THORACIC TRAUMA

CLAUDIA SARA CIMMINO

Blunt chest trauma is more common (70–80%) than penetrating and accounts for 20 to 25% of trauma deaths.

Coccolini *et al. World Journal of Emergency Surgery* (2025) 20:78
https://doi.org/10.1186/s13017-025-00651-1

World Journal of Emergency Surgery

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Thoracic trauma WSES-AAST guidelines

BLUNT CHEST INJURY

MILD to LIFE-THREATENING

- MOST are MILD
- MANAGED NON SURGICALLY

- SEVERE INJURIES can become RAPIDLY FATAL
- TIMELY DIAGNOSIS & IMMEDIATE SURGICAL INTERVENTION

R. G. aa 42

Causa dichiarata all'accettazione: TRAUMA CRANICO NON COMMOTIVO E TRAUMA DORSALE

Inviato da: Intervento C.O. 118

Codice Missione: 2019000019092759

Data Triage		Data Visita		Data Uscita	
14/06/2019	11:00	14/06/2019	11:15	14/06/2019	19:40

Anamnesi:

Dott. : CIMMINO CLAUDIA SARA

Giunge in ps accompagnato dal 118 per trauma cranico e dorsale in seguito a frenata brusca mentre viaggiava in autobus. Lamenta dolore a livello del rachide dorsale. In anamnesi ernia iatale. Nega farmacollergie


D10S
10

COMMITTEE ON TRAUMA

COURSE MANUAL | 11th Edition

Advanced Trauma Life Support® (ATLS®)

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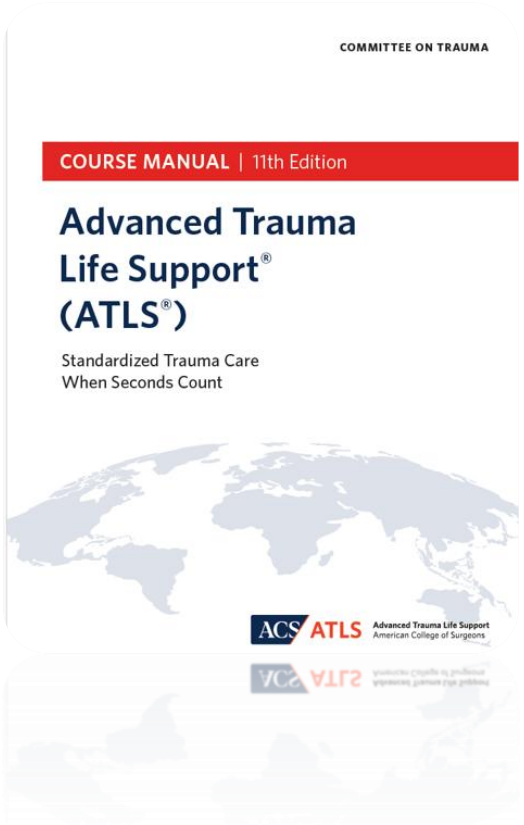
■ **Figure 1-1: Elements of the Initial Assessment.** The initial assessment is a continuum that starts with the Primary and Secondary Surveys and proceeds through Definitive Care. Frequent re-evaluation throughout is critical.

Three important concepts greatly enhance the ability to manage injured patients, regardless of the environment where care is provided:

1. Treat the greatest threat to life first.
2. The lack of a definitive diagnosis should not delay the application of urgent treatment.
3. An initial, detailed history is not essential to begin the evaluation and treatment of a patient with acute injuries.



The Primary Survey

& SIMULTANEOUS RESUSCITATION

		Key Causes and Issues
X	e**X**sanguinating e**X**ternal hemorrhage	Massive bleeding from open extremity and other wounds
A	**A**irway	Inability to maintain the airway patency due to direct injury, altered mental status, shock
B	**B**reathing	Compromise of oxygenation and/or ventilation due to direct injury, shock
C	**C**irculation	1. Presence of shock from hemorrhagic, neurogenic, cardiogenic, or other sources 2. Hemorrhage control 3. Restoration and maintenance of end-organ perfusion
D	**D**isability	Injury to the central nervous system • Traumatic brain injury • Spinal cord injury
E	**E**xposure/ **E**nvironment	1. Exposure to prevent missed injuries while maintaining patient dignity 2. Maneuvers to prevent hypothermia

The chest contains many structures that contribute to sustaining life. The internal structures such as the heart, aorta, lungs, trachea, oesophagus, diaphragm and other major vasculature all serve vital functions and when injured can be life-threatening. The chest wall surrounds the internal structures and serves the two important functions of protecting the internal organs as well as assisting in respiration. Given the superficial nature of the chest wall, it is quite vulnerable to injury and this can lead to accompanying internal organ damage. The anatomical structures in the chest wall include the skin, bones, musculature, cartilage, neurovascular bundles and the pleura, which line the internal wall of the chest.

ASSESSMENT OF THE CHEST

The immediate assessment of the patient should be prioritised according to the Early Management of Severe Trauma (EMST) or Advanced Trauma Life Support (ATLS) principles.[24,25]

Primary Survey – this should be conducted as soon as possible to detect serious lift threatening injuries that require immediate intervention, as outlined in section 3.2. This may be required to be reassessed multiple times.

Secondary survey – this is completed following the primary survey and after the patient has been stabilised. It includes a thorough review of the patient history and a full head-to-toe clinical examination to determine if any further assessment such as additional imaging and pathology is required.[26]

Tertiary survey – this should be completed within 24 hours of admission or as soon as practicably appropriate, to find any undetected or progressively evolving injuries.[27] This would include a complete physical re-examination of the patient, along with re-evaluation of laboratory and radiological findings. If the patient is intubated when the tertiary survey is undertaken, it is repeated after the patient is extubated.

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3.1.1.2. Primary assessment and stabilisation of life threatening conditions

The ABCDE approach must be the primary assessment tool for all patients and does not require a diagnostic work-up. It is a structured approach with which to identify and resuscitate the critically ill and injured. EPs must be able to assess, establish and maintain: Airway [A], Breathing [B], Circulation [C], Disability [D] and Exposure [E] of the patient.

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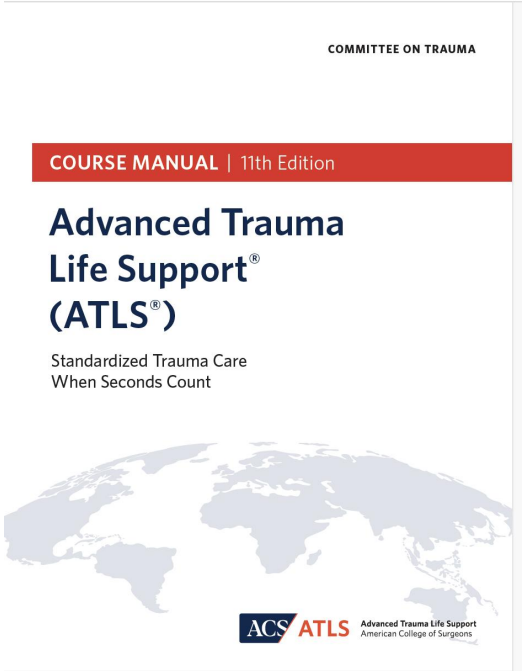
Thoracic trauma WSES-AAST guidelines

Table 1 Thoracic trauma classification (*Respiratory impairment*: reduced lung function without distress; *Respiratory distress:* an acute diffuse lung injury that occurs within a short period of time and can cause severe hypoxemia leading to hypoxic damage to various organs throughout the body

	Grade	Respiratory function	Haemodynamic
Minor	Grade I	Normal	Stable
Moderate	Grade II	Respiratory impairment	Stable
Severe	Grade III	Respiratory distress	Stable
	Grade IV	Any	Unstable



■ **Table 5-1: Physical Signs of Breathing Disorders and Injuries.**

Condition	PHYSICAL SIGN				Comment
	Breath Sounds	Tracheal Position	Neck Veins	Blood Pressure	
Pulmonary Contusion	Normal to Decreased	Midline	Unaffected	Unaffected	Signs vary based on severity
Simple Hemo/ Pneumothorax	Normal to Decreased	Midline	Unaffected	Unaffected	
Tension Hemo/ Pneumothorax	Decreased	Deviated AWAY from injury	Distended*	Decreased	Critical clinical diagnosis
Open Pneumothorax	Abnormal and decreased	Midline	Unaffected	Unaffected	Chest wound
Massive Hemothorax	Decreased	Midline**	Flat	Decreased	Hemorrhagic shock
Flail Chest	Decreased	Midline	Unaffected	Unaffected	Severity of associated pulmonary contusion determines degree of hypoxia
Diaphragm Injury	Decreased	Midline**	Unaffected***	Unaffected***	
Tracheobronchial	Decreased and abnormal	Midline**	Unaffected****	Unaffected	Continued air leak after chest tube insertion. Potential for massive subcutaneous empysema.

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3.2.17. TRAUMA IN ADULTS AND CHILDREN

- *Origin of trauma:*
  burns, blunt trauma, penetrating trauma
- *Anatomical location of trauma:*
  head and neck, maxillofacial, thorax, abdomen, pelvis, spine, extremities
- *Polytrauma patient*
- *Trauma in specific populations:*
  children, elderly, pregnant women.


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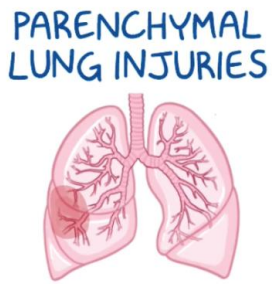
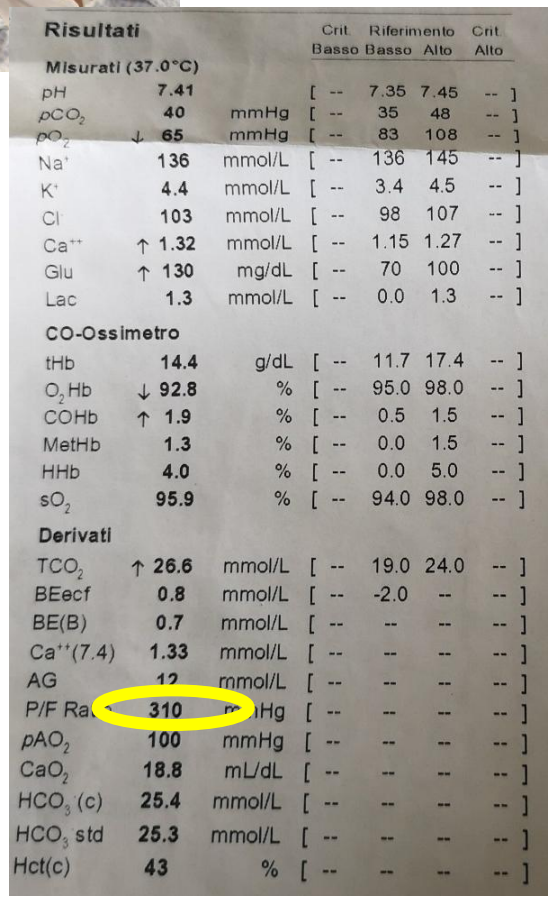
B
CTO TEAM

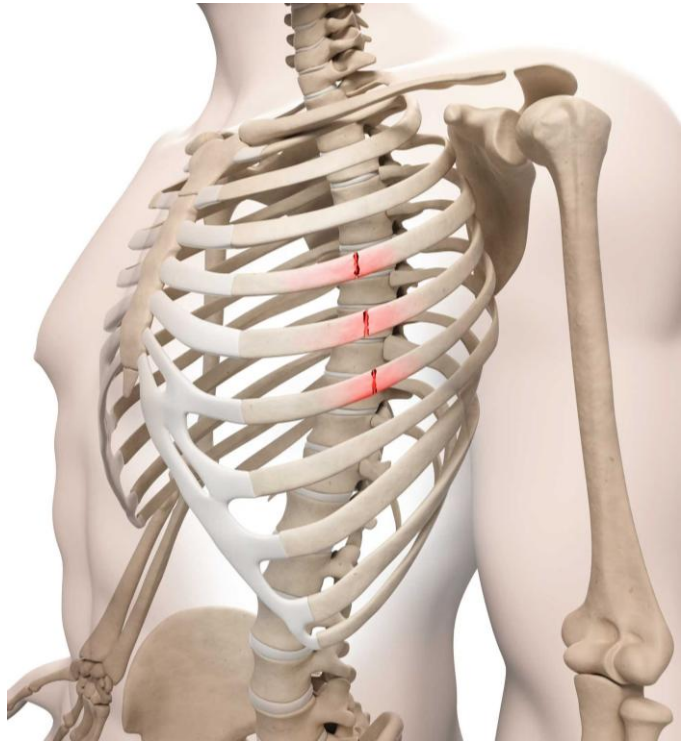


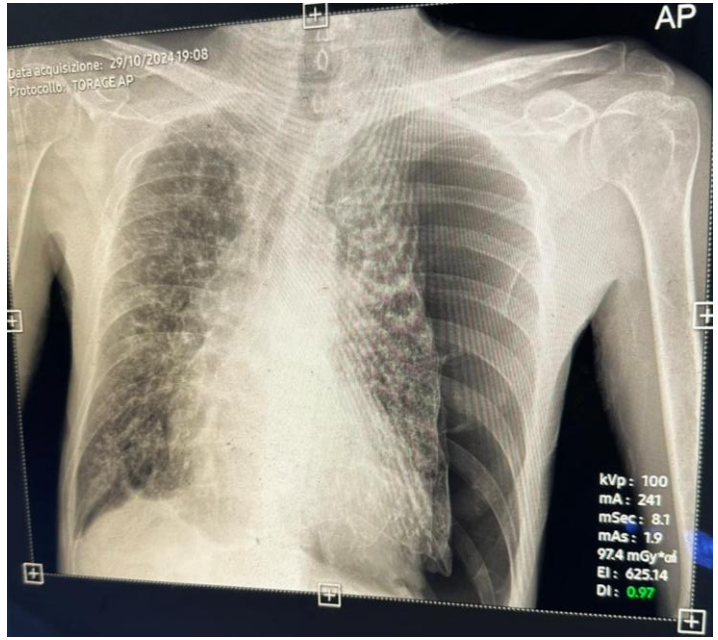


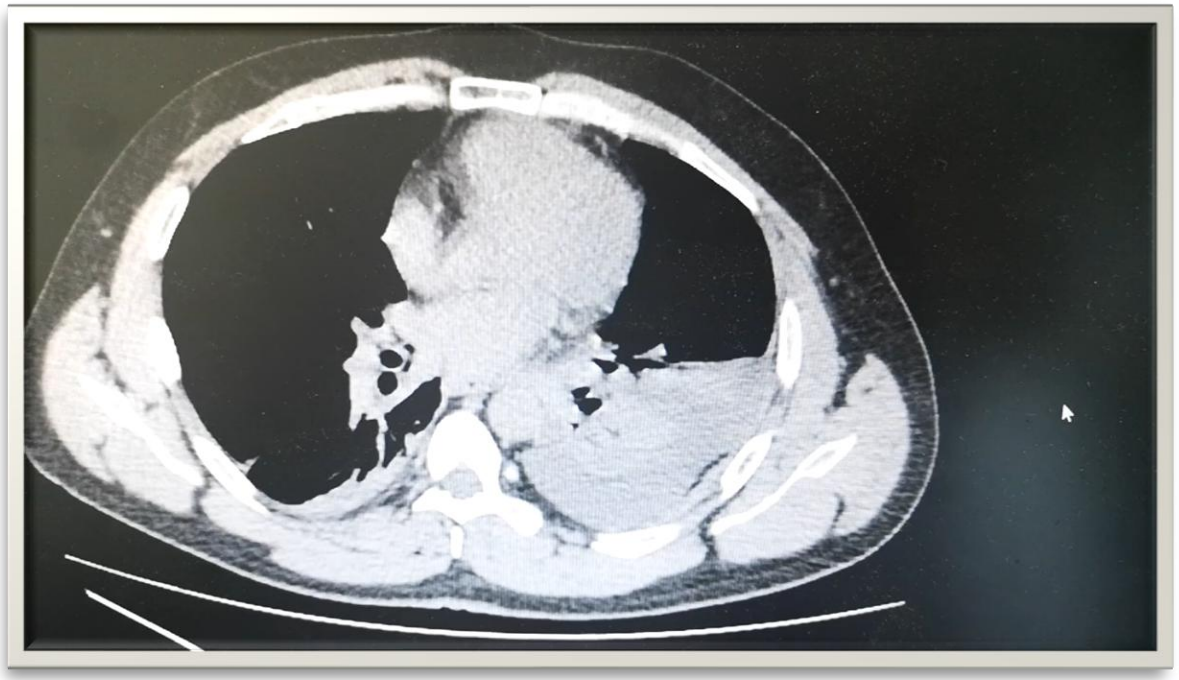
Risultati			Crit. Basso	Riferimento Basso	Riferimento Alto	Crit. Alto
Misurati (37.0°C)						
pH	7.41		[--	7.35	7.45	--]
pCO_2	40	mmHg	[--	35	48	--]
pO_2	↓ 65	mmHg	[--	83	108	--]
Na^+	136	mmol/L	[--	136	145	--]
K^+	4.4	mmol/L	[--	3.4	4.5	--]
Cl	103	mmol/L	[--	98	107	--]
Ca^{++}	↑ 1.32	mmol/L	[--	1.15	1.27	--]
Glu	↑ 130	mg/dL	[--	70	100	--]
Lac	1.3	mmol/L	[--	0.0	1.3	--]
CO-Ossimetro						
tHb	14.4	g/dL	[--	11.7	17.4	--]
O_2Hb	↓ 92.8	%	[--	95.0	98.0	--]
COHb	↑ 1.9	%	[--	0.5	1.5	--]
MetHb	1.3	%	[--	0.0	1.5	--]
HHb	4.0	%	[--	0.0	5.0	--]
sO_2	95.9	%	[--	94.0	98.0	--]
Derivati						
TCO_2	↑ 26.6	mmol/L	[--	19.0	24.0	--]
BEecf	0.8	mmol/L	[--	-2.0	--	--]
BE(B)	0.7	mmol/L	[--	--	--	--]
Ca^{++}(7.4)	1.33	mmol/L	[--	--	--	--]
AG	12	mmol/L	[--	--	--	--]
P/F Ra	310	mmHg	[--	--	--	--]
pAO_2	100	mmHg	[--	--	--	--]
CaO_2	18.8	mL/dL	[--	--	--	--]
HCO_3 (c)	25.4	mmol/L	[--	--	--	--]
HCO_3 std	25.3	mmol/L	[--	--	--	--]
Hct(c)	43	%	[--	--	--	--]

Trauma Severity Score; (TTSS) to predict outcomes in thoracic trauma patients.

Parameter	Finding	Points
Age	<30 years of age	0
	30 to 41 years of age	1
	42 to 54 years of age	2
	55 to 70 years of age	3
	>70 years of age	5
PaO2 to FIO2 ratio	>400	0
	301-400	1
	201-300	2
	150-200	3
	<150	5
Pulmonary contusion	None	0
	1 lobe, unilateral	1
	1 lobe, bilateral	2
	2 lobes, unilateral	2
	"<2 lobes, bilateral" (see below)	3
	≤ 2 lobes, bilateral	5
Pleural involvement	None	0
	Pneumothorax	1
	Unilateral hemothorax or hemopneumothorax	2
	Bilateral hemothorax or hemopneumothorax	3
	Tension pneumothorax	5
Rib fractures	0	0
	1 to 3	1
	3 to 6 (will use 4 to 6), unilateral	2
	>3, bilateral	3
	flail chest	5
Notes: for calculation of the total score, all categories are summed; a minimum value of 0 points and a maximum value of 25 points can be achieved.		







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U.O.C. RADIODIAGNOSTICA
Ospedale C.T.O. - Viale dei Colli Aminei 21 - 80131 Napoli
Direttore: dott. Antonio Pinto

Cognome e Nome: [redacted] GIANLUCA
Codice Fiscale: [redacted]02H096W
Provenienza: PS UOSD MEDICINA E CHIRURGIA DI ACCETTAZIONE E DI URGENZA (MCAU-CTO) - 513
Medico Richiedente: CIMMINO CLAUDIA
Op. Accettazione: ERRICHIELLO ROSA

Data di Nascita: 02/12/1976
Num. Accettazione: CTO2019054870
Data Richiesta: 14/06/2019 15:22
Data Accettazione: 14/06/2019 15:42
Data Esecuzione: 14/06/2019 16:01

Quesito clinico: **fratture costali multiple. Se presente contusione polmonare**

TC TORACE SENZA MDC

Esame eseguito in regime di urgenza senza somministrazione di mdc ev come da specifica richiesta.
In relazione al quesito clinico:
Allo stato non evidenza di falde di pnx.
Presenza in corrispondenza dei lobi inferiori di chiazze di aumentata densità parenchimale contusive-disventilatorie, più evidente a sinistra ove concomita sottile falda di versamento pleurico con disventilazione del parenchima mantellare posteriore.
A sinistra:
- frattura dell'arco medio-anteriore e dell'arco posteriore della V VI VII costa.
- frattura scomposta e pluriframmentata dell'arcon posteriore dell'VIII, IX, X, XI costa. Concomita disomogeneità ed ispessimento dei tessuti molli limitrofi.

Sottile falda fluida nel recesso pericardico (spessore massimo antero-inferiore 7 mm).
Necessario stretto monitoraggio clinico-strumentale ed a giudizio clinico ulteriori approfondimenti diagnostici.

Napoli, 14/06/2019 - 16:30:22

ID Operatore:

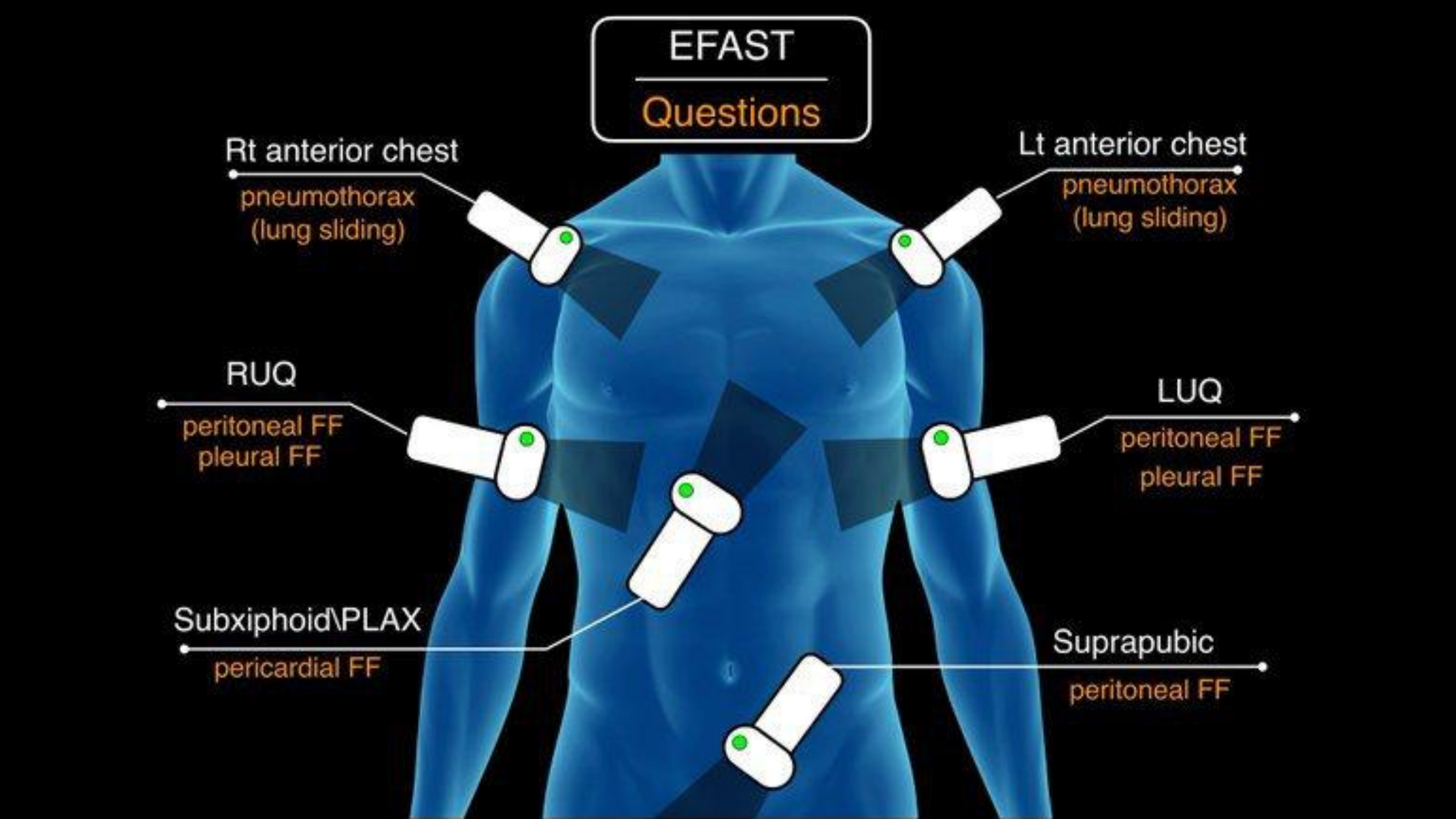
Paziente
ID:
Cognome: [redacted]
Nome: GIANLUCA
Data di nascita:

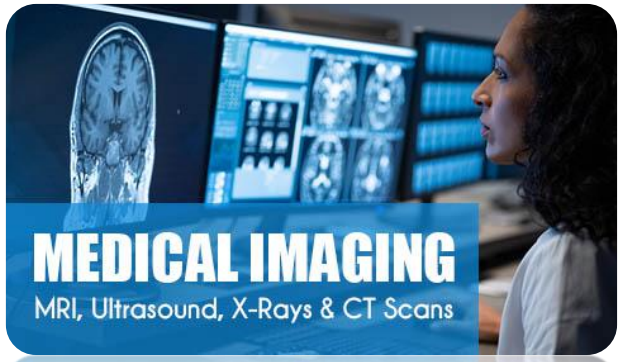
Cartuccia
Lotto N°: 190228C
S/N: 400100286
Scadenza: 18/06/2019

Analizzatore
Modello: GEM® *Premier 4000*
Area: MED URG
Nome: GP4000
S/N: 15028267

P/F 280

Risultati			Crit. Basso	Riferimento Basso	Riferimento Alto	Crit. Alto
Misurati (37.0°C)						
pH	7.42		[--	7.35	7.45	--]
pCO_2	37	mmHg	[--	35	48	--]
pO_2	↓ 59	mmHg	[--	83	108	--]
Na^+	137	mmol/L	[--	136	145	--]
K^+	↑ 4.7	mmol/L	[--	3.4	4.5	--]
Cl	106	mmol/L	[--	98	107	--]
Ca^{++}	1.18	mmol/L	[--	1.15	1.27	--]
Glu	↑ 108	mg/dL	[--	70	100	--]
Lac	0.6	mmol/L	[--	0.0	1.3	--]
CO-Ossimetro						
tHb	15.2	g/dL	[--	11.7	17.4	--]
O_2Hb	↓ 91.6	%	[--	95.0	98.0	--]
COHb	↑ 2.5	%	[--	0.5	1.5	--]
MetHb	1.2	%	[--	0.0	1.5	--]
HHb	4.6	%	[--	0.0	5.0	--]
sO_2	95.2	%	[--	94.0	98.0	--]
Derivati						
TCO_2	↑ 25.1	mmol/L	[--	19.0	24.0	--]
BEecf	-0.5	mmol/L	[--	-2.0	--	--]
BE(B)	-0.2	mmol/L	[--	--	--	--]
Ca^{++}(7.4)	1.19	mmol/L	[--	--	--	--]
AG	12	mmol/L	[--	--	--	--]
P/F Ratio	Incalc	mmHg	[--	--	--	--]
pAO_2	Incalc	mmHg	[--	--	--	--]
CaO_2	19.5	mL/dL	[--	--	--	--]
HCO_3 (c)	24.0	mmol/L	[--	--	--	--]
HCO_3 std	24.6	mmol/L	[--	--	--	--]
Hct(c)	46	%	[--	--	--	--]


EFAST
Questions
Rt anterior chest
pneumothorax
(lung sliding)
Lt anterior chest
pneumothorax
(lung sliding)
RUQ
peritoneal FF
pleural FF
LUQ
peritoneal FF
pleural FF
Subxiphoid\PLAX
pericardial FF
Suprapubic
peritoneal FF



Imaging is essential for the early diagnosis of all blunt chest trauma, which can in turn assist clinicians to provide rapid life-saving therapy. A chest x-ray (CXR), computed tomography (CT) and ultrasound are all imaging modalities that can provide valuable diagnostic information in the early stages of presentation.[28] The chest xray is essential on presentation of any suspected chest trauma and may rapidly diagnose a pneumothorax, mediastinal deviation, abnormal fluid presence and bony fractures, and to also assess any interventions such as intercostal catheter (ICC) or endotracheal tube (ETT) placement.

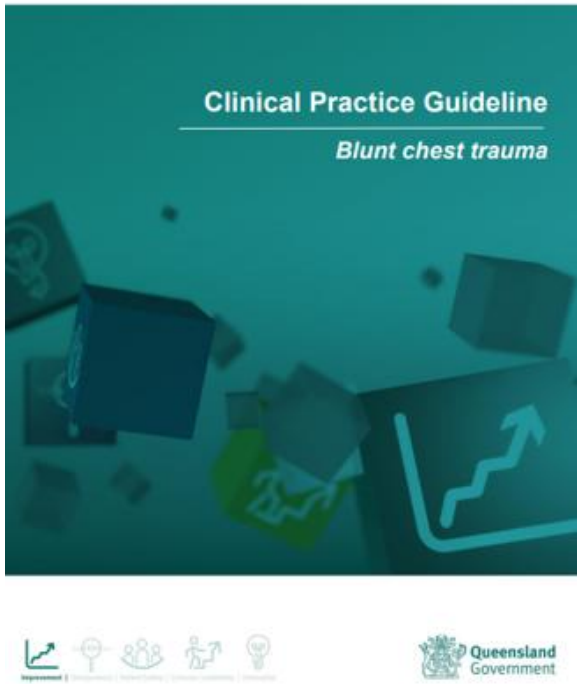
A CT scan of the chest with contrast in arterial phase (CTA) is recommended if there are any abnormalities detected on the chest xray, or in the case of a high-speed deceleration mechanism or suspicion of an aortic injury, mediastinal, vascular, lung, tracheobronchial or chest wall injury.

An extended Focused Assessment with Sonography in Trauma (eFAST) scan is used to identify the presence of free fluid in the thoracic or peritoneal cavities and has the highest sensitivity in the unstable trauma patient. Although it can assist in the diagnosis of trauma to the heart and great vessels,[29,30] it is not sensitive enough to delineate myocardial or great vessel injuries.

In addition to imaging, a 12 lead electrocardiogram (ECG) should be performed early on patients who are at high risk for myocardial contusion, as abnormalities such as arrhythmias, conduction delay or ST segment changes necessitate futher investigation and monitoring.

Pathology tests should be taken for a full blood count (FBC) and a chem-20 (electrolytes, renal and liver function as well as glucose levels). Venous blood gas (VBG) assessment of pH and lactate levels provide good monitoring of tissue oxygenation, circulatory status and response to resuscitation. Coagulation studies, group and hold and crossmatch are recommended when there is a high index of suspicion for major injuries requiring further care. Beta HCG should be taken where indicated. Isolated results from single blood tests may be misleading and results should be considered in the context of the whole patient and trended results utilised when available.[31]

ROTEM or TEG if available for point-of-care diagnostic testing is useful to measure, monitor and support coagulation, should be initiated as early as possible and used to guide a goal-directed treatment strategy for blood product transfusions and resuscitation endpoints.[32] Troponin testing is recommended when any ECG changes may indicate the presence of blunt cardiac injury, and serial testing should follow abnormal results, however optimal timing for this lacks clear evidence.[5]



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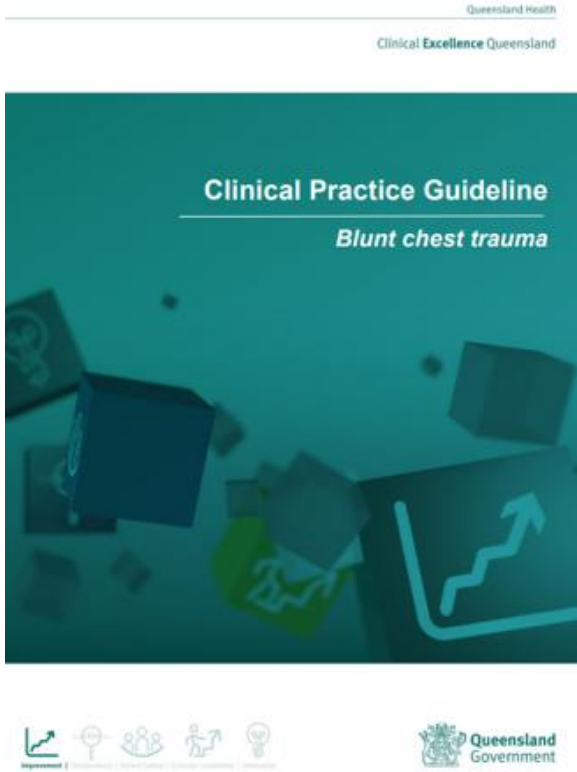
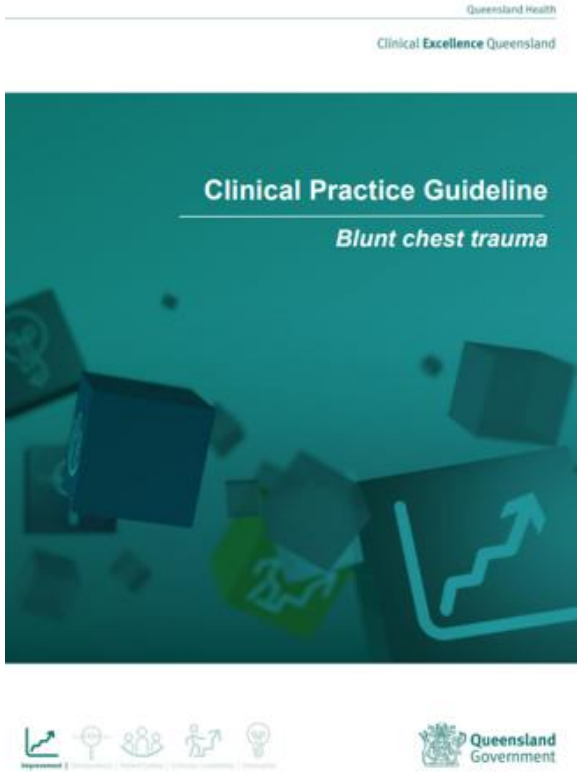


Bone and muscle contusions – A patient may be suitable for discharge if there are no accompanying signs of significant injury, however they should be given appropriate advice of warning signs and when to seek medical advice or return to the Emergency Department.

minor



Clavicle, sternum and scapular fractures – Clavicle fractures may be managed conservatively in a sling if there is minimal displacement and the patient is showing no signs of respiratory or neurovascular compromise. The main aim is to reduce swelling, ensure adequate pain control, and restrict shoulder range of motion until clinical union is attained. Sternal fractures with minimal or no displacement usually heal without any intervention, however the patient should adhere to limited lifting precautions during the healing phase. Scapular fractures are commonly managed non-operatively and heal well with conservative management in a shoulder immobiliser sling. All patients with these fractures should have a follow up review after discharge.

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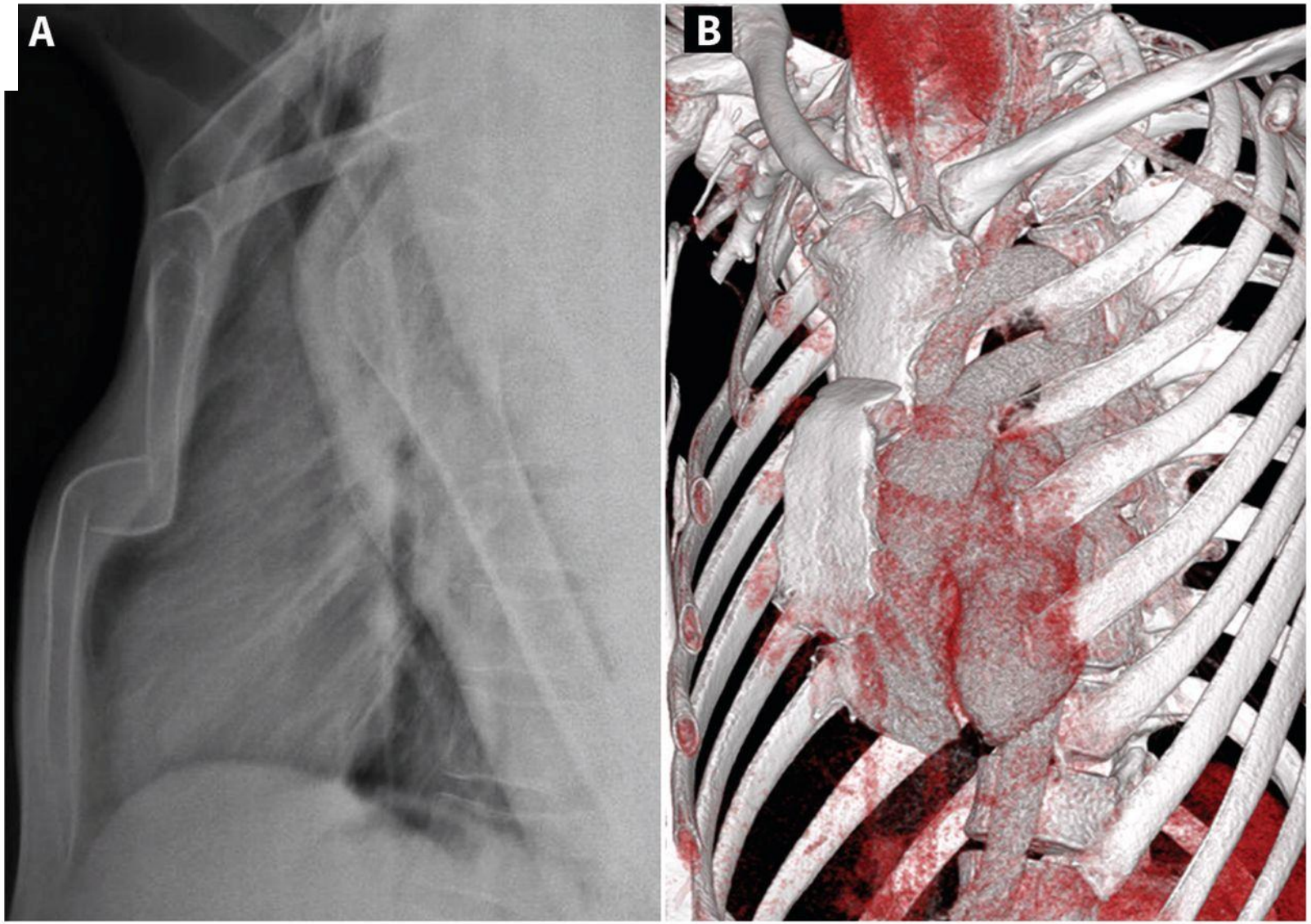
search

Practice

Stairlike fracture of the sternum

Recep Sade and Yener Aydin

CMAJ July 10, 2017 189 (27) E914; DOI: https://doi.org/10.1503/cmaj.161344



Sternal fracture caused by traffic collisions may occur in isolation or with fractures of the ribs, clavicle or spine.
It has an incidence of 0.64% to 4.8% in thoracic trauma.

In severe trauma, it may be associated with:

cardiac contusion,

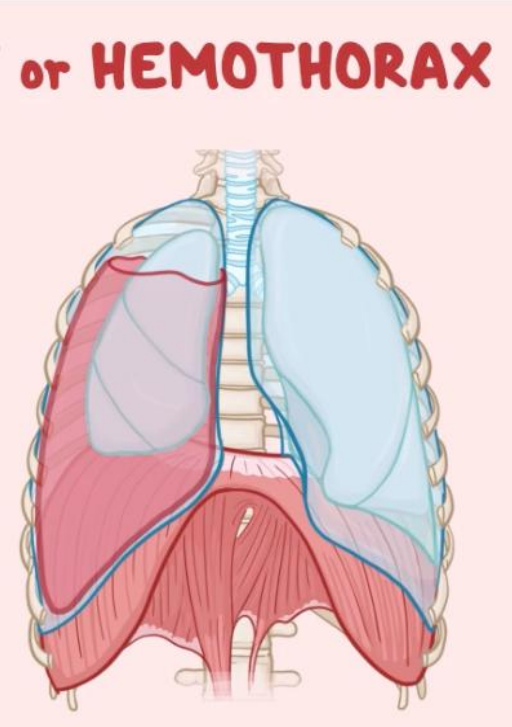
vascular injuries,

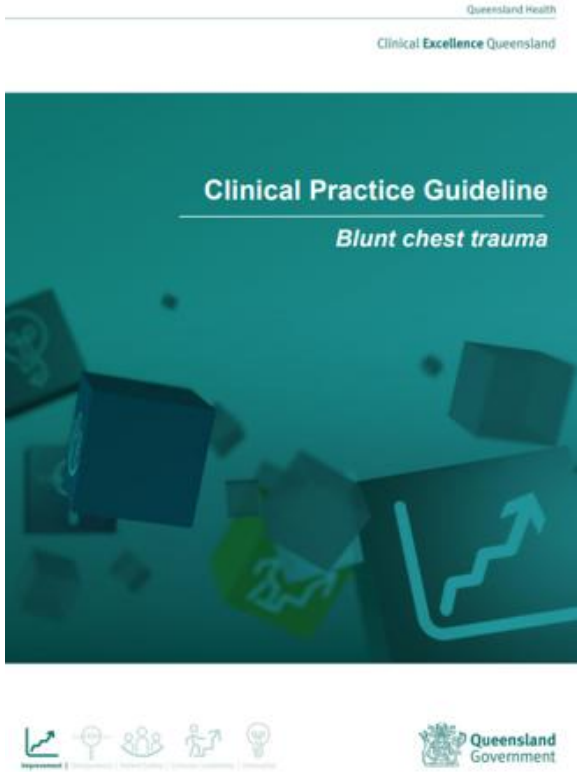
lung contusion

hemopneumothorax.


mindray

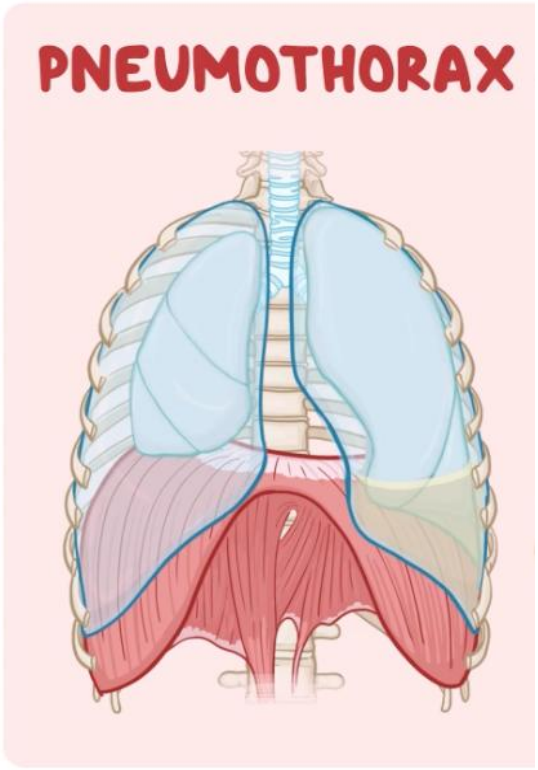
minor

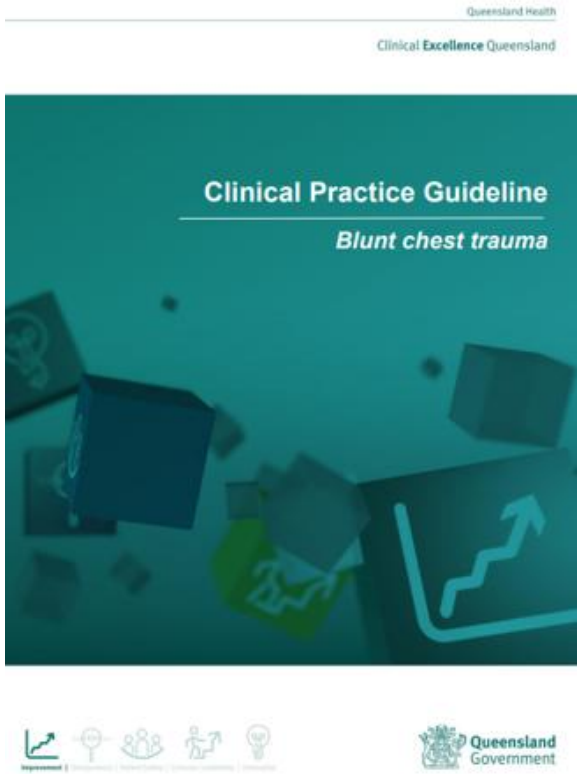




Haemothorax – Haemothoracies should be considered for drainage regardless of size.[39] If in a rural or regional area, a large bore catheter is recommended to prevent potential blockage during patient transfer for investigations or interhospital transfers. There is some evidence to suggest smaller bore catheters may be utilised in haemodynamically stable patients with no ventilator or transfusion requirements, that have a confirmed drainable haemothorax.[40-42] This should be used with caution and according to local expertise. Small haemothoracies can be observed closely in a stable patient with a repeat CXR to monitor progression.

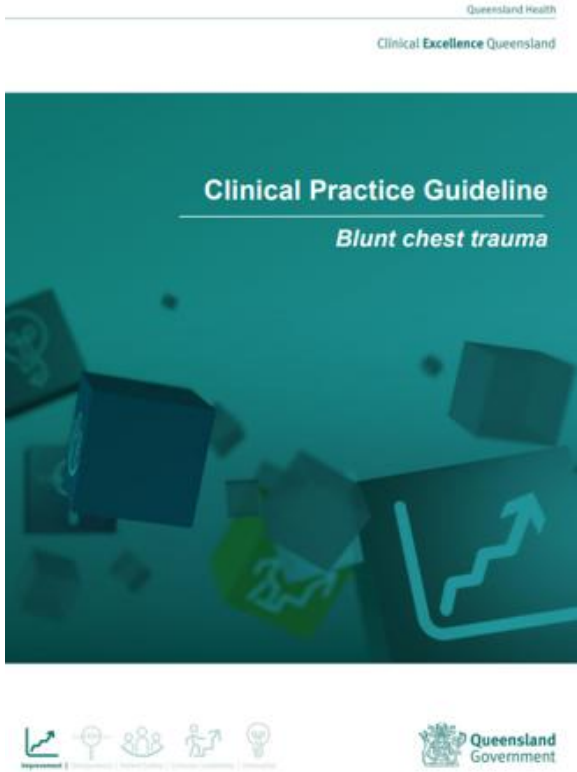
minor



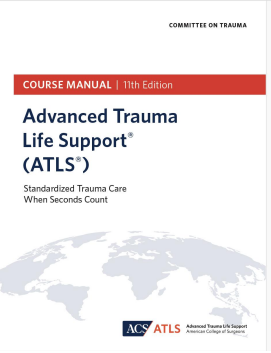


Pneumothoracies – small and occult pneumothoracies may not require an ICC, however moderate to large pneumothoracies require ICC placement, or a pigtail catheter could be considered.

minor



Rib fractures/cartilaginous injury – When greater than 3 ribs are fractured, consideration should be given to hospital admission due to the high risk of hypoventilation, atelectasis and pneumonia. Surgical rib fixation may be considered in some cases (refer to section 3.5 below), however conservative management is relatively common. Cartilage and soft tissue injuries are more likely to be detected with an MRI, however CT and ultrasound are more appropriate in the acute setting. These injuries need to be carefully managed, as any major disruption in soft tissue structures can cause an unstable rib cage, decreasing the body's ability to protect the vital organs. Patients with first or second rib fractures have significantly higher mortality and prevalence on concomitant great vessel injury than patients with fractures of ribs 3-12.[43] Therefore, consideration should be given for a CT neck (if not already indicated) for first and second rib fractures.



PARENCHYMAL LUNG INJURIES

PULMONARY CONTUSION PATHOPHYSIOLOGY

Pulmonary contusion is an injury to the alveolar capillaries without a tear in the lung tissue. **This is the most common intrathoracic injury,** although there may not be clinical consequences. Pulmonary contusions can occur in the presence or absence of rib fractures. **Secondary to flexible cartilaginous chest walls, lack of fracture is more common in the pediatric population.** The majority of younger patients with isolated pulmonary contusions recover. However, the mortality rate associated with development of long-term respiratory failure in the multiply injured patient is substantial. Blunt mechanism of injury produces a contusion by transmission of force to the lung. Penetrating and explosive mechanisms cause contusion either by direct lung injury or by cavitation effect.

Pulmonary contusion results in alveolar damage with blood and fluid accumulation in the pulmonary tissues. A mismatch between ventilation and perfusion occurs, thereby creating an intrapulmonary shunt and segmental lung damage with loss of lung compliance. These pathophysiological effects can lead to hypoxemia and hypercapnia. **The size, severity, and clinical impact of contusion frequently increase during the first 24–72 hours following injury.**

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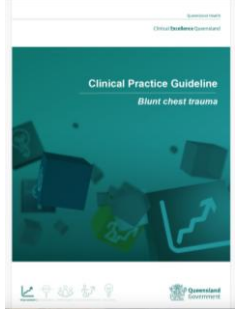
E
F

Charlson Comorbidity Index (CCI)

Condition	Points
Age (Every nine years over 50)	+ 1
Myocardial Infarction	+ 1
Peripheral Vascular Disease	+ 1
CVA or TIA	+ 1
Dementia	+ 1
COPD or CHF	+ 1
Connective Tissue Disease	+ 1
Peptic Ulcer Disease	+ 1
Hemiplegia	+ 2
Moderate to Severe CKD	+ 2
Leukemia or Lymphoma	+ 2
Solid Tumor	Localized = + 2 Metastatic = + 6
Liver Disease	Mild = + 1 Mod / Severe = + 2
Diabetes Mellitus	Uncomplicated = + 1 End-organ Damage = + 2
AIDS	+ 6

REBELEM



Flowchart: Blunt Chest Trauma

Follow ATLS/EMST guidelines for initial assessment and management of all trauma patients

For specific blunt chest trauma: Assessment and Management

If the patient is unable to cough, take a deep breath or mobilise despite adequate analgesia – an inpatient admission is required.

Consider an ICU review when any clinical deterioration is detected (e.g.↑ 02 or flow demand, ↑WOB, ↑ADDS score, ↓SpO2 or multiple red flags present). Escalate care as per local guidelines.

Arrange a review by the appropriate clinical team

Consider transfer to a major trauma centre and ensure early activation of the retrieval process[1] through **RSQ (1300 799 127)** where applicable

Red flags for potential deterioration

Age >65years[2-4]

Uncontrolled pain despite use of adequate analgesia

Previous lung disease:

Smoker, COPD, asthma

Morbid obesity

Respiratory compromise:

↑WOB, ↑RR, ↓SpO2

≥3 fractured ribs

Shallow breathing

Inability to cough

Associated injuries:

Pneumothorax or haemothorax

Pulmonary contusion

STUMBL/Battle Score

Predicts morbidity in patients with blunt chest wall trauma.

INSTRUCTIONS

Use this score in patients who present with blunt chest wall trauma to determine their risk of complications.

When to Use | Why Use

- Use in patients >18 years of age with blunt chest wall trauma to determine their risk of complications.
- Complications include mortality and morbidity, such as pulmonary complications, ICU admission, and prolonged length of stay.
- The original study excluded patients with a life-threatening injury and those admitted to the intensive care unit for other conditions.

Age, years		years
Number of rib fractures		fractures
Chronic lung disease	No 0	Yes +5
Pre-injury anticoagulant use	No 0	Yes +4
Oxygen saturation level	≥95% 0	90-94% +2
		85-89% +4
		80-84% +6

FORMULA

The STUMBL/Battle Score is calculated by the addition of the selected points:

Variable		Points
Age, years		1 point per 10 years, starting at age 10
Number of rib fractures		3 points per rib fracture
Chronic lung disease	No	0
	Yes	5
Pre-injury anticoagulant use	No	0
	Yes	4
Oxygen saturation level	≥95%	0
	90-94%	2
	85-89%	4
	80-84%	6

STUMBL/Battle Score

Predicts morbidity in patients with blunt chest wall trauma.

INSTRUCTIONS

Use this score in patients who present with blunt chest wall trauma to determine their risk of complications.

When to Use | Why Use

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Chronic lung disease	No 0	Yes +5
Pre-injury anticoagulant use	No 0	Yes +4
Oxygen saturation level	≥95% 0	
	90-94% +2	
	85-89% +4	
	80-84% +6	

STUMBL/Battle Score	Risk of Complications
0-10	13 ± 6%
11-15	29 ± 8%
16-20	52 ± 8%
21-25	70 ± 6%
26-30	80 ± 6%
≥31	88 ± 7%

Variabili	Punteggio
Età	1 punto per ogni decade partendo da 10 anni
Numero coste fratturate	3 punti per ogni costa fratturata
Terapia anticoagulante	Si=4 No=0
Malattia polmonare cronica	Si=5. No=0
Saturazione O_2	100-95=0 94-90=2 89-85=4 84-80=6 79-75=8 74-70=10
Risk score complicanze	0-10=13% – dimissione 11-15=29% -> ricovero ordinario 16-20=52% -> ricovero ordinario 21-25=70% -> ricovero ordinario 26-30=80% -> ricovero TSI/TI >31=88% -> ricovero TSI/TI

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CASI CLINICI PROCEDURE ECOGRAFIA EBM LINEE GUIDA CHOOSING WISELY COV

Blog Casi clinici Pronto soccorso Trauma

Esiste uno score per il trauma toracico?

di **Davide Tizzani** 3 Febbraio 2025 2818 2

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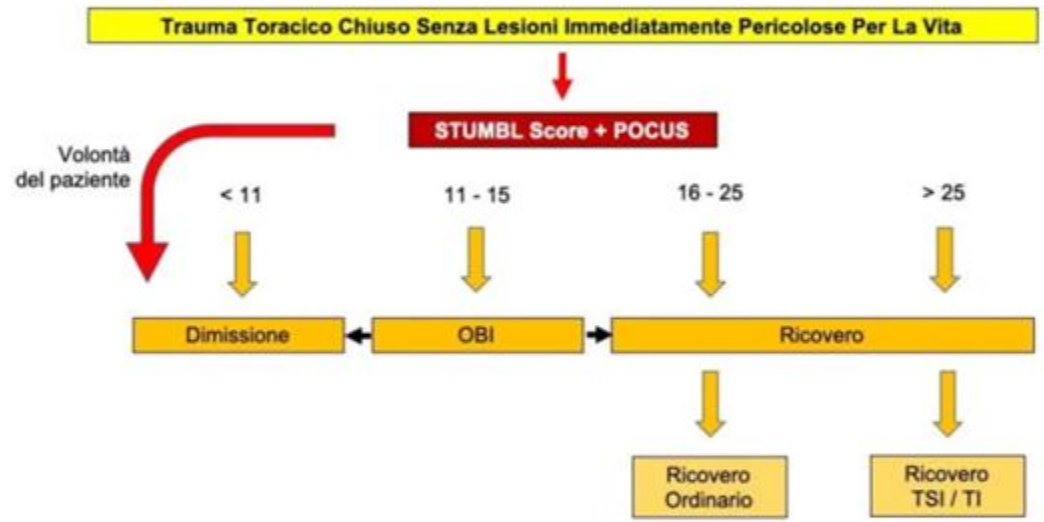
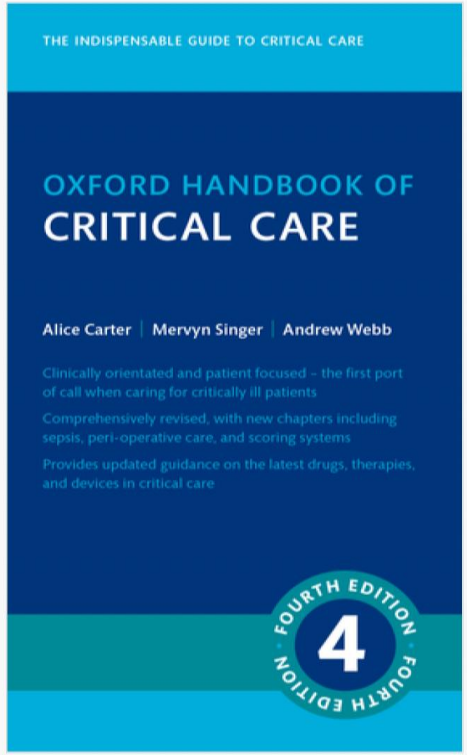


Sopra uno score di 11 il rischio di sviluppare complicanze diventa significativo a tal punto da suggerire il trattenimento in ospedale; sopra i 26 il paziente diventa meritevole di un monitoraggio sub/intensivistico.



Respiratory management

Management may vary depending on the presence of direct chest injury (e.g. flail chest, pneumothorax), or the need for a protective ventilation strategy (e.g. for head injury). Otherwise, standard lung protective ventilation should be provided.

If spontaneously breathing, maintain gas exchange, encourage deep breathing ± non-invasive support to prevent atelectasis and secondary infection. Ensure good analgesia, consider patient-controlled analgesia and regional blocks (e.g. epidural, paravertebral, or other chest blocks), and mobilize early, if possible.

Weaning from invasive ventilation depends on multiple factors including cardiorespiratory stability, pain control, stabilization of intracranial pressure (ICP), appropriate conscious level, upper airway patency, and likely ability to protect airway and secretion clearance and/or any need for imminent invasive procedures.

Coccolini et al. World Journal of Emergency Surgery (2025) 20:78
https://doi.org/10.1186/s13017-025-00651-1

Table 2 ARDS definition [5]

Criteria that apply to all ARDS categories			
Risk factors and origin of edema	Precipitated by an acute predisposing risk factor, such as pneumonia, non-pulmonary infection, trauma, transfusion, aspiration, or shock. Pulmonary edema is not exclusively or primarily attributable to cardiogenic pulmonary edema/fluid overload, and hypoxemia/gas exchange abnormalities are not primarily attributable to atelectasis. However, ARDS can be diagnosed		
Timing	Acute onset or worsening of hypoxemic respiratory failure within 1 week of the estimated onset of the predisposing risk factor or new or worsening respiratory symptoms		
Chest imaging	Bilateral opacities on chest radiography and computed tomography or bilateral B lines and/or consolidations on ultrasound not fully explained by effusions, atelectasis, or nodules/masses		
	Criteria That Apply to Specific ARDS Categories		
	Non-intubated ARDS	Intubated ARDS	Modified Definition for Resource-Limited Settings
Oxygenation	$PaO_2/FiO_2 \leq 300$ mmHg or $SpO_2/FiO_2 \leq 315$ (if $SpO_2 \leq 97\%$) on HFNO with flow of > 30 L/min or NIV/CPAP with at least 5 cmH_2O PEEP	- Mild: $200 < PaO_2/FiO_2 \leq 300$ mmHg or$235 < SpO_2/FiO_2 \leq 315$ - (if $SpO_2 \leq 97\%$) - Moderate: $100 < PaO_2/FiO_2 \leq 200$ mmHg or $148 < SpO_2$: $FiO_2 \leq 235$ - (if $SpO_2 \leq 97\%$) - Severe: $PaO_2/FiO_2 \leq 100$ mmHg or $SpO_2/FiO_2 \leq 148$ - (if $SpO_2 \leq 97\%$)	$SpO_2/FiO2 \leq 315$ (if $SpO_2 \leq 97\%$). Neither PEEP nor a minimum flow rate of oxygen is required for diagnosis in resource-limited settings

REVIEW Open Access

Thoracic trauma WSES-AAST guidelines

Respiratory Physiology & Neurobiology 274 (2020) 103363

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Arterial blood gas analysis utility in predicting lung injury in blunt chest trauma

Maria Viviana Carlino[a,*], Mario Guarino[a], Arturo Izzo[a], Daniele Carbone[a], Maria Immacolata Arnone[a,b], Costantino Mancusi[b], Alfonso Sforza[a]

[a] Emergency Department, C. T. O. Hospital, Naples, Italy
[b] Federico II University Hospital, Naples, Italy

Table 1
Baseline characteristics of the two subgroups based on the presence/absence of lung injury.

	LIG [n = 42]	NLIG [n = 9]	p
Age [years]	62,88 ± 19,73	53,11 ± 20,29	0,186
Sex [female]	40,48 %	44,44 %	0,830
Systolic BP [mm Hg]	137,58 ± 17,91	146,67 ± 12,50	0,156
Diastolic BP [mm Hg]	80,63 ± 13,5	86,67 ± 11,18	0,219
Heart rate [bpm]	79,21 ± 15,49	90,44 ± 9,24	0,043
Respiratory rate [breaths/min]	18,63 ± 2,12	18,71 ± 3,77	0,936
Oxygen saturation [%]	94,62 ± 4,18	98,11 ± 0,78	0,017
0 to 10 NRS	7,14 ± 1,65	7,25 ± 1,58	0,868
Number of ribs fractures detected by chest x-ray	2,88 ± 2,03	1,14 ± 1,47	0,04
Number of ribs fractures detected by CT scan	3,67 ± 1,87	1,33 ± 1,23	0,001
PaO_2 [mmHg]	64,45 ± 11,46	78,78 ± 8,01	0,001
PaO_2/FiO_2	306,92 ± 54,59	375,17 ± 38,23	0,001
Arterial/alveolar oxygen tension ratio	0,64 ± 0,11	0,77 ± 0,09	0,001
PaO_2 Deficit [mmHg]	14,59 ± 11,32	3,52 ± 10,85	0,01
pH	7,43 ± 0,04	7,44 ± 0,03	0,372
$AaDO_2$ [mmHg]	36,92 ± 11,64	24,00 ± 9,99	0,003
$AaDO_2$ augmentation [mmHg]	17,16 ± 11,31	7,94 ± 9,87	0,028
Lactate level [mmol/L]	1,29 ± 0,88	1,00 ± 0,41	0,365
ISS	16,43 ± 6,98	6,67 ± 2,78	0,000

LIG = Lung Injury Group; NLIG = Non-Lung Injury Group; BP = blood pressure; NRS = Numerical Rating Scale; CT scan = computed tomography scan; PaO_2 = partial pressure of oxygen in arterial blood; $AaDO_2$ = alveolar-arterial oxygen gradient; ISS = Injury Severity Score.

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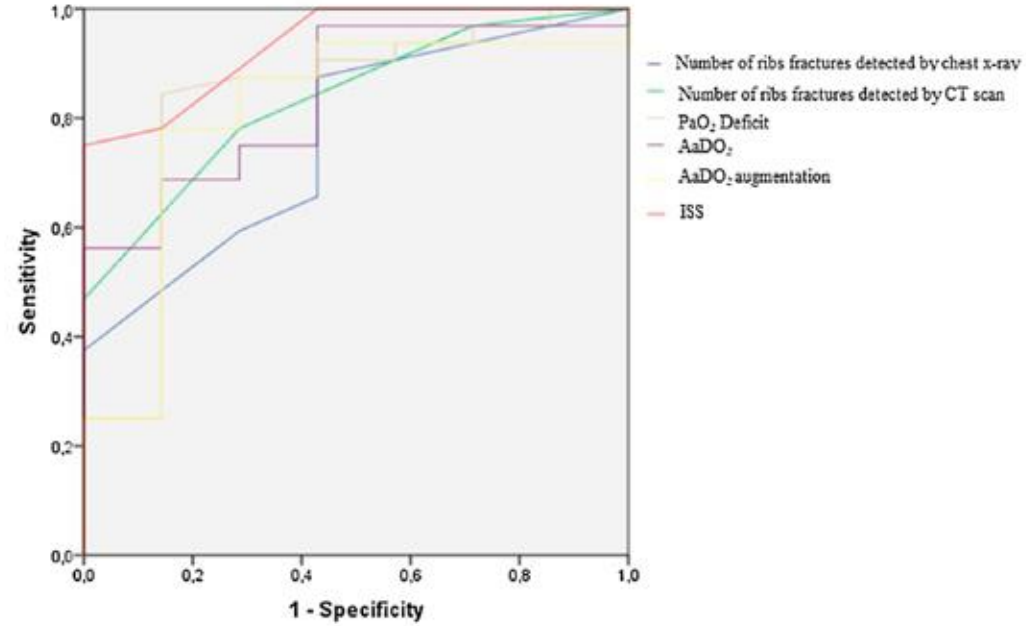

Parameter	Area under curve (AUC)	95% CI	p
ISS	0,935	0,852-1,000	0,000
$AaDO_2$	0,839	0,694-0,984	0,005
Number of ribs fractures detected by CT scan	0,835	0,692-0,977	0,006
PaO_2 Deficit	0,828	0,635-1,000	0,007
$AaDO_2$ augmentation	0,808	0,614-1,000	0,012
Number of ribs fractures detected by chest x-ray	0,763	0,581-0,946	0,031

Legend. CI Confidence Interval; CT scan = computed tomography scan; PaO_2 = partial pressure of oxygen in arterial blood; $AaDO_2$ = alveolar-arterial oxygen gradient; ISS = Injury Severity Score.

ver operating characteristic [ROC] curve comparing accuracy of different test in relation to the detection of lung injury in blunt chest trauma.

5. Conclusion

More severe hypoxemia, oxyhemoglobin hyposaturation and higher alveolar-arterial oxygen gradient are associated with the diagnosis of lung injury in patients with blunt chest trauma. Arterial blood gas analysis requires few minutes and has a reliable diagnostic ability to identify patients with lung injury in the setting of blunt chest trauma.

MAJOR

3.2 Major Chest Injuries

Diaphragm injury – This can present as a minor or major injury, depending on the location and severity and may be easily overlooked initially. If there is a high index of suspicion for diaphragmatic injury and initial trauma imaging is inconclusive, a diagnostic laparoscopy or thorascopy is recommended.[44] It can lead to disruption of respiratory function, as well as injury to the abdomen. A gastric tube may be inserted to deflate the stomach; however, a diaphragm rupture will likely require an either an open or minimally invasive surgical procedure.

Sternoclavicular dislocation – A direct and high velocity impact can cause dislocation in an anterior or posterior direction. Whilst a posterior dislocation is uncommon, it can result in significant internal injury e.g. tracheal compression, laceration or occlusion of the subclavian or brachiocephalic vessels, damage the lung parenchyma causing a pneumothorax, or injury the laryngeal nerve. A contrast CT will assist to identify the bony or vascular injury. Posterior dislocations can be difficult to relocate after 24hrs, therefore early diagnosis and treatment are important for management.

Large tracheobronchial Injuries – A leak from the large airway can occur from disruption to the tracheobronchial wall, causing large amounts of air under the skin that may rise and fall with ventilation. This subcutaneous emphysema can vary in severity and lead to further complications, so it is important to detect early, monitor closely, and consider an intercostal catheter if there are signs of respiratory failure or any positive pressure ventilation is indicated. A flexible bronchoscopy may assist to detect the location of the air leak; however, a large injury may require a rapid thoracotomy and surgical repair.

MAJOR

Tension pneumothorax – When air tracks into the pleural space, there is an increase in the intrathoracic pressure, which may cause lung collapse. Haemodynamic instability can then rapidly occur due to compression of the superior and inferior vena cava. Chest decompression via finger thoracostomy (followed by ICC placement) or needle thoracostomy are vital to restore pressures and allow venous return. Decision making around finger thoracostomy vs needle thoracostomy will be dependent on local skills and expertise in the procedures. Insertion of an ICC is required for definitive management for any ongoing drainage of air or fluids.

Open pneumothorax – Open wounds to the chest wall that allow air to flow into the chest cavity from outside the body and disrupt the intrathoracic pressure gradient lead to an open pneumothorax. A sterile, occlusive dressing sealed on three sides should be placed to create a one-way valve until ICC placement and wound closure is complete.

Massive haemothorax – A rapid blood loss greater than 1500mLs into the chest cavity, causes impaired ventilation and oxygenation, along with hypotension and shock. An immediate chest decompression via thoracostomy and ICC placement and restoration of blood volume are vital. An ICC can assist; however, a thoracotomy may still be indicated in the case of large and ongoing blood loss.

Flail chest – A flail chest occurs when three or more consecutive ribs are fractured in at least two places, causing a segment of the rib cage to detach from the chest wall. Flail chest can be identified radiologically or clinically. Clinical flail chest is represented by paradoxical movement of the chest wall, and the patient will typically report extreme pain and shortness of breath. Invasive or non-invasive ventilation may be required, and surgical fixation may be indicated, dependent on pain, chest wall deformity and non-union.

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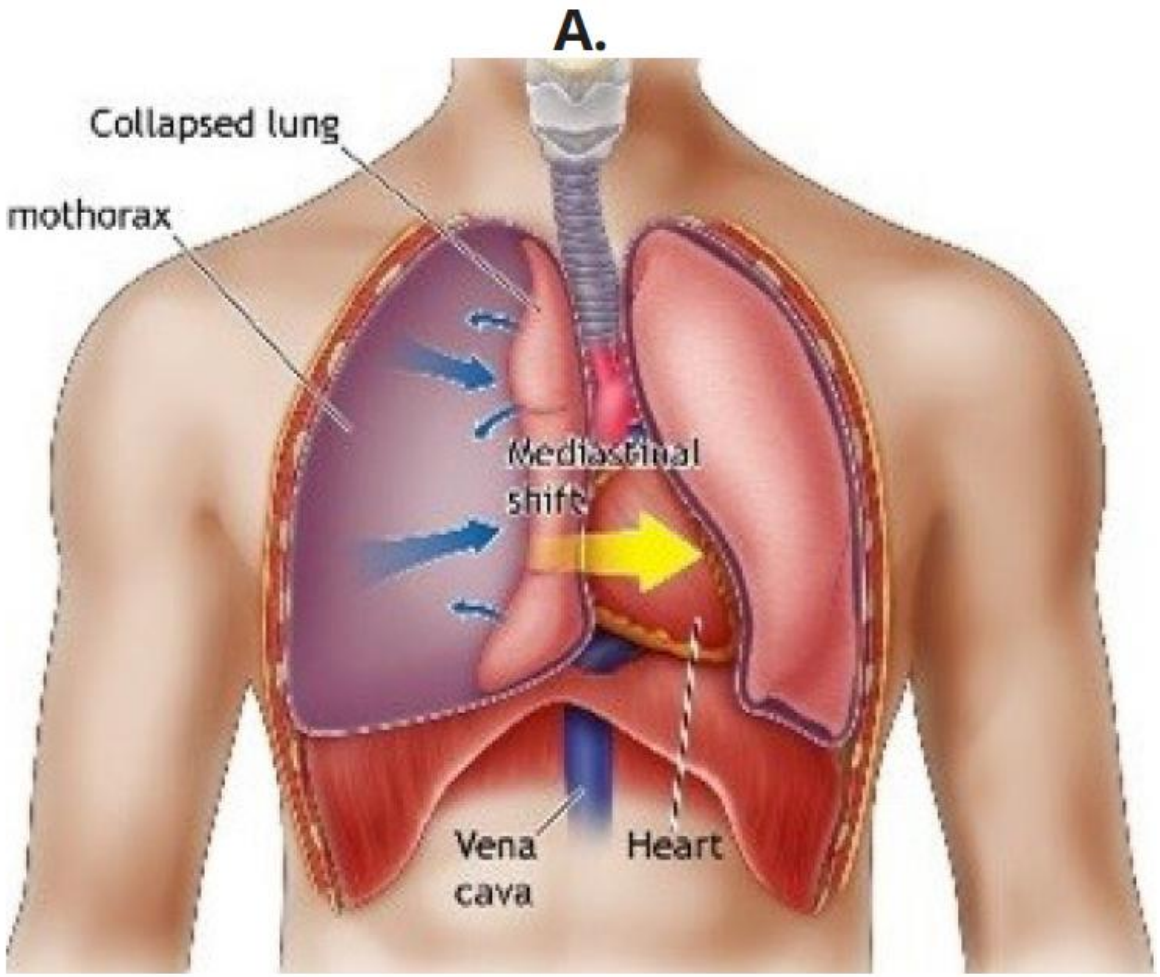
When Seconds Count



ACS ATLS Advanced Trauma Life Support American College of Surgeons

N.A. aa 53

Anamnesi:

Dott. : GUARINO MARIO
NA24161
15/04/2021 12:58

IN P.S PROVENIENTE DAL P.S. PER TRAUMA EMITORACE DI SINISTRA PER INCIDENTE SUL LAVORO. ESIBISCE REFERTO TC CHE MOSTRA FALDA DI PNX DA FRATTURE DI MULTIPLE COSTE E VERSAMENTO PLEURICO.

Esame Obiettivo:

Dott. : GUARINO MARIO
NA24161
15/04/2021 13:05

NRS 10
PARACETAMOLO 1 GRAMMO EV
FENTANEST 100 MCG IN FISIOLOGICA 250 ML

Dott. : GUARINO MARIO
NA24161
15/04/2021 14:06

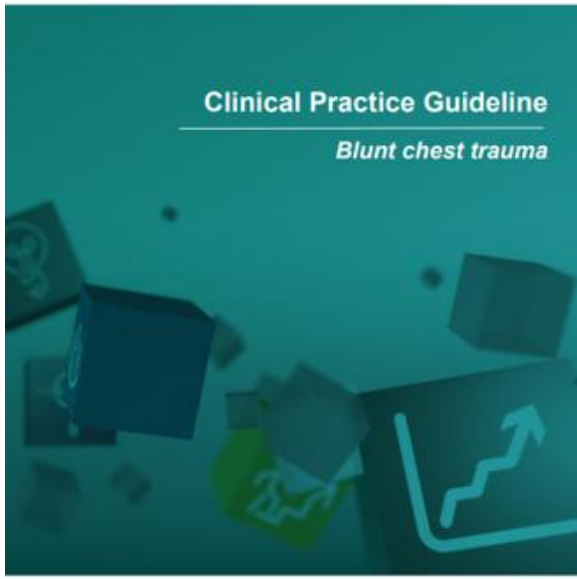
ALLA TC DEL TORACE PRESENZA DI PNX CON ESTESA CONTUSIONE POLMONARE POSTERIORE.
SI PARICA PROCEDURA DI INTRODUZIONE DRENAGGIO TORACICO IN SEDAZIONE PROCEDURALE MULTIMODALE CON PROPOFOL E MIDAZOLAM FINO A RAMSAY 3-4
NEUROMONITORING E CAPNOGRAFIA
PROCEDURA SENZA ESITI NE' COMPLICANZE. RISVEGLI CON WASHOUT DEI FARMACI.
RX DI CONTROLLO

Dott. : GUARINO MARIO
NA24161
15/04/2021 13:04

ALL'EGA PRESENZA DI IPOSSIEMIA
ECG: RITMO SINUSALE A FC DI 70 BATTITI/MINUTO

Dott. : GUARINO MARIO
NA24161
15/04/2021 12:58

QUICK-LOOK. SOFFERENTE. POSIZIONE ANTALGICA
A. VIE AEREE PERVIE
B. RIDUZIONE DELL'ESCURSIONE DELL'EMITORACE DI SINISTRA. ENFISEMA SOTTOCUTANEO A SINISTRA. FR 20/MINUTO SAO2 96% CON FIO2 21%.
C. PA 116-76 MMHG FC 80 BATTITI/MINUTO
D. GCS 4-5-6
E. ALL'ESPOSIZIONE NULLA DI RILEVANTE
ALL'EFAST ASSENZA DI SLIDING A SINISTRA CON LUNG-POINT AL 5° SPAZIO



The immediate management of injuries arising from blunt chest trauma may be in the form of respiratory interventions, medications, fluid resuscitation including blood products, bedside procedures (e.g. intercostal catheter insertion), haemorrhage control, surgical intervention, or a combination of these. Minor injuries also require effective management, to prevent them from evolving into more serious injuries.[33,34] A multi-disciplinary approach to care including nursing, medical, allied health, and surgical intervention are superior, and should be included in a clinical pathway.[35]

The position statement for prehospital thoracostomy management in the hospital environment recommends: [36–38]

- in most cases a prehospital thoracostomy can be used for chest tube insertion in the management of a pneumothorax or haemothorax in preference to new incisions.
- prehospital thoracostomy not requiring chest tube insertion can be sutured closed.
- prophylactic antibiotics are not routinely administered for tube placement in chest trauma for prehospital or hospital thoracostomy.

SECTION FOR EMERGENCY MEDICINE

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3.5.4. BREATHING AND VENTILATION MANAGEMENT SKILLS

- Assessment of breathing and ventilation
- Oxygen therapy
- Interpretation of blood gas analysis, pulse oximetry and capnography, spirometry, peak flow measurement
- Bag-mask-valve ventilation
- Thoracocentesis
- Decompression needle/ finger thoracostomy
- Chest tube insertion, connection to under-water drainage and assessment of functioning
- Non-invasive ventilation techniques
- Invasive ventilation techniques
- Setting up a transport ventilator

MAJOR

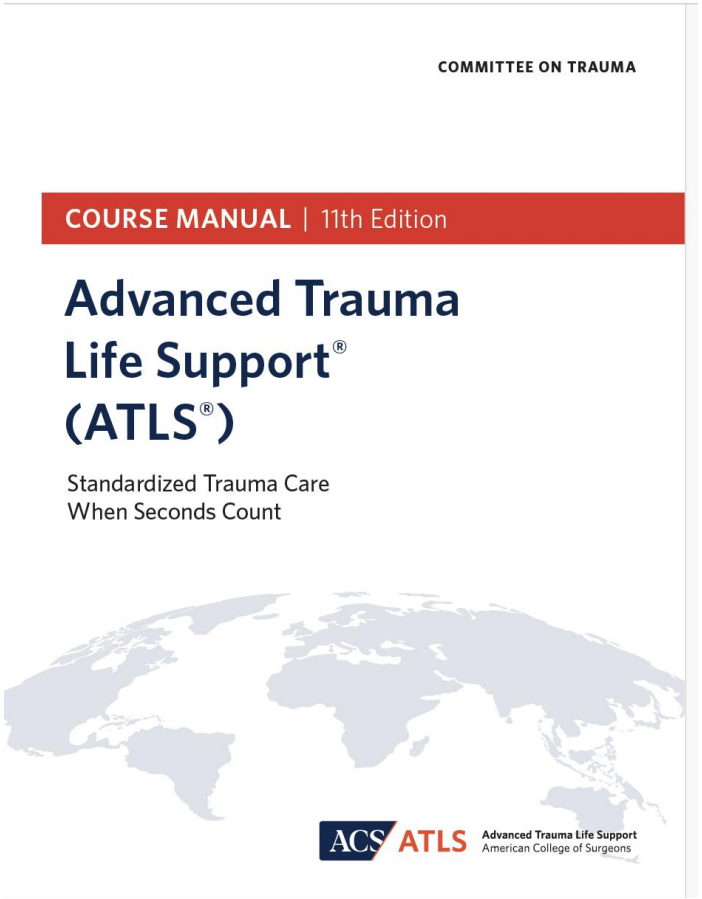
Pulmonary contusion – This injury to the lung tissue is often seen in moderate to severe blunt chest injury and is best detected by a CT scan. With haemorrhage into the interstitial space, complications including decreased lung compliance, ventilation-perfusion mismatch/shunt and hypoxia may lead to respiratory distress and failure. Strategies to support oxygenation and ventilation including escalation from mask and high flow oxygen therapy to NIV, or intubation, and if still unable to maintain oxygenation, extra-corporeal membrane oxygenation (ECMO) may be considered.

Great vessel injury – damage and subsequent haemorrhage of the aorta and its branches, pulmonary arteries and veins, superior/inferior vena cava and the innominate and thoracic veins needs to be recognised and managed promptly due to the high risk of mortality. The patient may present with hypotension, diminished pulses, unequal blood pressures of the upper and lower limbs, pulsating haematoma, intrascapular murmur, left flail chest, neurological deficits, or palpable thoracic or sternal fractures. Mediastinal widening on a plain CXR is common in great vessel injury, although CTA is the imaging modality of choice. Surgical specialists should be consulted, and treatment may consist of non operative management, endovascular stent-grafting or open repair.

Cardiac tamponade – An eFAST is used at the bedside for identification of free fluid in the pericardial sac, causing compression of the heart. A FAST scan has been demonstrated to be 90–95% accurate [24] (operator dependent). A FAST scan may miss small/focal collections and in patients where uncertainty exists and other causes of hameodynamic instability have been excluded, a formal ECHO may provide greater information and diagnostic accuracy. Surgically, a pericardial window can be used to clinically detect and manage important traumatic pericardial effusions. Cardiac tamponade is a life-threatening emergency that may require an emergency thoracotomy.

MAJOR

Blunt cardiac injury – This may include myocardial contusion, cardiac rupture or herniation, valvular injury or septal tears. An ECG should be performed in all cases where blunt cardiac injury is suspected and if any abnormality is present, the patient should be admitted for 24 hour cardiac monitoring. Blunt cardiac injury may be ruled out when both the ECG and troponin are normal,[5] however troponin testing may not be required in the presence of a normal ECG. An ECHO may be useful to confirm blunt cardiac injury or ventricular dysfunction where other causes of haemodynamic instability have been managed and/or excluded. Cardiothoracic specialists should be consulted to advise on any intervention that may be required for structural repair.



Injury to the chest wall and the structures located in the thoracic cavity is one of the most common sequelae of trauma. Injuries can involve the boney structure of the chest wall, the viscera contained within the chest (heart, lungs, diaphragm, and esophagus), and the great vessels of the mediastinum. **Thoracic injury can produce impaired ventilation with respiratory acidosis, impaired oxygen exchange leading to metabolic acidosis, impaired cardiac function from structural or electrical injury to the heart, or massive hemorrhage.** There can also be more subtle injury whose consequences may not manifest for days to years, such as esophageal and diaphragmatic injury.

The clinician must understand the anatomy of the chest, the basic physiology of the cardiorespiratory system, and how to assess for various types of injury following trauma. As well, the clinician must be comfortable performing urgent procedures, such as tube thoracostomy, that can be used to temporize, and perhaps definitively treat, some injuries. As severe rib fractures account for significant mortality and morbidity, the clinician should be aware of multimodal strategies to offer pain relief and the clinical significance of severe chest wall injury.

This chapter will review the anatomic boundaries that define the chest. It will then review the pathophysiology underlying common injuries that result from trauma to the chest, how to assess for them, and how to start treatment. Alternative diagnostic strategies that may be employed in resource-limited settings are reviewed. The chapter ends by addressing how to alter needed interventions to address the special needs of pregnant patients, those who are morbidly obese, and pediatric patients.

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3.5.3. ANALGESIA AND SEDATION SKILLS

- Assessment of the level of pain and sedation
- Monitor vital signs and potential side effects during pain management
- Provide procedural sedation and analgesia including conscious sedation (including testing of life support equipment)
- Use of appropriate local, topical and regional anaesthesia techniques - preferable ultrasound guided

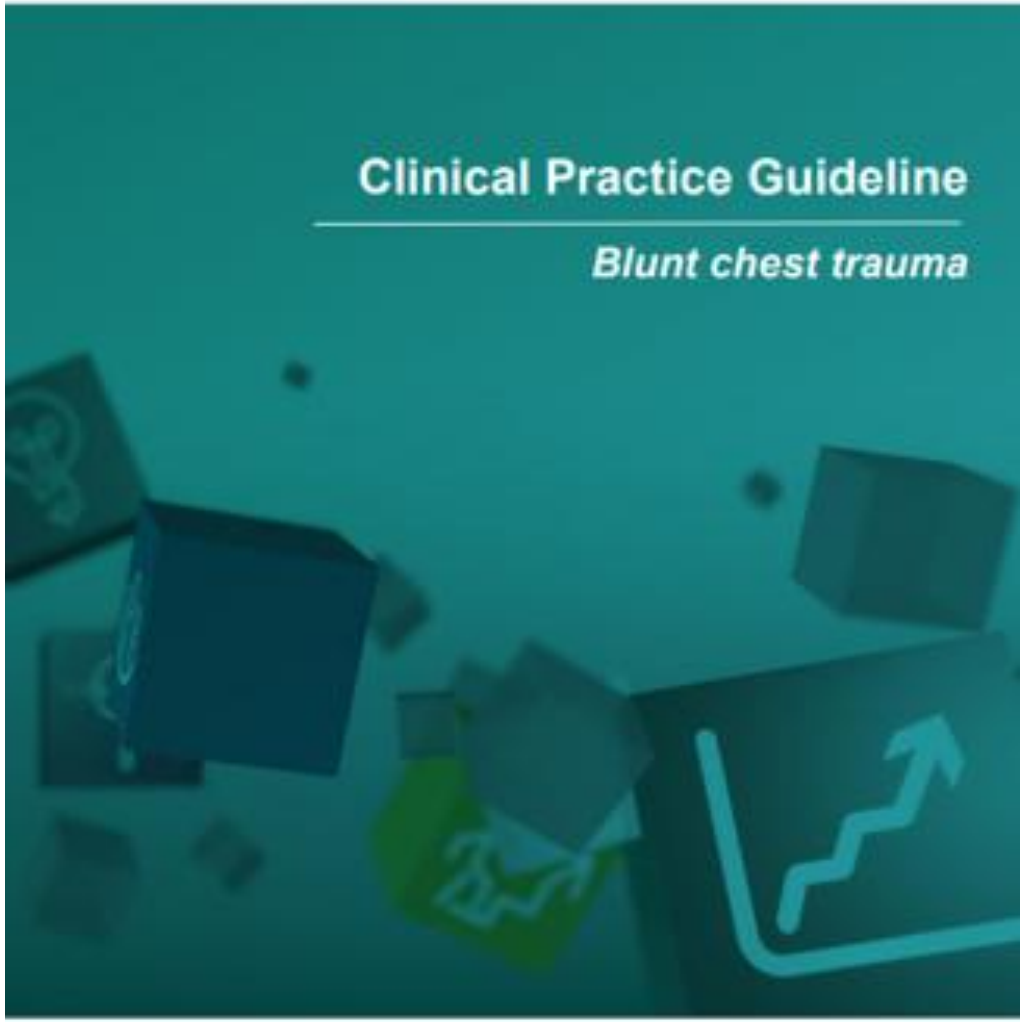
Ward-based Care
Consider respiratory adjuncts, analgesia requirements, and prevention of complications

Respiratory Adjuncts
Incentive Spirometry
Hourly deep breathing
Supported cough
Daily review by Physiotherapist
Consider HFNP (Flow/Fi02 and target SpO2 to be documented in the patients' medical record)

Analgesia
Referral to the Acute Pain Management Service (or equivalent if available) once a decision is made to admit the patient. If any RED FLAG risk factors are present, also refer for consideration of a Regional Block or PCA.
Ensure regular oral analgesia is available
Simple analgesia - paracetamol (age/weight appropriate dose)
NSAID - if clinically appropriate, review every 3 days
Oral Opioids - immediate or slow release or PRN
Patient Controlled Analgesia (PCA) - Opioid
Regional blocks - Erector Spinae Plane (ESP), Serratus Anterior Plane (SAP), Intercostal Nerve (ICN), Paravertebral
Epidural
Other - Ketamine - continuous infusion

Complication Prevention
Early documented clearance to mobilise
Encourage sitting out of the bed
Elevate bedhead
Daily chest physiotherapy
Early nutrition
Regular aperients
VTE prophylaxis (chemical and/or mechanical)

Queensland Health
Clinical Excellence Queensland



Clinical Practice Guideline

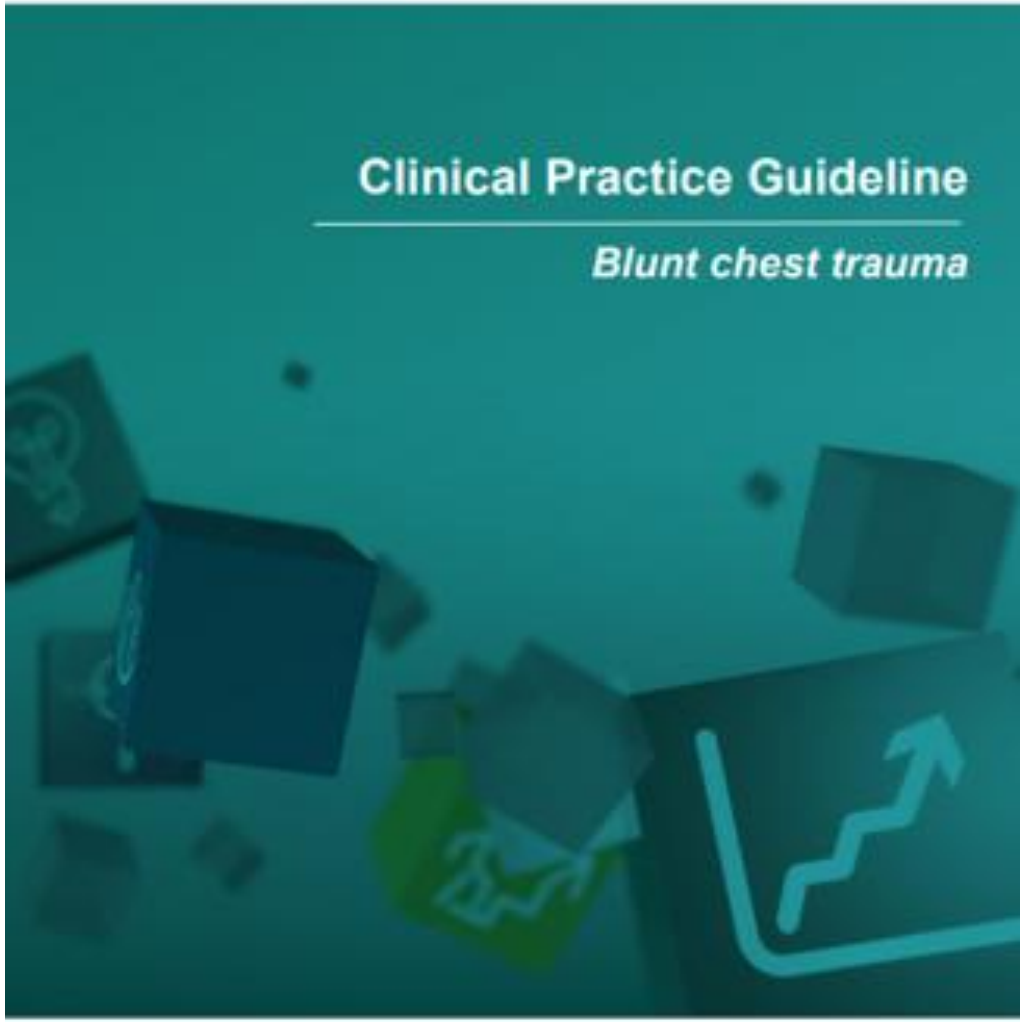
Blunt chest trauma

Queensland Government

Discharge Planning
Wean HFNP and analgesia as clinically indicated
Liaise with multidisciplinary team on any barriers to discharge such as mobility, carer support, home environment, return to work/activity limitations
Discharge home when pain well controlled on oral analgesics and respiratory function optimised

- Provide prescriptions for oral analgesia and aperients if required
- Ensure opioid weaning plan is documented in the Discharge Summary for the GP
- Arrange all follow up appointments including GP follow up within 3 days of discharge
- Provide patient with an information leaflet or relevant handout

Consideration for special patient groups
Elderly frail patients aged >65 - Early recognition, low threshold for CT, GP/Geriatrician/medical input, and opioid sparing analgesia strategies i.e. regional blocks.
Obstetric trauma patients Refer to Maternity and Neonatal Clinical Guideline *Trauma in Pregnancy*[8]
Paediatric trauma patients Refer to Paediatric Trauma Service: *Trauma Guidelines 11th Edition*[10]



Patients presenting with any red flags for deterioration following blunt chest injury should undergo a period of observation as a hospital inpatient. This will allow for regular clinical observation, titration of multimodal pain relief, management of coexisting injuries, as well as access to physiotherapy and other allied health disciplines as required. The admission pathway will depend on the patient age and comorbidities, severity of injury, services required and local admission policies. Admitting teams may include surgical, general medical, cardiothoracics or intensive care, with the potential of a shared-care arrangement between more than one team.

The Chest Wall Injury Society Guideline[7] recommends chest wall stabilisation in patients with:

- respiratory failure with unstable fracture patterns e.g. flail chest, offset rib fractures
- ≥ 3 severely displaced acute rib fractures in ribs 3-10, with ≥ 2 pulmonary physiologic derangements despite adequate anesthesia
- RR>20, <50% predicted volumes on incentive spirometry, pain score >5/10, inability to cough
- Failure to wean from the ventilator

In the non-ventilated patient chort who are not progressing clinically despite maximal multimodal analgesia, early consultation with a chest wall stabilisation centre should be considered.

Contraindications for surgical stabilisation of rib fractures include:

- shock or ongoing resuscitation
- fractures outside of ribs 3–10
- severe traumatic brain injury (TBI) or intracranial hypertension
- acute myocardial infarction (MI)

Analgesia is an essential component of preventing secondary complications in blunt chest trauma and needs to be considered as soon as practical. If a patient is having difficulty managing a deep breath or cough, they are at a very high risk of secondary pulmonary complications such as atelectasis, sputum retention, hypoventilation and pneumonia. A referral to an acute pain service or equivalent (if available) would be recommended for all patients presenting with blunt chest trauma involving multiple rib fractures. The side effects of many analgesics will include impaired bowel motions, which may be further exacerbated by the changing intrathoracic and abdominal pressures due to pain. Early consideration of aperients whilst on pain relief is recommended.

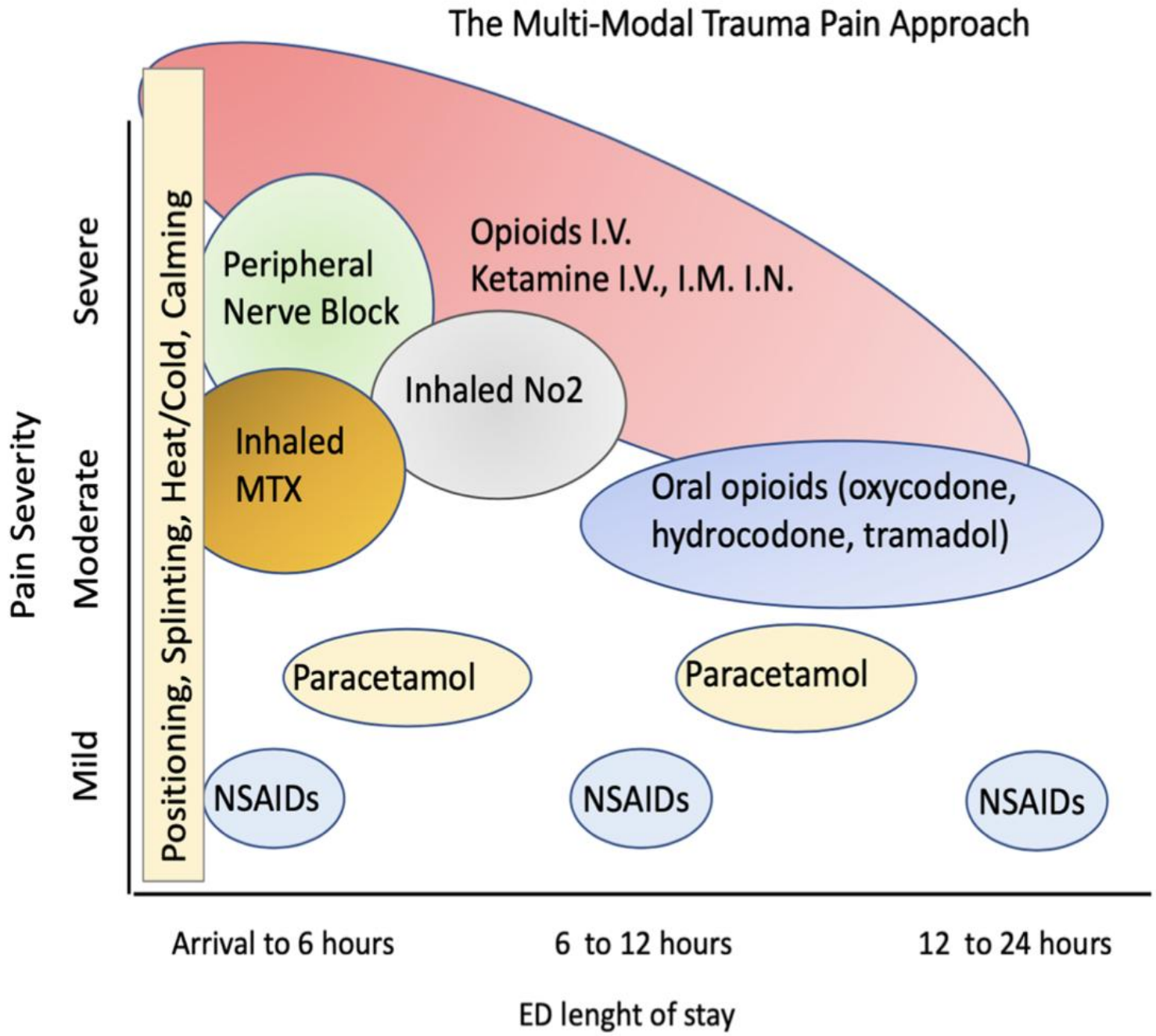
Journal of
Clinical Medicine

MDPI

Review

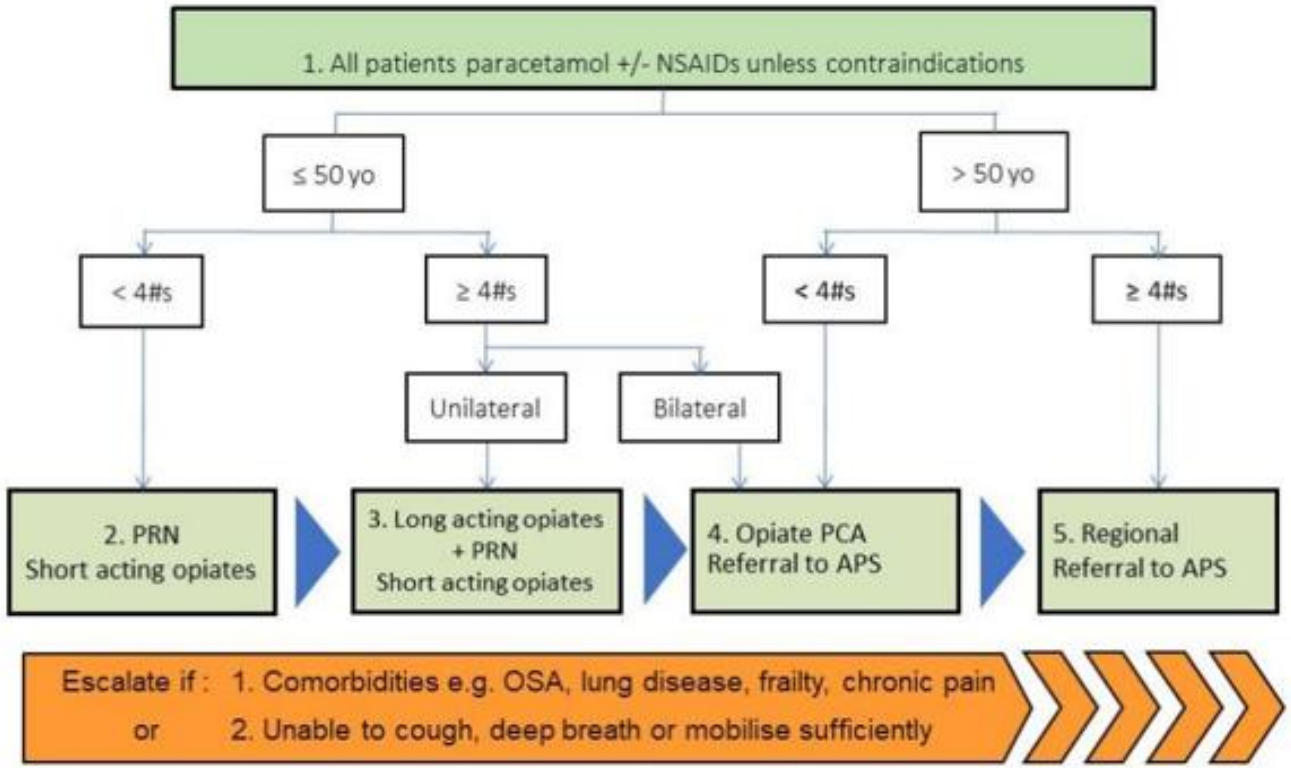
The Pain Management of Trauma Patients in the Emergency Department

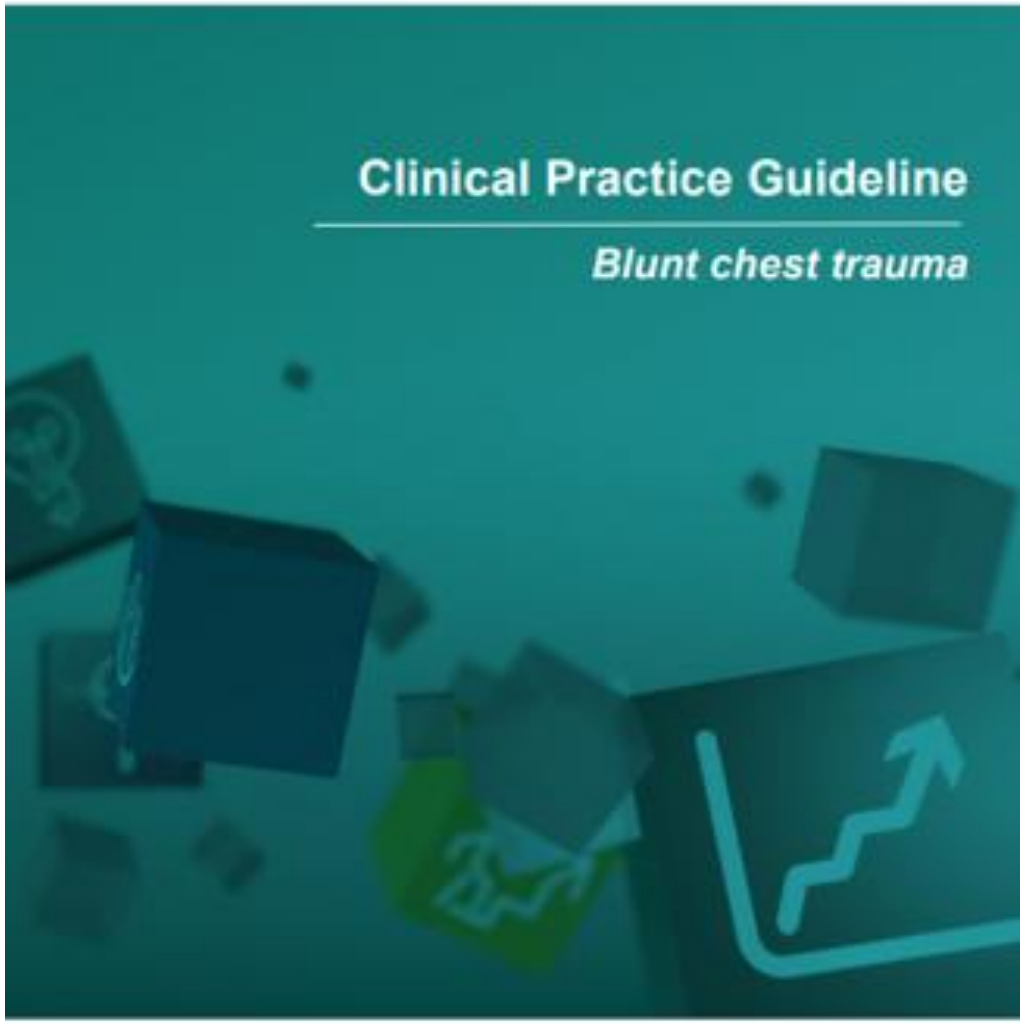
Andrea Fabbri [1,*], Antonio Voza [2], Alessandro Riccardi [3], Sossio Serra [4]
and Fabio De Iaco [5] on behalf of the Study and Research Center of the Italian Society of Emergency Medicine (SIMEU)



A multi-modal approach to pain management is always required and is essential to reduce morbidity and mortality. A pain management strategy may begin with incorporating simple and oral opioid analgesia, then potentially IV opioids, ketamine and regional analgesia adjuncts.

Figure 1 Example of an analgesia pathway for multiple rib fractures [48]





Vienna, Austria

27-28 September Pre-courses

28 September-1 October Congress

www.eusemcongress.org

EUSEM 2025 - Abstract Acceptance

M. Carelli Claudia,

The Abstract Committee has now reviewed all the submissions for **EUSEM 2025**.

We have the pleasure to confirm that your abstract:

#46719 : The Serratus Anterior Plane Block in the Management of Traumatic Chest Pain

has been accepted as: **Oral Presentation**

The EUSEM office will come back to you to confirm your date, time of presentation and technical aspects (time for the secretary to input all the datas in the scientific programme).

Please note that registration of the assigned presenter is required (the deadline for early bird registration is 10 June (included)). Click here for registration information.

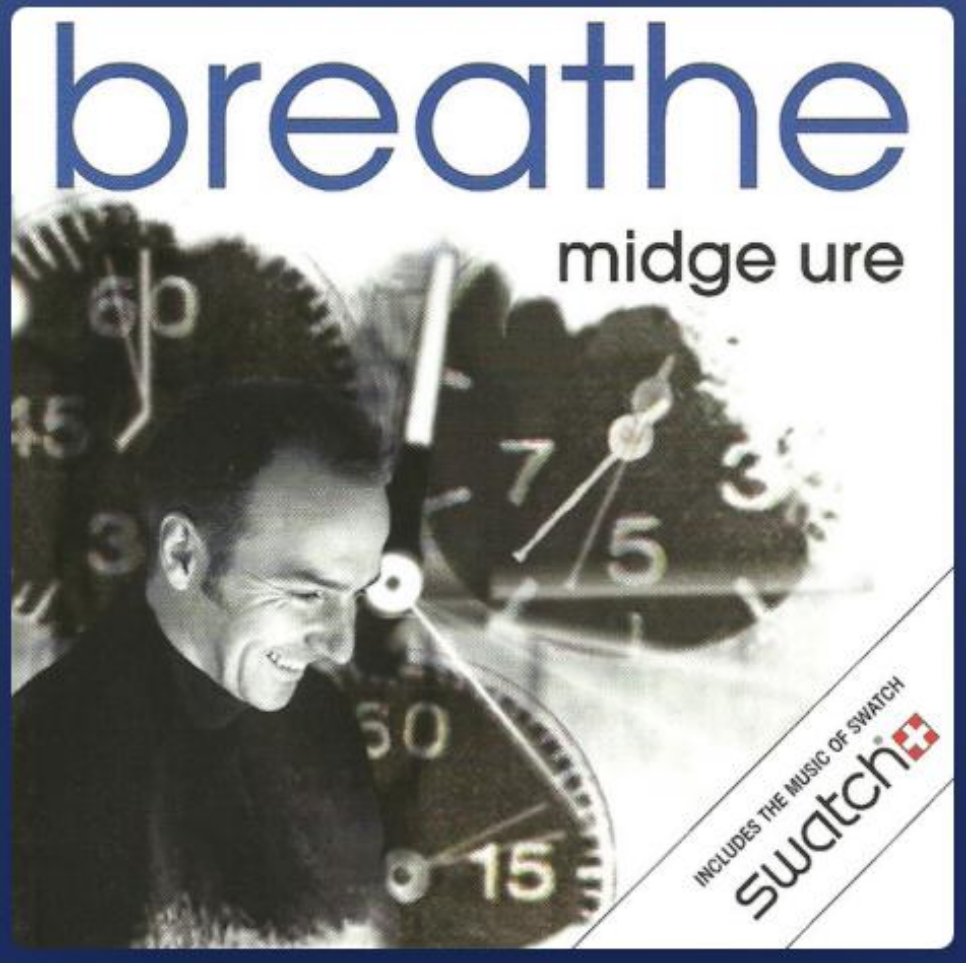
The programme is available here: https://cm.eusem.org/cmPortal/searchable/EUSEM25/config/normal#!sessionschedule

Thank you very much for your contribution,

Very best regards,

The Abstract Team

Adjunct therapies have an important role in supporting patients' presenting with blunt chest trauma. Respiratory modalities may be utilised such as high flow oxygen devices, non-invasive ventilation and airway clearance devices. These have been included in prior chest injury protocols[35] and should be implemented in the earliest phase of admission. Referrals to allied health clinicians should be made at the earliest appropriate time. A physiotherapist can assist with decreasing the risk of sputum retention, atelectasis and assisting with equipment prescription, brace/splint/sling fitting, and return to mobility as soon as able. An occupational therapist may be able to assist with testing for post traumatic amnesia (PTA), cognitive retraining, return to work guidance, activities of daily living and personal care tasks. A social worker should be engaged to provide support in the initial phase of injury, give some direction with the management of health and financial matters, and work with the patient and family members throughout the inpatient admission. A psychologist may be of benefit in the early stages of admission to assist with mood, adjustment and ongoing support. A dietician can aid in ensuring adequate nutrition is provided to the patient whilst they are recovering from multiple injuries.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