



THE UNIVERSITY OF TOLEDO MEDICAL CENTER

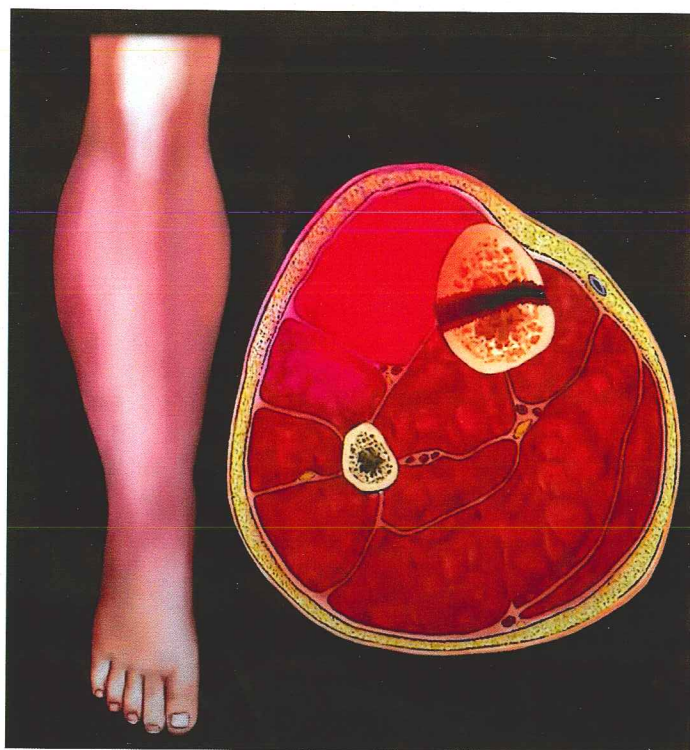
ORTHOPAEDIC MONTHLY

VOLUME 10, ISSUE 11 NOVEMBER 2020

BY NABIL A EBRAHEIM, MD

Acute and Chronic Leg Compartment Syndrome

Compartment syndrome is a condition in which increased pressure within a closed space compromises the circulation to the tissues contained within that space. The condition of compartment syndrome can affect any muscle compartment within the body, however it most commonly affects the lower leg. Almost any injury can cause compartment syndrome, including injury resulting from vigorous exercises, however the most common cause of compartment syndrome is due to fracture and soft tissue injuries. Edema and hemorrhage cause fluid accumulation, which elevates the compartment pressure and this causes occluding of the blood vessels and compression on the nerves. With clinical suspicion of the compartment syndrome, the compartment pressure is measured. An absolute pressure of 30mmHg or higher, or within 30 mmHg of the diastolic blood pressure is considered to be diagnostic of acute compartment syndrome. Without urgent decompression, tissue ischemia, necrosis, and functional impairment will occur. Anatomy is crucial in the treatment of compartment syndrome. The four compartments of the leg include anterior compartment, lateral compartment, superficial posterior compartment, and deep posterior compartment. Fasciotomy is the treatment of choice for compartment syndrome. Complete decompression of the lower leg is accomplished through a double incision, four compartment fasciotomies. The first incision is placed half way between the fibular shaft and the tibial crest. The fascia, anterior and posterior to the septum is opened transversely. The anterior compartment is released first, followed by release of the lateral compartment. Release the anterior compartment and the lateral compartment. Care should be taken not to injure the superficial peroneal nerve located within the lateral compartment. The second incision is made medial to the previous incision 2 cm posterior to the posterior tibial margin. Care should be taken not to injure the saphenous nerve and vein. The fascia, anterior and posterior to the septum, is opened transversely. The superficial posterior compartment is released first, followed by release of the deep posterior compartment. The double incision, four compartment fasciotomy is now complete. Chronic exertional compartment syndrome (CECS) is an exercise induced condition



that is different from acute compartment syndrome. In CECS patients, the resting intra-compartmental pressure is usually greater than 15mmHg. Pain begins within 20 minutes of exercise. Burning, cramping, or aching pain and tightness develops, leading to cessation of the activity. Pain, swelling, claudication, and paresthesia occurs after exercise. Compartment pressure that remains over 30mmHg one minute after the end of exercise or pressure that remains over 20mmHg for longer than 5 minutes after the end of exercise is considered diagnostic of CECS. While initial treatment can be conservative, a fasciotomy is probably the only proven successful treatment.

Coccydynia

The coccyx is commonly referred to as the tailbone. It is the final segment of the vertebral column comprising of two to four separate or fused vertebrae (the coccygeal vertebrae) and it lies below the sacrum. The coccyx is a very small bone and most doctors are not very familiar with this bone. The coccyx provides an important attachment for tendons, ligaments, and muscles. Lumbosacral spine x-rays and MRI will not show the coccyx. If you want to view and review the coccyx, order coccyx views or MRI. Dynamic stress views of the coccyx while the patient is sitting and leaning backwards should then be compared to non-weight bearing films with the patient standing or lying to the side. Excessive movement of the coccyx is abnormal. When sitting, the coccyx shifts forward and acts as a shock absorber. The coccyx bears more weight when the person is sitting and leaning backwards compared to when leaning forward. Coccyx pain symptoms include pain during sitting or when getting up from sitting, pain originating in the middle just above the anus, pain while leaning forward or to the side, or local tenderness over the area. Most frequent causes of coccyx pain include falling onto the buttocks or falling backwards, fracture or dislocation due to trauma or injury, malignancy, pregnancy/labor, or idiopathic. Falling on the tailbone can lead to coccygeal pain known as coccydynia, resulting in chronic inflammation of the sacrococcygeal joint. Types of coccyx injuries include anterior dislocation, posterior dislocation, anterior angulation, and hooked coccyx. In addition to hooking and dislocation causing pain, there may be a side bend deformity causing the coccyx to be angled sharply. The side bend deformity is usually to the left. Dural tension causing sacrococcygeal syndrome, low back pain, and other symptoms is a nonproven theory. Curving of the coccyx causes increased dural tension. Coccygeal extension relieves tension and back pain. Treatment of coccygeal injuries include manipulation, therapy, cushion for sitting (doughnut, balloon, etc.), injections, or surgery as a last resort. Surgical treatment of a coccyx injury is removal of the mobile or fractured coccyx.



Paget's Disease of the Spine

Sometimes you may be presented with an x-ray of the lumbar spine (usually AP view and lateral views) and the vertebra looks very white. They ask you a question, is it a Paget's disease affecting the vertebra or a metastatic tumor of the prostate? They probably do not make you rely on the radiologic pictures alone because they can look the same or similar in different conditions. The patients will require other tests to differentiate between Paget's and metastatic tumor. We are going to try to identify how we differentiate between the two conditions. In Paget's disease, the vertebra looks like a picture frame, and it is called "picture frame vertebra body". "Picture frame vertebra body" is a radiologic appearance, where the cortex or the vertebral body is thickened. There will be vertebral body expansion and coarsened trabeculae. There is increased opacity of the cortex on all sides of the vertebral body, which is in contrast to the Ruggier-Jersey spine, where the sclerosis is seen only at the superior/inferior vertebral endplate. There will be disorganized, new cortical bone

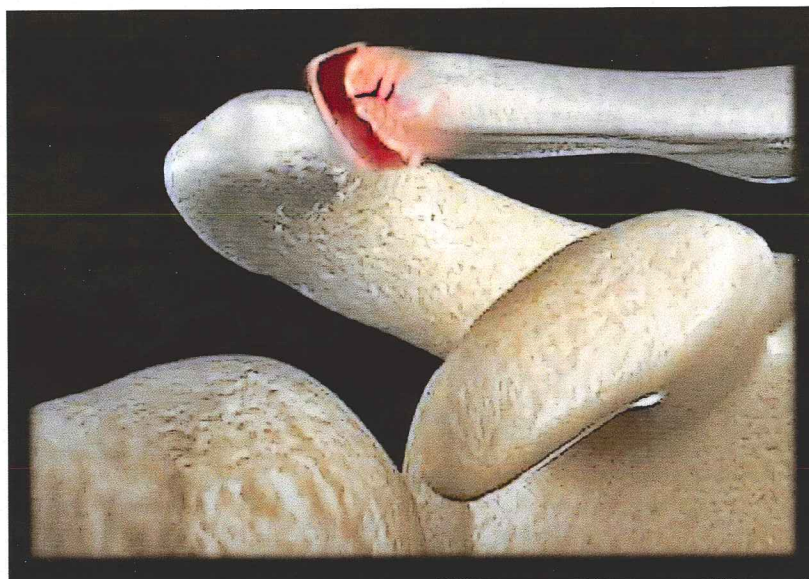
formation after excessive osteoclastic activity that causes resorption of the normal bone. You will see condensation of bone along its peripheral margins that resembles a picture frame. Metastatic prostate has an osteoblastic lesion. A metastatic breast tumor can also have an osteoblastic lesion. Paget's disease can also appear to have an osteoblastic lesion. In Paget's, there will be an increase in the alkaline phosphatase, an increase in the urinary hydroxyproline and in the N-telopeptide. In general, Paget's will have a mosaic pattern and also cement lines under the microscope. You can also see the cortical thickening in Paget's disease. If you see on an x-ray an osteoblastic lesion of the lumbar vertebra in an older, male patient or if you see it on a CT scan, then you are probably dealing with a metastatic prostate carcinoma. When you see the white vertebra in the examination or in the clinic, sometimes this is called the "ivory vertebra sign". There will be diffuse and homogenous increase in the opacity of the vertebral body.

The vertebral body is normal in size and contour with no change in the adjacent intervertebral discs (they are normal). In adult males, this indicates metastatic cancer of the prostate or it can be breast cancer in females. The histology will show adenocarcinoma with gland formation. The histology and x-rays will establish the diagnosis and the Prostate-Specific Antigen (PSA) will confirm the diagnosis. Paget's may be polyostotic and may be similar to prostatic metastatic carcinoma and the x-ray will probably show coarsening of the trabeculae pattern rather than an osteoblastic infiltrating process. There is another entity called Rugger-Jersey spine. This occurs due to hyperparathyroidism. Rugger-Jersey spine describes the prominent sub-endplate density at multiple continuous vertebra levels. There will be an alternating sclerotic, lucent appearance which looks like the horizontal stripes of a rugby jersey. Because Rugger-Jersey spine occurs with hyperparathyroidism, there will be an increased resorption due to excessive parathyroid hormone secretion with subsequent loss of bone mass (that is why you see the lucent areas). The osteoblasts make osteoid that does not have hydroxyapatite and does not appear dense on x-rays. The areas which are dense or sclerotic at the superior and inferior endplate of the vertebral body indicates accumulation of excess osteoid, and it appears dense when compared to the normal bone.



Osteolysis of the Distal Clavicle

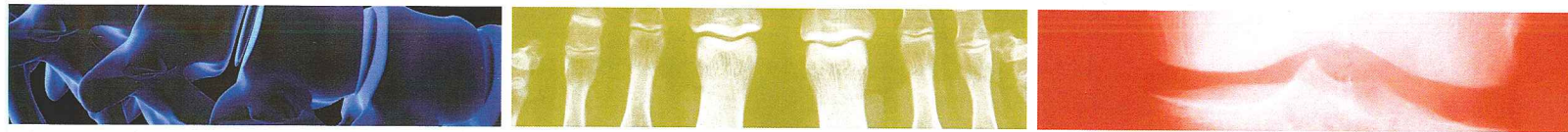
Osteolysis is bone erosion. The bone is dissolving or is lost. There is a localized area of inflammation, hyperemia, microfracture, bone resorption and eventually arthritis of the AC joint. The condition affects the distal end of the clavicle due to micro stress fractures. It typically affects young, male patients. It occurs from activities that require overhead heavy lifting, repetitive motion and the use of a jack hammer. The condition is also common in weight lifters. Osteolysis of the distal clavicle has localized pain, swelling and tenderness over the AC joint area. There will be positive cross body adduction test. X-ray shows erosion of the outer end of the clavicle. The acromion is ok. You may see Osteopenia, Osteolysis, tapering and cystic changes of the clavicle. An MRI may be obtained to rule out additional shoulder pathology. MRI will show high signal in distal clavicle. In acromioclavicular joint radiography, the Zanca view has the beam directed with cephalad angle of 10 degrees and 50% penetration. Clavicular osteolysis can be assessed using the Zanca view.



The acromion will be normal with the abnormality isolated to the distal clavicle. Zanca view is also used for diagnosis of arthritis of the AC joint. It will show osteophytes and joint space narrowing. The findings of the x-rays may not represent the patient's real symptoms. Erosion or absence of the distal ends of the clavicle may be seen in a wide range of conditions. Bilateral erosions can be caused by hyperparathyroidism, rheumatoid arthritis, or scleroderma. Unilateral erosion can be caused by post-traumatic osteolysis, myeloma, metastases, or osteomyelitis. Treatment is rest, NSAIDs,

ice and activity modification. It can also be treated with injections, blind injections or ultrasound guided injections. Surgery can be done if pain persists despite conservative treatment. Surgery is arthroscopic or open resection of the distal clavicle. Arthroscopy allows for evaluation of the entire shoulder joint. Open surgery must repair the trapezius and deltoid fascia adequately. Surgery is successful in about 90% of cases. Resect 5-10mm of bone of the clavicle. Keep the posterior-superior ligament intact, because it maintains most of the horizontal stability of the clavicle.

Department of Orthopaedic Surgery
The University of Toledo
3000 Arlington Ave., MS 1094
Toledo, Ohio 43614



Bilateral Quadriceps Tendon Rupture

The quadriceps is a large group that includes the muscles of the front of the thigh. The quadriceps muscles work to extend the knee. Quadriceps tendon rupture is more common than patellar tendon rupture. Quadriceps rupture is typically more common in older patients and occurs more often in males. Rupture of the patellar tendon is usually more common in younger patients. The patella is high in patellar tendon rupture because the intact quadriceps tendon is pulling it up. The patella position is low in quadriceps tendon rupture because the intact patellar tendon is pulling the patella down (distally). Bilateral rupture of the quadriceps tendon is rare. Bilateral rupture of the quadriceps tendon usually occurs in older patients, may be missed, or at least have a delay in the diagnosis, or may occur due to underlying disease. Possible underlying causes include rheumatoid arthritis, diabetes, gout, hyperthyroidism, renal failure, or steroid use. Patient with a quadriceps tendon rupture will be able to flex the knee but will not be able to extend the knee. Failure to actively extend the knee occurs because the tendon is not attached to the patella. There will be a palpable defect above the knee cap. Clinical presentation is pain and swelling above the knee. The patient will be unable to walk. X-ray will show that the patella is in a lower position than normal. MRI is the best study which will clearly show the injury. The diagnosis of quadriceps tendon rupture is more difficult (if you suspect it, get an MRI). Surgery should be done early to allow repair of the tendon. Drill holes into the patella for placement of sutures. Sutures are inserted through the quadriceps tendon for reattachment to the patella. Use a knee immobilizer for 4-6 weeks. Extension function of the knee is usually restored. The physician should be aware that bilateral quadriceps tendon rupture can occur. The patient should be examined for any underlying metabolic disease.

THE UNIVERSITY OF TOLEDO MEDICAL CENTER

ORTHOPAEDIC MONTHLY

Planners/Editors:

Editor/Planner: Dr. Nabil Ebraheim, Professor and Chairman, Department of Orthopaedic Surgery;
Planners: Amanda Critton; Abigail Overhulse; and Sara Bell

Dr. Ebraheim, Amanda Critton, Abigail Overhulse and Sara Bell do not have any financial interest or other relationships with a manufacturer of commercial product or service to disclose.

Department of Orthopaedic Surgery, The University of Toledo 3000 Arlington Ave., MS 1094 Toledo, Ohio 43614

Questions or Appointments, call 419.383.3761