

PRIMARY AND SECONDARY SURVEY FOR TRAUMA PATIENTS

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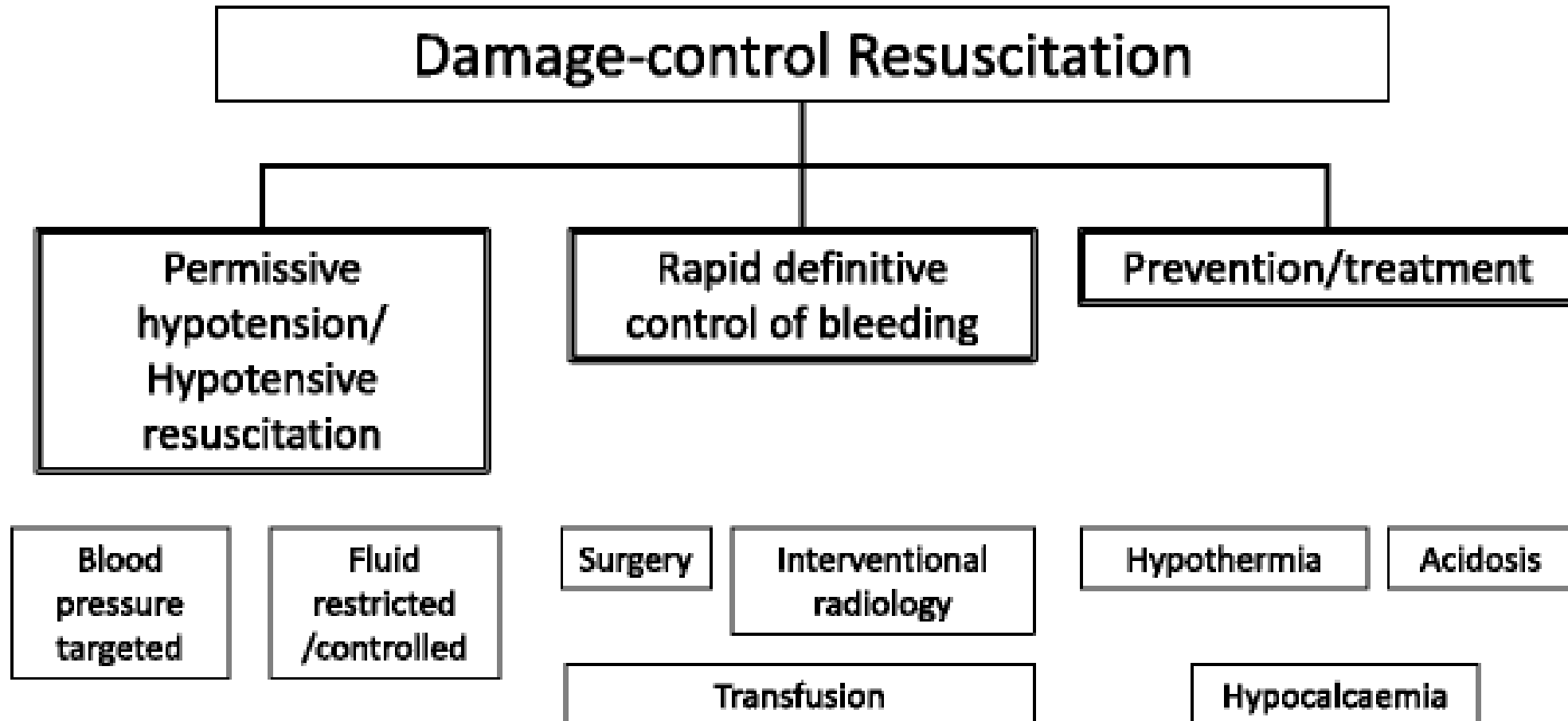
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DAMAGE CONTROL RESUSCITATION (DCR)

Kudo D, et al. Journal of Intensive Care 2017;5:11



FIRST, BEFORE DCR

- Advance planning for the arrival of trauma patients
- Patients are assessed, and their treatment priorities are established, based on their injuries, vital signs, and the injury mechanisms.
- Primary survey with simultaneous resuscitation of vital functions
- More detailed secondary survey
- The initiation of definitive care
- Damage control surgery on thoracic injury

BLS ACLS

Basic Life Support

Advanced Cardiovascular
Life Support



ATLS
ADVANCED TRAUMA LIFE SUPPORT



ATLS[®]

Advanced Trauma Life Support[®]

Student Course Manual

New to this edition ▶ **mATLS[™]**
MOBILE ADVANCED TRAUMA LIFE SUPPORT



AMERICAN COLLEGE OF SURGEONS
Inspiring Quality:
Highest Standards, Better Outcomes

- First, In 1978
- 1980, American College of Surgeons
 - ➔ ATLS has been accepted, 78 countries
- Standard protocol for injured patient

- In England:
 - ➔ Advanced for multidisciplinary approach

改訂第5版

外傷初期診療 ガイドライン

監修 一般社団法人 日本外傷学会、一般社団法人 日本救急医学会
監修 日本外傷学会外傷初期診療ガイドライン改訂第5版編纂委員会

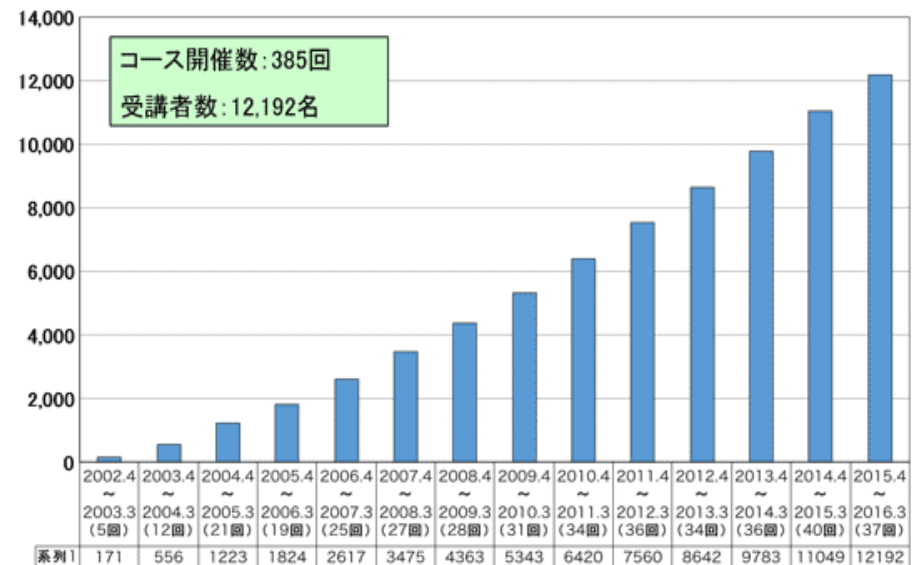
編集 公認社団法人 日本麻酔科学会、一般社団法人 日本脳神経外傷学会、
一般社団法人 日本骨折治療学会、一般社団法人 日本小児救急医学会、
NPO法人 再生期医療支援機構 (ALSO-Japan)、日本救急放射線研究会、
日本Acute Care Surgery学会、一般社団法人 日本熱傷学会



へる出版

- 일본 구급의학회 및 외상학회
- First course, in 2002, Now, over 14000 doctors
- Residents: associated with trauma care

JATEC 코스開催回数と受講者数(2002年4月~2016年3月31日)



IN SOUTH KOREA

- BLS, ACLS → 병원 인증평가
- KTAT (Korean Trauma Assessment and Treatment)
 - 대한응급의학회, 대한외상학회 + 대한외상소생협회
- First, 2011, Total 22 times (2018)
- Obligation for only trauma surgeon, not residents
- Previously, emergency medicine resident
- Management for trauma patient → Primary and secondary survey



Primary survey

WHEN TREATING INJURED PATIENTS

- Preparation
- Triage
- **Primary survey (ABCDEs) with immediate resuscitation** of patients with life-threatening injuries
- Adjuncts to the primary survey and resuscitation
- **Consideration of the need for patient transfer**
- **Secondary survey (head-to-toe evaluation and patient history)**
- Adjuncts to the secondary survey
- Continued postresuscitation monitoring and reevaluation
- Definitive care

PREPARATION



■ **FIGURE 1-1** Prehospital Phase. During the prehospital phase, personnel emphasize airway maintenance, control of external bleeding and shock, immobilization of the patient, and immediate transport to the closest appropriate facility, preferably a verified trauma center.



■ **FIGURE 1-3** Trauma team members are trained to use standard precautions, including face mask, eye protection, water-impervious gown, and gloves, when coming into contact with body fluids.

TRIAGE

Field Triage Decision Scheme

Measure Vital Signs and Level of Consciousness

- ♦ Glasgow Coma Scale score
- ♦ Systolic blood pressure
- ♦ Respiratory rate

≤13
<90 mm Hg
<10 or >29 breaths/min (<20 in infants <1 year)
or need for ventilatory support

NO

YES

Assess anatomy of injury

Transport to a trauma center. Steps 1 and 2 attempt to identify the most seriously injured patients. These patients should be transported preferentially to the highest level of care within the defined trauma system.

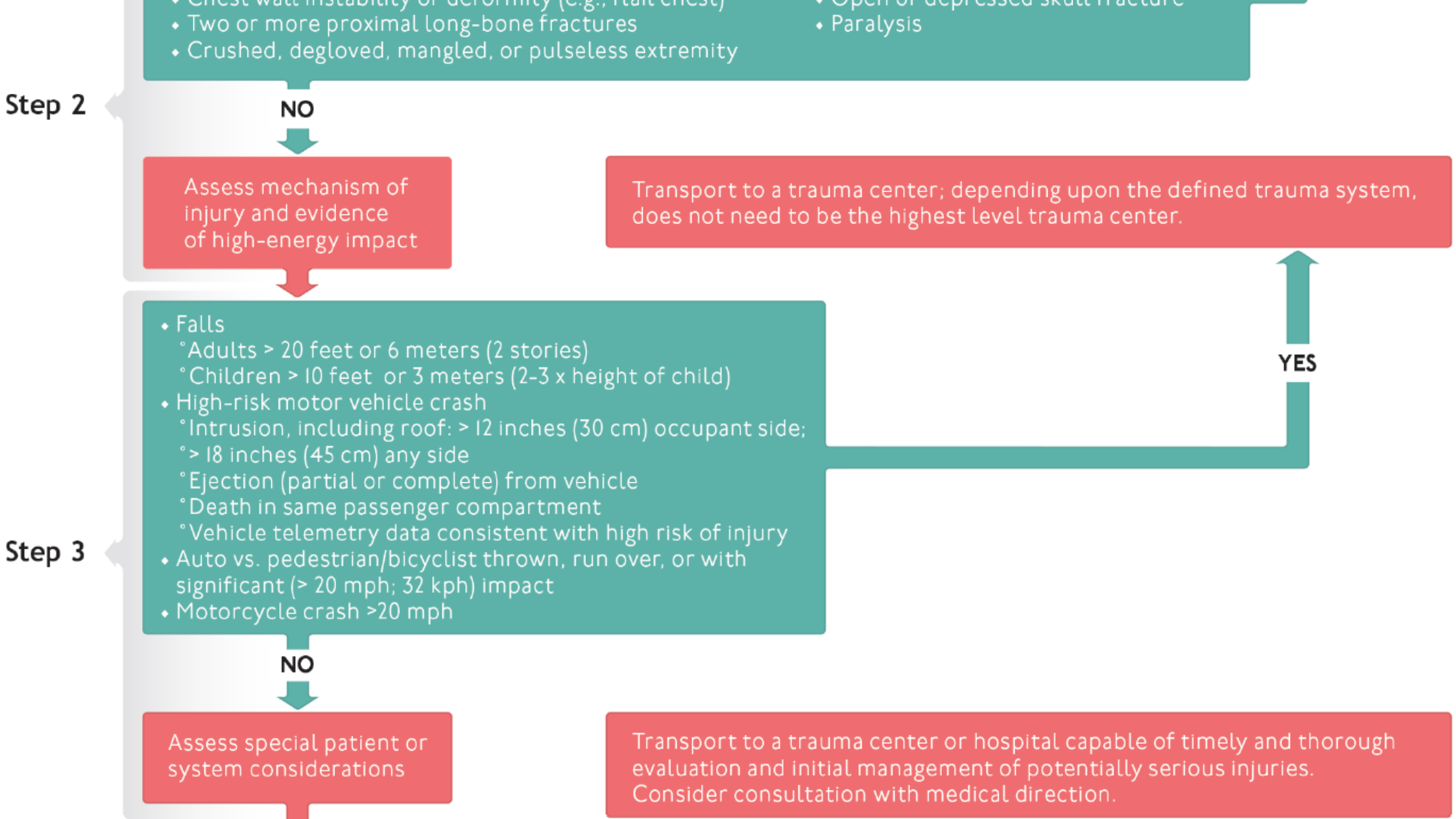
NO

YES

- ♦ All penetrating injuries to head, neck, torso and extremities proximal to the elbow and knee
- ♦ Chest wall instability or deformity (e.g., flail chest)
- ♦ Two or more proximal long-bone fractures
- ♦ Crushed, degloved, mangled, or pulseless extremity

- ♦ Amputation proximal to wrist or ankle
- ♦ Pelvic fractures
- ♦ Open or depressed skull fracture
- ♦ Paralysis

Step 1



Assess special patient or system considerations

Transport to a trauma center or hospital capable of timely and thorough evaluation and initial management of potentially serious injuries. Consider consultation with medical direction.

- ◆ Older adults
 - Risk of injury/death increases after age 55
 - Systolic BP < 110 may represent shock after age 65
 - Low-impact mechanism (e.g., ground-level fall)
 - can result in severe injury
- ◆ Children
 - Triage preferentially to pediatric-capable trauma center
- ◆ Anticoagulant use and bleeding disorders
 - Patients with head injury are at high risk for rapid deterioration
- ◆ Burns
 - Without trauma mechanism, triage to burn facility
 - With trauma mechanism, triage to trauma center
- ◆ Pregnancy >20 weeks
- ◆ EMS provider judgment

YES

Transport according to protocol

Step 3

When in doubt, transport to a trauma center

INITIAL ASSESSMENT AND MANAGEMENT

THE PRIMARY AND SECONDARY SURVEYS ARE REPEATED FREQUENTLY TO IDENTIFY ANY CHANGE IN THE PATIENT'S STATUS THAT INDICATES THE NEED FOR ADDITIONAL INTERVENTION.

PRINCIPLE

*THE PATIENT'S VITAL FUNCTIONS MUST BE
ASSESSED QUICKLY AND EFFICIENTLY.*

*MANAGEMENT CONSISTS OF A RAPID PRIMARY
SURVEY WITH SIMULTANEOUS RESUSCITATION OF
VITAL FUNCTIONS, A MORE DETAILED SECONDARY
SURVEY, AND THE INITIATION OF DEFINITIVE CARE*

QUESTION 1, ON TRAUMA BAY

- 50/M, Driver TA
 - On Scene: SOL (+), Upon arrival: SOL (-)
 - CPR time: (7) minutes
 - **Next step ??? What should you do for patient on trauma bay?**
- Signs of Life
 - Respiratory or Motor effort
 - Electrical activity
 - Pupillary activity

JUST 10 SECONDS (ABCD)

Clinicians can quickly assess A, B, C, and D in a trauma patient by identifying themselves, asking the patient for his or her name, and asking what happened.

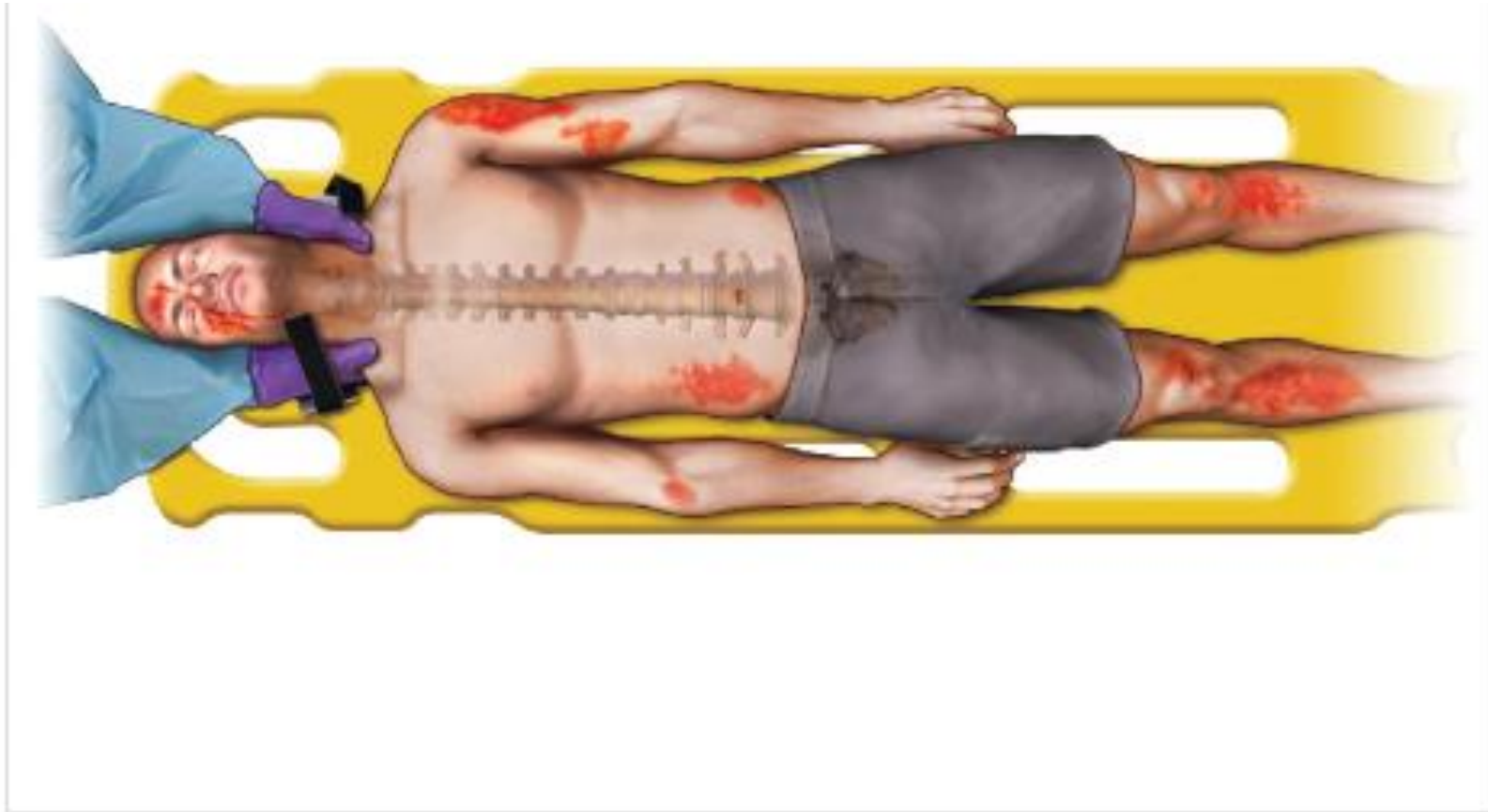
- **A**irway maintenance with restriction of cervical spine motion
- **B**reathing and ventilation
- **C**irculation with hemorrhage control
- **D**isability (assessment of neurologic status)
- **E**xposure/Environmental control

AIRWAY AND CERVICAL IMMOBILIZATION

- Airway maintenance
 - suctioning to clear accumulated blood or secretions
 - **GCS ≤ 8** : placement of a definitive airway
 - ➔ Establish a definitive airway if there is any doubt
- While assessing and managing a patient's airway,
 - ➔ take great care to **prevent excessive movement of the cervical spine**
 - if intubation cannot be accomplished ➔ Establish an **airway surgically**

AIRWAY AND CERVICAL IMMOBILIZATION

- Airway maintenance
 - suctioning to clear acc
 - **GCS ≤ 8** : placement c
 - Establish a definitive c
- While assessing and ma
 - take great care to **pr**
 - if intubation cannot be



■ **FIGURE 1-4** Cervical spine motion restriction technique. When the cervical collar is removed, a member of the trauma team manually stabilizes the patient's head and neck.

TEMPORARILY RELEASING THE CERVICAL COLLAR



BREATHING AND VENTILATION

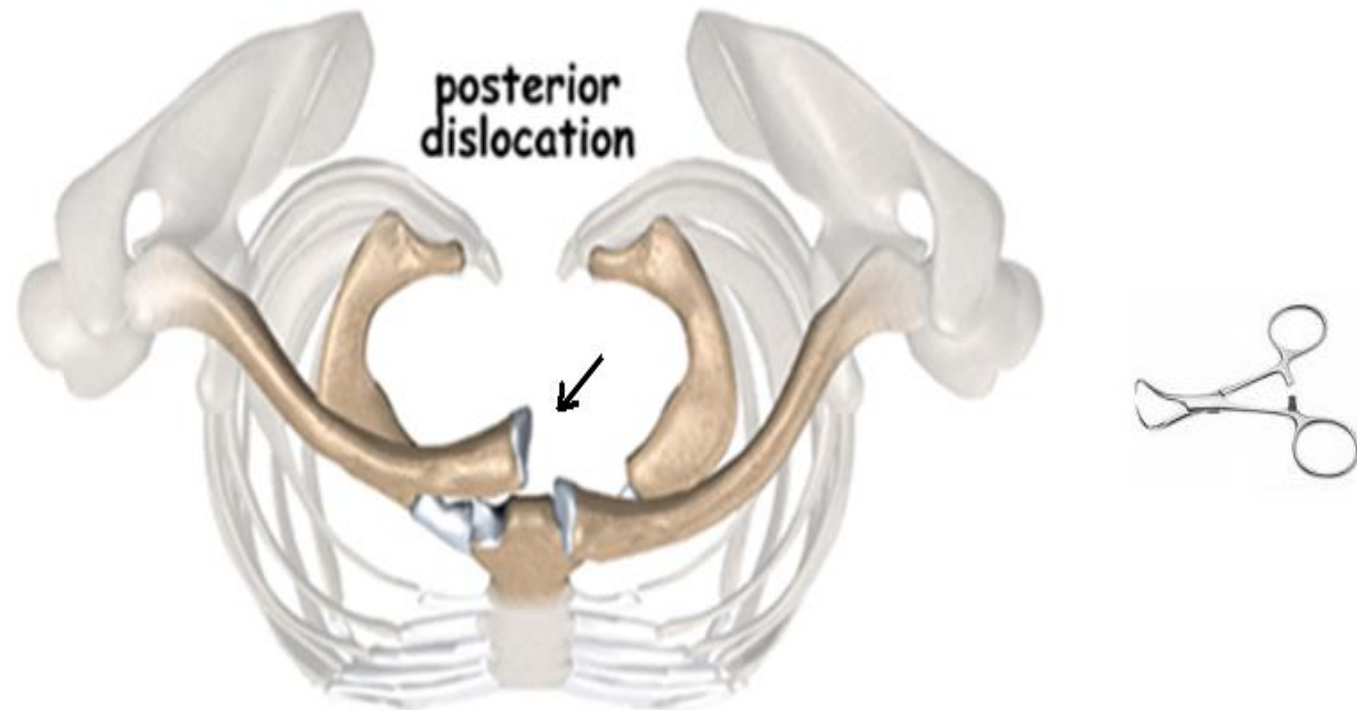
- Auscultation/ Visual inspection/ Palpation/ Percussion
- To adequately assess jugular venous distention, position of the trachea, and chest wall excursion, expose the patient's neck and chest.
- **Detect injuries:** Tension pneumothorax/ Massive hemothorax/ Open pneumothorax/ Trachea injury/ Flail chest c severe lung contusion/ Tamponade
- **A simple pneumothorax** can be converted to a **tension pneumothorax** when a patient is intubated and positive pressure ventilation is provided before decompressing the pneumothorax with a chest tube.

OPEN PNEUMOTHORAX



STRIDOR, MARKED CHANGE OF VOICE

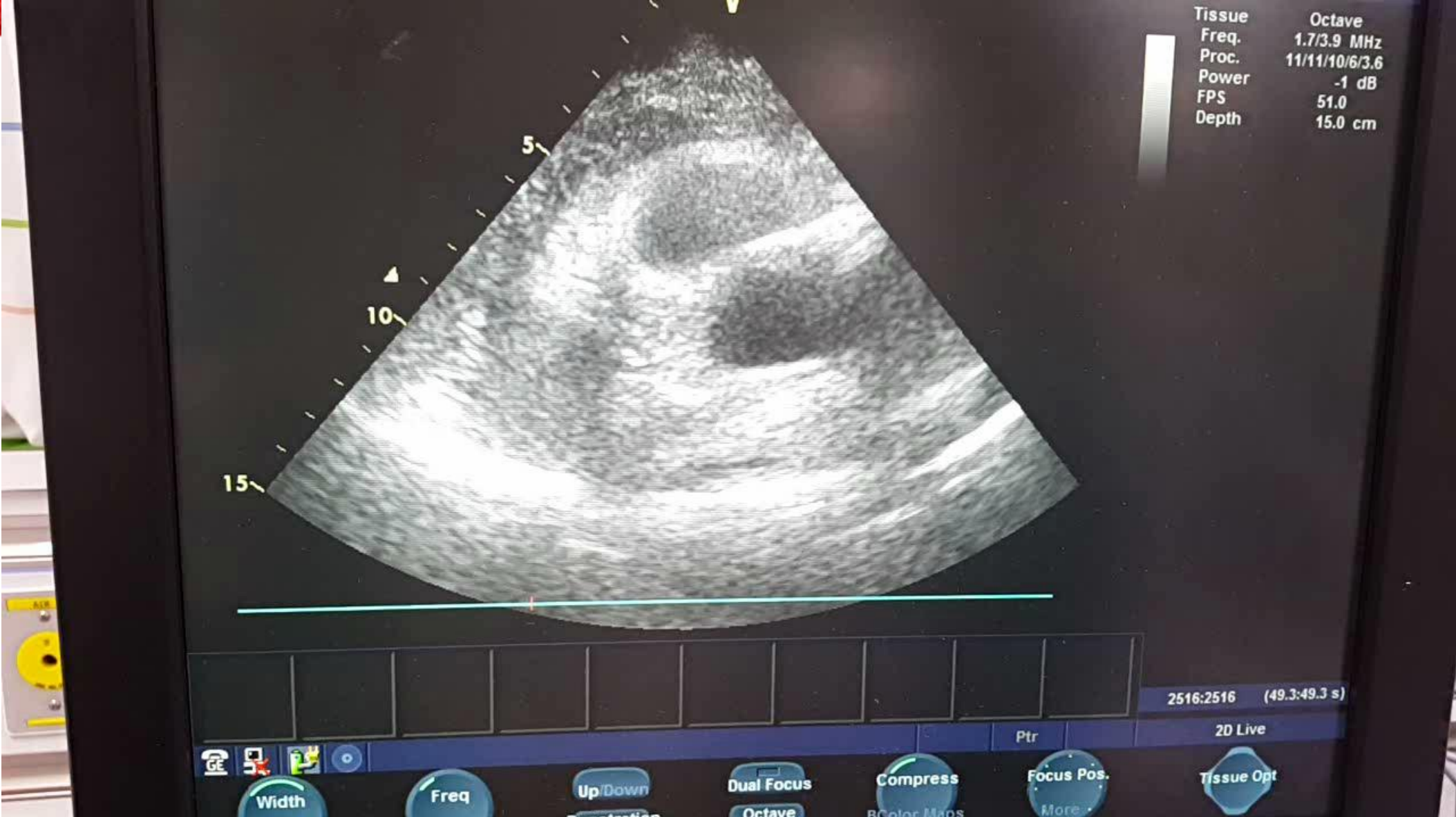
- Driver TA



LT. FLAIL CHEST C PARADOXICAL MOVEMENT



CARDIAC TAMPONADE



CIRCULATION WITH HEMORRHAGIC CONTROL

- Once **tension pneumothorax has been excluded** as a cause of shock,
→ consider that hypotension is due to **blood loss** until proven otherwise
- **Blood Volume and Cardiac Output:** Level of consciousness, skin, pulse etc
- **Bleeding:** Direct manual pressure, Tourniquets for extremity for selected patient, Application of a pelvic stabilizing device, **large-bore peripheral venous catheters**, tranexamic acid(within 3 hours of injury), **definitive control of hemorrhage** etc.
- All IV solutions should be **warmed**, a bolus of 1 L of an isotonic solution
→ unresponsive to initial crystalloid therapy, **a blood transfusion**

DISABILITY (NEUROLOGIC EVALUATION)

- Patient's level of consciousness and pupillary size and reaction
- GCS
- **Drug or alcohol intoxication** can accompany **traumatic brain injury**
- **Prevention of secondary brain injury** by maintaining adequate oxygenation and perfusion
- Patients with evidence of brain injury
 - ➔ Neurosurgeon contact, not available -> transfer

EXPOSURE AND ENVIRONMENTAL CONTROL

- **Completely undress** the patient, usually by cutting off
- After completing the assessment, cover the patient with **warm blankets**
- **Hypothermia** is a potentially lethal complication in injured patients
- A high-flow fluid warmer to heat crystalloid fluids to **39°C** is recommended.
- **A microwave** can be used to warm crystalloid fluids, but it should never be used to warm blood products.

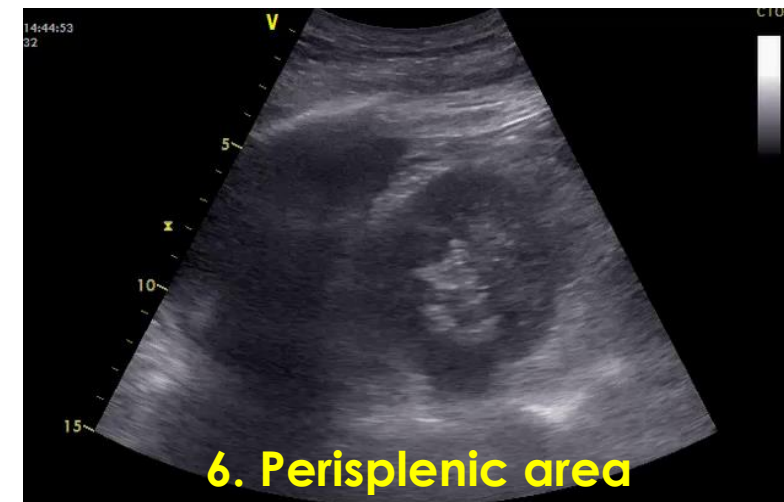
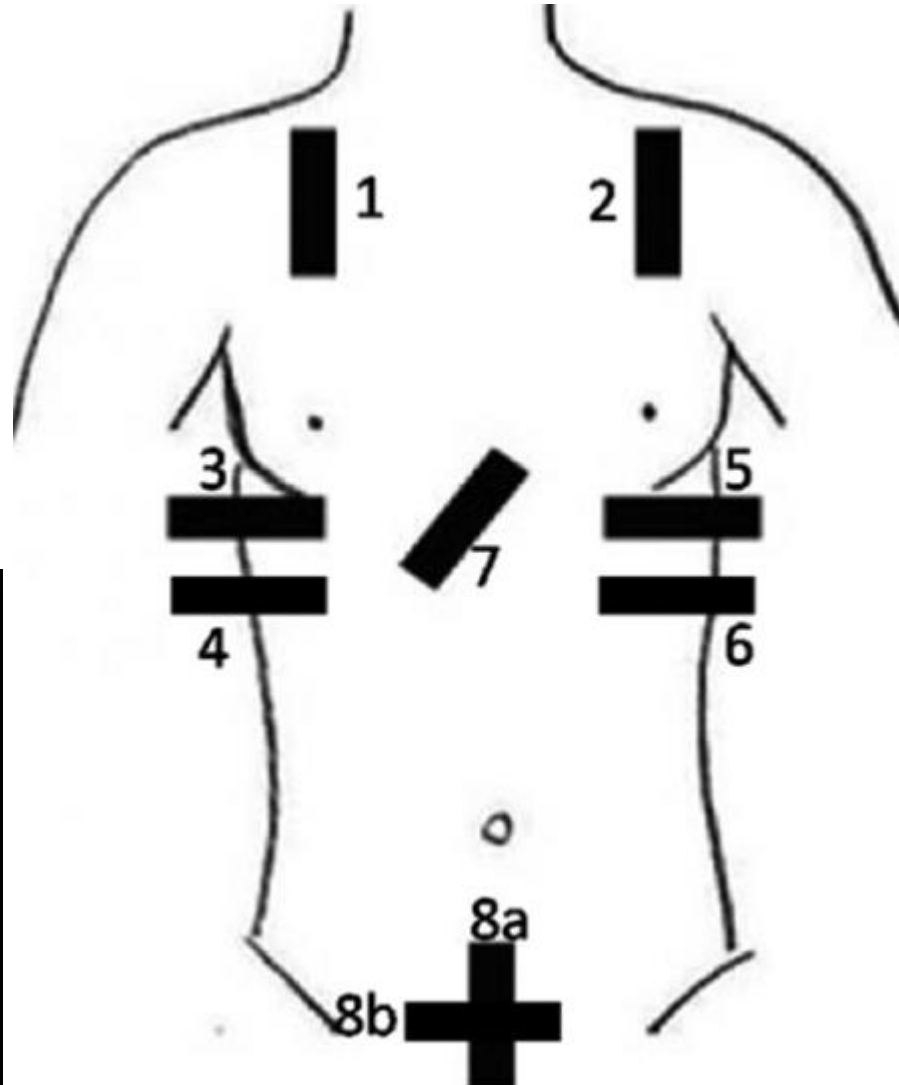
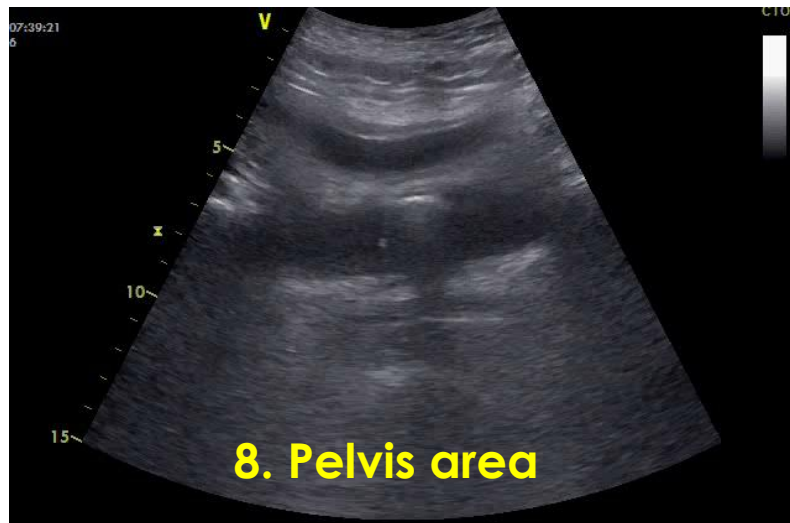
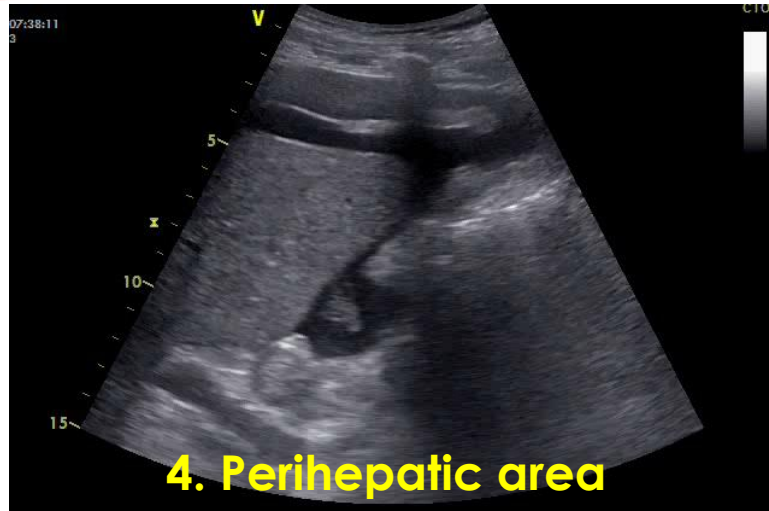
DURING THE PRIMARY SURVEY

- ECG monitoring
- Pulse oximetry
- Ventilatory Rate, Capnography, and Arterial Blood Gases
- Urinary and gastric catheters
- Trauma series (**X-ray; Chest AP, Pelvis AP, C-spine lateral**)
- FAST (focused assessment with sonography for trauma). Extended FAST
- Surgical consultation/ Patient transfer (not to delay transfer)

FAST (FOCUSED ASSESSMENT WITH SONOGRAPHY FOR TRAUMA)

- A rapid bedside ultrasound examination
- Screening test for blood around
 - Heart (Pericardial effusion)
 - Abdominal organs (Hemoperitoneum)
 - Morison's pouch, splenorenal recess, pelvic cavity
- Extended FAST (E-FAST)
 - Examination of both lungs (pneumothorax, hemothorax)

E-FAST



QUESTION 1, ON TRAUMA BAY

- 50/M, Driver TA
 - On Scene: SOL (+), Upon arrival: SOL (-)
 - CPR time: (7) minutes
 - Next step ???
- Signs of Life
 - Respiratory or Motor effort
 - Electrical activity
 - Pupillary activity

**During the primary survey,
life-threatening conditions
are identified and treated in a
prioritized sequence**

QUESTION 1, ON TRAUMA BAY

- 50/M, Driver TA
 - On Scene: SOL (+), Upon arrival: SOL (-)
 - CPR time: (7) minutes
 - FAST: Hemopericardium (+)
Hemoperitoneum (-)
 - V/S: **Not checkable**
 - **Next step ??? What should you do for patient on trauma bay**
- Signs of Life
 - Respiratory or Motor effort
 - Electrical activity
 - Pupillary activity

RESUSCITATIVE THORACOTOMY

- Indication

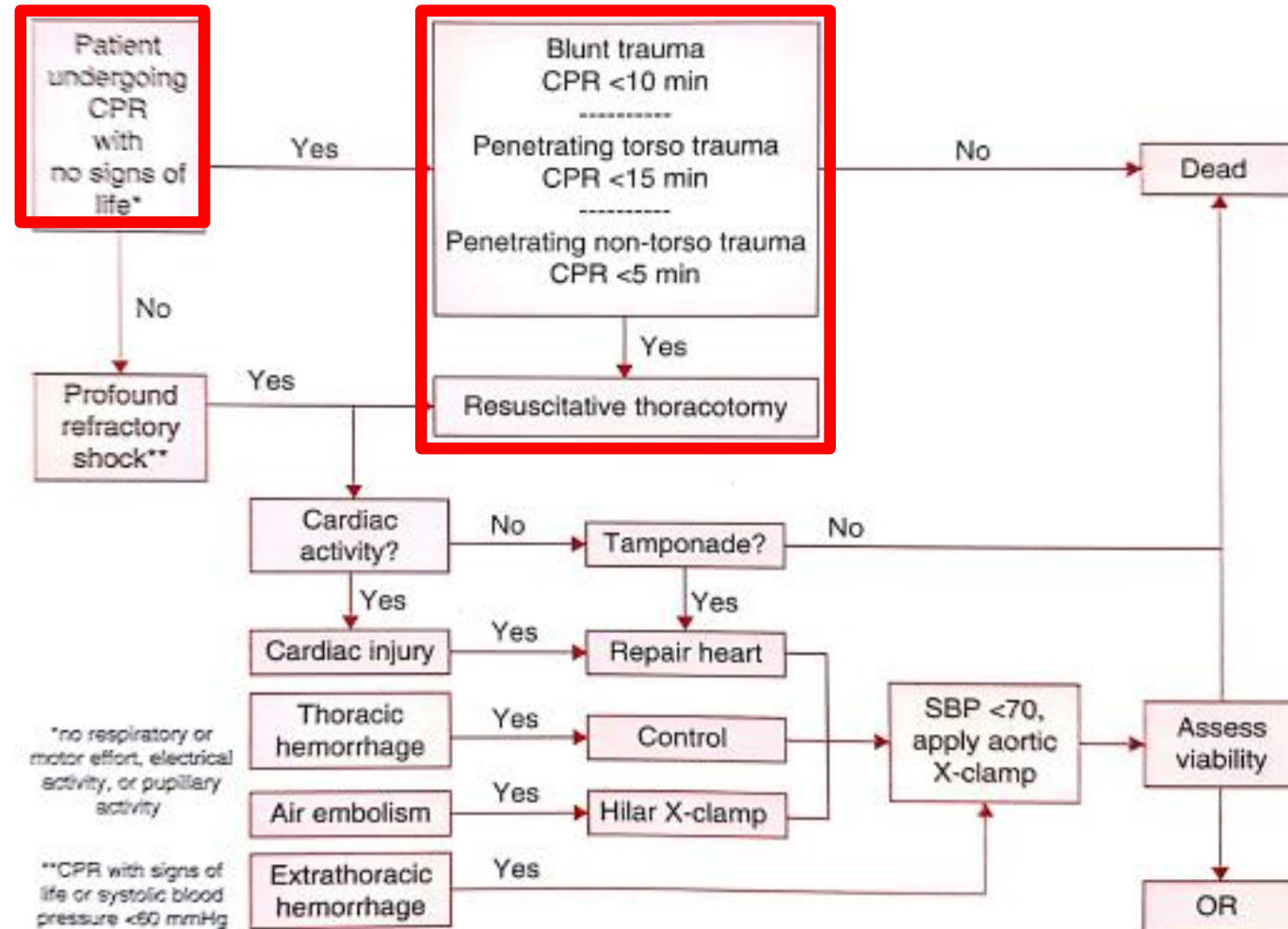
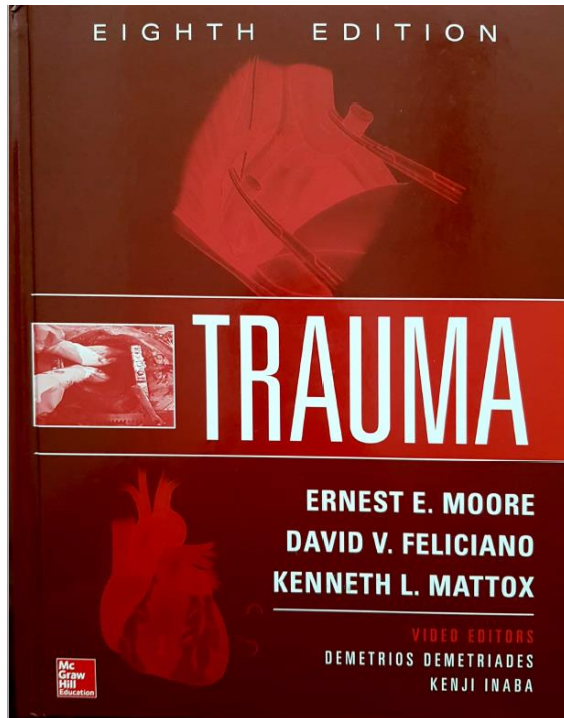


FIGURE 14-1 Algorithm directing the use of EDT in the multiply injured trauma patient.

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)

ROSC

ROSC = Return of Spontaneous Circulation

Usual management

No ROSC

Bilateral chest decompression

ROSC

Chest tubes

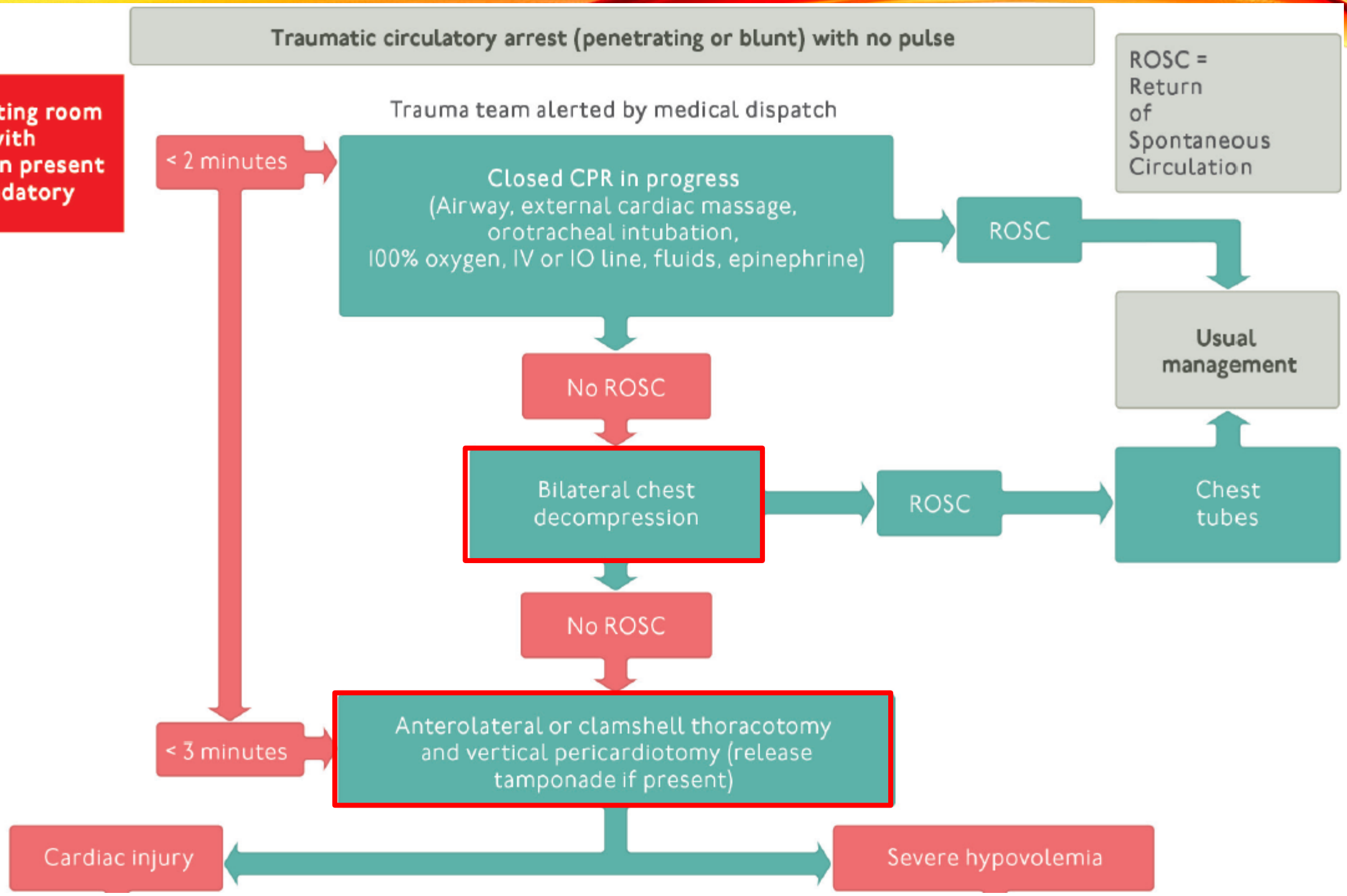
No ROSC

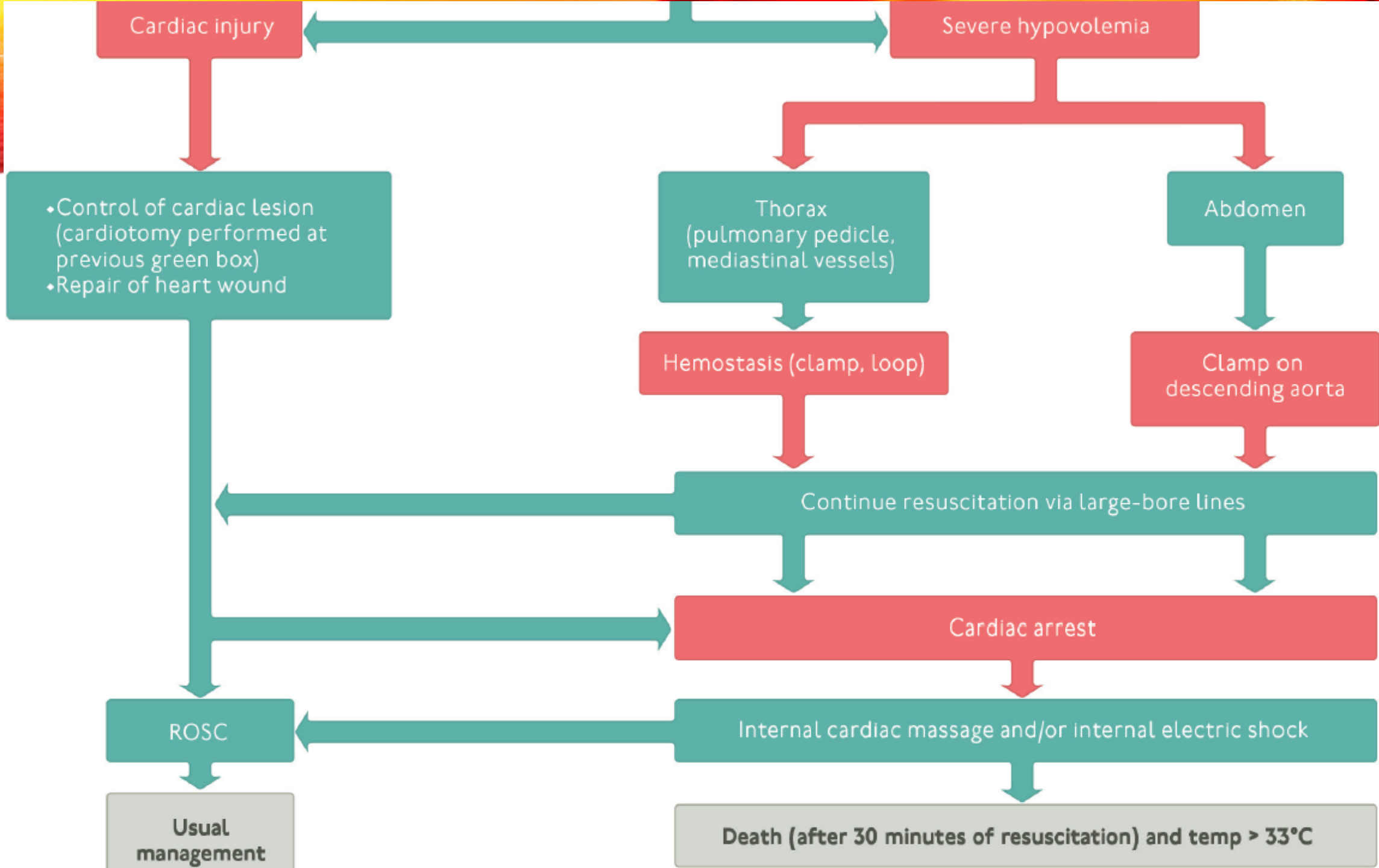
< 3 minutes

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

Cardiac injury

Severe hypovolemia





BILATERAL CHEST DECOMPRESSION

- In **TRAUMA patient**, What is the critical point during CPR?
- **CHEST DECOMPRESSION**

IS THE MOST IMPORTANT PROCEDURE **DURING CHEST COMPRESSION**

BILATERAL CHEST DECOMPRESSION

Resuscitation (2007) 75, 276–285

Outcome in 757 severely injured patients with traumatic cardiorespiratory arrest[☆]

Stefan Huber-Wagner^{a,*}, Rolf Lefering^b, Mike Qvick^a, Michael V. Kay^a, Thomas Paffrath^b, Wolf Mutschler^a, Karl-Georg Kanz^a,

Working Group on Polytrauma of the German Trauma Society (DGU)¹

Conclusions: Prehospital chest tube insertion was found to be a strong predictor for survival. On-scene chest decompression of TCRA patients is recommended in case of the decision to start with ECC. Based on our data, resuscitation after severe trauma seems to be more justified than the current guidelines state.

- Field thoracostomy





Traumatic Cardiac Arrest: Who Are the Survivors?

David Lockey, FRCA, FIMC,
RCS(Ed)

From the London Helicopter Emergency Medical Service, Royal London Hospital, London, United Kingdom.

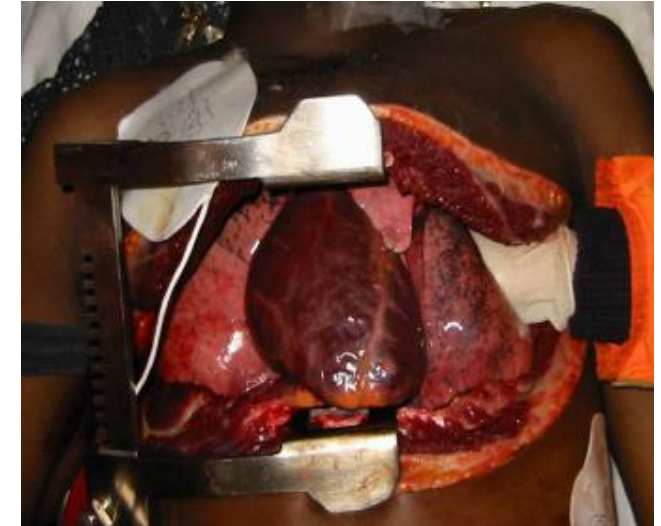
Kate Crewdson, MB, BS, BSc
Gareth Davies, FFAEM, FRCP

Study objective: Survival from traumatic cardiac arrest is poor, and some consider resuscitation of this patient group futile. This study identified survival rates and characteristics of the survivors in a physician-led out-of-hospital trauma service. The results are discussed in relation to recent resuscitation guidelines.

Methods: A 10-year retrospective database review was conducted to identify trauma patients receiving out-of-hospital cardiopulmonary resuscitation. The primary outcome measure was survival to hospital discharge.

Results: Nine hundred nine patients had out-of-hospital cardiopulmonary resuscitation. Sixty-eight (7.5% [95% confidence interval 5.8% to 9.2%]) patients survived to hospital discharge. Six patients had isolated head injuries and 6 had cervical spine trauma. Eight underwent on-scene thoracotomy for penetrating chest trauma. Six patients recovered after decompression of tension pneumothorax. Thirty patients sustained asphyxial or hypoxic insults. Eleven patients appeared to have had “medical” cardiac arrests that occurred before and was usually the cause of their trauma. One patient survived hypovolemic cardiac arrest. Thirteen survivors breached recently published guidelines.

Conclusion: The survival rates described are poor but comparable with (or better than) published survival rates for out-of-hospital cardiac arrest of any cause. Patients who arrest after hypoxic insults and those who undergo out-of-hospital thoracotomy after penetrating trauma have a higher chance of survival. Patients with hypovolemia as the primary cause of arrest rarely survive. Adherence to recently published guidelines may result in withholding resuscitation in a small number of patients who have a chance of survival. [Ann Emerg Med. 2006;48:240-244.]





Resuscitative Thoracotomy

Trauma Center

Chulalongkorn University Hospital

Sung Wook, Chang



Secondary survey

SECONDARY SURVEY

- Head-to-toe evaluation
- Complete history
- Physical examination
- Each region of the body
- The potential for missing an injury or failing

TABLE 1-1 MECHANISMS OF INJURY AND SUSPECTED INJURY PATTERNS

MECHANISM OF INJURY	SUSPECTED INJURY PATTERNS	MECHANISM OF INJURY	SUSPECTED INJURY PATTERNS
BLUNT INJURY			
Frontal impact, automobile collision <ul style="list-style-type: none"> • Bent steering wheel • Knee imprint, dashboard • Bull's-eye fracture, windshield 	<ul style="list-style-type: none"> • Cervical spine fracture • Anterior flail chest • Myocardial contusion • Pneumothorax • Traumatic aortic disruption • Fractured spleen or liver • Posterior fracture/dislocation of hip and/or knee • Head injury • Facial fractures 	Rear impact, automobile collision	<ul style="list-style-type: none"> • Cervical spine injury • Head injury • Soft tissue injury to neck
		Ejection from vehicle	<ul style="list-style-type: none"> • Ejection from the vehicle precludes meaningful prediction of injury patterns, but places patient at greater risk for virtually all injury mechanisms.
Side impact, automobile collision	<ul style="list-style-type: none"> • Contralateral neck sprain • Head injury • Cervical spine fracture • Lateral flail chest • Pneumothorax • Traumatic aortic disruption • Diaphragmatic rupture • Fractured spleen/liver and/or kidney, depending on side of impact • Fractured pelvis or acetabulum 	Motor vehicle impact with pedestrian	<ul style="list-style-type: none"> • Head injury • Traumatic aortic disruption • Abdominal visceral injuries • Fractured lower extremities/pelvis
		Fall from height	<ul style="list-style-type: none"> • Head injury • Axial spine injury • Abdominal visceral injuries • Fractured pelvis or acetabulum • Bilateral lower extremity fractures (including calcaneal fractures)

HISTORY

- History of the mechanism of injury (MOI)

TABLE 1-1 MECHANISMS OF INJURY AND SUSPECTED INJURY PATTERNS

MECHANISM OF INJURY	SUSPECTED INJURY PATTERNS	MECHANISM OF INJURY	SUSPECTED INJURY PATTERNS
PENETRATING INJURY		THERMAL INJURY	
Stab wounds <ul style="list-style-type: none"> • Anterior chest • Left thoraco-abdominal • Abdomen 	<ul style="list-style-type: none"> • Cardiac tamponade if within "box" • Hemothorax • Pneumothorax • Hemopneumothorax • Left diaphragm injury/spleen injury/hemopneumothorax • Abdominal visceral injury possible if peritoneal penetration 	Thermal burns	<ul style="list-style-type: none"> • Circumferential eschar on extremity or chest • Occult trauma (mechanism of burn/means of escape)
		Electrical burns	<ul style="list-style-type: none"> • Cardiac arrhythmias • Myonecrosis/compartment syndrome
		Inhalational burns	<ul style="list-style-type: none"> • Carbon monoxide poisoning • Upper airway swelling • Pulmonary edema
Gunshot wounds (GSW) <ul style="list-style-type: none"> • Truncal • Extremity 	<ul style="list-style-type: none"> • High likelihood of injury • Trajectory from GSW/retained projectiles help predict injury • Neurovascular injury • Fractures • Compartment syndrome 		

HISTORY

- History of the mechanism of injury (MOI)

AMPLE HISTORY

- Include a history of the mechanism of injury (MOI)
- Allergies
- Medications currently used
- Past illnesses/Pregnancy
- Last meal
- Events/Environment related to the injury

119 구급대 선생님 ~
적어주세요

사고발생시간
2019-02-06 03:50

119 신고시간
03:50

119 도착시간
03:55

사고 장소
신원동 서양병원 앞 하거리

사고 기전
행객(사). 한차는 인도바이 운전자로 신호가 빨라 의도적
인도바이가 추돌을 하여 2차로 SUV가 부딪혔던 듯.
SUV는 직진하고 있던 인도바이가 전회전 하다가 부딪혔던 듯.

5FR sheath / HXAS5	9
7FR sheath / HXAS7	10
Balloon cath / HXRBA	8
조영제 / RXIOBRG	8

- Visual acuity, Ocular entrapment
- Pupillary size
- Hemorrhage of the conjunctiva and/or fundi
- Penetrating injury
- Contact lenses (remove before edema occurs), Dislocation of the lens
- Maxillofacial structures

CERVICAL SPINE AND NECK


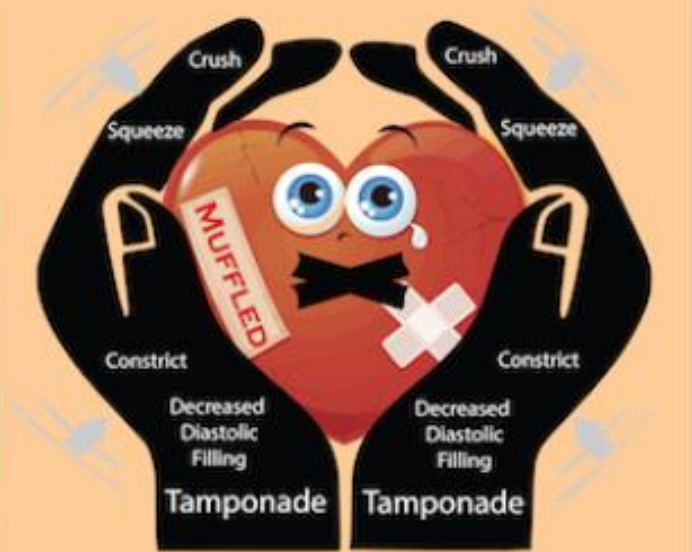

- Patients with **maxillofacial or head trauma** should be presumed to have a **cervical spine injury**, and **cervical spine motion must be restricted**.
- The absence of neurologic deficit **does not exclude** injury to the cervical spine
- Active arterial bleeding, an expanding hematoma, arterial bruit, or airway compromise usually requires operative evaluation.
- Protective helmet → protection of a potentially unstable cervical spine
- Unexplained **paralysis** of an upper extremity → a cervical nerve root injury

CHEST

- Inspection, palpation, auscultation and percussion of the chest
- **Cardiac tamponade vs. Tension pneumothorax** vs. Massive hemothorax

- Hypovolemia
- ➔ No neck vein distention

Cardiac Tamponade - Becks Triad

		
Jugular Venous Distension (JVD)	Muffled or Distant Heart Sounds	Low Blood Pressure

- Inspection, palpation, auscultation and percussion of the chest
- Cardiac tamponade vs. **Tension pneumothorax vs. Massive hemothorax**

TABLE 4-1 DIFFERENTIATING TENSION PNEUMOTHORAX AND MASSIVE HEMOTHORAX

CONDITION	PHYSICAL SIGNS				
	BREATH SOUNDS	PERCUSSION	TRACHEAL POSITION	NECK VEINS	CHEST MOVEMENT
Tension pneumothorax	Decreased or absent	Hyperresonant	Deviated away	Distended	Expanded immobile
Massive hemothorax	Decreased	Dull	Midline	Collapsed	Mobile

ABDOMEN, PELVIS, PERINEUM, RECTUM, AND VAGINA

- Early involvement of a surgeon is essential
- Pelvic fractures: ecchymosis over the iliac wings, pubis, labia, or scrotum.
- Pain on palpation of the pelvic ring is an important finding.
- Perineum and pelvis → Urethral injury
- A rectal examination
 - integrity of the rectal wall, and quality of sphincter tone
- Vaginal examination in patients with a risk of vaginal injury.

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PITFALL	PREVENTION
Pelvic fractures can produce large blood loss.	<ul style="list-style-type: none">• Placement of a pelvic binder or sheet can limit blood loss from pelvic fractures.• Do not repeatedly or vigorously manipulate the pelvis in patients with fractures, as clots can become dislodged and increase blood loss.

MUSKULOSKELETAL AND NEUROLOGICAL SYSTEM

PITFALL	PREVENTION
<p>Compartment syndrome can develop.</p>	<ul style="list-style-type: none">• Maintain a high level of suspicion and recognize injuries with a high risk of development of compartment syndrome (e.g., long bone fractures, crush injuries, prolonged ischemia, and circumferential thermal injuries).

ADJUNCTS TO THE SECONDARY SURVEY

- Additional x-ray examinations of the spine and extremities
- CT scans of the head, chest, abdomen, and spine
- Contrast urography and angiography
- Transesophageal ultrasound
- Bronchoscopy
- Esophagoscopy
- Other diagnostic procedures

REEVALUATION

TRAUMA PATIENTS MUST BE REEVALUATED

*CONSTANTLY TO ENSURE THAT NEW FINDINGS ARE NOT
OVERLOOKED AND TO DISCOVER ANY DETERIORATION IN
PREVIOUSLY NOTED FINDINGS*

AS INITIAL LIFE-THREATENING INJURIES ARE MANAGED,

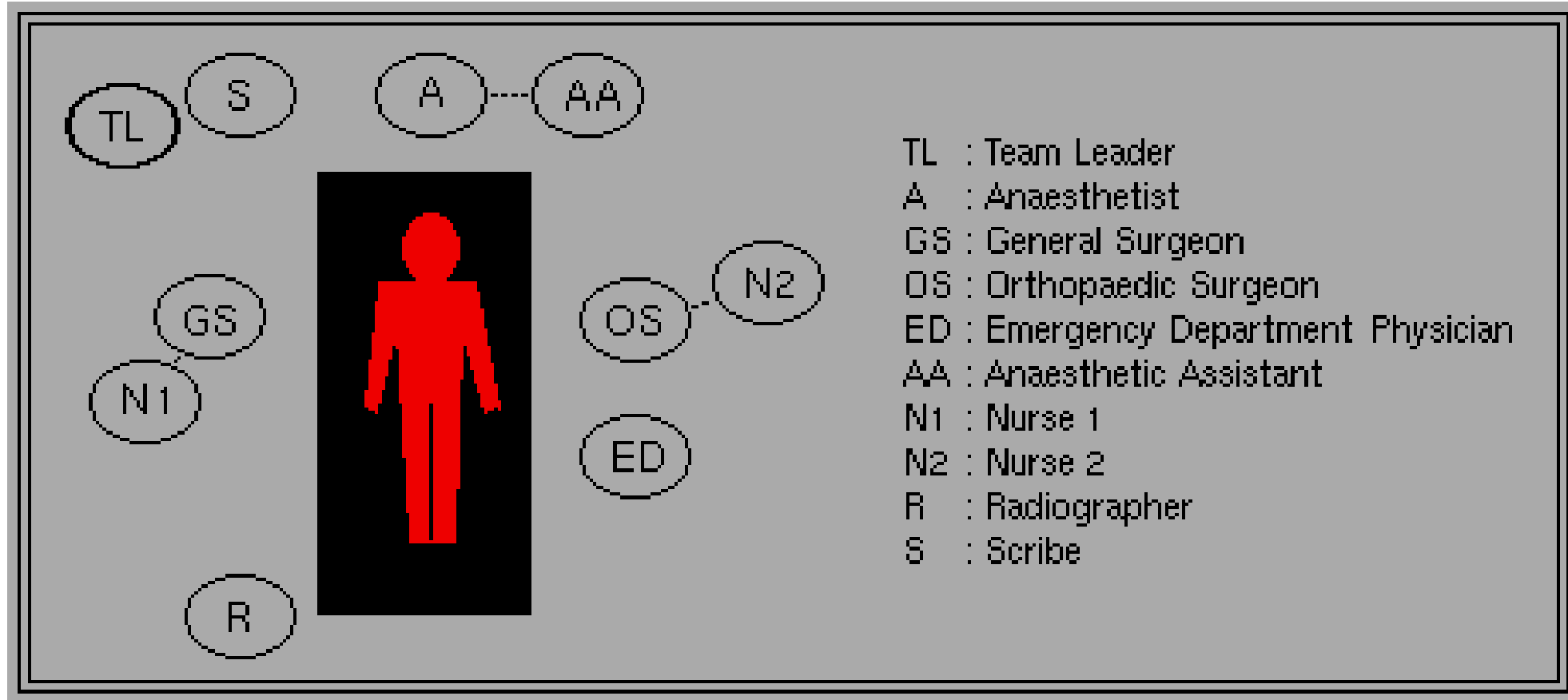
BUT OTHER LIFE-THREATENING PROBLEMS MAY....

DAMAGE CONTROL RESUSCITATION

- Why ??? Traumatology ???
- Highly preventable death rate on trauma in South Korea?
- It is not my business.
- I am not a trauma surgeon.
- I am not interested in traumatology.
- I am just thoracic surgeon/ cardiac surgeon/ vascular surgeon
- In trainee course, I don't have a chance to meet and treat the injured patient.

TRAUMA TEAMWORK

<http://www.trauma.org/archive/resus/traumateam.html>



Trauma Team Tasks.

TRAUMA TEAMWORK

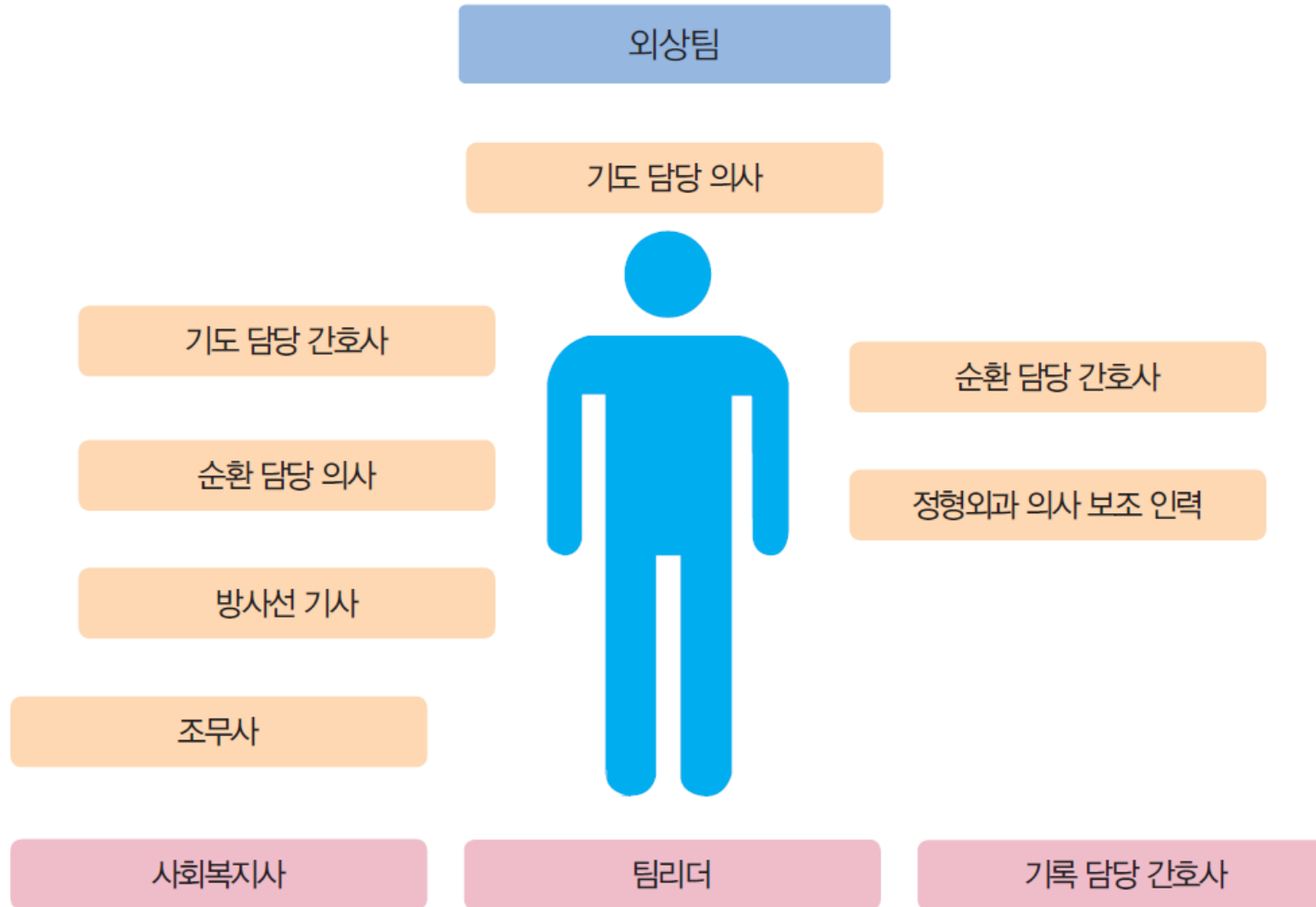


그림 5-1 외상팀의 배치

QUESTION 2, ON TRAUMA BAY

- 50/M, **After Penetrating injury**, Torso
 - On Scene: SOL (+), Upon arrival: SOL (-)
 - CPR time: (12) minutes
 - FAST: Hemopericardium (+)
Hemoperitoneum (-)
 - V/S: **Not checkable**
 - **Next step ??? What should you do for patient on trauma bay?**
- Signs of Life
 - Respiratory or Motor effort
 - Electrical activity
 - Pupillary activity