



April 25-28, 2019  
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# Tricks of Trauma Patients Management

## Resuscitative Thoracotomy: When?

**Hassan Al-Thani**

MD, MBA, CABS, FRCS (Ire), FRCS(C), FRCS (Glu), FACS  
Department of Surgery, Hamad General Hospital, Qatar  
26<sup>th</sup> April 2019



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**I have nothing to disclose**



## Resuscitative Thoracotomy: When?



# Primary Goals of Resuscitative Thoracotomy

1. Release of cardiac tamponade
2. Control of massive intra-thoracic bleed
3. Prevention or control of air embolism
4. Control of bronchopleural fistulae
5. Internal or open cardiac massage
6. Cross-clamping of descending aorta in order to redistribute limited blood flow to the myocardium and brain and limit sub-diaphragmatic hemorrhage

## Resuscitative Thoracotomy: When?

Right  
Patient

Right  
Provider

Right  
Place

Right  
Time

Right  
Option

Right  
Outcome





Eastern Association for the Surgery of Trauma  
Advancing Science, Fostering Relationships, and Building Careers



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

Mark J. Seamon, MD, Elliott R. Haut, MD, PhD, Kyle Van Arendonk, MD, Ronald R. Barbosa, MD, William C. Chiu, MD, Christopher J. Dente, MD, Nicole Fox, MD, Randee S. Jawa, MD, Kosar Khwaja, MD, J. Kayle Lee, MD, Louis J. Magnotti, MD, Julie A. Mayglothling, MD, Amy A. McDonald, MD, Susan Rowell, MD, MCR, Kathleen B. To, MD, Yngve Falck-Ytter, MD, and Peter Rhee, MD, MPH, Philadelphia, Pennsylvania

72 studies provided 10,238 patients who underwent EDT

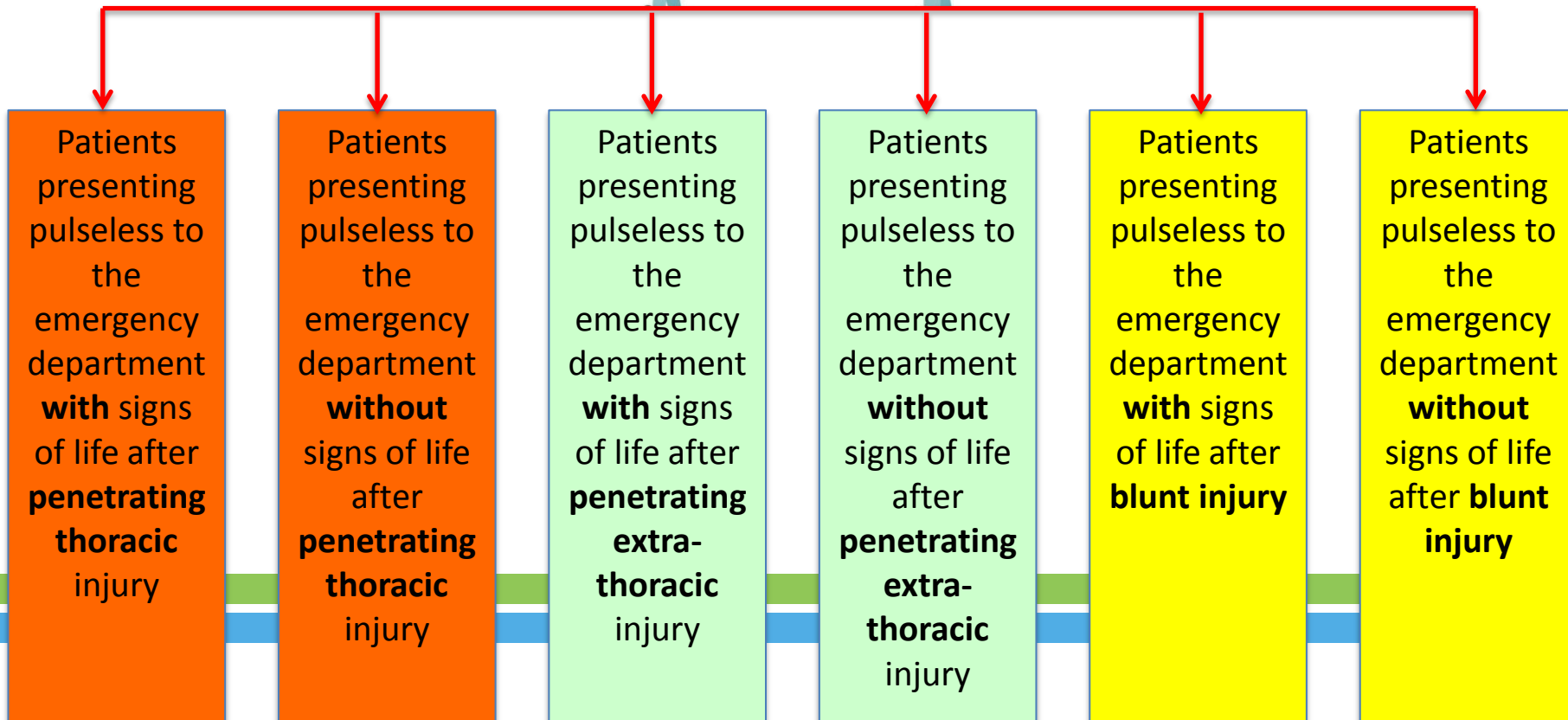
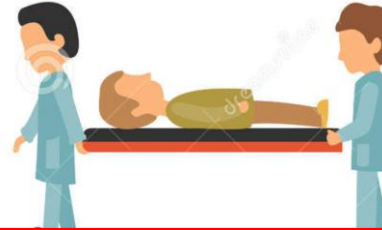
## **Objectives**

To evaluate whether **EDT vs. resuscitation without EDT**

## **Outcomes**

Hospital survival

Neurologically intact hospital survival



**QUESTION 1: Should Patients Who Present Pulseless to the Emergency Department:  
with SIGNS OF LIFE<sup>1</sup> after PENETRATING THORACIC INJURY  
Undergo Emergency Department Thoracotomy versus No Emergency Department Thoracotomy?**

Quality Assessment							Summary of Findings				
Participants (studies)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Overall Quality of Evidence	Study Event Rates (%)			Anticipated Absolute Effects	
							Without EDT	With EDT	Relative Effect	Risk without EDT	Risk Difference with EDT (95% CI)
Hospital Survival (CRITICAL OUTCOME)											
853 (32 cohort studies without controls)	serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	undetected	⊕⊕⊕⊖ MODERATE due to large effect	2.8% <sup>2</sup>	182/853 (21.3% pooled, 95% CI: 18.7%, 24.2%)	RR 7.6 <sup>3</sup>	28 survivors per 1000 <sup>2</sup>	185 more survivors per 1000 (from 156 to 215 more)
Neurologically Intact Hospital Survival (CRITICAL OUTCOME)											
454 (16 cohort studies without controls)	serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	undetected	⊕⊕⊕⊖ MODERATE due to large effect	2.5% <sup>4</sup>	53/454 (11.7% pooled, 95% CI: 9.0%, 15.0%)	RR 4.7 <sup>3</sup>	25 survivors per 1000 <sup>4</sup>	92 more survivors per 1000 (from 61 to 123 more)

**EAST strongly recommends** resuscitative ED thoracotomy

Based on patient preference for improved chance of survival and a moderate quality of evidence  
**(21.3 % survival** among 853 patients, of which **90 % were neurologically intact)**



**QUESTION 2: Should Patients Who Present Pulseless to the Emergency Department:  
without SIGNS OF LIFE<sup>1</sup> after PENETRATING THORACIC INJURY  
Undergo Emergency Department Thoracotomy versus No Emergency Department Thoracotomy?**

Quality Assessment							Summary of Findings				
Participants (studies)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Overall Quality of Evidence	Study Event Rates (%)			Anticipated Absolute Effects	
							Without EDT	With EDT	Relative Effect	Risk without EDT	Risk Difference with EDT (95% CI)
Hospital Survival (CRITICAL OUTCOME)											
920 (32 cohort studies without controls)	serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	undetected	⊕⊕⊕⊖ MODERATE due to large effect	0.2% <sup>2</sup>	76/920 (8.3% pooled, 95% CI: 6.6%, 10.2%)	RR 41.3 <sup>3</sup>	2 survivors per 1000 <sup>2</sup>	81 more survivors per 1000 (from 63 to 99 more)
Neurologically Intact Hospital Survival (CRITICAL OUTCOME)											
641 (16 cohort studies without controls)	serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	undetected	⊕⊕⊕⊖ MODERATE due to large effect	0.18% <sup>4</sup>	25/641 (3.9% pooled, 95% CI: 2.6%, 5.6%)	RR 19.5 <sup>3</sup>	2 survivors per 1000 <sup>4</sup>	37 more survivors per 1000 (from 24 to 54 more)

**EAST conditionally recommends** resuscitative ED thoracotomy

This is based on patient preference and moderate overall quality of evidence (**8.3 % survival** based on 920 patients in 32 studies). Among the 641 patients in whom neurologic outcome was reported, **3.9 % survived neurologically intact**

**QUESTION 3: Should Patients Who Present Pulseless to the Emergency Department:  
with SIGNS OF LIFE<sup>1</sup> after PENETRATING EXTRA-THORACIC INJURY<sup>2</sup>  
Undergo Emergency Department Thoracotomy versus No Emergency Department Thoracotomy?**

Quality Assessment							Summary of Findings				
Participants (studies)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Overall Quality of Evidence	Study Event Rates (%)			Anticipated Absolute Effects	
							Without EDT	With EDT	Relative Effect	Risk without EDT	Risk Difference with EDT (95% CI)
Hospital Survival (CRITICAL OUTCOME)											
160 (11 cohort studies without controls)	serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	undetected	⊕⊕⊕⊖ MODERATE due to large effect	1.7% <sup>3</sup>	25/160 (15.6% pooled, 95% CI: 10.6%, 21.9%)	RR 9.2 <sup>4</sup>	17 survivors per 1000 <sup>3</sup>	139 more survivors per 1000 (from 82 to 196 more)
Neurologically Intact Hospital Survival (CRITICAL OUTCOME)											
85 (6 cohort studies without controls)	serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	undetected	⊕⊕⊕⊖ MODERATE due to large effect	1.5% <sup>5</sup>	14/85 (16.5% pooled, 95% CI: 9.7%, 25.5%)	RR 11.0 <sup>4</sup>	15 survivors per 1000 <sup>5</sup>	150 more survivors per 1000 (from 71 to 229 more)

**EAST conditionally recommends** resuscitative ED thoracotomy

There was a **small patient population** that provided data for this clinical scenario  
Among the 160 patients in 11 studies, there was a **15.6 % survival rate**. Neurologic outcomes were cited in only 85 patients; **16.5 % survived intact**.

**QUESTION 4: Should Patients Who Present Pulseless to the Emergency Department:  
without SIGNS OF LIFE<sup>1</sup> after PENETRATING EXTRA-THORACIC INJURY<sup>2</sup>  
Undergo Emergency Department Thoracotomy versus No Emergency Department Thoracotomy?**

Quality Assessment							Summary of Findings				
Participants (studies)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Overall Quality of Evidence	Study Event Rates (%)			Anticipated Absolute Effects	
							Without EDT	With EDT	Relative Effect	Risk without EDT	Risk Difference with EDT (95% CI)
Hospital Survival (CRITICAL OUTCOME)											
139 (8 cohort studies without controls)	serious risk of bias	no serious inconsistency	no serious indirectness	serious risk of imprecision	undetected	⊕⊕⊕⊖ LOW	0.1% <sup>3</sup>	4/139 (2.9% pooled, 95% CI: 0.9%, 6.8%)	RR 28.8 <sup>4</sup>	1 survivor per 1000 <sup>3</sup>	28 more survivors per 1000 (from 0 to 56 more)
Neurologically Intact Hospital Survival (CRITICAL OUTCOME)											
60 (4 cohort studies without controls)	serious risk of bias	no serious inconsistency	no serious indirectness	serious risk of imprecision	undetected	⊕⊕⊕⊖ LOW	0.09% <sup>5</sup>	3/60 (5.0% pooled, 95% CI: 1.3%, 13.0%)	RR 55.7 <sup>4</sup>	1 survivor per 1000 <sup>5</sup>	49 more survivors per 1000 (from 0 to 104 more)

**EAST conditionally recommends resuscitative ED thoracotomy**  
**Survival was 2.9 % among this small data set of 139 patients from eight studies**  
**Neurologic outcome was reported for 60 patients, and only three of those survived neurologically intact**

**QUESTION 5: Should Patients Who Present Pulseless to the Emergency Department:  
with SIGNS OF LIFE<sup>1</sup> after BLUNT INJURY  
Undergo Emergency Department Thoracotomy versus No Emergency Department Thoracotomy?**

Quality Assessment							Summary of Findings				
Participants (studies)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Overall Quality of Evidence	Study Event Rates (%)			Anticipated Absolute Effects	
							Without EDT	With EDT	Relative Effect	Risk without EDT	Risk Difference with EDT (95% CI)
Hospital Survival (CRITICAL OUTCOME)											
454 (22 cohort studies without controls)	serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	undetected	⊕⊕⊕⊖ MODERATE due to large effect	0.5% <sup>2</sup>	21/454 (4.6% pooled, 95% CI: 3.0%, 6.9%)	RR 9.3 <sup>3</sup>	5 survivors per 1000 <sup>2</sup>	41 more survivors per 1000 (from 22 to 61 more)
Neurologically Intact Hospital Survival (CRITICAL OUTCOME)											
298 (10 cohort studies without controls)	serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	undetected	⊕⊕⊕⊖ MODERATE due to large effect	0.3% <sup>4</sup>	7/298 (2.4% pooled, 95% CI: 1.0%, 4.6%)	RR 7.8 <sup>3</sup>	3 survivors per 1000 <sup>4</sup>	21 more survivors per 1000 (from 3 to 38 more)

**EAST conditionally recommends** resuscitative ED thoracotomy  
**Survival was 4.6 %** among 454 patients in 22 studies. Neurologic outcome was reported in 298 of these patients, and only **2.4 % survived ED thoracotomy neurologically intact**

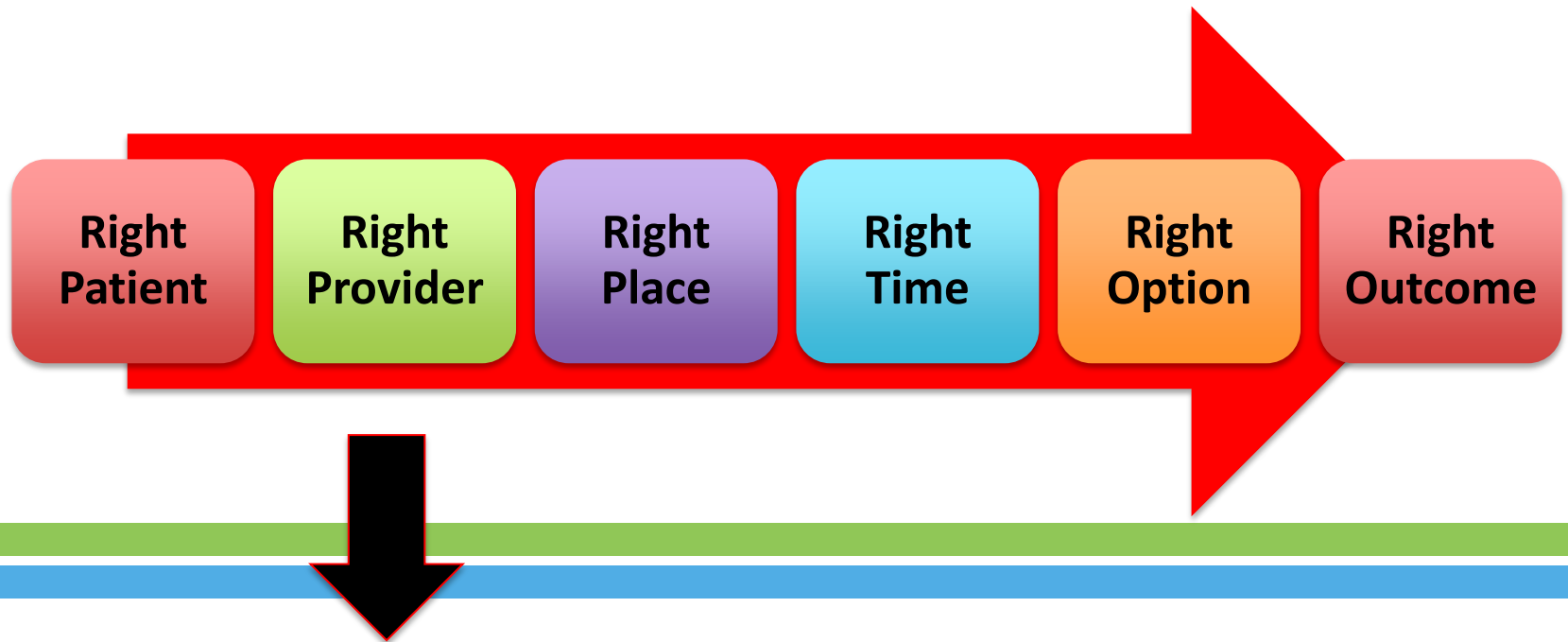
**QUESTION 6: Should Patients Who Present Pulseless to the Emergency Department:  
without SIGNS OF LIFE<sup>1</sup> after BLUNT INJURY  
Undergo Emergency Department Thoracotomy versus No Emergency Department Thoracotomy?**

Quality Assessment							Summary of Findings				
Participants (studies)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Overall Quality of Evidence	Study Event Rates (%)			Anticipated Absolute Effects	
							Without EDT	With EDT	Relative Effect	Risk without EDT	Risk Difference with EDT (95% CI)
Hospital Survival (CRITICAL OUTCOME)											
995 (24 cohort studies without controls)	serious risk of bias	no serious inconsistency	no serious indirectness	serious risk of imprecision	undetected	⊕⊕⊕⊖ LOW	0.001% <sup>2</sup>	7/995 (0.7% pooled, 95% CI: 0.3%, 1.4%)	RR 704 <sup>3</sup>	0 survivors per 1000 <sup>2</sup>	7 more survivors per 1000 (from 2 to 12 more)
Neurologically Intact Hospital Survival (CRITICAL OUTCOME)											
825 (11 cohort studies without controls)	serious risk of bias	no serious inconsistency	no serious indirectness	serious risk of imprecision	undetected	⊕⊕⊕⊖ LOW	0.0006% <sup>4</sup>	1/825 (0.1% pooled, 95% CI: <0.01%, 0.6%)	RR 202 <sup>3</sup>	0 survivors per 1000 <sup>4</sup>	1 more survivors per 1000 (from 0 to 4 more)

**EAST conditionally recommends against** resuscitative ED thoracotomy.  
**Survival was 0.7 %** based on data from 995 patients in 24 studies. Neurologic outcome in 825 patients showed only **0.1 % surviving neurologically intact** (one patient out of 825)

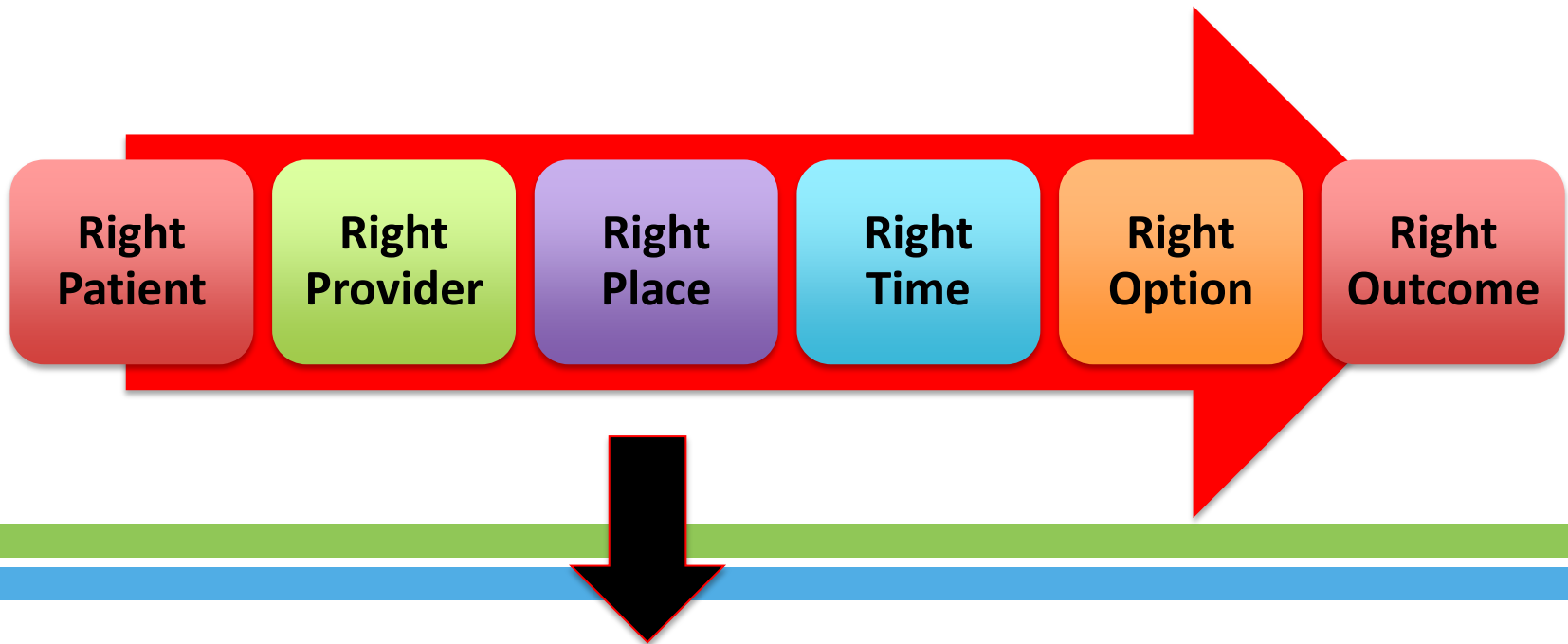


## Resuscitative Thoracotomy: When?



- Guidelines aren't meant to replace clinical judgment but rather to augment the decision-making process
- The decision to perform an ED thoracotomy **depends heavily on the downstream resources available** to the emergency physician

## Resuscitative Thoracotomy: When?



- The decision to perform **Resuscitative Thoracotomy** depends resources available



- The decision to perform F depends res

## Pre-Hospital

*Journal of Emergency Primary Health Care (JEPHC), Vol. 7, Issue 4, 2009 – Article 990356*

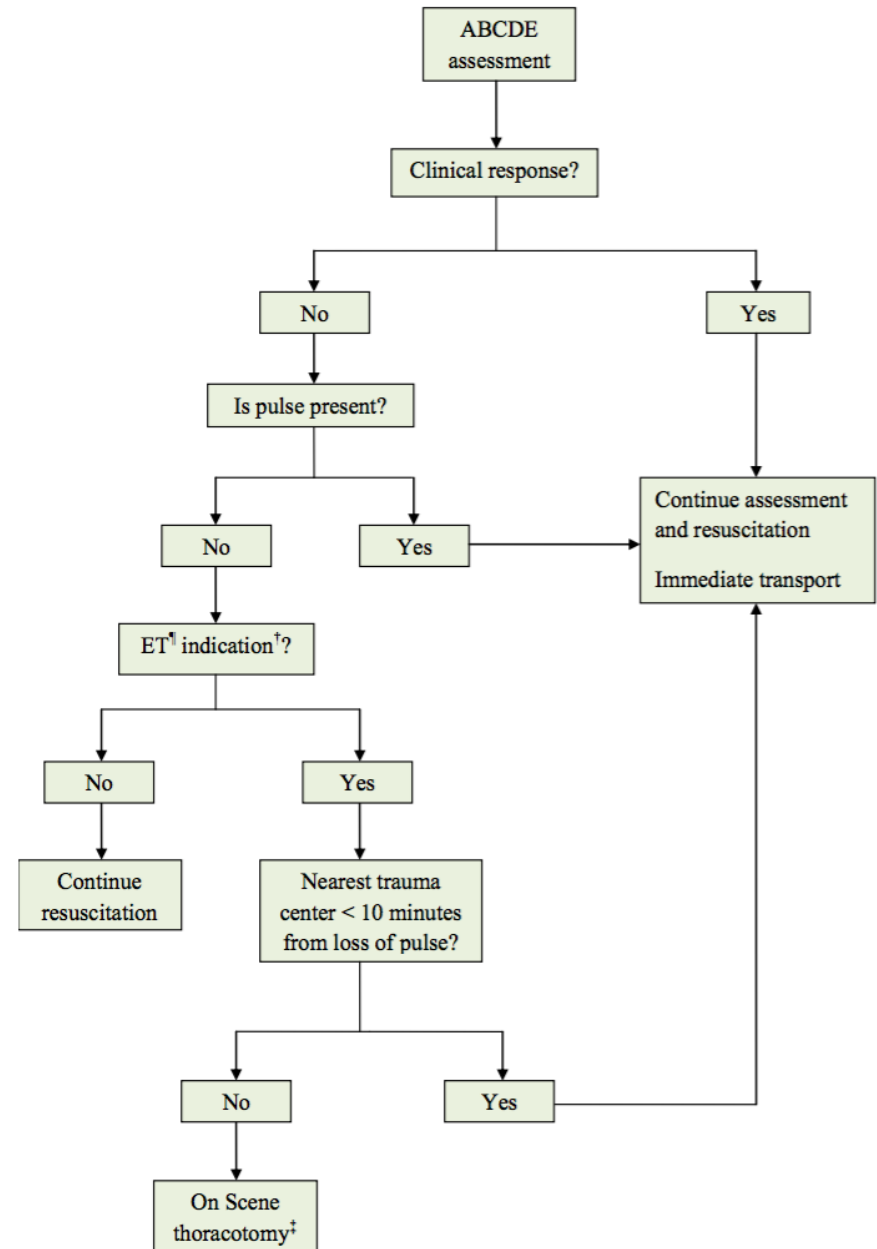
**e** Journal of Emergency Primary Health Care  
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### CLINICAL REVIEW

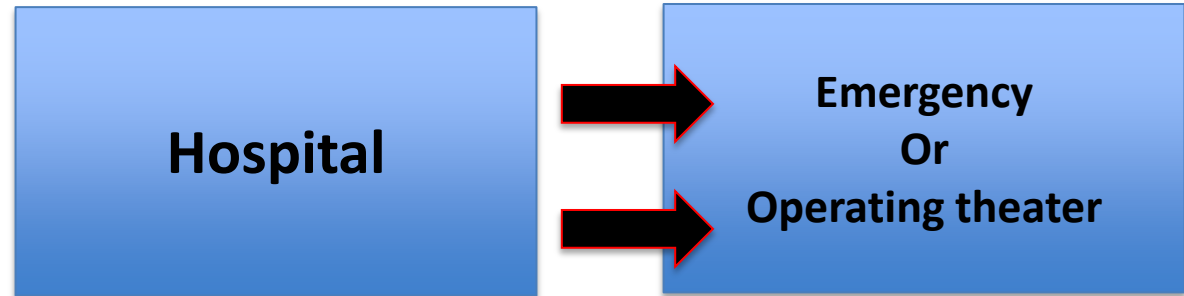
#### Prehospital emergency thoracotomy: when to do it?

Athanasios F. Chalkias, MD  
Department of General Medicine  
TZANEIO General Hospital of Piraeus, Greece





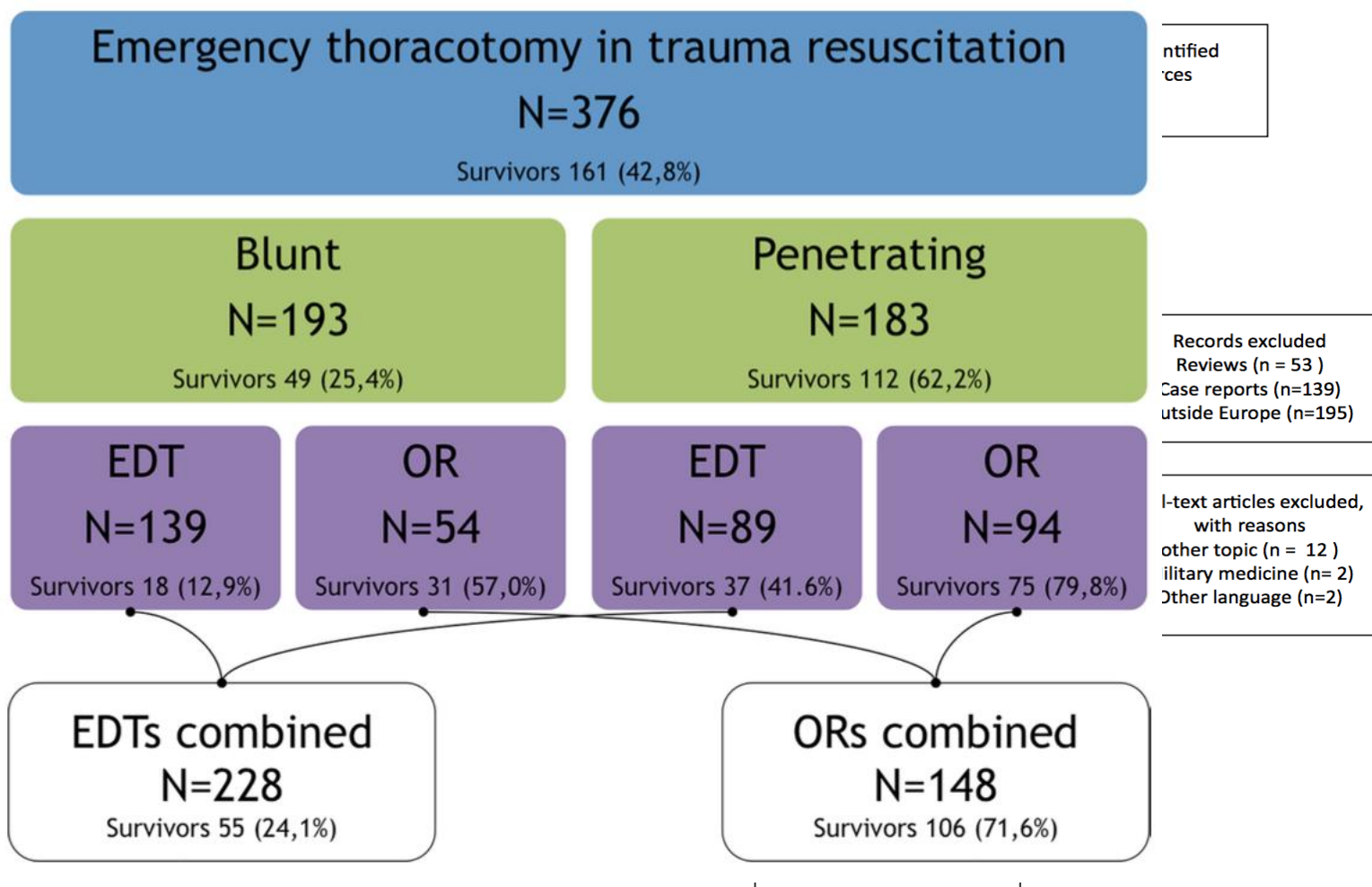
- The decision to perform **Resuscitative Thoracotomy** depends resources available



# Emergency resuscitative thoracotomy performed in European civilian trauma patients with blunt or penetrating injuries: a systematic review

J. K. Narvestad<sup>1</sup> · M. Meskinfamfard<sup>1</sup> · K. Søreide<sup>1,2</sup>

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© The Author(s) 2015. This article is published with open access at Springerlink.com



## Left Internal Mammary Artery Injury Requiring Resuscitative Thoracotomy: A Case Presentation and Review of the Literature

**Ammar Al Hassani,<sup>1</sup> Yassir Abdul Rahman,<sup>1</sup> Ahad Kanbar,<sup>1</sup>  
Ayman El-Menyar,<sup>2,3</sup> Abubaker Al-Aieb,<sup>1</sup> Mohammad Asim,<sup>3</sup> and Rifat Latifi<sup>1,2,3,4</sup>**

<sup>1</sup> Section of Trauma, Department of Surgery, Hamad General Hospital (HGH), H  
P.O. Box 3050, Doha, Qatar

<sup>2</sup> Weill Cornell Medical School, P.O. Box 24144, Doha, Qatar

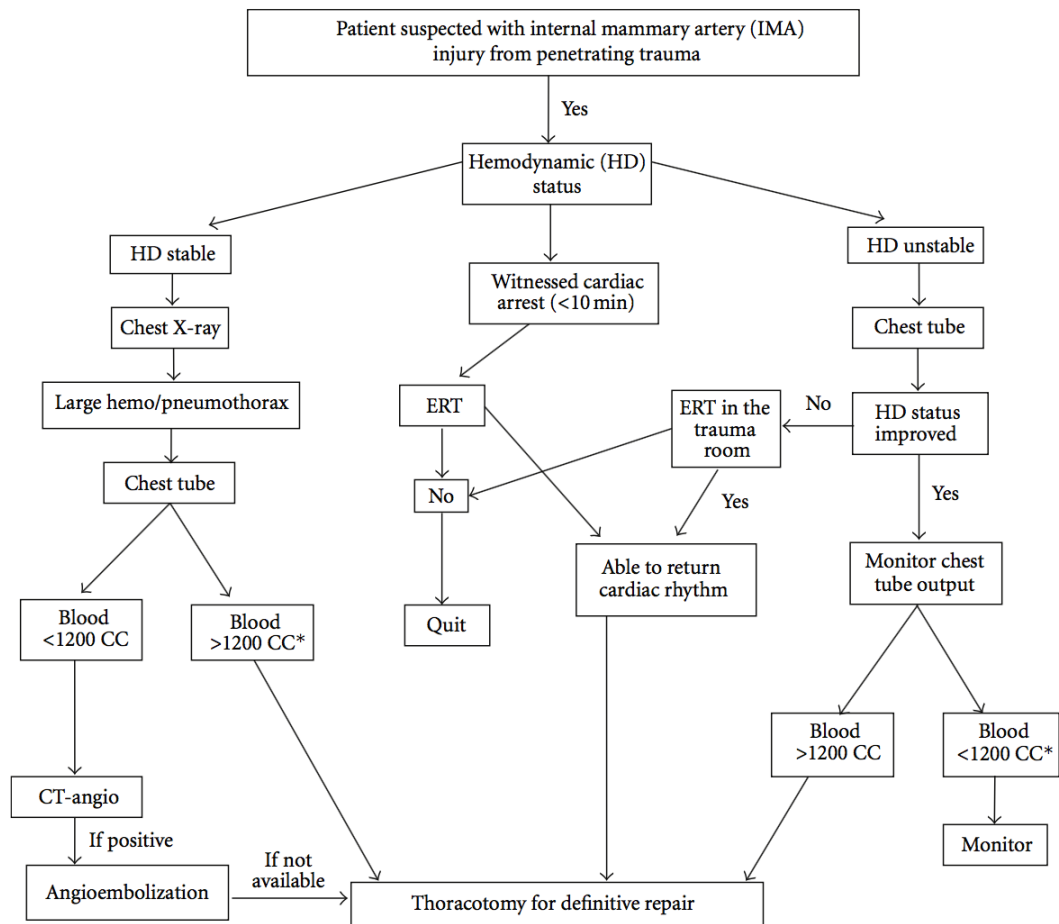
<sup>3</sup> Clinical Research, Section of Trauma, Department of Surgery, HGH, Hamad Me

<sup>4</sup> Department of Surgery, University of Arizona, Tucson, AZ 85724, USA

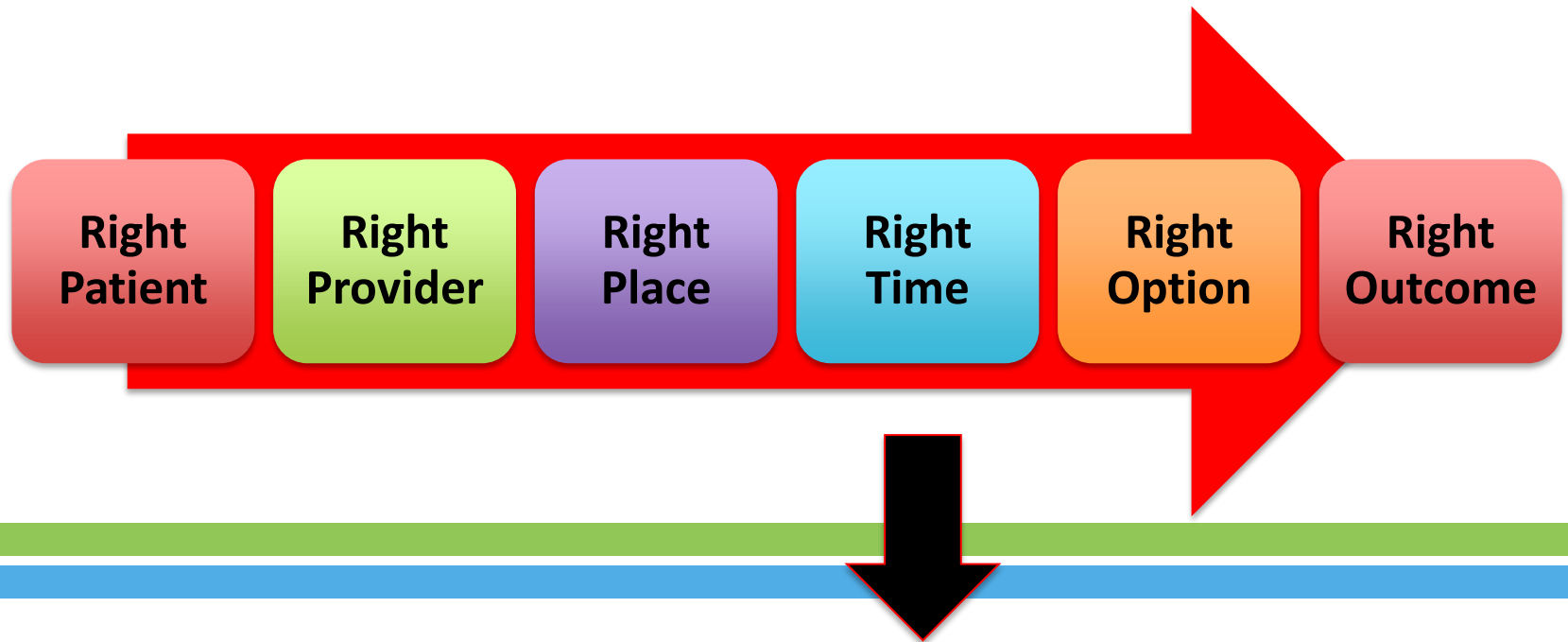
Algorithm approach for  
suspected internal mammary  
artery (IMA) injury.

Although current resuscitation by  
thoracotomy is bleed >1500 CC,  
we believe that if >1200 CC the  
patient should undergo  
thoracotomy.

IMA: Internal mammary artery, ERT:  
Emergency resuscitative thoracotomy



## Resuscitative Thoracotomy: When?



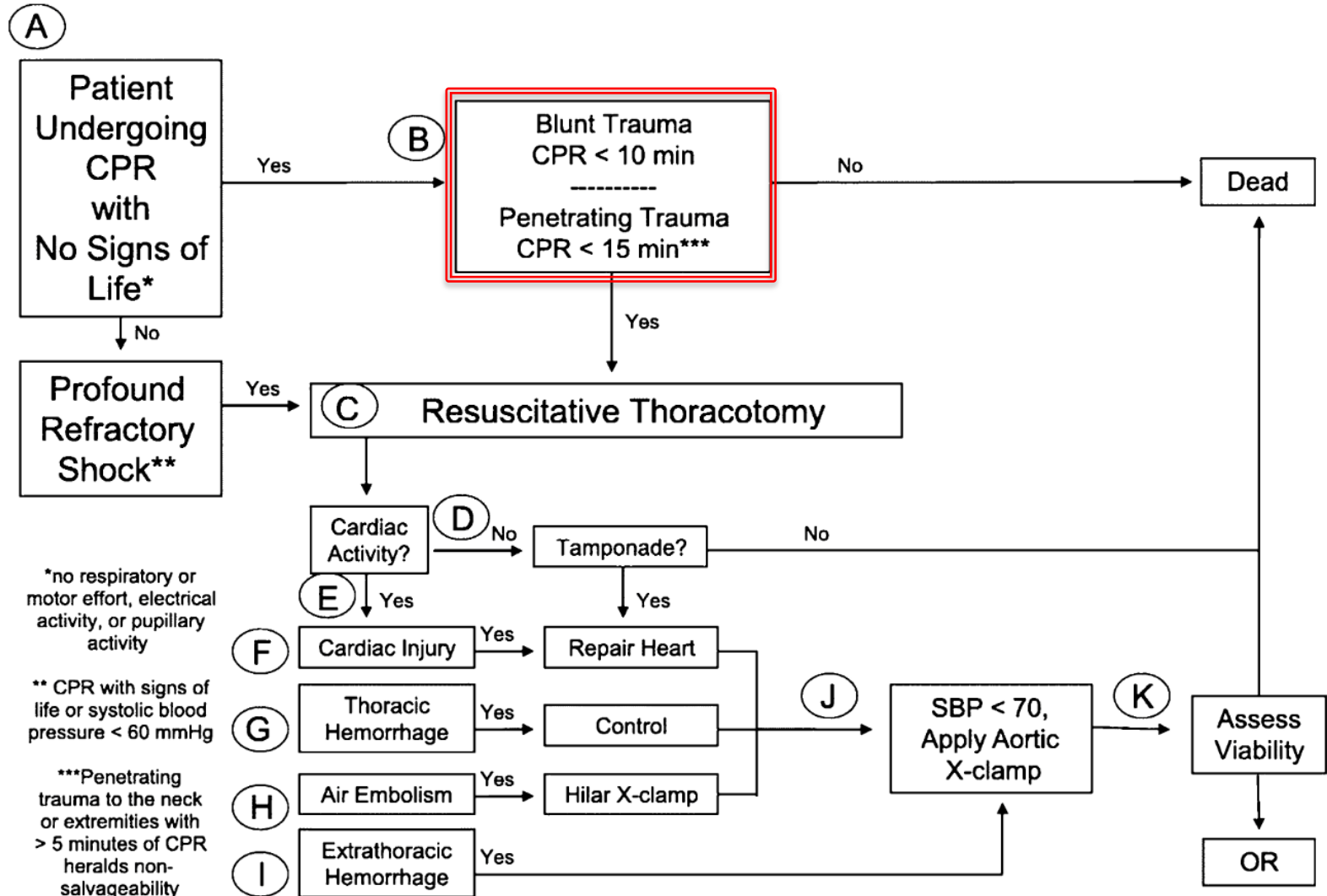
# Western Trauma Association ERT Algorithm



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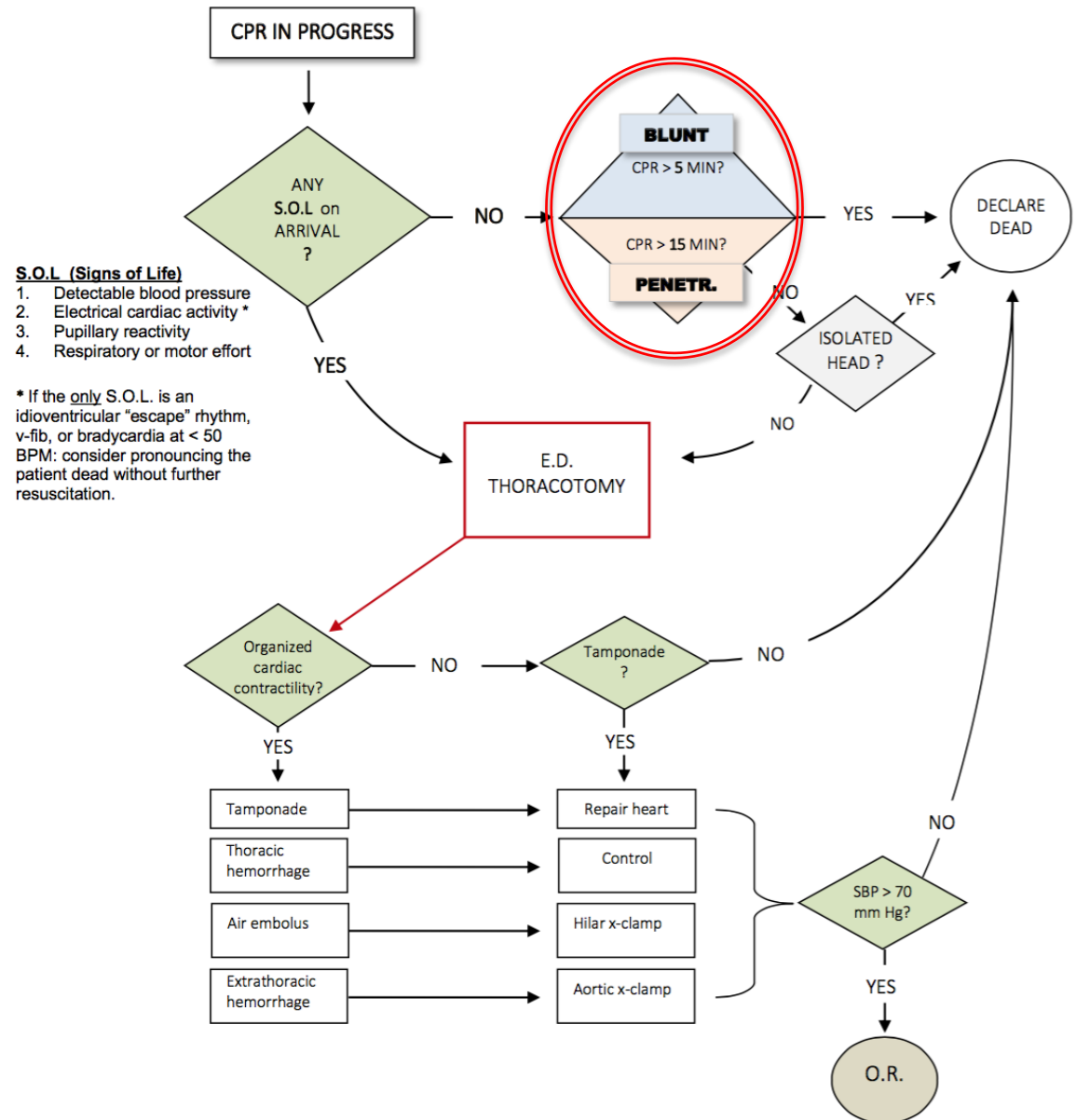






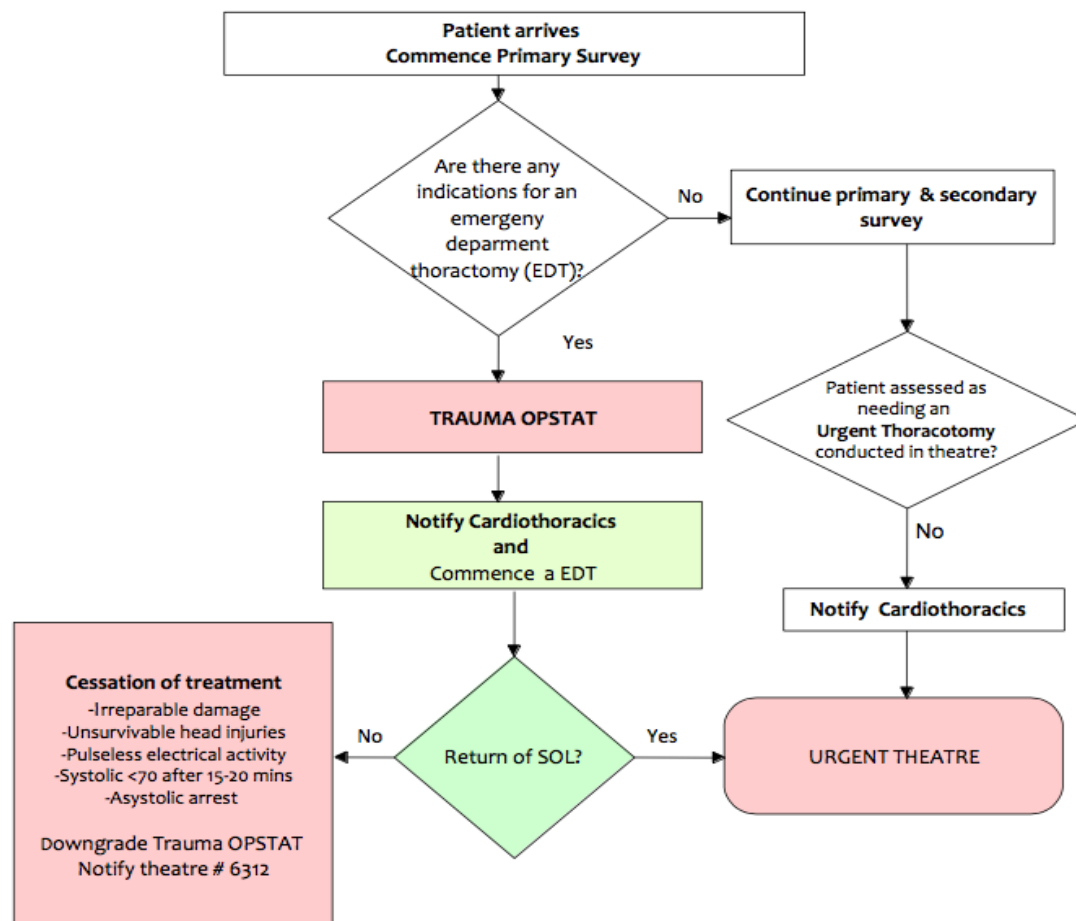
TACOMA  
TRAUMA  
TRUST

## ALGORITHM for EMERGENCY DEPARTMENT THORACOTOMY after TRAUMATIC CARDIOPULMONARY ARREST



## Emergency Department Thoracotomy

If patient is expected with penetrating/ blunt chest trauma in extremis notify cardiothoracic team



### Signs of Life

Pupil response  
Respiratory effort  
Cardiac activity  
Spontaneous Movement  
Palpable pulse

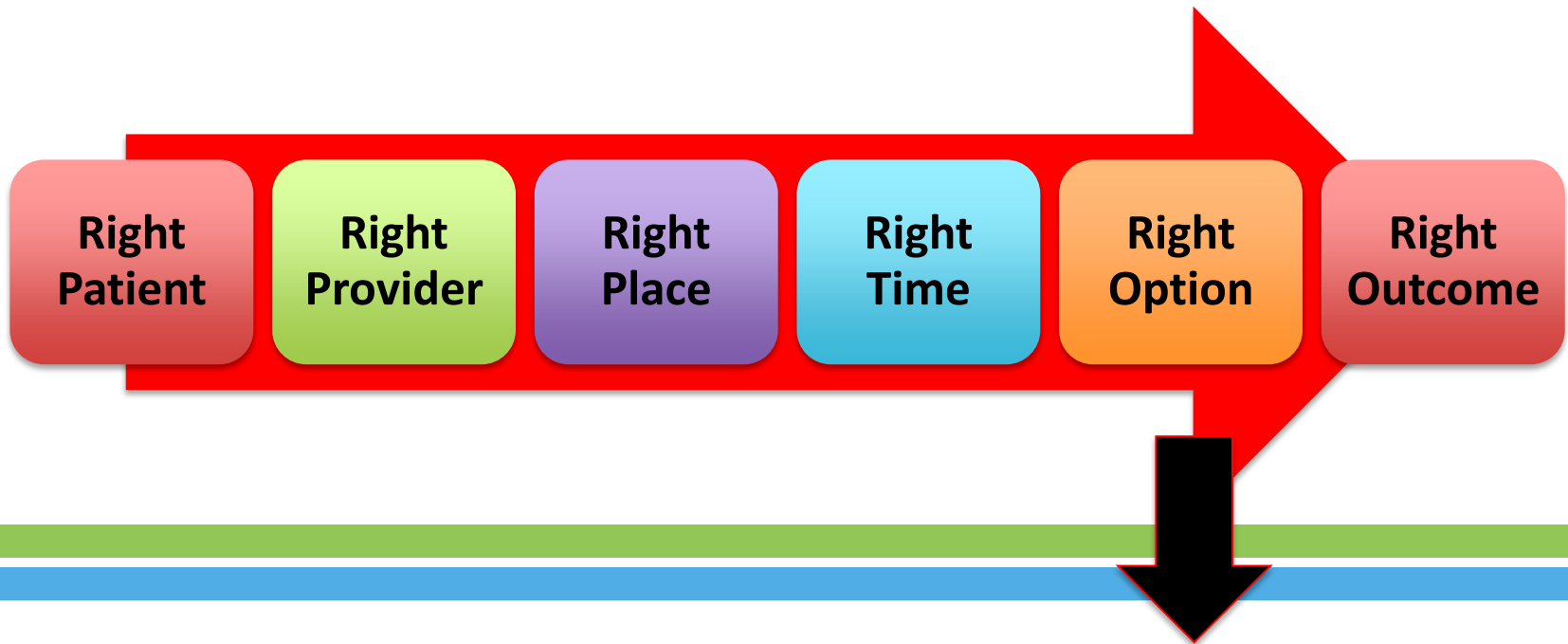
### Indications for EDT in Penetrating Trauma?

Extremis (BP <60 not responding to fluid resuscitation)  
No signs of life and prehospital CPR < 10 mins  
Witnessed cardiac arrest in ED

### Indications for EDT in Blunt Trauma?

No signs of life and pre hospital CPR < 5mins  
Witness cardiac arrest in ED

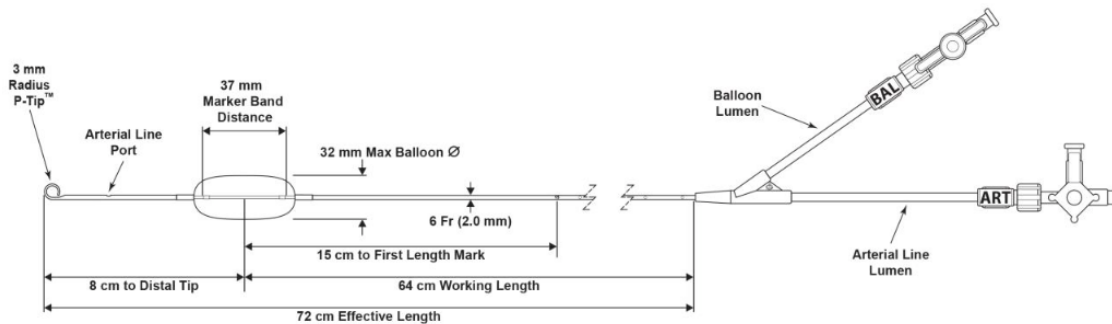
## Resuscitative Thoracotomy: When?



# REBOA

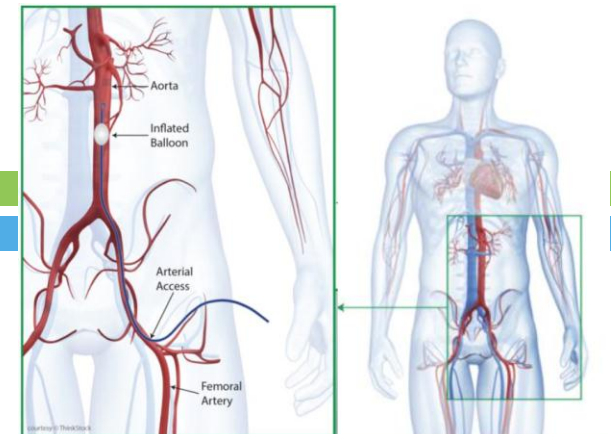
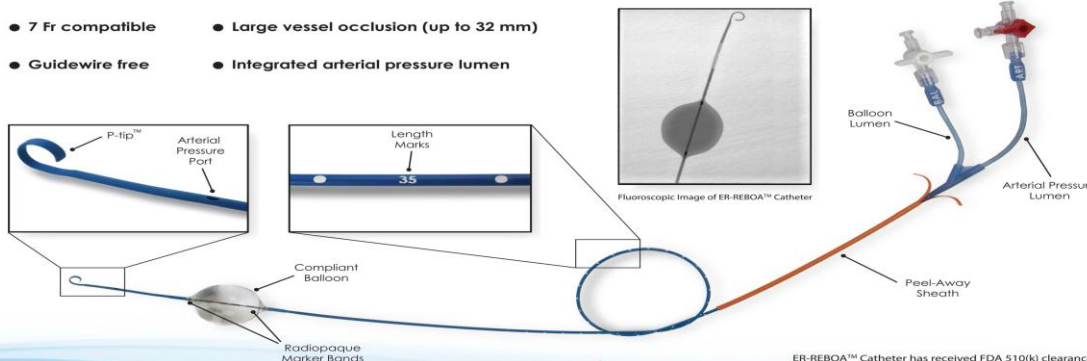
(Resuscitative Endovascular Balloon Occlusion of the Aorta)

Is a technique **maximizing** cerebral and coronary perfusion while limiting infra-diaphragmatic hemorrhage without the invasiveness of a thoracotomy



## ER-REBOA™ CATHETER

- 7 Fr compatible
- Large vessel occlusion (up to 32 mm)
- Guidewire free
- Integrated arterial pressure lumen



## Resuscitative Thoracotomy: When?

Right  
Patient

Right  
Provider

Right  
Place

Right  
Time

Right  
Option

Right  
Outcome





# Outcome

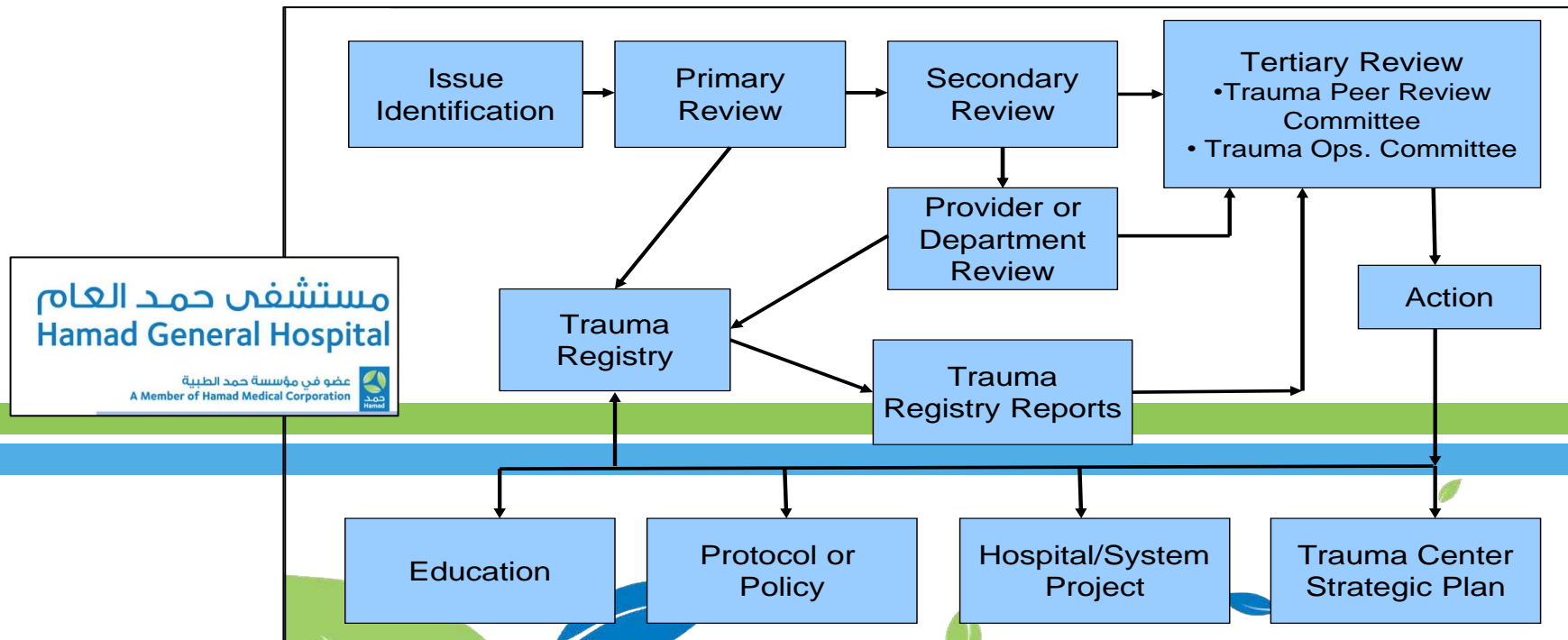
Both survival and neurological outcome need to be monitored

Structure

Process

Outcomes

Event Resolution (Closing the Loop)



## Conclusions



***“ Resuscitative Thoracotomy may be a lifesaving procedure when performed to the right patients in the right time with the right indications and approaches”***

Right  
Patient

Right  
Provider

Right  
Place

Right  
Time

Right  
Option

Right  
Outcome

**15<sup>TH</sup>**  
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**CONGRESS**

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**EMERGENCY**  
**MEDICINE**  
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**Thank you**



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