SCAPULA FRACTURES

Epidemiology

- This relatively uncommon injury represents 3% to 5% of shoulder fractures and 0.4% to 1% of all fractures.
- The mean age of patients who sustain a scapula fracture is 35 to 45 years.

Anatomy

- This flat, triangular bone links the upper extremity to the axial skeleton.
- Protection from impact is provided by the large surrounding muscle mass as well as the mobility of the scapula on the chest wall, which aids in force dissipation.

Mechanism of Injury

- Injury is usually the result of high-energy trauma.
- Motor vehicle accident in approximately 50% of cases and motorcycle accident in 11% to 25%
- Indirect injury occurs through axial loading on the outstretched arm (scapular neck, glenoid, intra-articular fracture).
- Direct trauma occurs from a blow or fall (scapula body fracture) or through direct trauma to the point of the shoulder (acromion, coracoid fracture).
- Shoulder dislocation may cause a glenoid fracture.
- Muscles or ligaments may cause an avulsion fracture.

Associated Injuries

- The presence of a scapula fracture should raise suspicion of associated injuries, because 35% to 98% of scapula fractures occur in the presence of comorbid injuries including:
  - Ipsilateral upper torso injuries (fractured ribs, clavicle, sternum)
Pneumothorax (11% to 55% of scapula fractures)
- Pulmonary contusion (11% to 54% of scapula fractures)
- Injuries to neurovascular structures (brachial plexus injuries, vascular avulsions)
- Spine injuries (20% lower cervical spine, 76% thoracic spine, 4% lumbar spine)

CLINICAL EVALUATION
- A full trauma evaluation is essential, with attention to airway, breathing, circulation, disability, and exposure.
- The patient typically presents with the upper extremity supported by the contralateral hand in an adducted and immobile position, with painful range of motion, especially shoulder abduction.
- A careful examination for associated injuries should be performed, with a thorough neurovascular assessment.
- Compartment syndrome overlying the scapula is uncommon, but it must be ruled out in the presence of pain out of proportion to the apparent injury. Comolli sign is triangular swelling of the posterior thorax overlying the scapula and is suggestive of hematoma resulting in increased compartment pressures.

RADIOGRAPHIC EVALUATION
- May first be picked up on a chest x-ray. Initial radiographs should include a trauma series of the shoulder, consisting of a true anteroposterior view, an axillary view, and a scapular-Y view (true scapular lateral); these generally are able to demonstrate most glenoid, scapular neck, body, and acromion fractures.
- The axillary view may be used to further delineate acromial and glenoid rim fractures.
- An acromial fracture should not be confused with an os acromiale, which is a rounded, unfused apophysis present in approximately 3% of the population. When present, it is bilateral in 60% of cases.
- Glenoid hypoplasia, or scapular neck dysplasia, is an unusual abnormality that may resemble glenoid impaction and may be associated with humeral head or acromial abnormalities. It has a benign course and is usually noted incidentally.
- A 45-degree cephalic tilt (Stryker notch) radiograph is helpful to identify coracoid fractures.
- Computed tomography may be useful for further characterizing intra-articular glenoid fractures.
- Because of the high incidence of associated injuries, especially to thoracic structures, a chest radiograph is an essential part of the evaluation.
CLASSIFICATION

Anatomic Classification (Zdravkovic and Damholt) (Fig. 13.1)

Type I: Scapula body
Type II: Apophyseal fractures, including the acromion and coracoid
Type III: Fractures of the superolateral angle, including the scapular neck and glenoid

Ideberg Classification of Intra-Articular Glenoid Fractures (Fig. 13.2)

Type I: Avulsion fracture of the anterior margin
Type IIA: Transverse fracture through the glenoid fossa exiting inferiorly
Type IIIB: Oblique fracture through the glenoid fossa exiting inferiorly
Type III: Oblique fracture through the glenoid exiting superiorly and often associated with an acromioclavicular joint injury
Type IV: Transverse fracture exiting through the medial border of the scapula
Type V: Combination of a type II and type IV pattern
Type VI: Comminuted glenoid fracture

Classification of Acromial Fractures (Kuhn et al.) (Fig. 13.3)

Type I: Minimally displaced
Type II: Displaced but does not reduce the subacromial space
Type III: Displaced with narrowing of the subacromial space

Classification of Coracoid Fractures (Ogawa et al.) (Fig. 13.4)

Type I: Proximal to the coracoclavicular ligament
Type II: Distal to the coracoclavicular ligament

![Anatomic classification](https://example.com/image.png)
FIGURE 13.2 Ideberg classification of glenoid fractures into five types, with the comminuted type VI of Goss added. The classification is historical, because decision making is based on displacement of the articular component. (From Bucholz RW, Heckman JD, Court-Brown C, et al., eds. Rockwood and Green’s Fractures in Adults. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2006.)
Type I acromion fractures are nondisplaced and include type IA (avulsion) and type IB (complete fracture). Type II fractures are displaced, but they do not reduce the subacromial space. Type III fractures cause a reduction in subacromial space. (Modified from Kuhn JE, Blasier RB, Carpenter JE. Fractures of the acromion process: a proposed classification system. *J Orthop Trauma* 1994;8:6–13.)

Classification of coracoid fractures: Type I is proximal to the coracoclavicular ligament attachment and type II is distal. (Modified from Ogawa K, Yoshida A, Takahashi M, Ui M. Fractures of the coracoid process. *J Bone Joint Surg Br* 1979;79:17–19.)
Orthopaedic Trauma Association Classification of Scapula Fractures


TREATMENT

Nonoperative

Most scapula fractures are extra-articular and are amenable to nonoperative treatment, consisting of sling use and early range of shoulder motion.

Operative

Surgical indications are controversial, but include:

- Displaced intra-articular glenoid fractures involving greater than 25% of the articular surface, with or without subluxation
- Scapular neck fractures with greater than 40-degree angulation or 1-cm medial translation
- Scapular neck fractures with an associated displaced clavicle fracture
- Fractures of the acromion that impinge on the subacromial space
- Fractures of the coracoid process that result in a functional acromioclavicular separation
- Comminuted fractures of the scapular spine

Specific treatment options include:

Glenoid fractures (Ideberg classification):

Type I: Fractures involving greater than one-fourth of the glenoid fossa that result in instability may be amenable to open reduction and internal fixation with screw fixation using an anterior or posterior approach.

Type II: Inferior subluxation of the humeral head may result, necessitating open reduction, especially when associated with a greater than 5-mm articular step-off. An anterior approach typically provides adequate exposure.

Type III: Reduction is often difficult and may require superior exposure for superior to inferior screw placement, partial-thickness clavicle removal, or distal clavicle resection in addition to anterior exposure for reduction. Additional stabilization of the superior suspensory shoulder complex (SSSC) may be necessary.

Type IV: Open reduction should be considered for displaced fractures, especially those in which the superior fragment of the glenoid displaces laterally.

Type V: Operative management does not necessarily result in improved functional results as compared with nonoperative treatment with early motion, but it should be considered for articular step-off greater than 5 mm.
Scapular body fractures: Operative fixation is rarely indicated, with nonoperative measures generally effective. Open reduction may be considered when neurovascular compromise is present and exploration is required.

Glenoid neck fractures: These generally may be treated symptomatically, with early range-of-motion exercises. If the injury is accompanied by a displaced clavicle fracture, an unstable segment may exist, including the glenoid, acromion, and lateral clavicle. Internal fixation of the clavicular fracture generally results in adequate stabilization for healing of the glenoid fracture.

Acromion fractures: Os acromiale must first be ruled out, as well as concomitant rotator cuff injuries. Displaced acromion fractures may be stabilized by dorsal tension banding, if displacement causes subacromial impingement.

Coracoid fractures: Complete third-degree acromioclavicular separation accompanied by a significantly displaced coracoid fracture is an indication for open reduction and internal fixation of both injuries.

Floating shoulder: This consists of double disruptions of the SSSC.

The SSSC is a bone-soft tissue ring that includes the glenoid process, coracoid process, coracoclavicular ligaments, distal clavicle, acromioclavicular joint, and acromial process (Fig. 13.5).

- The superior strut is the middle third clavicle.
- The inferior strut is the lateral scapular body and spine.

Traumatic disruption of two or more components of the SSSC usually secondary to high-energy injury is frequently described as a floating shoulder.

Historically, operative management has been recommended because of potential instability and displacement of the glenoid. This may

**FIGURE 13.5** Superior shoulder suspensory complex anatomy. (A) Anteroposterior view. (B) True lateral view. (Modified from Goss TP. Double disruption of the superior shoulder suspensory complex. *J Orthop Trauma* 1993;7:99–106.)
lead to shortening, loss of range of shoulder motion, and potential weakness.

- Recent series of nonoperative treatment of floating shoulders have reported good results.
- Glenopolar angle $<30$ degrees may predispose to poorer results (Fig. 13.6).

**Surgical Considerations**

- **Patient positioning**
  - Supine, lateral, or beach chair position, depending on the fracture type. Most scapula body and neck fractures are best treated with the patient in a lateral position. Anterior glenoid fractures would be reduced and stabilized from an anterior approach.

- **Radiographic positioning**
  - Image intensification can come from the opposite side of the table, the head or foot of the table, depending on patient positioning.

- **Surgical approach**
  - Anterior for coracoid and anterior glenoid fractures using a deltopectoral approach. To access the anterior glenoid, one can either open the rotator interval or split or take down the subscapularis.
  - Posterior for scapula body, neck, and posterior glenoid fractures. The Judet approach is extensile and is used for scapula body fractures.
  - Superior for acromial fractures
COMPLICATIONS

- **Associated injuries:** These account for most serious complications because of the high-energy nature of these injuries. Increased mortality is associated with concomitant first rib fracture.

- **Malunion:** Fractures of the scapula body generally unite with nonoperative treatment; when malunion occurs, it is generally well tolerated but may result in painful scapulothoracic crepitus.

- **Nonunion:** This is extremely rare, but when present and symptomatic it may require open reduction and internal fixation.

- **Suprascapular nerve injury:** This may occur in association with scapula body, neck, or coracoid fractures that involve the suprascapular notch.

Scapulothoracic Dissociation

- This injury is a traumatic disruption of the scapula from the posterior chest wall.

- This rare, life-threatening injury is essentially a subcutaneous forequarter amputation.

- The mechanism is a violent traction and rotation force, usually as a result of a motor vehicle or motorcycle accident.

- Neurovascular injury is common:
  - Complete brachial plexopathy: 80%
  - Partial plexopathy: 15%
  - Subclavian or axillary artery: 88%

- It can be associated with fracture or dislocation about the shoulder or without obvious bone injury.

- **Classification**
  - **Type I:** Musculoskeletal injury alone
  - **Type IIA:** Musculoskeletal injury with vascular disruption
  - **Type IIB:** Musculoskeletal injury with neurologic impairment
  - **Type III:** Musculoskeletal injury with both neurologic and vascular injury

- **Initial treatment**
  - Patients are often polytraumatized.
  - Advanced trauma life support protocols should be followed.
  - Angiography of the limb with vascular repair and exploration of brachial plexus are performed as indicated.
  - Stabilization of associated bone or joint injuries is indicated.
Later treatment

- Neurologic
  - At 3 weeks, electromyography is indicated.
  - At 6 weeks, cervical myelography or magnetic resonance imaging (MRI) is performed.
  - Shoulder arthrodesis and/or above elbow amputation may be necessary if the limb is flail.
  - Nerve root avulsions and complete deficits have a poor prognosis.
  - Partial plexus injuries have good prognosis, and functional use of the extremity is often regained.
  - MRI—“empty sleeve sign”

- Osseous
  - If initial exploration of the brachial plexus reveals a severe injury, primary above elbow amputation should be considered.
  - If cervical myelography reveals three or more pseudomeningoceles, the prognosis is similarly poor.

This injury is associated with a poor outcome including flail extremity in 52%, early amputation in 21%, and death in 10%.

**Intrathoracic Dislocation of the Scapula**

- This is extremely rare.
- The inferior angle of the scapula is locked in the intercostal space.
- Chest computed tomography may be needed to confirm the diagnosis.
- Treatment consists of closed reduction and immobilization with a sling and swathe for 2 weeks, followed by progressive functional use of the shoulder and arm.