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MEDICAL CENTER

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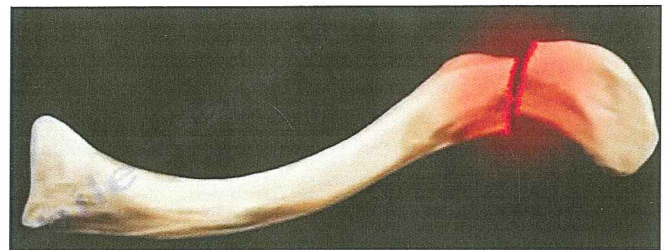
ORTHOPAEDIC MONTHLY

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Distal Third Clavicle fracture

Fracture of the distal third of the clavicle is a problem fracture. Its management and outcome can be complicated. There are two ligaments, the conoid and trapezoid ligaments, called the coracoclavicular ligament that go between the coracoid and the clavicle. The conoid is medial (inserts about 4.5cm from the end of the clavicle), and the trapezoid is lateral (inserts about 3 cm from the lateral end of the clavicle). The integrity of the conoid and trapezoid ligaments (coracoclavicular ligaments) are important. The coracoclavicular ligaments provide the primary resistance to superior displacement of the lateral clavicle. The ligaments are holding the clavicle down. If fracture of the lateral third of the clavicle occurs and the medial part is not attached to the ligaments, then the medial part of the clavicle will become displaced superiorly by the pull of the sternocleidomastoid muscle. When you assess for fracture of the lateral or distal third of the clavicle, you assess the stability of this fracture. The stability of this fracture is based on the location of the fracture in relationship to the coracoclavicular ligaments, the AC joint, and the fracture pattern. There are basically two fracture types. Stable fracture type with no displacement, or displaced fracture with coracoclavicular ligament not attached to the proximal fragment. The proximal fragment will displace superiorly. This type will have delayed union up to 50% and nonunion in approximately 20%. This occurs because the proximal fragment is not attached to any ligaments, it is just displaced superiorly. The distal segment continues to be attached to the coracoid by the coracoclavicular ligament. You should determine the stability and the displacement of the fracture prior to surgery in order to make the proper decision for treatment and proper selection of implant for dealing with this problem. The Zanca view x-ray may be needed. This is done by using a 15 degree cephalic tilt to show the superior inferior displacement. A fracture that is lateral to the ligament makes the fracture stable and you will treat the patient conservatively with a sling. A fracture that is medial to the ligament makes the fracture unstable, it is treated by open reduction internal fixation. You can use the guideline of the ligament insertion, which is 4.5 cm from the AC joint. Use the Zanca view to help you visualize the displacement superiorly and inferiorly. When the fracture is medial to the ligament that is unstable, this means that you need to do ORIF because if you treat it conservatively, there will be a high incidence of nonunion. You can use multiple techniques for reduction and fixation of the

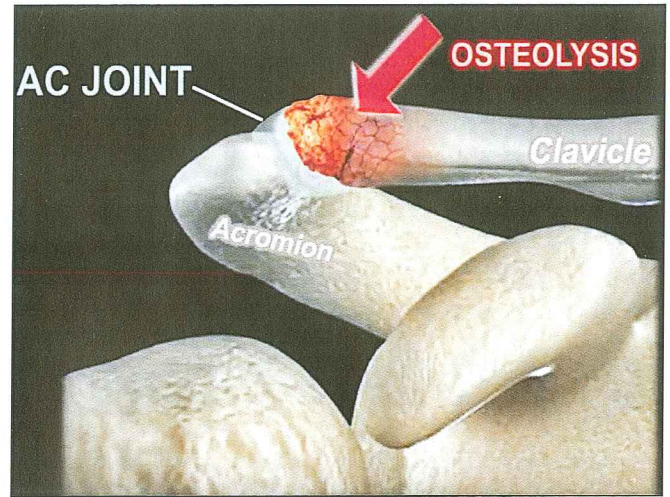


distal clavicle fracture. One of these techniques is plates and screws called a "cluster plate". It has multiple holes which allow you to put small screws and lock the screws to the plate. Another technique is the hook plate which is used when there is insufficient bone in the distal segment for fixation with plates and screws. There are two potential problems with the hook plate. Not every hospital has the hook plate. You may not be able to fix the distal clavicle fracture with a plate and screws in surgery so you should make sure you have the hook plate in house in case it is needed (hook plate is a backup plan). Secondly, most hook plates will require removal after healing of the fracture (secondary surgery). Most non unions are asymptomatic. What if the fracture of the distal clavicle is a nonunion and the patient has symptoms? You need to fix this fracture with a plate and a bone graft if the fracture is atrophic. This problem is very difficult to treat and it does not matter what type of fixation that you use, there will be a high incidence of failure in the treatment of nonunion of the distal clavicle. The patient may require two types of stabilization for this nonunion. The first type is a plate and bone graft fixation. The second type is additional help to the plate and bone graft by stabilizing the coracoclavicular area. You can use a tendon allograft or you can use anchors in the coracoid or a tight rope fixation. Fracture distal to the line drawn vertically to the coracoid process is probably a stable fracture. You will give the patient a sling for comfort and give a structured physical therapy program when the pain is less, starting with pendulum exercises and progress to active assisted when the pain is manageable. In a child, a distal clavicle fracture could be a periosteal sleeve fracture which will remain attached to the intact coracoclavicular ligament. This fracture usually remodels and only requires a sling for comfort with no surgery needed.



Distal Clavicle Osteolysis

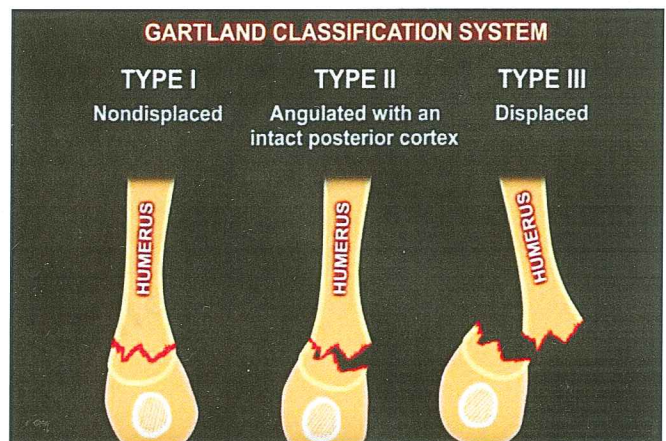
Osteolysis means bone erosion, dissolving or the bone is lost. There is a localized area of inflammation, hyperemia, microfracture, bone resorption and eventually arthritis of the AC joint. It is either a micro-stress fracture or a stress reaction in the distal clavicle with subsequent bone resorption. It typically affects younger male patients. It occurs from activities that require heavy overhead lifting, repetitive motion, and the use of a jackhammer. The condition is also common in weight lifters, laborers, and it occurs more often in younger people than patients with primary AC joint arthritis. There is hyperemic response in the distal clavicle with localized bone resorption and cyst formation. Secondary AC joint arthritic changes may occur later during the disease process. The weight lifter will complain that they are no longer able to lift their usual amount of weight. There will be localized pain, swelling and tenderness over the AC joint area. The patient will have pain with terminal shoulder elevation and cross body motion. The cross body adduction test is done by positioning the patient with a 90 degree flexed arm adducted across the chest to the opposite side, the area of pain and tenderness will be directly over the AC joint. X-ray imaging will show erosion of the distal end of the clavicle but the acromion will be normal. You may see osteopenia, osteolysis, tapering and cystic changes of the distal clavicle. An MRI may be obtained to rule out additional shoulder pathology. The MRI will show high signal in the distal clavicle. The Zanca View is usually helpful in showing the acromioclavicular joint. The beam is directed with the cephalad angle of 10 degrees and 50% penetration. Clavicular osteolysis can be assessed using the Zanca view. This view can be helpful for determining AC joint pathology. The acromion will be normal with the abnormality isolated to the distal clavicle. The Zanca view is also used for diagnosis of arthritis of the AC joint. It will show osteophytes and joint space narrowing. The finding of the x-rays may not represent the patients' real symptoms. The differential diagnosis is the erosion or absence of the distal ends of the clavicle



and may be seen in a wide range of conditions. For example in bilateral erosions the patient may have hyperparathyroidism, rheumatoid arthritis or scleroderma. In unilateral erosions the patient may have post-traumatic osteolysis, myeloma, metastases, or osteomyelitis. The treatment includes rest, ice, activity modification, anti-inflammatory medications and injections, either blind or ultrasound guided. Surgery may be considered if pain persists despite conservative treatment. The surgery will be arthroscopic or open resection of the distal clavicle. The arthroscopy will allow for evaluation of the shoulder joint and for any other shoulder pathology. If you do open resection, then repair the trapezius and deltoid fascia adequately. Surgery is successful in about 90% of cases (Distal clavicle resection surgery will most likely lead to a long term successful outcome). Resect 5-10 mm of the bone. Keep the posterior- superior ligament intact because it maintains horizontal stability of the clavicle.

Supracondylar fracture of the Humerus in Children

The age is between 4-10 years. The injury is caused by a fall onto an outstretched hand. The majority of the fractures are extension type fractures. Type III is a displaced fracture, and it carries a high incidence of neurovascular deficit and compartment syndrome. Compartment syndrome may not develop right away; it may take hours to develop. The physician should not confuse compartment syndrome with the arterial injury. You can have arterial injury and compartment syndrome or compartment syndrome without arterial injury, and in this case, you will need fasciotomy to release the compartment syndrome. The anterior interosseous nerve is involved in the extension type injury. The patient cannot do the OK sign. If you have an extension type injury and you find that the patient has an ulnar nerve palsy after surgery, then it is probably not due to the extension type injury, but rather is due to the medial pin that may have affected the ulnar nerve.



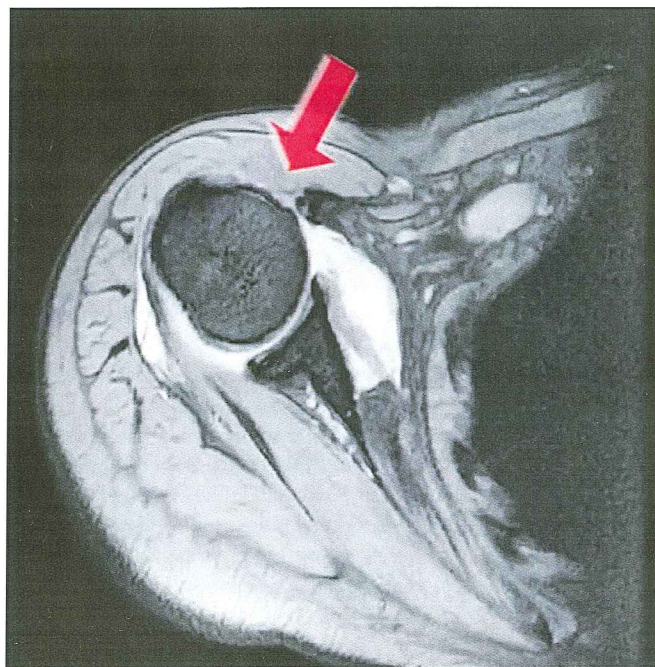
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In the flexion type injury, the ulnar nerve injury is more common. Based on the Gartland Classification System, a Type I fracture is nondisplaced, a Type II fracture is angulated with an intact posterior cortex, and a Type III fracture is displaced. To treat a Type I fracture, immobilize the patient's arm. To treat Type II and Type III fractures, do closed reduction and percutaneous pinning. If you cannot get the alignment correct, then do open reduction. You will place two or three lateral pins. If a medial pin is needed, be careful of the position of the ulnar nerve. Use open incision to introduce the medial pin. Have the elbow in extension, not in flexion, when you place the medial pin because this will relax the ulnar nerve. When you use the pins, do diversion pins. The cross pins configuration, medial and lateral pins, gives the maximum rotatory stability. The crossing should be approximately 2 cm proximal to the fracture. Normally we use two diversion lateral pins and adding a third pin will increase the stiffness in case of medial comminution. Avoid malposition of the fragments because it can lead to malunion and cubitus varus. Very rarely you may have to do corrective osteotomy for the cubitus varus (it is only a cosmetic problem, not a functional problem). If you have a pulseless, pink hand or a pulseless, white hand, then there is decreased perfusion. You will need to do emergency closed reduction and pinning. If closed reduction cannot be done, then you will do open reduction and pinning. After this, if the hand is pink and warm, then you observe. Observe for capillary refill, for temperature,

and for color with the elbow in some flexion, but not in hyperflexion. If after the closed reduction and pinning and the hand continues to be white and cold, you will do exploration of the artery. A pulseless, white hand from the beginning and you reduced and pinned the fracture, but the hand continues to be white, then you need to explore and repair the artery. You will repair the artery through an anterior approach and you will do fasciotomy after that. Initially, if the circulation was good, but after reduction and fixation you have a pulseless, white hand, then you need to unreduced the fracture fixation. When you have a nerve injury, observe the patient, do not explore the nerve. The recovery will start in about 6-12 weeks and the majority are completed in 4-5 months. Do not explore the nerve in closed fractures. The anterior humeral line should intersect the middle third of the capitellum in children more than 5 years old, and it touches the capitellum in children less than 5 years old. You want to maintain this relationship between the anterior humeral line and the capitellum. You will remove the pin at 3 weeks, you will allow gentle range of motion, you do not need routine physical therapy and the stiffness usually resolves in about 6 months. Do reduction and fixation when the hand is well perfused (pink and warm), then you can wait overnight to do the reduction in the morning. The urgent cases where you cannot wait to do reduction and fixation are the open fractures, the ones with neurovascular deficit, floating elbow, or impending compartment syndrome.

Subscapularis Muscle Tear

The subscapularis muscle is a large muscle that originates on the anterior surface of the scapula and lies in front of the shoulder. The subscapularis muscle tendon inserts into the lesser tuberosity of the humerus. The subscapularis muscle provides about 50% of the total cuff strength. The subscapularis muscle inserts into the lesser tuberosity of the humerus, while the other rotator cuff muscles have an insertion into the greater tuberosity. The long head of the biceps tendon lies in a groove anteriorly and is held in its position by the transverse humeral ligament. The action of the subscapularis muscle is adduction and internal rotation of the shoulder. The upper and lower subscapular nerves originate from the posterior cord of the brachial plexus. The suprascapular nerve is a different nerve, it innervates the supraspinatus and the infraspinatus muscles. A fall onto an outstretched arm during abduction is usually the mechanism of injury. The presentation is usually anterior shoulder pain following a forcible external rotation injury to the shoulder. A tear of the subscapularis tendon may follow anterior shoulder surgery. There may be an avulsion of the lesser tuberosity of the humerus. Subscapularis tendon tear may be isolated, or it may be associated with other rotator cuff tears. 88% of patients with biceps tendon subluxation are found to have subscapularis tendon tear. Tears can be either acute or chronic. There will be pain in front of the shoulder with weakness of internal rotation and increased passive external rotation. The diagnosis could be difficult and the condition could be missed. The transverse humeral ligament may be torn with complete rupture of the subscapularis tendon, and this may lead to medial dislocation of the biceps tendon from its groove. The Lift-off



test, bear-hug test, and belly press test all show weakness of internal rotation of the shoulder, when the patient is unable to lift his hand away from the lower back while the shoulder is maximally internally rotated.



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If you hear that there is a hyper abduction injury after an open repair of the shoulder and an inability to move the dorsum of the hand away from the back, then this is a subscapularis tendon tear. Tears of the subscapularis tendon can be diagnosed with an ultrasound or MRI. The MRI will show detachment of the subscapularis from its insertion into the lesser tuberosity of the humerus. The sagittal MRI will also show you if there is an atrophy of the muscle. If the patient has a total shoulder repair, and the patient fell down and there is an increase in the passive external rotation of the shoulder, the x-ray shows that everything is good, then you will probably need to do ultrasound evaluation of the shoulder to check the integrity of the subscapularis tendon. Arthroscopic identification of a chronic subscapularis tear can be done by the comma sign, which represents avulsion of the superior glenohumeral ligament. Chronic supraspinatus and infraspinatus tear in a young patient, and the tear cannot be repaired, then you will do latissimus dorsi transfer. Both the lift off test and the abdominal compression test needs to show that the patient has a good subscapularis muscle function before you do the latissimus dorsi transfer. Preoperative subscapularis function is necessary for good clinical outcome. In case of posterior dislocation of the shoulder in a young patient, when the humeral head defect is large but less than 50%, you may transfer the subscapularis tendon and the lesser tuberosity into the humeral head defect which is called a reverse Hill-Sachs lesion. Treatment is usually surgery. For a complete acute tear, do open or arthroscopic surgical repair. Biceps tenodesis is needed if there is subluxation of the long head of the biceps. For a chronic subscapularis tendon tear, do pectoralis major muscle transfer. When the subscapularis tear is missed and the tear is chronic, the tendon becomes retracted and atrophic and you will do subcoracoid pectoralis major tendon transfer. It may improve the function and decrease the pain. The subcoracoid position of the transfer allows redirection of the pectoralis major in a direction that is recreating the vector of the subscapularis tendon.

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