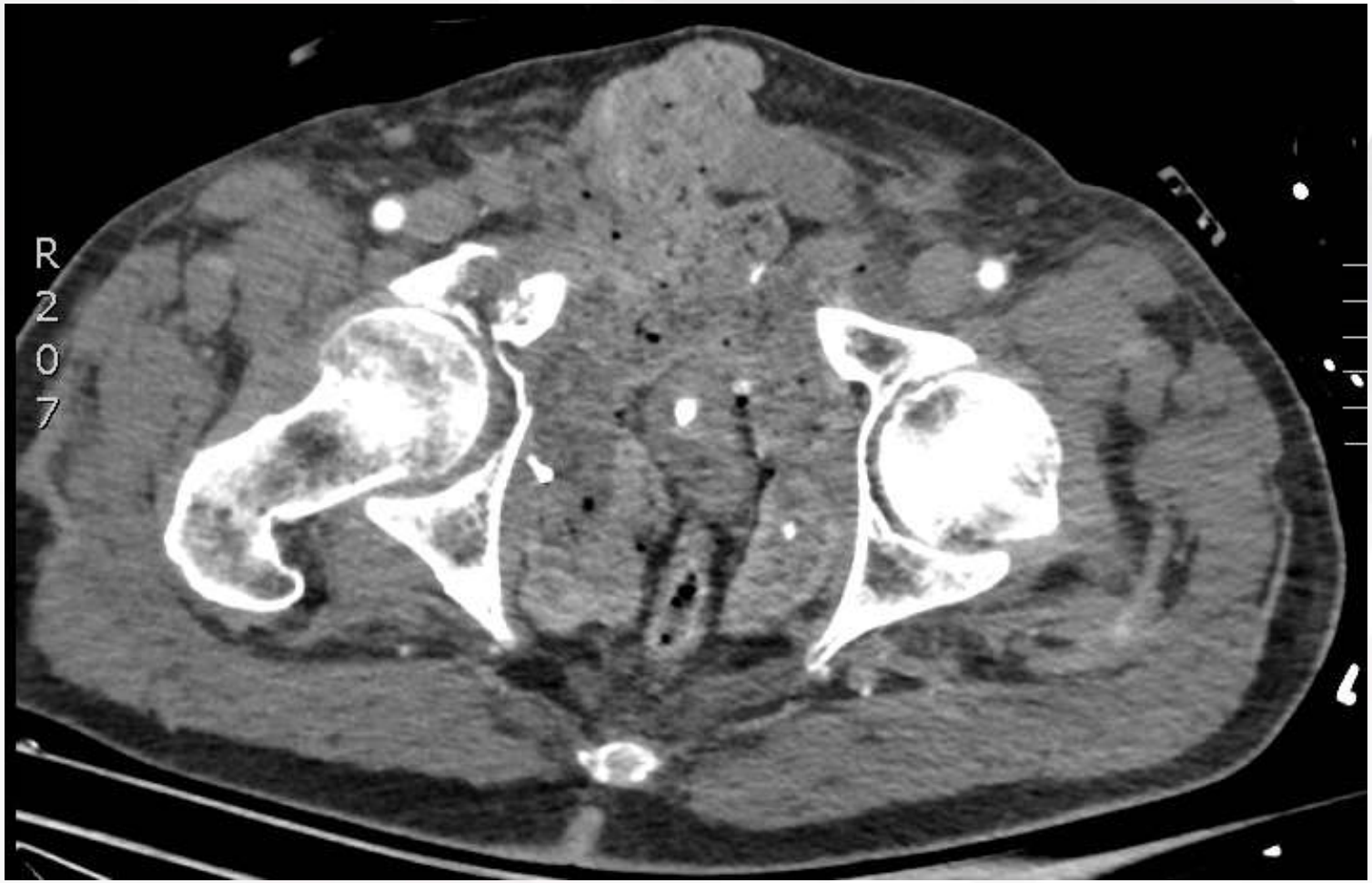
3/more pads for each side down to the presacral space

Close the fascia or at least the skin





Smith et al. J Trauma 2005; 59:1510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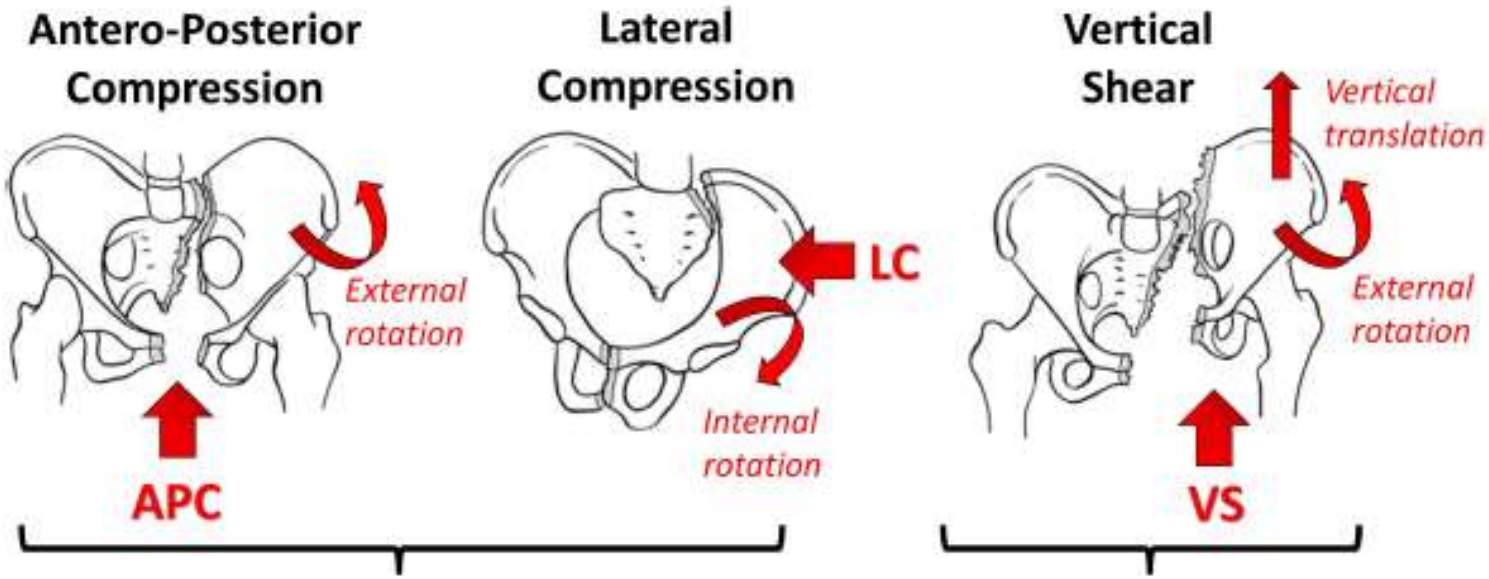
External Fixation



Anterior "resuscitation frame"

Posterior "C-clamp"

WRAPpER

Hemodynamically unstable pelvic trauma

Wrap

Resuscitate

(Resuscitative Thorac)

Angioembolization

Preperitoneal

packing

External fixation

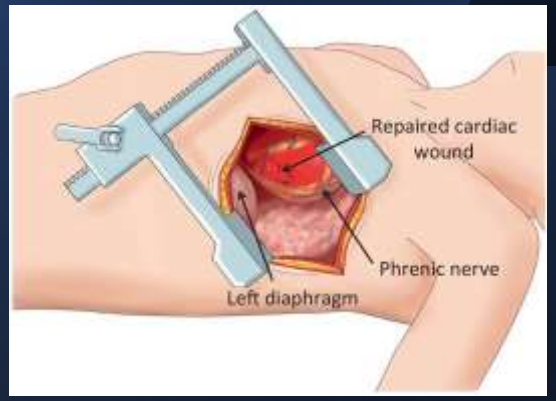
Reboa

DIFFERENTLY COMBINED

TEMPORARY *"BRIDGE"* SOLUTION

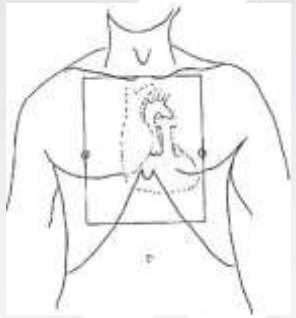
Resuscitative thoracotomy and aortic cross clamping

RESUSCITATIVE THORACOTOMY



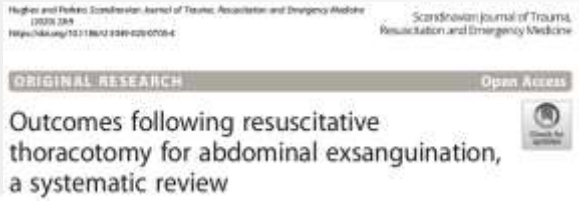
PENETRATING TRAUMA

- 10 to 20% survival rate
- Plays a role

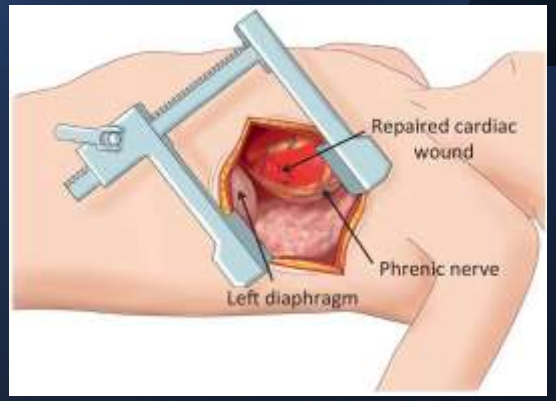


BLUNT TRAUMA

- < 6% survival rate
- Controversial role


Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine
ORIGINAL RESEARCH Open Access
Outcomes following resuscitative thoracotomy for abdominal exsanguination, a systematic review

RESUSCITATIVE THORACOTOMY



INDICATIONS

- Pre-hospital cardiac arrest:
  - PENETRATING: < 15 min CPR
  - BLUNT: < 10 min CPR
- Cardiac arrest in a trauma patient occurring on arrival in the emergency department
- Trauma patients with refractory shock and persistent systolic blood pressure <65 mm Hg

E-FAST to detect cardiac motion!!!!!

POTENTIAL SURVIVORS

ORGAN DONORS (brain death)

PRACTICE MANAGEMENT GUIDELINES

Practice Management Guidelines for Emergency Department Thoracotomy

Working Group, Ad Hoc Subcommittee on Outcomes, American College of Surgeons–Committee on Trauma

European Journal of Trauma and Emergency Surgery
https://doi.org/10.1007/s00068-018-0937-4

REVIEW ARTICLE

Should pre-hospital resuscitative thoracotomy be reserved only for penetrating chest trauma?

Edward J. Nevins[1] · Parisa L. Moori[2] · Jonathan Smith-Williams[3] · Nicholas T. E. Bird[1] · John V. Taylor[1,2] · Nikhil Misra[1,2]

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Table 1 Case reports of PHRT survivors

Paper	Location	Patient	Sub-speciality of physician	Medical transport time (mins)	Injury sustained	Patient condition on arrival	Time spent on scene (mins)	Estimated transport time (mins)	Findings of PHRT	Reason for PHRT	Outcome
Wright and Murphy [24]	London, UK	Teenage male	Medical team doctor	15	Stab to anterior left chest	Agonal breathing then cardiac arrest	18	4	Tamponade	Massive haemothorax found on thoracostomy	Survived, no neurological deficit
Will et al. [12]	Texas, USA	30-year-old male	General surgical trainee	7	4 inch stab to left chest	Apnoeic with HR > 140 BPM	Not stated	15–20	2 L of blood in chest, no obvious source	Patient arrested and prolonged journey time	Survived, no neurological deficit
Keogh and Wilson [9]	London, UK	34-year-old male	HEMS doctor	10	Two stabs to anterior left chest	Two weak breaths then cardiac arrest	> 20	15	Tamponade with 1.5 cm right ventricular laceration	Patient arrested and prolonged journey time	Survived, no neurological deficit
Deakin [10]	Winchester, UK	50-year-old male	Medical ambulance doctor	11	Stab to lateral left chest	Cardiac arrest with agonal ECG rhythm	31	20	Tamponade and haemothorax	Patient arrested and prolonged journey time	Survived, now able to live independently
Craig et al. [13]	London, UK	Middle-aged male	Anaesthetist	14	Stab to chest*	Cardiac arrest	22	2	Tamponade with ventricular laceration	Patient arrested	Survived, no neurological deficit
Corral et al. [11]	Madrid, Spain	Young male	Emergency doctor	7	Several stabs to chest*	Cardiac arrest	> 13	> 10	Tamponade	Patient arrested and prolonged journey time	Survived, no neurological deficit

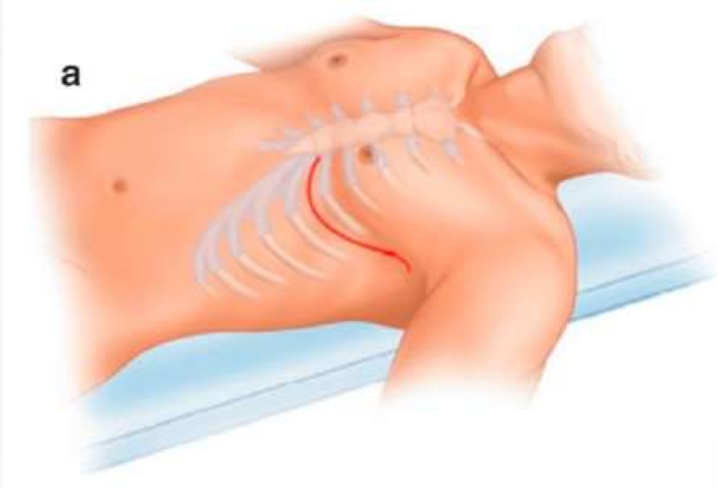
Table 2 Papers demonstrating case series of PHRT

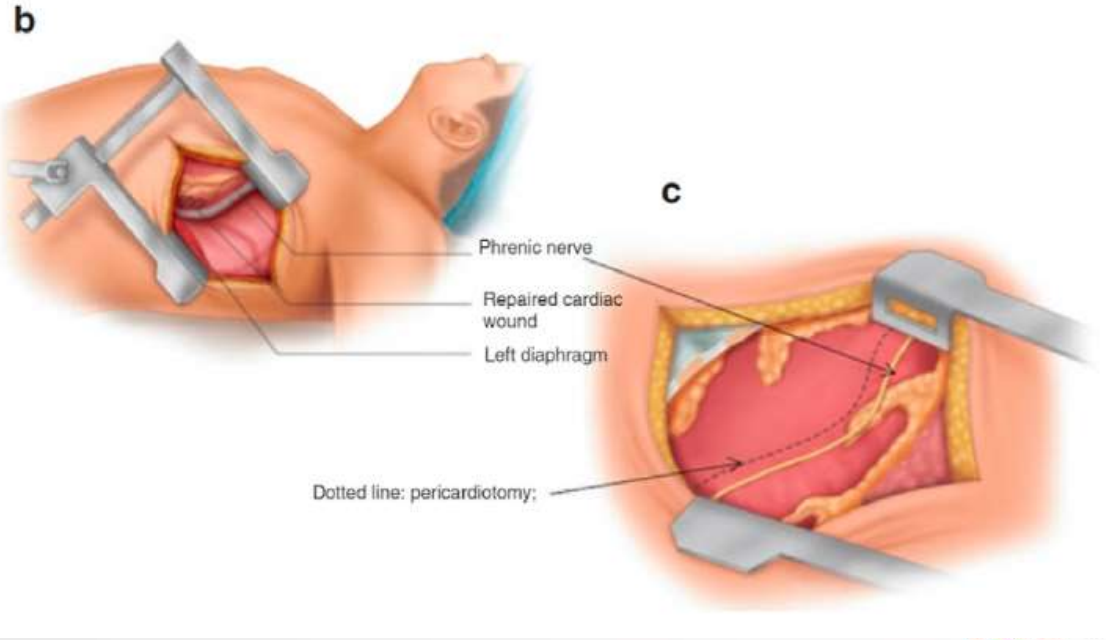
Paper	Location	Number of PHRTs performed	Dates included	Number of males (%)	Age (years)	Number of survivors to discharge (%)	Transport time to patient (mins)	Method of transport to patient	Method of transport to hospital
Athanasiou et al. [7]	London, UK	31	1994–2002	41* (77.3)	Mean 36.7*	3 (9.7)	Mean 9.29*	**	**
Davies and Lockey [15]	London, UK	71	1993–2008	**	**	13 (18.3)	**	Air or road	Air or road
Coats et al. [14]	London, UK	39	1993–1999	35 (89.7)	Mean 45	4 (10.3)	Mean 12.5	Air or road	Air or road
Matsumoto et al. [18]	Chiba, Japan	34	2003–2008	22 (64.7)	Median 35.7	0 (0)	**	Air	Air
Van Vledder et al. [17]	Holland	33	2011–2016	**	Median 38[†] and 31[††]	1 (3)	**	Air or road	**

Contraindication	$n=9$
Massive traumatic brain injury	7
Time since cardiac arrest	7
Time to Major trauma centre	2
Blunt trauma	3
Extreme patient age	1
Multiple critically injured patients resulting in resource limitations	4

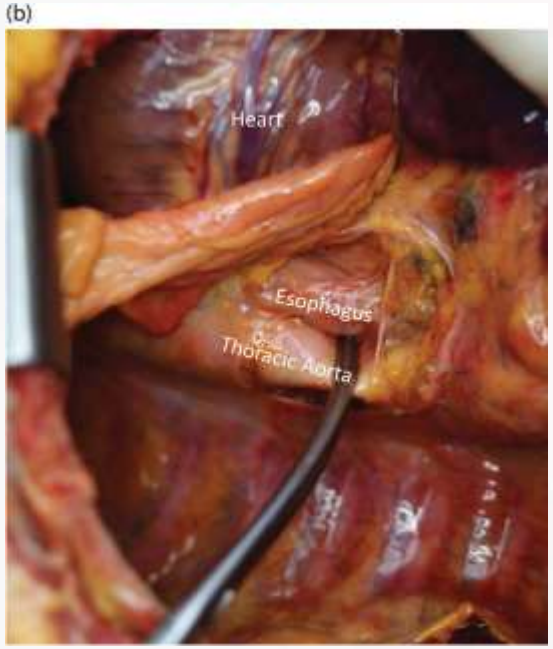
It could be argued that if a pre-hospital team witnesses a cardiac arrest secondary to trauma, or arrives within 5 min of it occurring, that PHRT should be performed immediately, regardless of the mechanism of injury, as long as the pre-hospital team is adequately trained, and that concurrent DCR is initiated. This may provide a good outcome in a small number of patients who would otherwise not survive.

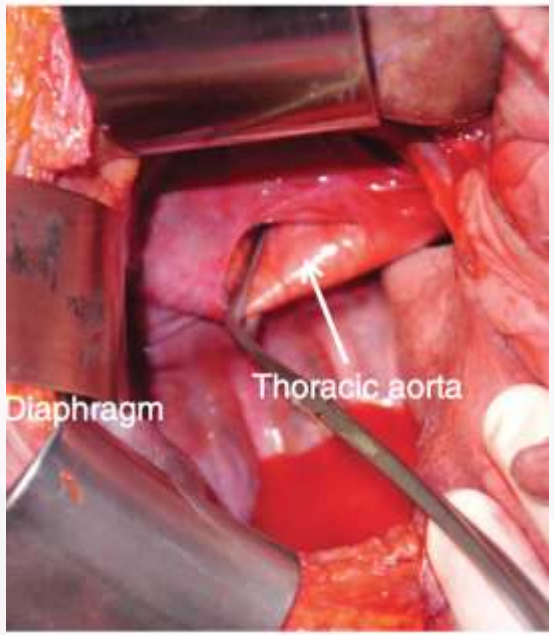
RESUSCITATIVE THORACOTOMY





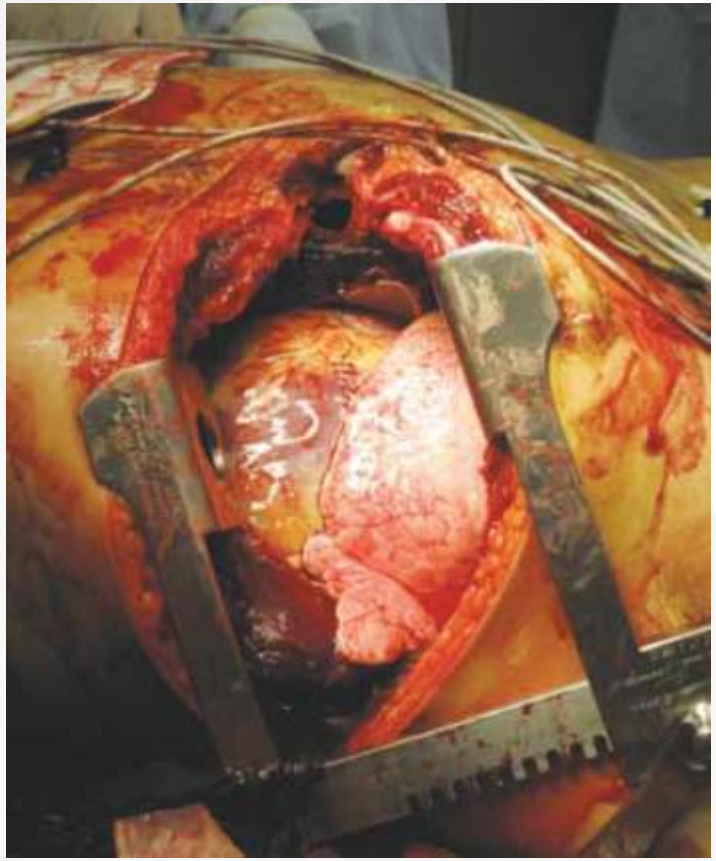
RESUSCITATIVE THORACOTOMY



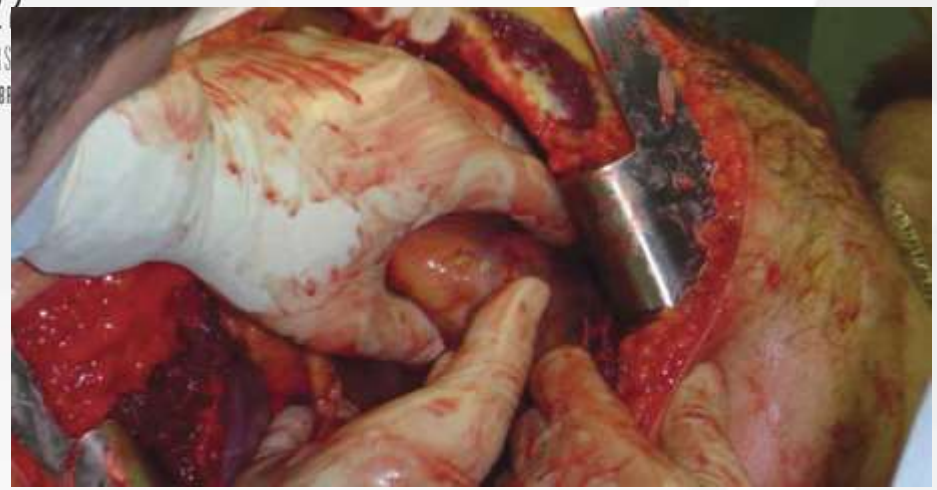


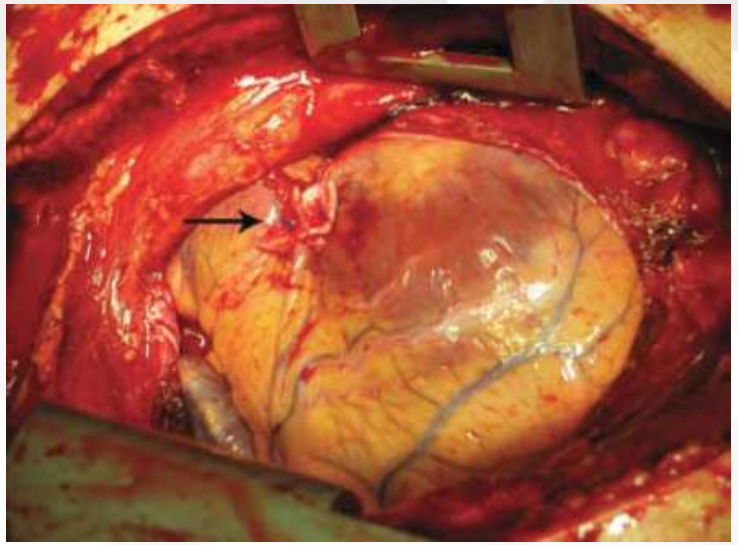
WHAT TO DO:

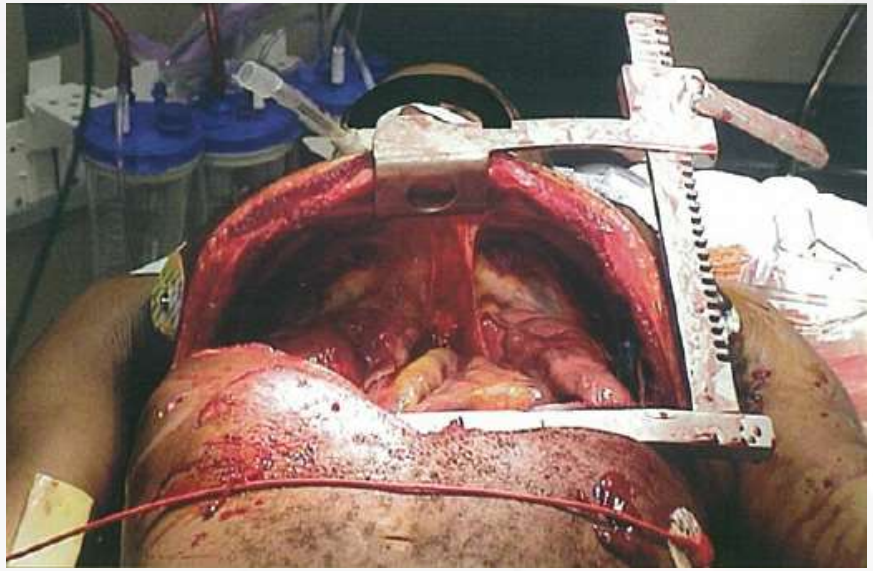
- Decompress the heart (tamponade) and repair the heart
- Aortic cross-clamp → improve coronary/cerebral arterial blood flow
- Open cardiac massage
- Search/repair thoracic injuries (control the hemorrhage from lung and vessels)

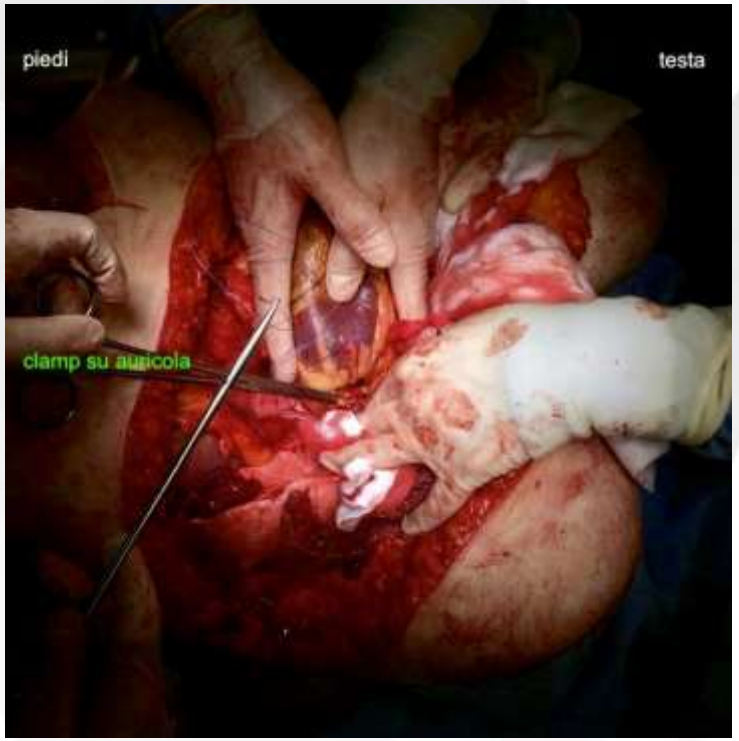


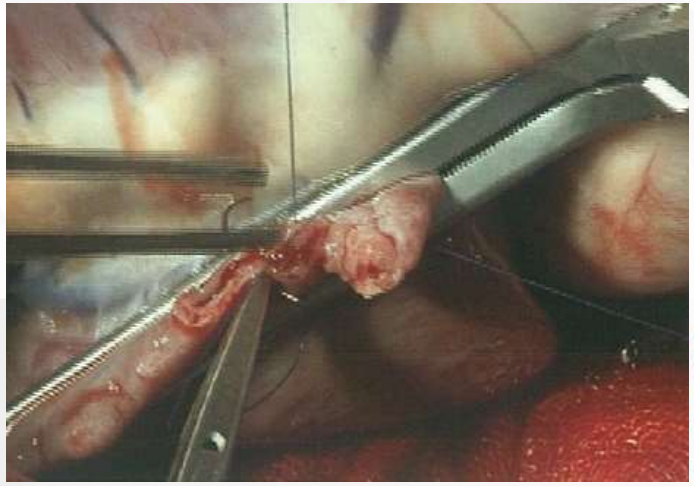

Pericardium
Phrenic nerve



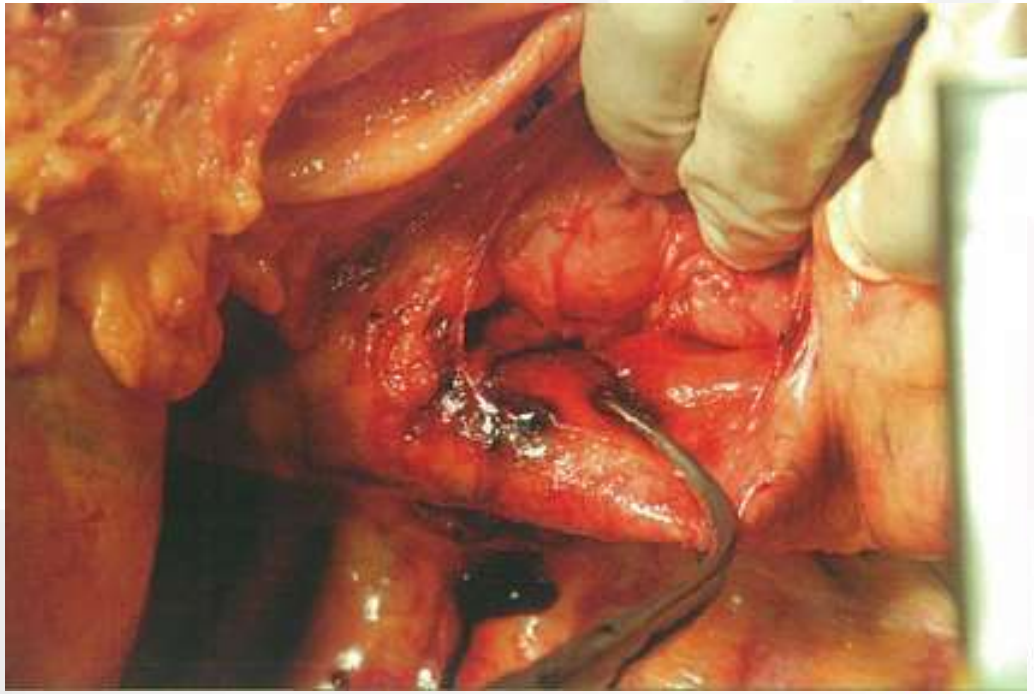





piedi
testa
clamp su auricola



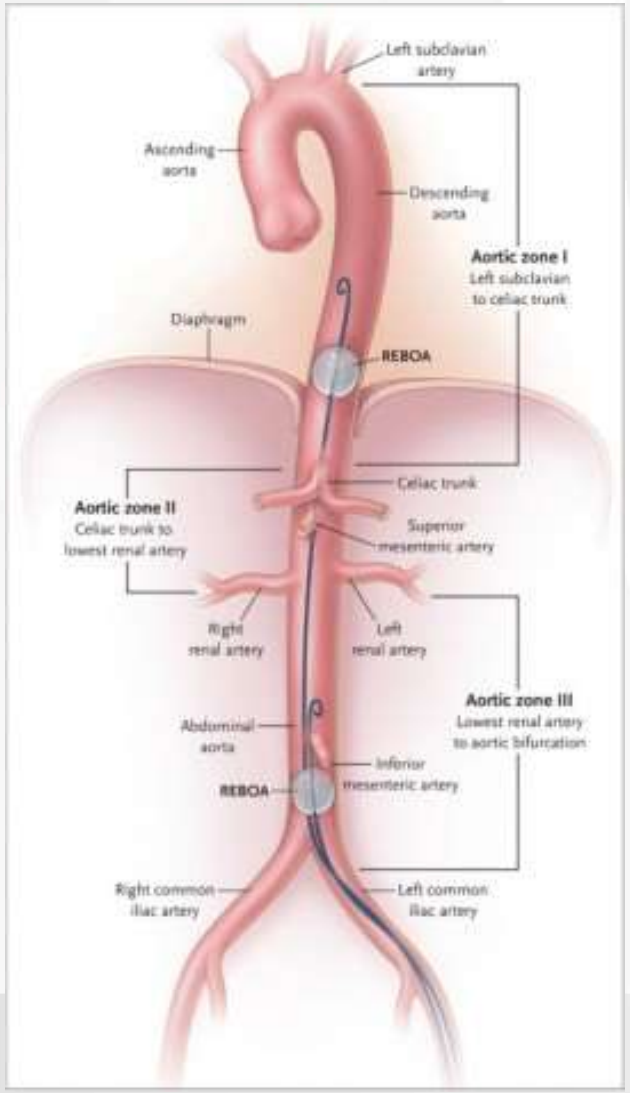
Aortic cross-clamping

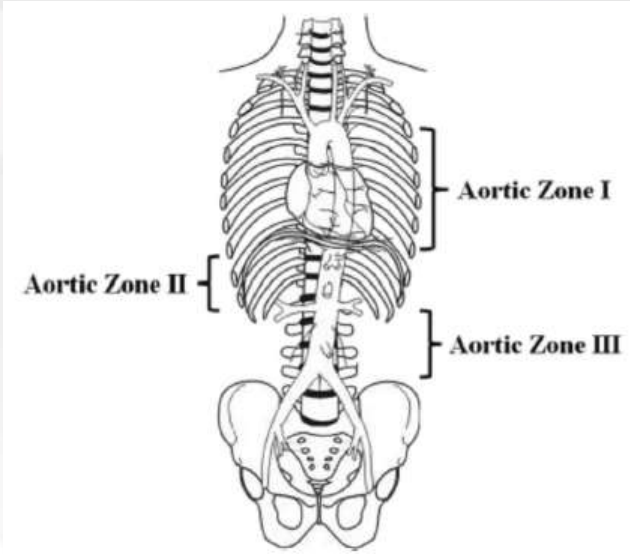


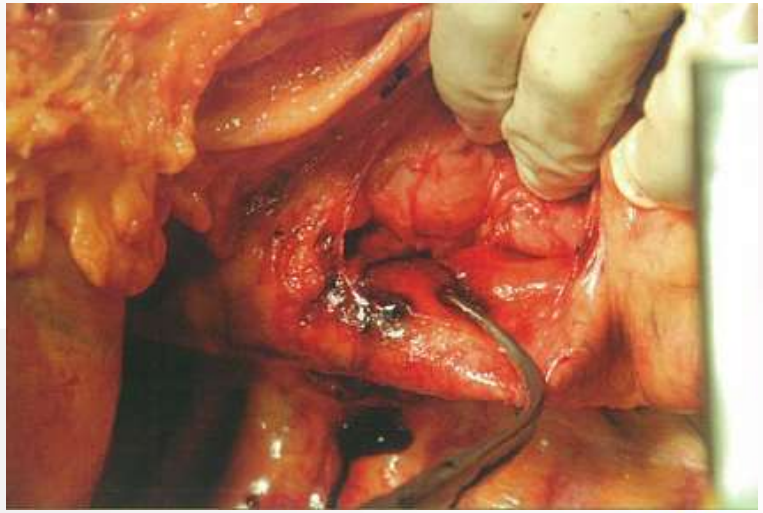
REBOA

(Resuscitative Endovascular Balloon Occlusion of the Aorta)

Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA)







EDT & PPP Vs. REBOA

	REBOA	EDT	PPP
Easyness	-/+	-/+	++
Rapidity	-/+	-/+	++
Organizational complexity	-/+	-/+	-/+
Indications	+/-	+	+/-
"Diffusibility"	-	-/+	++
Possibility of treatment	+/-	+/-	+/-
Complications directly linked to the procedure	+	+	+
Risks for the personel	-/+	-/+	-/+
Costs	++	+/-	--

CENTRE/TEAM

"COMFORT ZONE"

BUT

ATTENTION TO NOT POSTPONE PATIENT NECESSITY
TO THE SYSTEM UNPREPAREDNESS

CONGRESSO NAZIONALE IRC 2022

TRAUMA: NUOVE EVIDENZE E PERCORSI

AUDITORIUM DELLA TECNICA - ROMA - 14-15 OTTOBRE

UNIVERSITÀ DI PISA

THANK YOU FOR YOUR KIND ATTENTION

federico.coccolini@gmail.com

IRC Italian Resuscitation Council

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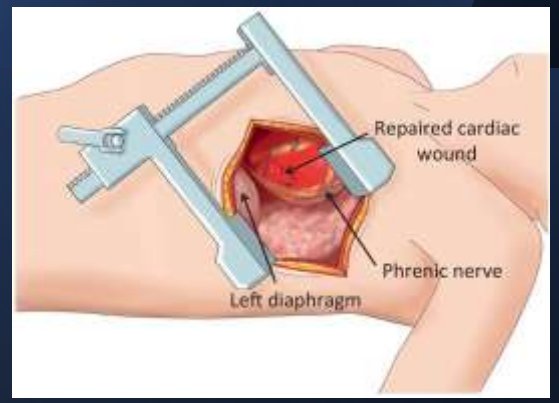
RESUSCITATIVE THORACOTOMY



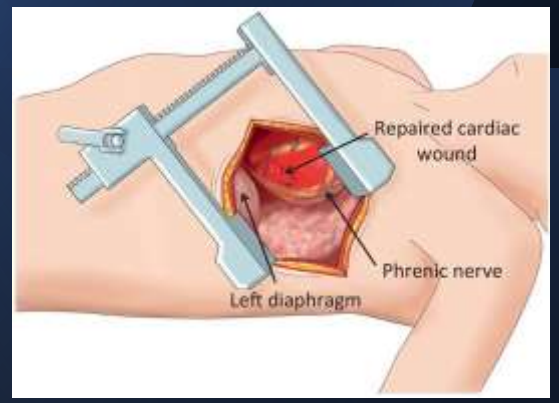
American College of Surgeons Committee on Trauma Class II Recommendations for Emergency Resuscitative Thoracotomy		
ERT…	**Conditions**	**Notes**
Is **BEST** applied for	(1) **penetrating cardiac** injuries that (2) arrive at trauma centers after (3) a short scene/transport time with (4) witnessed or objectively measured SOL	
SHOULD be performed	In penetrating non-cardiac **thoracic** injuries	Generally, low survival rate. Establishes presence or not of cardiac injuries.
CAN be performed	In exsanguinating **abdominal** vascular injuries	Generally, low survival rate. REBOA may be equally appropriate salvage procedure.
Should **RARELY** be performed	In arrest secondary to blunt trauma. Should be limited to those arriving with vital signs and witnessed arrest	Very low survival rate and poor neurologic outcomes

PRACTICE MANAGEMENT GUIDELINES

Practice Management Guidelines for Emergency Department Thoracotomy

Working Group, Ad Hoc Subcommittee on Outcomes, American College of Surgeons–Committee on Trauma

RESUSCITATIVE THORACOTOMY



Box 6
Eastern Association for the surgery of trauma guidelines for resuscitative thoracotomy

Strong Recommendation:
- Pulseless patient presenting to ED with SOLs after penetrating thoracic injury

Conditional Recommendations:
- Pulseless patient presenting to ED without SOLs after penetrating thoracic injury (consider time without SOL in decision making)
- Pulseless patient presenting to ED with SOL after penetrating nonthoracic injury (consider location of injury in decision making)
- Pulseless patient presenting to ED without SOLs after penetrating nonthoracic injury (few patients may benefit, low quality evidence, and excludes isolated intracranial injury)
- Pulseless patient presenting to ED with SOLs after blunt injury (some patients may not wish to undergo EDT considering concomitant severe traumatic brain injury)

Recommendation Against:
- Pulseless patient presenting to ED without SOLs after blunt injury (most patients would not wish to undergo EDT considering concomitant severe traumatic brain injury and dismal outcomes)

Updates in Traumatic Cardiac Arrest

William Teeter, MD, MS*, Daniel Haase, MD

From Seamon MJ, Haut ER, Van Arendonk K, et al. An evidence-based approach to patient selection for emergency department thoracotomy: A practice management guideline from the Eastern Association for the Surgery of Trauma. J Trauma Acute Care Surg 2015;79:159-73.