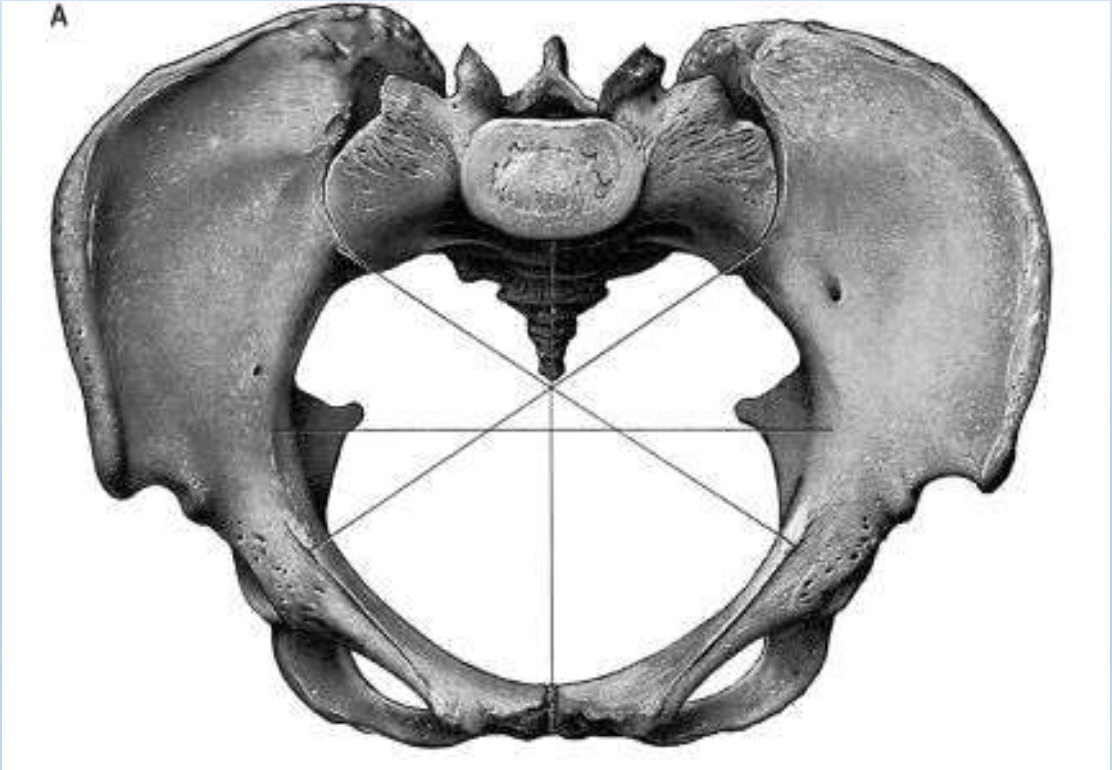
MAKING SENSE OF PELVIC INJURIES: PAHO-BIOMECHANICS

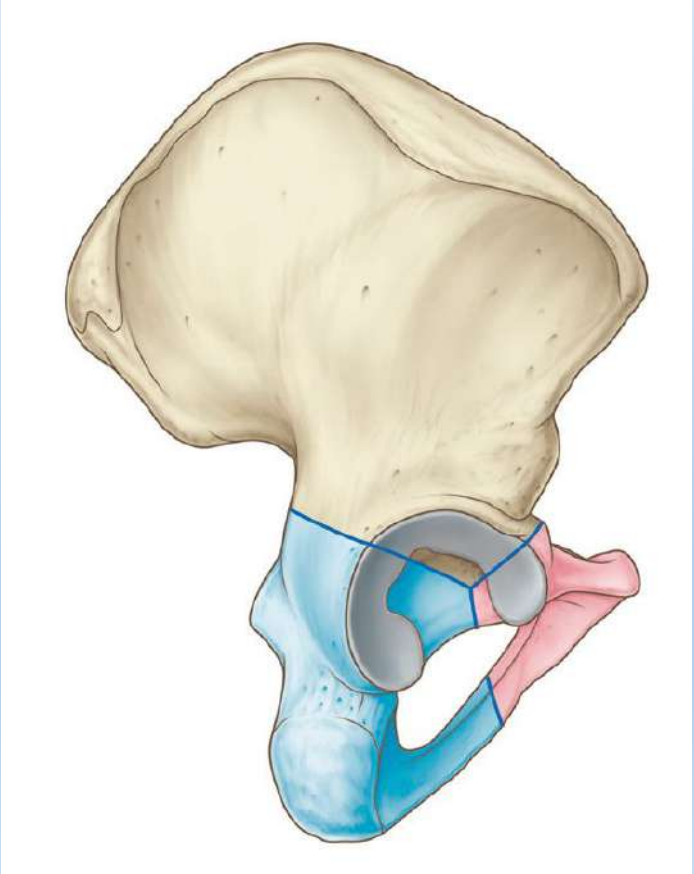
BONES OF PELVIS

Sacrum (in between)

Two Innominate bones (ilium, ischium, pubis)

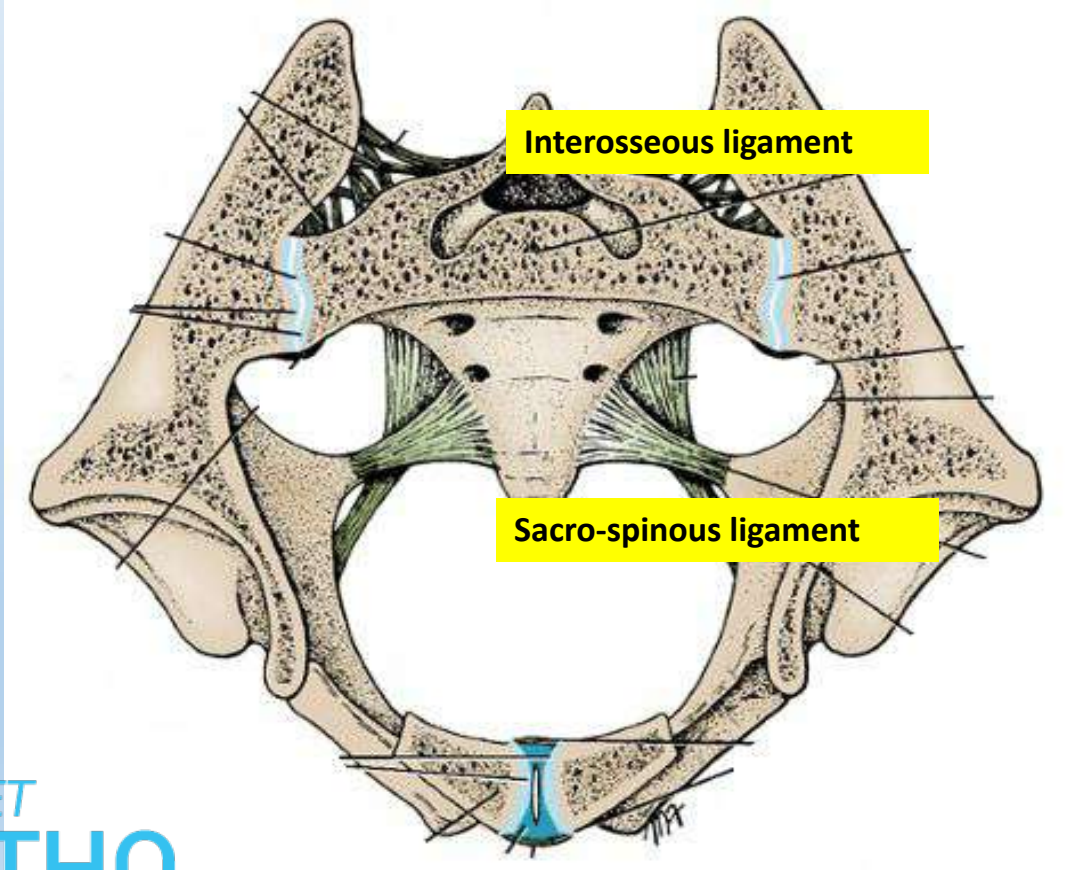
Connected by SIJ and Symphysis pubis

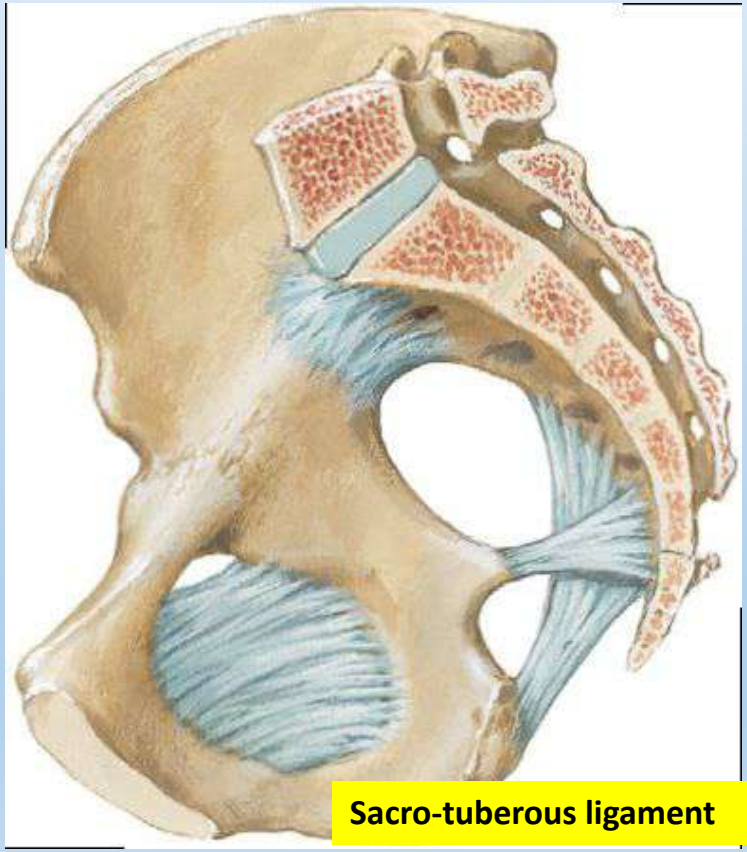




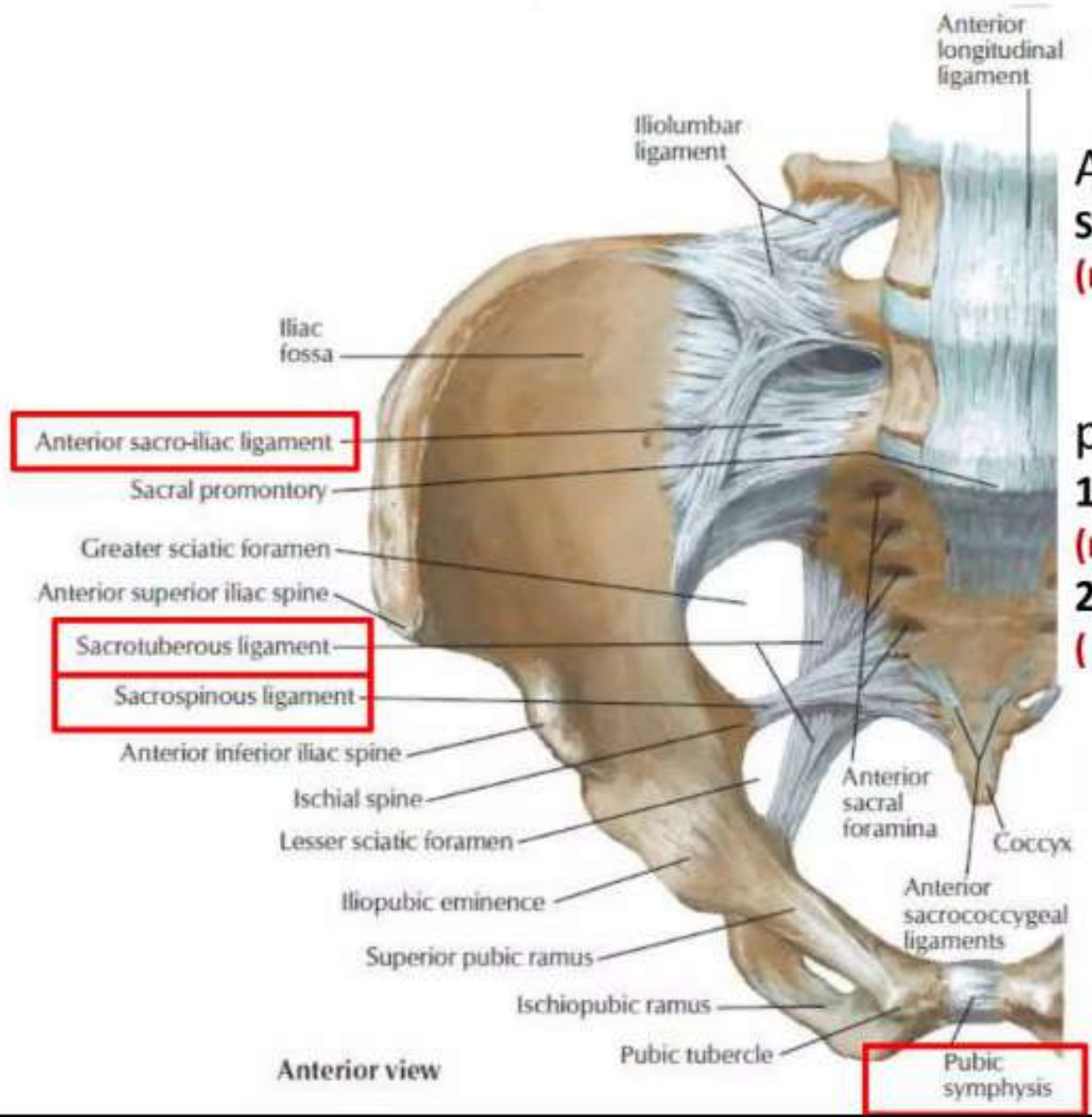
LIGAMENTOUS ANATOMY

- Sacrotuberous - resists shear and ante-flexion
- Sacrospinous - resists external rotation





2.Ligaments



Anterior ligaments

Symphyseal ligaments

(resist external rotation)

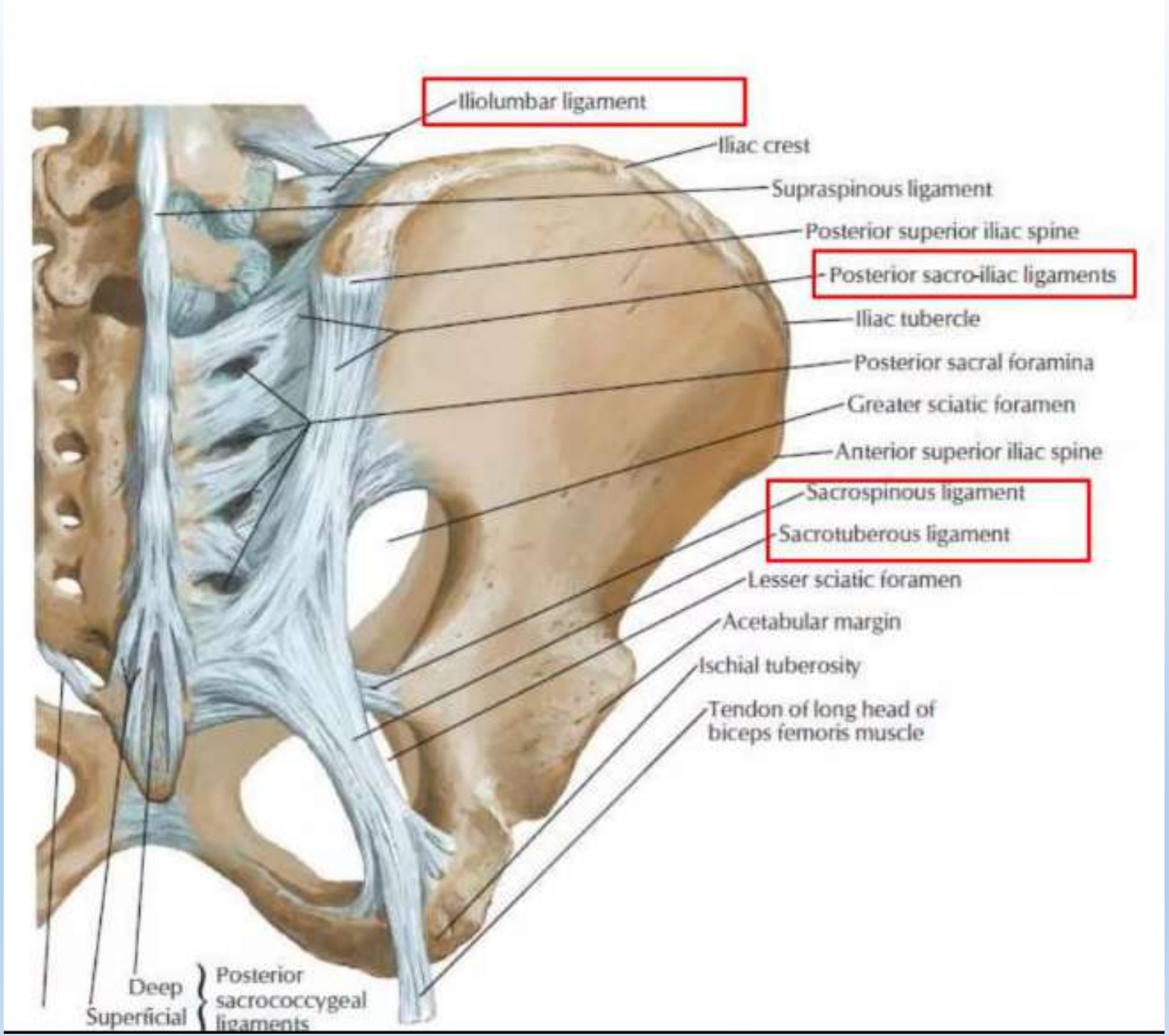
pelvic floor

1.sacrospinous ligaments

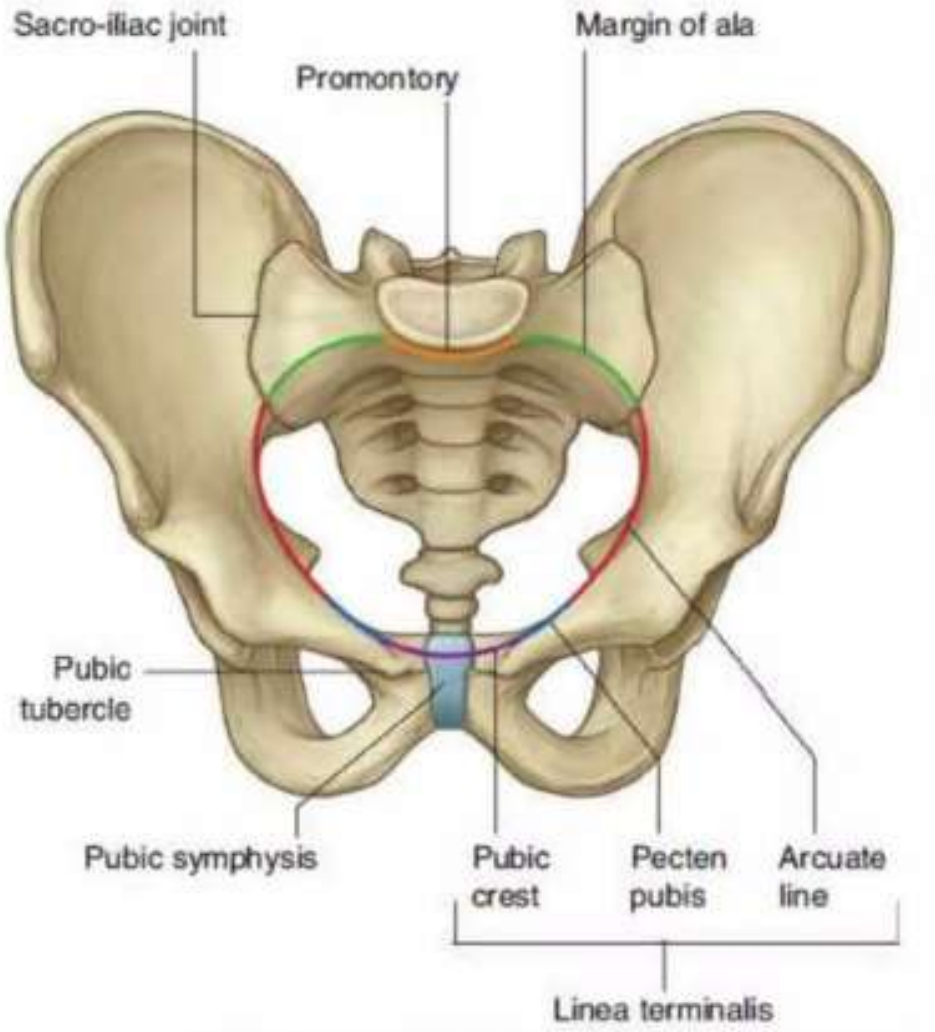
(resist external rotation)

2.sacrotuberous ligaments

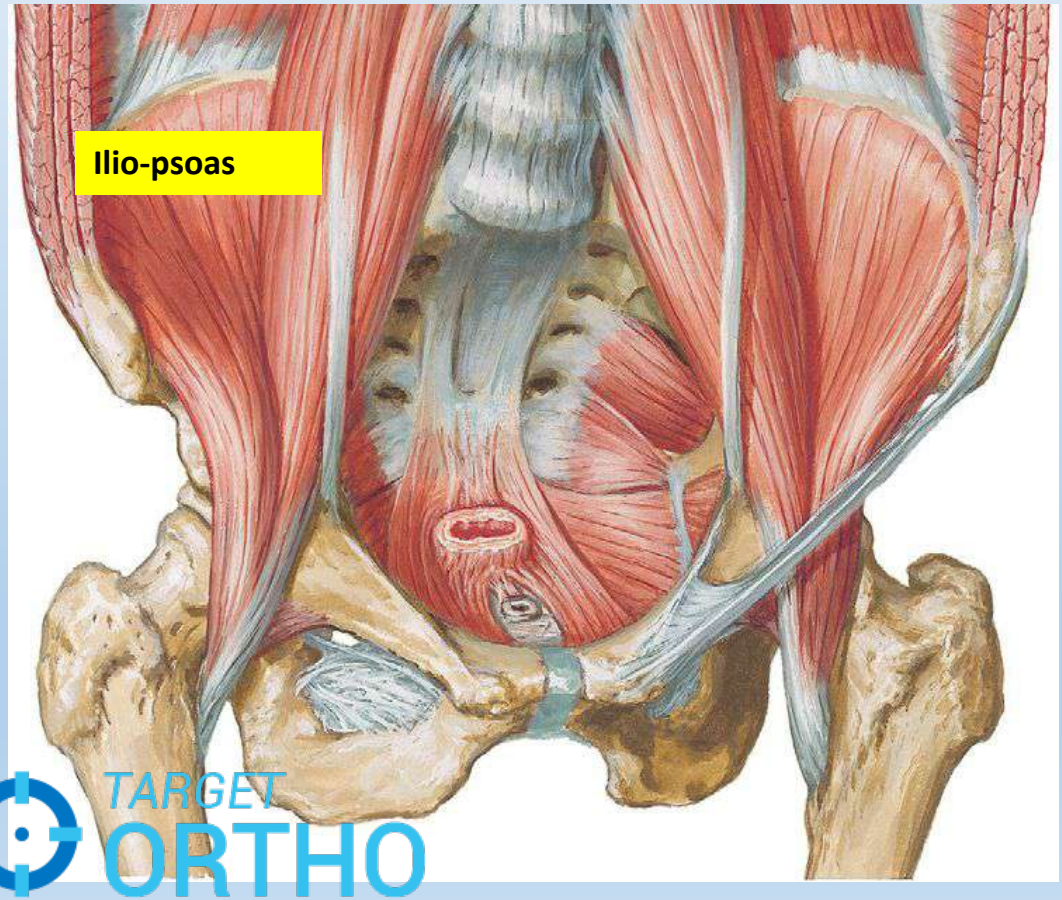
(resist shear and flexion)



Pelvic inlet /pelvic ring/pelvic brim (egde of the inlet)



MUSCULAR ANATOMY



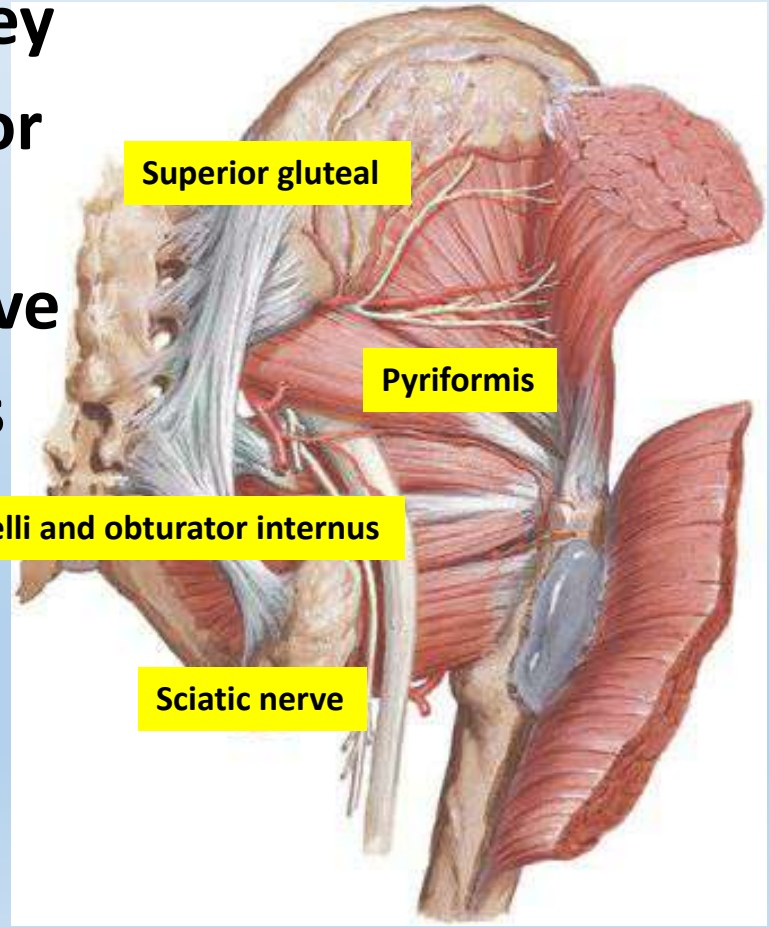
Posteriorly..

Pyriformis is the key

Gemilli & Obturator internus

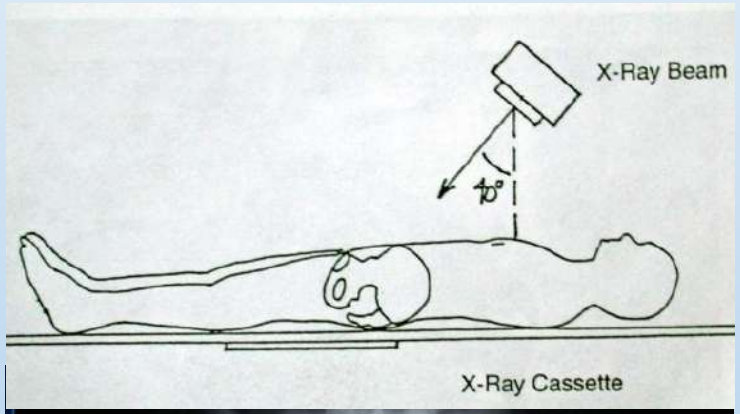
protect Sciatic nerve

Quadratus femoris

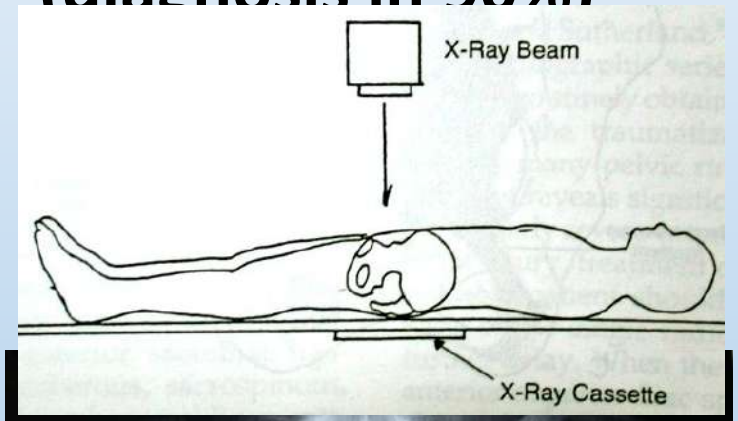


RADIOLOGICAL EVALUATION OF PELVIS

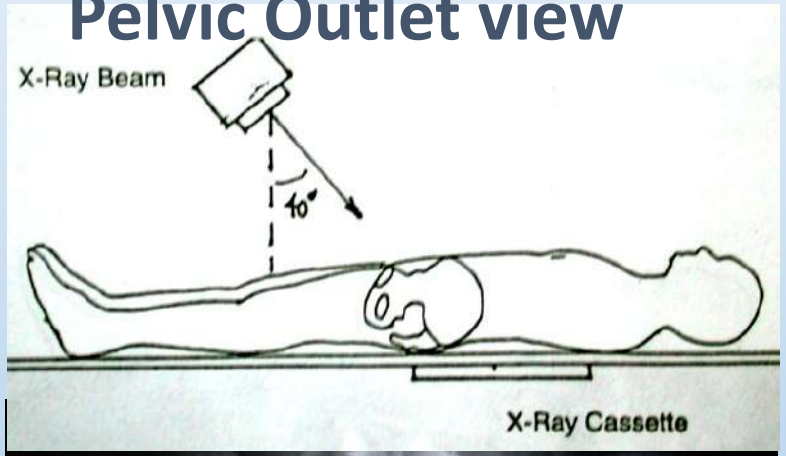
Pelvic Inlet view



Antero-Posterior view (diagnosis in 90%)

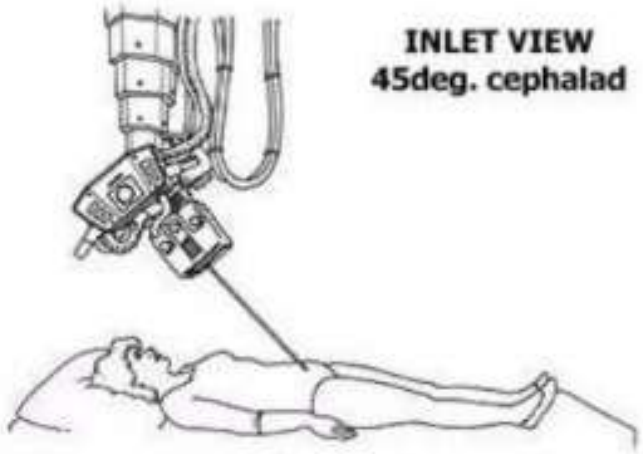


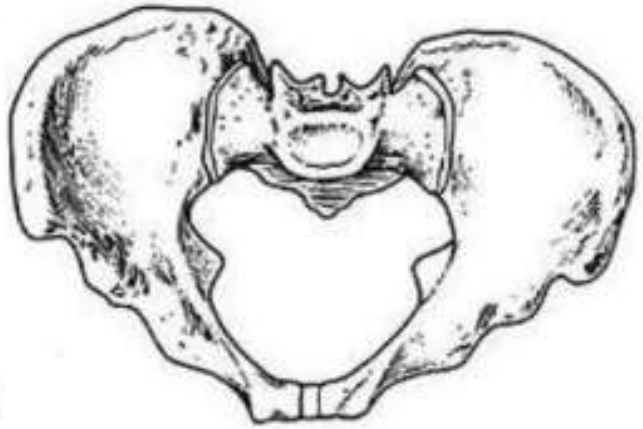
Pelvic Outlet view



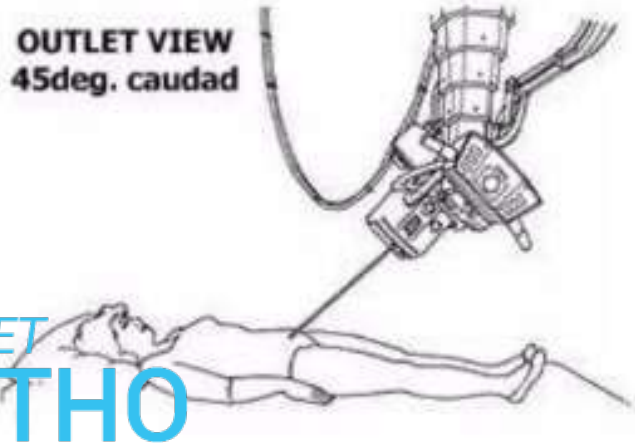
Pelvic inlet view

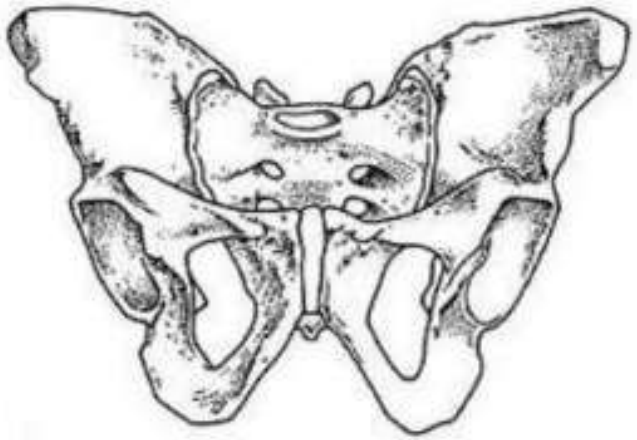
Inlet view:





Outlet View:





INLET VIEW shows

1.fractures of the sacrum

2.AP displacement of injured portions of the ring, and

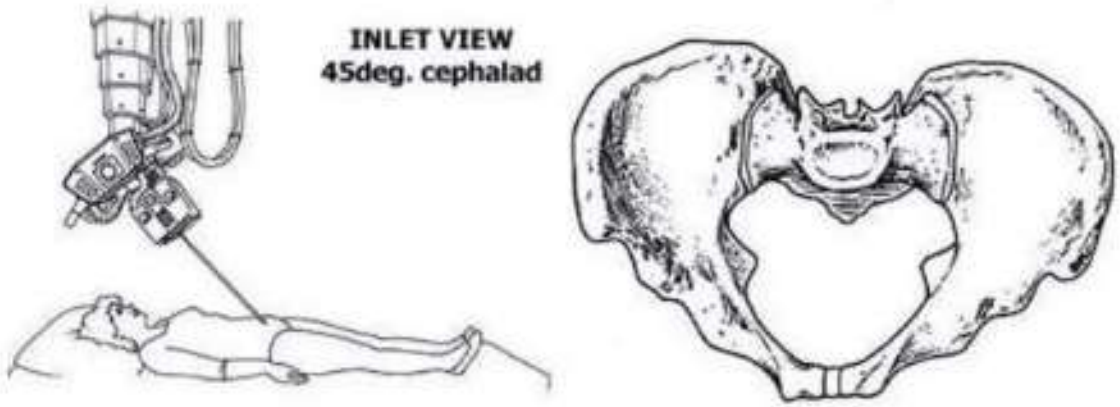
3.the degree and severity of **rotational displacement** of the injured hemipelvis.

4. Widening of the sacroiliac or symphysis pubis joint is clearly visible on the inlet view.

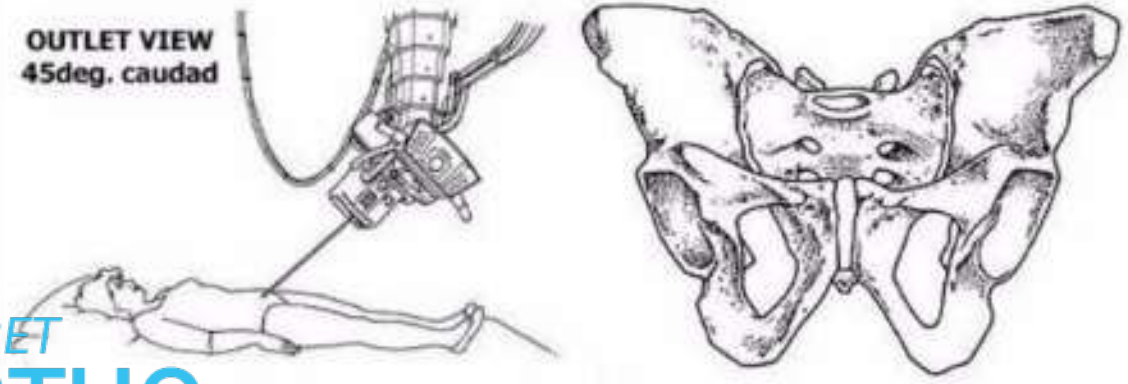
5.fractures of the pubic rami are usually well visualized.

Pelvic outlet view

Inlet view:



Outlet View:



Outlet view shows

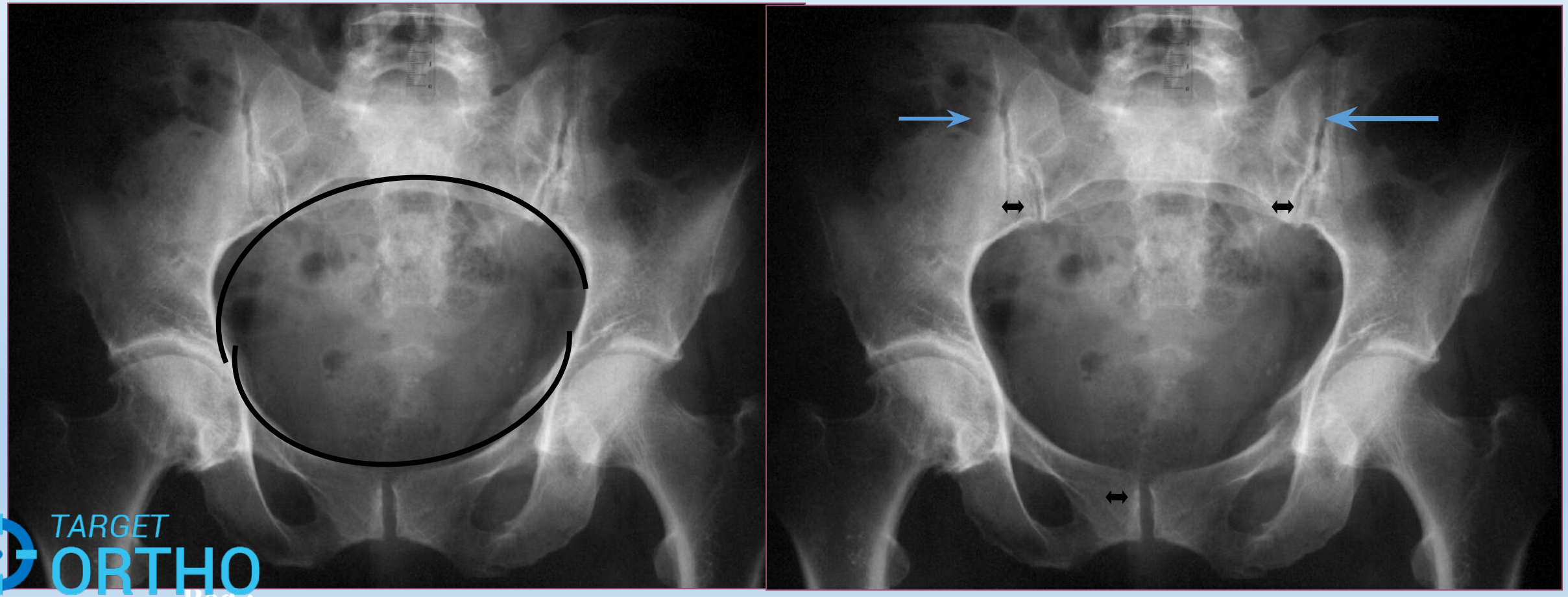
1.fractures of the sacrum.

2.Fractures of the **posterior iliac wing** are visible on the outlet view, as are fractures of the pubic rami.

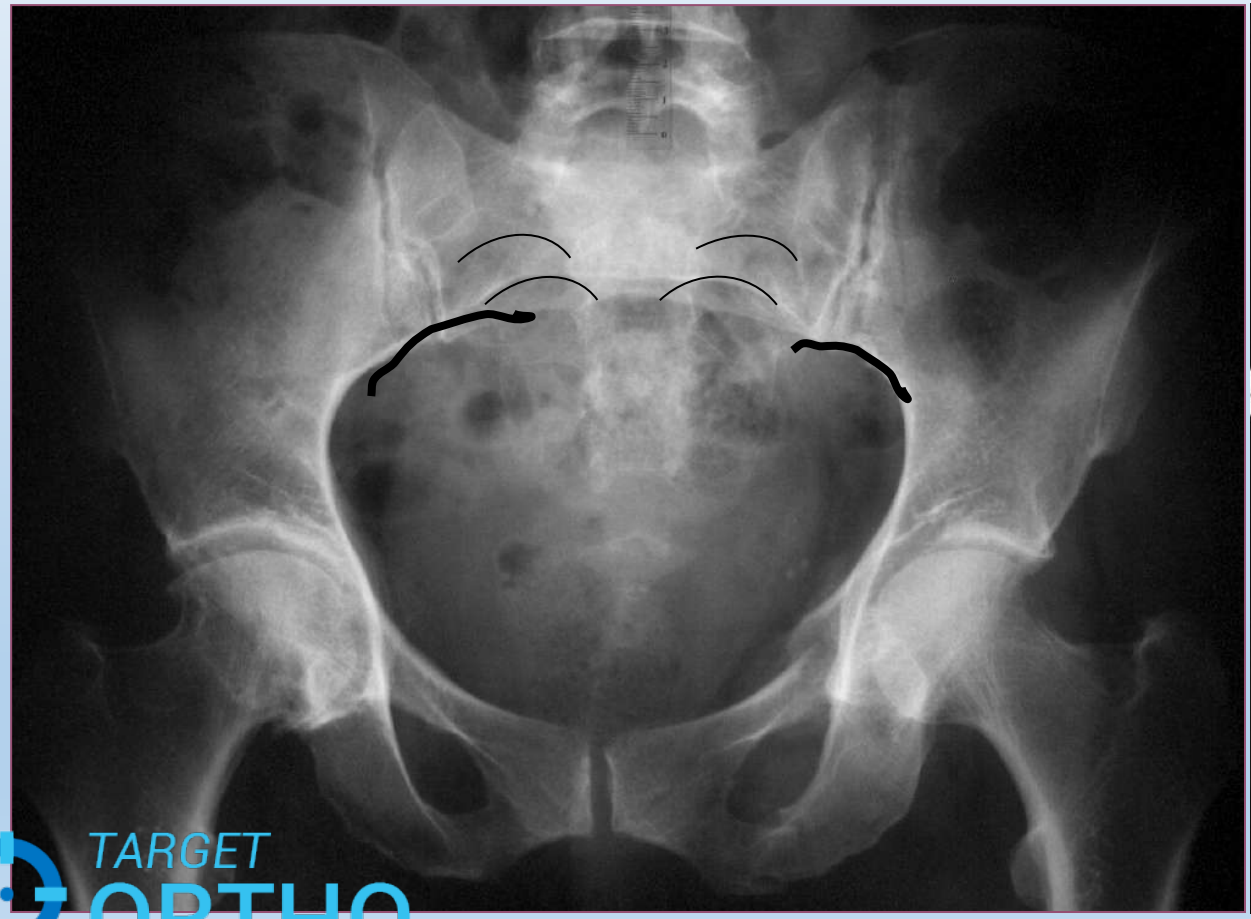
3.Widening of the sacroiliac joint can be noted.

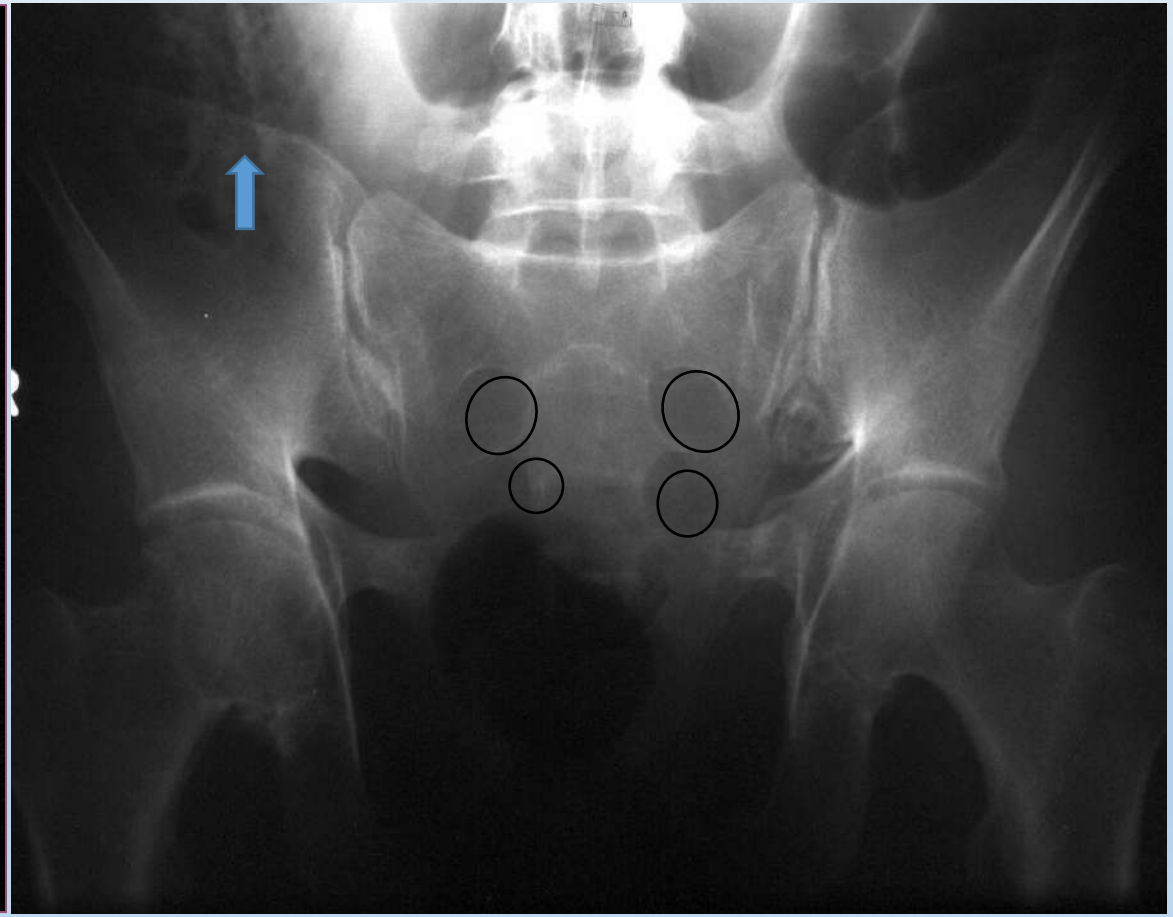
4.The outlet view also demonstrates **cephalad or caudad displacement** of the injured hemipelvis

RADIOLOGICAL ANALYSIS OF PELVIS

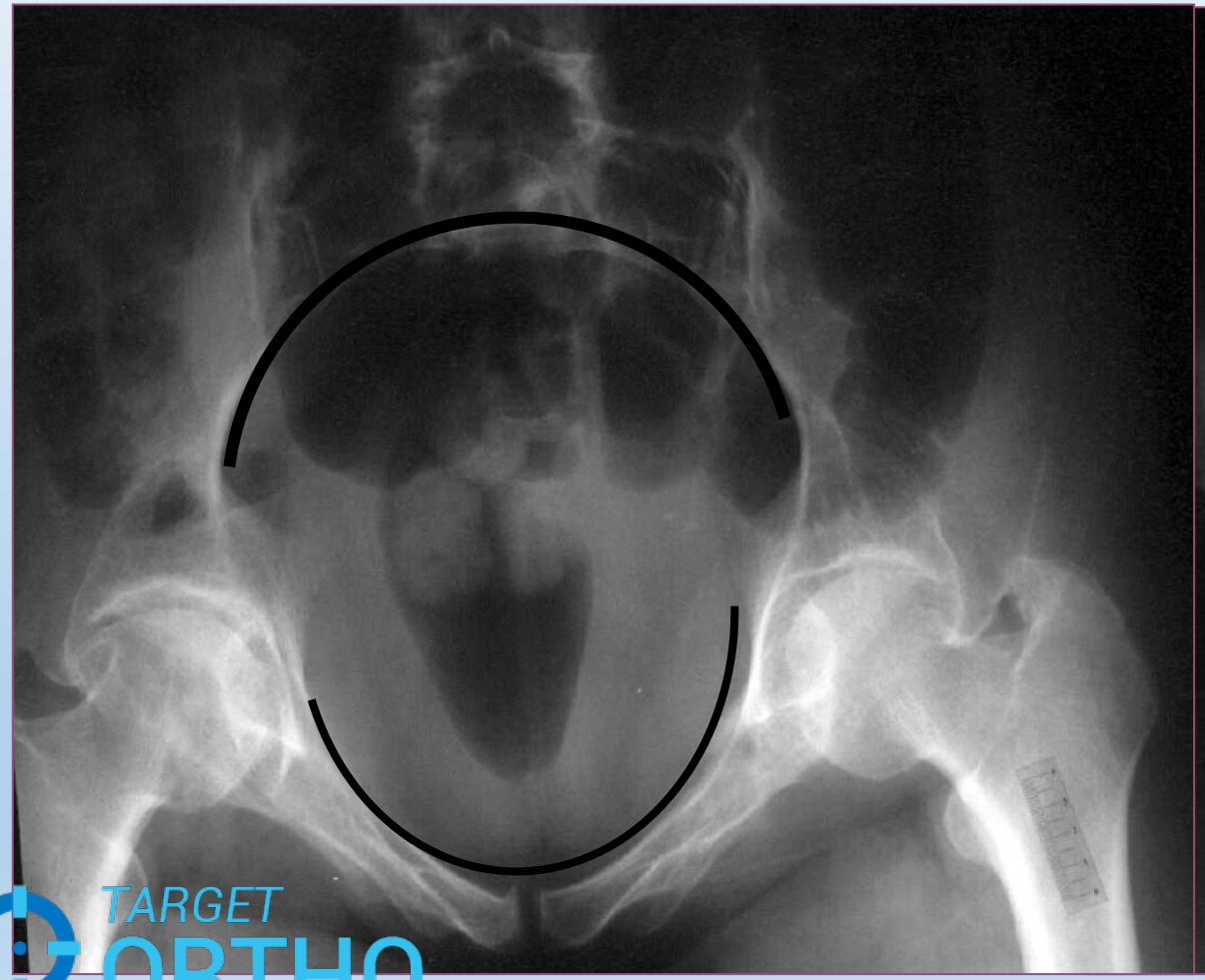


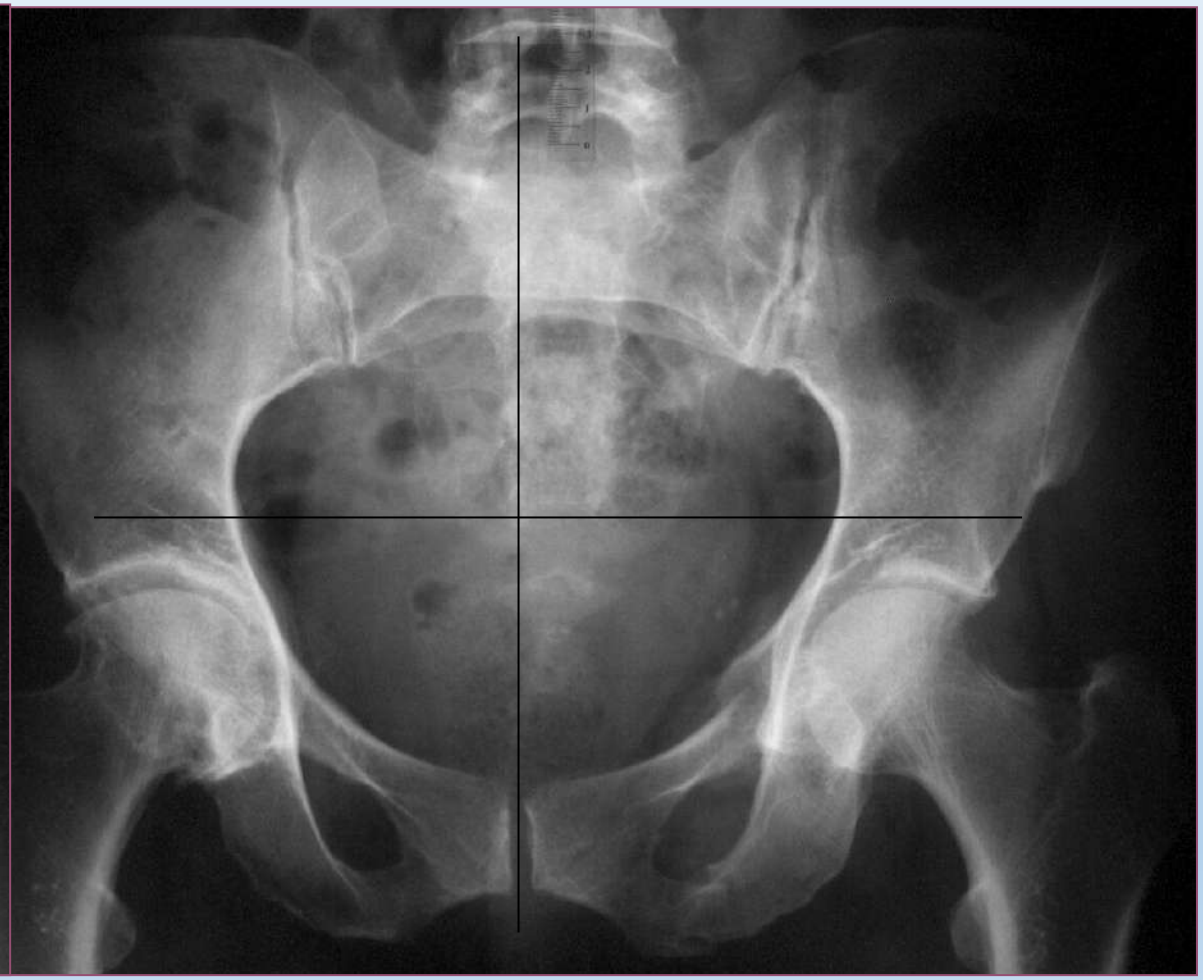
RADIOLOGICAL EVALUATION OF PELVIS





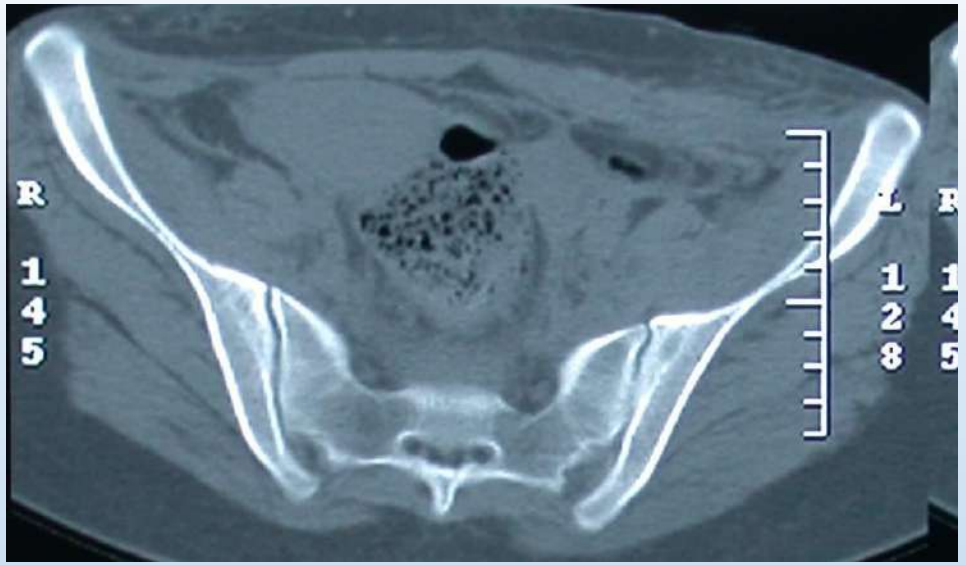
RADIOLOGICAL EVALUATION OF PELVIS

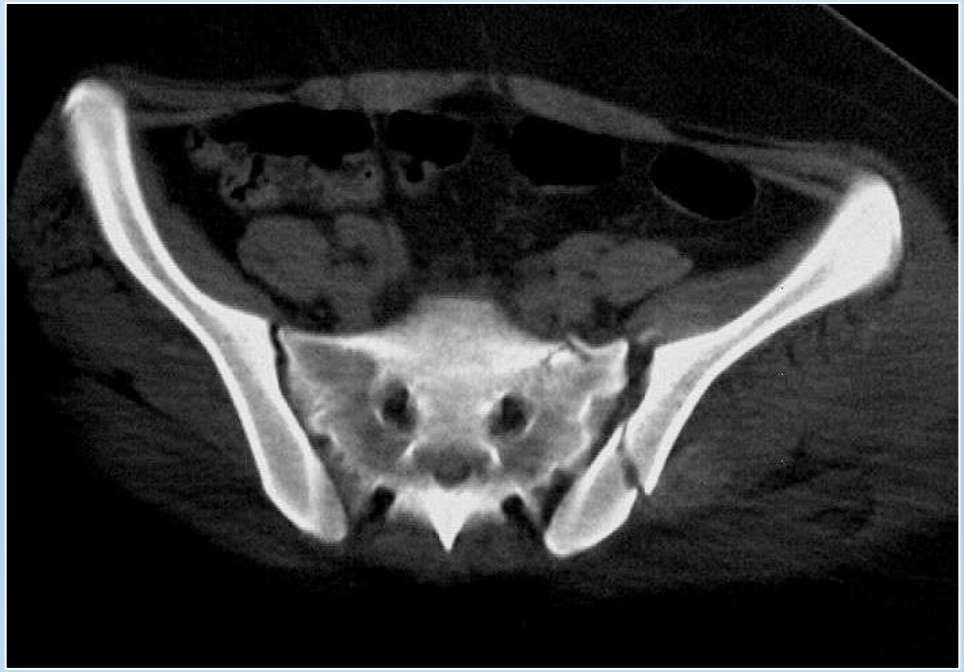




CT EVALUATION OF PELVIS

- Superior details of fracture
- Position of fracture fragments
- Extent of diastasis of SI joint & Pubic symphysis
- Better evaluation of Sacrum & Acetabulum





3 D CT IMAGES OF PELVIS

Better perception ring disruption

Better preoperative planning

WEIGHT BEARING AXIS

Sacrum - Keystone

↓

Sciatic buttress

↓

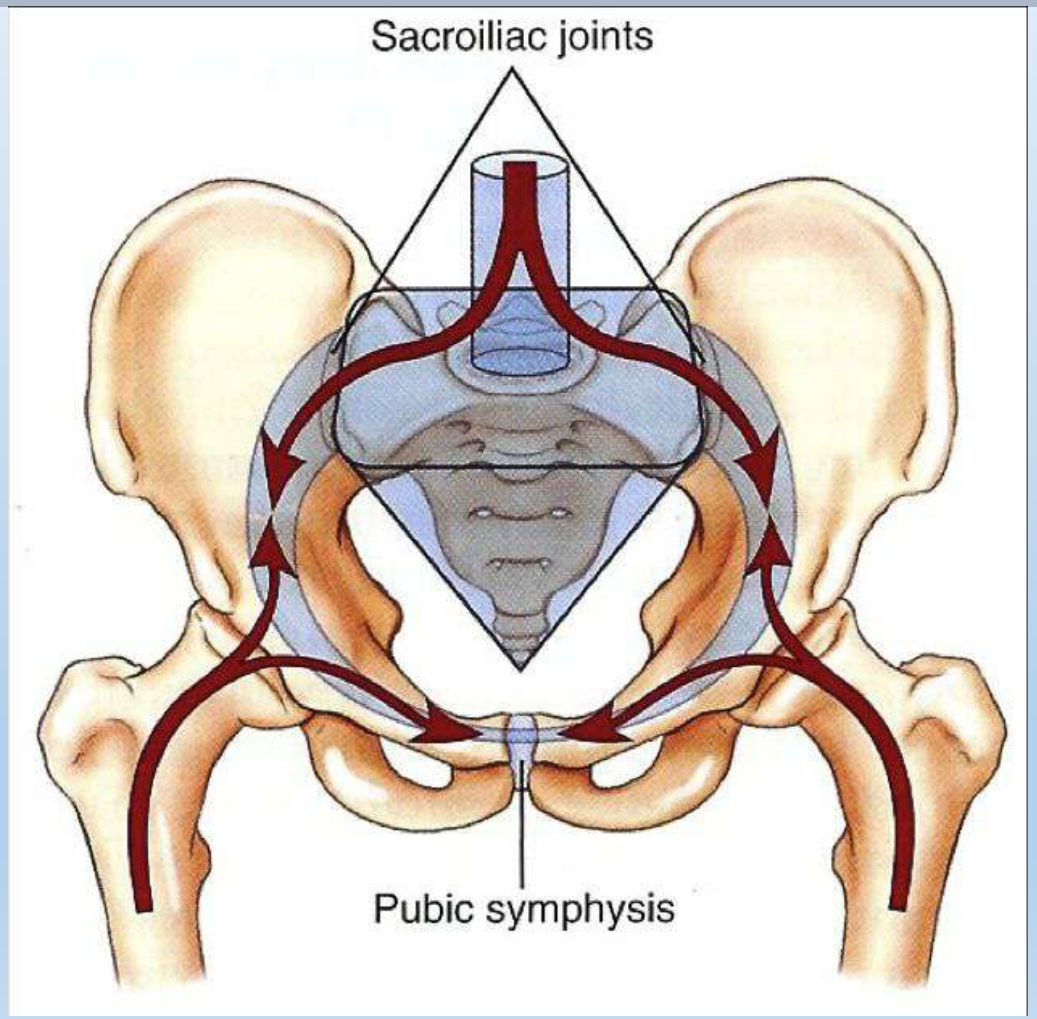
Pelvic brim

↓

Acetabulum (standing)

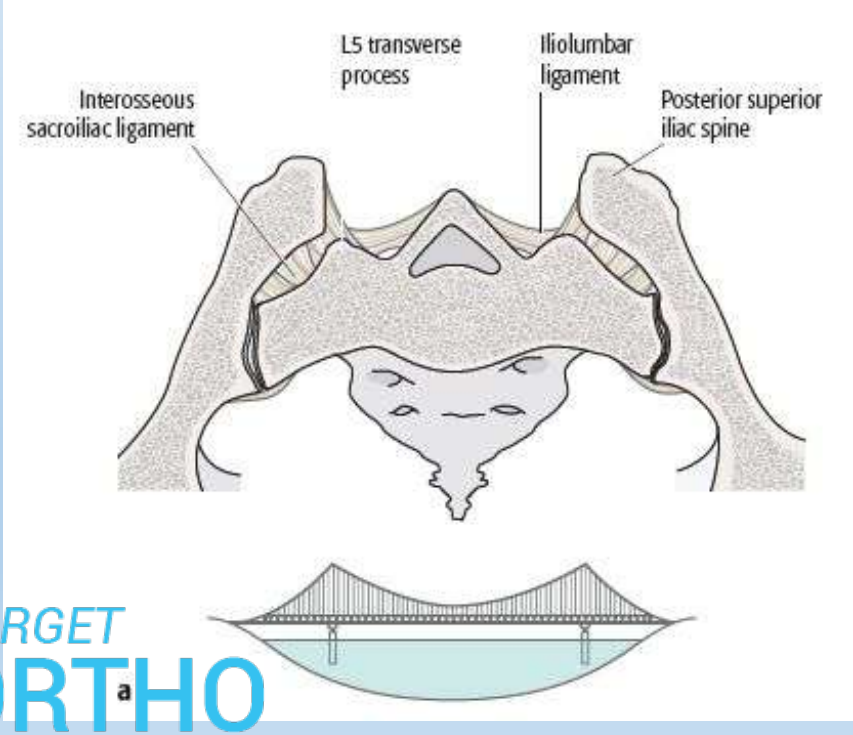
Ischium (sitting)

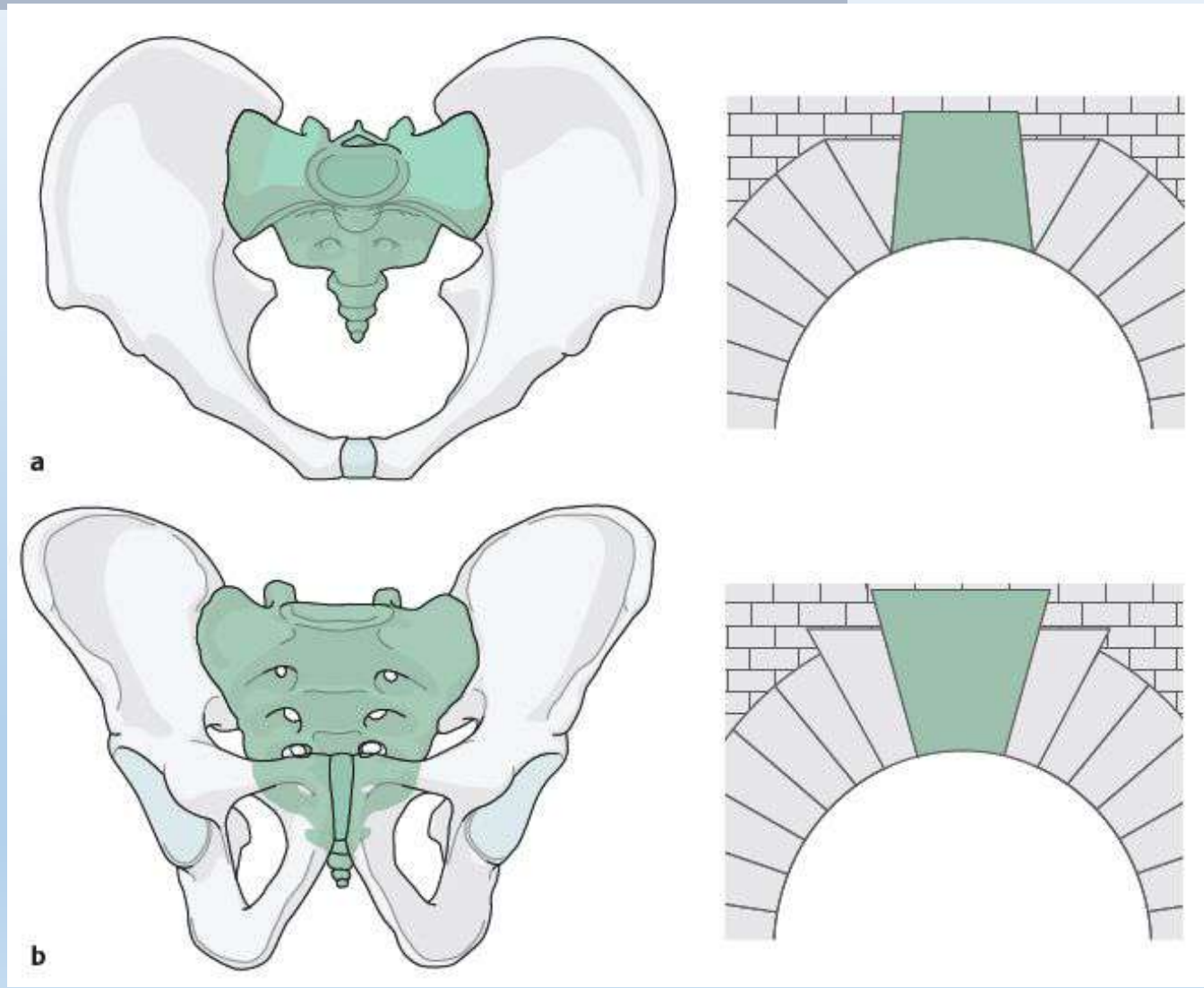
Pubis - Ant. Strut



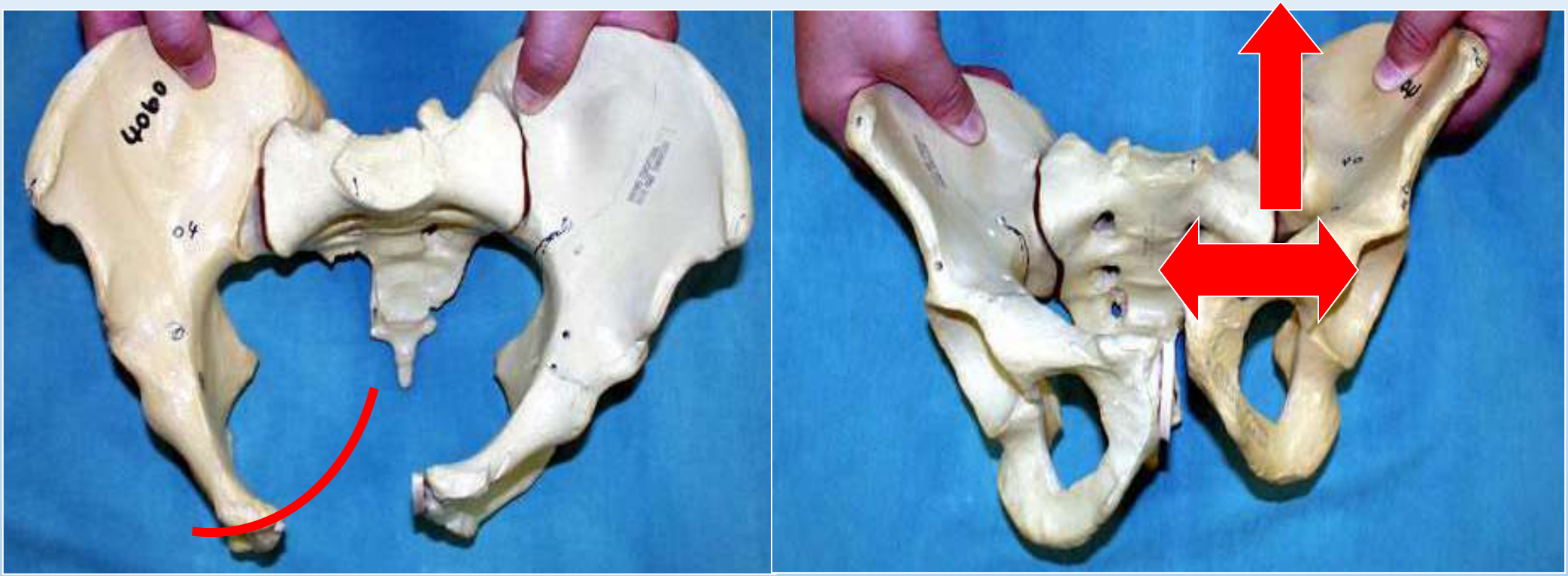
STABILITY OF THE PELVIS

- Ring structure
- Keystone
- Suspension bridge





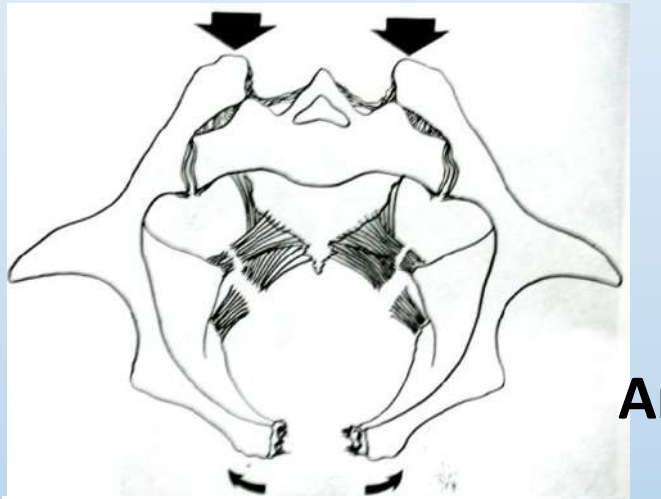
UNSTABLE PELVIC INJURY



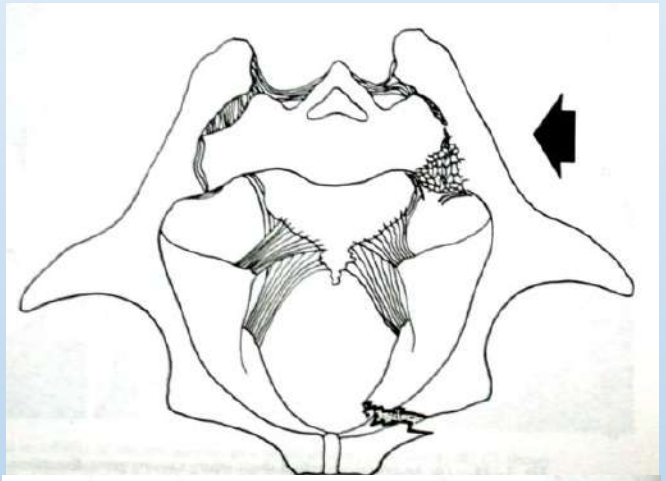
B- ROTATIONALLY UNSTABLE , VERTICALLY STABLE

C- ROTATIONALLY UNSTABLE , VERTICALLY UNSTABLE

YOUNG & BURGESS CLASSIFICATION OF PELVIC INJURY

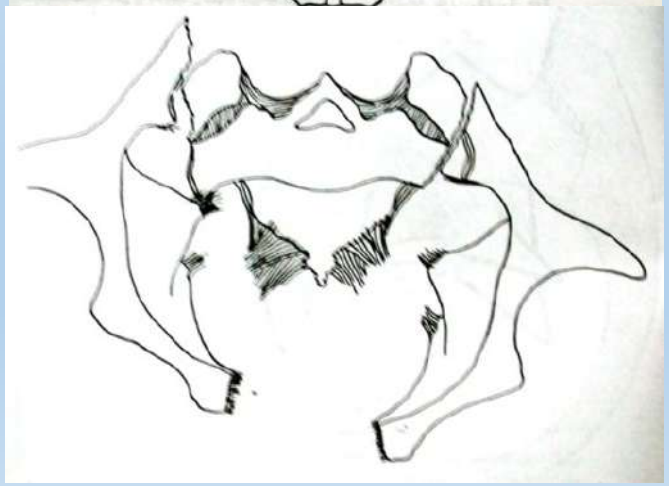


Antero-Posterior compression



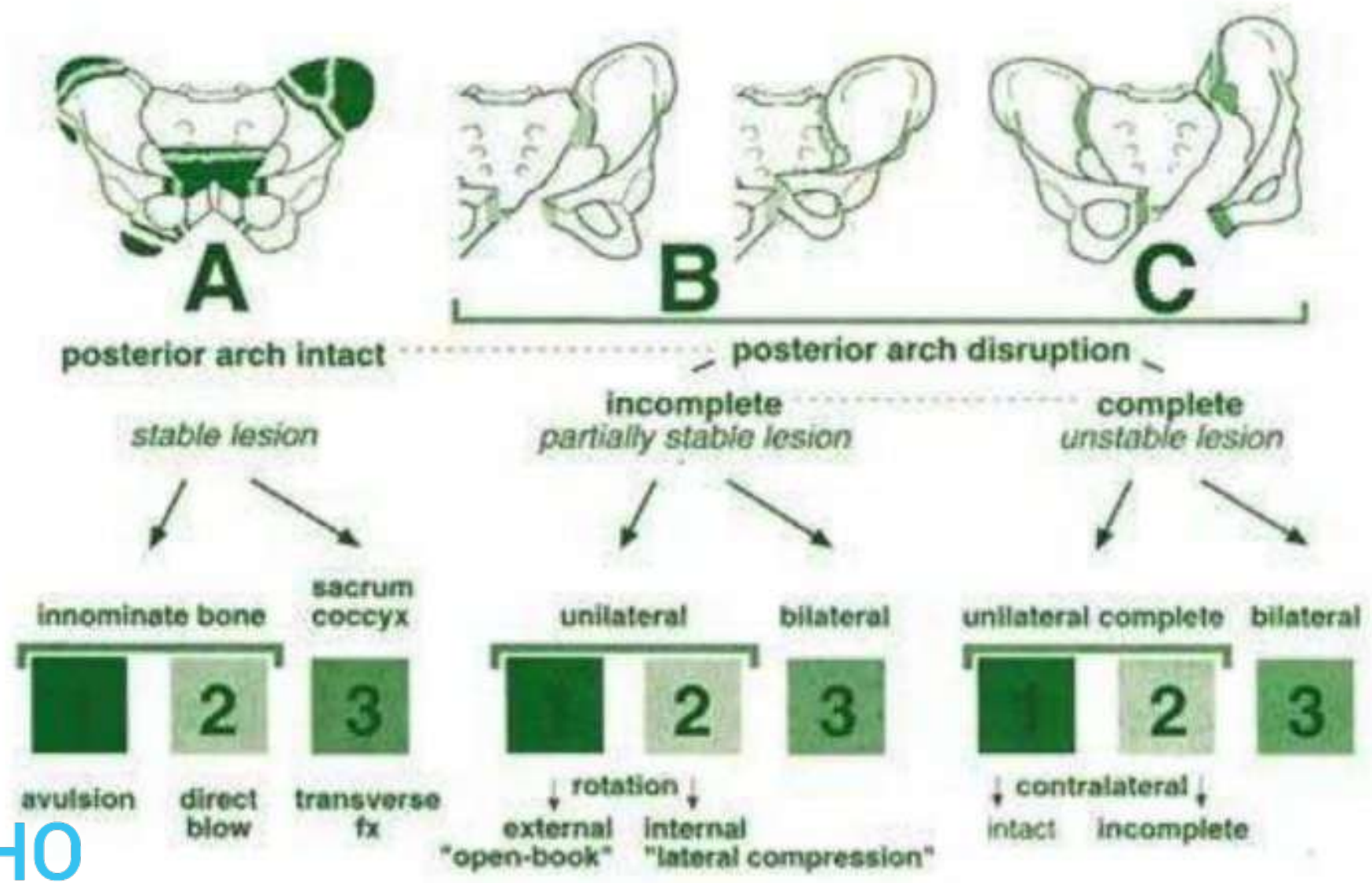
Lateral compression

Vertical shear



Combined mechanical injury

Tiles system



Classification of pelvic

BOX 56-1 Classification of Pelvic Ring Lesions

Type A: Stable (Posterior Arch Intact)

A1	Avulsion injury
A2	Iliac wing or anterior arch fracture caused by a direct blow
A3	Transverse sacrococcygeal fracture

Type B: Partially Stable (Incomplete Disruption of Posterior Arch)

B1	Open book injury (external rotation)
B2	Lateral compression injury (internal rotation)
B2-1	Ipsilateral anterior and posterior injuries
B2-2	Contralateral (bucket-handle) injuries
B3	Bilateral

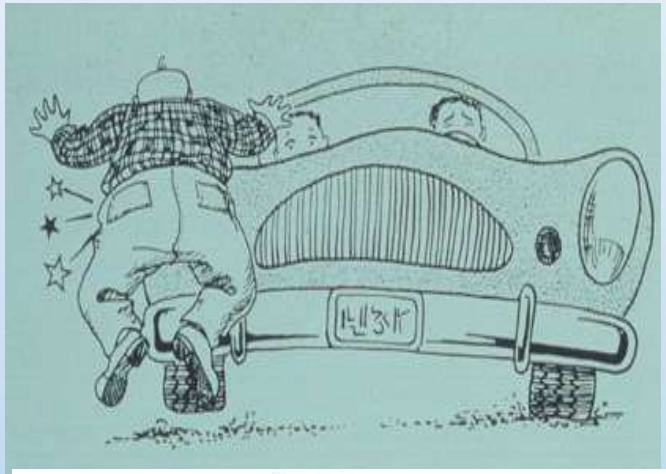
Type C: Unstable (Complete Disruption of Posterior Arch)

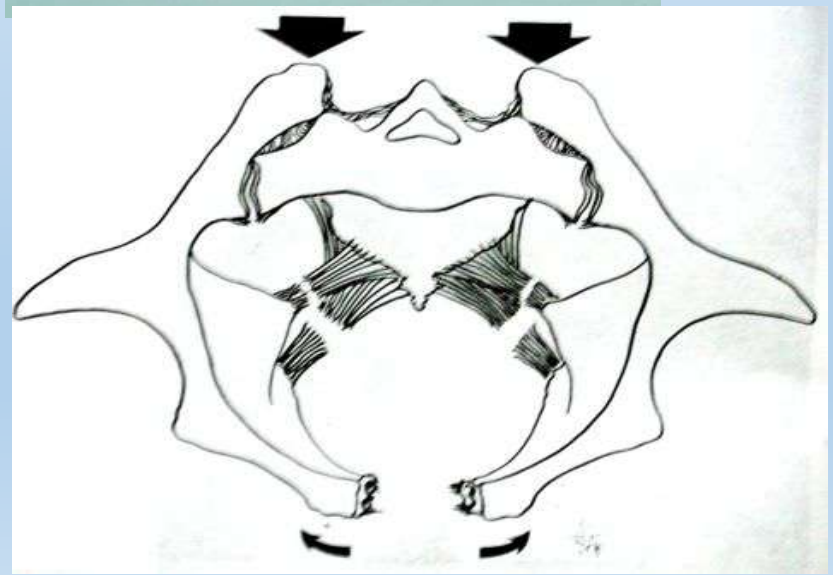
C1	Unilateral
C1-1	Iliac fracture
C1-2	Sacroiliac fracture-dislocation
C1-3	Sacral fracture
C2	Bilateral, with one side type B, one side type C
C3	Bilateral

From Tile M: Acute pelvic fractures, part I: Causation and classification, *J Am Assoc Orthop Surg* 4:143, 1996.

ANTEROPOSTERIOR COMPRESSION INJURY

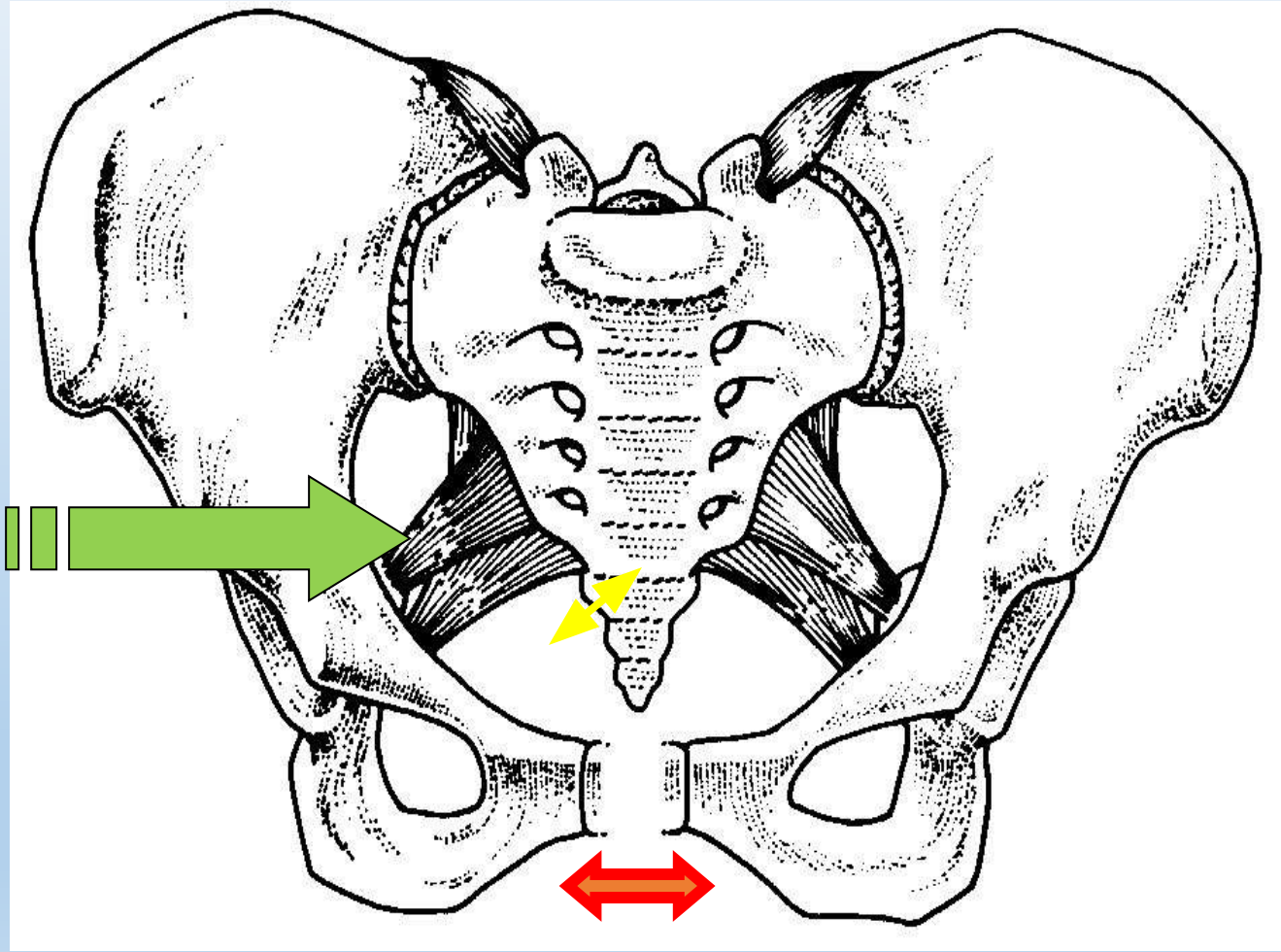
- Pubic diastasis with or without posterior ring injury.
- Pelvis to open: One or both hemi-pelvis undergo external rotation.
- Various degrees of AP compression injuries





AP COMPRESSION, TYPE I

- Note that the ligaments are stretched, and not torn

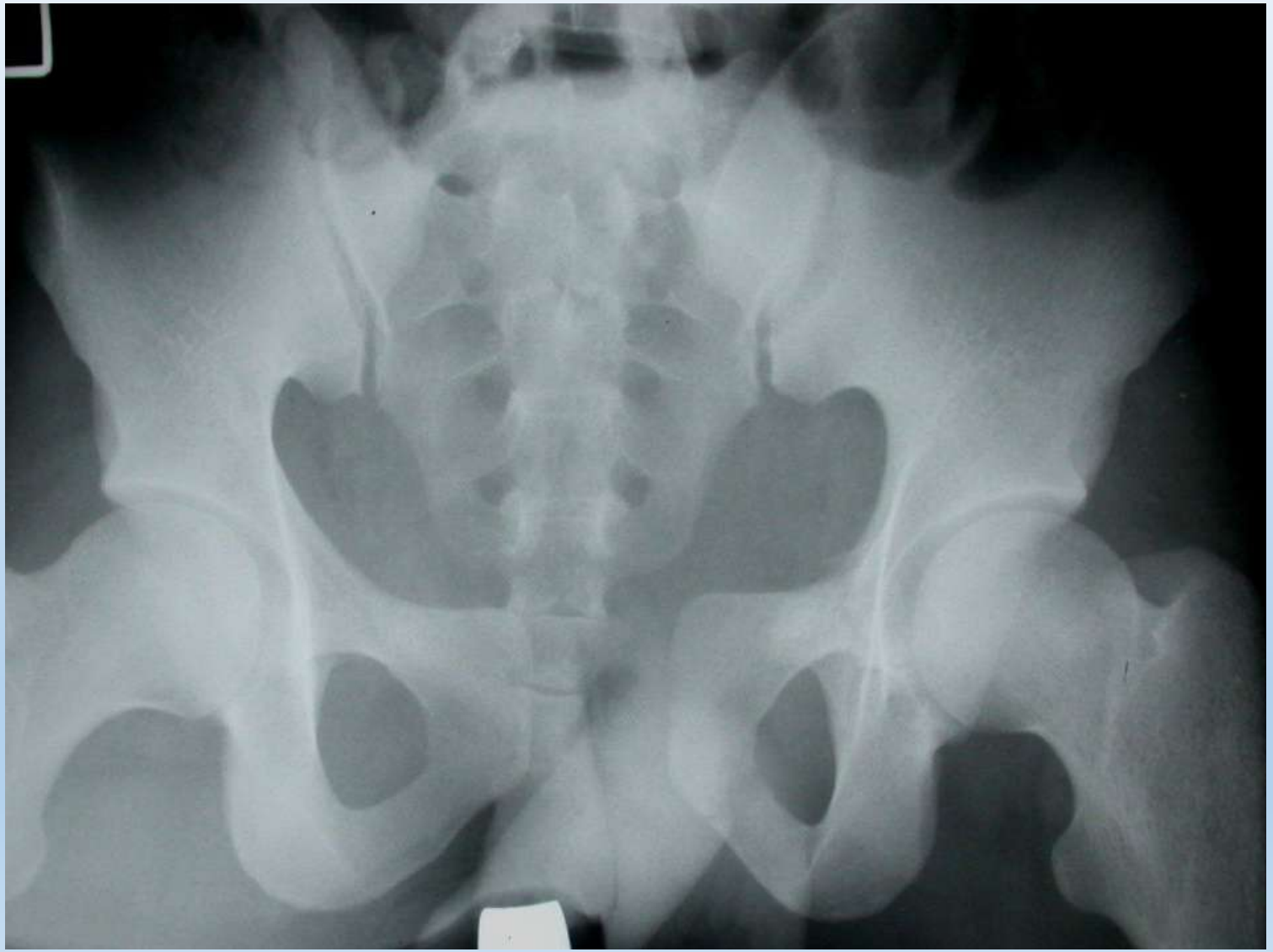


AP COMPRESSION, TYPE I

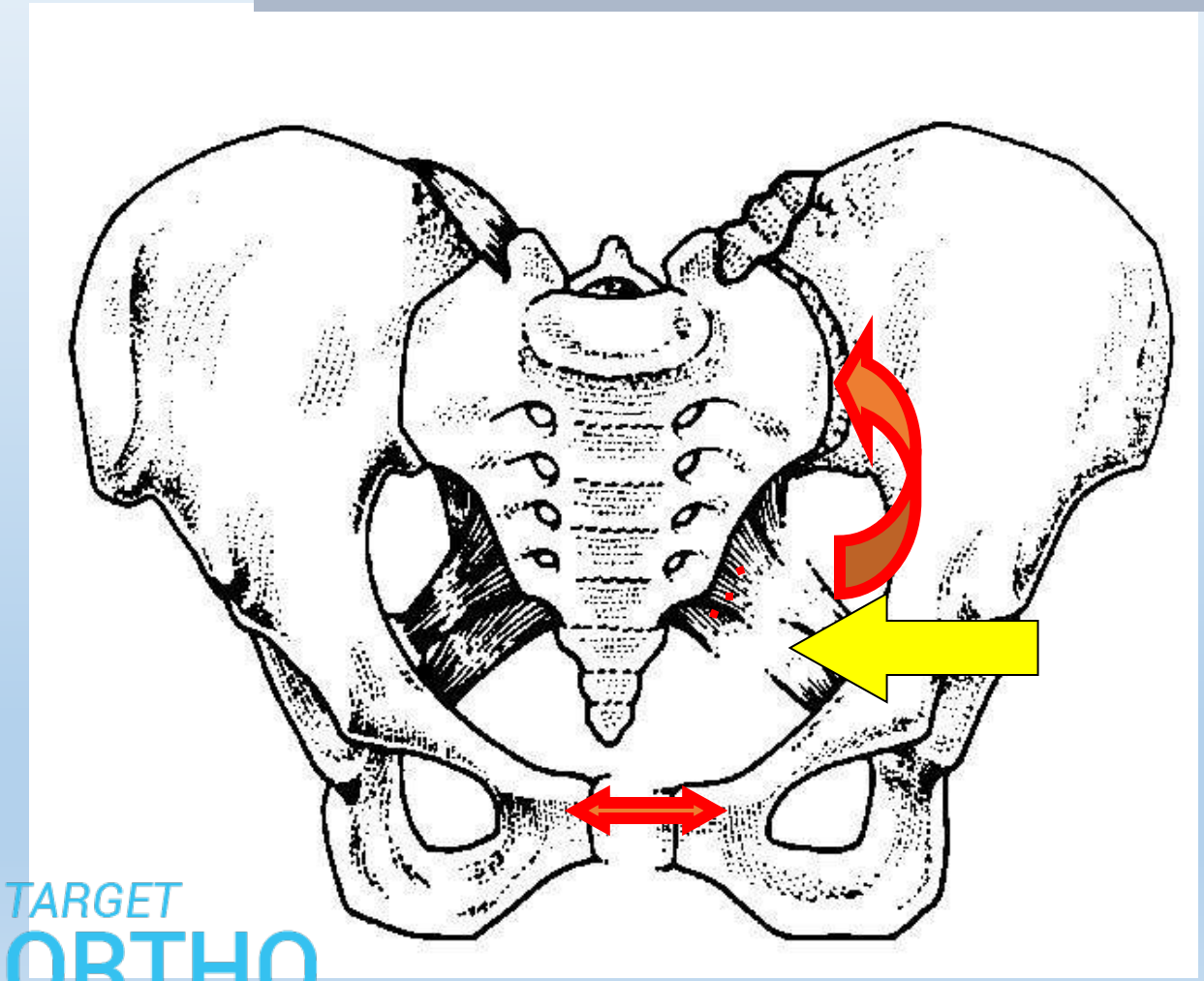
Pubic diastasis <2.5 cm

External rotation

Stable



AP COMPRESSION, TYPE II

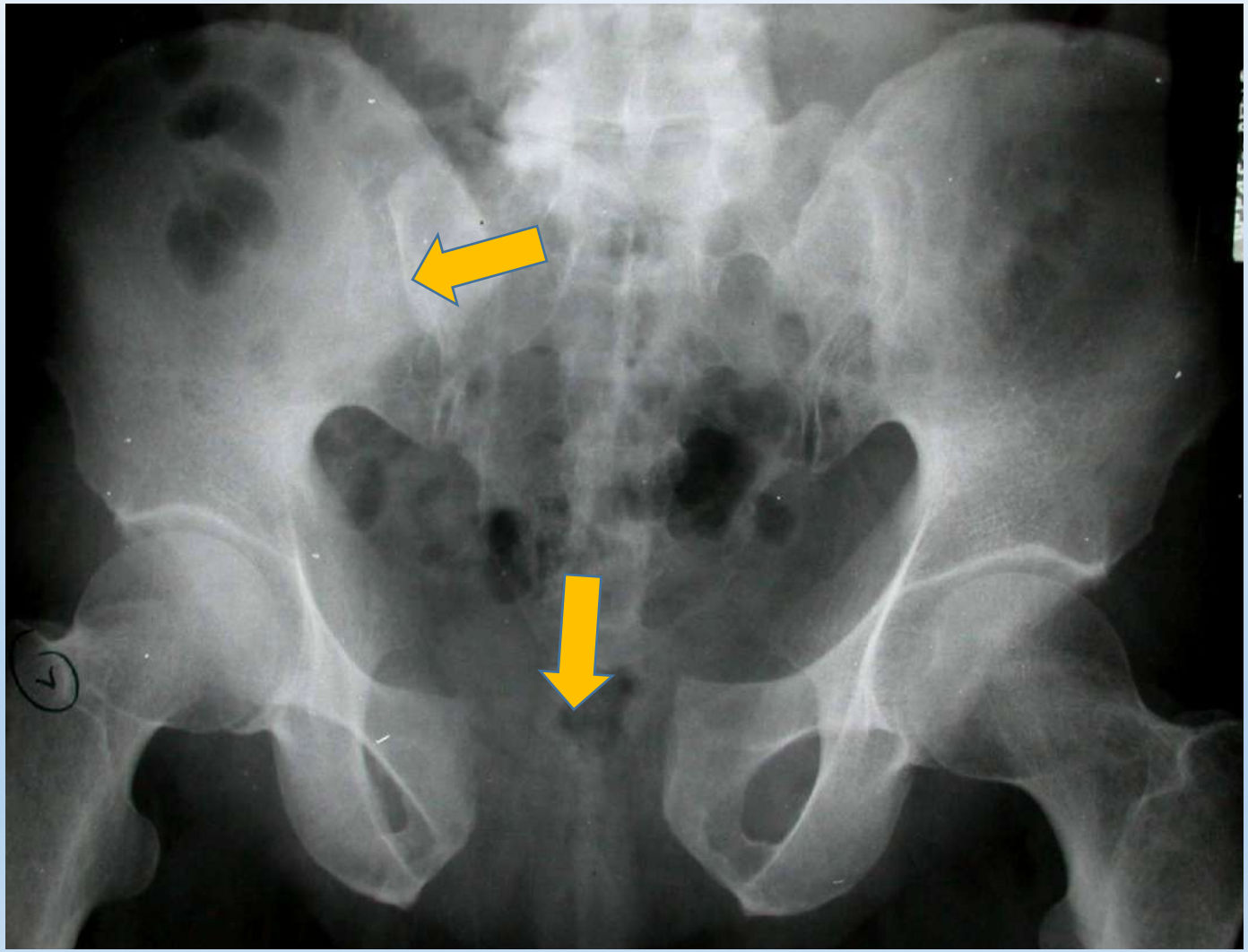


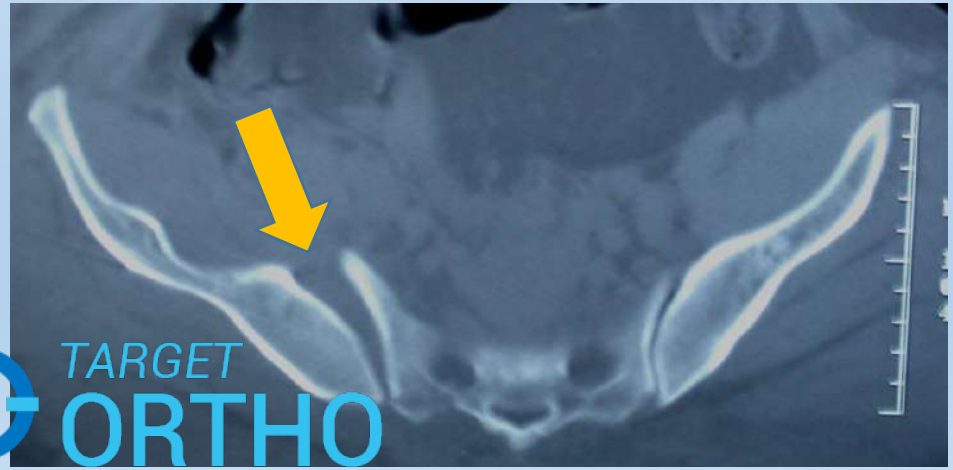
- Sacrotuberous,
- Sacrospinous, and
- Anterior SI joint ligaments

disrupted (post SI ligaments intact)

AP COMPRESSION, TYPE II

- Pubic diastasis >2.5 cm,
- Anterior SI joint disruption
  External rotation
- Rotationally unstable, vertically stable

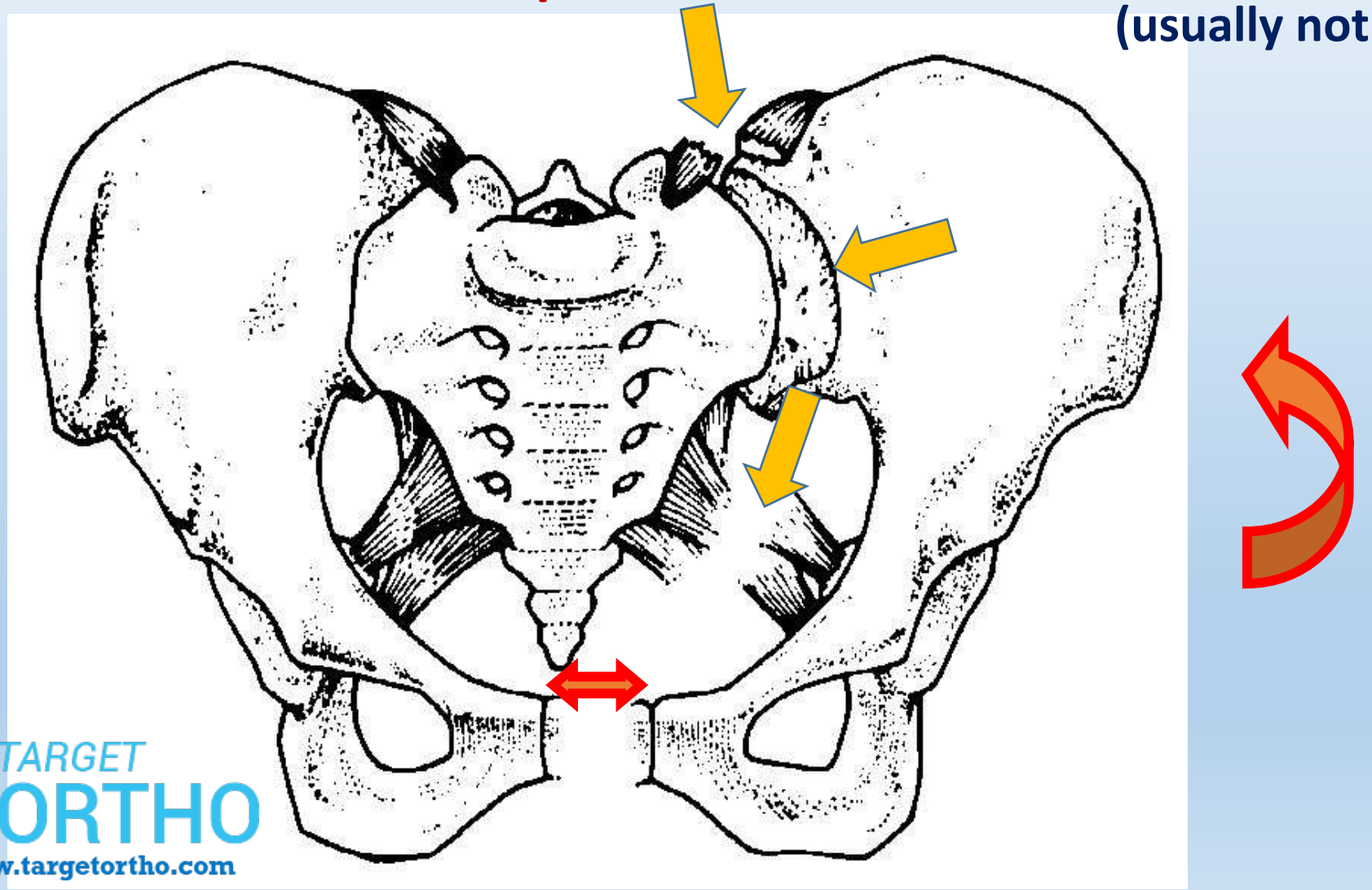




AP COMPRESSION, TYPE III

Complete ilio-sacral dissociation

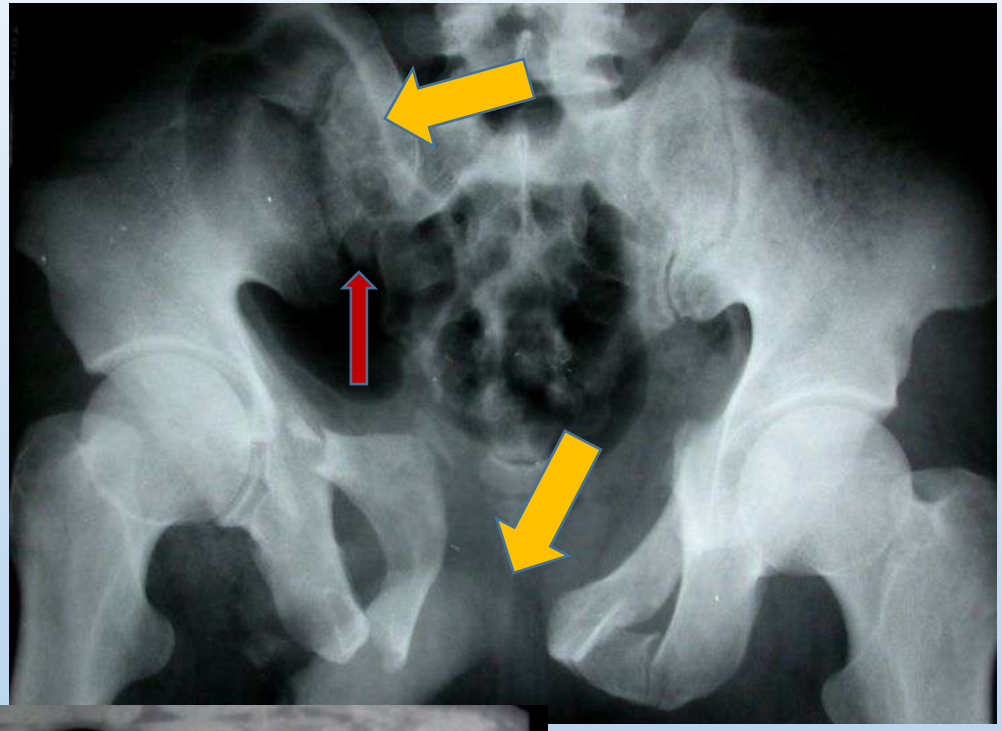
(usually not vertically displaced)



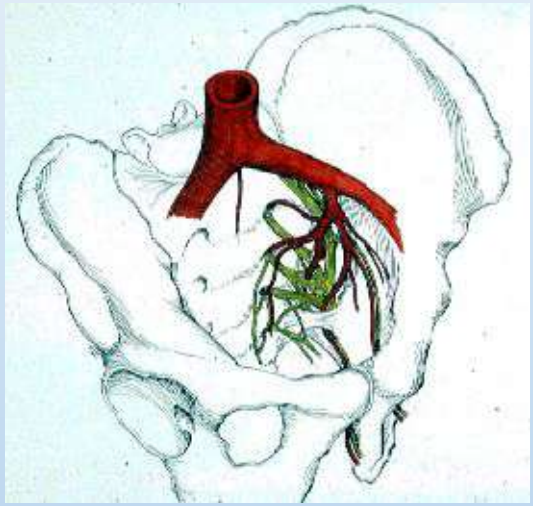
AP COMPRESSION, TYPE III

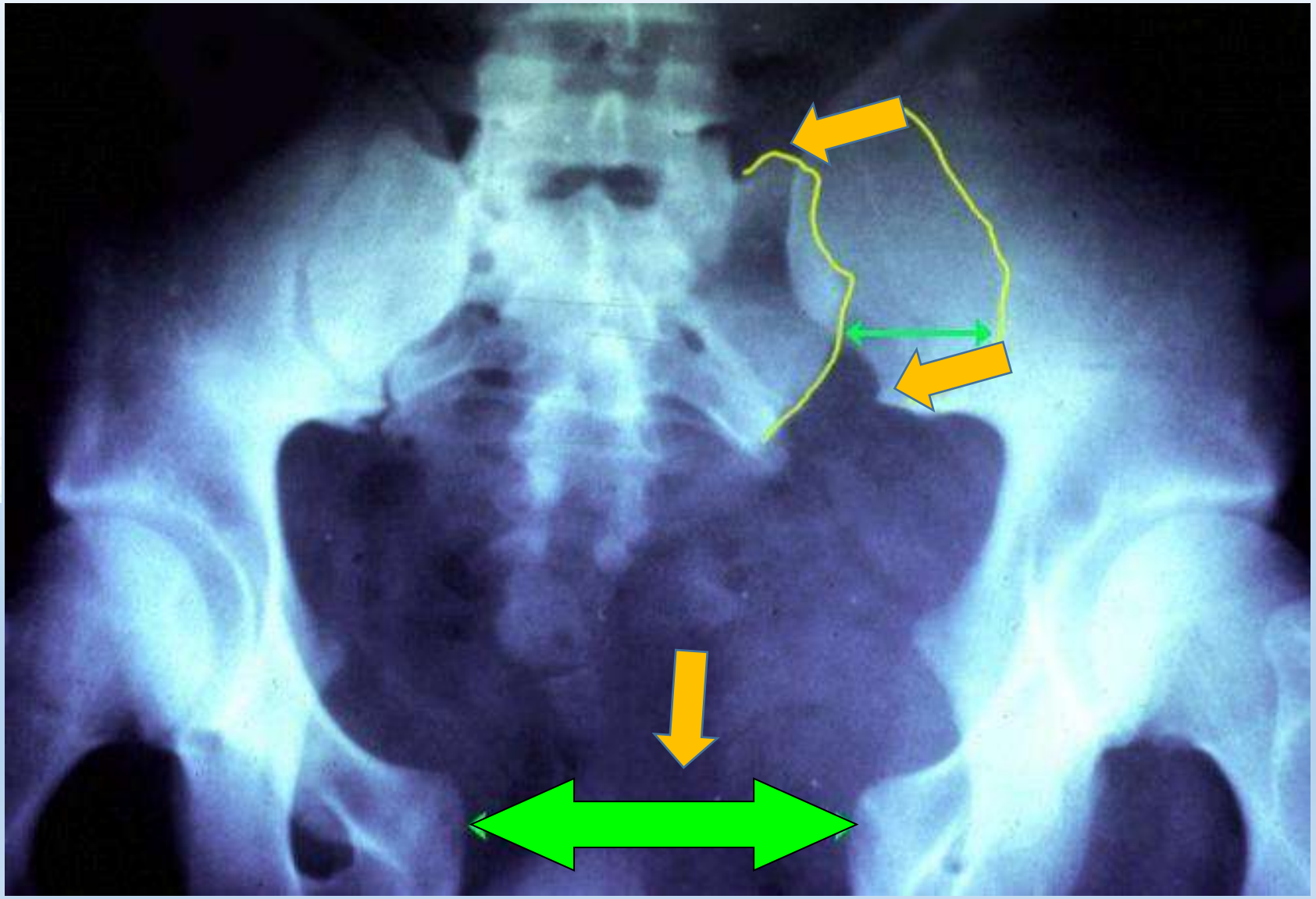
Type II plus posterior SI joint disruption

- **External rotation**
- **Rotationally unstable,**
- **Vertically unstable**



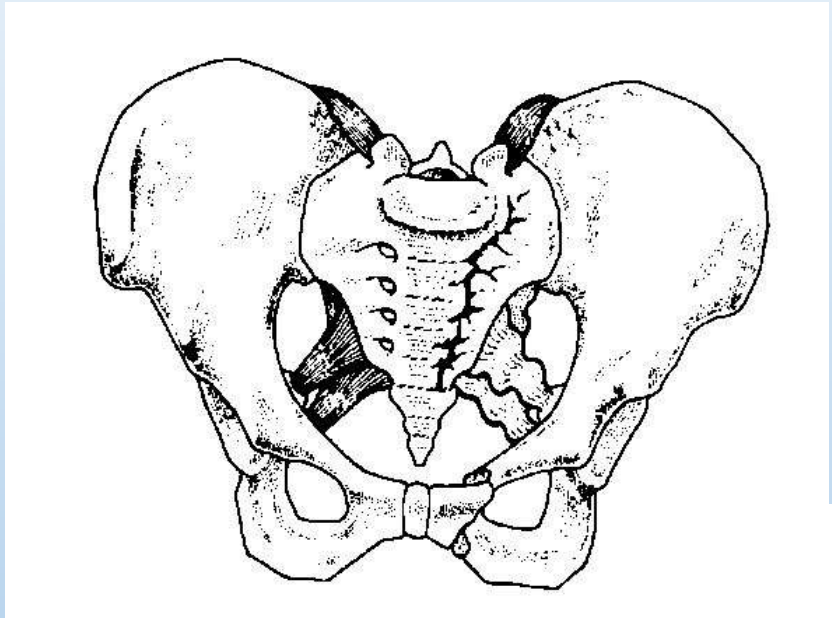
AP COMPRESSION, TYPE III

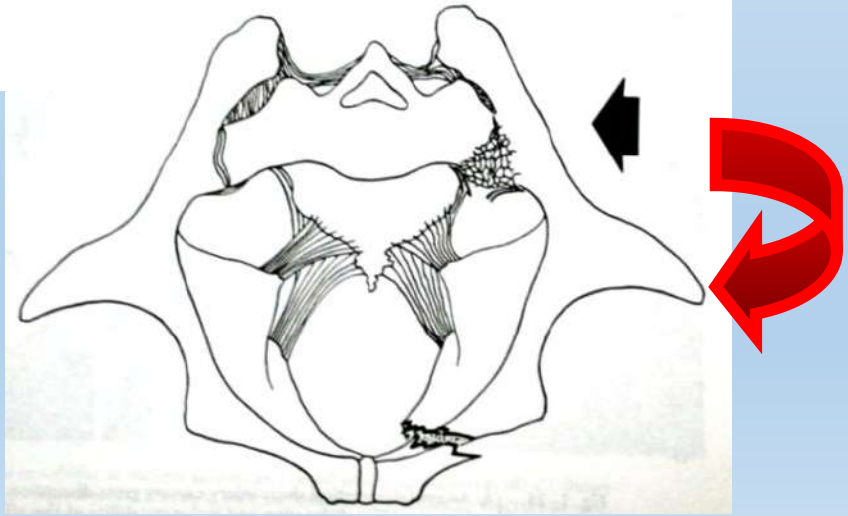




LATERAL COMPRESSION INJURY

By side hit as to a pedestrian, common Injuries

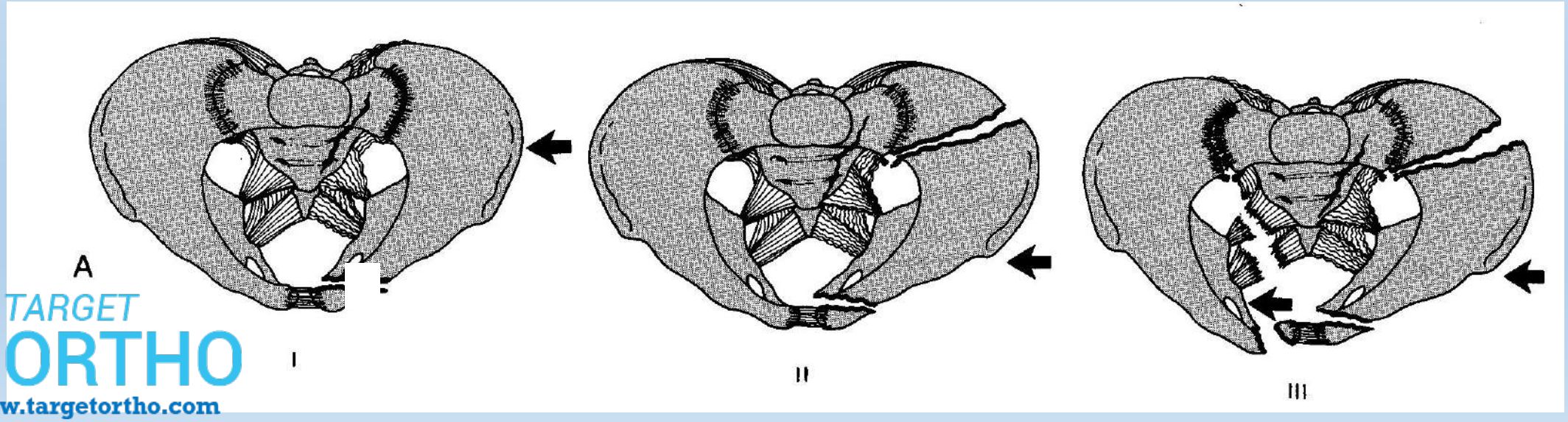




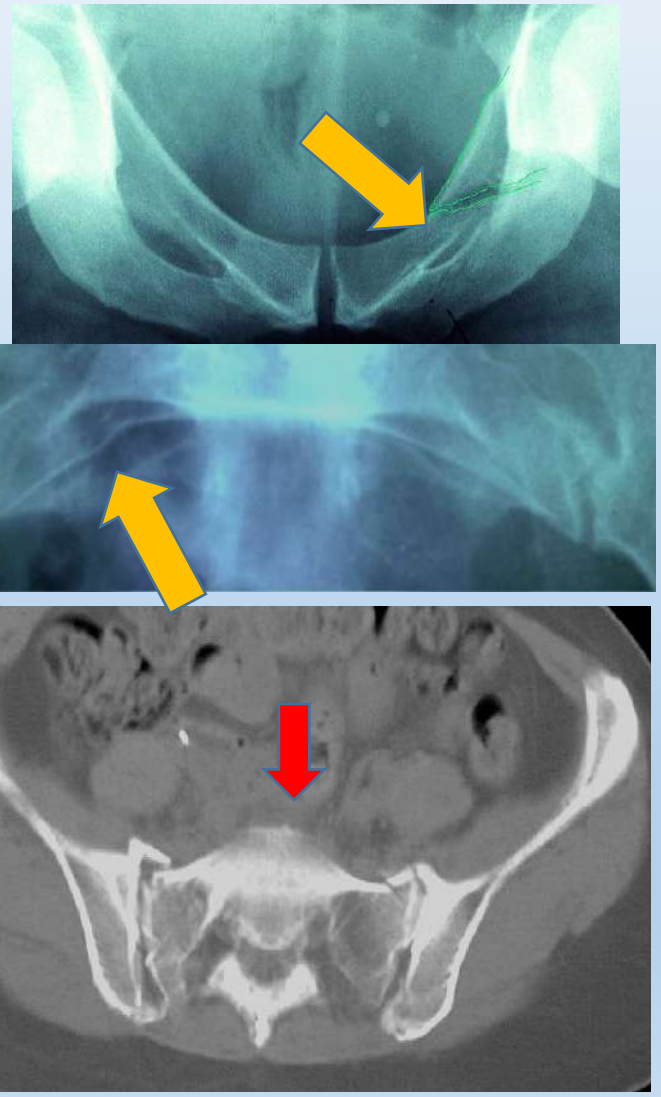
LATERAL COMPRESSION INJURY

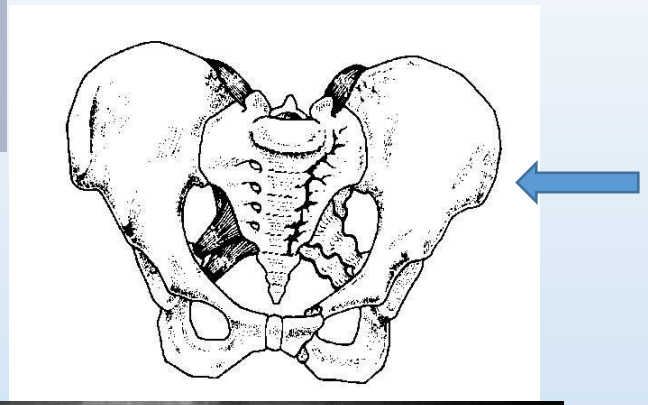
Most common pattern.

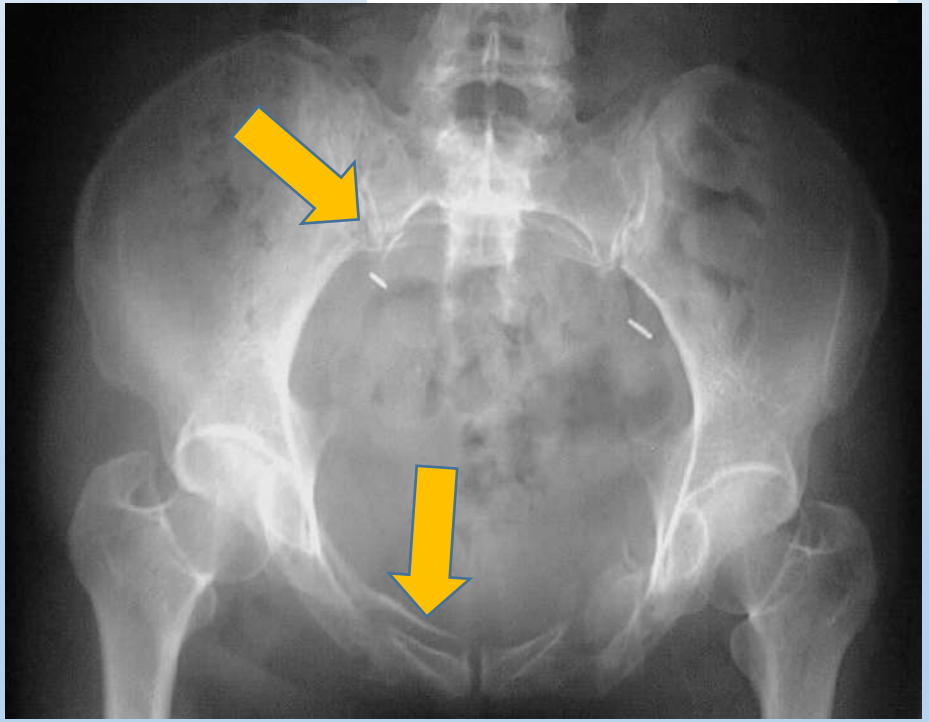
- **LC1 – stable, load to posterior ring.**
- **LC2 – load to anterior ring, posterior ligaments injured, ST and SS intact.**
- **LC3 – LC2 + external rotation injury of the other side.**



LATERAL COMPRESSION-I





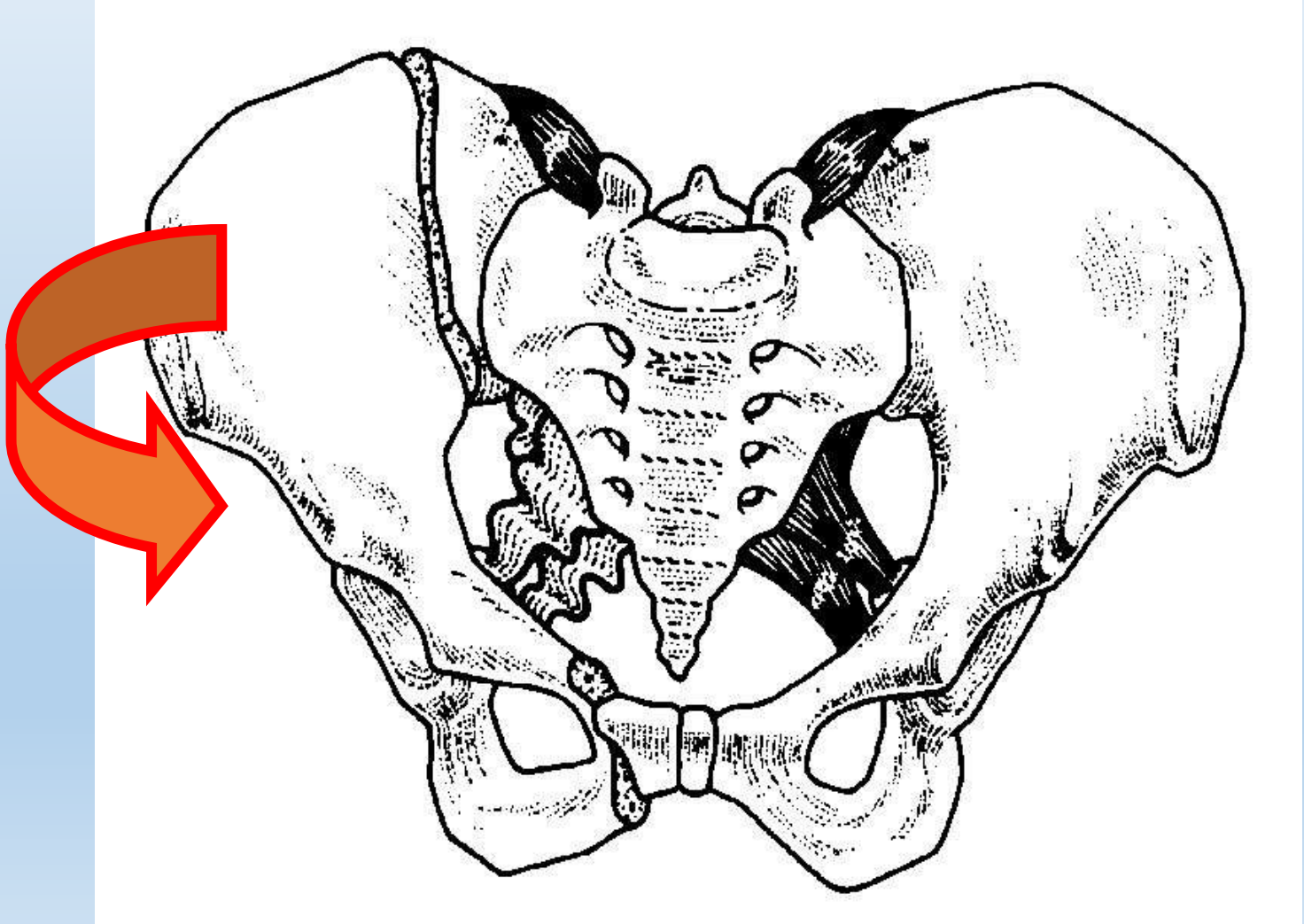


Stable, load to posterior ring.

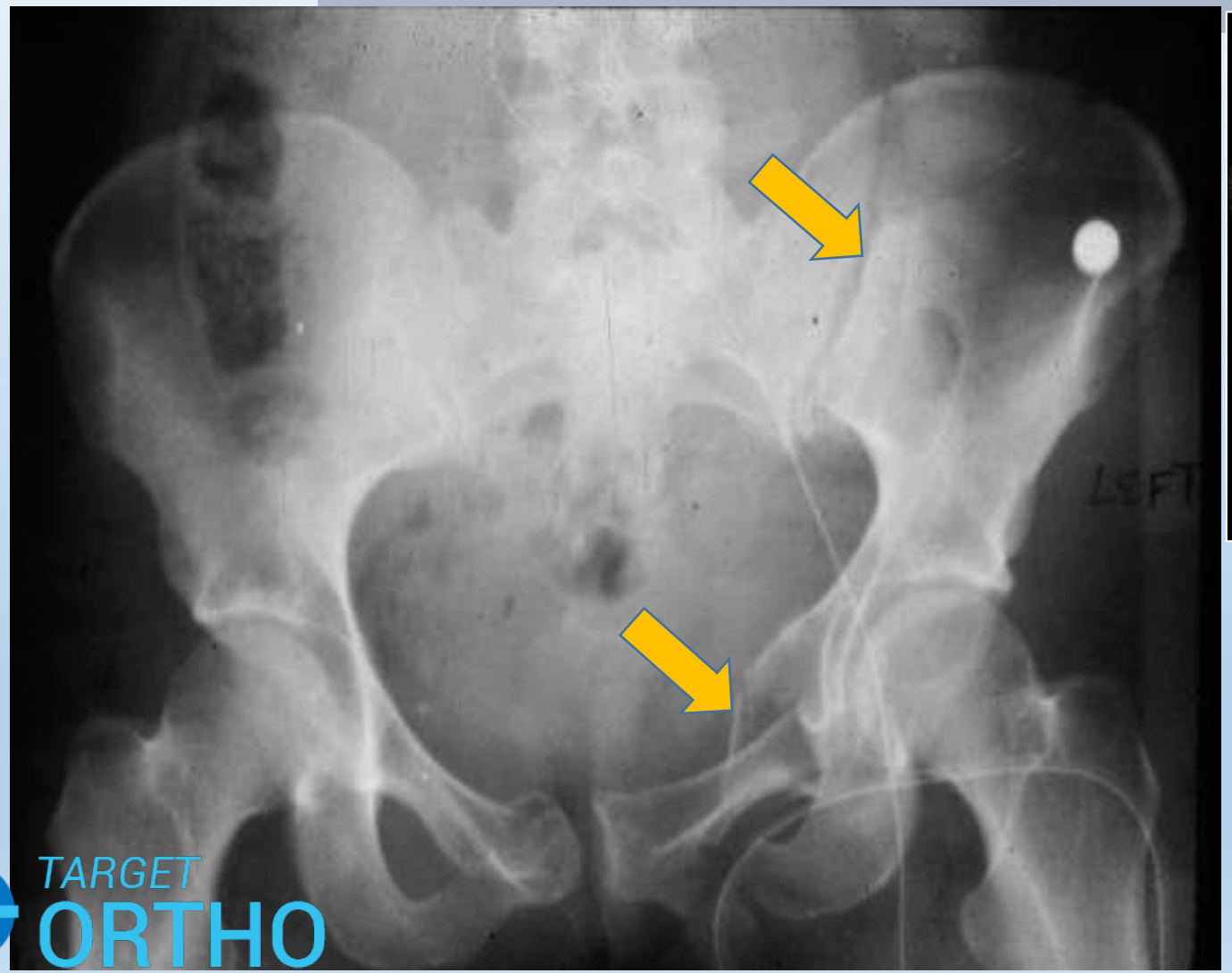
LATERAL COMPRESSION II

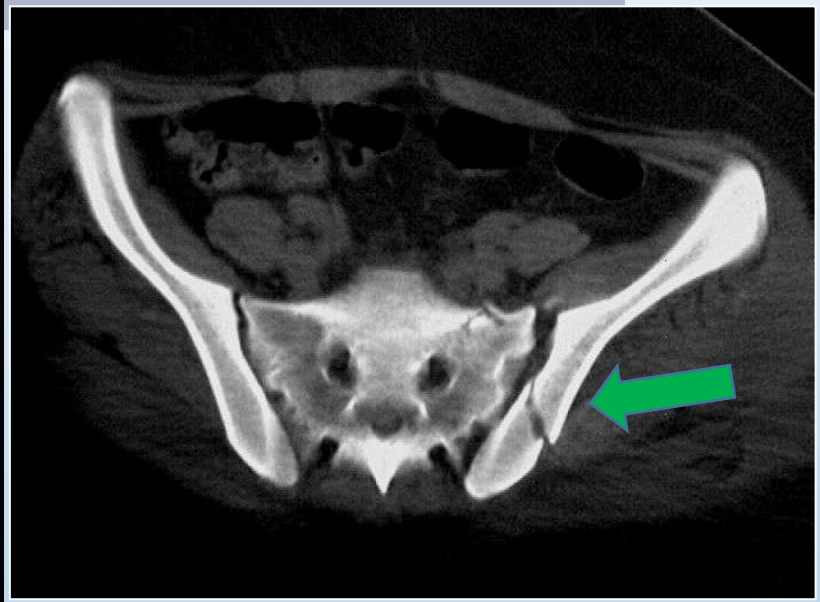
LC II: Iliac wing fracture

load to anterior ring, posterior ligaments injured, ST and SS intact



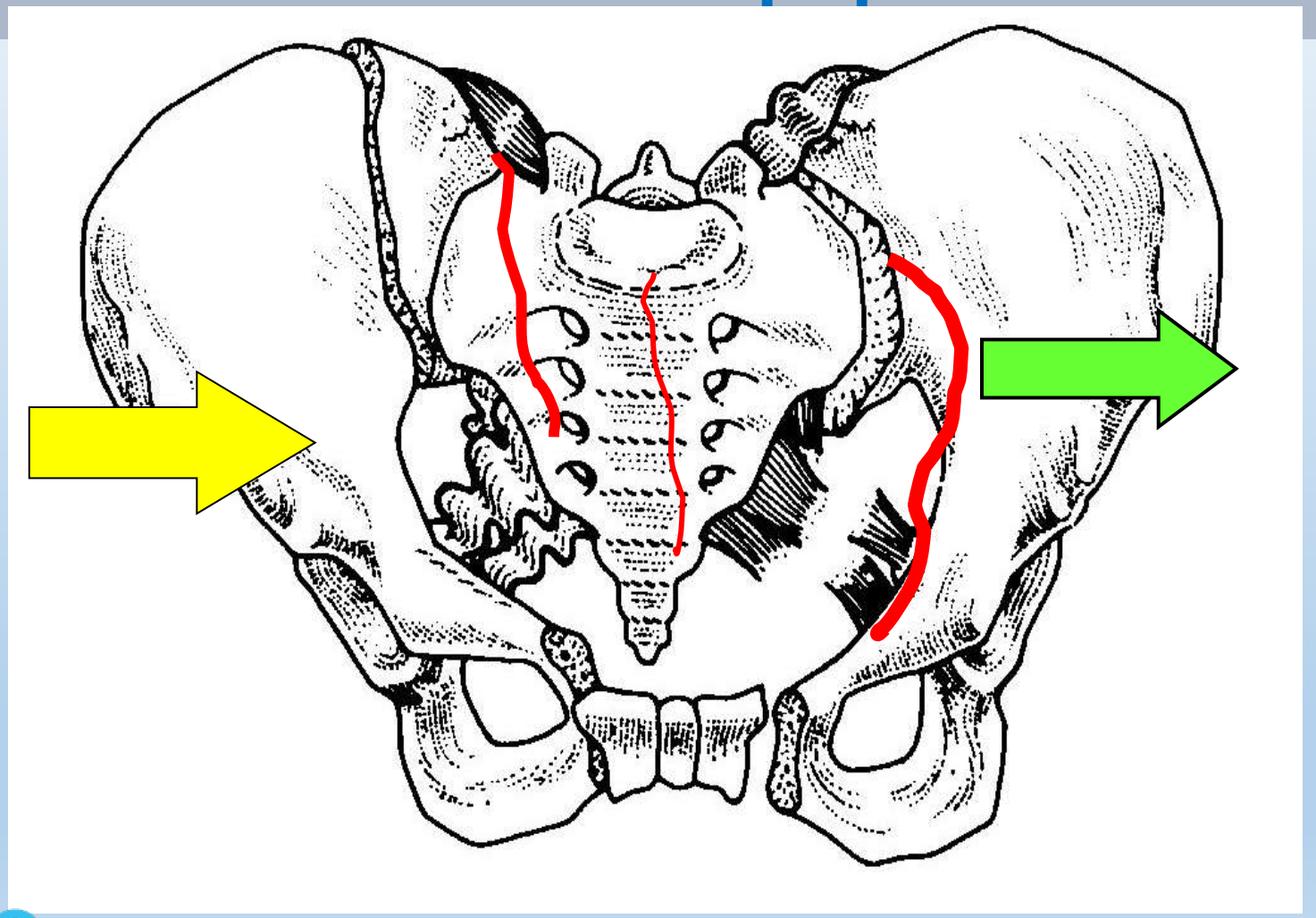
LATERAL COMPRESSION-II





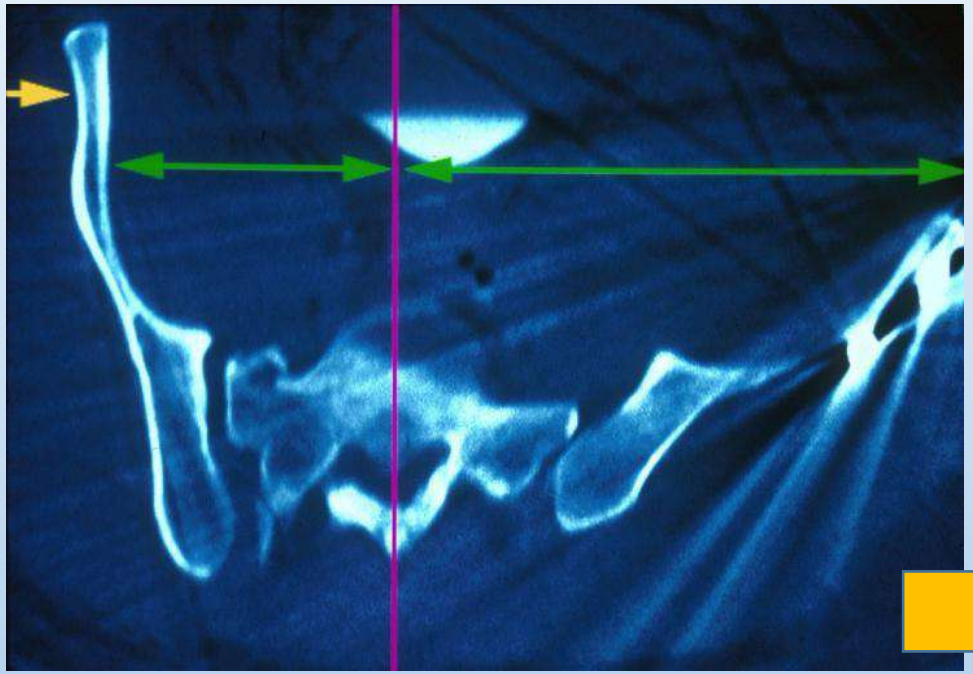
LATERAL COMPRESSION III

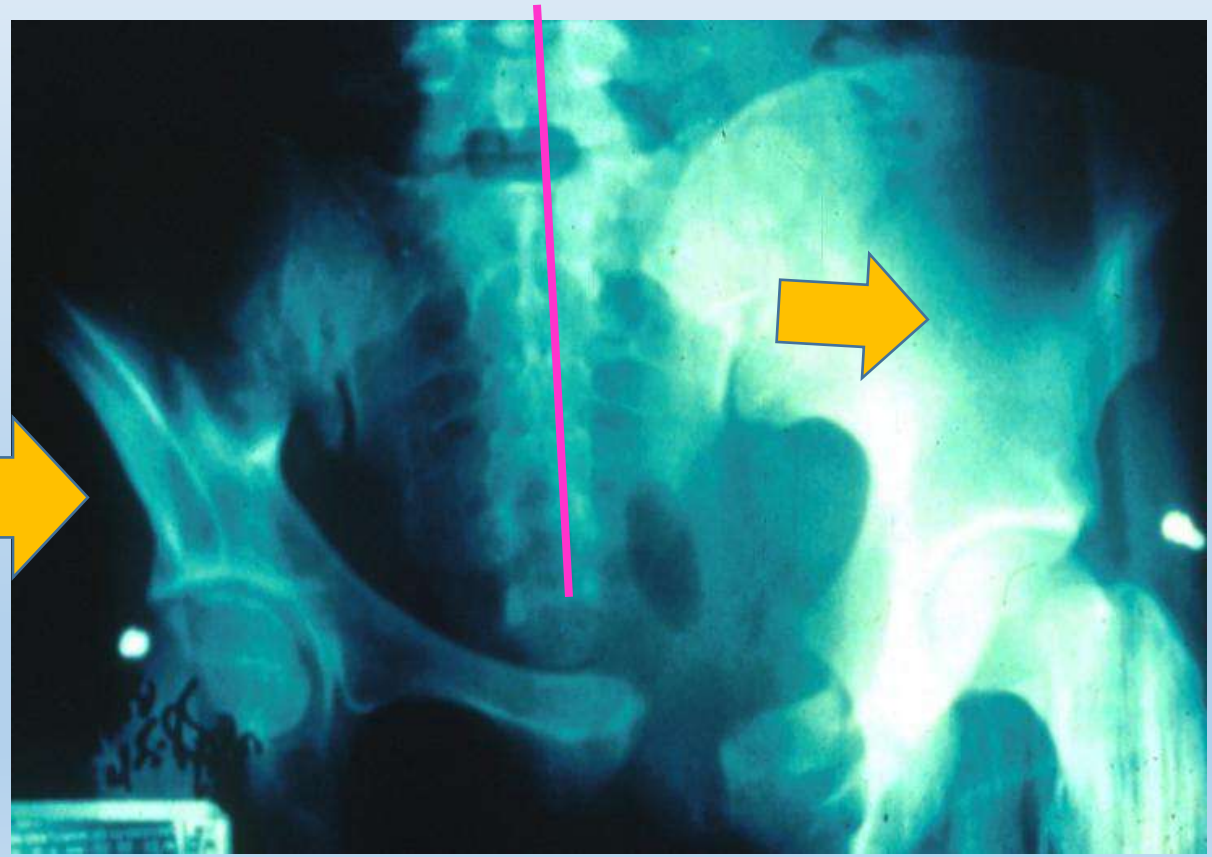
" Windswept pelvis"



LC3 – **LC2 + External Rotation Injury of the other side.**

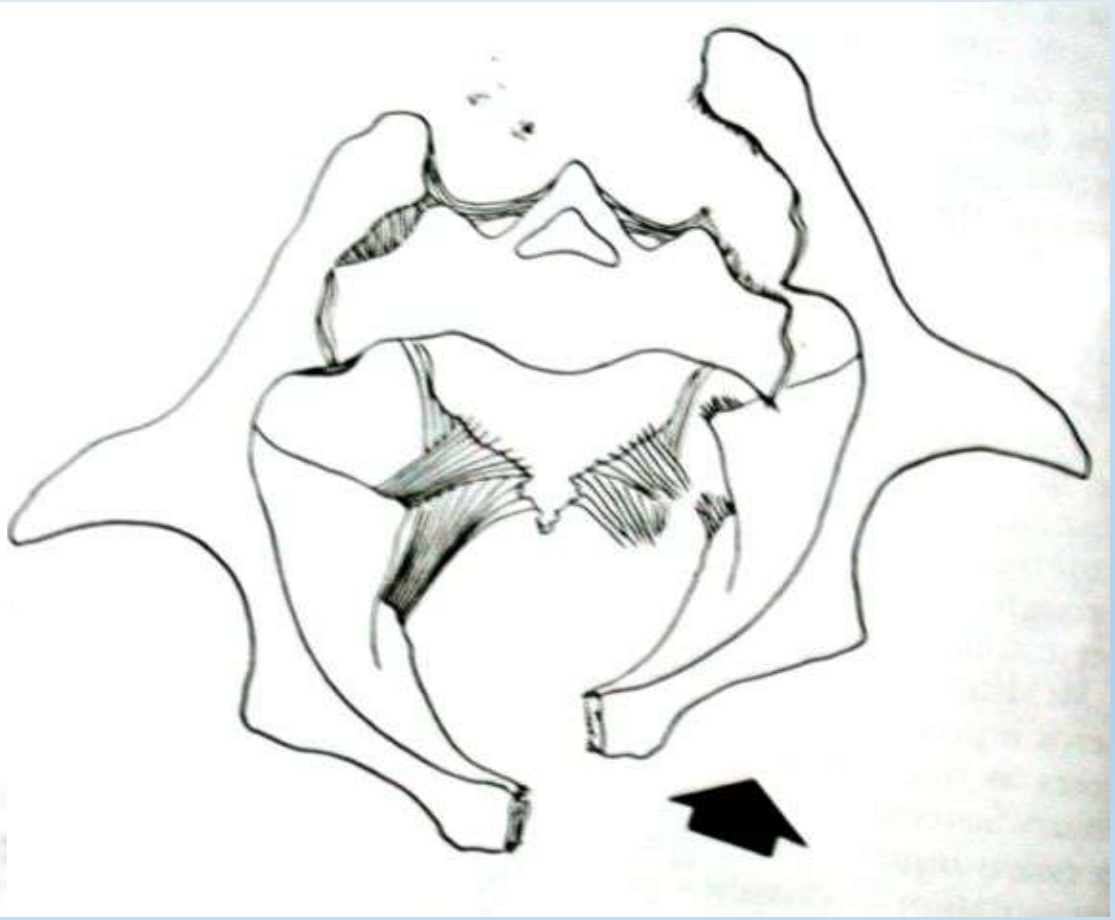
LATERAL COMPRESSION III





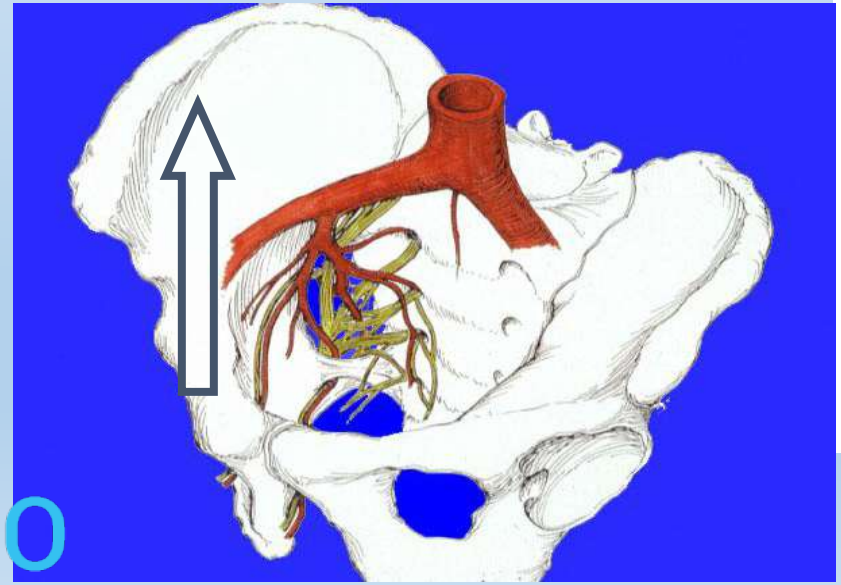
VERTICAL SHEAR INJURY

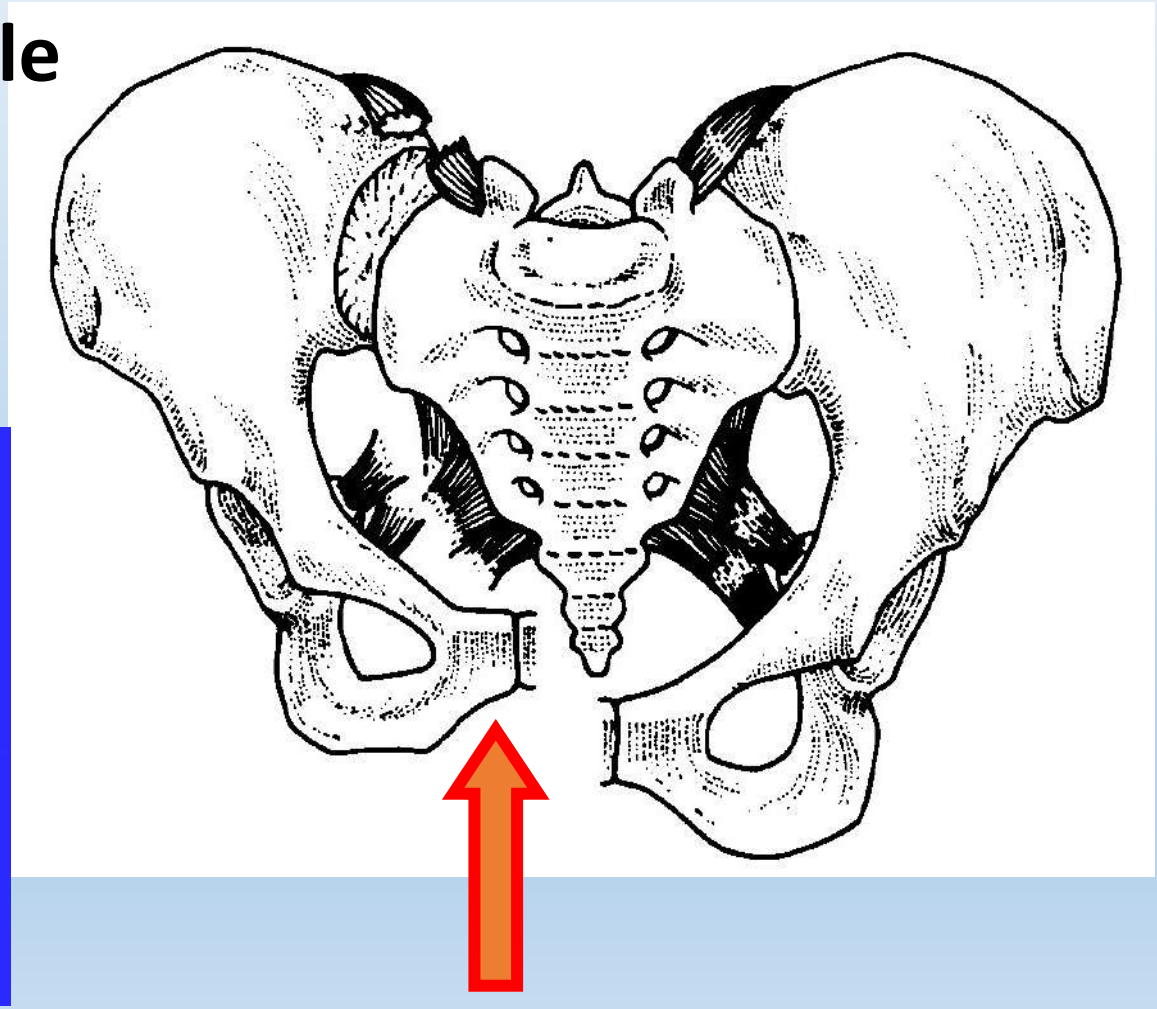
By Fall from height : Fractures vertically oriented, Through joints / syndesmosis / bones, Whole hemi-pelvis displaced s



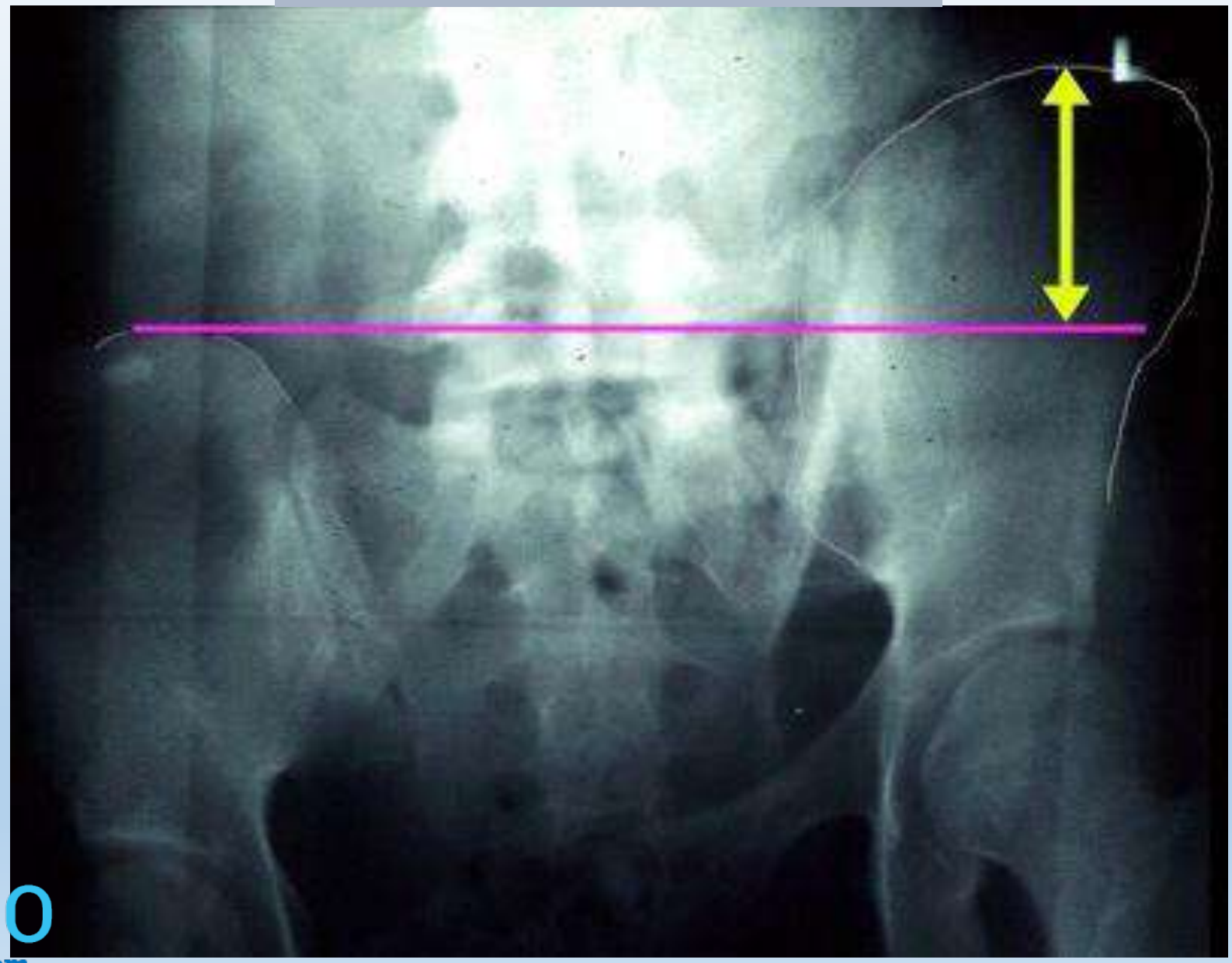
VERTICAL SHEAR

Ant. symphsis or vertical rami fractures-post. Injury variable
Vertical displacement
Vertically unstable –
due to a unilateral injury.



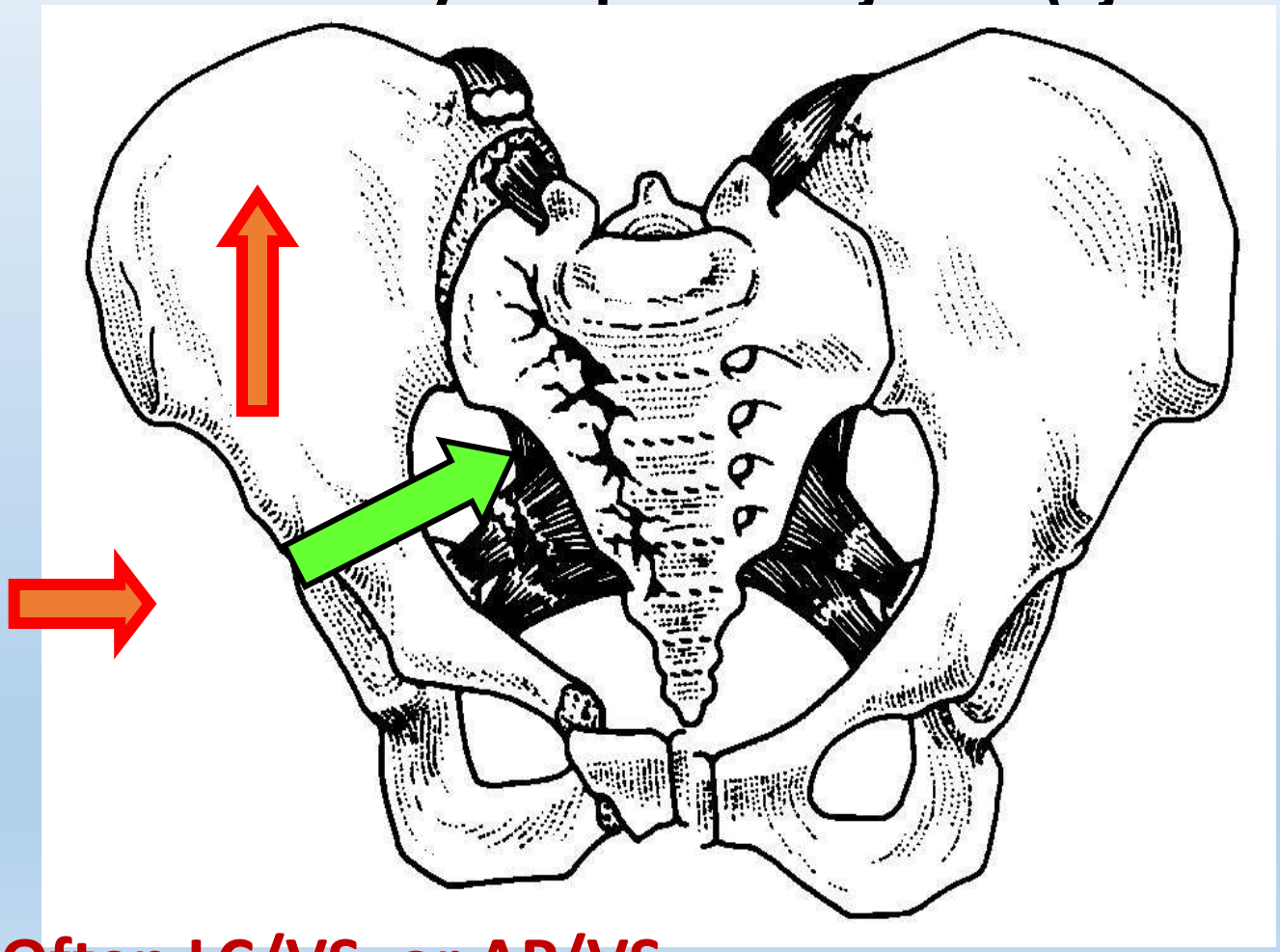


VERTICAL SHEAR



COMBINED MECHANICAL INJURY

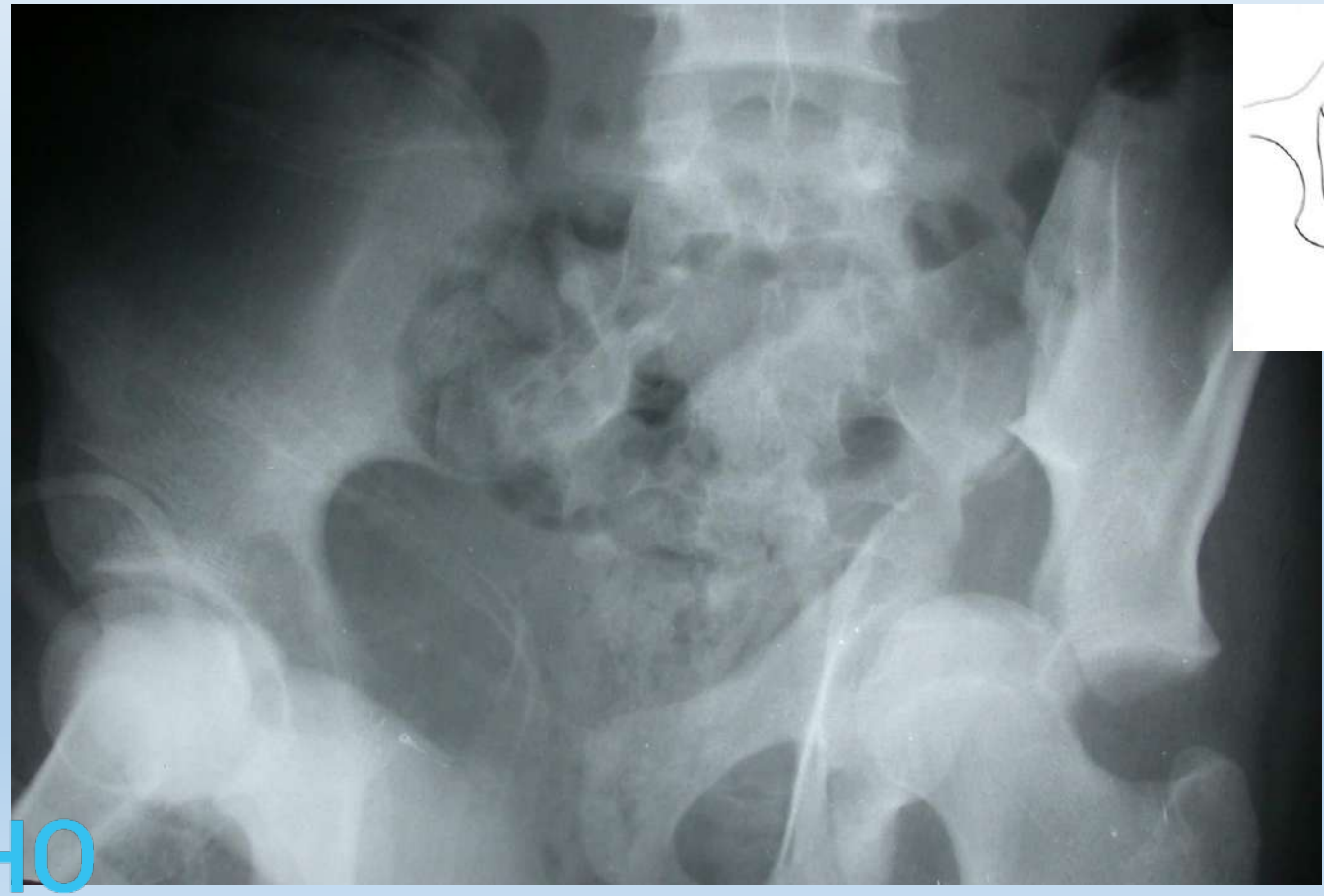
Combined vectors occasionally 2 separate injuries (ejection/landing)



Often LC/VS, or AP/VS

COMBINED MECHANICAL INJURY

In MVA : Combination of vectors of the forces causing injury, Multiple fracture patterns



Interobserver Reliability of the Young-Burgess and Tile Classification Systems for Fractures of the Pelvic Ring

Henry Koo, MD, FRCS(C), Mike Leveridge, MD,* Charles Thompson, MD,* Rad Zdero, PhD,† Mohit Bhandari, MD, FRCS(C),‡ Hans J. Kreder, MD, FRCS(C),§¶ David Stephen, MD, FRCS(C),§¶ Michael D. McKee, MD, FRCS(C),*§ and Emil H. Schemitsch, MD, FRCS(C)*†§*

Objectives: The purpose of this study was to measure interobserver reliability of 2 classification systems of pelvic ring fractures and to determine whether computed tomography (CT) improves reliability. The reliability of several radiographic findings was also tested.

Key Words: interobserver, reliability, classification, fracture, pelvis, radiographs

(*J Orthop Trauma* 2008;22:379–384)

Young-Burgess system may be optimal for the learning surgeon.

Tile classification system, of particular benefit for those people who have specialty training in pelvic and acetabular surgery.

0022-5282/90/3007-0848$02.00/0
THE JOURNAL OF TRAUMA
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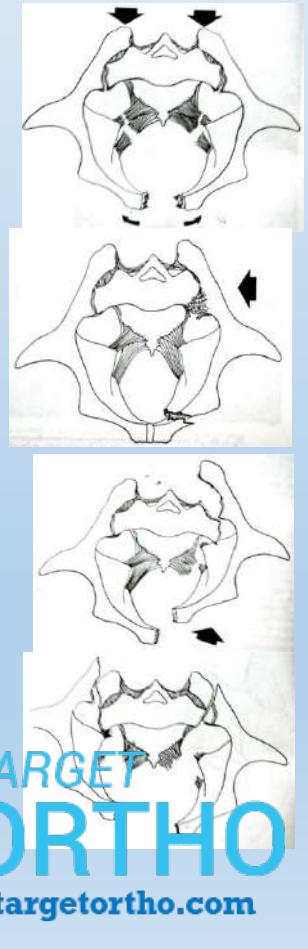
Vol. 30, No. 7
Printed in U.S.A.

Pelvic Ring Disruptions: Effective Classification System and Treatment Protocols

ANDREW R. BURGESS, M.D.*, BRIAN J. EASTRIDGE, M.D.,† JEREMY W. R. YOUNG, M.D.†, T. SCOTT ELLISON, M.D.*, P. STRIBLING ELLISON, JR., M.D.*, ATTILA POKA, M.D.*, G. HOWARD BATHON, M.D.*, AND ROBERT J. BRUMBACK, M.D.*

YOUNG AND BURGESS CLASSIFICATION



Blood replacement averaged 5.9 units (LC -3.6 units; APC-14.8 units; VS-9.2 units, CMI-8.5 units).

No patient with an isolated or vertical shear pelvic injury died.

The predictive values of classification system and treatment protocols based on it reduce the morbidity and mortality related to pelvic ring disruption

SUMMARY

- In managing pelvic ring injuries, the most important biomechanical consideration is stability.
- The determination of pelvic stability and the related injury classification help to guide treatment.
- That is, every unstable pelvis does not require an operation.
- Pelvic stability is just one factor to be included in the analysis of risks and benefits necessary for each individual patient

THANK YOU