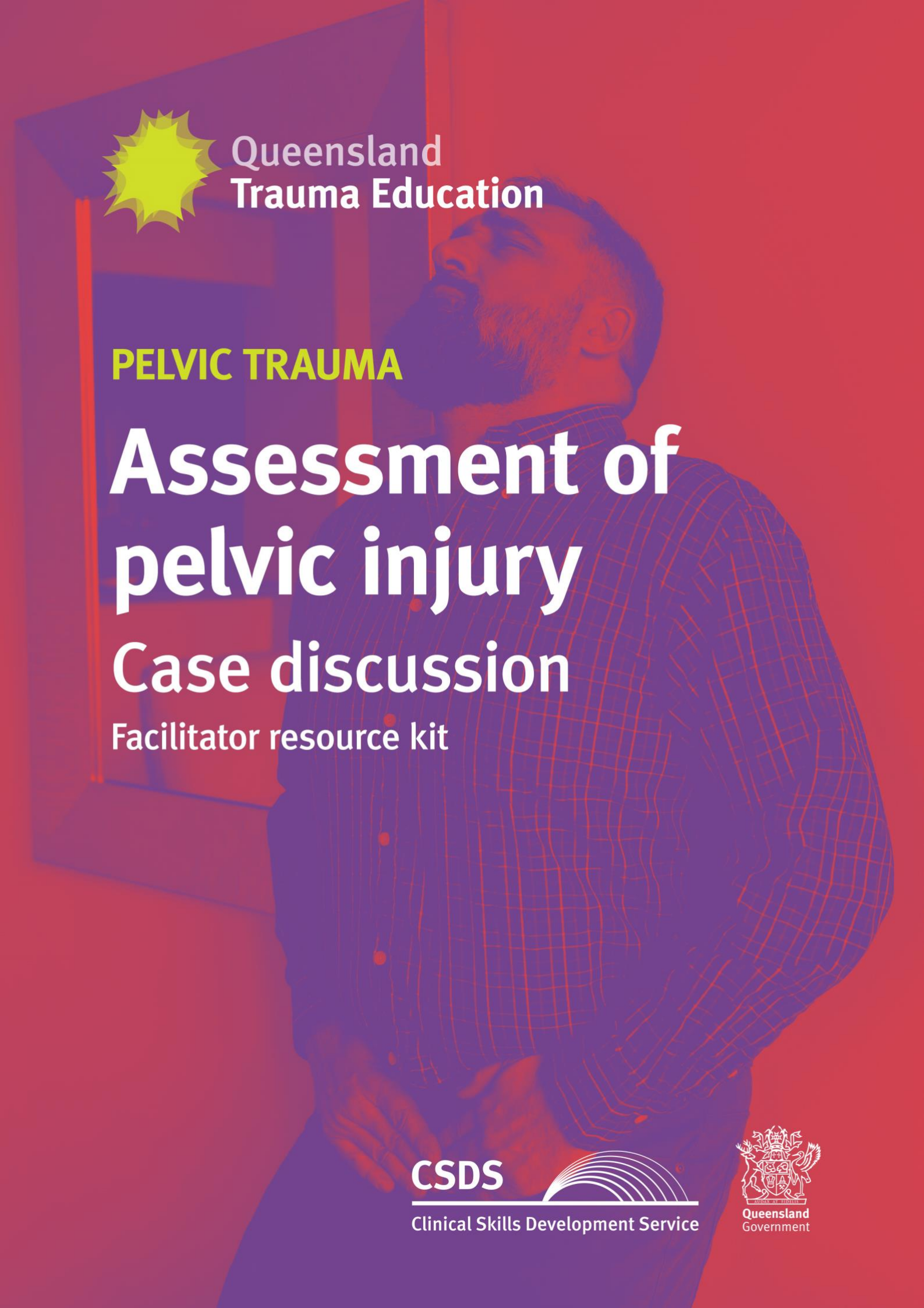

Queensland
Trauma Education

PELVIC TRAUMA

Assessment of pelvic injury

Case discussion

Facilitator resource kit

CSDS
Clinical Skills Development Service

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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.

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Reviewed by
Education Working Group, Statewide Trauma Clinical Network - Clinical Excellence Queensland

Queensland Trauma Education
Pelvic Trauma – Assessment of pelvic injury: Case discussion – Facilitator resource kit
Version 1.0

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About this training resource kit

This resource kit provides healthcare workers with knowledge of the clinical assessment and specific investigations required to identify and manage a patient suffering suspected pelvic trauma.

National Safety and Quality Health Service (NSQHS) Standards

Target audience

Emergency department medical and nursing clinicians.

Duration

45-60 minutes.

Group size

9-12 participants (divided into groups of 3-4 for each case) ***or*** 6-9 participants (divided into groups of 2-3 for each case).

Learning objectives

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

- demonstrate an understanding of clinical assessment in suspected pelvic trauma
- discuss the use of imaging studies in pelvic trauma
- recognise other investigations required for associated injuries in identified pelvic trauma.

Facilitation guide

1. Facilitator to utilise an electronic device to access links to display content/images throughout case discussion.
2. Facilitator to provide participant resource kit to participants.
3. Facilitator to divide participants into 3 groups and distribute different case studies to each group.
4. Facilitator to deliver case discussion and utilise the question and answer guide to promote discussion.
5. Utilise supporting documents to reinforce learning throughout discussion.

Overview of pelvic trauma

The care of patients with major pelvic trauma is focussed on the identification of both mechanical and physiological instability and directing management towards the stabilisation of both. Different classification systems exist for pelvic injuries, some based on anatomical patterns and others reflective of mechanism of injury and need for operative management.

Pelvic injury occurs in 3% of patients who have sustained a skeletal injury, with the patients often being young with significant multisystem injury. Overall, the clinical care is targeted towards optimising the haemodynamic status, restoring the anatomical pelvic ring stability and managing the associated injuries. This often requires a multidisciplinary approach to manage the resuscitation, control the bleeding and stabilise the bony injury.

Further reading

Predictors of bleeding from stable pelvic fractures	
Publication	Archives of surgery
Link	https://doi.org/10.1001/archsurg.2010.277

The effect of pelvic fracture on mortality after trauma: an analysis of 63,000 trauma patients	
Publication	The Journal of bone and joint surgery
Link	https://doi.org/10.2106/JBJS.H.00598

Fatal haemorrhage following a low-energy fracture of the pubic ramus	
Publication	The Journal of bone and joint surgery
Link	https://doi.org/10.1302/0301-620X.87B9.16696

Predictors of positive angiography in pelvic fractures: a prospective study	
Publication	Journal of the American College of Surgeons
Link	https://doi.org/10.1016/j.jamcollsurg.2008.05.025

Preperitoneal pelvic packing for hemodynamically unstable pelvic fractures: a paradigm shift	
Publication	The Journal of trauma
Link	https://doi.org/10.1097/TA.0b013e31803c7632

WSES pelvic injuries classification	
Publication	World Journal of Emergency Surgery
Link	https://wjes.biomedcentral.com/articles/10.1186/s13017-017-0117-6/tables/2

Pelvic Trauma Management algorithm	
Publication	World Journal of Emergency Surgery
Link	https://wjes.biomedcentral.com/articles/10.1186/s13017-017-0117-6/tables/2

Primary Clinical Care Manual 10th edition, Fractured Pelvis	
Organisation	Queensland Health
Link	https://www.health.qld.gov.au/rrcsu/clinical-manuals/primary-clinical-care-manual-pccm

Case discussion

Case study 1

92yo F has had an unwitnessed fall in a RACF (residential aged care facility).

She is complaining of pain in her R) hip and is unable to mobilise with nursing staff prior to ambulance arrival.

Her vital signs are within normal limits and her neurological exam is normal.

Case study 2

18yo M involved in a high-speed motorbike crash (MBC) vs. tree.

He is hypotensive at the scene: BP 95/60mmHg, HR 120, GCS 15, sats 97% 15L NRB, resp rate 22.

He complains of pain around pelvis and lower back with minimal bruising/abrasions to the area.

Case study 3

43yo M has fallen from a horse.

He is complaining of pain across his L) lower quadrant and pubic symphysis.

His vital signs are within normal limits on arrival to the Emergency Department, but he complains of urinary retention.

An IDC is placed for bladder volume >300mls on bedside scan, haematuria is drained.

Question and answer guide

1. How do you clinically examine a patient following trauma for a pelvic injury?

Examine patient for the following:

- alignment of ASIS/iliac crests
- equality of leg length (shortening)
- abnormal external rotation of one or both legs
- pain on gentle palpation
- bruising, seatbelt abrasions, wounds, lacerations to abdomen and flank
- rectal, vaginal or penile bleeding/haematoma/swelling/ecchymosis
- neurological exam - lumbosacral plexus injury - L5/S1
- rectal tone (up to 15% may experience neurological injury)
- haematuria (M>F).

2. What are the complications of 'springing' the pelvis? (Springing the pelvis involves applying firm pressure with the palms of both hands over the greater trochanters and 'spring/push' the pelvis down and release multiple times.)

- Pain associated with the pressure of procedure.
- Disrupt venous clot causing further/commencement of bleeding.[1]
- Does not identify mechanical instability (poor sensitivity (26-59%) and specificity (71%).[1, 2, 3]

3. In major pelvic injury what is the role of the pelvic binder?

- A pelvic splint **is not used to reduce the volume of the pelvis** or achieve perfect anatomical alignment. The reduction and stabilisation of the pelvic ring is to reduce the degree of fracture, decrease bleeding from the fracture, while protecting any initial blood clot from disruption.[4, 5] In theory, a small decrease in the pelvic volume may create a tamponade thus reducing venous bleeding.[6]
- Contrary to widely held belief, the pelvis does not 'fill' with blood. Haemorrhage spreads through disrupted tissue planes, extending through the retroperitoneum out of the pelvis into the abdominal retroperitoneum up into the thorax, and anteriorly around the bladder and the anterior abdominal wall.[7]
- The increase in volume of the pelvis following fracture is much less than expected: a large pubic separation of 10cm corresponds to only a 35% increase in pelvic volume, or 480cm.[8]

4. Should a pelvic binder be applied to any of the 3 aforementioned case studies? Provide a rationale for each.

- **Case study 1**: Suspected low velocity trauma (given the fall was unwitnessed). Pain to R hip with inability to mobilise with haemodynamic stability. (This patient does not need a pelvic binder).
- **Case study 2**: High velocity trauma, haemodynamically unstable, complaining of pelvic pain. High index of suspicion for major pelvic injury. Pelvic binder should be applied pre-hospital to reduce and stabilise the pelvic ring. If not applied pre-hospital, the pelvic binder should be applied ASAP on arrival to the Emergency Department.
- **Case study 3**: Fall from height, complaining of pain across LLQ and pubic symphysis, haemodynamically stable. (This patient needs further assessment prior to pelvic binder application).

5. In suspected major pelvic trauma how should the patient be moved?

- Limit movement as much as possible.
- Log roll only to 15 degrees to avoid disrupting the pelvic clot.
- Use of backboards and carrier devices for limited periods of high movement times (e.g. prehospital transport).

6. What patterns of pelvic injury are more likely to be haemodynamically unstable?

Young and Burgess Classification:

i. Anteroposterior compression: result in an open book or sprung pelvis fractures.
ii. Lateral compression: result in a windswept pelvis (unilateral AP compression injury with a contralateral lateral compression injury).
iii. Vertical shear: results in Malgaigne fracture (pubic rami and sacral ala) or bucket handle fracture.
iv. Combined mechanical: occur when two different force vectors are involved and results in a complex fracture pattern.

7. What pelvic injuries are likely to be haemodynamically stable?

Tile classification A type injuries are commonly haemodynamically stable.

A1 - fracture not involving the ring (iliac wing injury).

A2 - stable or minimally displaced ring fracture.

A3 - transverse sacral fracture (Denis zone 3 sacral fracture).

NB: All pelvic fractures can lead to bleeding depending on fracture pattern, patient factors (including medication therapies) and other trauma.

8. How do you examine a pelvic Xray for injury?

*Refer to the **supporting documents** description of three rings, acetabular lines and joint spaces.*

- https://radiopaedia.org/articles/pelvic-radiograph-an-approach?lang=us
- Examine for disruption to the three rings, joint spaces, acetabulum, sacral foramina, proximal femur.
- Sacroiliac joints 2-4mm wide and symmetrical, pubic symphysis <5mm.
- NB: Re-Xray patients who deteriorate following removal of pelvic binder as the binder placement may conceal pelvic fractures.

9. a) The 3 cases have had pelvic Xray. Discuss the assessment and findings of each Xray.

Issue each pelvic Xray to group and encourage the group to discuss findings.

Case study 1 - Pelvic Xray findings:
Pubic rami fractures [If there is a concurrent sacral alar fracture = Malgaigne fracture, changes injury to being type of vertical shear (this is high risk of bleeding)].

Case study 2 - Pelvic Xray findings:
Open book pelvic fracture, significant diastasis of pubic symphysis and disruption with widened SI joints bilaterally.

Case study 3 - Pelvic Xray findings:
R) Pubic rami fracture, in dwelling catheter in situ.

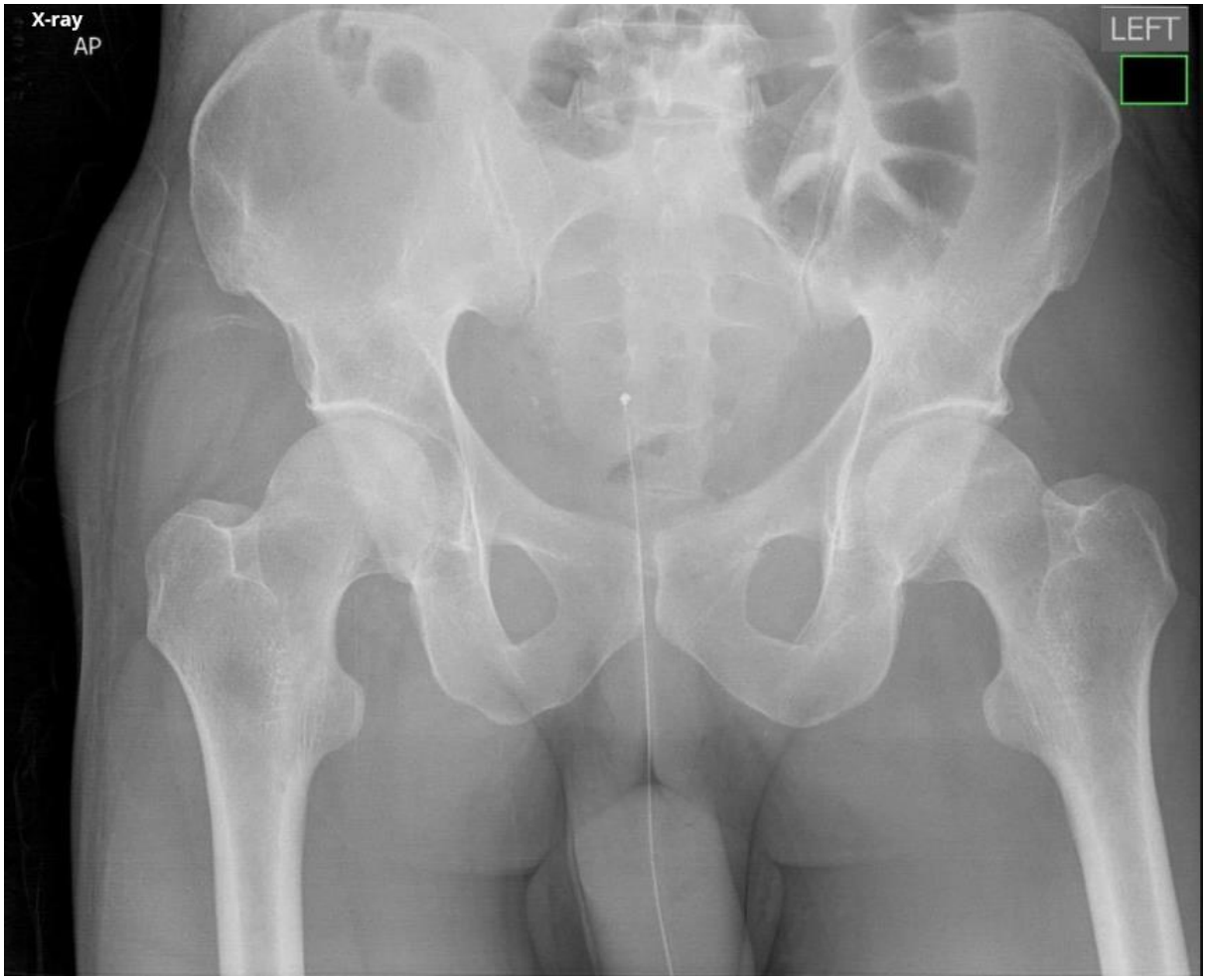
Case study 1 – Pelvic Xray

Case courtesy of Dr Andrew Dixon, Radiopaedia.org, rID: 31610.

Case study 2 – Pelvic Xray

Case courtesy of Dr Gagandeep Singh, Radiopaedia.org, rID: 6611.

Case study 3 – Pelvic Xray



b) Case study 3 had a CT pelvis axial non-contrast. See images of extraperitoneal bladder rupture: https://radiopaedia.org/cases/extraperitoneal-bladder-rupture-4?lang=gb. Assess and discuss your findings.

Case courtesy of Dr Vikas Shah, Radiopaedia.org, rID: 61059.

10. a) What are the indications for a pelvic CT as part of the trauma imaging protocol?

Mechanistic major trauma criteria for CT pelvis include:

- high speed motor vehicle collision
- non-trivial motorcycle collision
- fall from height >2 meters
- other concerning mechanism of injury
- abnormal FAST, or trauma chest or pelvis Xray
- abnormal vital signs.

b) When is an arterial phase or delayed IV contrast phase required when using CT to image the pelvis?

Arterial pelvic contrast should be used when: active bleeding is suspected (abnormal pelvic x-ray, haemodynamically unstable without other clear source).

Delayed phase with IV contrast is used to assess possible renal tract, bladder or urethral injury.

c) Of the case studies, which are indicated for pelvic CT and of those would they require contrast and arterial phase?

Case study 1: Isolated pubic rami fractures do not require CT imaging unless evidence of bleeding and haemodynamic compromise. Look for other features of haemorrhage: Hb drop, haemodynamic instability, bladder displacement with haematoma.

Case study 2: This patient meets requirements for a CT, with arterial and delayed phase contrast, if haemodynamics improve with volume resuscitation. However, if the patient remains shocked and a 'non responder' to volume resuscitation, then should progress to surgical control of bleeding source.

Case study 3: This patient needs a CT with delayed contrast to identify the bladder injury.

11. What other injuries are associated with pelvic trauma and need to be assessed for?

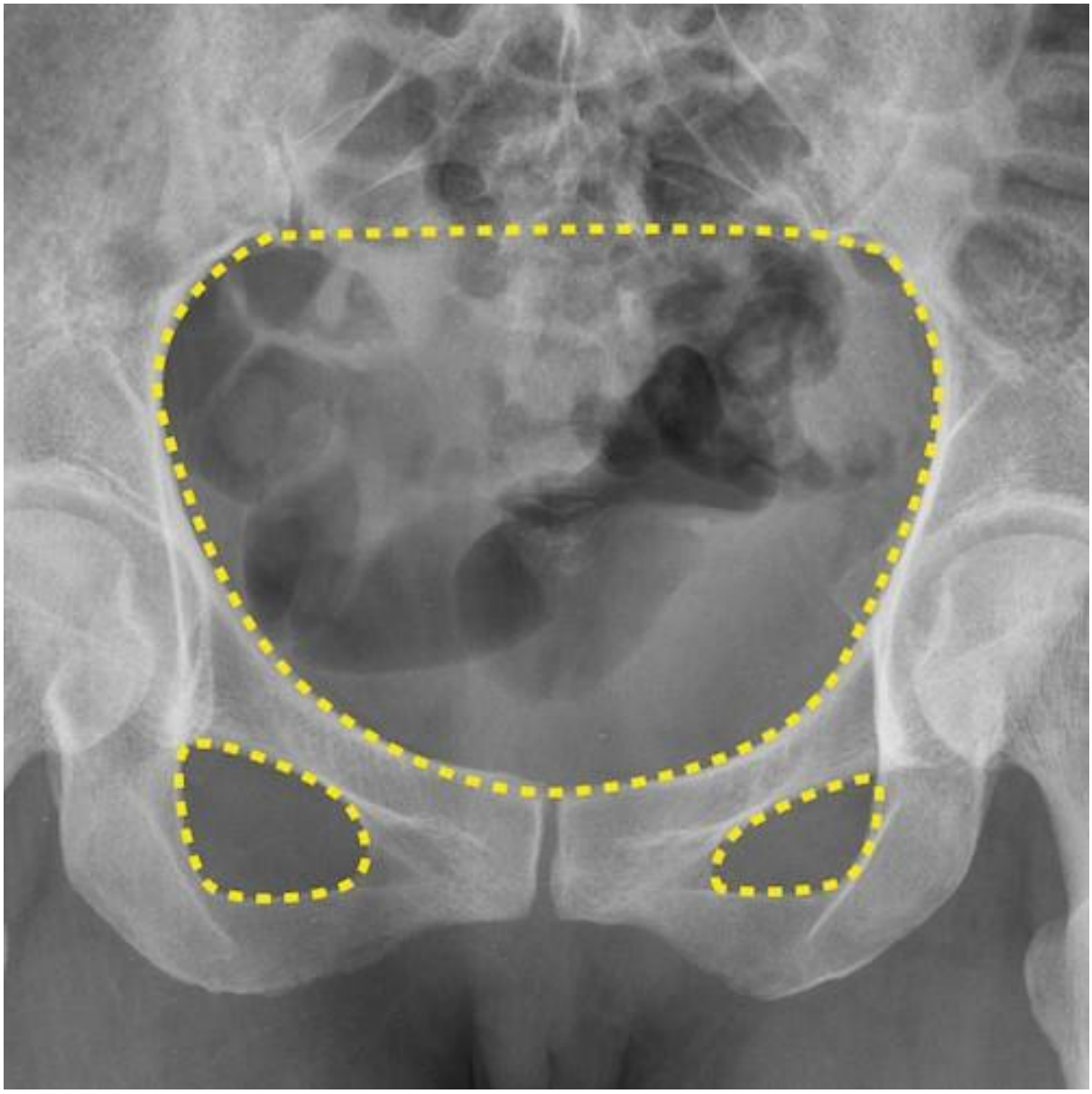
- Bladder - by CT cystography, to identify if the bladder rupture is intraperitoneal or extraperitoneal.[10]
- Urethral - in the setting of trauma, the classic triad of blood of the external urethral meatus or vaginal introitus may be seen but is an unreliable sign, as is haematuria. Inability to void may be seen in complete urethral disruption. Examination may reveal blood on digital rectal exam and perineal ecchymosis.
    - Voiding cystourethrography is the most appropriate way to evaluate the posterior part of the male urethra and injuries to the female urethra.
    - Retrograde urethrography is the modality of choice to investigate the anterior part of the urethra. It will demonstrate extraluminal contrast, which has extravasated from the urethra at the site of injury. It is important to determine if this is above the urogenital diaphragm (anterior) or below (posterior) it. Patients with incomplete injuries may represent subsequently with strictures.[11]
- Rectal - up to 5%, associated with open fractures. These are more likely to be haemodynamically unstable.
- Vaginal - tears may occur with open fractures in female patients.

Supporting documents

The following supporting documents are provided for this case discussion:

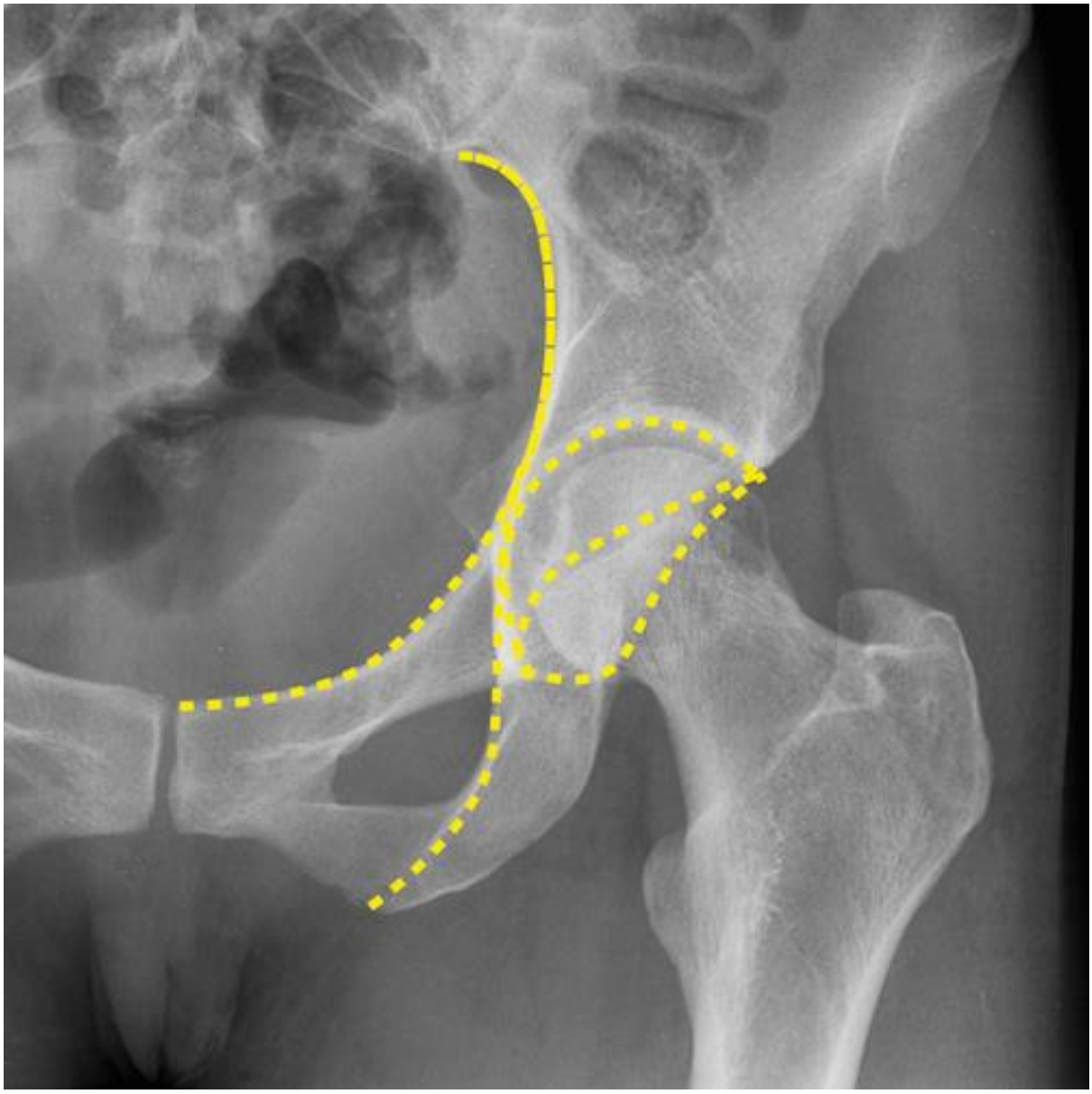
1. Pelvic Xray – Three rings
2. Pelvic Xray – Acetabular lines
3. Pelvic Xray – Joint spaces
4. Pelvic ring fracture classification

Pelvic Xray – Three rings



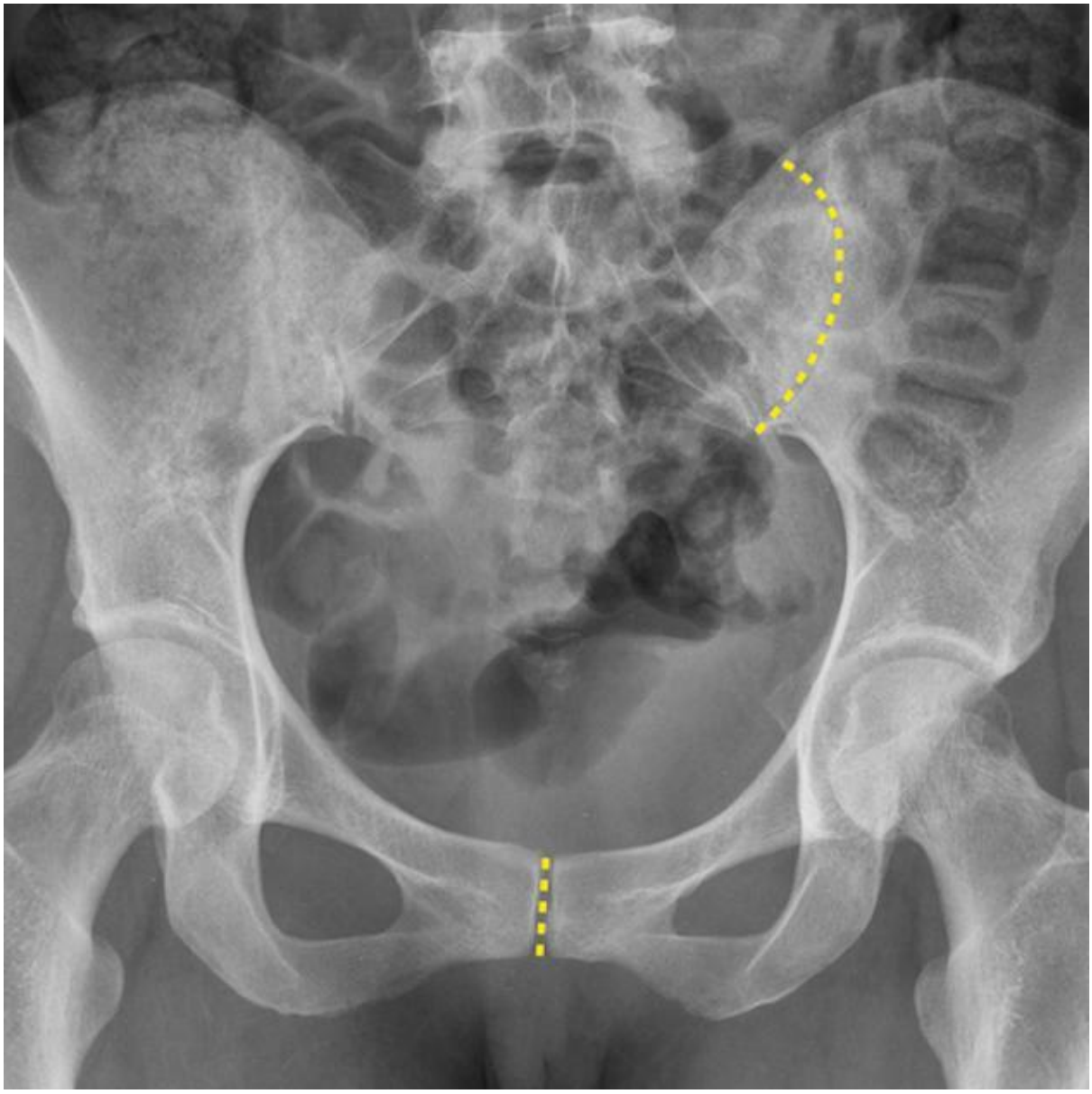
Case courtesy of Dr Jeremy Jones, Radiopaedia.org, rID: 28928.

Pelvic Xray – Acetabular lines



Case courtesy of Dr Jeremy Jones, Radiopaedia.org, rID: 28928.

Pelvic Xray – Joint spaces



Case courtesy of Dr Jeremy Jones, Radiopaedia.org, rID: 28928.

Pelvic ring fracture classification

Courtesy of https://www.orthobullets.com/trauma/1030/pelvic-ring-fractures

- **Tile classification**

Tile classification		
A: Stable		
	A1: fracture not involving the ring (avulsion or iliac wing fracture)	
	A2: stable or minimally displaced fracture of the ring	
	A3: transverse sacral fracture (Denis zone III sacral fracture)	
B: Rotationally unstable, vertically stable		
	B1: open book injury (external rotation)	
	B2: lateral compression injury (internal rotation)	
	B2-1: with anterior ring rotation/displacement through ipsilateral rami	
	B2-2-with anterior ring rotation/displacement through contralateral rami (bucket-handle injury)	
	B3: bilateral	
C: Rotationally and vertically unstable		
	C1: unilateral	
	C1-1: iliac fracture	
	C1-2: sacroiliac fracture-dislocation	
	C1-3: sacral fracture	
	C2: bilateral with one side type B and one side type C	
	C3: bilateral with both sides type C	

- **Young-Burgess Classification**

Anterior Posterior Compression (APC)		
APC I	Symphysis widening < 2.5 cm	
APC II	Symphysis widening > 2.5 cm. Anterior SI joint diastasis. Posterior SI ligaments are intact. Disruption of sacrospinous and sacrotuberous ligaments.	
APC III	Disruption of anterior and posterior SI ligaments (SI dislocation). Disruption of sacrospinous and sacrotuberous ligaments. APCIII associated with vascular injury	

Lateral Compression (LC)		
LC I	Oblique or transverse ramus fracture and ipsilateral anterior sacral ala compression fracture.	
LC II	Rami fracture and ipsilateral posterior ilium fracture dislocation (crescent fracture).	
LC III	Ipsilateral lateral compression and contralateral APC (windswept pelvis). Common mechanism is rollover vehicle accident or pedestrian vs auto.	

Vertical Shear (VS)		
Vertical shear	Posterior and superior directed force. Associated with the highest risk of hypovolemic shock (63%); mortality rate up to 25%	

Acronyms and abbreviations

Term	Definition
MBC	motor bike collision
IDC	indwelling catheter
ASIS	anterior superior iliac spine
LLQ	left lower quadrant
FAST	focussed assessment of sonography in trauma
CT	computerised tomography

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