

Queensland  
Trauma Education

**ABDOMINAL TRAUMA**

**Blunt abdominal  
trauma imaging**

**Case discussion**

**Facilitator resource kit**

**CSDS**



Clinical Skills Development Service



Queensland  
Government

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**Queensland Trauma Education****Abdominal Trauma - Blunt abdominal trauma imaging: Case discussion - Facilitator resource kit  
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## Queensland Trauma Education

The resources developed for Queensland Trauma Education are designed for use in any Queensland Health facility that cares for patients who have been injured as a result of trauma. Each resource can be modified by the facilitator and scaled to the learners needs as well as the environment in which the education is being delivered, from tertiary to rural and remote facilities.

## National Safety and Quality Health Service (NSQHS) Standards



## About this training resource kit

This resource kit provides healthcare workers with an understanding of the role of imaging and interventional techniques utilised in the management of blunt abdominal trauma.

### Target audience

- Emergency department medical and nursing clinicians
- Allied health clinicians

### Duration

30-45 minutes

### Group size

Small group participation

### Learning objectives

By the end of this session the participant will be able to:

- Understand the benefits and limitations of imaging techniques in blunt abdominal trauma.
- Understand the grading of injury utilising the AAST guidelines.
- Discuss the role of interventional radiology in splenic trauma and ongoing care of the patient post embolization.

## Facilitator guide

1. Facilitator to provide participant resource kit to learner.
2. Facilitator to present case study overview to group and use the question and answer guide to facilitate discussion.
3. Utilise PowerPoint presentation to present images to group for discussion.

## Participant resource kit

- Learning objectives
- Overview of blunt abdominal trauma
- Further reading

# Overview of blunt abdominal trauma

Blunt abdominal injury often occurs as a result of road traffic crashes and falls. It is a common body region injured with up to 22% of traumatic injury following trauma. Blunt abdominal injury can often be challenging to diagnose with significant injury present without external signs of trauma.<sup>1</sup> A direct blow to the abdomen can cause solid organ rupture, visceral damage and haemorrhage, contamination from peritoneal contents and peritonitis. The spleen, liver and small bowel are commonly injured following blunt trauma.

Significant injury should be suspected with the presence of a seatbelt injury, peritonitis- with rebound tenderness or guarding, hypotension (SBP <90mmHg) and other associated trauma.<sup>2</sup>

## Further reading

Coccolini, F., Montori, G., Catena, F., Kluger, Y., Biffl, W., Moore, E. E., Reva, V., Bing, C., Bala, M., Fugazzola, P., Bahouth, H., Marzi, I., Velmahos, G., Ivatury, R., Soreide, K., Horer, T., Ten Broek, R., Pereira, B. M., Fraga, G. P., Inaba, K., ... Ansaloni, L. (2017). Splenic trauma: WSES classification and guidelines for adult and pediatric patients. *World journal of emergency surgery : WJES*, 12, 40.

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# Case discussion

## Case study

A 20 year old male patient involved in a single vehicle, high-speed RTC rollover. The patient was ejected from the vehicle. He was haemodynamically unstable initially – HR 120 and BP 80/60. On scene, he was intubated following RSI and had a L decompressive finger thoracostomy by pre-hospital team before transport to ED.

On arrival to ED, the patient is intubated and ventilated and remains haemodynamically unstable: HR 105, BP 100/65, SpO2 97% FiO2 1.0. The patient is moved to the resuscitation bay.

## Question and answer guide

### 1. What imaging techniques can be used in the resuscitation bay?

- Plain radiography: chest and pelvic Xray.
- Ultrasound- EFAST.

### 2. Discuss the imaging (see supporting documents) interpretation and findings.

- a. **CXR** - intubated, nasogastric tube, monitoring leads, L pulmonary contusion, L subcutaneous emphysema, L Pneumothorax.
- b. **Pelvic Xray** - pelvic binder buckle over R hip joint, pelvic ring intact with binder in position, warming device to R of patient, monitoring leads.
- c. **EFAST - LUQ** - positive free fluid in Morrison's space (RUQ).
- d. **EFAST - LUQ** - positive free fluid in Splenorenal space (LUQ).
- e. **EFAST - Bladder/pelvis** - normal.
- f. **EFAST - Subxiphoid** - normal, nil pericardial effusion.
- g. **EFAST - R Lung** - normal m mode to indicate lung sliding (sea shore sign).
- h. **EFAST - L Lung 1** - abnormal m mode to indicate no lung sliding on L (barcode sign).
- i. **EFAST - L Lung 2** - free fluid above diaphragm indicating haemothorax.

### 3. Following transfusion of 2 units of warmed PRBC his haemodynamic parameters improve. He now has a HR 100 and BP 100/90mmHg.

#### He is moved to CT for a 'trauma scan'. What does this involve?

- CT scan is the gold standard, sensitivity and specificity 96-100%.
- Use of arterial and portal venous +/- delayed for renal/urinary injuries.
- All patients should undergo arterial phase CT abdominal imaging to examine for active extravasation/ blush of solid organs.
- Arterial contrast is continued from the CTA of chest down to renal arteries to identify active extravasation of contrast signifying active bleeding.
- Consideration of mechanism will also include imaging of chest, head, spine and pelvis.

### 4. What injuries does his CT show?

- i. Bilateral moderate pneumothoraces, pulmonary contusion and traumatic pneumatoceles.
- ii. Grade 3 liver injury.
- iii. Grade 4 splenic injury.
- iv. R kidney grade 3 and L kidney grade 1 injuries.

**5. How do we determine severity of solid organ injuries?**

- i. **AAST** grading (American association for the surgery of trauma) - used to standardise the grading of all traumatic injuries. Anatomical grading system. **See supporting documents.**
- ii. **WSES** classification (World society of emergency surgery): anatomy and physiology.<sup>1</sup>  
This grading system directs operative management with abnormal physiology even with lower grade injuries.<sup>2,3,4,5,6</sup>

**6. An ICC has been placed on the L to formalise the pre-hospital thoracostomy. 20 minutes later he becomes tachycardic with a HR 150 but BP maintained at 100/90. How do you investigate his change in HR?**

- Consider sedation and analgesia – may require bolus of sedation and analgesia.
- Review blood results - haemoglobin, electrolytes, acid base status.
- Repeat EFAST- check for changes/increase in abdominal free fluid.
- Repeat CXR.

**6a. Following the repeat CXR, you are asked to review the image (see supporting documents). What does it show?**

- **CXR** findings: Increased size of R pneumothorax.

**A R ICC is inserted with improvement in his vital signs. His HR is now 100 and BP 110/80.**

See supporting document: **Post R ICC CXR.**

**7. His vital signs remain stable with a HR 100 and BP 120/80mmHg with no further blood or blood product resuscitation. He is then moved to the intensive care unit. What further assessment and management should occur for his splenic injury?**

- i. Grade 3 injury and above- repeat CT Abdomen day 3-5 to investigate for vascular malformations (pseudo aneurysms). These have increased rate of delayed rupture.
- ii. If pseudo aneurysms present/or blush (active extravasation) on CT- for splenic angioembolization.<sup>7,8</sup>

**8. On day 3, he has a repeat CTA where vascular abnormalities are identified. This leads to concern for increased risk of bleeding. He progresses to have a proximal splenic artery embolization (see supporting documents).****9. Following the splenic embolization, what further management is required?**

- Hospital dependant.
- Howell Jolly bodies (HJB) for splenic function given proximal coiling (at >14 days post embolization).
- Repeat CT Abdomen for splenic flow (timing as per Interventional Radiology team).
- If HJB present- indicates splenic dysfunction -> vaccination schedule and manage as 'asplenia'.
- Spleen Australia<sup>9</sup> or local infectious disease follow-up pathway.

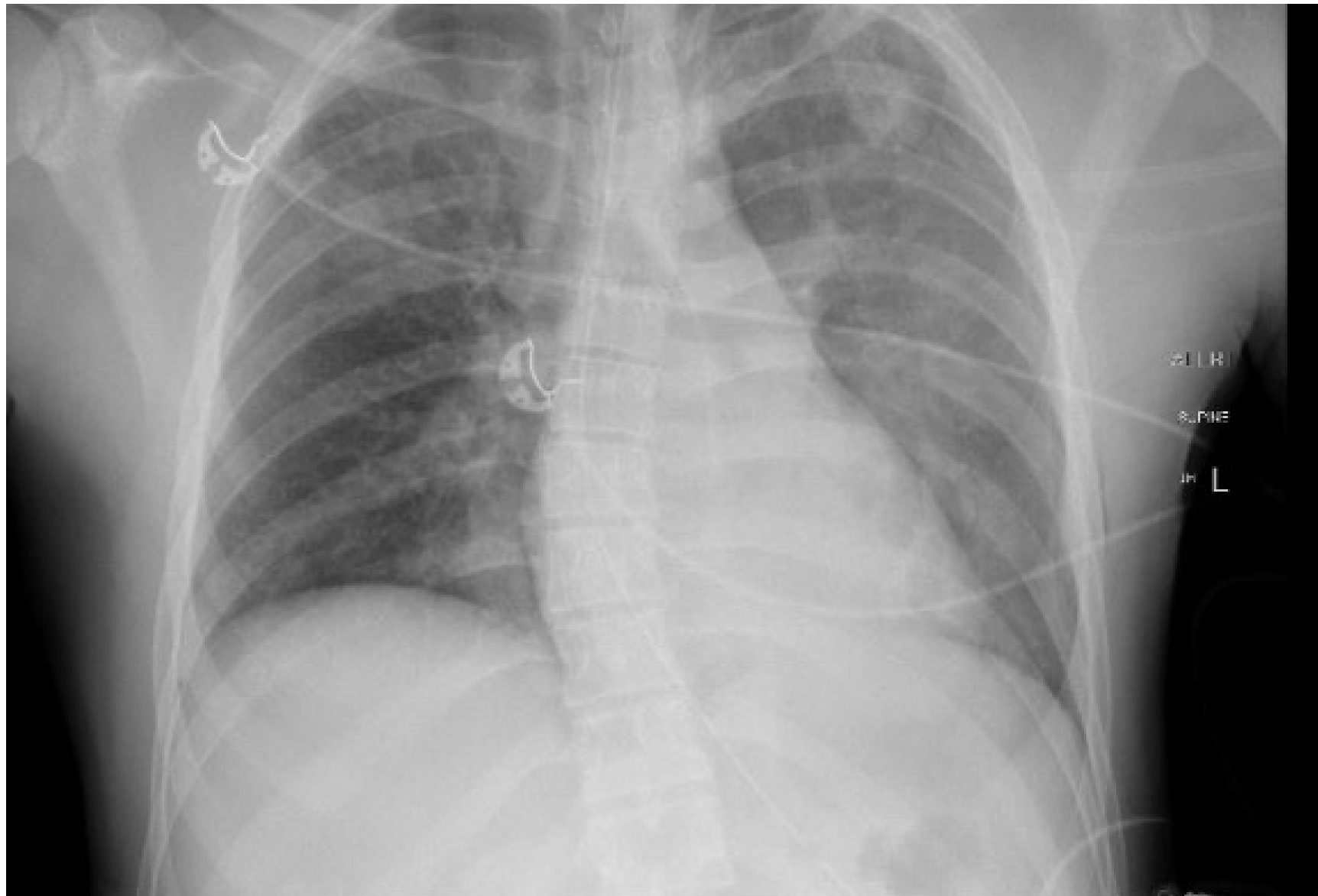


## Supporting documents

The following supporting documents are provided for this case discussion:

1. Question 2a: CXR.
2. Question 2b: Pelvic Xray.
3. Question 2c: EFAST RUQ.
4. Question 2d: EFAST LUQ.
5. Question 2e: EFAST Bladder/pelvis.
6. Question 2f: EFAST Subxiphoid.
7. Question 2g: EFAST R Lung.
8. Question 2h: EFAST L Lung 1.
9. Question 2i: EFAST L Lung 2.
10. Question 4: CT.
11. Question 5: AAST Spleen injury scale.
12. Question 5: AAST Liver injury scale.
13. Question 5: AAST Kidney injury scale.
14. Question 6a: Repeat CXR.
15. Question 6a: Post R ICC CXR.
16. Question 8: CTA of proximal splenic artery embolization.

**Supporting document 1 - Question 2a: CXR**



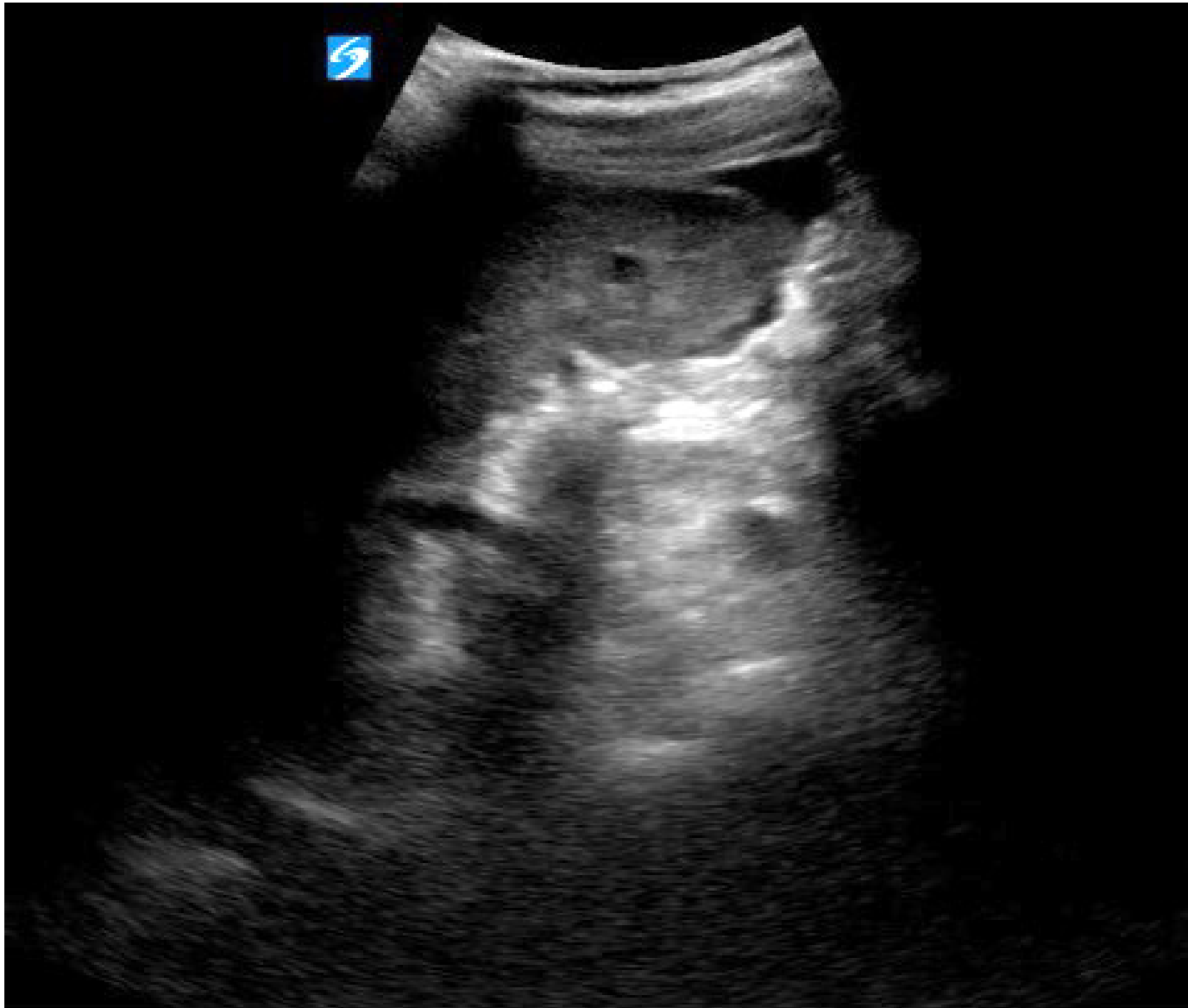
**Supporting document 2 - Question 2b: Pelvic Xray**



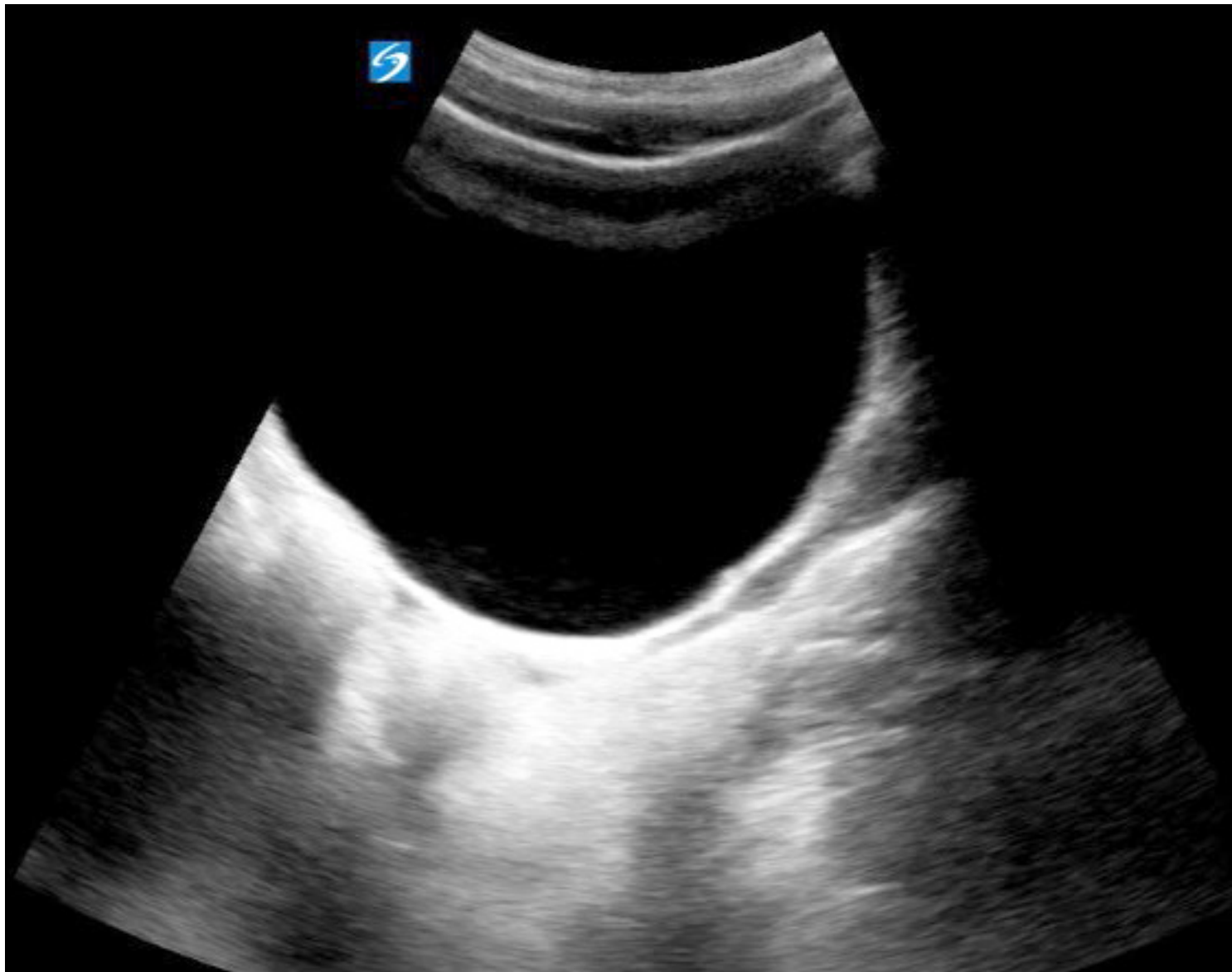
**Supporting document 3 - Question 2c: EFAST RUQ**



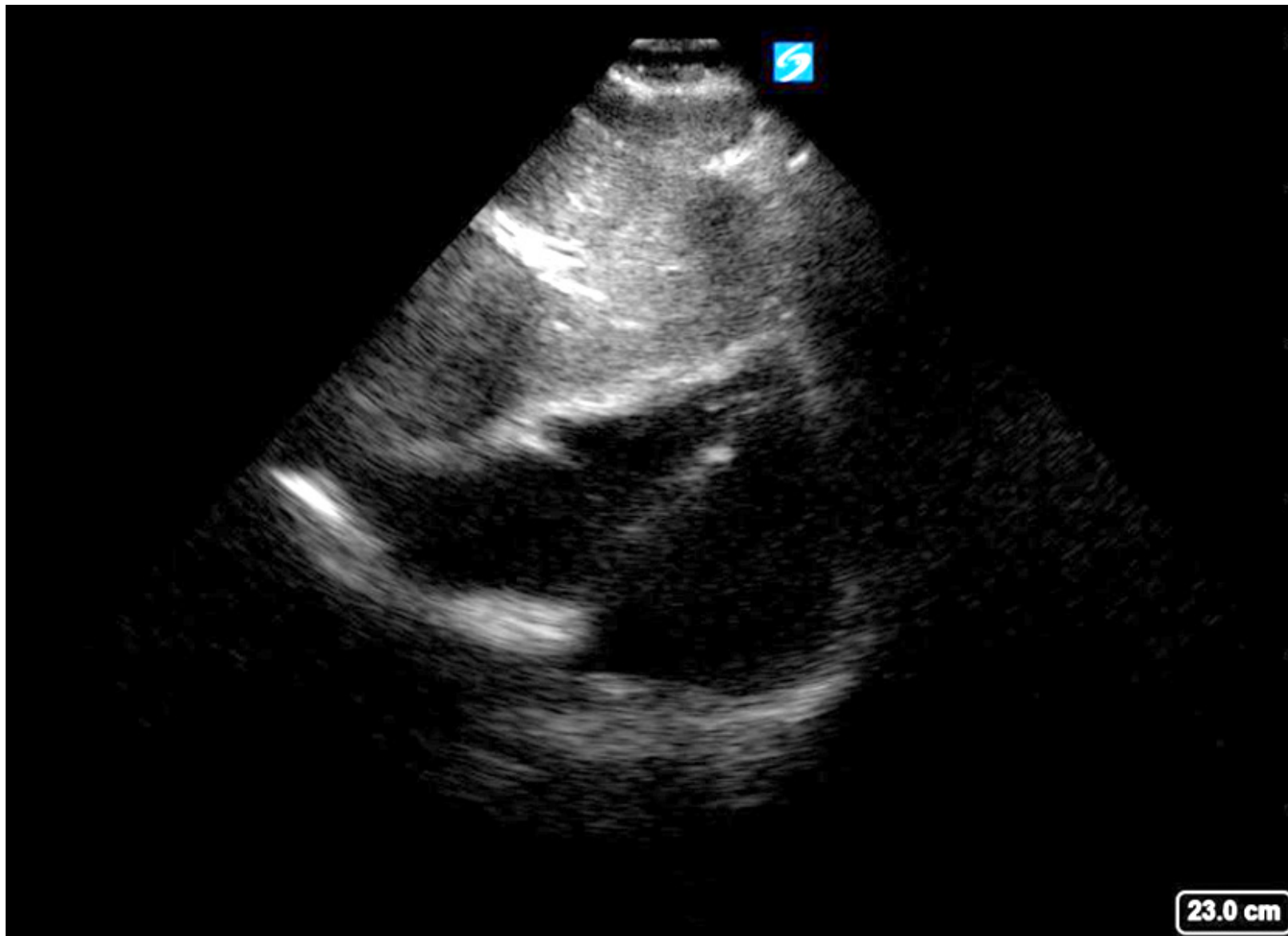
**Supporting document 4 - Question 2d: EFAST LUQ**



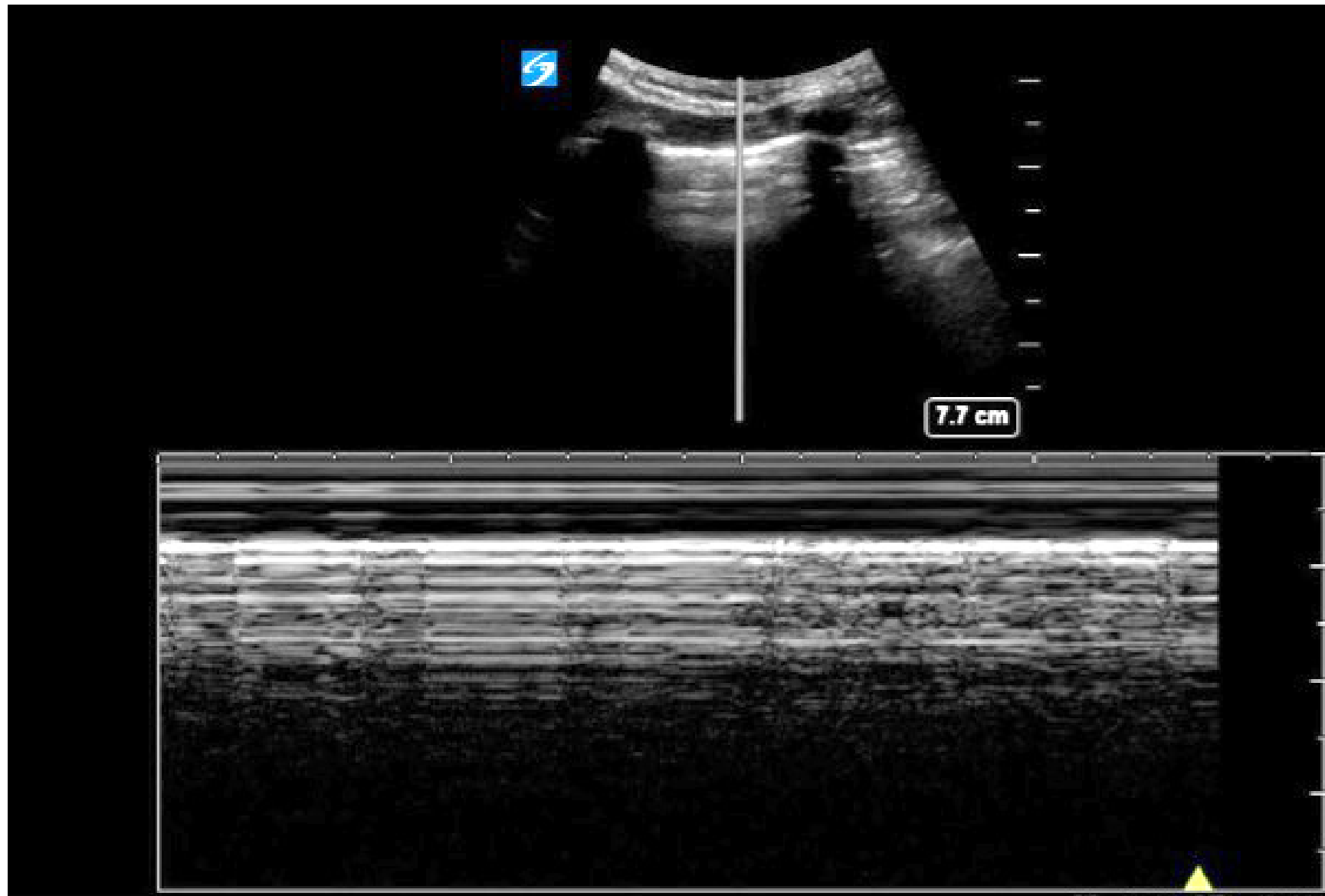
**Supporting document 5 - Question 2e: EFAST Bladder/pelvis**



## Supporting document 6 - Question 2f: EFAST Subxiphoid

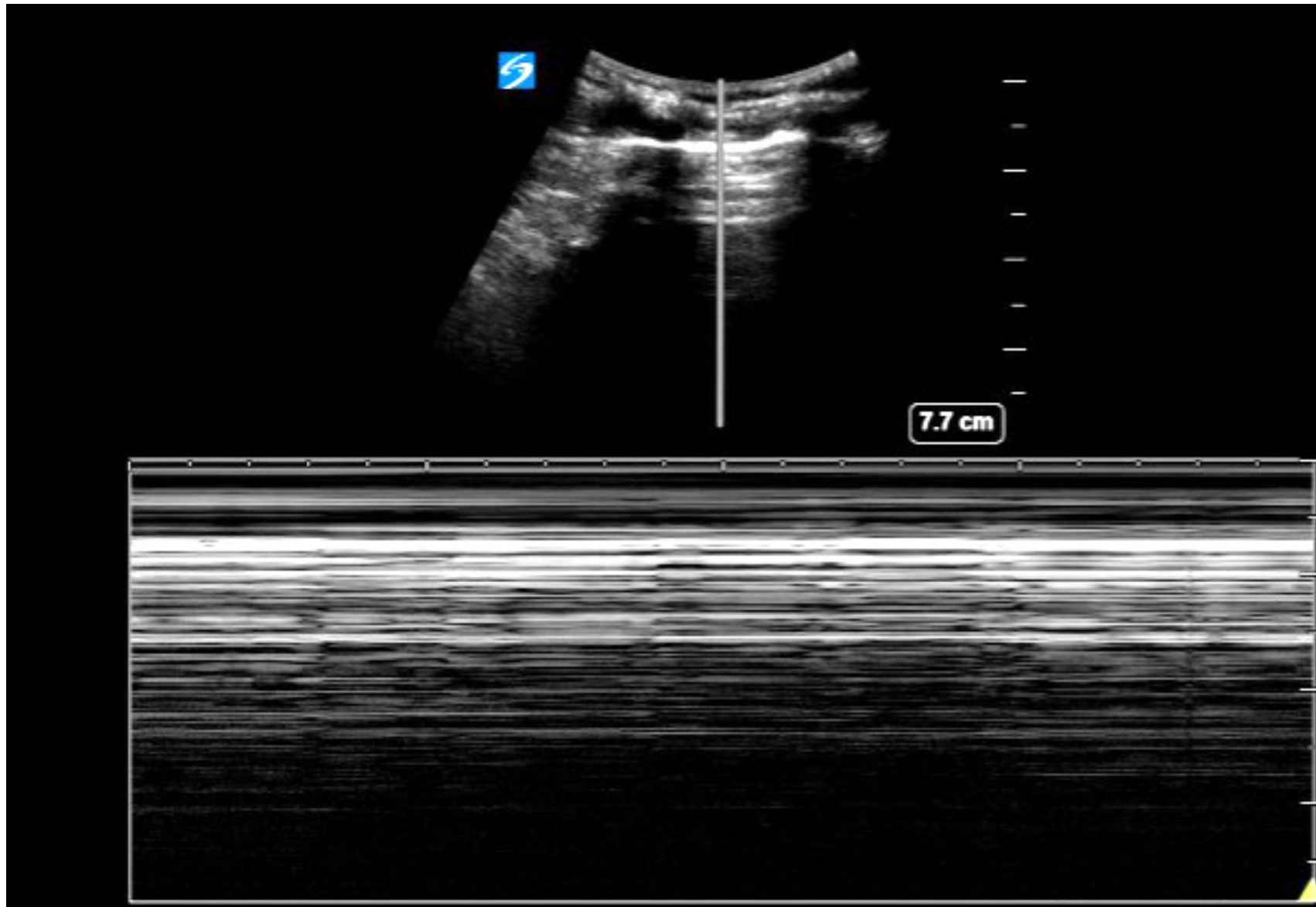


**Supporting document 7 - Question 2g: EFAST R Lung**





**Supporting document 8 - Question 2h: EFAST L Lung 1**



**Supporting document 9 - Question 2i: EFAST L Lung 2**



## **Supporting document 10 - Question 4: CT**

**Supporting document 11 - Question 5****AAST Spleen injury scale (1994 revision)**

Grade*	Type of injury	Description of injury	ICD-9	AIS-90
<b>I</b>	Haematoma	Subcapsular, < 10% surface	865.01 865.11	2
	Laceration	Capsular tear, < 1cm parenchymal depth	865.02 865.12	2
<b>II</b>	Haematoma	Subcapsular, 10%-50% surface area; intraparenchymal, <5 cm in diameter	865.01 865.11	2
	Laceration	Capsular tear, 1-3cm parenchymal depth that does not involve a trabecular vessel	865.02 865.12	2
<b>III</b>	Haematoma	Subcapsular, > 50% surface area or expanding; ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma > 5 cm or expanding		3
	Laceration	> 3 cm parenchymal depth or involving trabecular vessels	865.03 865.13	3
<b>IV</b>	Laceration	Laceration involving segmental or hilar vessels producing major devascularization (>25% of spleen)		4
<b>V</b>	Laceration	Completely shattered spleen	865.04	5
	Vascular	Hilar vascular injury with devascularizes spleen	865.14	5

\*Advance one grade for multiple injuries up to grade III

**Supporting document 12 - Question 5****AAST Liver injury scale (1994 revision)**

Grade*	Type of injury	Description of injury	ICD-9	AIS-90
<b>I</b>	Haematoma	Subcapsular < 10% surface	864.01 864.11	2
	Laceration	Capsular tear < 1cm parenchymal depth	864.02 864.12	2
<b>II</b>	Haematoma	Subcapsular 10-50% surface area; intraparenchymal, < 10cm diameter	864.01 864.11	2
	Laceration	1-3cm parenchymal depth, < 10 cm in length	864.03 864.13	2
<b>III</b>	Haematoma	Subcapsular > 50% surface area or expanding, ruptured subcapsular or parenchymal haematoma. Intraparenchymal haematoma > 10cm or expanding		3
	Laceration	> 3cm parenchymal depth	864.04 864.14	3
<b>IV</b>	Laceration	Parenchymal disruption 25-75% of hepatic lobe or 1-3 Couinaud's segments	864.04 864.14	4
<b>V</b>	Laceration	Parenchymal disruption involving > 75% of hepatic lobe or > 3 Couinaud's segments within a single lobe		5
	Vascular	Juxtavenous hepatic injuries i.e retrohepatic vena cava/central major hepatic veins		5
<b>VI</b>	Vascular	Hepatic avulsion		6

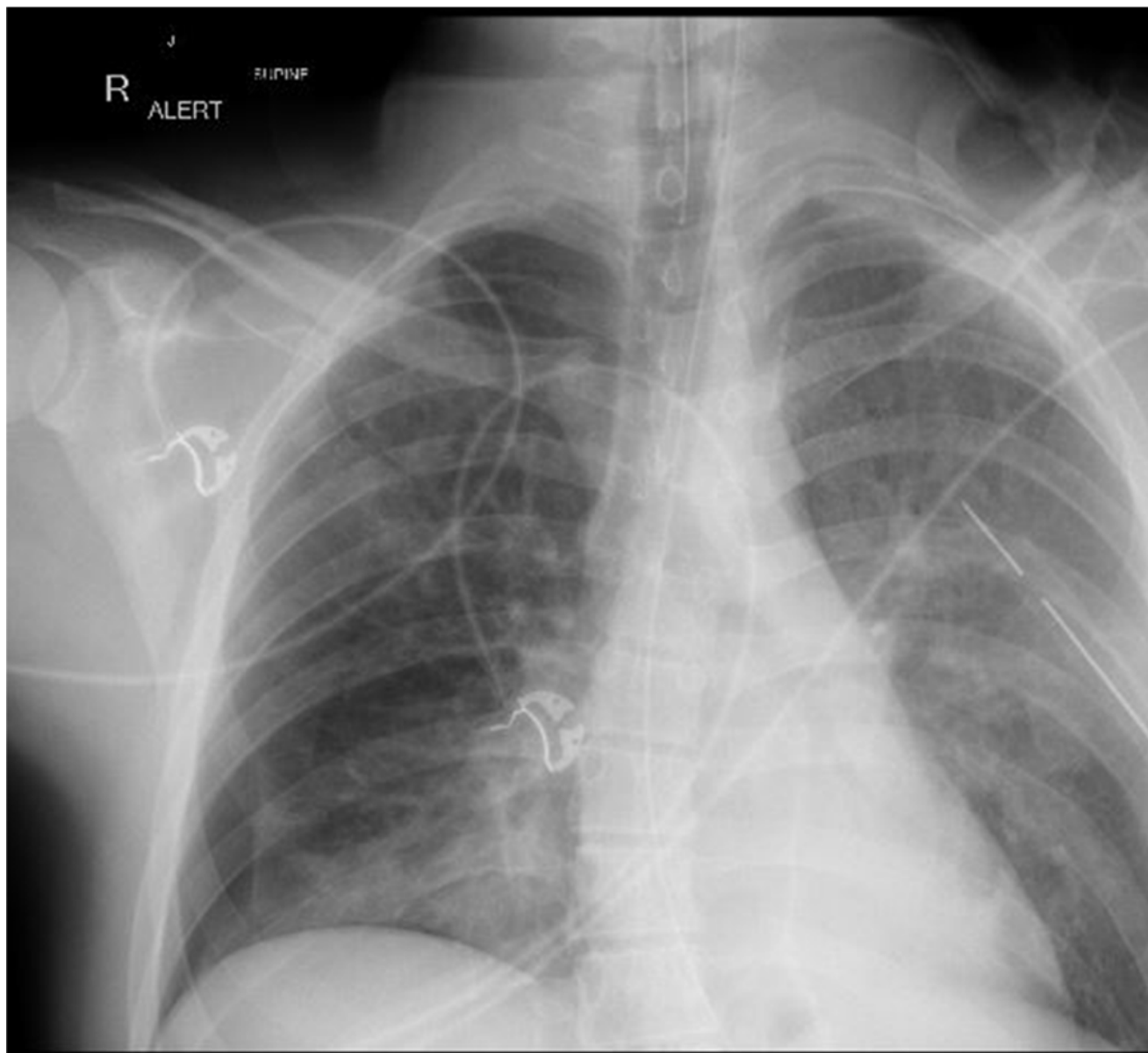
\*Advance one grade for multiple injuries up to grade III

**Supporting document 13 - Question 5****AAST Kidney injury scale (1994 revision)**

Grade*	Type of injury	Description of injury	ICD-9	AIS-90
<b>I</b>	Contusion	Microscopic or gross hematuria, urologic studies normal	866.01	2
	Hematoma	Subcapsular, nonexpanding without parenchymal laceration	866.11	2
<b>II</b>	Haematoma	Nonexpanding perirenal hematoma confirmed to renal retroperitoneum	866.01 866.11	2
	Laceration	< 1.0 cm parenchymal depth of renal cortex without urinary extravagation	866.02 866.12	2
<b>III</b>	Laceration	< 1.0 cm parenchymal depth of renal cortex without collecting system rupture or urinary extravagation	866.02	3
	Laceration	Parenchymal laceration extending through renal cortex, medulla, and collecting system	866.12	3
<b>IV</b>	Vascular	Main renal artery or vein injury with contained hemorrhage		4
<b>V</b>	Laceration	Completely shattered kidney	866.03	5
	Vascular	Avulsion of renal hilum which devascularizes kidney	866.13	5

\*Advance one grade for bilateral injuries up to grade III

**Supporting document 14 - Question 6a: Repeat CXR**

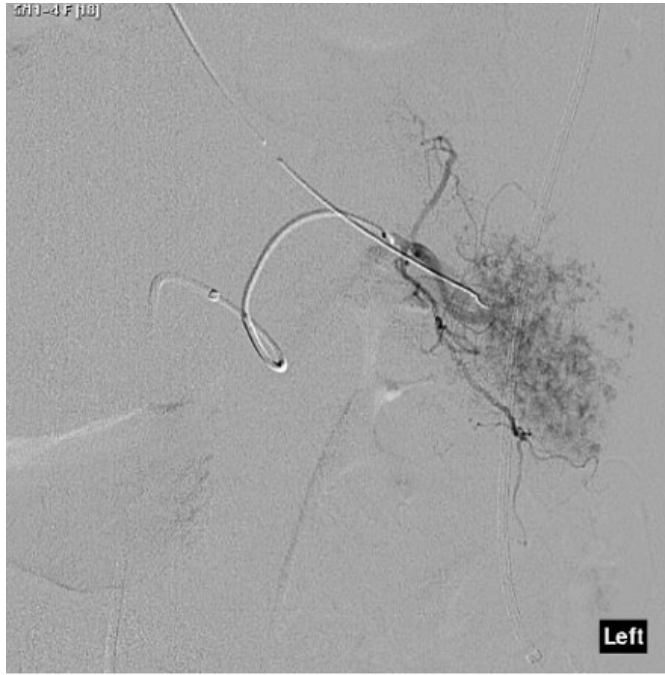


**Supporting document 15 - Question 6a: Post R ICC CXR**





## Supporting document 16 - Question 8: Proximal splenic artery embolization



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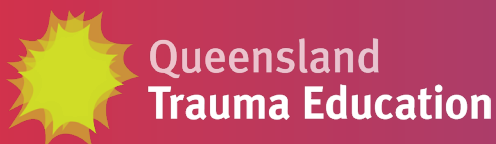
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