



# Pelvic Trauma

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# ***Introduction***

- **Common in setting of multi-trauma patients**
  - **25% of rapidly fatal MVA's complicated by pelvic fractures.**
- **May be associated with multiple comorbid injuries**



UAB, 2002



# Etiology & pathogenesis

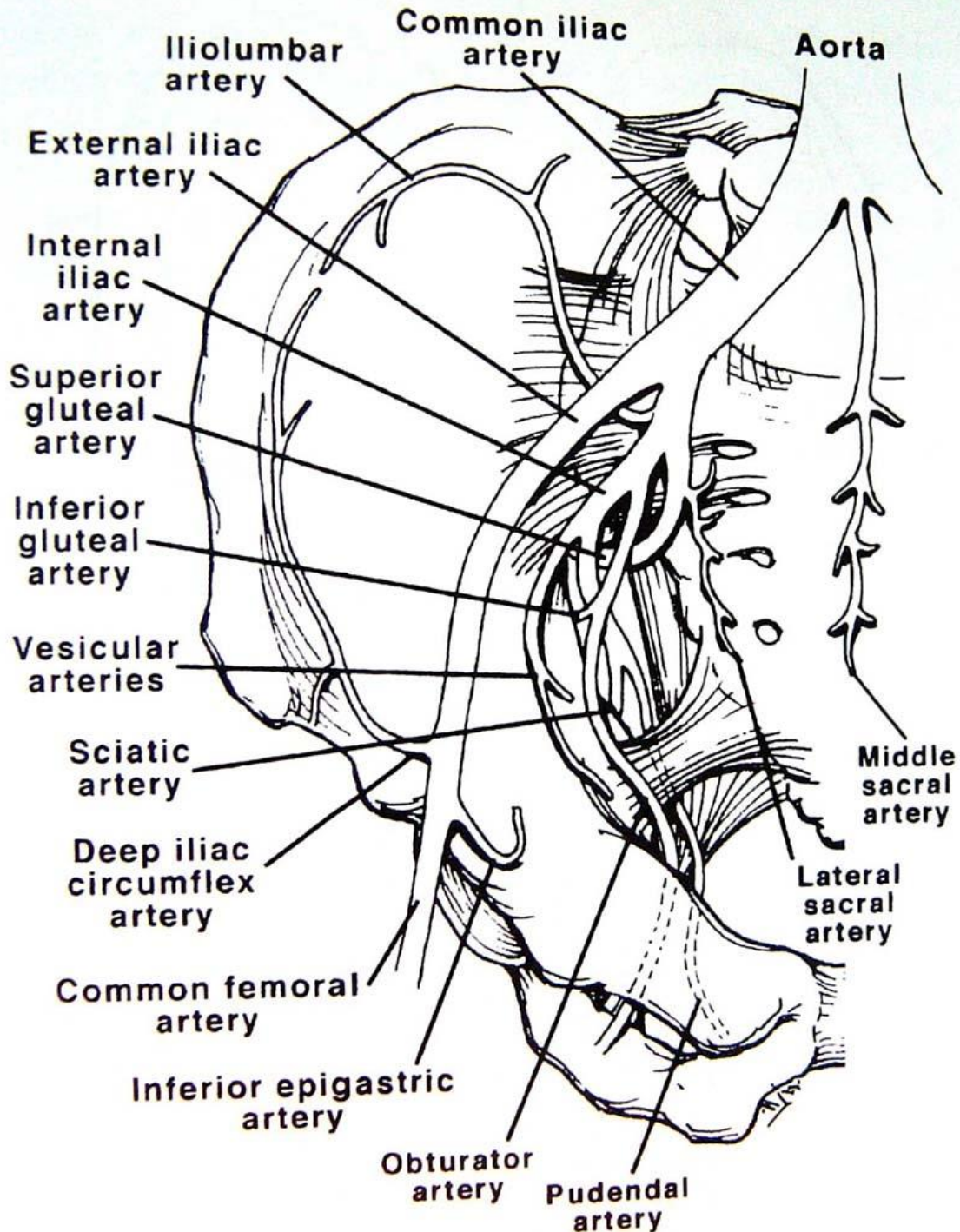
- **Most commonly due to MVA**
- **falls, crush injuries, tumor, metabolic bone disease, sports also possible**



# Importance

- **1. Complex anatomic relation, pathway of nerves and vessels networks.**
- **2. Substantial force.**
- **3. There are many organs in it.**
- **4. Connects to abdominal and retroperitoneal space.**





# Associated injuries

- The pelvic fracture itself is not usually the major cause of morbidity or mortality.
- Outcome is determined by concomitant injuries.
  - hemorrhage from other sites
  - head injury
  - sepsis or multiple-organ failure
  - pulmonary injury or PE
  - pelvic hemorrhage



# Diagnosis

- **1. General: abrasion, contusion, hematoma, over bony prominence of pelvis, scrotal, vulvar hematoma.**
- **2. PE: Rectal vaginal laceration**
- **3. X-ray**
- **4. CT for fracture and to r/o retroperitoneal hemorrhage.**



# Approach to the patient with a pelvic fracture...

- **ABCD's**
- **grossly unstable patients with free fluid require emergent laparotomy**





# Approach to the patient with a pelvic fracture...

- Intravenous resuscitation
- Physical Examination
  - Inspect
  - Palpate
  - GU/GI injuries
  - Vascular, Neurological
  - Imaging



# Approach to the patient with a pelvic fracture...

- **Inspection:**
  - **leg-length discrepancy**
  - **malrotated pelvis**
  - **concomitant LE injuries**
  - **neurovascular status**
  - **massive butt or flank contusions and swelling may indicate significant bleeding.**
  - **Open fracture?**



# Approach to the patient with a pelvic fracture...

- **Palpation**
  - **for stability:**
    - “the first clot is the best clot”
  - **for bony discontinuity**
    - **posterior: hematomas, fractures, SI dislocation**
    - **anterior: symphysis disruption**



# Approach to the patient with a pelvic fracture...mgt of the vascular injury

- fluid resuscitation
- External fixator
- Angiography/embolization
- emergent laparotomy  $\pm$  ORIF
  - beware losing tamponade!
- C Clamp
- Distal femoral traction
- MAST
- Sheet



# Approach to the patient with a pelvic fracture...Vascular injury

- **Hemodynamics: beware hemorrhage, especially retroperitoneal**
  - posterior pelvic venous plexus
  - External or internal iliac vessel
  - superior gluteal artery
  - open book fractures associated with high incidence of retroperitoneal hemorrhage



# Approach to the patient with a pelvic fracture... Neurologic injury

- Lumbosacral plexus, nerve roots, sciatic nerve
- vertical shear injuries



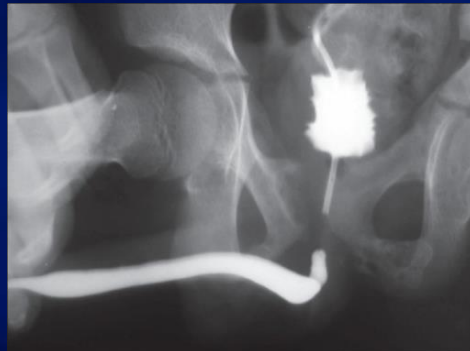
# Open fractures

- **fracture stabilization**
- **hemorrhage control**
- **resuscitation**
- **Anterior, lateral wounds -usually not contaminated**
- **Posterior, perineal--rectal, urinary, vaginal contamination common**
- **Colostomy may be necessary**



# Approach to the patient with a pelvic fracture... GI / GU injury

- Anterior-posterior injuries
- Bladder: 20%
- Urethral 10%
  - M > F
  - blood at meatus or upon catheterization
  - hi-riding prostate on DRE
  - retrograde urethrogram if needed.





# Approach to the patient with a pelvic fracture... GI / GU injury

- **DRE**
- **rectal, anal, or vaginal perforations due to osseous fragments**
- **GI entrapment and obstruction at fracture site rare**



# Approach to the patient with a pelvic fracture...(cont)

- Imaging
  - CXR, C spine, Abdomen, Pelvis
- Pelvis plain films
  - **AP**
  - **inlet** (rotational deformity or AP displacement)
  - **outlet** (vertical displacement)
  - **obturator, iliac oblique** (acetabular fx)



# Approach to the patient with a pelvic fracture...(Imaging)

- MRI of limited use
- CT demonstrates bony, soft tissue, and ligamentous injuries
  - 3 mm axial cuts from SI jt to acetabulum
  - 1.5 mm cuts thru acetabulum
- Stress views
  - $> 0.5 - 1.0$  cm motion  $\Rightarrow$  instability
  - “push-pull” for vertical instability



# Stability

- Can withstand normal physiological stresses without deformation
- conferred by ligamentous structures
- Unstable lesions classified by direction of instability:
  - rotationally
  - vertically
  - both



# Approach to the patient with a pelvic fracture...Plain XR

- **Signs of instability**
  - **widened symphysis (sacrospinous) (R)**
  - **avulsion of lat sacrum, ischial spine (R)**
  - **sacral fx with gap (V)**
  - **avulsion of L5 TP at iliolumbar ligament (V)**
- **but things are not always as they appear...**



# Classification

- 1. Vectors of injury

Lateral compression

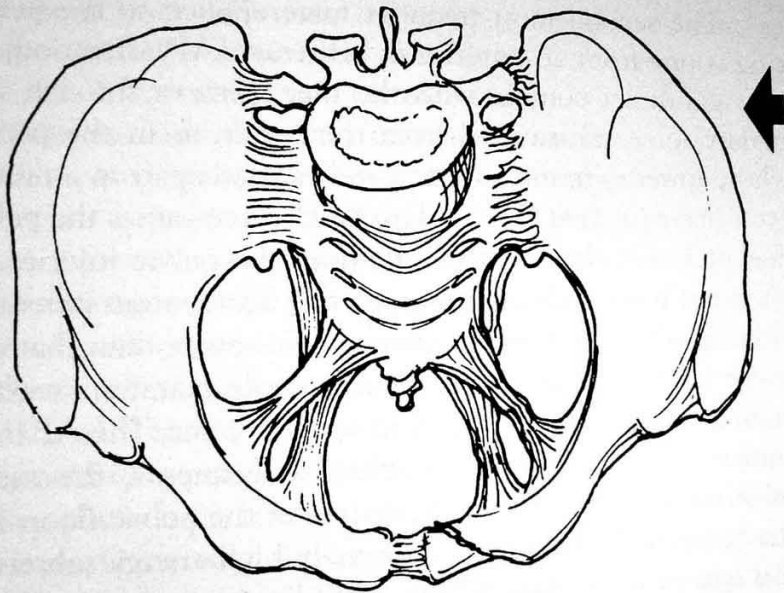
AP-direction

Vertical shear

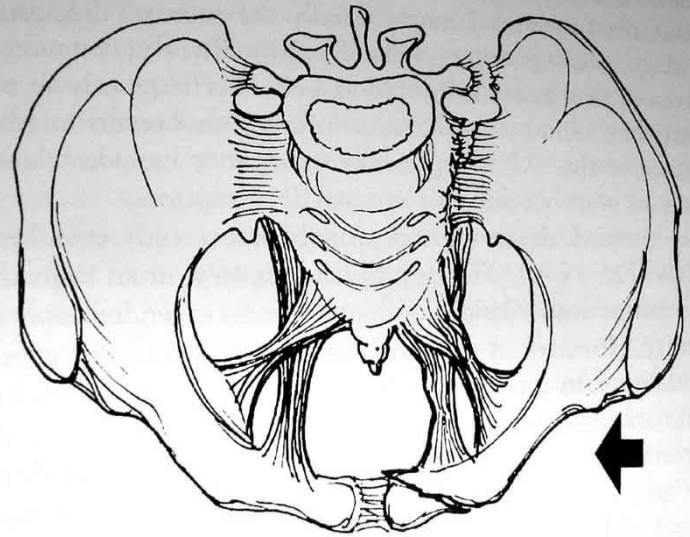
- 2. Young and Burgess's classification scheme—prediction of pelvic fracture related hemorrhage

Young JWR, Burgess AR, Brumback RJ, Poka A: Pelvic fractures: value of plain radiography in early assessment and management. Radiology 160:445, 1986.

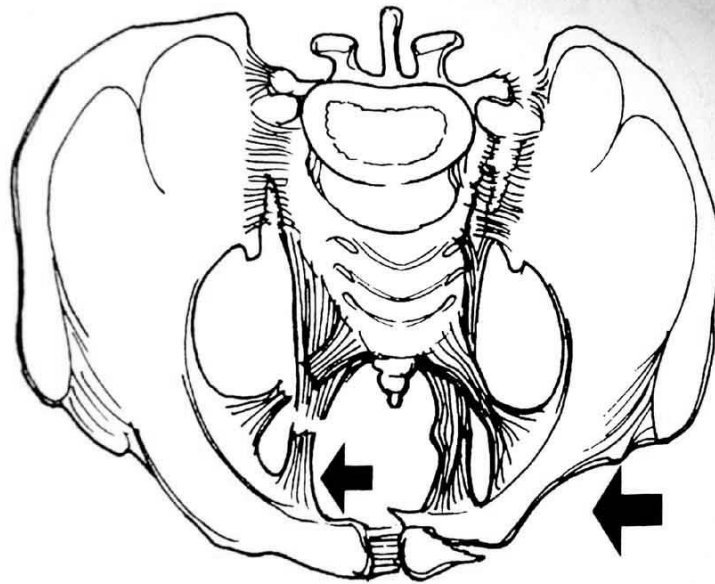




**lateral  
compression  
type I**

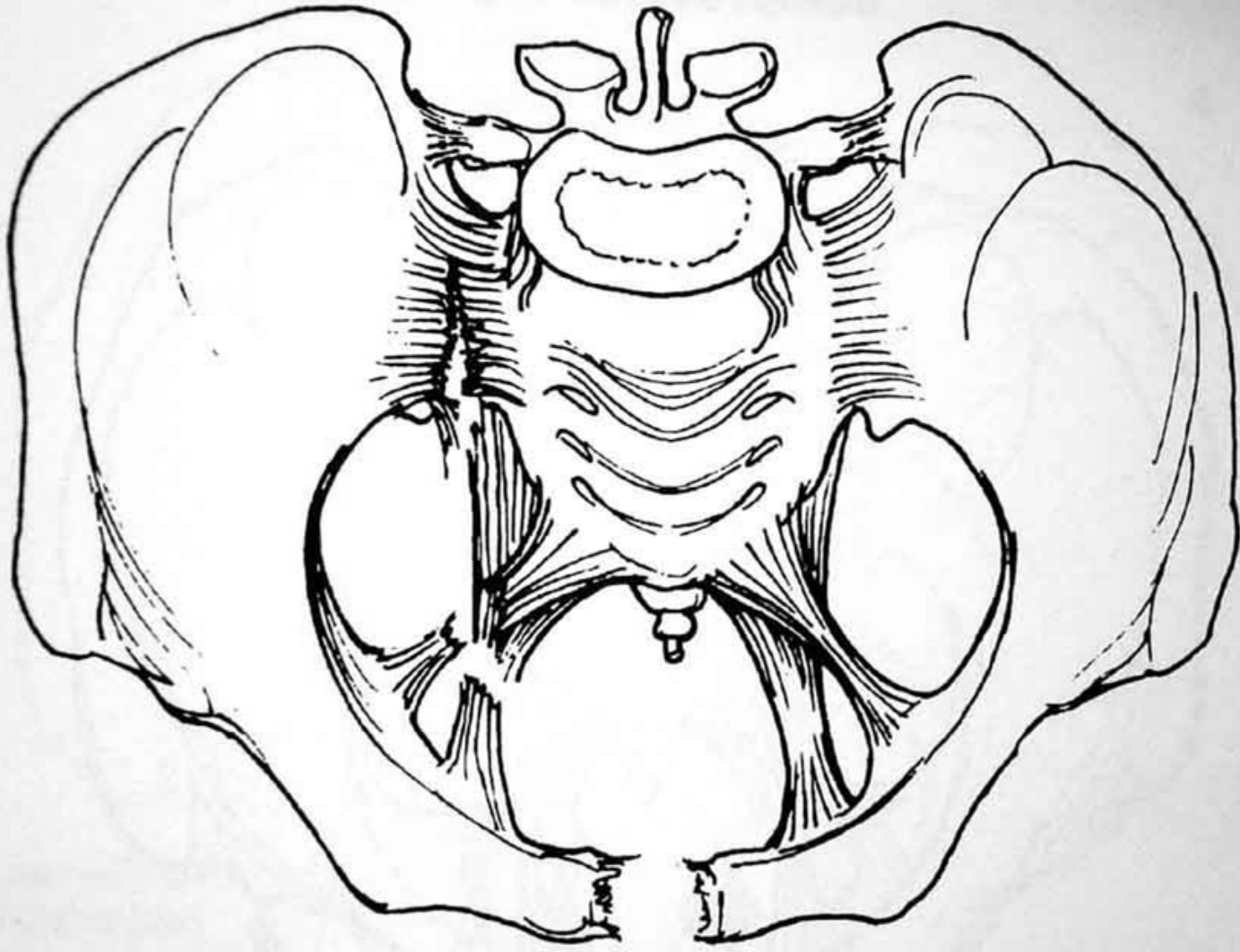


**lateral  
compression type II**



**lateral  
compression type III**

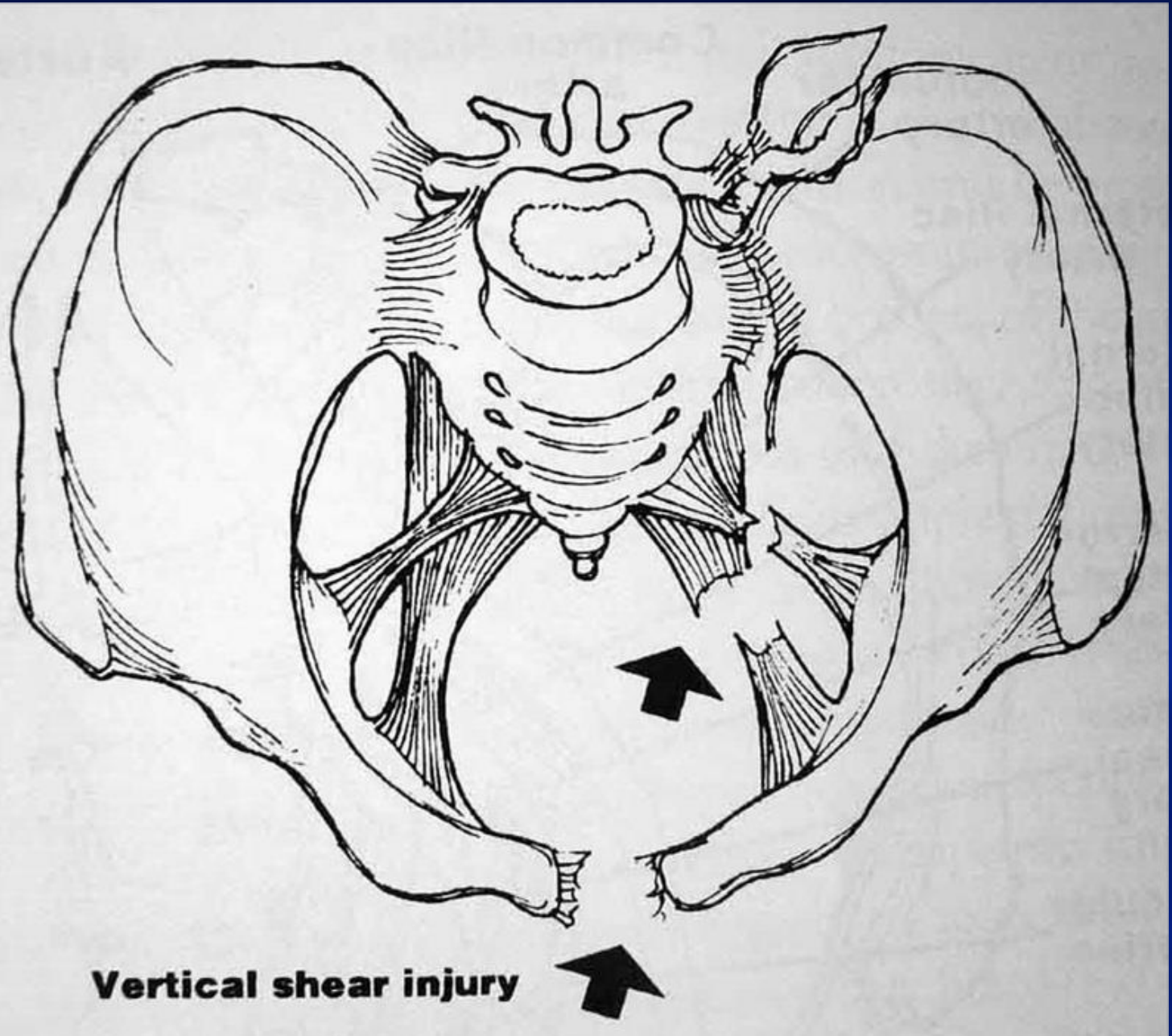




↑ anterior compression







**Vertical shear injury**



**TABLE 37-1. CLASSIFICATION OF PELVIC FRACTURES**

**Anteroposterior Compression**

Type I	Disruption of the pubic symphysis of < 2.5 cm of diastasis; no significant posterior pelvic injury
Type II	Disruption of the pubic symphysis of > 2.5 cm, with tearing of the anterior sacroiliac and sacrospinous and sacrotuberous ligaments
Type III	Complete disruption of the pubic symphysis and posterior ligament complexes, with hemipelvic displacement

**Lateral Compression**

Type I	Posterior compression of the sacroiliac joint without ligament disruption; oblique pubic ramus fracture
Type II	Rupture of the posterior sacroiliac ligament; pivotal internal rotation of hemipelvis on the anterior SI joint with a crush injury of the sacrum and an oblique pubic ramus fracture
Type III	Findings in type II injury with evidence of an anteroposterior compression injury to the contralateral hemipelvis

Source: Young JWR, Burgess AR, Brumback RJ, Poka A: Pelvic fractures: Value of plain radiography in early assessment and management. Radiology 160:445, 1986.

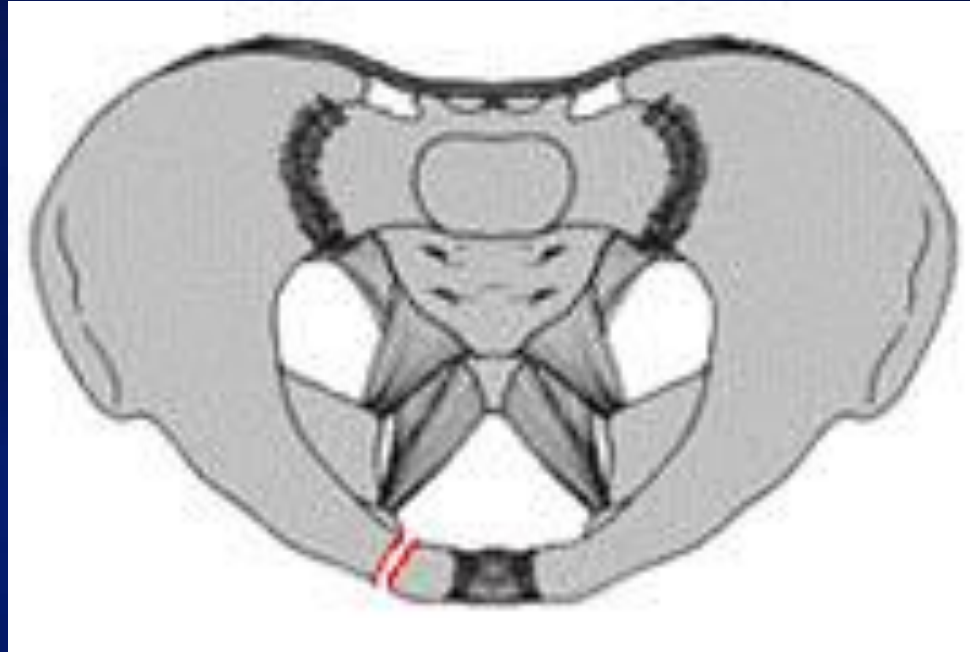


# Orthopaedic Trauma Association

- **Modification of Tile Nomenclature**
- **Types A, B, C**
- **Criterion of STABILITY**
- **A : vertically and rotationally stable**
- **B: rotationally unstable**
- **C: rotationally and vertically unstable**



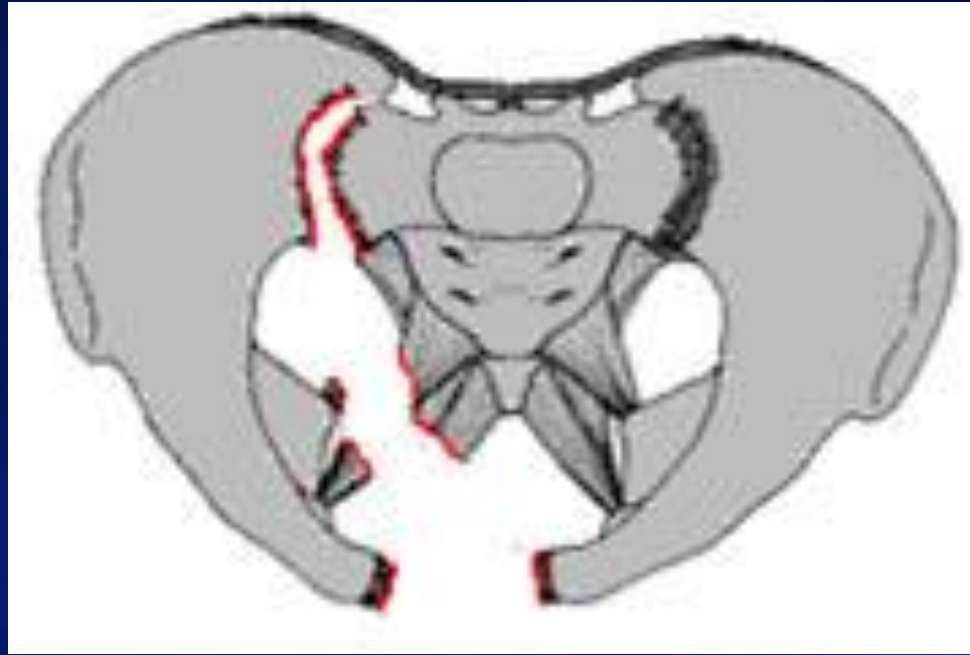
# Tile; OTA



- **Type A : vertically and rotationally stable**
- **posterior ring intact**



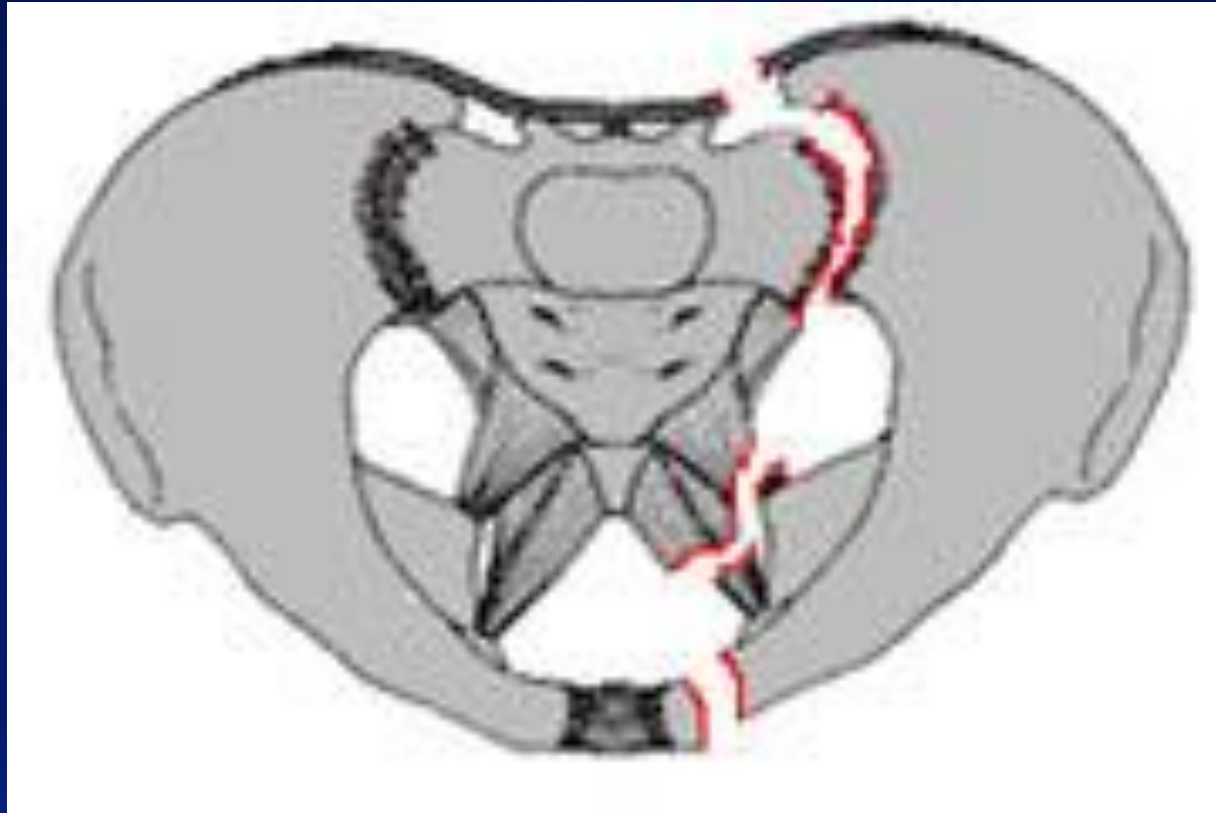
# Tile; OTA



- **Type B: rotationally unstable**



# Tile; OTA

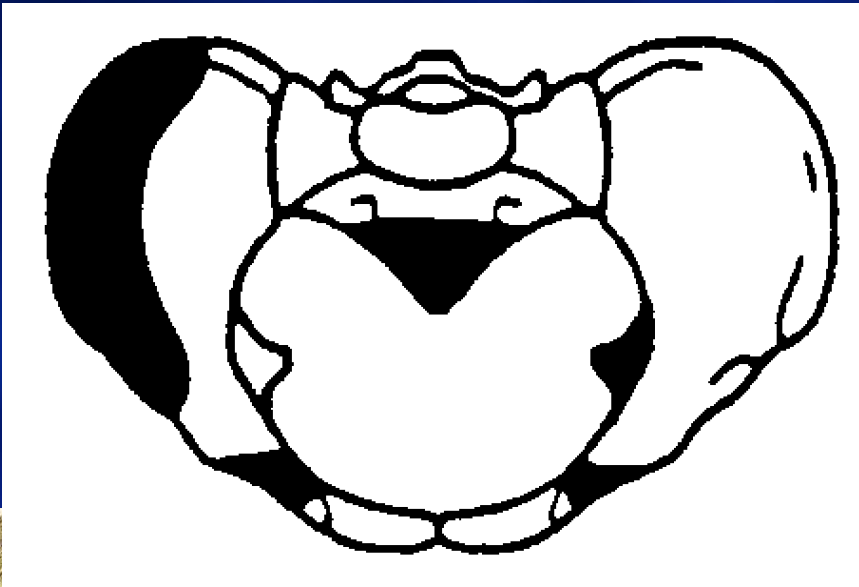


- **Type C: rotationally and vertically unstable**



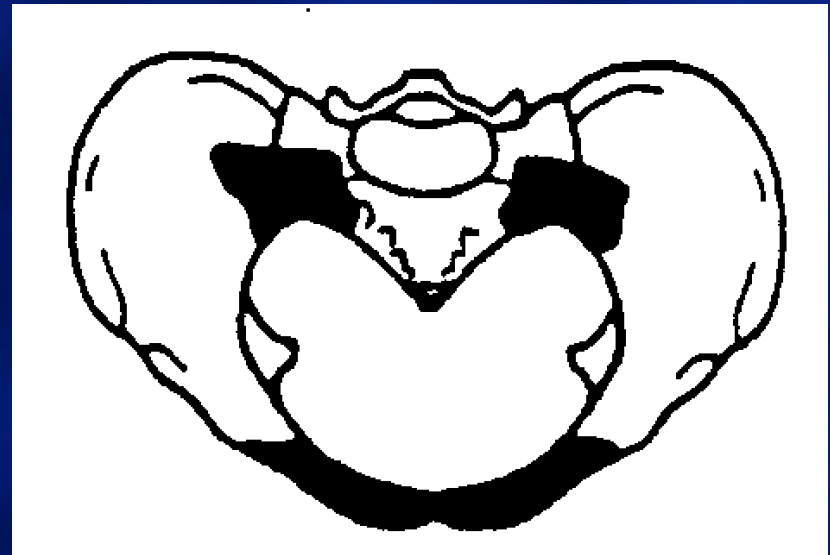
# Orthopaedic Trauma Association

- A1: avulsion injury
- A2: iliac wing or anterior arch fx
- A3 Transverse sacrococcygeal fracture

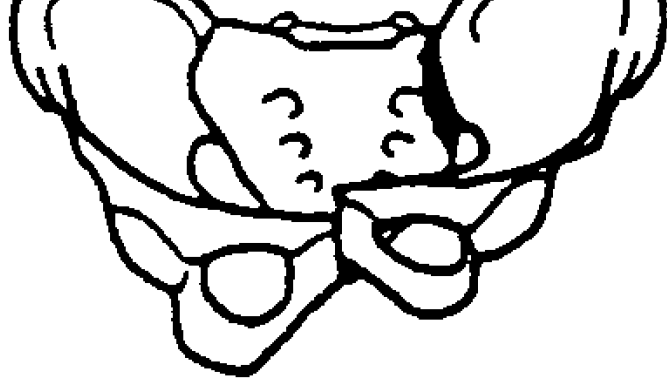


# Orthopaedic Trauma Association

- 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

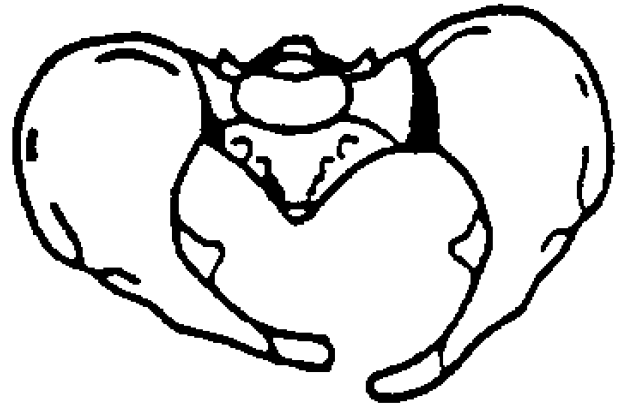
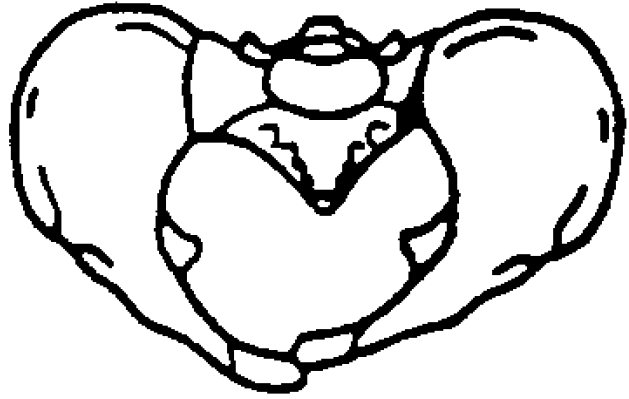
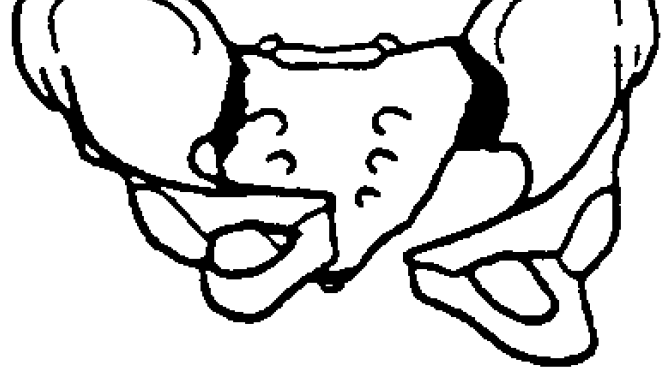




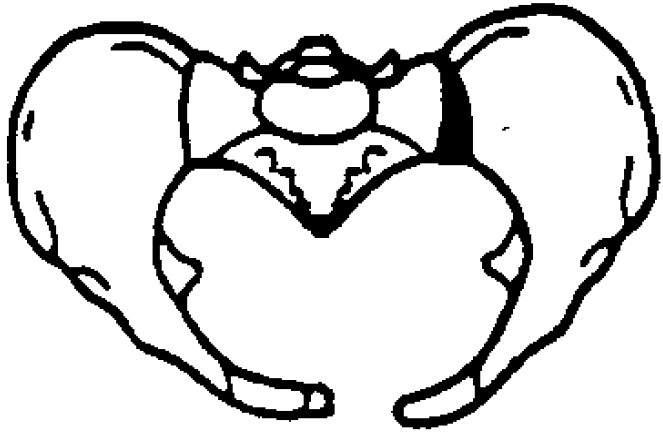


trauma

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ion injury (internal rotation)  
anterior and posterior injuries  
al (bucket handle) injuries



# Ortho

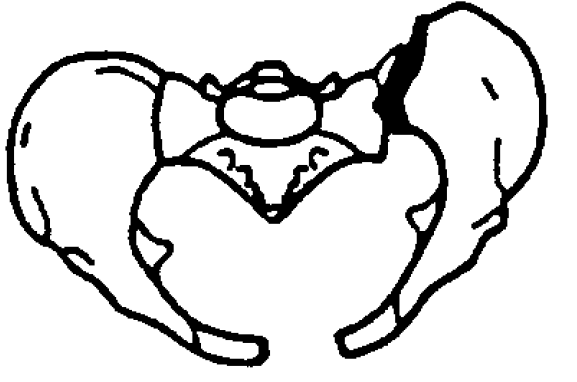
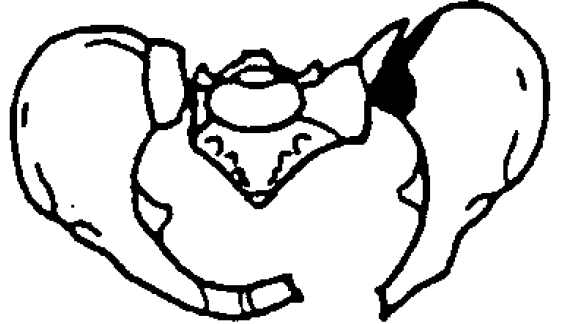
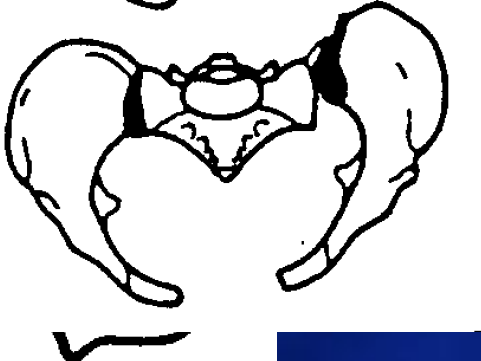
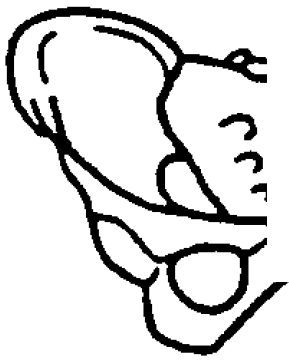
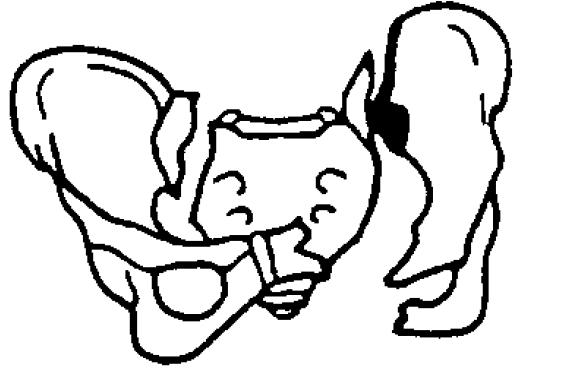
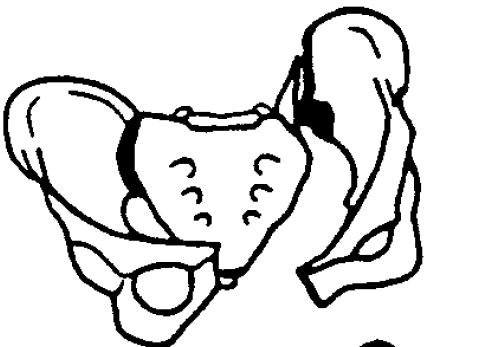
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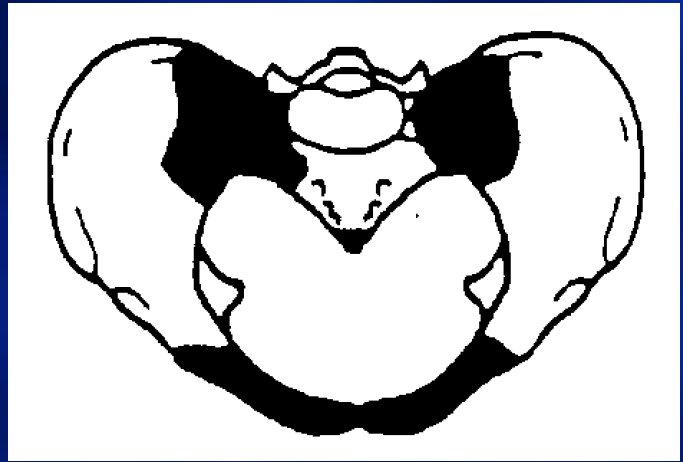
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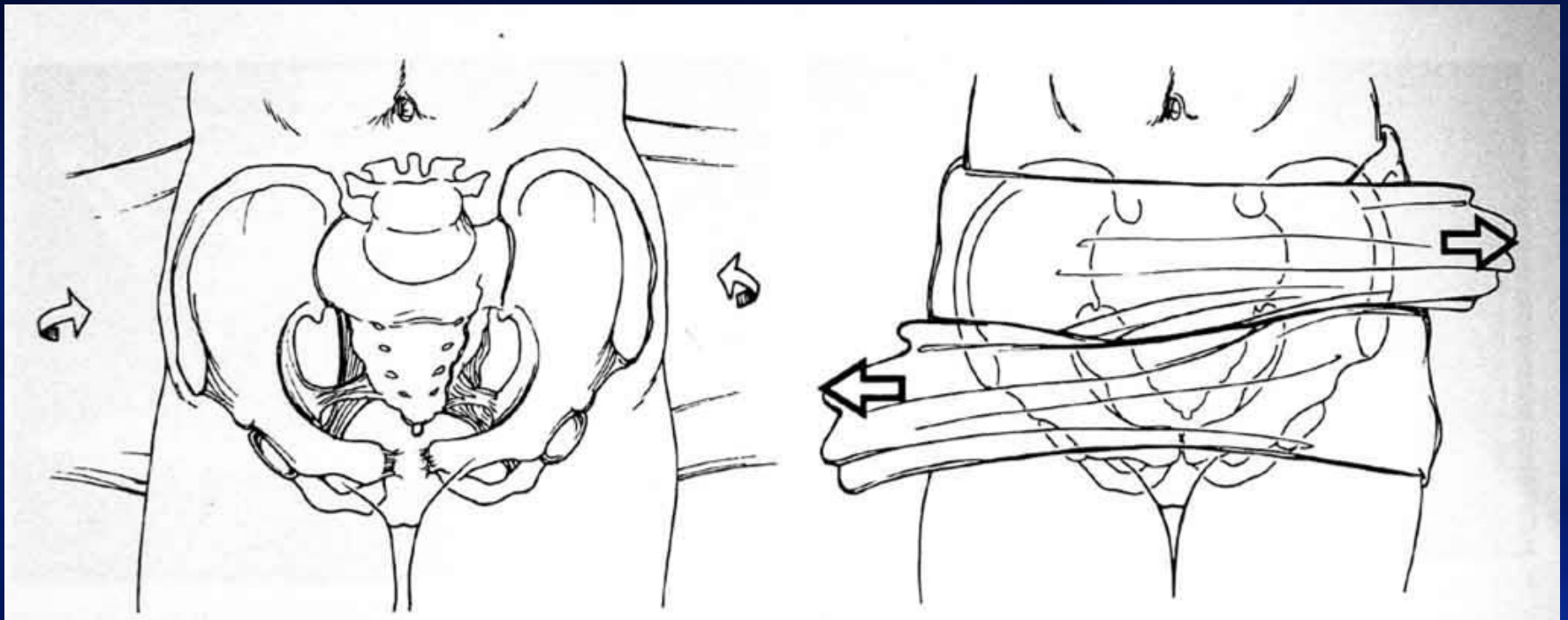
th 1 side type B, 1 side type C



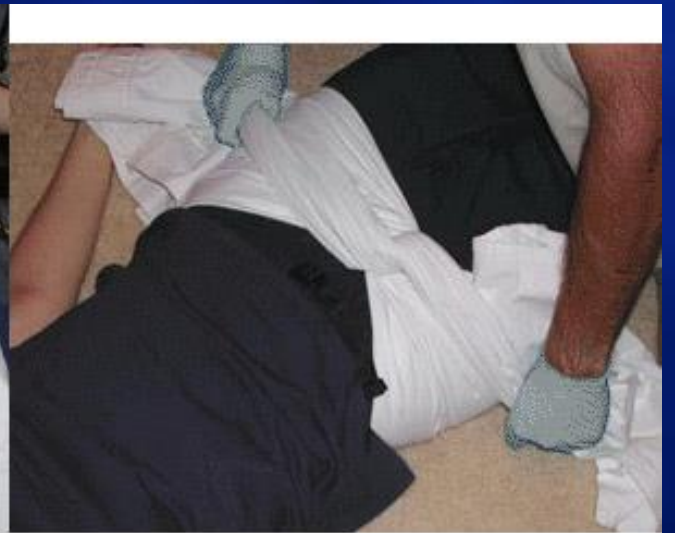
# Management I

- 1. Prehospital - transport with bed sheet, MAST, pelvic clumps.
- 2. ABC ( 2<sup>nd</sup> -intubation, IV line, monitor, transfusion)
- 3. Evaluation of intra-abdominal bleeding.





**WRONG!**



**RIGHT!**



# Management II

I. Constant reassessment to avoid late bleeding

II. FAST (Focused Assessment with Sonography for Trauma) screening for Trauma

1. stable with positive finding → non OP

2. negative finding → CT

3. unstable with negative finding → DPL

III CT for stable patient.



# Management III

## III. Angio or external fixation

1. Angio for large blood loss & hematoma or vessel injury showed by CT.
2. External fixation for fast stabilization of the structure.

IV. OR if patient is unstable with FAST or DPL positive finding.



# General treatment options

- Protected WB status, symptomatic care
- Traction
- External Fixation
- Internal fixation



# Treatment

- **Type A (Stable)** early mobilization & analgesia





# Treatment, continued...

- **Type B (rotationally unstable)**

- diastasis  $> 2.5$  cm;
- rami fx with  $> 2$  cm displacement;  
LLD  $> 1.5$  cm;
- unacceptable rotational deformity
- Ex Fix, ORIF with ant plate,  
Retrograde pubic ramus screws  
(percutaneous or open)



# Treatment, continued...

## Type B (rotationally unstable)

- **Ex Fix:**

- complications more common with inadequate reduction
- useful when concomitant GI/GU or soft tissue injuries are present

- **ORIF (anterior plate)**

- 4 or 6 hole 3.5 mm recon plate
- suprapubic catheter/ bladder injuries may/not be contraindication?



# Treatment, continued...



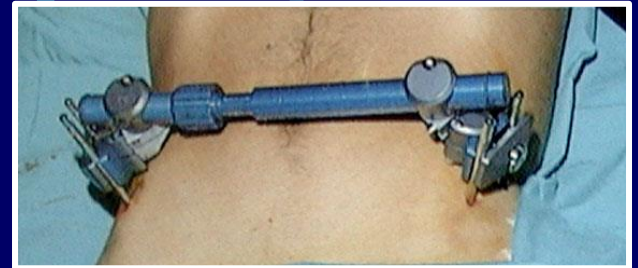
- **Type C (unstable)**
  - require fixation
  - ex fix alone not recommended (50%)
- **Anterior: Ex fix or anterior plate**
- **Posterior: varies according to site, surgeon**
  - iliosacral screws, posterior plating, transiliac bars, tension band plating



# External fixation

## 1. Advantages

- It helps tamponade bleeding from bone edges .
- Stabilizing the clots and the bone.
- Could be done in 20 min.



## 2. Disadvantages

- Can't stop arterial bleeding. Delay the embolization for ongoing arterial hemorrhage.
- Degrade the quality of CT and angio.

# General treatment options

- **Ex Fix**
  - **LC** 3-6 weeks, mobilization based upon concomitant injuries
  - **APC** 8-12 weeks
  - **Vertical Shear** 12 weeks. May need ORIF as well
- **Complications:** pin tract infection, loosening, requirement for orif
- peroxide swabs BID



# General treatment options - ORIF

- **Iliac wing fx**
  - interfragmentary compression screws and neutralization plates
- **Pubic symphysis diastasis**
  - plate if laparotomy, no open injury or cystostomy tube
- **Sacral Fracture**
  - plate or SI screws
- **Unilateral SI dislocation**
  - cancellous screws or anterior SI plate
- **Bilateral SI dislocation**
  - screws



# Post-operative care

- Early mobilization
- Pulmonary toilet
- Thromboembolic prophylaxis
  - SCD, TED, AC, filter
- Antibiotics (48-72hrs)
- WB progression
  - full on contra-lateral LE within days
  - partial  $\times \geq 6$  weeks
  - Full WB  $\leq 12$  weeks



# Post-operative care

- **Bilateral injuries?**
  - **OOBTC until XR evidence of healing**
  - **Partial WB on less injured LE usually by 12 weeks**





# Complications

- Infection (0-25%)
- Thromboembolism
- Malunion, Nonunion
- MOF, sepsis syndrome
- M&M from concomitant injuries
- Chronic pain, disability



# Associated injuries

**TABLE 37-4. ASSOCIATED INJURIES (%)**

Closed-head injury	51
Long-bone fracture	48
Peripheral nerve injury	26
Thoracic injury	20
Bladder	10
Spleen	10
Liver	7
Gastrointestinal tract	7
Kidney	7
Urethra	6
Mesentery	4
Diaphragm	2

# Outcomes I

- Mortality is about 6%.  
from 18/236 mortality of patient with pelvic fracture.  
39% due to bleeding. (1/18 due to pelvic bleeding.  
31% due to head injury.  
30% due to sepsis & multi-organ failure.

# Outcomes II

- Morbidity depends on the nature of the fracture and adequacy of reduction.
  1. Residual fracture displacement  $<1\text{cm}$   
90% no pain, 80% normal function
  2. Residual fracture displacement  $>1\text{cm}$   
70% severe pain, 70% abnormal function.

# Protocol 1

Hemodynamically unstable

FAST

Negative

Attempt

hemodynamic  
stabilization



Positive

OR for repair of  
abdominal  
injuries

Unable to stabilize



Open DPL

Positive

Negative

OR for abdominal  
Exploration

able to  
external fixation

not amenable to  
external fixation

Follow algorithm  
for positive FAST

apply fixation  
in the ED

Angio embolization  
if positive





Able to stabilize

amenable to  
External fixation

Not amenable  
to external fixation

Apply external  
fixation in the ED

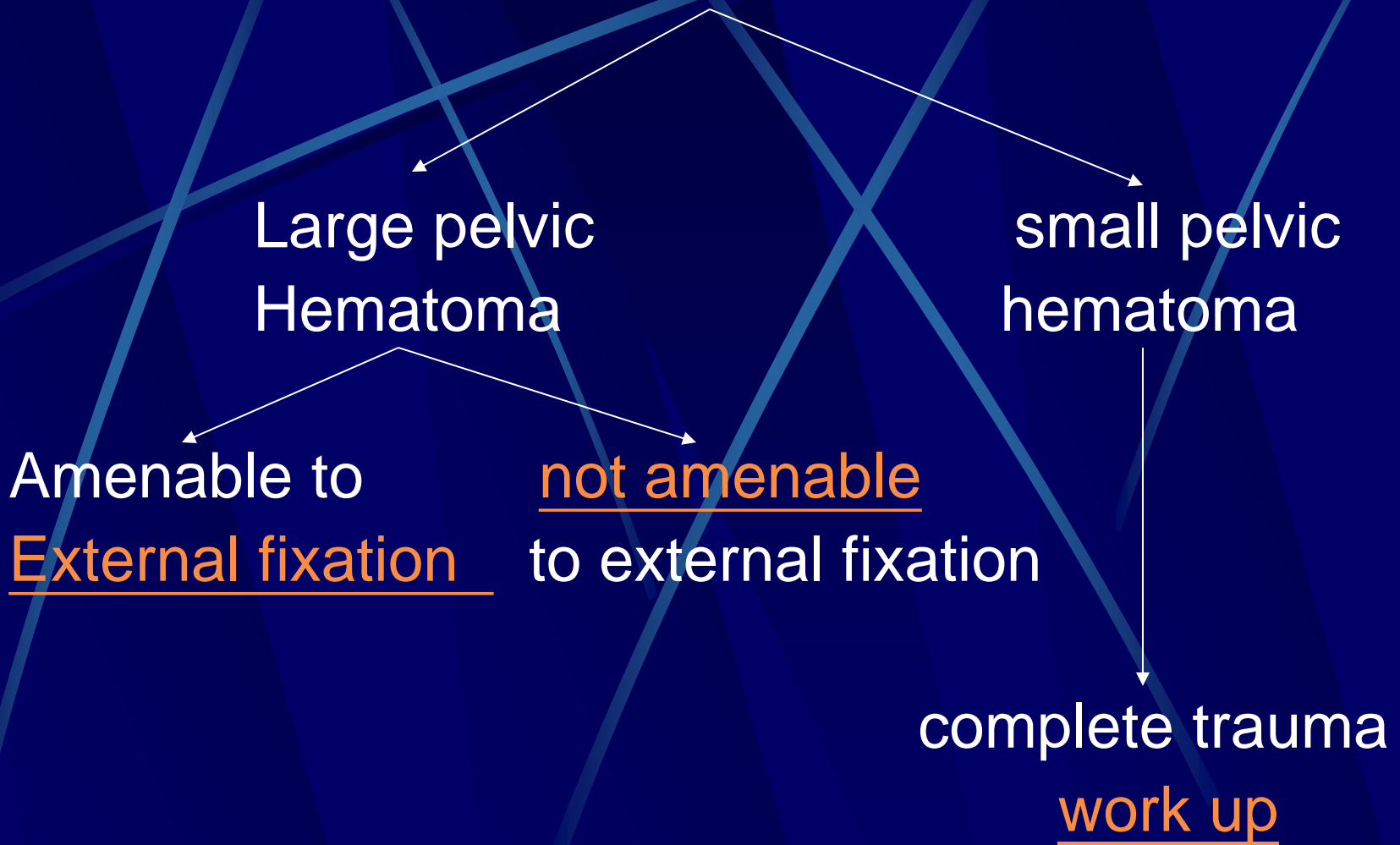
Angio

Positive

Negative

Embolize

Observe





# Apply external Fixation in the OR

No evidence  
of ongoing  
blood loss

Complete trauma  
work up

Evidence of ongoing  
blood loss

Angio

Positive

Embolize

Negative

Observe



No evidence  
Of ongoing  
Blood loss

Complete trauma  
work up

Evidence of ongoing  
blood loss

Angio

Positive

Embolize

Negative

Observe



# Protocol 2

Hemodynamically stable



FAST



Negative



Urgent CT



Positive



Reassess stability

Large pelvic  
Hematoma

↓  
Plan for  
Angio

←  
Amenable to  
External fixation

↓  
External fixaion

↓  
Angioembolization  
if positive finding

→  
Not amenable to  
external fixation

↓  
Continued  
resuscitation

↓  
Angioembolization  
if positive finding

Solid visceral  
injury

Angio

Positive

Negative

Embolize

Observe



No visceral  
injury and small  
pelvic hematoma



Complete trauma

workup

Unstable  
or evidence of  
Ongoing  
blood loss

↓  
OR

Remains stable



Emergent CT

Large pelvic  
Hematoma



Plan for  
Angio



Amenable to  
External fixation



External fixation



Angioembolization  
if positive finding



Not amenable to  
external fixation



Continued  
resuscitation



Angioembolization  
if positive finding



Solid visceral  
injury



Angio



Positive

Negative



Embolize



Observe

No visceral  
injury and small  
pelvic hematoma

```
graph TD; A[No visceral injury and small pelvic hematoma] --> B[Amenable to External fixation]; A --> C[Not amenable to external fixation]; B --> D[External fixation In the OR]; C --> E[Complete trauma workup];
```

Amenable to  
External fixation

External fixation  
In the OR

Not amenable to  
external fixation

Complete trauma  
workup

**Thank you for your  
attention !**