Orthopedic Emergencies 2

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- Open Fractures
- Fractures with neurovascular Injuries
- Unstable Polytrauma Patients With A Pelvic Fracture

Objectives

- To be able to **identify and diagnose** patients with an open fracture, a fracture with nerve or vascular injury and poly-trauma patients with pelvic injuries

- To be **knowledgeable** about the **pathophysiology and morbidity** associated with these injuries

- To be able to **apply the principles of management** of these injuries at the site of accident and in the emergency room

Open Fractures

- Definition:
  - A fracture that that at some point communicated with the environment
  - An open joint is managed similarly

Open fracture

- Usually requires higher injury
  - Not always!
- Sometimes can be missed

Open fractures

- Commonly occurs in bones with minimal soft tissue coverage
- Usually higher energy is required in deep bones

Open fractures

- Pathology:
  - Traumatic energy to the soft tissue and bone
    - Inoculation of organisms
    - Necrotic tissue
    - Injury to vessels and microvasculature
    - Raised compartment pressure
    - Ischemia and lack of immune response
      - INFECTION

OPEN fractures

- Infection in the presence of a fracture
  - Difficult to eradicate
  - Prolonged antibiotics
  - Multiple surgeries
  - Significant morbidity
  - Significant costs

Open fractures

- An open fracture is a usually a “red flag” warning of significant trauma
  - Detailed assessment of the patient is necessary
- An open fracture is associated with significant morbidity
  - Must act quickly

Open fractures

- A delay in management is proven to increase the likelihood of complications
  - Give urgent priority while triaging, provide initial management and consult urgently

•Open fractures

Diagnosis

- Some times obvious!

- Other times, settle,,, be observant

- A wound close to a fracture is an open fracture until proven otherwise!

- Whenever a fracture is diagnosed, go back and check the skin

•Open fractures

Diagnosis

- A small wound continuously oozing blood, especially, if you see fat droplets within the blood, is an open fracture!
- Not always close to the fracture
- Don’t probe!!
- If in doubt, use good light, if there is a break in the dermis or fat is seen, call it an open fracture
- Better to overcall than miss it !

•Open fractures

Algorithm

- Assess and stabilize the patient, ATLS principles
- Assess the condition of the soft tissue and bone to help grade the open fracture
- Manage the wound locally
- Stabilize the fracture
- IV antibiotics
- Tetanus status

•Open fractures

Algorithm

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•Open fractures

Assessment

- If polytrauma, apply ATLS principles
- If isolated injury:
  - Mechanism and circumstances of injury
  - Time since injury
  - PMH/PSH/Allergy/Drugs/Smoking
  - Tetanus vaccination status

•Open fractures

Assessment

- Examine the affected region for:
  - Soft tissue:
    - Degree of contamination
    - Necrotic and devitalized tissue
    - Size of wound
    - Coverage loss
    - Compartment syndrome

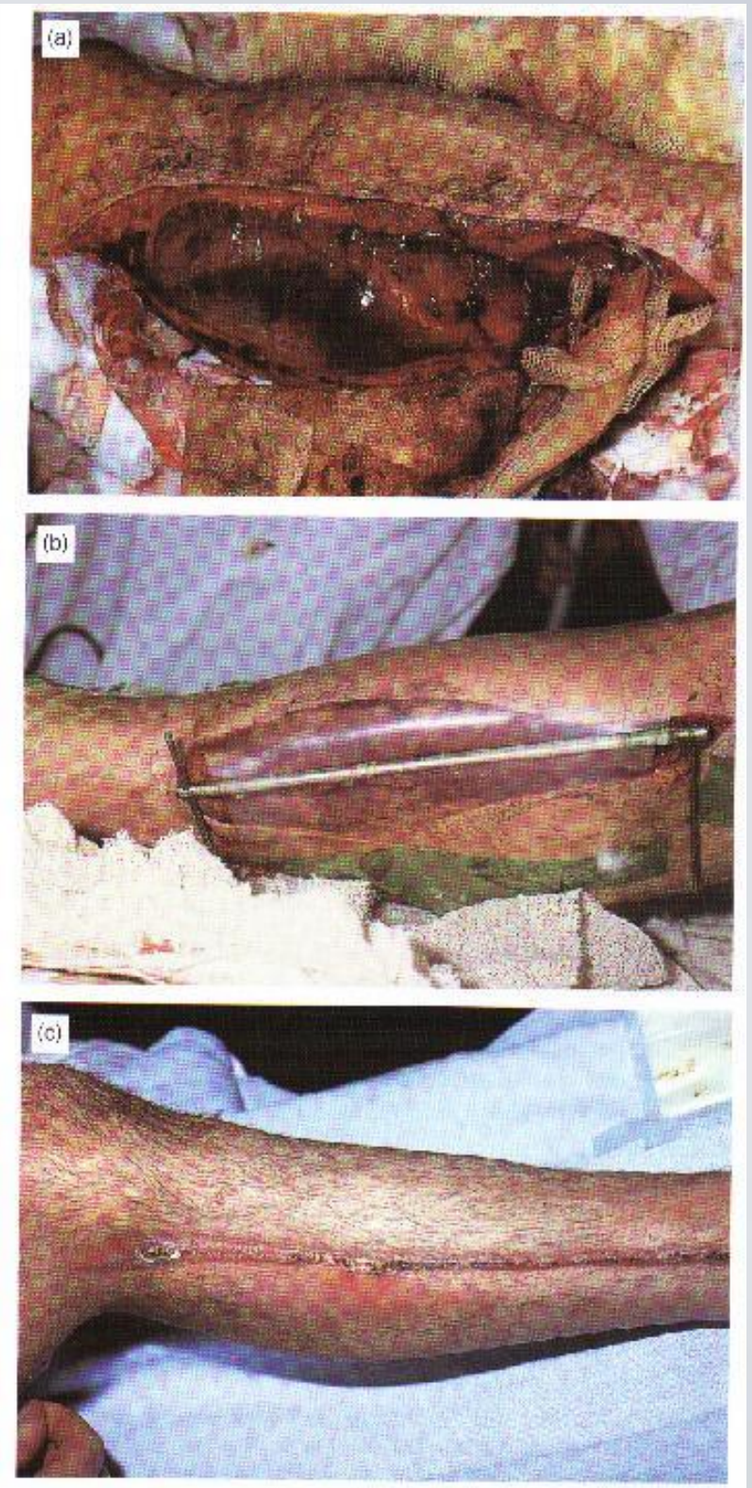


Fig. 23.40 Fasciotomy closure device being used to close a large fasciotomy over a period of 1 week: (a) immediately postfasciotomy; (b) 4 days later; and (c) after healing.

•Open fractures

Assessment

- Bone:
  - Comminution
  - Stripping of bone periosteum
  - Away from injury to joint above and below
  - X-rays to joint above and below

•Open fractures

Assessment

- Neurovascular status distally:
  - On arrival and post reduction and splinting later

•Open fractures

Assessment

- Open fracture grade:
  - Grade 1:
    - Less or equal to 1 cm, clean, non segmental nor severely comminuted fracture, less than 6 hours since injury

•Open fractures
Assessment

- Grade 2 open fracture:
  - >1cm wound, not extensive soft tissue injury or contamination, non segmental nor severely comminuted fracture, no bone stripping and with adequate soft tissue coverage

•Open fractures

Assessment

- Grade 3 open fracture:

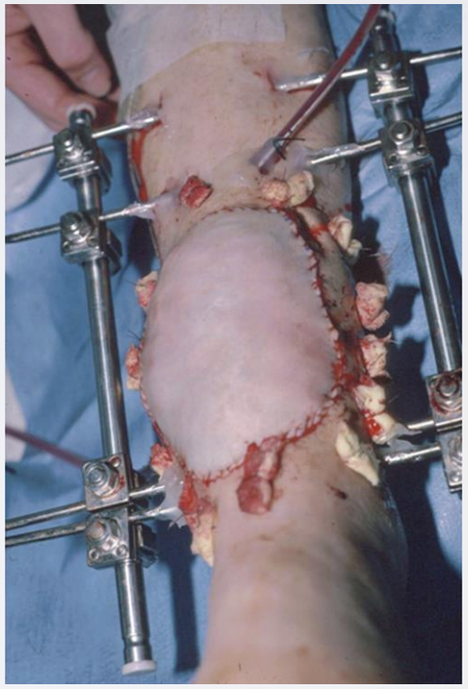
  - 3A: Any size with extensive soft tissue contamination or injury but not requiring soft tissue coverage procedure, or with a segmental or severely comminuted fracture, or late presentation more than 6 hours

  - 3B: Any open fracture that requires soft tissue coverage procedure

  - 3C: Any open fracture that requires vascular repair

•Open fractures

Assessment



•Open fractures
Management

- Local:
  - Take a picture!
  - If dirty, irrigate with normal saline to remove gross contamination
  - If bone sticking out try to reduce gently then immobilize and re-check neurovascular status
  - Cover with sterile wet gauze
  - If bleeding apply direct pressure on wound
  - No culture swabs in ER

•Open fractures
Management

- Antibiotics:

  - First generation Cephalosporin for gram positives (Ex: Cefazolin) in all open fractures

  - Aminoglycoside to cover gram negatives (Ex: Gentamicin) sometimes not required in grade 1 but in general it is safer to give in all grades

  - Add penicillin or ampicillin or clindamycin for clostridium in grade 3 open fractures and all farm and soaked wounds

•Open fractures
Management

- Tetanus prevention:
- Wound types:

1. **<u>Clean wounds:</u>**
   - <6 hours from injury
   - Not a farm injury
   - No significant devitalized tissue
   - Non immersed wound
   - Non contaminated wound
2. **<u>Other wounds</u>**

•Open fractures

Management

- Tetanus prevention:

<table>
<tr><th colspan="3">Clean wounds</th><th colspan="3">Other wounds</th></tr>
<tr><td colspan="2">Completed vaccination</td><td>Not completed or unknown</td><td colspan="2">Completed vaccination</td><td>Not completed or unknown</td></tr>
<tr><td>Booster < 10 years</td><td>Booster >10 years</td><td rowspan="2">Td 0.5ml IM</td><td>Booster < 5years</td><td>Booster > 5 years</td><td rowspan="2">TIG 250U
And
Td 0.5ml IM</td></tr>
<tr><td>nothing</td><td>Td 0.5 ml IM</td><td>nothing</td><td>Td 0.5ml IM</td></tr>
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Open fractures

Management

- As soon as patient is stable and ready, alert the OR, and consent for surgery
- Plan: Irrigation, debridement and fracture stabilization
- The sooner the less risk of further morbidity

•Open fractures
Management

- In the OR:
  - Extend wound if necessary
  - Thorough irrigation
  - Debride all necrotic tissue
  - Remove bone fragments without soft tissue attachment except articular fragments
  - Usually requires second look or more every 48-72 hours
  - Generally do not close open wounds on first look

•Open fractures
Management

- Fracture management:
  - Generally avoid internal fixation (plate and screw)
  - Generally external fixator is used.
  - Femur and tibia fractures can usually be treated immediately with IM nail except severe injuries and contamination
  - Observe for compartment syndrome post-operatively

•Open fractures

Results

- If all principles applied:
  - 2% complication rate in grade 1
  - 10% complication rate in grade 2
  - Up to 50% complication rate in grade 3

Fractures with nerve or vascular injuries

- Don’t miss it !!!!
- Always perform an accurate assessment at presentation, post manipulation and reduction, post surgical fixation, serially until condition stabilizes
- Serial examination helpful in deciding line of treatment
- Serial examination helps avoid confusion

Fractures with nerve or vascular injuries

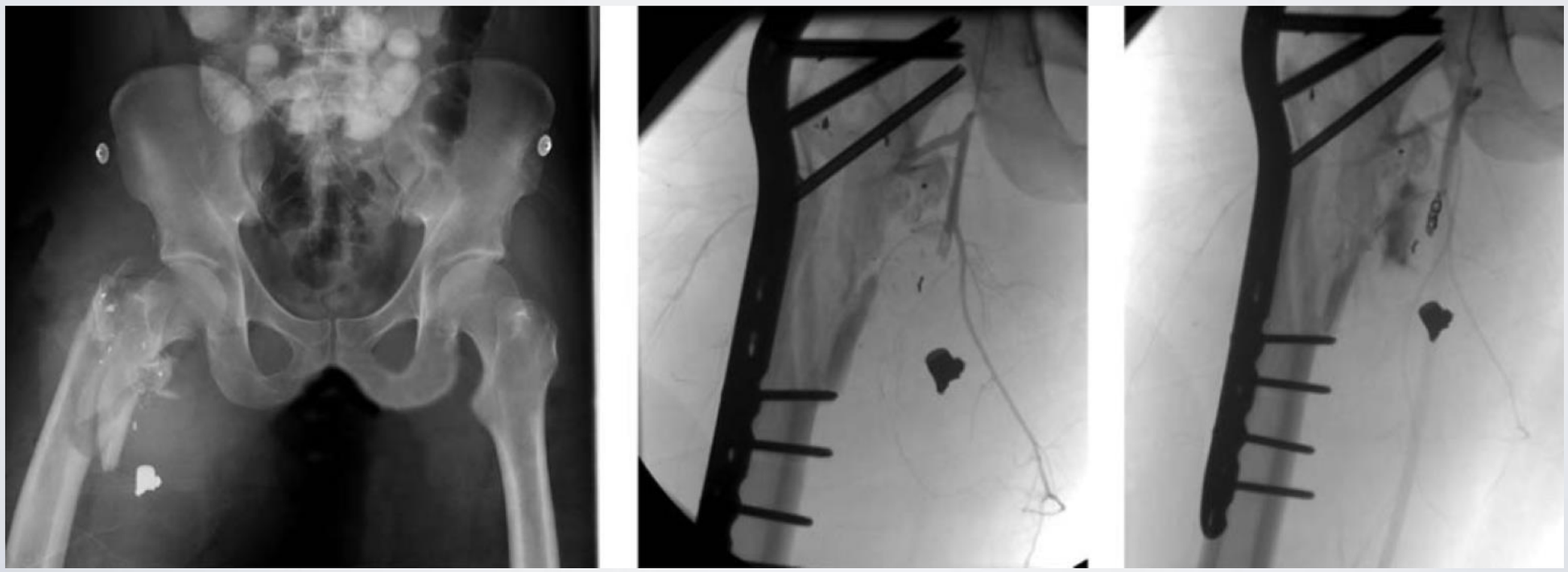
- High correlation between vascular injury and nerve injury
  - Proximity

Fractures with nerve or vascular injuries

- Mechanisms:
  - Penetrating trauma
  - High energy blunt trauma
  - Significant fracture displacement
    - Keep in mind tissue recoil at presentation

Vascular injuries

- Direct laceration
- Traction and shearing



Vascular injuries
Assessment

- Always check:
    - Pulse, Color, Capillary refill, Temperature, compartment pressure
- Keep high index of suspicion:
    - High energy trauma
    - Associated nerve injuries
    - Fractures/ Dislocations around the knee

Vascular injuries

Assessment

Table 1

Hard and Soft Signs of Vascular Injury Associated With Extremity Trauma

Hard signs
Pulselessness
Pallor
Paresthesia
Pain
Paralysis
Rapidly expanding hematoma
Massive bleeding
Palpable or audible bruit
Soft signs
History of bleeding in transit
Proximity-related injury
Neurologic finding from a nerve adjacent to a named artery
Hematoma over a named artery

Vascular injuries

Assessment

- Hard signs > realignment of limb > if persistant >
  - vascular intervention
- Hard signs > realignment of limb > improved >
  - Close observation
  - Realignment can result in unkincking of vessels, lowering compartment pressure, relaxation of arterial spasm

Vascular injuries

Assessment

- ABI
  - < 0.9 associated with vascular pathology
  - Rarely can give false negative result (Ex. Profunda femoris)
  - Always used in high risk fractures (knee)
  - If positive > Urgent vascular intervention

Vascular injuries
Assessment

- Angiography, CT angiography
- Gold standard
- Not without risks
- Vascular surgeon to arrange with interventional radiologist

Vascular injuries
Management

- Once vascular injury is confirmed:
  - Coordination between:
    - Vascular surgeon
    - Orthopedic surgeon
    - General surgeon
  - To emergently re-establish perfusion and protect repair with skeletal stabilization

Vascular injuries

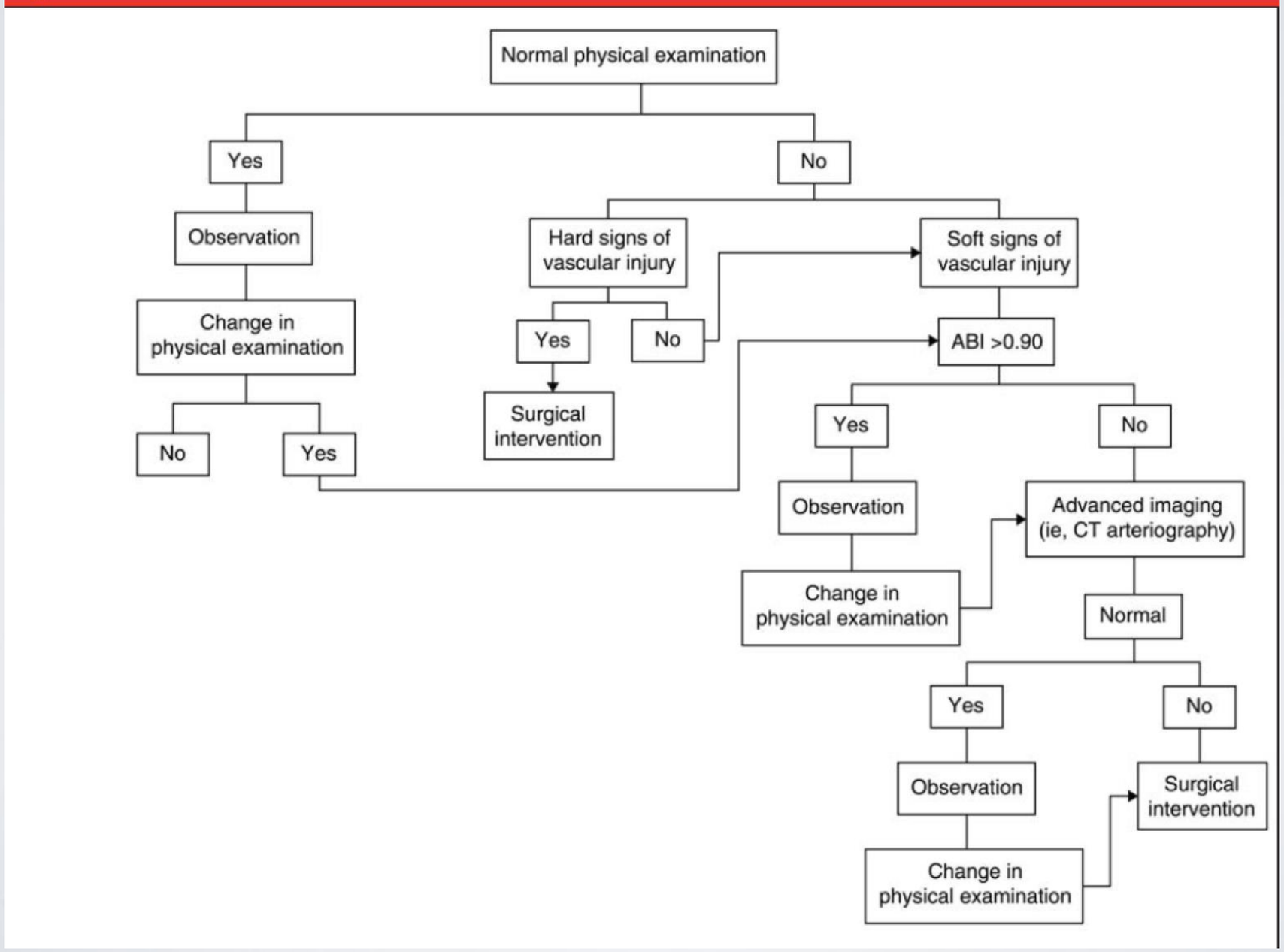
Management

- Warm ischemia time dictates treatment
- Most times, a quick external fixator is applied, followed by vascular repair
- Avoid prolonging warm ischemia to do

Vascular injuries

Management

Figure 3



Vascular injuries

Management

- Prolonged warm ischemia >6 hours
  - Prophylactic fasciotomy
- Grade 3C open fractures have the worst outcome
- Amputation may be necessary in severe cases

Nerve injuries

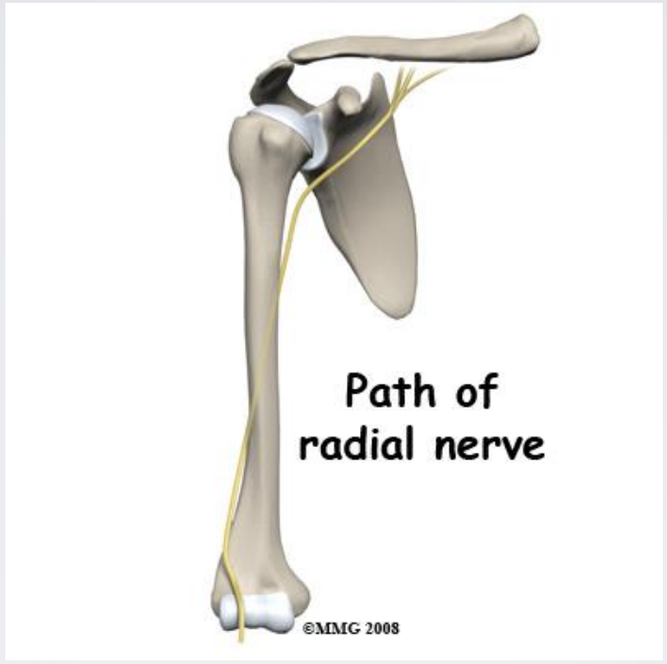
- Cause of medico-legal concern
- Accurate assessment and documentation at presentation, post reduction, post surgery is essential
- Remember to examine for motor and sensation prior to sedation

Nerve injuries

- Closed fractures not requiring surgery with nerve injuries:
  - Usually good outcome >80%
  - Usually managed conservatively in the early stages
  - Recovery may take more than 6 months

Nerve injuries

- Intact nerve before reduction, absent after reduction:
  - Controversial management
  - Usually observe

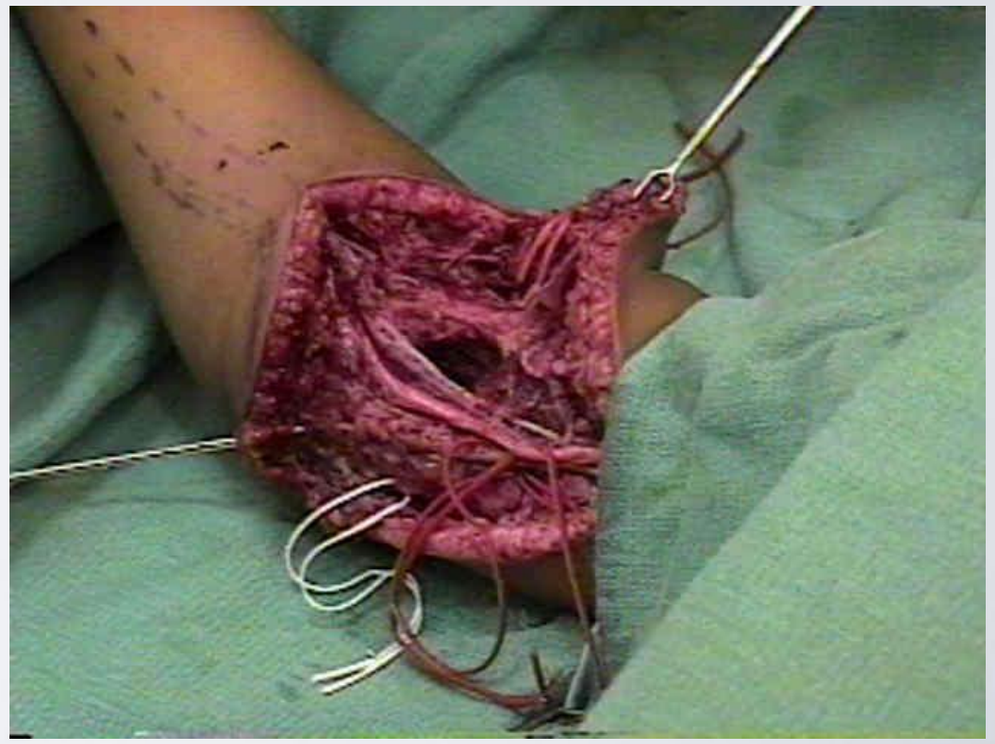


Nerve injuries

- Fracture requiring surgery with nerve injury:
  - Limited exploration

Nerve injuries

- Open fracture with nerve injury:
  - Explore, tag nerve ends for later repiar



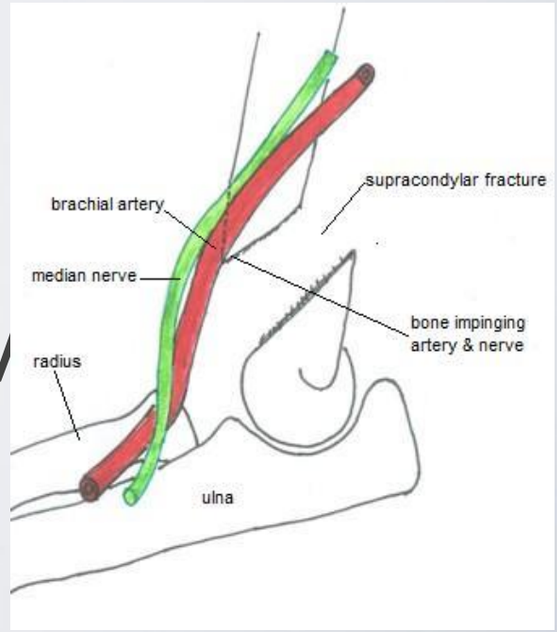
Nerve injuries

- Follow up:
  - Clinically
  - Electrodiagnostic assessment start at 6 weeks then serially every 6 weeks
  - If no improvement:
    - Nerve exploration: neurolysis / repair / grafting
    - Tendon transfers to preserve function

Nerve injuries

Common sites

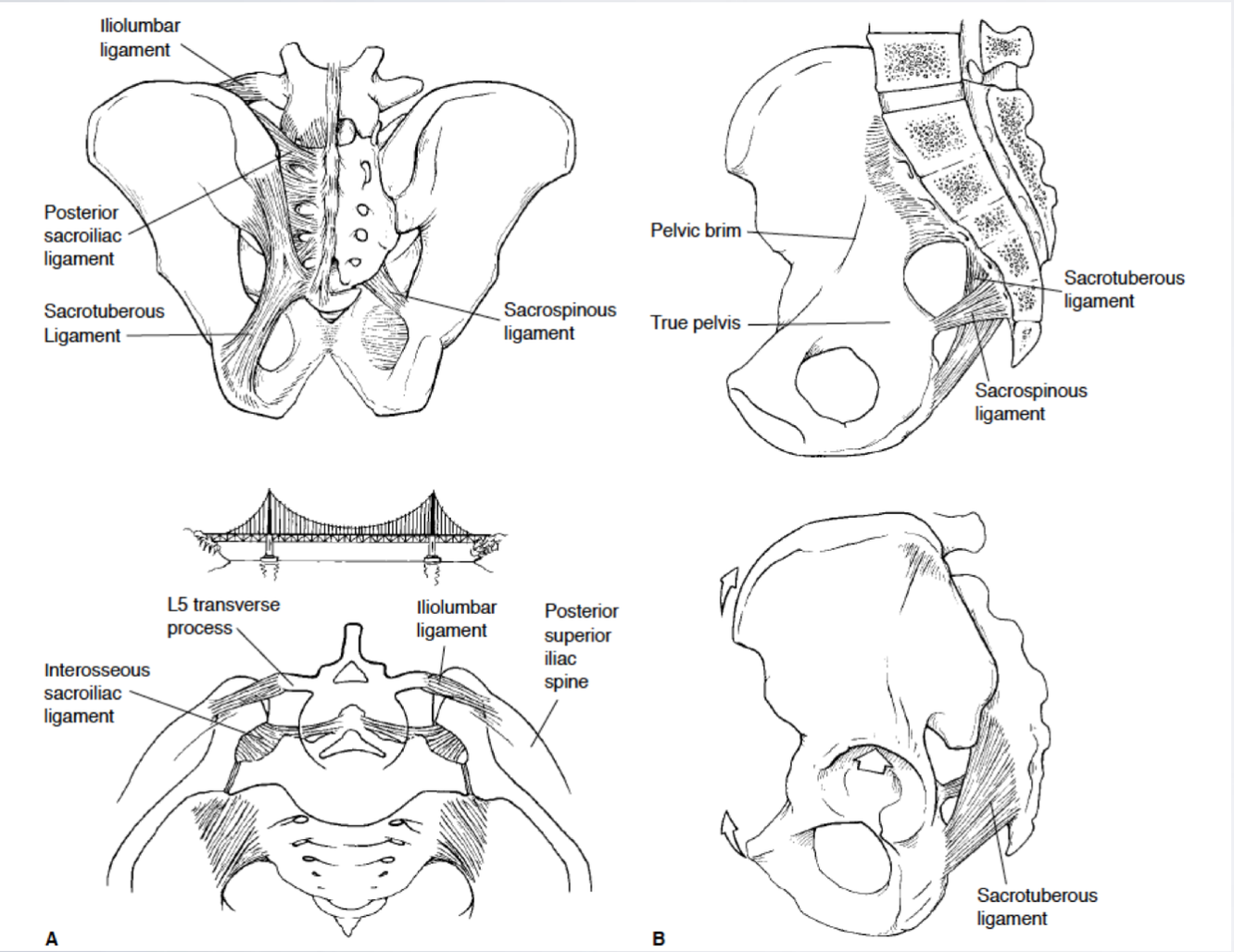
- Shoulder fracture / dislocation > Axillary nerve
- Distal humeral shaft fracture > Radial nerve
- Elbow fracture / dislocation > Median>>radial>>ulnar
- Hip fracture / dislocation > Sciatic nerve
- Knee fracture / dislocation > Peroneal nerv

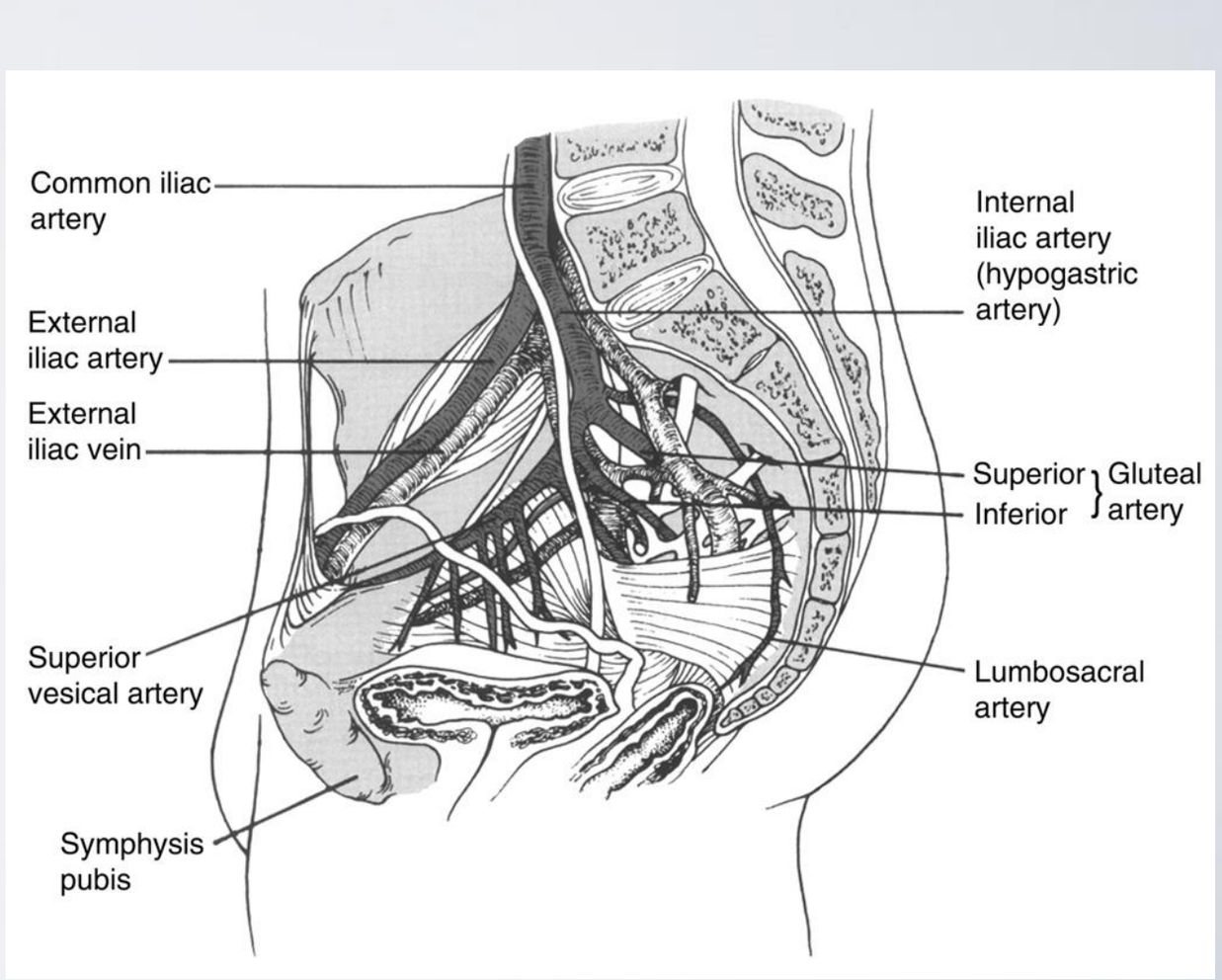


Pelvic trauma

In the poly trauma patient

- PELVIS
  ANATOMY

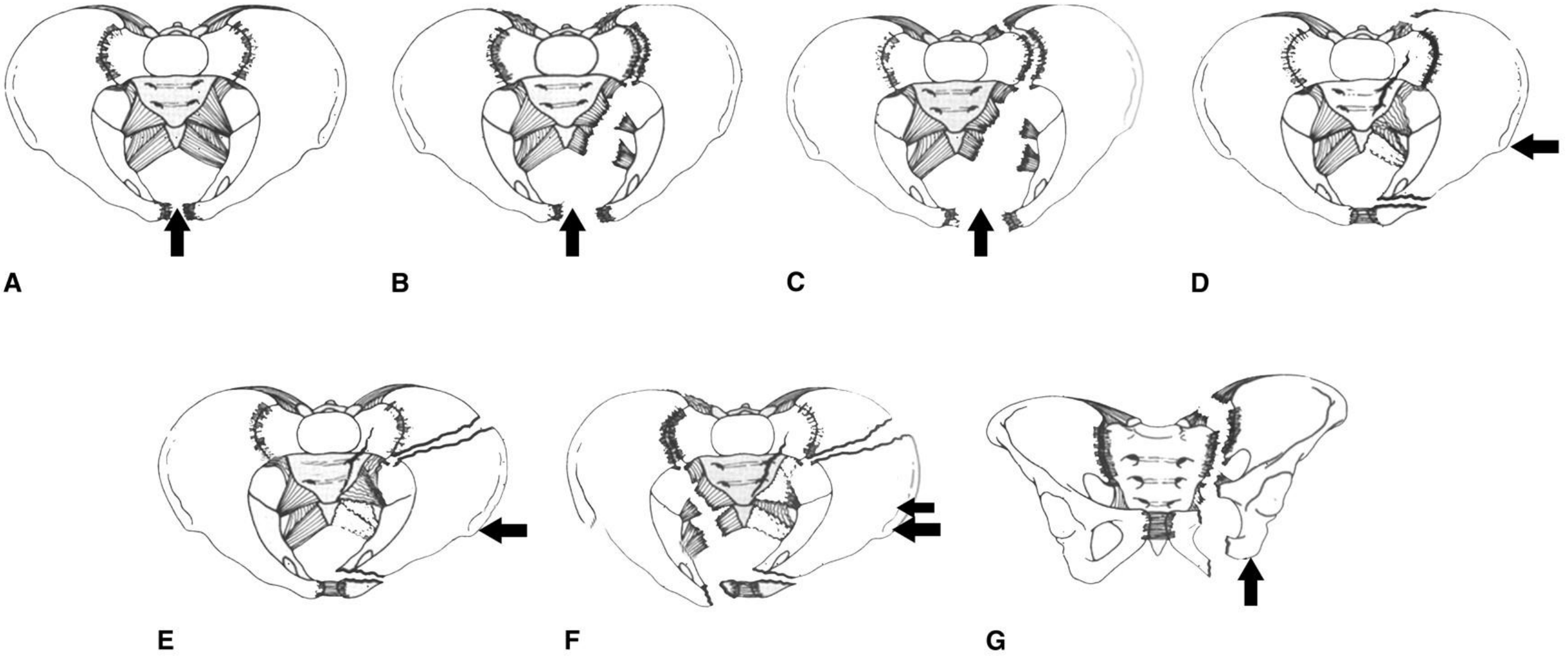




Pelvic trauma

In the poly trauma patient

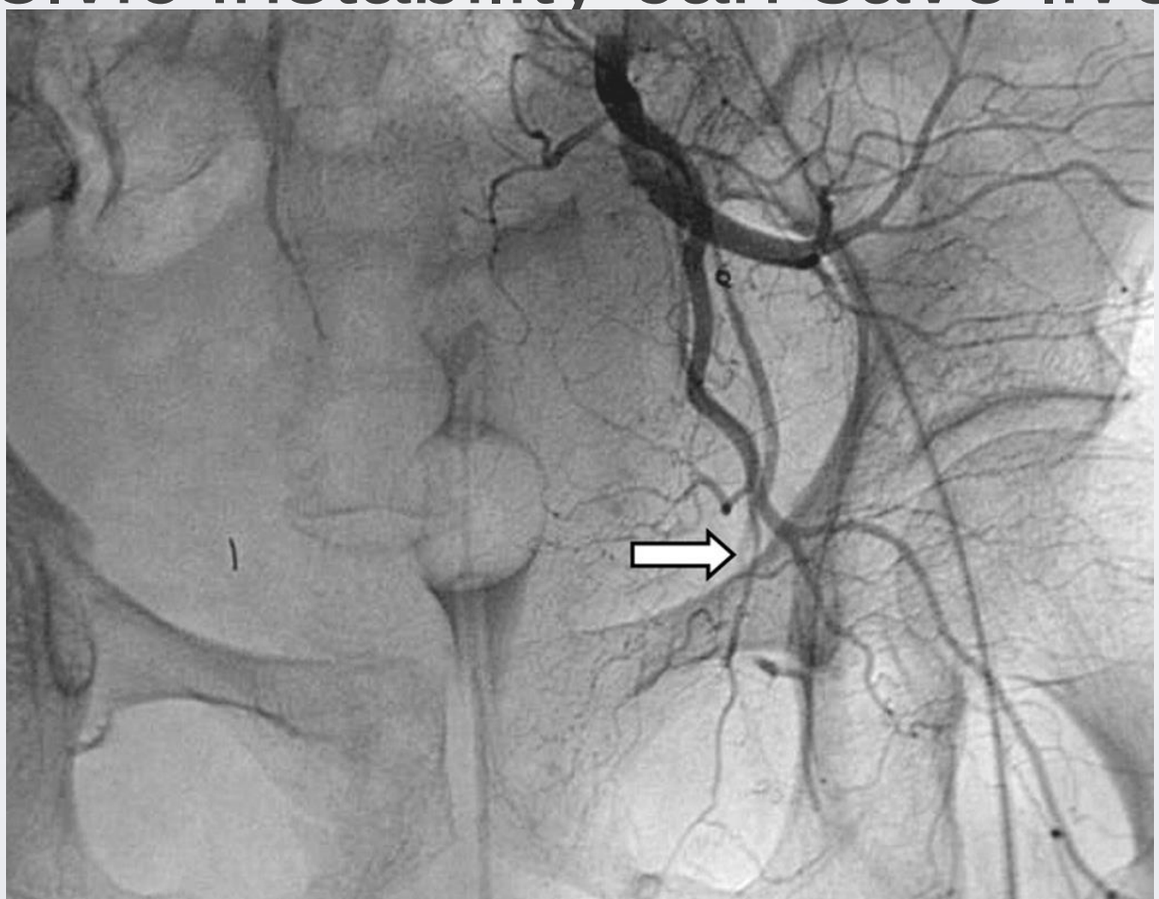
- Pathology



Pelvic trauma

In the poly trauma patient

- Pelvic fractures / instability may cause life threatening bleeding
- Diagnosing pelvic instability can save lives



Pelvic trauma

In the poly trauma patient

- Diagnosis:
  - History: High vs. Low eneregy trauma
  - Mechanism of injury: Anterior vs. Lateral vs. Axial force
  - Pelvic skin contusion, bruising
  - Short extremity
  - Careful neurologic assessment

Pelvic trauma

In the poly trauma patient

- Diagnosis:
  - Primary survey : part of “C”
    - Assess stability by gentle compression on the *A*
    - Traction on the leg and assess pelvic instability
      - If unstable or painful:
        - Apply sheet around hips and close the pelvis gently
        - This results in decreased intra-pelvic volume leading to tamponading the bleeding
        - Traction on the leg to stabilize vertical instability
        - This minimizes ongoing vasculature injury and bleeding

Pelvic trauma

In the poly trauma patient

- Diagnosis:
  - Rectal exam:
    - Bone fragments (be careful)
    - High riding prostate
    - bleeding
- Blood at the meatus
- Labial or scrotal echymosis
- Vaginal exam

Pelvic trauma

In the poly trauma patient

- Management:
  - Stabilize pelvis with binder
  - If vertically unstable apply traction
  - IV resuscitation
  - Look for other injuries
  - Check response

Pelvic trauma

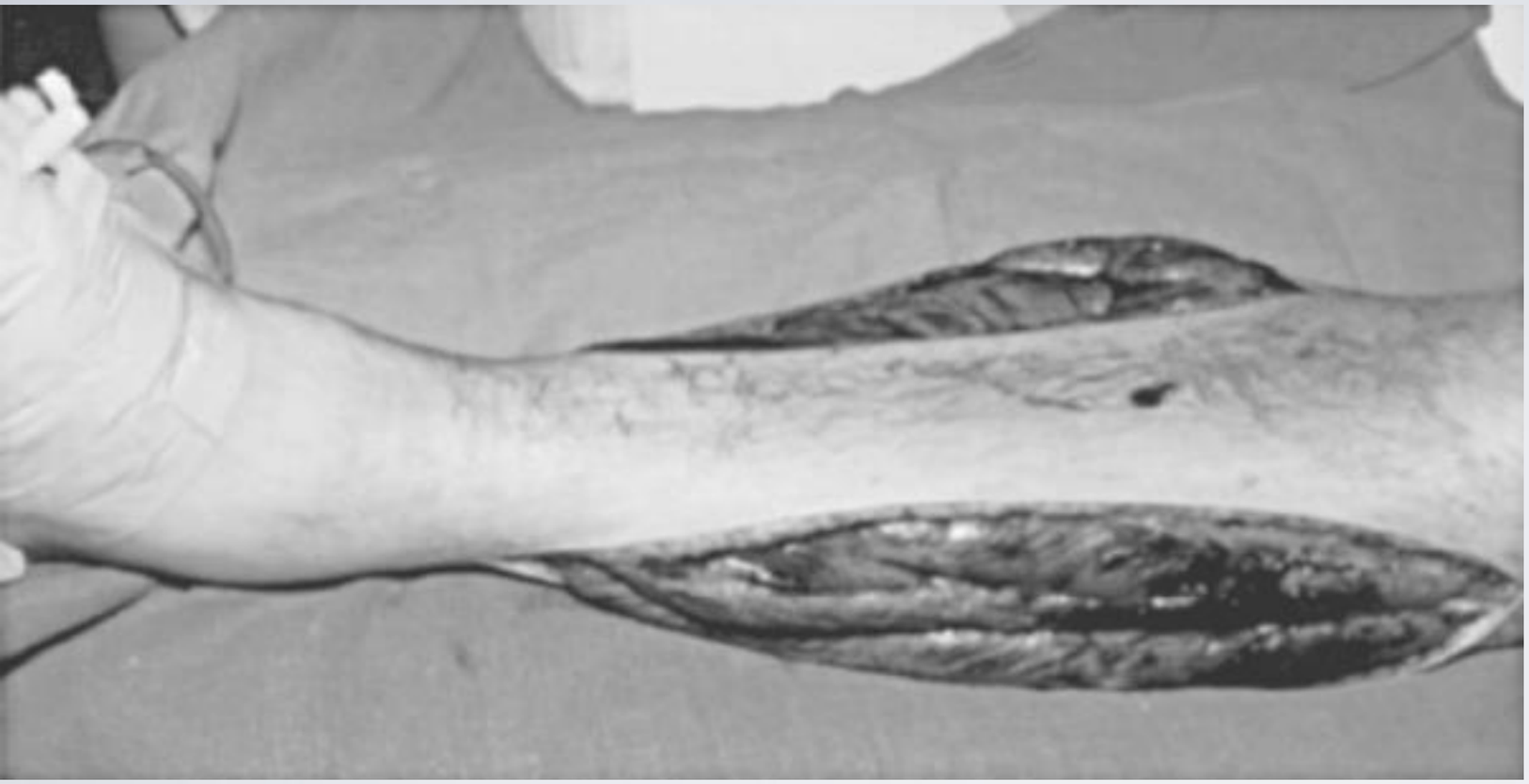
In the poly trauma patient

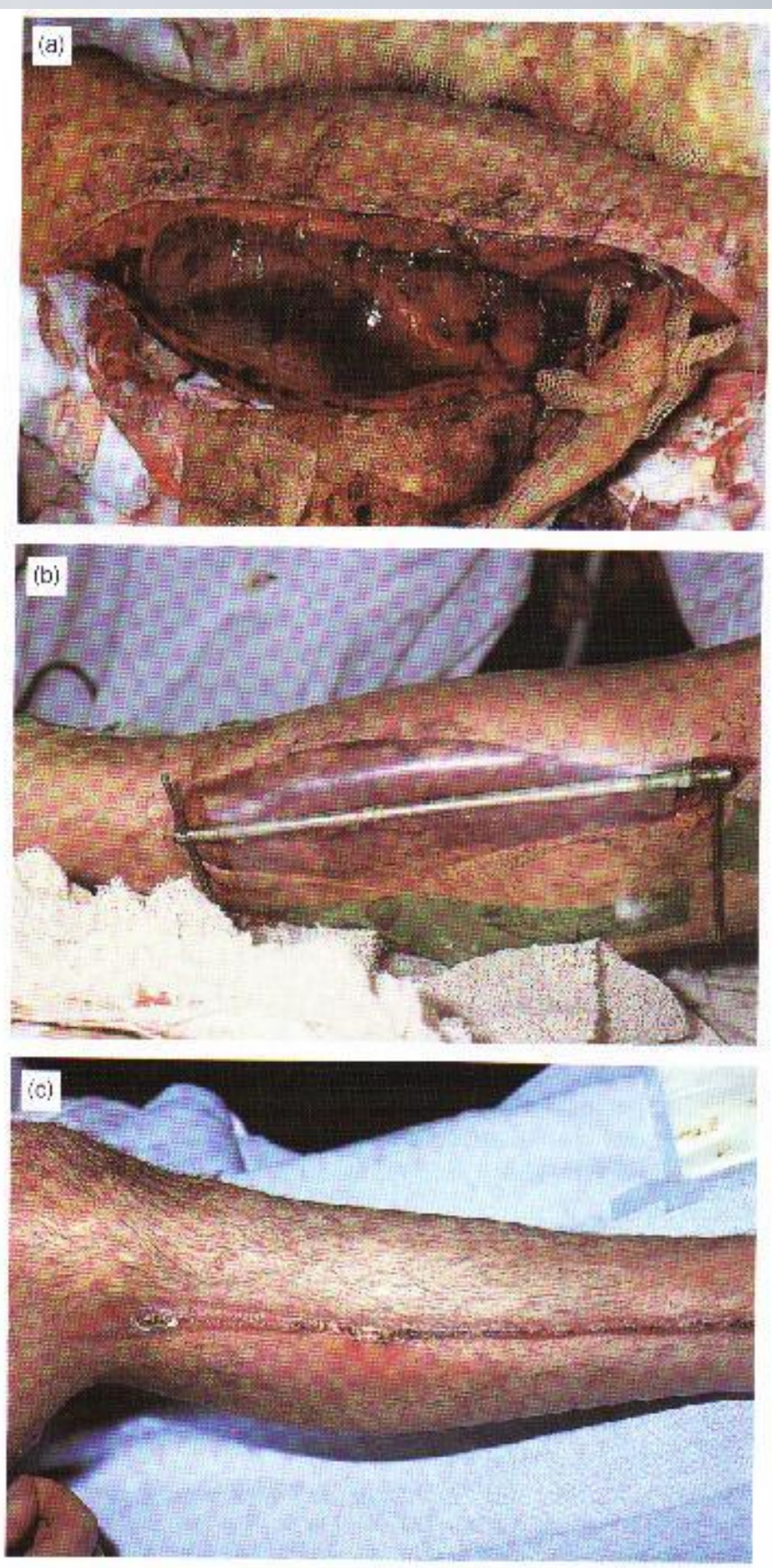
- Management:
- If partial response, may require angiography for embolization of bleeders
- May require external fixator and/or pelvic clamp

Pelvic trauma

In the poly trauma patient

- Early diagnosis
- Aggressive resuscitation
  - Coordinated team effort
    - Save lives





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