Orthopaedic Trauma

Key Points
18.1 UPPER EXTREMITY INJURIES

Clavicle Fractures

- Diagnose fractures from the history and by physical examination
- Treat with a sling and early range of motion
- Fracture healing takes 4 weeks in children and 6–8 weeks in adults.
18.1 UPPER EXTREMITY INJURIES

CLAVICLE FRACTURES

Figure 18.1

Figure 18.2
18.1 UPPER EXTREMITY INJURIES

Rehabilitation

Figure 18.3
18.1 UPPER EXTREMITY INJURIES

Acromial-clavicular joint Separation

- Separation of the acromial-clavicular joint results from falls on the tip of the shoulder.
- Cases are classified by the amount of upward displacement of the clavicle (Figure 18.4).

Figure 18.4
18.1 UPPER EXTREMITY INJURIES

**Acromial-clavicular joint Separation**

- Make the diagnosis based on the history and a physical examination
- Treat with an arm sling
- When comfortable, begin a range of motion and active muscle strengthening in the shoulder.
Shoulder Dislocation
Evaluation
18.1 UPPER EXTREMITY INJURIES

Shoulder Dislocation

• Make the diagnosis by physical examination

• Treat with closed manipulation

• X-rays help to evaluate the reduction and the presence of fractures

• Recurrent dislocations are common, especially in younger patients.
18.1 UPPER EXTREMITY INJURIES

Shoulder Dislocation

Treatment

Figure 18.7
Figure 18.8
Figure 18.9
18.1 UPPER EXTREMITY INJURIES

Proximal Humerus Fractures

Figure 18.10

Figure 18.11
18.1 UPPER EXTREMITY INJURIES

Proximal Humerus Fractures

- The anatomical location of the fracture defines the treatment
- X-rays are needed to evaluate the injury
- Treat displaced fractures with closed manipulation
- The major complication is shoulder stiffness.
18.1 UPPER EXTREMITY INJURIES

Humeral Shaft fractures

- Humeral shaft fractures result from direct trauma or rotation of the arm
- Treat by closed means in a coaptation splint
- The most significant complications are radial nerve injury and non-union.
18.1 UPPER EXTREMITY INJURIES

**Humeral Shaft fractures**

Treatment
18.1 UPPER EXTREMITY INJURIES

- Supracondylar fractures of the humerus are complex, unstable fractures

- Treat with closed reduction, followed by a cast or traction

- In cases of incomplete reduction in adults, consider open treatment

- Injury to nerves and arteries leads to significant complications.
18.1 UPPER EXTREMITY INJURIES

SUPRACONDYLAR FRACTURES OF THE HUMERUS

Fracture patterns include:

- Supracondylar
- Intercondylar (Figure 18.16)
- Fractures of the medial and lateral epicondyles
- Isolated fractures of the capitellum and trochlea.
18.1 UPPER EXTREMITY INJURIES

Supracondylar Fractures Of The Humerus

Treatment
18.1 UPPER EXTREMITY INJURIES

Olecranon Fractures

Treatment

Suture of the torn triceps tendon
Placement of percutaneous pins with rubber bands
18.1 UPPER EXTREMITY INJURIES

Olecranon Fractures

Treatment

• Make the diagnosis by clinical examination and confirm by X-ray

• Treat non-displaced fractures with a long arm splint at 90 degrees

• Splint displaced fractures with the elbow extended or consider surgical stabilization.
18.1 UPPER EXTREMITY INJURIES

**Olecranon Fractures**

- Olecranon fractures result from a fall on the tip of the elbow.
- The triceps muscle pulls the fracture fragments apart (Figure 18.19).
Fractures Of The Radial Head And Neck

- Fractures are classified by the articular involvement
18.1 UPPER EXTREMITY INJURIES

Fractures Of The Radial Head And Neck

Treatment

• In fractures with minimal displacement, treat with closed reduction and a posterior splint and begin motion as soon as comfortable.

• Treat displaced intra-articular fractures with early motion and consider surgical treatment, if available.
18.1 UPPER EXTREMITY INJURIES

Elbow Dislocation

- Injury occurs with a fall on the outstretched arm
- Treat with immediate closed reduction
- In children, the medial epicondyle may become entrapped in the joint and may require surgical removal.
18.1 UPPER EXTREMITY INJURIES

**Elbow Dislocation**

- Dislocations of the elbow occur with a fall on the outstretched arm.
- They may be in the posterior or posterior lateral direction (Figure 18.24).
Forearm Fractures

- Forearm fractures are complex fractures which, in adults, usually require surgical stabilization.

- They occur as three major types:
  - Midshaft fractures
  - Proximal (Monteggia) dislocations
  - Distal (Galeazzi) fracture dislocations

- The most common complication is loss of forearm rotation.
18.1 UPPER EXTREMITY INJURIES

Forearm Fractures
Evaluation
18.1 UPPER EXTREMITY INJURIES

Forearm Fractures

Treatment

Figure 18.27
18.1 UPPER EXTREMITY INJURIES

Distal Radius Fractures

• The distal radius is one of the most common upper extremity fractures

• Treatment is usually by closed reduction and application of a U-shaped splint coaptation

• The adequacy of the reduction can be judged by specific parameters visible on the post reduction X-ray

• The most common complication is malposition and loss of motion.
18.1 UPPER EXTREMITY INJURIES

Distal Radius Fractures

- Fractures of the distal radius occur with a fall on the outstretched hand.

- The direction of the deformity depends on the position of the wrist at the time of impact (Figure 18.28).
18.1 UPPER EXTREMITY INJURIES

Distal Radius Fractures

- The goal of fracture treatment is to restore the normal anatomy of the following deformities:
  - Shortening of the radius relative to the ulna (Figure 18.29)
  - Loss of the volar tilt of the radial articular surface, seen in the lateral X-ray (Figure 18.30)
  - Disruption of the articular surface.
18.1 UPPER EXTREMITY INJURIES

Distal Radius Fractures

Treatment
Carpal Fractures And Fracture Dislocations

- The injury results from a fall on the outstretched hand in hyperextension
- Diagnosis is difficult and is often overlooked
- Adequate X-rays are necessary for accurate diagnosis
- Closed reduction is the initial treatment, but surgical stabilization may be necessary.
18.1 UPPER EXTREMITY INJURIES

Carpal Fractures And Fracture Dislocations

Figure 18.33

Figure 18.34
18.2 THE HAND

**Lacerations**

- Treat lacerations promptly with
  - careful evaluation,
  - debridement and
  - lavage

- Close wounds only when clean, using suture, spontaneous healing or skin grafts

- After injury, elevate the hand to control swelling and begin motion early

- Nail bed injuries require special treatment.
18.2 THE HAND

Lacerations

Treatment

Figure 18.35

Figure 18.36
18.2 THE HAND

FRACTURES AND DISLOCATIONS

Fracture dislocation of the first carpometacarpal joint (Bennett’s fracture)
18.2 THE HAND

FRAC TURES AND DISLOCATIONS

Figure 18.39

Phalanges

Mallet finger

Figure 18.40

Figure 18.41
Pelvic ring fractures

- Pelvic ring fractures result from high-energy trauma and are classified as:
  - stable or
  - unstable

- Unstable fractures are associated with significant blood loss and multiple system injury

- Treat initially with systemic resuscitation and temporary pelvic compression

- Complications include:
  - deep vein thrombosis,
  - sciatic nerve injury and
  - death from bleeding or
  - internal organ damage.
18.3 FRactures of the pelvis and hip

Pelvic ring fractures

Figure 18.42  Figure 18.43
18.3 FRACTURES OF THE PELVIS AND HIP

Pelvic ring fractures

Treatment
Unstable Fractures
Acetabular fractures

- Acetabular fractures result from high-energy pelvic injuries

- Treatment aims to restore the congruence of the femoral head with the acetabulum by traction or by surgery if available

- Complications include
  - deep venous thrombosis,
  - sciatic nerve injury and
  - late degenerative arthritis of the hip

- Do not send patient to another hospital unless you are certain that the complicated surgery is available there
18.3 FRACTURES OF THE PELVIS AND HIP

- Hip fractures are classified as
  - intra-capsular (femoral neck fractures) or
  - extra-capsular (inter-trochanteric and subtrochanteric fractures)

- Treat displaced intra-capsular fractures with
  - internal fixation,
  - prosthetic replacement or
  - early ambulation

- Treat extra-capsular fractures with traction or internal fixation

- Perkin’s traction works well and avoids the immobilization necessary with other techniques.
18.3 FRACTURES OF THE PELVIS AND HIP

Fractures Of The Proximal Femur (Hip Fractures)

Classify fractures by their anatomic location (Figure 18.46):

- Intra-capsular (femoral neck fractures)
- Extra-capsular: intertrochanteric
- Extra-capsular: subtrochanteric.

Figure 18.46
18.3 FRACTURES OF THE PELVIS AND HIP

Hip Dislocations

• Make the diagnosis from the:
  – history and
  – clinical findings;
  – use X-rays to confirm associated fractures

• To avoid the complications of vascular necrosis and loss of joint motion, reduce the dislocation as soon as possible

• Closed reduction is usually successful if carried out promptly.
18.3 FRACTURES OF THE PELVIS AND HIP

Hip Dislocations
**18.4 INJURIES OF THE LOWER EXTREMITY**

- **Femoral shaft fractures** result from high-energy trauma and are often associated with other significant injuries.

- Debride and lavage open fractures under sterile conditions as soon as possible.

- Treat in traction and monitor the fracture position with or without X-rays.

- Fracture of the femoral neck is the most common associated skeletal injury and frequently overlooked.
18.4 INJURIES OF THE LOWER EXTREMITY

- Distal femoral fractures occur as supracondylar fractures or extend into the knee joint as intercondylar fractures.
- Treat non-displaced fractures in a cast.
- Treat displaced fractures in traction.
- Popliteal artery injuries require immediate surgical correction if the limb is to be saved.
18.4 INJURIES OF THE LOWER EXTREMITY

Distal femoral fractures

Figure 18.49  Figure 18.50  Figure 18.51
18.4 INJURIES OF THE LOWER EXTREMITY

Patella injuries

Figure 18.52
18.4 INJURIES OF THE LOWER EXTREMITY

- **Patella injuries** are caused by direct trauma to the anterior knee.

- Displaced fractures are associated with rupture of the quadriceps tendon complex; they need surgical repair to restore knee extensor function.

- Popliteal artery injuries require immediate surgical correction if the limb is to be saved.
18.4 INJURIES OF THE LOWER EXTREMITY

Tibial plateau fractures
18.4 INJURIES OF THE LOWER EXTREMITY

- **Tibial plateau fractures** are intra-articular injuries of the weight-bearing portion of the knee joint.

- Treat non-displaced fractures with a splint or cast.

- Treat displaced or unstable fractures with traction or surgical stabilization.

- Evaluate for injury to the popliteal vessels.
18.4 INJURIES OF THE LOWER EXTREMITY

Tibial shaft Fractures

Figure 18.54
18.4 INJURIES OF THE LOWER EXTREMITY

- Healing response and complication rate are related to the extent of soft tissue injury.
- Open fractures are common and require immediate debridement.
- Closed reduction and cast application is appropriate for most fractures.
- External fixation is useful for fractures associated with open wounds or severe comminution and instability.
- Complications include compartment syndrome, nonunion and infection.
Ankle fractures result from inversion, eversion/external rotation and vertical forces.

The anatomic structures involved include the tibia, fibula and talus and three sets of ligaments.

Isolated fibula fractures are stable.

Most other injuries involve two or more of the above structures and require closed reduction or surgical stabilization.

External fixation may be used in vertical load fractures.
18.4 INJURIES OF THE LOWER EXTREMITY

**Ankle fractures**

![Ankle fracture images]

*Figure 18.55, Figure 18.56, Figure 18.57, Figure 18.58*
18.4 INJURIES OF THE LOWER EXTREMITY

Foot Injury

- Clinical examination suggests this fracture, but X-rays are needed to confirm the diagnosis and to guide treatment.

- Treat with closed reduction and immobilization.

- Fracture dislocations may require open reduction.
18.4 INJURIES OF THE LOWER EXTREMITY

Foot Injury

Figure 18.59
18.4 INJURIES OF THE LOWER EXTREMITY

- Calcaneal fractures occur:
  - either through the body of the calcaneous and into the subtalar joint, or
  - as avulsion fractures of the posterior portion of the tuberosity

- The mechanism of the injury is a vertical load which may also cause vertebral body compression fractures

- Treat with:
  - compression,
  - elevation,
  - splinting and
  - gradual resumption of weight bearing.
18.4 INJURIES OF THE LOWER EXTREMITY

**Calcaneal fractures**
INJURIES OF THE LOWER EXTREMITY

Fractures of the metatarsals and toes

Figure 18.62

Figure 18.63
18.4 INJURIES OF THE LOWER EXTREMITY

Fractures of the metatarsals and toes

- The injury results from forced plantar flexion of the forefoot.
- Diagnosis is by X-ray showing fractures of the base of the metatarsal bones with subluxation or dislocation of the tarsal-metatarsal joints.
- Treat with closed reduction and immobilization. Pin fixation may be necessary to secure the position.
- Long-term mid-foot pain is common.
- Fractures of the metatarsals and toes are common injuries resulting from minor trauma.
- Treat fractures and dislocations in this area by closed reduction and immobilization.
18.5 SPINE INJURIES

Figure 18.64

Figure 18.67
18.5 SPINE INJURIES

- Evaluate the spine based on:
  - history of injury,
  - physical examination,
  - complete neurological examination and X-rays

- Spinal column injuries are stable or unstable, based on bone and ligament damage

- Neurological function may be normal, show incomplete injury or complete spinal cord disruption

- Base your treatment on the extent of injury.
18.6 Fractures in Children

Figure 18.68

Figure 18.69

Figure 18.70
18.6 FRACTURES IN CHILDREN

• Open growth plates and the thick periosteal membrane make fractures in children different from those in adults.

• Treat fractures by closed reduction; certain displaced epiphyseal fractures may need surgical reduction.

• Future growth will remodel some residual deformity in length, angulation and displacement but not in rotation.
18.6 FRACTURES IN CHILDREN

Specific Fracture types

Figure 18.71

Figure 18.72

Figure 18.73

Figure 18.74
18.7 AMPUTATIONS
18.7 AMPUTATIONS

- Limb amputation is a definitive procedure, which requires careful preoperative thought and consultation.

- Amputations are performed in emergency situations for severe limb trauma and in elective situations for infection or tumours.

- Amputations in children should, when possible, preserve the growth plates.

- Rehabilitation efforts are focused on the substitution of lost function.
18.8 COMPLICATIONS

Figure 18.79

Figure 18.80

Figure 18.81
18.8 COMPLICATIONS contd.
18.8 COMPLICATIONS

- Compartment syndrome is caused by swelling within closed fascial spaces; as the intra-compartmental pressure increases, blood supply to the muscles is lost.

- Treat with immediate surgical release of the skin and fascia over the involved compartment.
18.9 WAR-RELATED TRAUMA

- The severity of the gunshot wound is related to bullet size, shape and velocity

- Low velocity injuries cause minor wounds and are treated with:
  - superficial debridement,
  - antibiotics and
  - tetanus prophylaxis

- High velocity injuries cause extensive soft tissue and bone damage and are treated with careful debridement and lavage, as are all open fractures; do not close the wound initially

- Treat associated fractures with plaster, traction or external fixation.
18.9 WAR-RELATED TRAUMA

- Injury patterns are related to the type of landmine encountered

- Blast injuries occur from pressure sensitive mines, while trip-wire mines produce injury from multiple flying fragments

- Evaluate the entire patient for injury to multiple systems

- Treat extremity injuries with debridement and skin coverage

- Amputation is often necessary.