- 3. **Crush:** Weight of the object, site of the injury, duration of weight application.
- 4. **Explosion:** Blast magnitude; patient distance from the blast; primary blast injury (force of the blast wave); secondary blast injury (projectiles).

General Examination

The clinical orthopaedic examination requires assessment of the axial skeleton, pelvis, and extremities. Swelling, haematomas, and open wounds are assessed visually in the undressed patient. It is obligatory to palpate the entire spine, pelvis, and each joint. Examination soon after trauma may precede telltale swelling in joint or long bone injuries. In the unresponsive patient, only crepitation and false motion may be discerned. Patients with a better mental status, however, can provide feedback regarding pain resulting from palpation. The pelvis is examined by gentle compression of the iliac wings in a mediolateral, anterior–posterior direction and palpation of the pubis.

Neurological Examination

The neurological examination of the extremities should be documented to the fullest extent possible, in light of the patient's mental status, as it is central to subsequent decision making. This examination includes delineation of sensory function in the major nerves and dermatomes in the upper and lower extremities. Perianal sensation is also important in cases of spinal injuries.

Muscle Examination

Motor examination can be difficult because of pain or impaired mental status, but even in such cases, useful and relatively complete information can be obtained. Particularly important in the face of spinal cord injury and suspected injury are the reflexes of the anal "wink" and bulbocavernosus muscle.

Imaging Studies

Radiological assessment follows the same general hierarchy as the clinical assessment.

- 1. **First level:** The severely injured polytrauma patient requires plain films of the chest, abdomen, and pelvis to indicate sources of respiratory and circulatory compromise.
- 2. **Second level:** Requires the cervical spine cross-table lateral view. The information obtained from this film dictates treatment and the need for any further evaluation of the cervical spine.
- 3. **Third level:** Subsequent evaluation is dependent on clinical findings. Any long bone or joint with a laceration, haematoma, angulation, or swelling must

undergo X-ray evaluation. Any long bone fracture requires complete evaluation of the joints proximal and distal to the fracture. At the minimum, two views of the extremities are needed, usually the anteroposterior and lateral views.

"CLEARING" THE CERVICAL SPINE

In the evaluation of the trauma patient, an important consideration is the status of the cervical spine. The cervical spine is easily injured because of the large mass of the head relative to the neck, especially in motor vehicle accidents involving rapid acceleration or deceleration. Consequently, the cervical spine can receive significant force and suffer injury. In the conscious and responsive patient, swelling or tenderness on physical examination of the cervical spine is readily apparent. In the unconscious patient, cervical spine injuries can go undetected, and a careful physical examination must be performed with heavy reliance upon radiographic evaluation.

The essential radiographs for evaluation of the cervical spine include anterior–posterior (AP) views, lateral views, and an open-mouth odontoid view (Fig. 2.3). It is essential to be able to see to the top of T1 (first thoracic vertebra).

Immediate Management of Musculoskeletal Trauma

The orthopaedic injuries in the polytrauma patient are seldom truly emergency situations, except for those involving neural or vascular compromise.

For example, fracture-dislocation of the ankle or knee resulting in distal ischaemia justifies immediate attempts at reduction to minimize the sequelae of ischaemia. A more subtle situation requiring emergent treatment would be dislocation of the hip in which vascular compromise of the femoral head may result. Arterial bleeding from an open fracture should be treated immediately with pressure to minimize blood loss. Other bone and joint injuries, although urgent, may be approached in a more deliberate manner.



Fig. 2.3: Open mouth, AP and lateral views of cervical spine

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Fig. 3.17: Knee dislocation

- *Dislocation:* A dislocation is a total disruption of the joint surface with loss of normal contact between the two bony ends (Fig. 3.17).
- *Subluxation:* A subluxation is a partial disruption of a joint with partial contact remaining between the two bones that make up the joint.
- *Diastasis:* Certain bones come together in a syndesmotic articulation in which there is little motion. An interosseous membrane that traverses the area between the two bones interconnects these joints. Two syndesmotic joints occur in humans between the radius and ulna and between the fibula and tibia. A disruption of the interosseous membrane connecting these two joints is called a diastasis.

Common Dislocations at Different Joints (Table 3.1)

Table 3.1			
Joint	Direction	Cause	
Hip	Posterior	Dash board injury	
Shoulder	Anterior	Common due to intrinsic instability	
	Posterior	Seen in epileptics	
	Luxatio erecta	Inferior dislocation of shoulder	
Elbow	Posterior		
Knee	Posterior	Dashboard injury	
Patella	Lateral		

Diagnosis

Usually dislocations can be diagnosed easily on clinical examination due to following features

- 1. Pain—dislocations are very painful
- 2. Deformity (Table 3.2)

Table 3.2: Common deformities of various joint dislocations

Shoulder anterior	Abduction deformity, loss of
dislocation	contour of shoulder
Elbow posterior	Flexion, bow stringing of triceps
dislocation	
Hip posterior	Flexion, adduction, internal
dislocation	rotation
Hip anterior	Abduction, external rotation
dislocation	
Knee posterior	Flexion, external rotation
dislocation	

However, sometimes deformity is not evident clinically, e.g. posterior dislocation of shoulder.

- 3. Shortening of the limb
- 4. Loss of movements
- 5. Telescopy test is positive but may be difficult to elicit in acute dislocations.

Treatment

- 1. *Acute dislocation:* It requires urgent reduction by closed or open method. Most of the times closed methods succeed.
- 2. *Old unreduced dislocations:* Usually require open reduction.
- 3. Recurrent dislocations need additional reconstructive procedures, e.g. Bankart's repair for recurrent anterior dislocation of shoulder.

LIGAMENT INJURY

An injury to a ligament is called a sprain.

Classification of Sprain

- 1. *First degree sprain:* It occurs when only a few fibres are torn.
 - Little pain and swelling.
 - No disability or instability.
- 2. *Second degree sprain:* It occurs when significant number of fibres are torn.
 - Significant pain and swelling.
 - Inability to use the joint.
 - Significant pain on stress test.
- 3. *Third degree sprain:* It occurs when all the fibres are torn.
 - Significant pain and swelling
 - Significant instability in using the limb.
 - Opening up of the joint on stress test (Fig. 3.18)

Diagnosis

History of injury followed by pain, swelling and ecchymosis is typical. Usually haemarthrosis is noticed

<u>CHAPTER</u>

Open Fractures



DEFINITION

An open fracture is the one in which fracture fragments or its haematoma communicates with exterior due to breach in the overlying soft tissue and skin. The breach of the skin may be because of injury force causing fracture (external compounding) or the fractured end of the bone poking through the overlying skin (internal compounding).

CLASSIFICATION

Gustilo and Anderson have classified open fractures by the severity of associated soft-tissue damage and degree of wound contamination (Fig. 5.1 and Table 5.1).

Table 5.1: Gustilo	Anderson classification of open fracture
Classification	Description
Туре І	Puncture wound of less than or equal to 1 cm with minimal soft tissue injury Minimal wound contamination or muscle crushing
Туре II	Wound is greater than 1 cm in length Moderate soft-tissue injury Soft tissue coverage of the hope is
	adequate Comminution is minimal
Type IIIa	Extensive soft tissue damage Includes massively contaminated, severely comminuted, or segmental fractures Soft tissue coverage of the bone is
Type IIIb	adequate Extensive soft tissue damage with periosteal stripping and bone exposure Usually severely contaminated and comminuted
Type IIIc	Flap coverage is required to provide soft tissue coverage Associated with an arterial injury requiring
7 1	repair for limb salvage



Fig. 5.1: Grades of open fracture

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 Table 6.7: Common sites of avascular necrosis

Head of femur Proximal part of scaphoid Proximal part of talus Transcervical femur fracture Scaphoid waist fracture Talar neck fracture



Fig. 6.12: Bilateral AVN hip

- a. Affected part appears more sclerosed as compared to other areas
- b. Collapse of the affected part
- c. Osteoarthritis of the adjacent joint
- 2. Bone scan can pick up avascular necrosis much earlier than X-rays.
- 3. *MRI*: It is the investigation of choice as it detects AVN earlier than X-rays. It reveals geographical areas of avascularity prominently.

Prevention

Avascular necrosis can be prevented by earliest reduction and fixation of the fracture. During surgery, one must know vascular supply of that bone so as to preserve it.

Treatment

- 1. Delay weight bearing on necrotic bone so as to prevent collapse
- 2. Vascularised grafts, e.g. Meyer's procedure for AVN hip
- 3. Bisphosphonates have definite role in slowing down progression of AVN
- 4. Excision of necrosed part, e.g. scaphoid
- 5. Excision of necrosed part followed by prosthetic replacement, e.g. total hip arthroplasty
- 6. Arthrodesis.

COMPLEX REGIONAL PAIN SYNDROME (REFLEX SYMPATHETIC DYSTROPHY)

Previously known as reflex sympathetic dystrophy, the term complex regional pain syndrome (CRPS) was

created to better describe this syndrome, which is not always associated with extremity dystrophy or involvement of the sympathetic nervous system. Other terms that have been used synonymously include posttraumatic reflex dystrophy, Sudeck's atrophy, reflex dystrophy, shoulder-hand syndrome, and causalgia.

CRPS is a painful condition of an extremity that follows trauma, infection, or surgery. It is most common in young adults and occurs in women more frequently than men by a ratio of 3:1.

Pathology

The pathophysiology of CRPS is not fully understood. Normally, following an extremity injury, the sympathetic nervous system is activated. Vasoconstriction in the limb leads to decreased blood flow. If sympathetic tone persists inappropriately, oedema, capillary collapse, and ischaemia result. These symptoms result in further pain, which re-excites the sympathetic nerves and creates a positive feedback circuit. This pathologic reflex of the sympathetic nervous system results in blood flow abnormalities, pain, and ultimately, atrophy (Fig. 6.13).

Stages of CRPS

- 1. *Acute stage:* The patient complains of a constant burning or aching pain in the extremity. A key feature to the early diagnosis of this syndrome is that the pain increases with external stimuli or motion and is out of proportion to the severity of the preceding injury. Over the ensuing months, the skin becomes cold and glossy with limited range of motion.
- 2. *Dystrophic stage* is characterized by the presence of chronic pain with neuropathic descriptors (burning, allodynia, dysesthesia, hyperalgesia to cold) in an extremity.



Fig. 6.13: Pathophysiology of CRPS

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