

Introduction

Epidemiology

incidence

75-80% of all clavicle fractures will occur in the [middle third segment](#)

demographics

most often seen in young, active patients

Pathophysiology

mechanism

fall on an outstretched arm or direct trauma to lateral aspect of shoulder

pathoanatomy

displaced fractures

medial fragment: sternocleidomastoid muscle pulls the medial fragment [posterolaterally](#)

lateral fragment: pectoralis and weight of arm pull the lateral fragment [inferomedially](#)

open fractures usually the result of the medial fragment "buttonhole" through platysma

Associated injuries

are rare but may include:

ipsilateral scapular fracture

scapulothoracic dissociation

should be considered with significantly displaced/widened fracture fragments

rib fracture

pneumothorax

neurovascular injury

[Pediatric Clavicle fractures](#)


fracture patterns include

medial clavicle physeal injury ▶

distal clavicle physeal injury ▶

Relevant Anatomy

Acromioclavicular Joint Anatomy ▶

AC joint stability 

static stabilizers

[acromioclavicular ligament](#)

provides anterior/posterior stability

has superior, inferior, anterior, and posterior components

[superior ligament](#) is strongest, followed by posterior

[coracoclavicular ligaments](#) (trapezoid and conoid)

provides superior/inferior stability

trapezoid ligament inserts [3 cm](#) from end of clavicle

conoid ligament inserts [4.5 cm](#) from end of clavicle in the posterior border

[conoid ligament is strongest](#)


[capsule](#)

dynamic stabilizers

deltoid and trapezius

Classification

Nondisplaced	Less than 100% displacement	No
Displaced	Greater than 100% displacement Nonunion rate of 4.5%	Op

AO Classification - Middle third clavicle fracture 		
Type A=Simple	A1 = spiral A2 = oblique A3 = transverse	
Type B=Wege	A1 = spiral wedge A2 = bending wedge A3 = fragmented wedge	
Type C=Complex	A1 = complex spiral A2 = segmental A3 = irregular	

Presentation

Symptoms

anterior shoulder pain

Physical exam

deformity

perform careful neurovascular exam

tenting of skin (impending open fracture)

Imaging

Radiographs

views

[sitting/standing upright](#), standard AP view of bilateral shoulders

additional views

15° cephalic tilt (ZANCA view) determine superior/inferior displacement

may consider having the patient hold 5 to 10 lbs weight in affected hand

CT

views

coronal, saggital, axial

3D reconstruction views

findings

may help evaluate displacement, shortening, comminution, articular extension, and n

vascular injury

Treatment

Nonoperative

[sling immobilization with gentle ROM exercises at 2-4 weeks and strengthening](#)

indications




minimally displaced Group I (middle third)

shortening and displacement <2cm

no neurologic deficit

no significant displacement to the superior shoulder suspensory complex (<10mm dis

outcomes

[nonunion](#) (1-5%)   

risk factors for nonunion

comminution

100% displacement & shortening (>2 cm)

advanced age and female gender

poorer cosmesis

decreased shoulder strength and endurance ?

seen with displaced midshaft clavicle fracture healed with > 2 cm of shortening

Operative

open reduction internal fixation

indications ?

absolute

open fxs

displaced fracture with skin tenting 📷

subclavian artery or vein injury

floating shoulder (clavicle and scapula neck fx)

symptomatic nonunion

symptomatic malunion

relative and controversial indications

displaced Group I (middle third) with >2cm shortening ?

bilateral, displaced clavicle fractures

brachial plexus injury (questionable b/c 66% have spontaneous return)

closed head injury

seizure disorder

polytrauma patient

outcomes

advantages of ORIF

improved results with ORIF for clavicle fractures with >2cm shortening and 100% displacement

improved functional outcome / less pain with overhead activity ?

faster time to union

decreased symptomatic malunion rate ?

improved cosmetic satisfaction

improved overall shoulder satisfaction

increased shoulder strength and endurance

disadvantages of ORIF

increased risk of need for future procedures

implant removal

debridement for infection

Techniques

Sling Immobilization

technique

sling or figure-of-eight (prospective studies have not shown difference between sling and braces) ?

after 2-4 weeks begin gentle range of motion exercises

strengthening exercises begin at 6-10 weeks

no attempt at reduction should be made

Closed Reduction, Intramedullary Fixation 📷

equipment options

cannulated screw

specialized screw systems (e.g, Dual Trak)

titanium elastic nail

Hagle pin

approach

beach chair or supine

posterolateral incision

contraindications

substantial comminution

segmental fractures

advantages

smaller incision

less soft-tissue disruption

less prominent hardware

avoids the supraclavicular cutaneous nerves commonly injured with plating

disadvantages

higher complication rate including hardware migration

[biomechanically inferior to plating](#)

Open Reduction, Plate and Screw Fixation

equipment

most common

limited contact precontoured, dynamic compression plate 📷

k-wires for preliminary fixation

others

3.5mm reconstruction plate 📷

locking plates 📷

approach

beach chair or supine

direct superior vs anterior incision

biomechanics

superior vs anteroinferior plating 📷 📷

[higher load to failure](#) (superior plating > anteroinferior plating)

[plate strength with inferior bone comminution](#) (anteroinferior plating > superior plating)

[lower risk of neurovascular injury](#) (anteroinferior plating > superior plating)

[lower removal of deltoid attachment](#) (superior plating > anteroinferior plating)

outcomes

time to union

operative (16.4 weeks) vs. non-operative (28.4 weeks)

Postoperative Rehabilitation

early

slings for 7-10 days followed by active motion

late

strengthening at ~ 6 weeks when pain free motion and radiographic evidence of union
full activity including sports at ~ 3 month

Complications

Nonoperative treatment

[nonunion](#) (1-5%)

risk factors

fracture comminution (e.g, Z deformity)

fracture displacement ?

female

advancing age

smoker

treatment of nonunion

if asymptomatic, no treatment necessary

if symptomatic, ORIF with plate and bone graft (particularly atrophic nonunion) 📷 ??

[malunion](#)

definition

shortening >3cm, angulation >30 degrees, translation >1cm

complaints

increased fatigue with overhead activities

thoracic outlet syndrome

dissatisfaction with appearance

difficulty with shoulder straps, backpacks and the like

treatment

clavicle osteotomy with bone grafting, if symptomatic

Operative treatment

[hardware prominence](#)

~30% of patient request plate removal

superior plates associated with increased irritation

[neurovascular injury](#) (3%)

superior plates associated with increased risk of subclavian artery or vein penetration

subclavian thrombosis

[nonunion](#) (1-5%)

[infection](#) (~4.8%)

risk factors

illicit drug use

diabetes

previous shoulder surgery

[mechanical failure](#) (~1.4%)

[pneumothorax](#)

[adhesive capsulitis](#)

4% in surgical group develop adhesive capsulitis requiring surgical intervention