



THE UNIVERSITY OF TOLEDO
MEDICAL CENTER

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THE UNIVERSITY OF TOLEDO MEDICAL CENTER

ORTHOPAEDIC MONTHLY

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Triceps Tendon Rupture

The triceps muscle is a powerful extensor of the elbow joint. The triceps muscle has three heads: the long head, the lateral head, and the triceps. All three heads of the triceps muscle share a common tendon that inserts into the olecranon process at the elbow. An injury to the triceps tendon can be missed. Rupture of the triceps muscle typically occurs in male athletes such as body builders, football players, and in athletes who lift heavy weights. The injury can also occur due to a fall onto an outstretched hand. The tear is usually seen in middle aged men. A rupture of the tendon can be either complete, or incomplete. The rupture occurs at the bony insertion of the tendon. The patient may have pain, swelling, and some ecchymosis around the posterior part of the elbow. Mechanisms of injury include stress from sudden increase in intensity of training, direct trauma to the tendon, and laceration of the tendon. Rupture of the tendon may also occur due to local steroid injection or it may be due to a history of anabolic steroid use. Rupture may also occur due to systemic diseases such as renal disease, gout, or it may occur due to previous elbow surgery. Other risk factors include use of cipro (ciprofloxacin), diabetes mellitus, rheumatoid arthritis, osteoarthritis, and olecranon bursitis. There will be painful limitation of range of motion and the patient will not be able to extend the elbow against resistance. The patient may hear a "pop" and the tendon may retract upwards. A gap may be felt in the back of the elbow where the rupture occurs. There is a squeeze test for the distal biceps injury, achilles tendon injury, and also a squeeze test for the triceps injury. This test is completed when the patient is laying prone. The forearm will be hanging down with the elbow at the edge of the table and then squeeze the triceps. The inability of the patient to extend the elbow against gravity means that the patient has a complete tear of the triceps. X-rays may show a small bony avulsion. The "flake" sign identifies the avulsion and the position of the tendon on a lateral x-ray. The x-ray shows an avulsion of a small piece of bone from the elbow. X-rays can be helpful in the



Flake Sign

diagnosis of a triceps tendon rupture however, MRI is the best study for visualizing the tear. Establish the correct diagnosis early, early repair of the tendon in acute cases is important. With delay in diagnosis, primary repair of the tendon may not be possible, and the patient may require tendon reconstruction with a less favorable outcome. Reconstruction of the tendon by a graft in chronic neglected cases can be done especially if the patient has a major disability in elbow extension.

Sternoclavicular joint Injuries

The sternoclavicular joint is composed of the proximal end of the clavicle and the manubrium of the sternum. Sternoclavicular joint injuries are uncommon shoulder injuries. In young patients, the

injury is usually a physeal injury. Medial clavicle physeal fracture occurs in a patient less than 25 years old.

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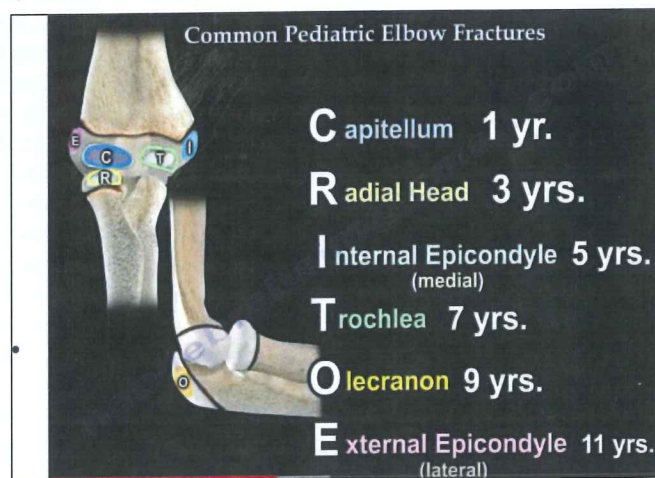
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The epiphysis ossifies at the age of 18 and closes between 20-25 years of age. Anterior dislocation is more common than posterior dislocation. The AP x-ray is difficult to interpret, and we get what is called the Serendipity view X-ray, which is 40° cephalic tilt view with the beam focused on the manubrium: then you compare both clavicles. The serendipity view allows for identification of the anterior or posterior translation. In practice clinically, the anterior dislocation will be obvious. The posterior dislocation will not be obvious. A CT scan is the best study to evaluate acute, traumatic injuries of the sternoclavicular joint. It will help determine what type of injury or dislocation (anterior or posterior). A CT scan will show if the injury is a physeal injury or if it is a true dislocation. It shows the status of the mediastinal structures. Anterior dislocation is common. The patient will have pain, a bump, or swelling that is increased by abduction of the arm. Anterior dislocation is unstable if you reduce it, but it is benign. If it is acute, try to reduce it, otherwise accept the deformity. Observe the patient and treat the patient symptomatically. The anterior sternoclavicular dislocation is rarely symptomatic when left unreduced. Most of the time the patient will do very well, and it will not affect function or range of motion (resuming of unrestricted activity in 3 months). If the injury is chronic and symptomatic, then you will do surgery. The type of surgery that is done is a resection of the medial part of the clavicle. Resect less than 15 mm of the medial clavicle. Do soft tissue stabilization of the residual medial clavicle with costoclavicular ligament reconstruction. A reconstruction of the sternoclavicular joint utilizing tendon graft allograft, or autograft can be used. The hamstring tendon technique is popular, and the figure eight

technique is commonly used because it provides great stability. The posterior sternoclavicular dislocation is less common and is a true orthopaedic emergency. One third of the posterior dislocations may have compressive effect by exhibiting pressure on the great vessels, esophagus, and the trachea. It may cause dyspnea, tachypnea, dysphagia, or paresthesia and it needs reduction. It has minimal, visible clinical findings. Sometimes the affected shoulder is shortened with forward thrust. The posterior sternoclavicular dislocation will be stable after reduction. You will have general anesthesia with thoracic surgeon backup. With a posterior sternoclavicular dislocation start with closed reduction with the hand or with a towel clip and lift the clavicle up. When you do closed reduction, the initial position for the extremity is the same for anterior and posterior dislocation. You will have general anesthesia and you will do abduction and extension of the shoulder. For the posterior dislocation, you will do abduction and extension. There will be a bump underneath the medial scapula. You will manipulate the medial clavicle with a towel clamp or with the fingers, lifting the clavicle up and reducing the joint. The posterior dislocation is usually stable, so give the patient a sling for 3-4 weeks. For the anterior dislocation, you will do direct pressure. If the reduction is stable, you will use a figure 8 strap or sling, and do therapy at 3-4 weeks. If posterior dislocation is unstable or irreducible, you will do reduction or excision of the medial clavicle plus stabilization of the soft tissue. If it is chronic, recurrent, or symptomatic, you will do excision of the medial clavicle plus soft tissue stabilization. Do not try to do closed reduction in late or chronic cases, because there are mediastinal adhesions that may cause problems inside the chest.

Common Pediatric Elbow Fractures

Pediatric elbow fractures can include supracondylar fractures of the humerus and pediatric elbow fractures that involve the ossification centers. Diagnosing and managing elbow fractures in a child can be challenging. The most common injuries of the ossification centers of the elbow include: transepiphyseal separation of the distal humerus, fracture of the lateral condyle, fracture of the medial condyle, fracture of the radial head, and fracture of the radial neck. Transepiphyseal separation of the distal humerus is uncommon: suspect child abuse in these injuries. It is usually confused with elbow dislocation however, in elbow dislocation the elbow moves posteriorly and laterally and in transepiphyseal separation the olecranon moves posteriorly and medially. One important key here is that the radiocapitellar line remains the same; it is not interrupted. If the radiocapitellar shows that the capitellum and the radial head are aligned, then this is not an elbow dislocation, it is a transepiphyseal separation. The diagnosis is usually difficult and can be missed. It should be highly suspected with elbow injuries before the age of 1 year. Understanding when the ossification centers appear around the elbow is important. C.R.I.T.O.E.- Capitellum, 1 year of age. Radial head, 3 years of age. Internal Epicondyle, 5 years of age. Trochlea, 7 years of age. Olecranon, 9 years of age. External Epicondyle, 11 years of age. A fracture of a lateral condyle is an important fracture. Lateral condylar fractures are usually Salter-Harris Type IV fractures. If the



fracture appears nondisplaced, then get an internal rotation view of the elbow that will show the amount of displacement of the fracture. If deciding to treat the nondisplaced fracture conservatively then have close, follow up appointments with repeat x-rays at short intervals to make sure that the fracture does not displace. This is a joint injury.

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Most fractures will appear displaced and surgery should be done with a lateral approach and not a posterior approach. The posterior approach will compromise the blood supply of the capitellum and can cause avascular necrosis. Complication of lateral condylar fractures include nonunion and cubitus valgus. This happens because the medial part of the elbow will grow more than the lateral part that is injured, and the elbow will be in valgus. Ulnar nerve symptoms may take years to develop because the ulnar nerve gets stretched by the cubitus valgus. If the nonunion occurs and the patient has good motion of the elbow but complains of pain, then you will perform a bone graft and fixation. If there is associated ulnar nerve symptoms, then you need to release or transpose the ulnar nerve. Lateral condylar fracture of the humerus is a surgical case. The medial epicondyle growth plate is the last one to fuse. Fracture of the medial epicondyle is usually treated conservatively. If there is displacement more than 1 cm, then the surgeon may decide to do surgery. The amount of displacement that requires surgery is controversial. The medial epicondyle fracture is commonly

associated with dislocation of the elbow. Look for the medial epicondyle on the post reduction x-rays. If the medial epicondyle fragment becomes trapped within the elbow joint, then it needs to be removed and fixed. Radial head fractures should be treated conservatively when there is less than 30° of angulation or 30° of displacement. A closed reduction is done when displacement is more than 30°. Percutaneous pin may be used for reduction as a joystick. Open reduction is done if there is more than 45° of residual angulation after failure of closed reduction or percutaneous joystick method. Complications include synostosis and fusion of the radius to the ulna. Reflected periosteum is a possible cause of synostosis. Osteonecrosis due to interruption of the blood supply of the radial head and loss of motion at the elbow are also possible complications. Nonunion of the radial neck fracture is rare, interposition of the periosteum is a possible cause of a nonunion. Radial head fractures may be associated with compartment syndrome. Watch for the development of compartment syndrome in a child with radial head fracture.

Occult Injury of the Elbow & Joint Effusion

Elbow joint effusion can be subtle. It can indicate elbow trauma, or injury. If there is a history of a fall or trauma to the elbow and the patient has pain but no fracture is seen in the x-ray, then we look for the fat pad signs, especially the posterior fat pad which is usually considered as a sign of an occult fracture. There are two fat pads in the elbow. The posterior fat pad is deep and covers the olecranon fossa. The anterior fat pad is shallow and located in front of the coronoid fossa. Swelling around the elbow or the olecranon fossa has nothing to do with the fat pads, it is merely an olecranon bursitis. The anterior fat pad sits in front and parallel to the distal humerus. The posterior fat pad is normally not seen on the lateral x-ray but is hidden within the olecranon fossa. Normal fat pads are darkened areas of lower density than the muscles. When trauma occurs to the elbow, it creates effusion. The effusion cannot be seen because it has the same density as the muscle. The effusion displaces the fat pad from its normal position and the fat pads are a darkened area. When joint effusion occurs due to fluid or blood, the effusion expands the capsule and displaces the fat pads away from the humerus. The anterior fat pad will go anteriorly and up, and the posterior fat pad will be displaced posteriorly. When the anterior fat pad gets displaced, the triangular appearance of the displaced anterior fat pad is usually called the "sail sign", which corresponds to elbow joint effusion. Identifying an elbow effusion on a lateral x-ray by finding the "sail sign" and finding the displaced posterior fat pad is important because it indicates trauma or injury to the elbow that causes elbow effusion and displacement of this important landmark. Displaced posterior fat pad is important because it can indicate trauma. Diagnosing elbow trauma can be complex, especially in children. Elbow pain that occurs usually after a fall may be caused by

a fracture. In children, supracondylar fracture is the most common cause of elbow effusion. Undisplaced fractures around the elbow may be difficult to visualize.

Interpretation of the x-rays can be challenging. In adults, radial head and neck fracture is the most common cause of occult elbow joint effusion after trauma. In occult radial neck fractures, effusion and the fat pad sign may be absent because part of the radial neck is extra-articular. A radiocapitellar view (Greenspan view) of the elbow may be helpful in these situations to detect an occult fracture of the radial head or the radial neck. The elbow is flexed to 90° and the thumb is directed upwards. The beam is directed 45° proximally. The fat pad is one element which is important in the diagnosis of an occult elbow trauma. There are at least four things that every clinician must consider when reading x-rays of the elbow in a child. First, you need to have high definition x-rays. Second, you need to know and memorize the timing and appearance of the ossification centers. Memorizing the mnemonic C.R.I.T.O.E. may help with this. Capitellum- 1 year of age, Radial head- 3 years of age, Internal (medial) epicondyle- 5 years of age, Trochlea- 7 years of age, Olecranon- 9 years of age, and External epicondyle- 11 years of age. Third, look for fractures and abnormalities on the x-ray such as ossification centers that you expect to be there, however it is not there. Look inside the joint for a medial epicondyle fracture that could be trapped. If you do not find any fracture or dislocation, then look for the fat pad sign. Some of the fractures can be hidden and easily missed. The fat pad sign, especially the posterior one, can indicate elbow effusion possibly from trauma.

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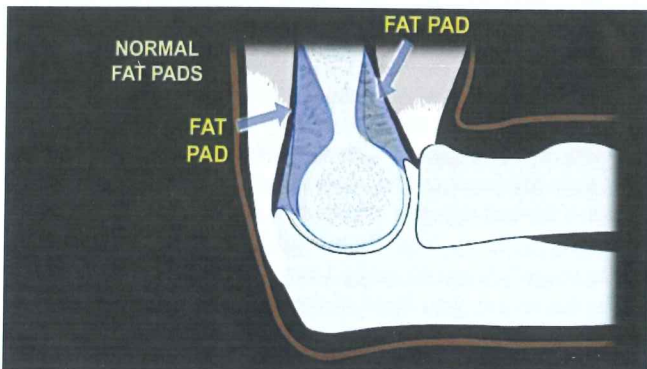
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Occult Injury of the Elbow & Joint Effusion continued

The posterior fat pad is important and when you see it, it should be treated as a problem because it means that there is an occult fracture. The fourth thing to consider is that the capitellum is the first bone to ossify and it is there on the x-rays. Draw two lines and connect them to the capitellum. The anterior humeral line should intersect the middle third of the capitellum and will diagnose supracondylar humeral fracture and the mechanism or injury (flexion or extension). The radiocapitellar line, from the neck of the radius to the capitellum in all views is important in the diagnosis of radial head subluxation.



Displaced fat Pad

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