1- A 38-year-old man has increasing left knee pain and occasional instability. Several years earlier he sustained a noncontact twisting injury to his knee. He had initial soreness and pain but was able to resume his normal activities while avoiding sports. On examination, he has medial joint line tenderness, a grade 2+ Lachman, and a slight varus thrust. His radiographs reveal mild-to-moderate medial compartment osteoarthritis with varus alignment. In addition to ligament reconstruction, what surgical treatment strategy is most likely to alleviate his pain and instability?

A. Distal femoral osteotomy
B. Total knee replacement
C. High tibial osteotomy (HTO), lateral closing wedge
D. HTO, medial opening wedge with decreased tibial slope

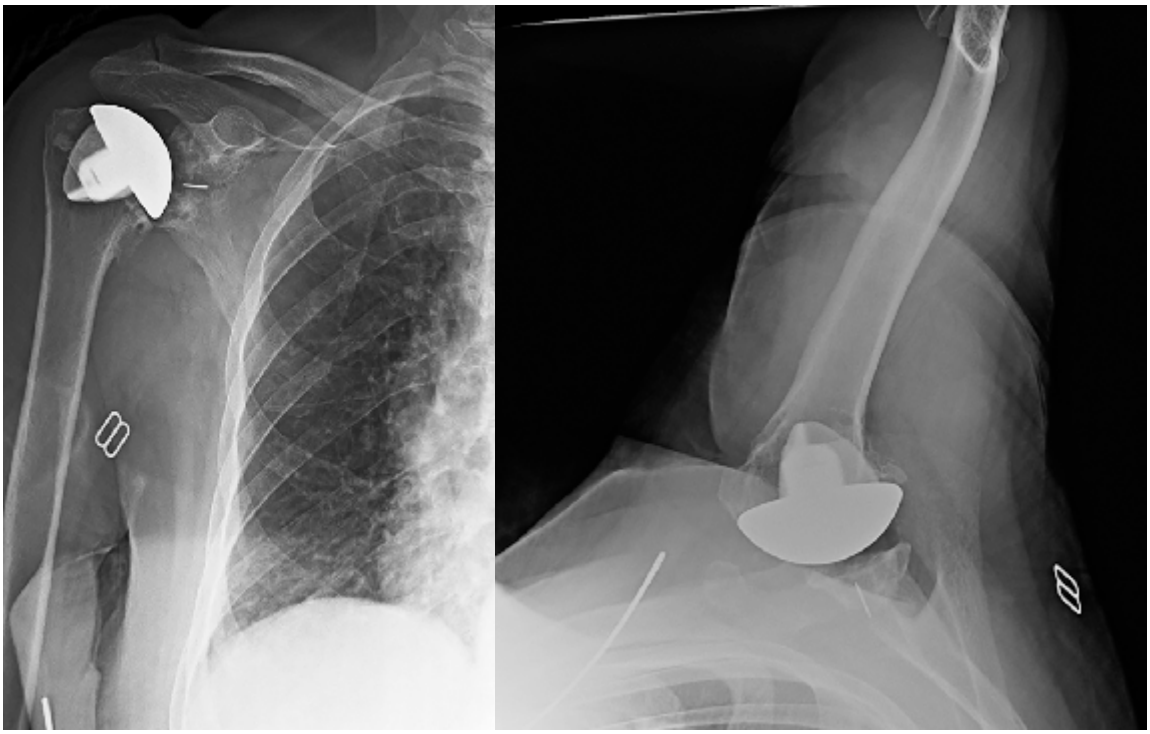
The patient had a previous anterior cruciate ligament (ACL) and posterolateral complex injury. With chronic instability and osteoarthritis, the best option is HTO with a decrease in the tibial slope to reduce anterior laxity. Distal femoral osteotomy is better suited to address valgus malalignment. The lateral closing-wedge osteotomy would not allow for adequate correction of the tibial slope. If the patient continues to experience instability following correction of the varus malalignment, reconstruction of the ACL and posterolateral corner would be appropriate at that time.
Correct answer : D

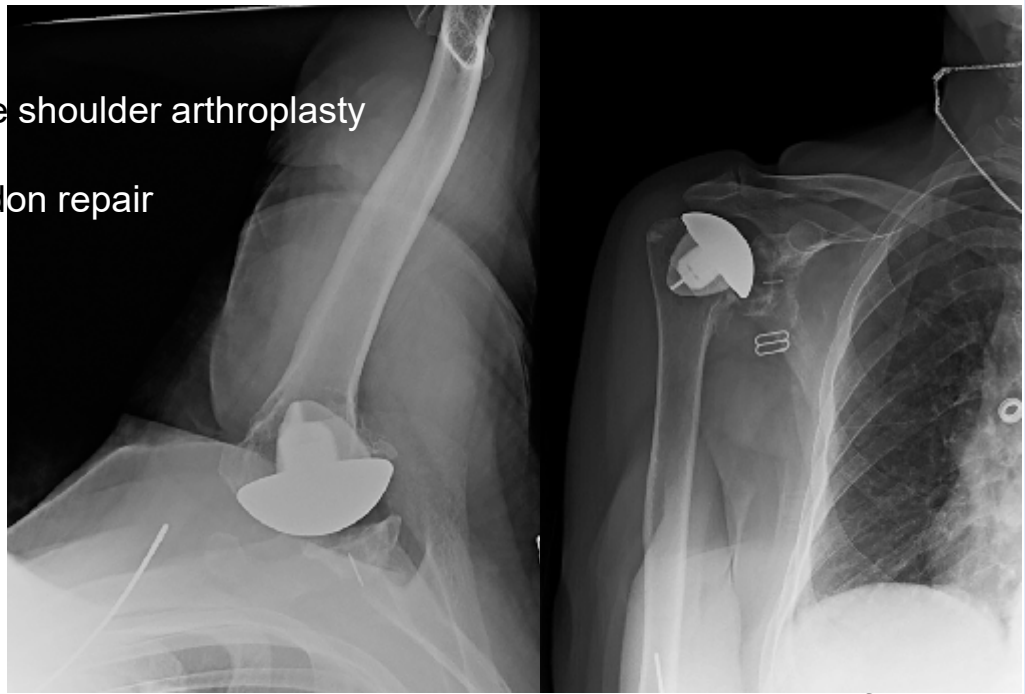
2- A 14-year-old girl has a head-on-head collision while playing basketball. She had no loss of consciousness but had persistent headaches for 2 weeks. The patient is now back to school and has no headaches. What is the best next step?

A. Return to full basketball activity
B. Start light aerobic activity
C. Obtain baseline neuropsychological testing
D. MRI scan of the brain

Mild traumatic brain injury is common in the adolescent child. Neuropsychological examination is widely used but, in this case, the patient is asymptomatic and has no baseline testing. There is a limited role for MRI in the recovery process of concussions. Furthermore, higher levels of physical/cognitive activity should be avoided due to their potential to increase total recovery time. In this scenario, a graduated return to activity is most appropriate thus, the next appropriate step is to start light aerobic activity.
Correct answer : B

3- A 55-year-old woman with degenerative joint disease underwent total shoulder arthroplasty (TSA). She was doing well without complications at her 2-week visit (Figures 1 and 2). She returned at 6 weeks with increased pain, shoulder clicking, and difficulty with forward elevation and internal rotation. She recalls slipping, and to prevent a fall, moved her arm suddenly to grab a rail. New radiographs are shown in Figures 3 and 4. What is the best next step?





A. Revision to reverse shoulder arthroplasty
B. Electromyography
C. Subscapularis tendon repair
D. Closed reduction

The patient underwent TSA. At her regular 2-week follow-up appointment, radiographs show a reduced glenohumeral joint. She then sustained a traumatic injury and the radiographs at her 6-week appointment show anterior subluxation of the glenohumeral joint indicative of subscapularis insufficiency. Subscapularis repair is the next best step in management, especially in this age group, with well-fixed and well-aligned components.

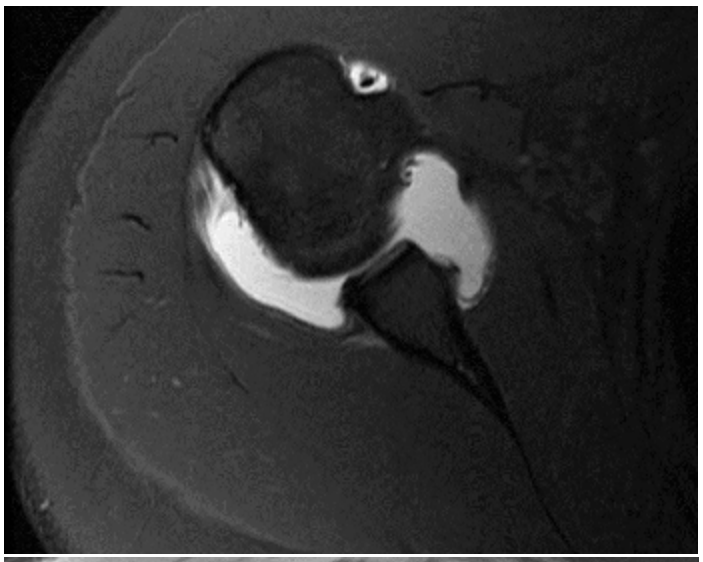
Correct answer : C

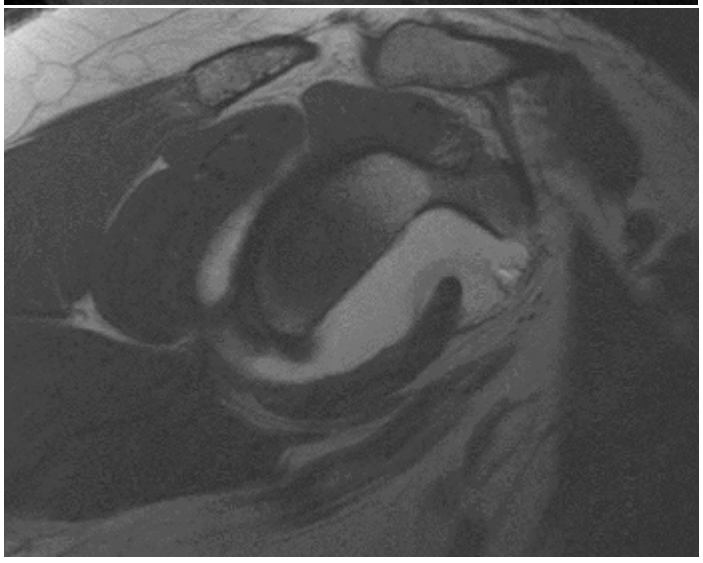
4- Which factor increases the success rate associated with all-inside lateral meniscal repair?

A. Concomitant anterior cruciate ligament (ACL) reconstruction
B. Concomitant medial meniscus repair
C. Older patient age
D. Varus knee alignment

Decreased patient age, neutral alignment, and a concomitant ACL tear are associated with improved success rates of meniscal repair. Meniscus tears on the contralateral side of the knee and articular cartilage defects are not associated with improved healing rates.
Correct answer : A

5- A 39-year-old right-hand dominant woman presents with many years of right shoulder instability. She tried physical therapy several times over the years without any benefit. Figure 1 shows her current axillary radiograph. Figures 2 and 3 are representative MR arthrogram images. What is the best treatment plan?





A. Open Bankart repair and capsular shift
B. Arthroscopic anterior labral repair and remplissage
C. Coracoid transfer
D. Glenoid osteotomy

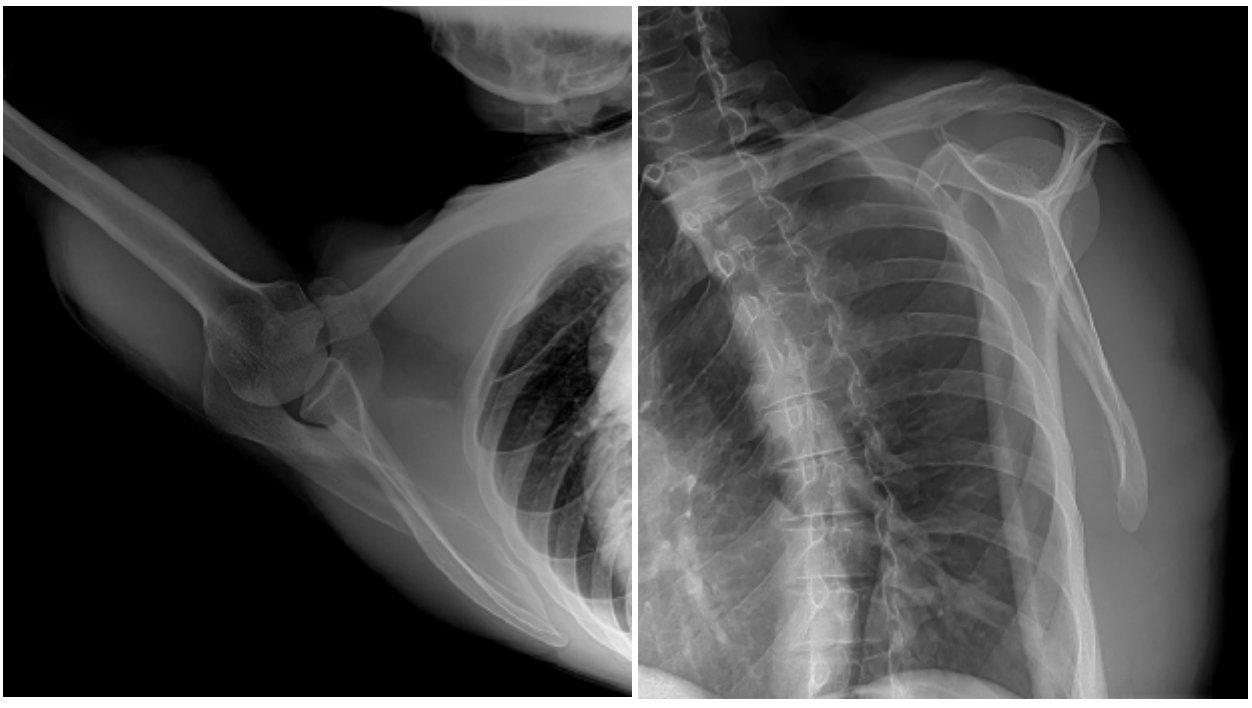
The question stem describes a patient with long-standing anterior glenohumeral joint instability. The axillary view plain radiograph shows blunting of the anterior glenoid rim. The axial cut from the MR arthrogram shows loss of anterior glenoid contour and tear and medialization of the anteroinferior labrum consistent with anterior glenohumeral joint instability. The sagittal cut shows loss of pear-shaped glenoid. With a patient describing innumerable dislocations and anterior glenoid bone loss, the best option is for coracoid transfer or Latarjet. Open or arthroscopic bankart repair does not address the bone loss. Glenoid osteotomy has been advocated for posterior shoulder instability and glenoid retroversion, which the patient does not have.
Correct answer : C

6- Figure 1 is the MRI scan of a high school hockey player who is checked from behind and falls forward to the ice onto his flexed knees. He complains of swelling and posterior knee pain. Nonoperative treatment of the injured structure will most likely result in increased risk of degenerative change in

A. medial and patellofemoral compartments.
B. lateral and patellofemoral compartments.
C. medial compartment only.
D. patellofemoral compartment only.

The injury mechanism and MRI scans demonstrate an isolated posterior cruciate ligament (PCL) tear. PCL injury may result in posterior translational macro-instability of the knee, but may also result in more subtle and subclinical increases in varus and posterior tibial translation during normal gait and other activities of daily living. These changes result in increased contact stresses in the medial (due to varus forces) and patellofemoral (due to posterior forces) compartments, leading to an increased risk of degenerative chondrosis in these areas.
Correct answer : A

7- A 32-year-old man with a history of seizure disorders is evaluated in the emergency department following a recent seizure. The patient complains of new onset shoulder pain following the seizure. After emergency department workup, he is discharged home. The patient follows up in the office 2 weeks after the seizure with continued shoulder pain. Radiographs obtained in the office are shown in Figures 1 through 4. What is the most likely diagnosis?



A. Anterior instability
B. Acromioclavicular joint separation
C. Rotator cuff tear
D. Posterior instability

Radiographs reveal a reverse Hill-Sachs lesion. This can only occur following a posterior shoulder dislocation. In this case, the patient sustained a posterior shoulder dislocation secondary to seizure activity. The dislocated shoulder is self-reduced. Seizures are a common mechanism for posterior instability because of the severe posterior muscular contractions that occur. It is important to evaluate radiographs for subtle signs of pathology. The axillary image reveals the reason for this patient's shoulder pain showing a reverse Hill-Sachs lesion.

Correct answer : D

8- Injury to the structure noted with an arrow in the MRI in Figure 1 would lead to what clinical condition?

A. Pain in the elbow with resisted wrist flexion
B. Pain in the elbow with resisted wrist extension
C. Lateral elbow pain and instability with varus elbow force
D. Medial elbow pain and instability with valgus elbow force

The image depicts the medial ulnar collateral ligament of the elbow. This ligament is the primary restraint to valgus forces at the elbow. It is commonly injured in baseball pitchers. Pain with resisted wrist flexion would suggest medial epicondylitis. Pain with resisted wrist extension would suggest lateral epicondylitis. Lateral elbow pain and varus instability would suggest posterolateral rotatory instability.

Correct answer : D

9- A 54-year-old right-hand dominant man with a recent history of cervical lymph node biopsy for suspected metastatic melanoma complains of a 1-month history of atraumatic left shoulder pain and weakness. He has difficulty lifting objects overhead. He denies any neck pain or tingling/numbness in the extremities. He became concerned regarding the asymmetry he notices in the mirror (Figures 1 and 2). What physical examination finding is most likely to be seen?

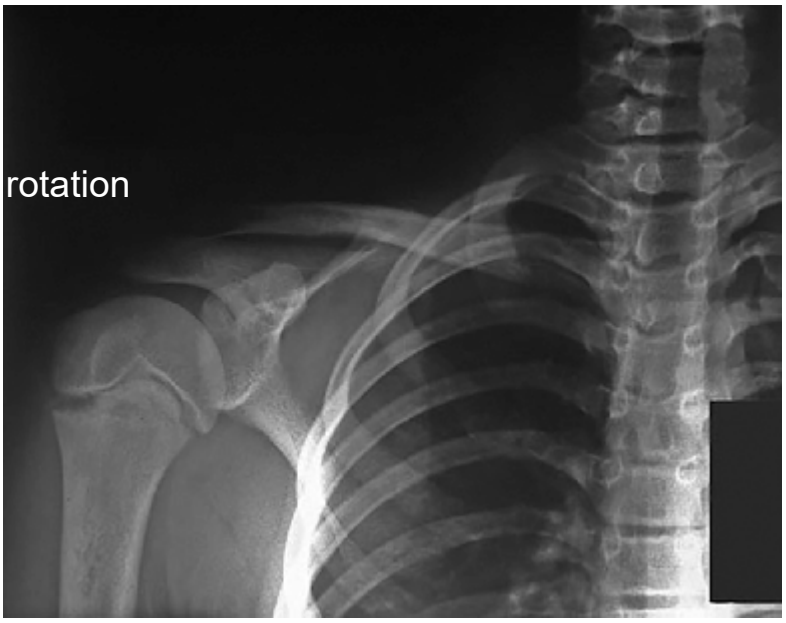
A. Lateral scapular winging
B. Medial scapular winging
C. Triceps weakness
D. Deltoid atrophy

Left-sided trapezial atrophy is shown in both images. Trapezial palsy is the most common cause of lateral scapula winging, a finding illustrated in the picture of the patient's back. This is likely related to dysfunction of the spinal accessory nerve. A common scenario for injury to the spinal accessory nerve would be after a radical neck dissection. In contrast medial scapular winging is likely related to dysfunction of the serratus anterior and long thoracic nerve. Other causes of scapular winging could be direct injuries/avulsions of the serratus anterior, trapezius, and/or rhomboids.

Correct answer : A

10- Figure 1 is the radiograph of a 12-year-old right-hand dominant baseball pitcher who has had right shoulder pain for the past 3 months. He recalls no specific injury. Pain initially occurred only with throwing, but now is bothersome during daily activities. He denies neck pain, or extremity numbness or tingling. Examination demonstrates a BMI of 31.5, a mild decrease in passive glenohumeral internal rotation with a symmetric increase in external rotation, and normal neurovascular findings. What factor most is likely related to the patient's pain?

A. Above average body weight
B. Use of breaking ball pitches
C. Number of innings pitched
D. Excessive glenohumeral external rotation



The description and radiograph reveal a case of proximal humeral epiphysiolysis, also called Little Leaguer's shoulder (LLS). This is an overuse condition resulting from chronic repetitive microtraumatic forces imposed on the unossified cartilage of the proximal humeral physis. Classic radiographic findings include widening of the proximal humeral physis with increased sclerosis and/or mineralization/lucency. Many factors have been studied as possible contributors to the development of LSS, including all options presented. However, no clear relationship between body weight/height or throwing mechanics exist with LSS. It has also been claimed that the use of breaking pitches (e.g. curve balls, sliders) at an early age are a contributing factor, but this has been refuted by a number of recent studies. By far, the most important factors are the numbers of pitches thrown and the frequency of pitching. This is reflected in a number of indicators, including numbers of innings pitched, number of throwing days, numbers of pitches or pitched innings per week, month and year, and playing for multiple teams.

Correct answer : C

11- A coach of three football teams—the B team, junior varsity team, and varsity team—wants to study the average times in the 40-yard dash for his players. Which test would help him determine if the mean 40-yard dash times for the athletes on one team are different from those on the other teams?

A. Independent 2-sample t test
B. Analysis of variance (ANOVA)
C. Chi-square test
D. Fisher's exact test

Data collected in research studies fall into one of two categories—continuous or discrete. Continuous data can be displayed on a curve. Examples include height, weight, and time recorded in a 40-yard dash. Discrete data represent data that fall into specific categories such as gender or the presence or absence of a risk factor.

ANOVA is used to determine statistical significance in mean values of continuous data when there are more than two independent samples. The 2-sample t test compares mean values of continuous data between two independent groups. The Chi-square test and Fisher's exact tests are tests used to analyze discrete data.

Correct answer : B

12- A 19-year-old female volleyball player presents after injuring her knee playing volleyball. She has had two prior anterior cruciate ligament (ACL) reconstruction procedures; the first with bone-patellar-tendon autograft, the second procedure involved an Achilles allograft. She has a 2B Lachman examination and asymmetric high-grade pivot shift. MRI and CT scans are shown in Figures 1 through 3. She has instability with activities of daily living. What is the best next step in management?

A. Bone grafting and removal of hardware
B. Anterolateral ligament reconstruction
C. Open reduction and internal fixation (ORIF) of tibial plateau
D. Brace and return to play

Images show substantial tunnel widening 17 mm on coronal and 21 mm on sagittal views. Generally, two-stage ACL revision is recommended for tunnels >14 mm. Anterolateral ligament reconstruction or lateral-extra-articular tenodesis alone would not be adequate to restore knee stability. There is no fracture to necessitate ORIF. Bracing and return to play in a symptomatic, ACL insufficient athlete is not recommended.

Correct answer : A

13- A 25-year-old male professional lacrosse player collides with another player, with injury resulting from a knee impacting the athlete's thigh. He has immediate pain in the mid-thigh area and is unable to return to the game because of difficulty with running. Examination reveals developing swelling in the anterior mid-thigh area. The thigh compartments are soft, and he is able to extend his knee against gravity. Knee flexion at 90° gives him discomfort in the thigh but no knee pain. The knee and hip examinations are otherwise unremarkable. Plain films of the femur are negative. What is the best next step?

A. Intracompartmental pressure monitoring
B. Immobilization of the knee in a flexed position
C. Fasciotomy of the thigh
D. MRI scan of the femur

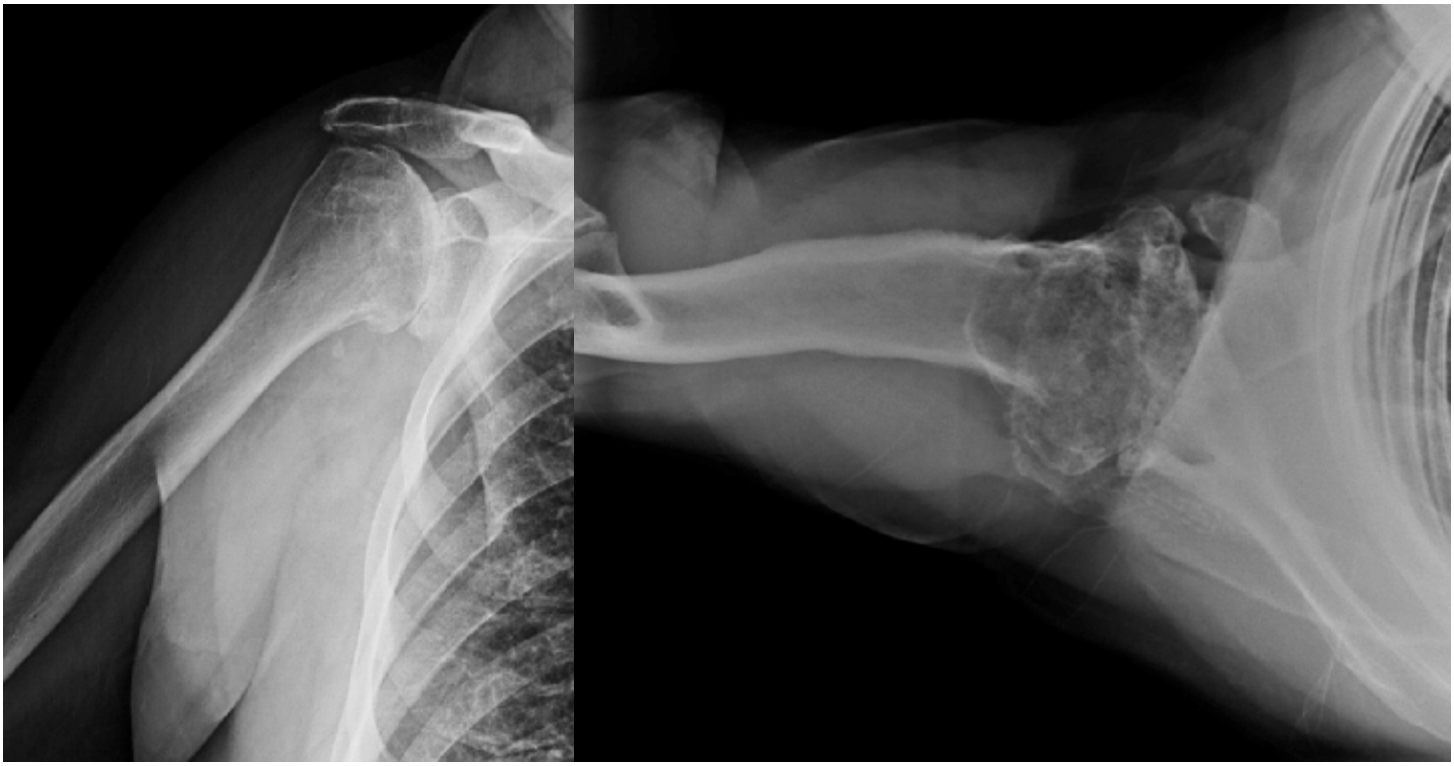
This athlete has experienced a quadriceps contusion with hemorrhage and swelling into the anterior compartment of the thigh. Initial treatment for these injuries is immobilization of the knee in flexion to reduce the amount of bleeding into the anterior compartment. Rest and anti-inflammatory medication may be used in the rehabilitation process but should not take the place of immobilization in flexion. The compartments are soft and therefore, there is no indication for fasciotomy. MRI scan of the femur may demonstrate hematoma in the anterior thigh compartment but is not required to make the diagnosis.
Correct answer : B

14- The lesion seen in the MRI scan in Figure 1 is treated with a marrow stimulation technique. The reparative tissue formed by this technique is predominantly composed of

A. only type 1 collagen.
B. only type 2 collagen.
C. type 1 and type 2 collagen.
D. neither type 1 or type 2 collagen.

The MRI scan shows a full-thickness cartilage defect. When treated with a marrow stimulation technique, such as a microfracture, the reparative tissue is fibrocartilage. Unlike hyaline cartilage, which is composed of only type 2 collagen, fibrocartilage is composed of both type 1 and type 2 collagen.
Correct answer : C

15- Figures 1 and 2 are the radiographs of a 58-year-old retired laborer who has had many years of right shoulder pain. He initially experienced relief with anti-inflammatory medication over the past year, but this no longer provides him pain relief. He has pain with overhead activities and is dissatisfied with his shoulder function. Examination indicates active and passive forward elevation to 130°, full strength with external rotation, and a negative belly press test. MRI demonstrates an intact rotator cuff. What is the best next step in treatment?

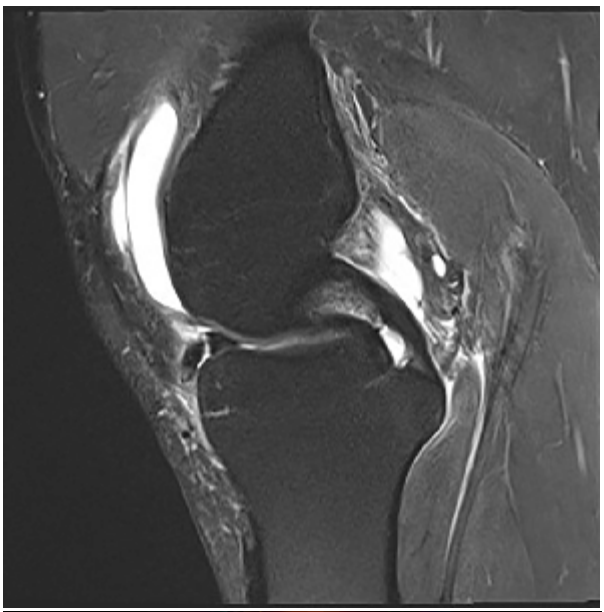


A. Anatomic total shoulder arthroplasty (TSA)
B. Hemiarthroplasty
C. Reverse shoulder arthroplasty
D. Arthroscopy with debridement and biceps tenodesis

The patient has glenohumeral osteoarthritis based on the radiograph. His examination demonstrates limited motion and no significant rotator cuff pathology – full strength with external rotation, negative belly press, and no pseudoparalysis. Of all the answer choices, an anatomic TSA would be the most appropriate treatment option. Hemiarthroplasty does not address glenoid pathology and provides inferior pain relief and function, compared with TSA. A reverse shoulder arthroplasty is utilized for patients with degenerative shoulder changes in conjunction with irreparable rotator cuff pathology. Shoulder arthroscopy with debridement and biceps tenodesis is not appropriate for those with severe degenerative changes of the shoulder.

Correct answer : A

16- According to the MRI scan shown in Figure 1, which pathologic finding is expected to be encountered during arthroscopy?



A. Figure 2
B. Figure 3
C. Figure 4
D. Figure 5

The sagittal MRI scan is a clear example of a double posterior cruciate ligament (PCL) sign. This sign has a high specificity for a displaced bucket handle tear of the medial meniscus as seen in Figure 4. The other arthroscopic images show a flap tear of the medial meniscus (Figure 2), anterior cruciate ligament tear (Figure 3), and a full thickness articular cartilage defect (Figure 5). Other less likely causes of a double PCL sign include intermeniscal ligament, meniscofemoral ligaments, loose bodies, osteophytes, and fracture fragments. **Correct answer : C**

17- Figures 1 and 2 are the radiographs of a 21-year-old football player who underwent anterior cruciate ligament (ACL) reconstruction with patellar tendon autograft 1 year ago. He reports mild stiffness in his knee. Upon examination, he has a negative Lachman test, trace effusion, and range of motion from 0 to 85° of knee flexion. Which factor is most contributory to his examination findings?

A. Incorrect graft choice
B. Improper tunnel position
C. Tibial graft-tunnel mismatch
D. Femoral fixation at 80° flexion

Technical failure is the most common reason for ACL reconstruction failure. Tunnel position is the most frequent cause of technical failure. Malpositioning of the tunnel affects the length of the graft, causing either decreased range of motion or increased graft laxity. This patient has anterior and vertical placement of his femoral tunnel, which has been shown to cause stiffness in knee flexion. Although graft choice is an important factor when planning ACL reconstruction, overall outcomes with autograft tissues are fairly similar. Fixation of the graft at the femoral or tibial end is not as important as tunnel position. Fixing the graft in flexion can cause extension loss when isometry is not achieved, but this condition is not touched upon in this scenario.

Correct answer : B

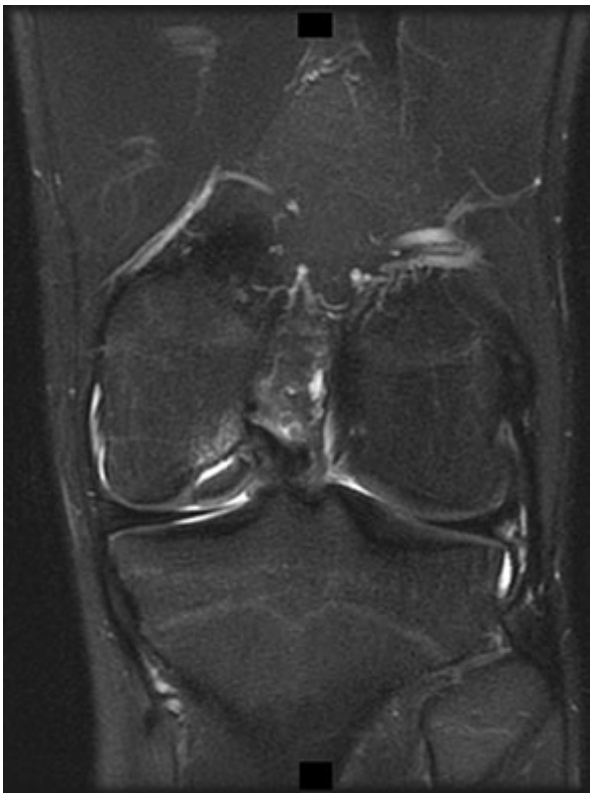
18- Figure 1 is the MRI scan of a high school soccer player who sustained a right knee injury during a game while making a cut toward the ball. He felt a pop and his leg gave way. During physical examination, as the knee is moved from full extension into flexion with an internal rotation and valgus force, you notice a "clunk" within the knee. What is the most likely biomechanical basis for the "clunk"?

A. n extension with internal rotation/valgus force, the medial tibial plateau is subluxated; with flexion, the medial tibial plateau reduces.
B. In extension with internal rotation/valgus force, the medial tibial plateau is reduced; with flexion, the medial tibial plateau subluxates.
C. In extension with internal rotation/valgus force, the lateral tibial plateau is reduced; with flexion, the lateral plateau subluxates.
D. In extension with internal rotation/valgus force, the lateral tibial plateau is subluxated; with flexion, the lateral plateau reduces.

This patient sustained an isolated anterior cruciate ligament (ACL) injury based upon the mechanism described and examination findings. The finding that produces the “clunk” is the pivot-shift maneuver, which is positive in a knee with an incompetent ACL. With an ACL-deficient knee in full extension and internal rotation, the lateral tibial plateau subluxates anteriorly. As the knee is flexed, the lateral tibial plateau slides posteriorly into a reduced position, causing an audible clunk. Response D correctly describes the pathomechanics that result in the audible clunk heard during the pivot-shift maneuver. Responses A and B are incorrect because they describe the medial tibial plateau, which is not part of the pathomechanics of the pivot shift. Response C is incorrect because in extension, the lateral tibial plateau is subluxated, not reduced.

Correct answer : D

19- Figure 1 is the MRI scan of a 15-year-old boy who has had knee pain with running for 5 months. What is the most appropriate treatment?



A. Arthroscopic or open reduction and internal fixation
B. Arthroscopic loose body removal
C. Activity restriction for up to 9 months
D. Subchondral drilling

The MRI reveals an osteochondritis dissecans (OCD) lesion that is unstable and has a large osseous component. OCDs are acquired lesions of the subchondral bone. Patients with OCD initially report nonspecific pain and variable amounts of swelling. Initial radiographs help identify the lesion and establish the status of the physes. An MRI scan is useful for assessing the potential for the lesion to heal with nonsurgical treatment. Nonsurgical treatment is appropriate for small, stable lesions in patients with open physes and focuses on activity restriction for 3 to 9 months. Surgical treatment is necessary for unstable or detached lesions. Stable lesions with intact articular cartilage can be treated with subchondral drilling to stimulate vascular ingrowth, with radiographic healing at an average of 4.4 months. Fixation is indicated for unstable or hinged lesions, and stabilization of the fragment can be achieved using a variety of implants through an arthroscopic or open approach. The fragment should be salvaged, and the normal articular surface restored whenever possible. In this patient, the fragment is unstable and therefore stabilization of the fragment with internal fixation would be the best treatment option.

Correct answer : A

20- A 20-year-old division 1 collegiate football player presents with an acute left ankle injury. He states that as he was carrying the football, his left foot became trapped under another player while his body was rotated inward, causing a hyperexternal rotation moment to his ankle. He was unable to return to the game secondary to pain and inability to bear weight. Radiographs did not show any fracture. An external rotation stress radiograph is shown in Figure 1. In comparison to screw fixation, suture button fixation of this injury has demonstrated what clinical outcomes?

A. Decreased American Orthopaedic Foot and Ankle Society (AOFAS) scores at 2-year follow-up
B. Slower return to work
C. Increased rate of hardware removal
D. Decreased rate of syndesmotic malreduction

The clinical vignette demonstrates an unstable left ankle syndesmotic injury, also known as a “high ankle sprain”. The distal tibiofibular syndesmosis comprises five structures: the anteroinferior tibiofibular ligament, posteroinferior tibiofibular ligament, the interosseous membrane, the interosseous ligament, and the inferior transverse ligament. This injury commonly occurs secondary to a forced external rotation motion of the foot. Stable grade 1 strains without diastasis on stress radiographs can be treated with a period of non-weight bearing followed by physical therapy. Unstable injuries, grade 2 and 3, which demonstrate diastasis on external rotation stress radiographs, are commonly treated operatively. Fixation constructs commonly include screw fixation, suture button fixation, or a hybrid combination technique. Naqvi and associates demonstrated more accurate syndesmotic reduction with suture button fixation versus screw fixation. Syndesmotic malreduction has been shown to be an important independent predictor of decreased clinical outcomes. Andersen and associates demonstrated higher AOFAS scores and diminished syndesmotic widening at radiographic follow-up at 2 years with suture button fixation. In a systematic review, Zhang and associates demonstrated higher AOFAS scores, diminished need for implant removal (3.7% vs 40.2%), diminished implant failure, and lower rates of malreduction (1% vs 12%). Thornes and associates demonstrated a faster return to work following suture button fixation versus screw fixation.

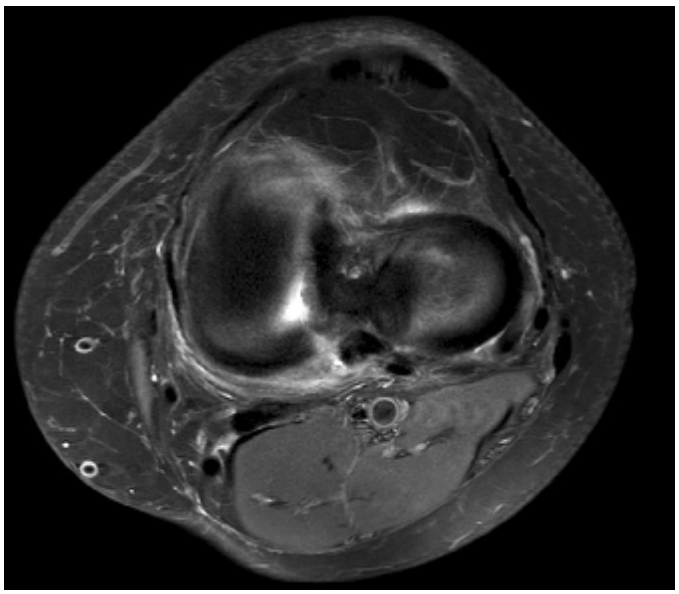
Correct answer : D

21- A 26-year-old weightlifter has increasing pain in his left shoulder for 4 months. Nonsurgical treatment consisting of anti-inflammatory medication, corticosteroid injections, and rest fails to alleviate his symptoms. He undergoes an arthroscopic distal clavicle resection with excision of the distal 8 mm of clavicle (Mumford procedure). Three months after surgery, he reports mild pain and popping by his clavicle. His clavicle demonstrates mild posterior instability on examination without any obvious deformity on his radiographs. What structures were compromised during his excision?

A. Anterior and superior acromioclavicular joint ligaments
B. Posterior and superior acromioclavicular joint ligaments
C. Conoid ligament
D. Trapezoid ligament

The posterior and superior acromioclavicular ligaments provide the most restraint to posterior translation of the acromioclavicular joint and must be preserved during a Mumford procedure. Anterior and superior acromioclavicular joint ligaments are the opposite of the preferred response and prevent anterior translation of the clavicle. Injuries to the conoid and trapezoid ligaments are more pronounced with grade III or higher acromioclavicular separations, with superior migration of the clavicle relative to the acromion.
Correct answer : B

22- Figures 1 and 2 are the T2-weighted MRI scans of a 54-year-old woman with medial knee pain and catching of 6 months' duration. What treatment option is most likely to be associated with a favorable outcome?



A. Physical therapy
B. Meniscal repair
C. Meniscectomy
D. Reconstruction

The MRI scans reveal a posterior horn root tear of the medial meniscus. LaPrade and associates found that outcomes after posterior meniscal root

repair significantly improved postoperatively and patient satisfaction was high, regardless of age or meniscal laterality. Patients aged <50 years had outcomes similar to those of patients ≥50 years, as did patients who underwent medial versus lateral root repair. In patients undergoing pullout fixation for posterior medial meniscus root tear, Chung and associates (in "Pullout Fixation of Posterior Medial Meniscus Root Tears") found that patients with decreased meniscus extrusion at postoperative 1 year have more favorable clinical scores and radiographic findings at midterm follow-up than those with increased extrusion at 1 year. Krych and associates found that nonoperative treatment of medial meniscus posterior horn root tears is associated with poor clinical outcome, worsening arthritis, and a relatively high rate of arthroplasty at 5-year follow-up. Reconstruction would have no role in the setting of a reparable meniscal root tear.

Correct answer B

22- A 24-year-old semiprofessional baseball player has noted increasing medial elbow pain for the past 2 months. This has been associated with a concomitant loss in velocity and control. He denies pain, numbness, or tingling in the hand or digits. Examination demonstrates medial elbow tenderness and swelling. Elbow range of motion is full. There is pain with milking maneuver and valgus stress test. Tinel's sign is negative over the cubital tunnel, and there is no ulnar nerve subluxation. His MRI scan is shown in Figure 1. After thorough discussion, the player elects to undergo surgical intervention. What surgical variable has been associated with inferior outcomes?

A. Use of palmaris autograft
B. Ulnar nerve transposition
C. Muscle-splitting approach
D. Use of a docking technique

The information and image provided describe a throwing athlete with a complete tear of his ulnar collateral ligament (UCL) of the elbow. Numerous techniques have been described for UCL reconstruction, and at this time, optimal graft choice and fixation methods have not been established. Most studies show no. major differences in outcome between gracilis autograft palmaris autograft, and allograft. Similarly, no clear advantage has been established when comparing use of bone tunnels with interference screws, tunnels with a docking technique, modified docking techniques, and combination

approaches. Use of a muscle-splitting approach, rather than muscle detachment, appears to improve outcomes, with a larger percentage of patients reporting excellent results and a lower rate of postoperative ulnar neuropathy. With regard to the ulnar nerve itself, routine transposition is no longer indicated in patients such as this with no preoperative neurologic symptoms, as limited handling of the nerve is associated with improved patient-reported outcomes and lower rates of postoperative neuropathy
Correct answer : B

24- A 19-year-old collegiate lacrosse player stumbles to the sideline after a collision with an opposing player during the first quarter of a game. She complains of dizziness and is disoriented to place and time. She initially shows disturbances in balance. The player is diagnosed as having sustained a concussion and is removed from the rest of the game. What should the coaching staff be advised of regarding the player's return to activity?

A. The player should be kept in dark, quiet rooms until she returns to baseline function.
B. The player is eligible to return to play tomorrow if she remains symptom-free.
C. The player needs to show return to baseline computerized neuropsychological scores and then is cleared to play.
D. The player can return to sub-symptom threshold light aerobic exercise after 24 to 48 hours if symptom-free.

Concussions can be defined as a traumatically induced transient disturbance of brain function. There is currently no consensus regarding the definition of a concussion, nor is a there a defined biomechanical threshold of a concussion. Concussions occur when either linear and/or rotational forces are transmitted to the brain. A complex disturbance in neurometabolic activity follows. Until normal metabolic activity is restored, a second injury can result in worsening metabolic changes and significant cognitive defects. Given this reasoning, under no circumstances should an athlete be allowed same-day return to physical activity. In terms of return to play, studies have shown that strict rest may actually delay recovery and prolong symptoms. Most studies recommend a 24 to 48 hour period of symptom limited cognitive and physical rest, followed by sub-symptom threshold light aerobic activity.
Correct answer : D

25- A 19-year-old collegiate basketball player lands awkwardly after a jump and feels a “pop” in the knee. She is unable to return to play and develops a large effusion within 8 hours after injury. Physical examination includes a positive Lachman's test and a positive lateral McMurray's test. As part of her evaluation, her team physician orders radiographs and an MRI scan. The abnormality present in Figure 1 represents injury to what structure?

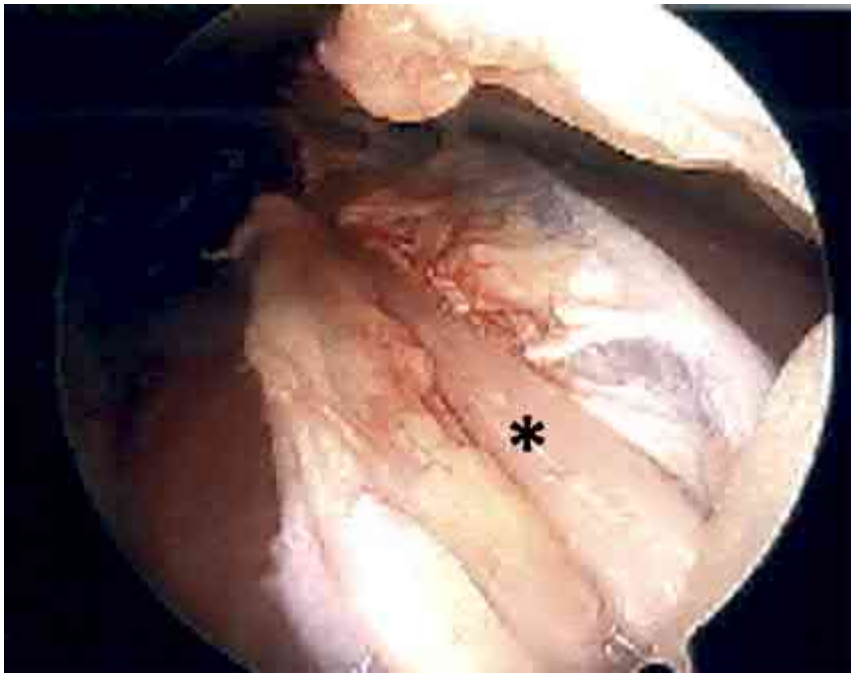
A. Anterolateral ligament/capsule
B. Anteromedial bundle of the anterior cruciate ligament (ACL)
C. Posterolateral bundle of the ACL
D. Lateral meniscus

The injury mechanism and examination findings describe a classic ACL tear. The positive lateral McMurray's test may represent a lateral meniscus tear or may result from the lateral compartment pivot-shift contusion that typically accompanies an ACL tear. The anterolateral ligament (ALL) is an accessory ligament coursing from the lateral femoral epicondylar region to the anterolateral tibial plateau. It tears frequently, if not always, in association with ACL tears. The abnormality shown in the radiograph is known as a “Segond fracture.” This is a bony avulsion from the anterolateral tibial plateau and is believed to represent avulsion of the ALL. A Segond fracture is thought to be pathognomonic for the diagnosis of ACL tear.

Correct answr : A

27- A 16-year-old female high school soccer player presents with more than one year of bilateral anterior and lateral lower extremity pain, tightness and a heavy feeling in her lower legs that starts 5 minutes after she begins running and resolves about 10 to 15 minutes after she stops. She describes feeling as though her foot slaps down on the ground when she is running. She failed extensive nonsurgical management and was ultimately indicated for surgery. At the time of endoscopically assisted treatment of this condition, damage to the structure identified by an asterisk in Figure 1 would result in what complication?

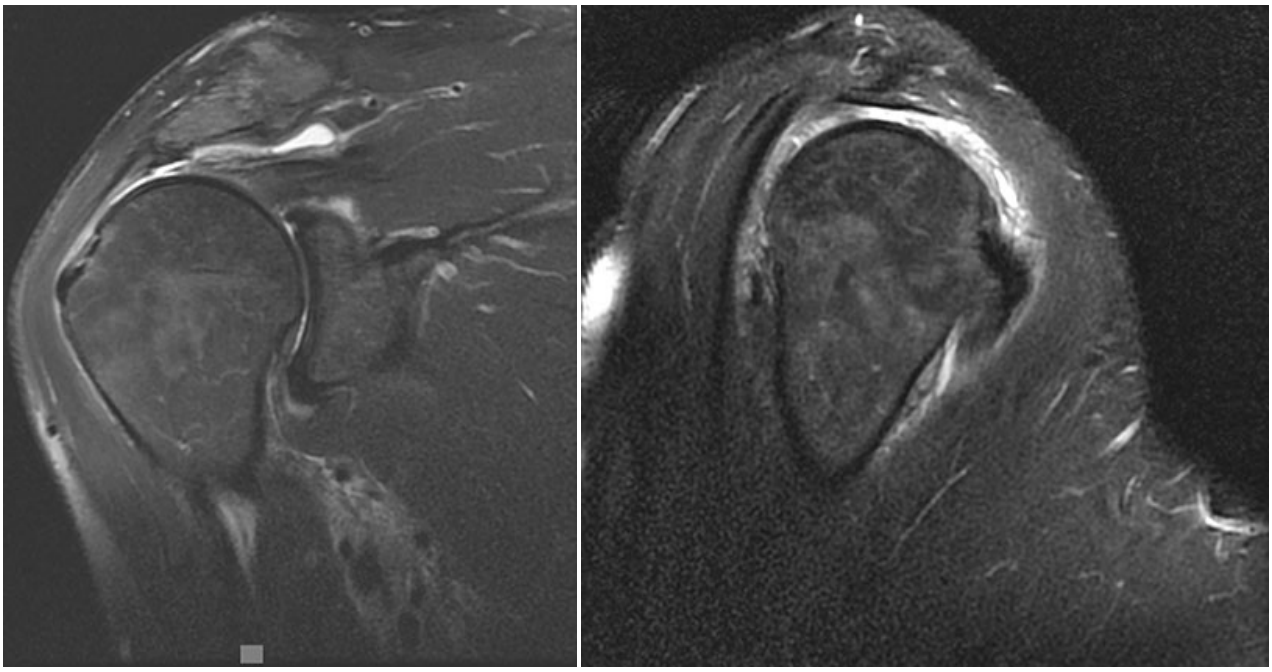
A. Postoperative hematoma
B. Medial leg numbness
C. Weakness of foot eversion
D. Dorsal foot numbness



chronic exertional compartment syndrome is commonly seen in running athletes and causes a constellation of lower leg pain, weakness and/or numbness/paresthesias. It is an exercise-induced condition that is thought to result from muscle swelling during activity and resultant hypoperfusion to the muscles and nerves within the compartment. The description of this patient, with symptoms in the anterior and lateral areas of her lower legs and the foot slap that she describes, indicates symptoms localized to the anterior and lateral compartments as opposed to posterior compartment symptoms. The anterior and lateral compartments would have been released in this patient. The structure seen lays between two released muscular compartments over the intermuscular septum and is the superficial peroneal nerve, which pierces the fascia 10 to 12 cm proximal to the tip of the lateral malleolus.

The structure that would cause medial leg numbness would be injury to the saphenous nerve. Her symptom description is not consistent with posterior compartment syndrome, and these compartments would not have been released at the time of surgery. The structure is not a blood vessel.
Correct answer : D

27- Figures 1 and 2 are the MRI scans of a 57-year-old man who dislocated his left shoulder after a fall while playing tennis. On examination, he had full passive shoulder range of motion, but he was unable to actively elevate his injured shoulder. Sensation was intact to light touch over the lateral shoulder. What is the most likely etiology of his shoulder weakness?



A. Axillary nerve injury
B. Cervical radiculopathy involving the C6 nerve root
C. Massive rotator cuff tear with loss of the transverse force couple
D. Long head of the biceps tendon rupture with loss of superior stabilizing effect

This patient has a massive rotator cuff tear resulting in disruption of the transverse force couple between the subscapularis anteriorly and the infraspinatus and teres minor posteriorly. These muscles provide dynamic shoulder stability throughout active elevation, and loss of the force couple produces a pathologic increase in translation of the humeral head and decreased active abduction. Active shoulder elevation <90° in the presence of full passive motion is termed pseudoparalysis. The most common neurologic deficit after shoulder dislocation is isolated injury to the axillary nerve. This patient's sensory examination suggests that the axillary nerve is intact. Cervical radiculopathy is less common after shoulder dislocation but has been reported. Conflicting evidence exists regarding the contribution of the long head of the biceps tendon to glenohumeral stability. One study reported minimal electromyographic activity in the biceps during ten basic shoulder motions.

Correct answer : C

28- A 14-year-old gymnast misses her dismount off of the uneven bars, hits the mat face first, and loses consciousness for about 15 seconds. She is dazed and confused for several minutes. She does not complain of pain, numbness, or weakness and she is moving all extremities without deficit. The athlete and coach would like to return to competition that day. What is the best next step?

A. Advise that loss of consciousness precludes same day return to play.
B. Order an urgent MRI scan; if findings are normal, she can return to play.
C. Order neurocognitive testing; if findings are normal, she can return to play.
D. If she is symptom-free after a 15-minute exertional test, she may return to play.

The National Collegiate Athletic Association's health and safety guidelines regarding concussion management recommend no return to play on the same day of an injury. In particular, athletes sustaining a concussion should not return to play the same day as their injury. Before resuming exercise, athletes must be asymptomatic or returned to baseline symptoms at rest and have no symptoms with cognitive effort. They must be off of medications that could mask or alter concussion symptoms. Neurocognitive testing can be a helpful tool in determining brain function even after all symptoms of concussion have resolved. With a comparison baseline test, this evaluation, in conjunction with a physician's examination, may reduce risk for second impact syndrome. The athlete's clinical neurologic examination findings (cognitive, cranial nerve, balance testing) must return to baseline before resuming exercise. Research has shown that among youth athletes, it may take longer for tested functions to return to baseline (compared with the recovery rate in adult athletes). Brain MRI scan has no role in evaluating athletes for return to play in this situation.
Correct answer : A

29- A 19-year-old linebacker underwent a coracoid transfer procedure for recurrent anterior glenohumeral instability. At his 1-week postsurgical check-up, his incision is healing well; however, he reports numbness over the lateral aspect of his forearm. What nerve may have been injured during his surgery?

A. Axillary
B. Median
C. Musculocutaneous
D. Radial

The patient has sustained an injury to the musculocutaneous nerve, which is at risk during a coracoid transfer procedure. The terminal branch of this nerve is the lateral antebrachial cutaneous nerve of the forearm. The axillary nerve provides sensation to the lateral arm. The median nerve provides sensation more distally. The radial nerve is not likely to be injured with a coracoid transfer procedure; if it is, the injury would result in numbness near the wrist.in the posterior forearm.
Correct answer : C

30- A 32-year-old volleyball player has dull posterior shoulder pain. An examination reveals moderate external rotation weakness with his arm at his side but normal strength on supraspinatus isolation. Deltoid and supraspinatus bulk appear normal, although there appears to be mild infraspinatus atrophy. Sensation is normal throughout the shoulder and shoulder girdle. What is the most likely diagnosis?

A. Calcified transverse scapular ligament
B. Parsonage-Turner syndrome
C. Spinoglenoid notch cyst
D. Quadrilateral space syndrome

This clinical scenario describes a patient with an isolated injury affecting the infraspinatus muscle. The anatomic location of such a lesion would be at the spinoglenoid notch, at which the suprascapular nerve may be compressed distal to its innervation of the supraspinatus but proximal to the infraspinatus innervation. A calcified transverse scapular ligament would also affect the suprascapular nerve but is proximal to the innervation of both muscles. Quadrilateral space syndrome would affect innervation of the deltoid (and teres minor). Parsonage-Turner syndrome is a more diffuse, and often severely painful, brachial plexus neuropathy.
Correct answer : C

31- A patient underwent a right hip arthroscopy, CAM resection, and labral repair while positioned supine on a fracture table with a perineal post. The leg was in traction for 4 hours, and no intrasurgical complications were noted. At the 2-week follow-up appointment, the patient was experiencing numbness and tingling in the perineum on the surgical side and noted pain predominantly while sitting. What is the likely cause of these symptoms?

A. Traction injury to the sciatic nerve
B. Traction injury to the femoral nerve
C. Compression injury to the pudendal nerve
D. Direct injury to the lateral femoral cutaneous nerve

Although all of these responses are known complications related to hip arthroscopy, the symptoms of perineal numbness and pain associated with prolonged traction time indicate a compression injury to the pudendal nerve against the perineal post used to provide counter traction. Perineal numbness usually occurs on the surgical side, with pain in the area of the anus to the penis/clitoris. Pain is predominantly experienced while sitting, but is relieved when sitting on a toilet. Pain can be relieved with a diagnostic pudendal nerve block. This injury is not unique to hip arthroscopy; it also is described in the trauma literature. To prevent compression-type injuries, a well-padded post larger than 9 cm in diameter should be positioned against the medial thigh. Traction force should be kept to a minimum and the extremity positioned in slight abduction. Continuous traction time should not exceed 2 hours, with intermittent traction used during prolonged procedures.
Correct answer : C

32- An 18-year-old female collegiate soccer player presents with right knee pain and swelling after a noncontact pivoting injury during a game. Four years prior, she underwent successful anterior cruciate ligament (ACL) reconstruction with hamstring autograft on the same knee. Physical examination and MRI scan are consistent with ACL graft rupture without associated meniscal tears. What statement can be made about the graft options in counseling this patient on revision ACL reconstruction?

A. Two-year sports function, as measured by International Knee Documentation Committee (IKDC), is better with allograft.
B. At 1-year follow-up, there is greater knee laxity with the use of autograft.
C. There is a higher infection rate with autograft.
D. Risk of graft rerupture is higher with allograft.

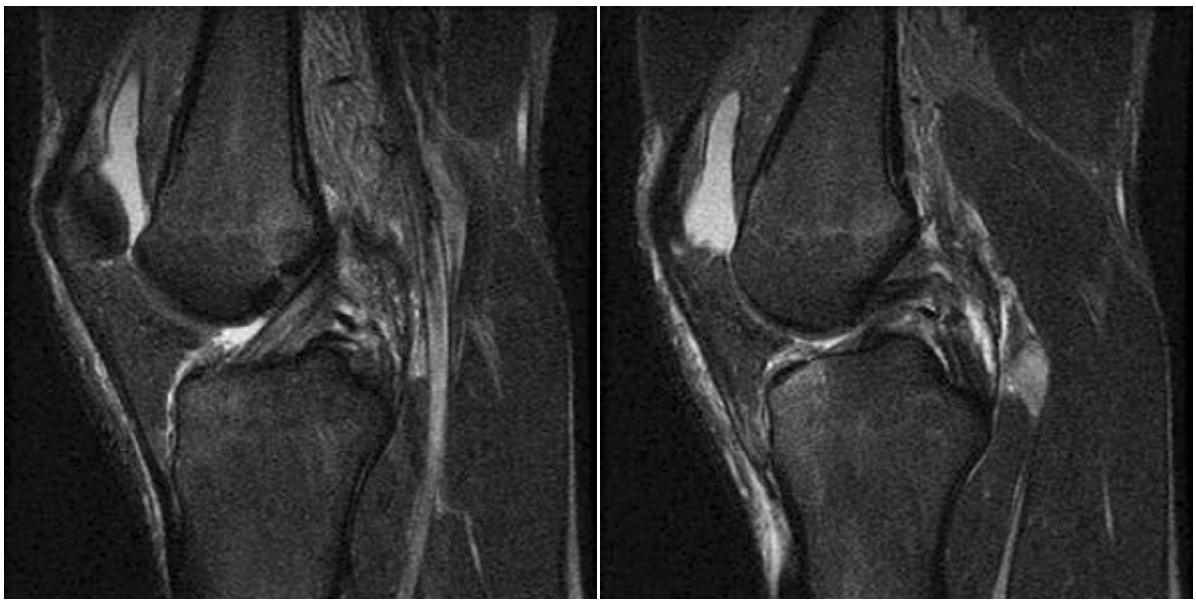
Based upon large multicenter studies and registries including the MARS group and Danish registry, re-tear rates after revision ACL reconstruction are higher when allograft is used as compared with autograft. Sport function, as assessed by the IKDC, is better with the use of autograft. Furthermore, no differences in retear rates or function have been shown between soft tissue and bone patellar tendon bone autograft.
Correct answer : D

33- An investigation studying whether physical therapy or subacromial injection can be successfully used to treat shoulder pain is conducted. Two groups are identified. One group is prescribed physical therapy, while the other receives a subacromial injection. The groups have similar baseline demographics and shoulder pathologies. Ten patients are randomized in each group and findings show that there is no significant difference in any patient-reported outcome measure. An increase in sample size would reduce the risk of what parameter?

A. Type I error
B. Type II error
C. Selection bias
D. Recall bias

This study represents a randomized clinical trial with two groups. However, the sample size is small, increasing the risk for type II error, or false-negative findings. Increasing the number of patients in each group would lead to increased power, thereby reducing the risk of a type II error. A type I error is the rejection of a true null hypothesis (false-positive). A randomized trial reduces the risk of selection bias as patients are assigned to groups in a random fashion. Recall bias occurs when participants do not accurately remember previous events or experiences from the past.
Correct answer : B

34- A football player injures his knee when he is tackled and falls awkwardly. He does not note any discreet "pop," but pain prevents him from returning to the game. An effusion is noted the following day and an MRI scan is ordered. Selected images are shown in Figures 1 through 3. Based on these images, physical examination findings likely include



A. positive Lachman test, normal posterior drawer, positive pivot shift.
B. positive Lachman test, positive posterior drawer, negative pivot shift.
C. normal Lachman test, positive posterior drawer, positive pivot shift.
D. normal Lachman test, positive posterior drawer, negative pivot shift.

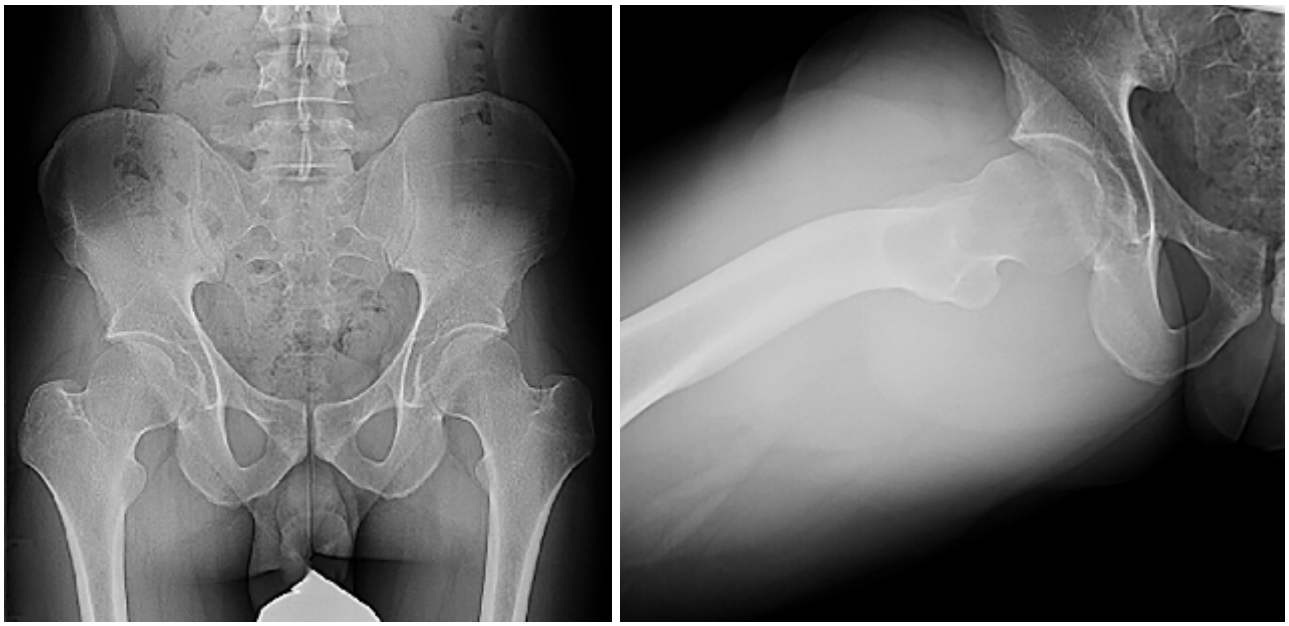
The images provided reveal a posterior cruciate ligament (PCL) disruption with an intact anterior cruciate ligament (ACL). Common diagnostic findings for a PCL tear include a positive posterior drawer test, positive reverse pivot shift, positive quadriceps active test, and positive posterior sag. A positive Lachman test, which would indicate a torn ACL, would not be expected to be positive. A false-positive result for a Lachman test can arise with a torn PCL because of the overall increased anterior-posterior translation; this must be avoided by careful attention to initial resting position and station of the knee.
Correct answer : D

35- A 20-year-old collegiate pitcher has had increasing pain over his medial elbow for 3 months. He has point tenderness over his medial epicondyle and reproduction of his symptoms with a moving valgus stress test. What phase of the throwing cycle most likely will reproduce his symptoms?

A. Early cocking
B. Late cocking
C. Acceleration
D. Deceleration

This patient is experiencing soreness over his medial (ulnar) collateral ligament. Valgus overload is likely to reproduce his symptoms and is most pronounced during the late cocking phase of the throwing cycle. In wind up, very little elbow torque is required. In early cocking, the arm is getting loaded and maximum valgus is not yet achieved at the elbow. In acceleration and deceleration, more force is generated at the level of the shoulder joint.
Correct answer : B

36- Figures 1 and 2 are radiographs of a 25-year-old man who has had persistent right hip pain for over a year. There was an acute injury and the pain has progressively worsened and is now 9/10 in severity. The pain interferes with activities of daily living and the patient's capacity to participate in sports. The patient has failed nonsurgical treatment in the form of physical therapy and activity modification. On physical examination, forward flexion is limited to 90°, internal rotation is limited to 10°, and flexion adduction internal rotation examination is positive. The hip pain was relieved on physical examination after intra-articular administration of local anesthetic. The patient had an MRI and CT scan. What is the most appropriate surgical option?

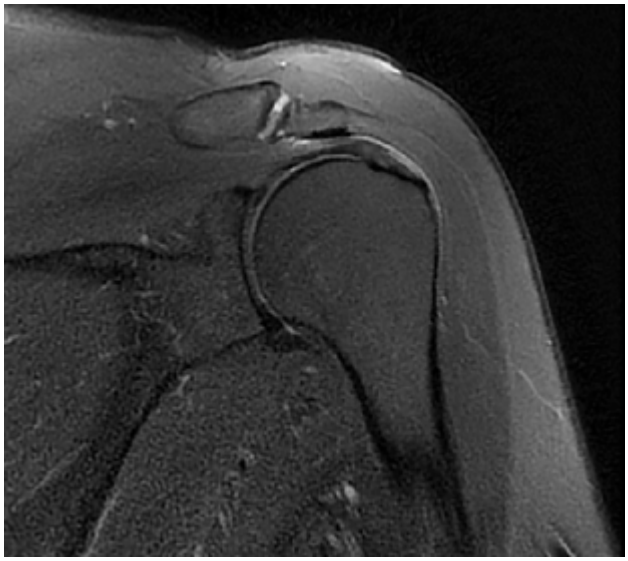


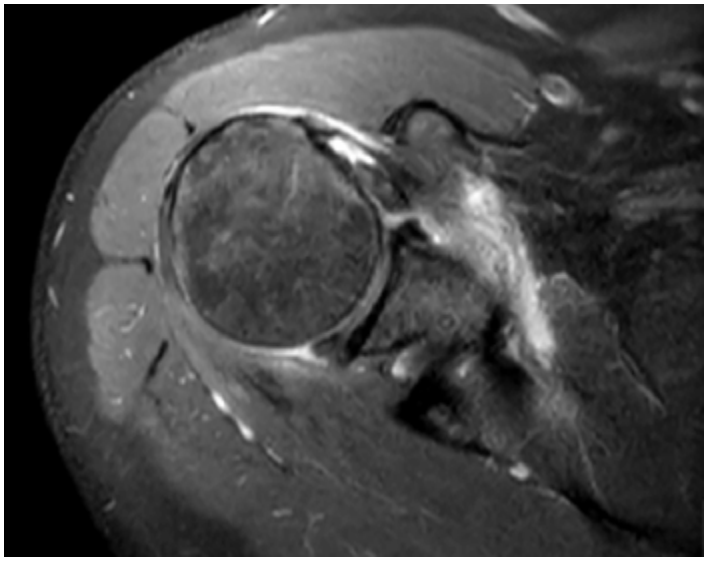
A. Hip arthroscopy with labral repair, rim trimming and femoral osteochondroplasty
B. Hip arthroscopy with labral repair and periacetabular osteotomy with femoral osteochondroplasty
C. Open surgical hip dislocation with labral repair, rim trimming and femoral osteochondroplasty
D. Hip arthroscopy with labral repair and reverse periacetabular osteotomy with femoral osteochondroplasty

The radiographs show a large cam lesion on the anterosuperior aspect of the femoral head, and this is confirmed by high alpha angle (76). Cam and pincer lesions commonly cause labral tears and lead to femoroacetabular impingement. After failure of nonoperative treatment, surgery involves hip arthroscopy, labral repair or debridement, rim trimming (resection of acetabulum), and femoral osteochondroplasty. A periacetabular osteotomy is the preferred surgery in dysplastic patients. Dysplasia is defined as undercoverage of the femoral head, typically a center-edge angle <25. Reverse periacetabular osteotomy is used for a true retroverted acetabulum. Lastly, open dislocation is the preferred method when the hip deformity is too severe to treat arthroscopically or when the femoral head is significantly overcovered by the acetabulum (center-edge angle >40).

Correct answer : A

A 50-year-old right-hand dominant man presents after a traumatic fall on an outstretched right upper extremity. Based upon the MRI scans shown in Figures 1 and 2, what examination test would be abnormal?

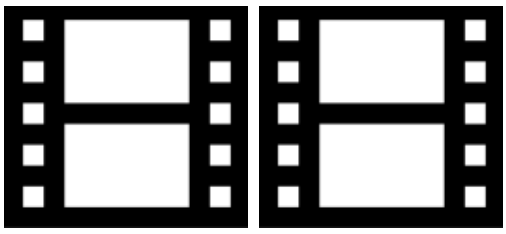




A. Belly press
B. Hornblower's test
C. External rotation strength
D. Empty can test

A fall on an outstretched upper extremity can commonly result in a traumatic rotator cuff tear. The images require appropriate interpretation of an acute subscapularis tendon rupture with medial subluxation of the biceps tendon. Subscapularis tendon tears result in a positive belly press or lift-off test. Hornblower's tests for external rotation strength with the arm abducted 90° (teres minor weakness). Empty can tests supraspinatus strength. External rotation strength with the arm at the side tests for infraspinatus weakness.
Correct answer : A

38- Videos 1 and 2 are the coronal plane MRI scan and arthroscopic evaluation of a 48-year-old woman with 2 weeks of posterior knee pain after feeling a "pop" in the knee while climbing stairs. Physical examination reveals passive range of motion of +5° to 120°, with pain limiting her in terminal extension. Failure of surgical repair of the injured structure is most associated with



A. poor vascularity of the injured tissue.
B. BMI >35 kg/m^2.
C. valgus alignment >5°.
D. repair technique.

The MRI scan and surgical video are showing an example of a posterior medial meniscal root tear/avulsion. Many studies have shown successful treatment of these tears with repair using various techniques and minimal progression to osteoarthritis (OA). Most studies exclude patients with high BMI. Brophy and associates demonstrated in their series that high BMI was associated with higher rates of clinical OA and need for subsequent surgery.

Multiple studies in the literature demonstrate good results with a variety of techniques. A valgus alignment in this setting would be considered protective, as opposed to a varus alignment >5°, which has also been associated with worse outcomes. The vascularity of the meniscus is consistently poor throughout most of its volume, including the root, and is not considered to be significantly different from person to person and should affect all root repairs equally.

Correct answer: B

39- A 47-year-old man who is an avid tennis player and laborer has had one year of shoulder pain and weakness. His pain occurs at night and radiates to the deltoid laterally. The patient denies any anterior based pain. He reports no prior surgeries and has been managed with steroid injections and physical therapy. On examination, he has full passive motion with significant weakness with external rotation. His neurologic examination is unremarkable. MRI evaluation reveals a posterior-superior rotator cuff tear with Goutallier grade 4 fatty infiltrate in the supraspinatus and infraspinatus with retraction beyond the glenoid. He is concerned about the lack of rotation of his arm and reports that this disability creates significant disability with his occupation as a mason. What is the best next step?

A. Shoulder arthroscopy and subacromial decompression
B. Tendon transfer
C. Total shoulder arthroplasty
D. Reverse total shoulder arthroplasty

In younger active patients, tendon transfer is considered a preferable treatment option. The patient has failed a course of nonoperative management. Subacromial decompression may offer pain relief but may not be advisable in a patient with rotator cuff deficient shoulder. A total shoulder arthroplasty requires functionality of the supraspinatus and infraspinatus. A reverse total shoulder is an option to alleviate pain and perhaps improve forward flexion height and strength; however, reverse arthroplasty would not improve external rotation in this patient, and there is concern for longevity of the implant in younger patient populations.

Correct answer : B

40- A multicenter prospective study of 7,500 patients that assesses differences in rerupture rates after anterior cruciate ligament (ACL) reconstruction using hamstring autograft shows a decreased rate of rerupture when the graft diameter is >9.0 mm versus <9.0 mm (p = 0.05). A follow-up study done at a single institution of 200 patients fails to show any difference in rerupture rates based upon graft size. If the multicenter trial is assumed to be accurate, which statistical error occurred in the follow-up study?

A. Type-I error
B. Type-II error
C. Selection bias
D. Alpha error

Type-II errors, or beta errors, occur when the null hypothesis is accepted and should have been rejected. An underpowered study is at risk of this type of error. Power is defined as 1-probability of a type-II (beta error), and this is generally set at a level of 80% for most studies. The type-II error occurs when a study concludes that there is no association between the studied variables when in fact one exists. The type-I error, or alpha error, is defined as rejecting the null hypothesis when it should have been accepted. Alpha errors occur when a study suggests an association does exist when in reality it does not. Selection bias occurs when proper randomization is not achieved and therefore, the study cohort is not representative of the population intended to be analyzed.
Correct answer : B

41- A 17-year-old male soccer player sustains repeated lateral patellar dislocations refractory to physical therapy, bracing, and taping. After a workup including radiographs and MRI, the orthopaedic surgeon considers an isolated tibial tubercle osteotomy (TTO). A 60-degree anteromedialization is planned to address instability and to unload the patellofemoral joint. What is a relative contraindication to this procedure?

A. Grade III chondrosis of the proximal patella
B. Caton-Deschamps ratio of 1:1
C. Tibial tubercle-trochlear groove (TT-TG) distance of 21 mm
D. Q angle of 17°

TO is a common treatment for patellofemoral instability. The angle of correction must be customized to each patient's anatomy. For this patient, the orthopaedic surgeon plans an osteotomy that will both anteriorize and medialize the tubercle. This will consistently result in a change of

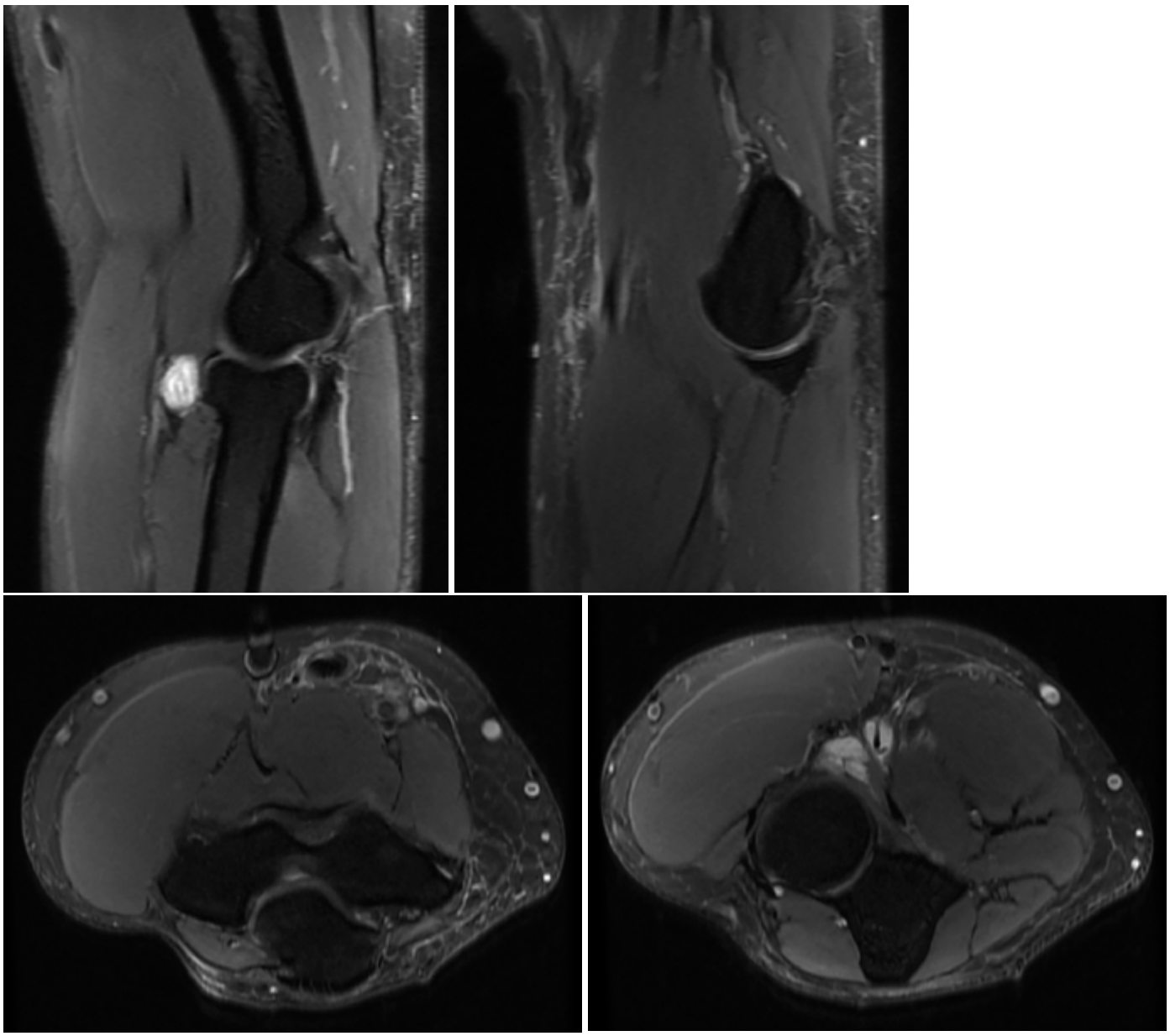
patellofemoral kinematics and contact pressures. Medialization decreases lateral and increases medial patellofemoral contact pressures, and anteriorization shifts contact pressures from distal to proximal. Significant anteriorization may not be desired in a patient with proximal patellar chondrosis unless a concomitant chondral procedure is performed as well. The patellar height (Caton-Deschamps ratio) is normal, precluding the need for distalization but not medialization. The TT-TG distance, at more than 20 mm, is a strong indication for osteotomy. The Q angle, although a less precise indicator of malalignment, is also elevated and would be considered an indication for osteotomy.
Correct answer : A

42- During preseason training camp, a 23-year-old football player comes to the sideline complaining of nausea, dizziness and headache after a 2-mile run. Vital signs include blood pressure 110/80, heart rate 115 bpm and core body temperature of 39°C (102°F). He is otherwise alert and oriented. What is the recommended initial treatment?

A. Immediate ice water bath immersion
B. Immediate return to training
C. Rehydration with a carbohydrate-electrolyte beverage
D. Emergent transportation to a local emergency department

The patient has exertional heat exhaustion (EHE). In cases of exertional heat illness with elevated core body temperature, it is critical to differentiate between EHE and exertional heat stroke (EHS). Patients suffering from EHE often complain of dizziness, nausea, cramping and headache. Vital signs can show mild tachycardia and normal to low blood pressure. EHS is defined by elevated core body temperature >40°C (104°F) and organ failure. Rapid cooling is critical in the setting of EHS, but not EHE. In the setting of EHE, the patient should be placed in a cool, shaded area and given fluids. Studies suggest that the presence of carbohydrate (<8%) in combination with electrolytes mildly promotes fluid retention better than drinking water alone.
Correct answer : C

43- Surgical repair of the injury shown in the MRI scans in Figures 1 through 4 through a single-incision approach has a higher incidence of



A. heterotopic ossification.
B. posterior interosseous nerve injury.
C. secondary surgery.
D. lateral antebrachial cutaneous nerve injury.

The MRI scans show a distal biceps tendon avulsion with significant retraction. When addressing these injuries, a single-incision approach has been associated with an increased risk of lateral antebrachial cutaneous nerve injury. A two-incision approach has been associated with an increased risk of heterotopic ossification, second surgeries and posterior interosseous nerve injury.

Correct answer : D

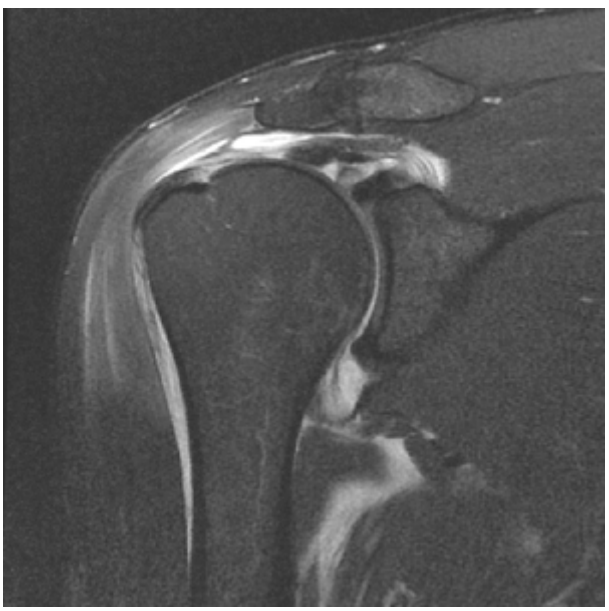
44- Figure 1 is the T2 coronal MRI scan of a 52-year-old woman with a 6-month history of shoulder pain. She does not recall a history of trauma. Physical therapy is recommended. What is the most significant predictor of failure of nonoperative treatment?

A. Tear size
B. Pain scale score
C. Strength deficit
D. Patient expectations

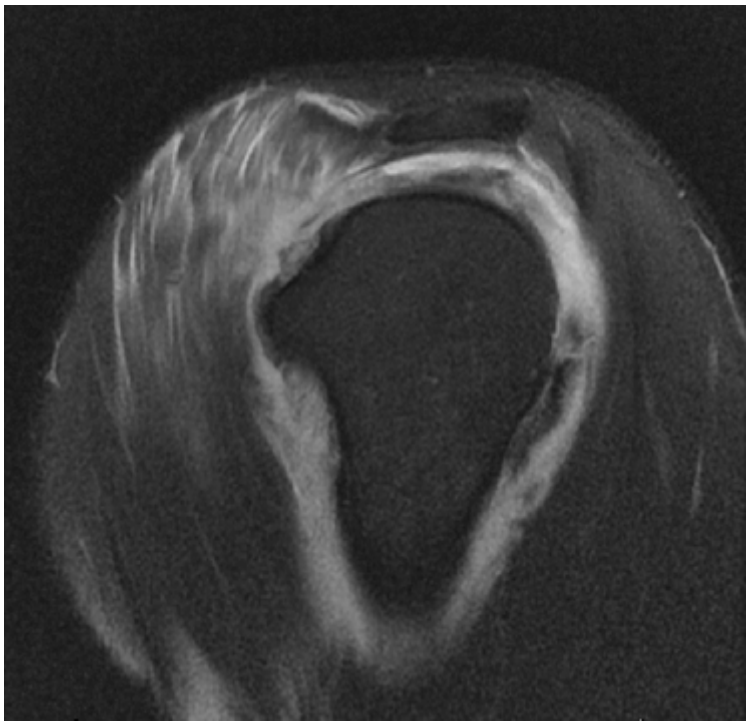
The MRI reveals a large full thickness supraspinatus tear. A large, prospective study showed that physical therapy can be effective in the treatment of atraumatic full-thickness rotator cuff tears. Patient expectations regarding the role of rehabilitation were the strongest predictor of surgery. Other factors associated with surgery were higher activity level and not smoking. Anatomic features of the rotator cuff tear and the severity of patient's reported pain did not predict failure of nonoperative treatment. Patients who have low expectations regarding the effectiveness of physical therapy are more likely to fail nonoperative treatment.

Correct answer : D

45- Figures 1 through 3 are the MRI scans of a 51-year-old active man who injured his right shoulder after a fall while sailing 4 days ago. Optimal surgical management of the patient's pathology is expected to involve



A. supraspinatus, infraspinatus and subscapularis repair and biceps tenodesis.
B. supraspinatus and subscapularis repair and biceps tenodesis.
C. supraspinatus and infraspinatus repair.
D. supraspinatus, infraspinatus and teres minor repair.



The MRI scans show a full-thickness tear of the supraspinatus, infraspinatus, subscapularis and medial subluxation of the long head of biceps tendon. Teres minor appears intact on the images. Although the tear of the subscapularis is not as well-visualized, medial subluxation of the long head of biceps is reliably correlated with a subscapularis tear.
Correct answer : A

46- A 16-year-old swimmer has right shoulder pain with activity. She describes the continued sensation that her shoulder is "loose." She has been in physical therapy for 7 months to work on strengthening the muscles around her shoulder and scapula. She denies being able to voluntarily dislocate her shoulder. Upon examination, you can feel the humeral head slide over the glenoid rim both anteriorly and posteriorly with the load and shift test. She has a grade III sulcus sign. What is the most appropriate next step?

A. Arthroscopic superior labrum anterior to superior repair
B. Arthroscopic Bankart repair
C. Latarjet procedure
D. Capsulorrhaphy

Nonsurgical treatment with activity modification and physical therapy is generally considered the first-line approach for young athletes with multidirectional instability (MDI) of the shoulder. Physical therapy focuses on exercises to strengthen the scapular stabilizers and rotator cuff muscles and restore scapulohumeral rhythm. Although a definitive length of time to assess physical therapy failure is not known, many surgeons believe that a patient with MDI should undergo at least 6 months of physical therapy and activity

modification before considering surgery. Although an open inferior capsular shift has historically been considered the gold standard for surgical treatment for MDI, studies have shown good success rates for arthroscopic capsulorrhaphy. Arthroscopy can allow a surgeon to assess all intra-articular structures and address a patient's particular problem based on arthroscopic findings.
Correct answer : D

47- A 12-year-old boy who plays multiple sports has had insidious-onset heel pain while running for 4 months. On examination, he had ankle dorsiflexion of 5°. The squeeze test result was positive and the Thompson test result was negative. He has no pain with forced ankle plantar flexion. What is the most likely diagnosis?

A. Achilles rupture
B. Gastrocnemius strain
C. Calcaneal apophysitis
D. Os trigonum syndrome

Calcaneal apophysitis (Sever's disease) is a common cause of heel pain in adolescent athletes who participate in running or jumping sports. The condition occurs primarily before or during peak growth and is characterized by a tight Achilles tendon, a positive squeeze test, and tenderness over the calcaneal apophysis. Pain is localized to the heel and exacerbated by running. Os trigonum syndrome involves posterior ankle impingement and is commonly associated with ballet dancers. Gastrocnemius strain typically causes pain more proximally at the myotendinous junction. The Thompson test is performed with the patient lying prone on the examination table. Absence of ankle plantar flexion when the examiner squeezes the calf constitutes a positive test and is indicative of Achilles rupture.
Correct answer : C

48- A 21-year-old female cross-country runner is brought to the medical tent after completing her run. The race took place during an unseasonably warm day in August. The patient is disoriented upon her arrival to the tent and cannot state the exact date. What is the next most appropriate course of action?

A. Administration of intravenous fluids
B. Immediate transport by ambulance to the closest hospital
C. Immersion in a cold-water ice bath
D. Temperature check with an oral thermometer

The patient is suffering from heat stroke due to the neurologic changes noted by confusion (can not state the date). This is a medical emergency and should be treated with immediate cold-water ice bath immersion and temperature monitoring with a rectal thermometer. Administration of IV fluids is controversial and is not first-line treatment for heat stroke. Transport to a hospital should be delayed until immediate cooling has been achieved and rectal temperature begins to decrease.
Correct answer : C

49- A 14-year-old male high school wrestler presents to the training room with the lesions seen in Figures 1 and 2. He reports that he had a low-grade fever last week. Prior to the appearance of the lesions, he was experiencing some itching and burning in the affected area. What is the most appropriate treatment for this condition?

A. Oral trimethoprim-sulfamethoxazole
B. Oral acyclovir
C. Oral fluconazole
D. Topical mupirocin

The images are consistent with herpes gladiatorum. This condition is caused by herpes simplex type 1 and occurs in 2% to 7% of wrestlers. It is spread via direct skin contact and is generally seen on the head, neck and shoulders. The lesions are characterized by fluid-filled blisters on an erythematous base. Return to play is permitted after the patient has been treated for 5 days with anti-viral medications, no new lesions are seen within 72 hours and previous active lesions have scabbed over.
Correct answer : B

50- A 24-year-old former high school wrestler had anterior cruciate ligament (ACL) reconstruction with hamstring autograft 6 years ago. He now experiences daily instability of his knee with routine activities including walking. Examination reveals a grade 3+ Lachman test with a soft endpoint, varus laxity at 30°, and a positive dial test at 30° that dissipates at 90° of knee flexion. He has mild medial joint line tenderness. When walking, there is a slight varus thrust. Radiographic alignment is neutral. What treatment is most likely to lead to a successful outcome?

A. Revision ACL reconstruction
B. Revision ACL reconstruction and posterior cruciate ligament (PCL) reconstruction
C. Revision ACL reconstruction and posteromedial corner reconstruction
D. Revision ACL reconstruction and posterolateral corner reconstruction

The patient underwent an ACL reconstruction that has now failed. Based on his examination, he also has a posterolateral corner injury. Because this concomitant injury was not treated, the patient had undue strain on his graft, resulting in ultimate failure. Hamstring grafts are as effective as other graft types for ACL reconstruction. The medial meniscus provides secondary stabilization to the knee; however, this patient has a missed lateral ligamentous injury, and meniscus tears do not result in the development of a varus thrust. An unrecognized PCL tear likely results in mild-to-moderate medial and patellofemoral osteoarthritis without significant lateral laxity and thrust.
Correct answer : D

51- Figure 1 is the anteroposterior radiograph of a 20-year-old dancer who fell during his routine and injured his right foot. What is the most appropriate treatment?

A. Closed reduction and cast
B. Open reduction and internal fixation
C. In situ percutaneous pinning
D. Posterior splint immobilization and controlled ankle motion (CAM) walker ambulation

This patient has sustained a Lisfranc fracture dislocation of the forefoot. To fully restore foot function, an open reduction and internal fixation should be performed to anatomically reduce this dislocation. Closed reduction is unlikely to restore normal foot biomechanics and would likely result in delayed arthritis and joint incongruity. Posterior splint immobilization, CAM walker ambulation, and in situ percutaneous pinning will not adequately reduce the fracture and restore normal function to the foot.
Correct answer : B

52- A 38-year-old woman underwent left knee anterior cruciate ligament (ACL) reconstruction with patellar tendon autograft and medial meniscus repair 11 years ago. She has no complaints of instability since surgery. She presents with left knee pain, swelling and the inability to extend her knee after getting up from a kneeling position one week prior. She reports feeling a pop in her knee at the time of injury. On examination she lacks 5° of extension and has a symmetric Lachman test. Figure 1 is the radiograph of her knee. Figures 2 through 4 show the findings at the time of arthroscopy. What is the most appropriate treatment?




A. artial lateral meniscectomy
B. Revision ACL reconstruction and medial meniscus repair
C. Lateral meniscus repair
D. Partial medial meniscectomy

The arthroscopic images and the patient's history are consistent with a bucket handle tear of the medial meniscus. The ACL graft is intact and well-vascularized as shown in the arthroscopic image. The morphology of the meniscus and that the images are one of a left knee allows the determination that this is a tear of the medial and not the lateral meniscus. The image of the reduced bucket handle medial meniscus tear reveals plastic deformation and a large overlapping peripheral remnant that would make the possibility of healing after revision medial meniscus repair unlikely or suboptimal. The best treatment option for this patient is partial medial meniscectomy.

Correct answer : D

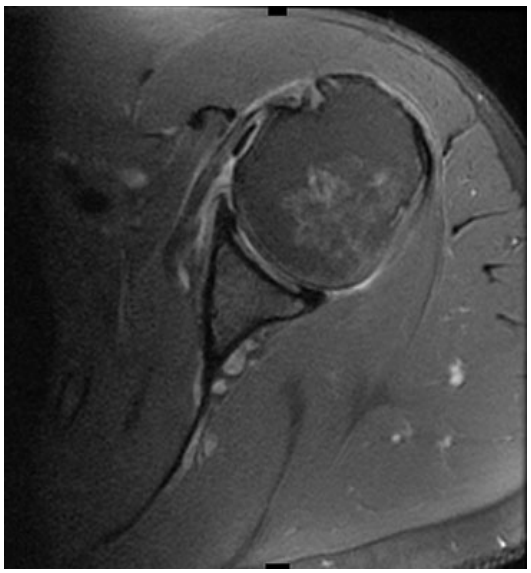
53- A 19-year-old running back lands directly on his anterior knee after being tackled. He has mild anterior knee pain, a trace effusion, a 2+ posterior drawer, a grade 1A Lachman, no valgus laxity, and negative dial tests at 30° and 90°. What is the best treatment strategy at this time?

A. Physical therapy with a focus on quadriceps strengthening
B. Physical therapy and delayed posterior cruciate ligament (PCL) reconstruction
C. PCL reconstruction
D. PCL and posterolateral corner reconstruction

This patient has likely sustained an isolated PCL injury. The examination is consistent with a grade II injury to the PCL. In patients with isolated PCL injuries, such as this scenario, the best initial option is nonsurgical treatment and return to play as symptoms subside and strength improves. Physical therapy and delayed PCL reconstruction is not the answer because this patient can likely be treated without surgery. The absence of valgus laxity and negative dial testing findings suggest that an injury to the posteromedial and posterolateral corners has not occurred. Initial nonsurgical treatment is indicated for this patient. If he completes rehabilitation and experiences persistent disability with anterior and/or medial knee discomfort or senses the knee is "loose," PCL reconstruction should be considered at that time.
Correct answer : A

54- Figure 1 is the MRI scan of a 61-year-old man who had left shoulder pain with a massive rotator cuff tear. Active forward elevation was 120°. Arthroscopic examination revealed that the rotator cuff tear was irreparable. The articular surfaces of the glenohumeral joint have a normal appearance without significant degenerative changes. What is the most appropriate treatment option for pain relief in this patient?

A. Biceps tenotomy
B. Loose body removal
C. Latissimus dorsi transfer
D. Reverse total shoulder arthroplasty

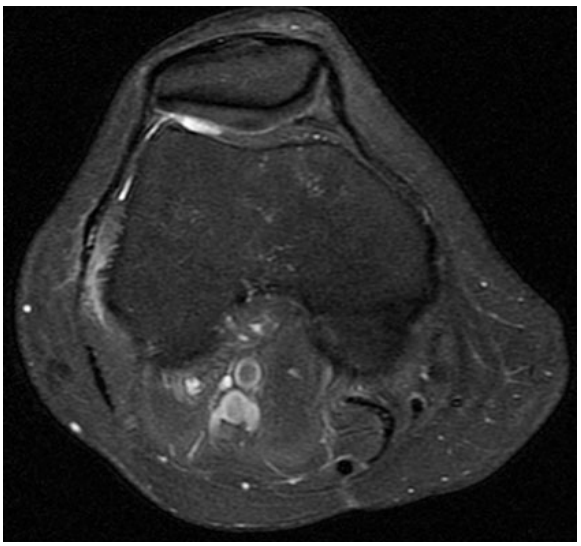


The MRI scan shows medial subluxation of the biceps tendon. Biceps tenotomy has been an effective treatment option for patients with large to massive rotator cuff tears when the tear is irreparable and pain is the main symptom. There is no evidence of a loose body on the MRI. Patients with severe external rotation deficit and a deficient teres minor may experience a better functional result with latissimus dorsi transfer. Reverse total shoulder arthroplasty is an option in patients with cuff tear arthropathy and pseudoparalysis.

Correct answer : A

55- Figure 1 is the MRI scan of a 52-year-old runner who has right knee pain that has been occurring 10 minutes into her run for 2 months. On examination, she has tenderness over the lateral epicondyle. Her Ober test result is positive. What is the most appropriate initial treatment?

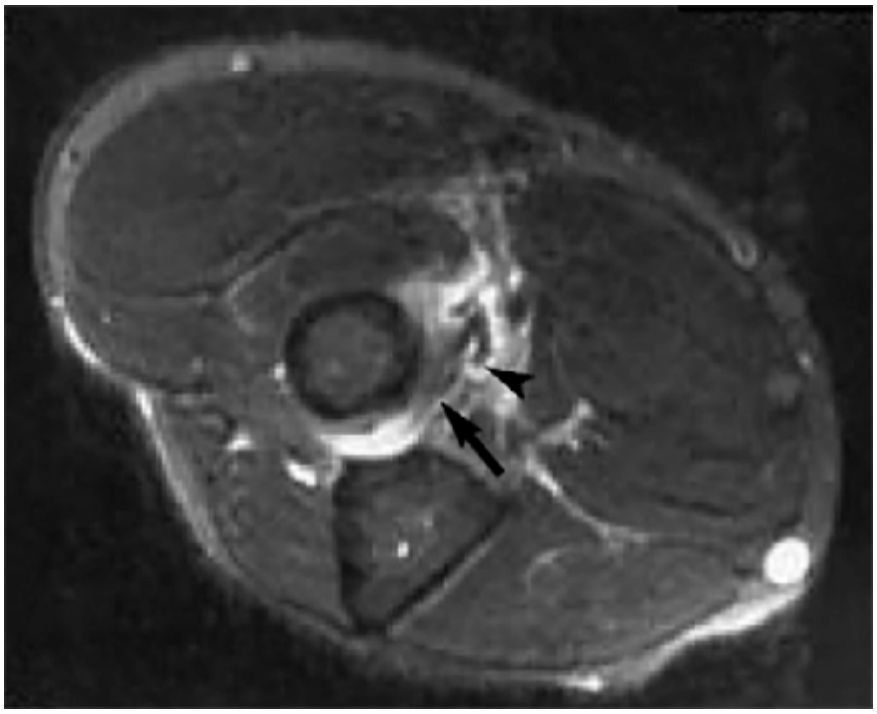
A. liotibial band bursectomy
B. Z-lengthening of the iliotibial band
C. Partial excision of the iliotibial band
D. Home stretching program and cross training



Iliotibial band syndrome (ITBS) is a common cause of lateral knee pain in runners. Potential etiologies for the pain include repetitive friction, compression, and bursal inflammation. An Ober test is used to assess iliotibial band tightness. With the patient lying on the unaffected side, the affected leg is abducted and extended. The test result is positive if the examiner is unable to adduct the leg from this position. An MRI scan can be helpful in making the diagnosis, but a negative MRI scan does not rule out ITBS. Studies have reported increased signal intensity on T2-weighted images deep to the iliotibial band adjacent to the lateral epicondyle, with thickening of the iliotibial band. Nonsurgical treatment is most appropriate initially and involves activity modification, ice, anti-inflammatory medications, and stretching. Corticosteroid injection to the iliotibial bursa is also an option to treat acute pain. After the initial inflammation improves, a strengthening program is started. Multiple surgical procedures have been described for recalcitrant cases, including iliotibial band excision, Z-lengthening, and iliotibial band bursectomy.

Correct answer :D

56- A 43-year-old mechanic presents with acute onset right elbow pain after attempting to lift a heavy car bumper while at work during which he felt an immediate sharp pain and snapping sensation deep within the elbow. An MRI scan of his injury is shown in Figure 1. When considering operative management for this injury, what operative technique has been shown to increase supination strength?



A. Utilization of the single-incision technique
B. Repairing the tendon in an ulnar position on the radial tuberosity footprint with the forearm in supination
C. Repairing the tendon through a bone-tunnel technique
D. Utilizing a cortical suspensory button for tendon fixation

The increase in available options for fixation regarding distal biceps tendon repair has led to an abundance of literature comparing various surgical techniques over the past 20 years. Distal biceps tendon tears most commonly occur in the dominant extremity of males in their 40s. Nonoperative management leads to a 40% loss of supination strength and a 30% loss in flexion strength. The injury frequently occurs during eccentric contraction of the biceps muscle. The tendon insertion is comprised of both the long- and short-head insertions. The short head inserts distally on the radial tuberosity acting as a better flexor, whereas, the long head inserts on the apex of the radial tuberosity acting as a better supinator.

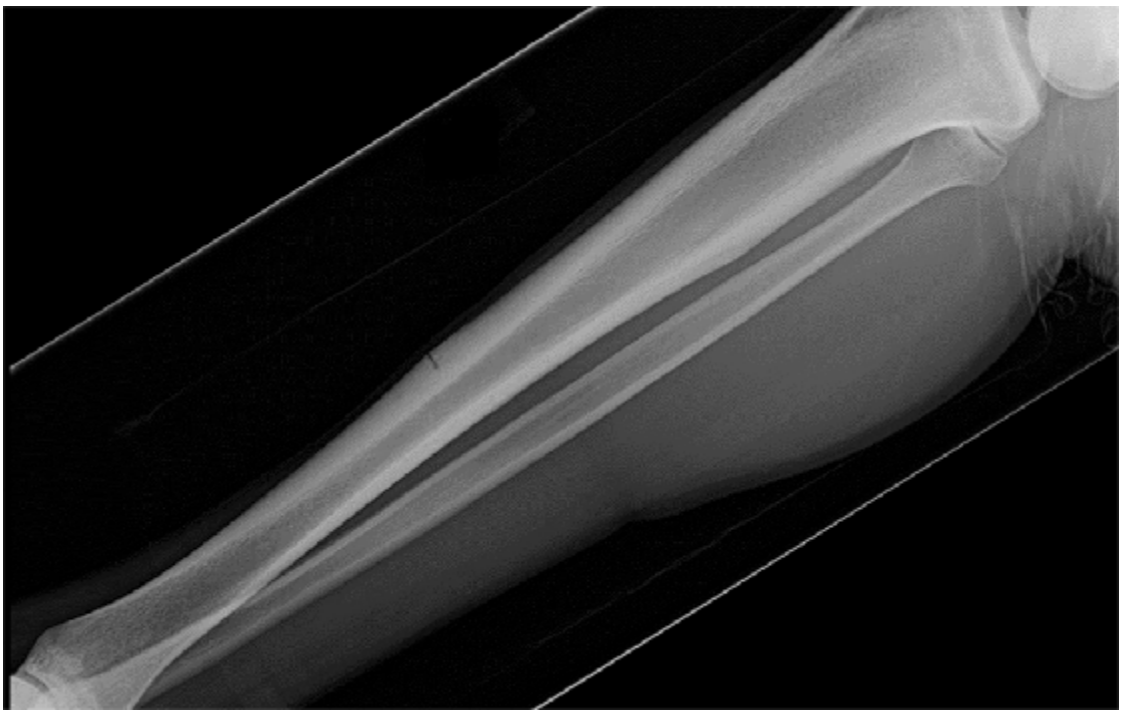
Prud'homme-Foster and associates demonstrated that a more anatomic reconstruction on the ulnar aspect of the radial tuberosity is essential to restore maximal supination strength. Both single- and dual-incision techniques

have demonstrated excellent outcomes; however, each has been shown to have a unique complication profile, which should be taken into consideration when considering operative intervention.

In a meta-analysis, Amin and associates demonstrated that lateral antebrachial cutaneous neuropraxia is the most common complication of the single-incision technique and heterotopic ossification was the most common complication of the dual-incision technique. The complication rate following single-incision technique is higher than that of the dual-incision technique secondary to the high frequency of lateral antebrachial cutaneous nerve neuropraxia.

In a study of complications over 784 procedures, Dunphy and associates demonstrated higher rates of posterior interosseus nerve palsy, heterotopic bone formation and reoperation with the dual-incision technique. There was no significant difference in tendon rerupture rates. Biomechanical studies have demonstrated increased pullout strength with the use of a cortical suspensory button versus transosseous bone tunnels or suture anchors.
Correct answer : B

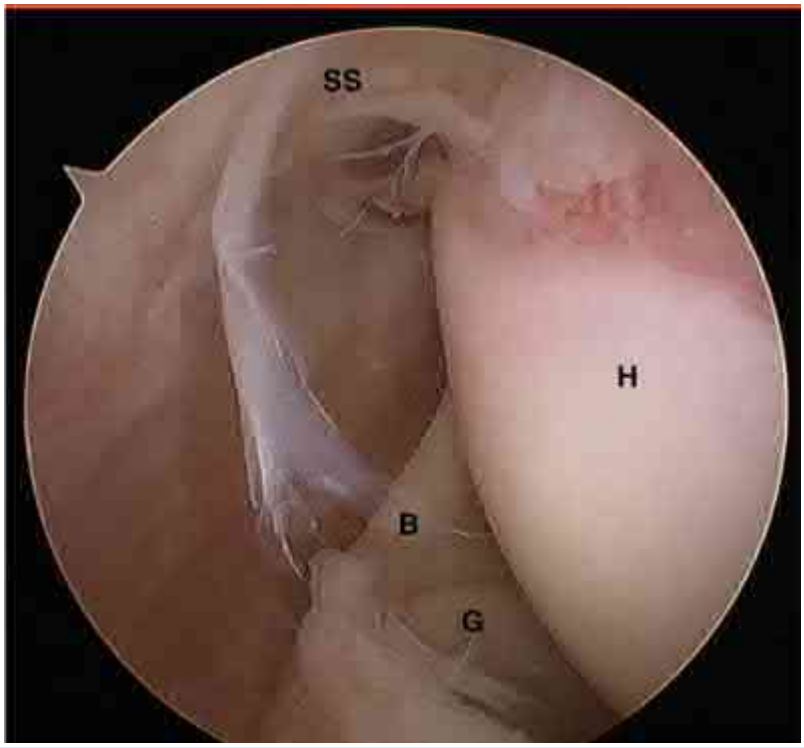
57- A 21-year-old Division 1 collegiate track and field athlete has had acute worsening right anterior shin pain for the past week. He reports having shin pain since sophomore year of high school but has continued to run through the pain. Upon presentation, he was diagnosed with a tibial stress fracture and underwent 8 weeks of nonoperative treatment and correction of vitamin D levels. His follow-up radiograph is shown in Figure 1. In counseling the patient about his surgical treatment options, what information should be discussed regarding the risks of compression plating versus intramedullary (IM) nailing in the treatment of this injury?

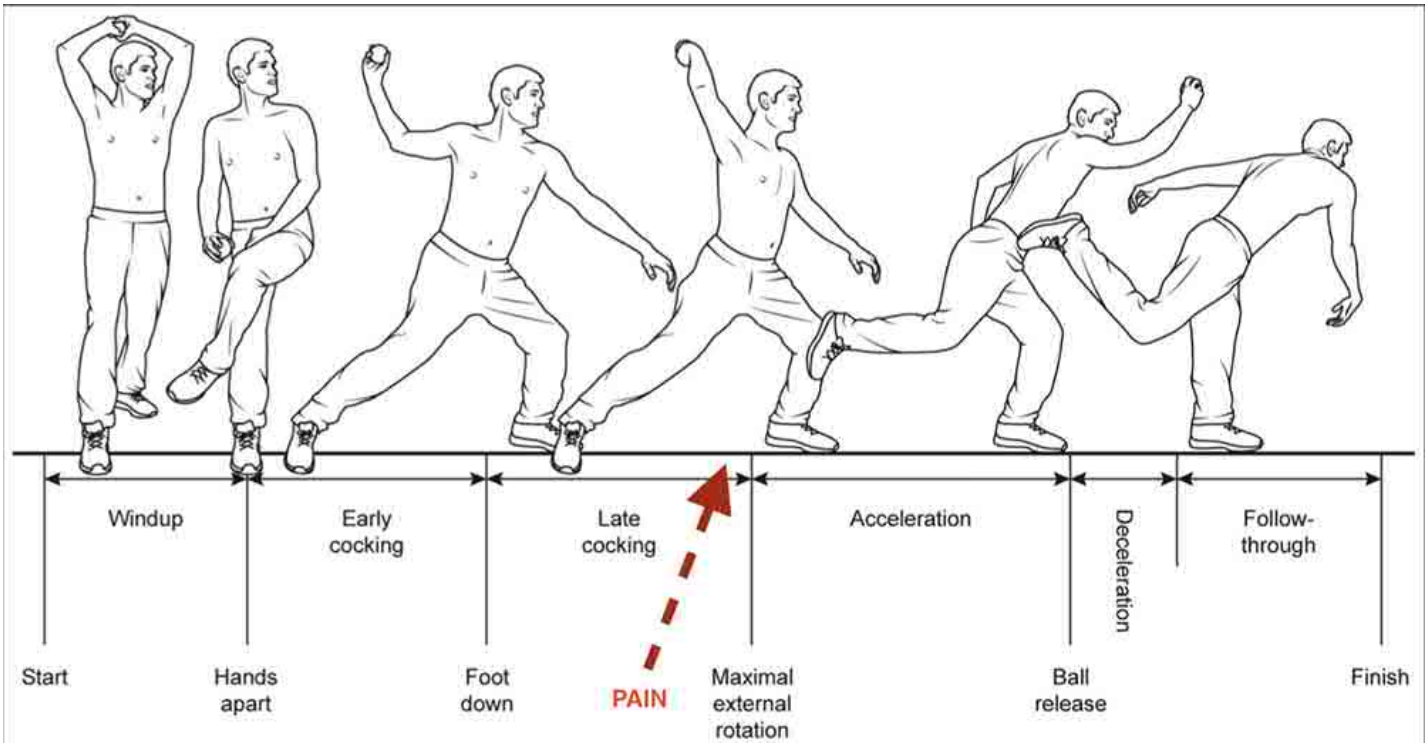


A. Compression plating results in a lower rate of symptomatic hardware.
B. IM nailing allows for faster time to radiographic union.
C. Risk of fracture progression or completion is greater after compression plating.
D. There is a lower rate of anterior knee pain after compression plating.

The case and radiograph describe a chronic anterior tibial stress fracture with radiographic evidence of the "dreaded black line". Both tibial IM nailing and compression plating are acceptable treatment options in the high-level athlete and are associated with a high rate of return to sport. Compression plating results in a higher rate of symptomatic hardware (20%) as compared with tibial IM nailing. Time to radiographic union may be faster with compression plating. This may be due to the mechanical advantage of neutralizing tensile forces and fracture micromotion. Plating avoids disruption of the knee extensor mechanism and the anterior knee pain associated with IM nailing. There are several reports of fracture completion after tibial IM nailing, requiring revision open reduction and internal fixation.
Correct answer : D

58- A star high school pitcher comes to see you in clinic for shoulder pain with throwing. He has been a pitcher since Little League. He has had pain for approximately one year, typically not during normal activities. On examination, his scapula is protracted on his throwing arm, and he has a positive Mayo dynamic shear test. Figure 1 shows the point in the throwing motion when he is having pain. Figure 2 is an arthroscopic image from the posterior portal. What phenomenon is most directly responsible for the findings on examination and on arthroscopic evaluation?





A. Subacromial impingement
B. Internal impingement
C. Anterior instability
D. Posterior instability

Internal impingement is the direct contact of the undersurface of the posterior supraspinatus on the posterosuperior labrum in late cocking during the typical throwing motion. This can result in labrum tearing, undersurface rotator cuff tearing or both in their respective locations (as illustrated in Figure 2). Anterior glenohumeral instability (or microinstability) can happen in the setting of throwing for many years as the anterior capsule stretches in the throwing position. This is thought to be exacerbated by posterior capsule tightness that can occur from repetitive microtrauma and scarring during the latter stages of throwing. Posterior instability and subacromial impingement are not typical pathology in the thrower's shoulder and are not exemplified in the throwing motion or arthroscopic images.

Correct answer : B

59- Figure 1 is the MRI scan of a 16-year-old high school football player who sustained a traumatic dominant shoulder dislocation during a game. On-field reduction was unsuccessful. The shoulder is reduced in the emergency department, and the player and his family follow-up in clinic. Which factor is most associated with failure of surgical treatment in this scenario?

A. Dominant shoulder
B. Age
C. Size of labral tear
D. Periosteal stripping

The MRI scan reveals a Bankart lesion. Arthroscopic Bankart repair failure likelihood is increased by numerous factors. Age, number of recurrences, and bony defects are most associated with failure of arthroscopic repair. Shoulder dominance, amount of periosteal stripping, and difficulty of reduction do not correlate with increased recurrence risk following surgery.
Correct answer : B

60- Figure 1 is the radiograph of a 13-year-old right-hand dominant male baseball pitcher who presents with new onset right shoulder pain. Over the past month, he has participated in several tournaments. He was unable to complete his most recent game secondary to continued pain while throwing. Examination reveals a healthy, adolescent male in no apparent distress. Range-of-motion examination of the bilateral shoulders is symmetric with mild pain at the end points of motion. He reports pain on palpation over the lateral aspect of his deltoid. What pathologic process is most likely responsible for this patient's pain?

A. Posterior capsular tightness
B. Excessive humeral retroversion
C. Internal impingement of the articular side of supraspinatus
D. Microtrauma to proximal humeral physis

The clinical vignette describes a 13-year-old boy with Little Leaguers' shoulder. This is an injury to the proximal humerus growth plate specifically involving the hypertrophic zone of the physis. This condition is considered a Salter-Harris 1 injury to the proximal humerus physis and most commonly affects male throwing athletes ages 11 to 16. The proximal humerus growth plate closes between the ages of 18 to 21. The mechanism of injury involves microtrauma to the growth plate from exposure to excessive rotational torque and distraction forces during the late cocking; early acceleration and deceleration phases of throwing, respectively. High pitch counts have been implicated as risk factors for injury. The diagnosis is frequently made clinically; however, radiographs of the shoulder may reveal widening of the proximal humeral physis in comparison with the contralateral side. Treatment includes cessation of throwing for 3 to 6 months. The patient should be asymptomatic prior to return to a throwing program. Physical therapy and a program of guided return to throwing that enforces proper pitching mechanics can be helpful during a return to play. Following established pitch counts and allowing for appropriate rest before throwing can help to prevent future recurrence.

Correct answer : D

61- A 25-year-old woman has lower leg pain during exercise without numbness, tingling, or weakness. The symptoms resolve within 45 minutes of exercise cessation. Compartment pressure measurements obtained 1 minute after exercise are shown in Figure 1. She undergoes anterior compartment fasciotomy with complete resolution of symptoms. Two years later, she has recurrent pain and tightness with exercise. Radiographs, a technetium bone scan, and noninvasive vascular study findings are normal. Compartment pressure measurements obtained 1 minute after exercise are shown in Figure 2. What is the most likely etiology for her recurrent symptoms?

Table 1

Compartment	Pressure (mm Hg)
Anterior	40
Lateral	21
Superficial Posterior	18
Deep Posterior	16

Table 2

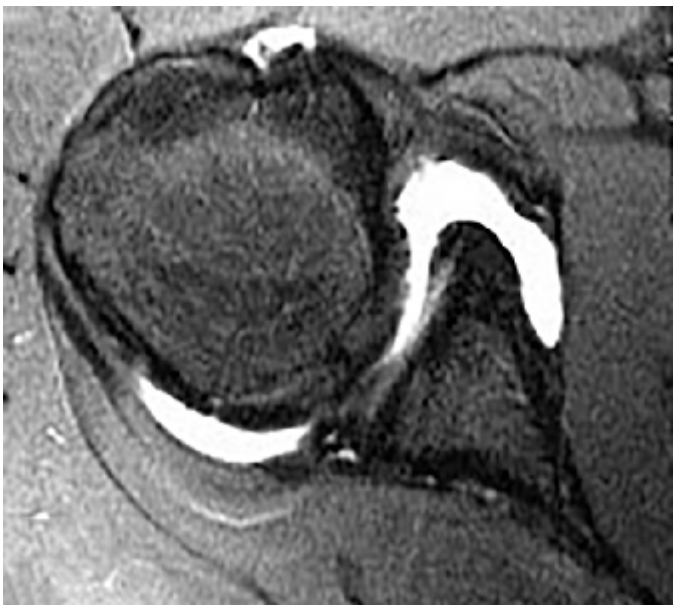
Compartment	Pressure (mm Hg)
Anterior	36
Lateral	24
Superficial Posterior	18
Deep Posterior	15

A. Misdiagnosis
B. Hematoma formation
C. Postsurgical fibrosis
D. Failure to recognize involvement of other compartments

Exertional compartment syndrome involves an increase in compartment pressure caused by exercise or sports activity that restricts blood flow in the compartment, resulting in pain with continued activity. Compartment pressures of at least 15 mm Hg measured at rest, at least 30 mm Hg measured 1 minute after exercise, and at least 20 mm Hg measured 5 minutes after exercise are diagnostic. Surgical fasciotomy for exertional compartment syndrome is successful for the majority of patients, but recurrence rates as high as 20% have been reported. Scar formation within the fascial defect can result in recurrent symptoms and/or nerve entrapment, and recurrence is typically observed after an initial symptom-free period. In a series of 18 patients, recurrent symptoms occurred at a mean of 23.5 months after the index procedure. Other potential causes of recurrence include inadequate fascial release, failure to recognize involvement of other compartments, nerve compression, and misdiagnosis. Surgical complications after fasciotomy include hemorrhage leading to excessive fibrosis, neurovascular injury, and hematoma or seroma formation.

Correct answer : C

62- Figure 1 is the T2 axial MRI scan of a 21-year-old man who was injured while playing for his college football team. His pain was aggravated with blocking maneuvers and alleviated with rest, and he had to stop playing because of the pain. What examination maneuver most likely will reproduce his pain?



A. Forward elevation in the scapular plane
B. External rotation and abduction
C. Flexion, adduction, and internal rotation
D. Flexion and abduction

This patient has a mechanism of injury and MRI scan consistent with a posterior labral tear and posterior instability. Flexion, adduction, and internal rotation produce a net posterior vector on the glenohumeral joint and should reproduce this patient's symptoms. Pain or instability with the arm elevated in the scapular plane describes an impingement sign. Pain or instability with the arm in external rotation and abduction describes the apprehension sign. Pain or instability with the arm in flexion and abduction is a nonspecific finding.

Correct answer : C

63- Figures 1 and 2 are the radiographs of a 55-year-old man who has a 3-year history of right shoulder pain. He has maximized nonoperative management and is interested in operative treatment. He had an open Bankart repair 20 years ago and did well until a few years ago. What is most important to know when deciding on the best surgical treatment for this patient?

A. Range of motion
B. Infraspinatus strength
C. Activity level
D. Quality of the subscapularis

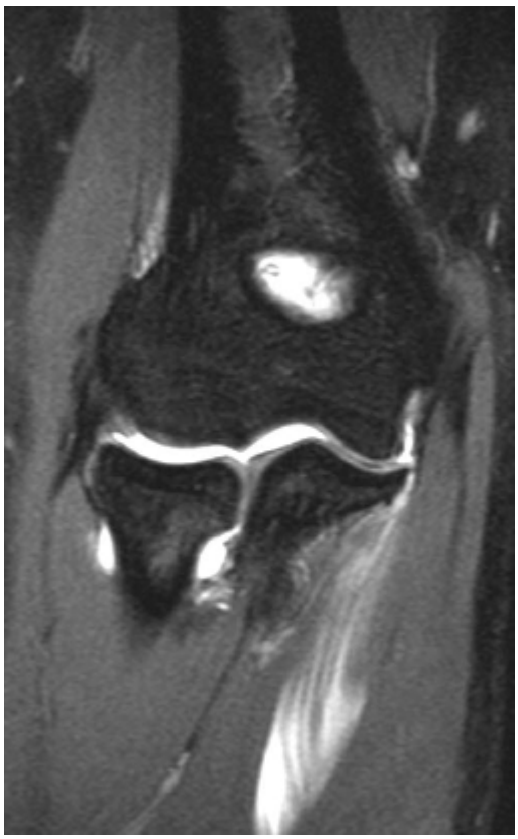
The radiographs show severe osteoarthritis of the shoulder. The best surgical option would be an arthroplasty. The major determining factor for which type of arthroplasty to choose is the integrity of the rotator cuff tendons. Although the radiographs do not reveal any obvious signs of rotator cuff failure, the patient had had an open Bankart 20 years ago. The integrity of the subscapularis tendon following a previous open shoulder procedure is crucial in deciding which type of arthroplasty to consider. Range of motion and infraspinatus strength do not affect the decision-making process, assuming the rotator cuff is intact. Activity level can be important when deciding whether to proceed with an arthroplasty, but it is not as important as the rotator cuff integrity when choosing which arthroplasty to use.
Correct answer : D

65- Which group experiences the highest rate of anterior cruciate ligament (ACL) tears?

A. Female athletes with valgus knee alignment and small femoral notch width
B. Female athletes with valgus knee alignment and large ACL width
C. Male athletes with valgus knee alignment and small ACL width
D. Male athletes with varus knee alignment and small femoral notch width

ACL tears are several times more common among women than men. Women who land from jumps in increased valgus and external rotation are at particularly increased risk for ACL tears. Women have smaller notch widths and a smaller ACL cross-sectional area than men, but these factors have not been definitively proven to increase risk for ACL tears.
Correct answer : A

65- Figure 1 is the MRI scan of a 20-year-old Division I baseball pitcher who has a 1-month history of medial elbow pain in his throwing arm. He also notes a decrease in both control and pitching velocity. An examination reveals tenderness at the medial epicondyle that is exacerbated with valgus elbow stress. The strongest indication for ulnar collateral ligament (UCL) reconstruction is

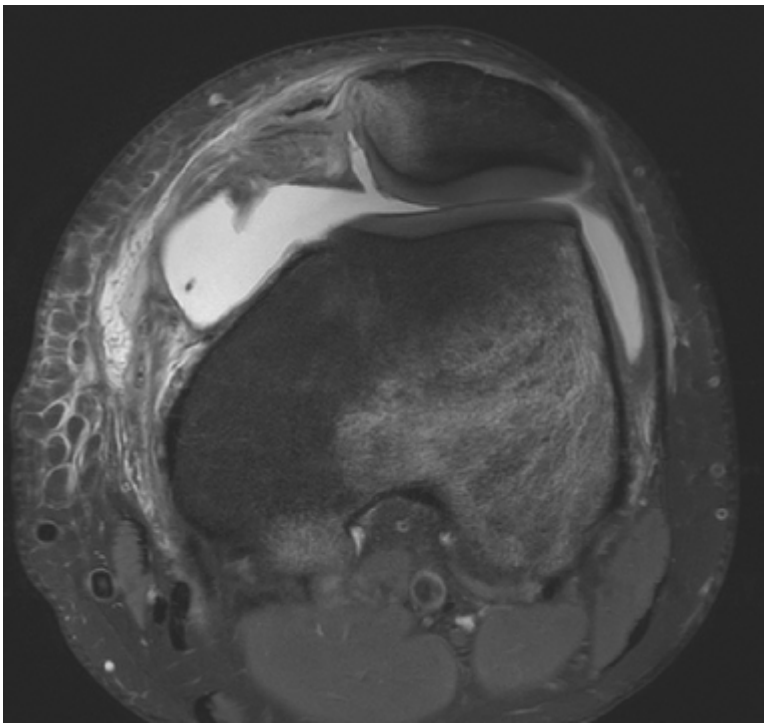


A. progressive ulnar neuropathy.
B. a decision to enter the Major League Baseball (MLB) draft.
C. pain with resisted wrist flexion.
D. failure to improve after prolonged nonsurgical treatment.

All responses represent findings that may be associated with chronic UCL insufficiency. Responses A and C reflect injury to the UCL itself. In most patients, particularly young patients, UCL reconstruction should not be considered until an appropriate trial of nonsurgical measures has failed. This trial should include, at a minimum, 6 weeks of throwing abstinence followed by rehabilitation to address pitching mechanics and shoulder

motion deficits and core strengthening. Although the decision to enter the MLB draft may influence surgical decision making, a pitcher with a 1-month history of elbow symptoms should attempt nonsurgical therapy before making a surgical decision that is not based on clinical data.
Correct answer : D

66- Figure 1 is the MRI scan of a patient with recurrent knee instability, which persists after a period of nonsurgical treatment. Anatomic reconstruction of the torn ligament is recommended. What radiographic finding is the most important independent predictor of recurrent instability following surgery?



A. Tibial tubercle to trochlear groove (TT-TG) distance
B. Patella alta
C. Tibial slope
D. Trochlear dysplasia

The MRI scan is consistent with an episode of patellar instability with concomitant bruising of the medial patellar facet and lateral femoral condyle. The medial patellofemoral ligament appears torn and attenuated. Kita and associates reported that severe trochlear dysplasia is the most important predictor of residual patellofemoral instability after isolated medial patellofemoral ligament reconstruction. An increased TT-TG affected outcomes of patients with type D trochlear dysplasia (Dejour classification). Wagner and associates also found that high degrees of trochlear dysplasia correlate with poor clinical outcome due to graft overload in dysplastic situations. Other studies by Nelitz and associates and Matsushita and associates have also suggested that TT-TG distance did not reliably correlate with clinical outcome. Tibial slope would not affect recurrent patellar instability.
Correct answer : D

67- An otherwise healthy 31-year-old man has had right knee pain for the past 9 months. His former physician administered a cortisone injection and ordered 6 months of physical therapy. The patient later had an arthroscopy with debridement of the right knee by another physician and completed another course of physical therapy. He had minimal relief from these treatments and still is not able to walk longer distances or go on hikes. On examination, he is a healthy appearing male with a body mass index of 24 kg/m2. He has a small effusion, minimal quadriceps atrophy, no

tenderness about the knee, full range of motion, stable to varus and valgus stress at 30° of flexion, a grade 1 Lachman test, and a normal posterior drawer. Figures 1 through 4 are his arthroscopic views, radiograph and MRI scan from his prior surgical procedure. What is the next most appropriate step in treatment?

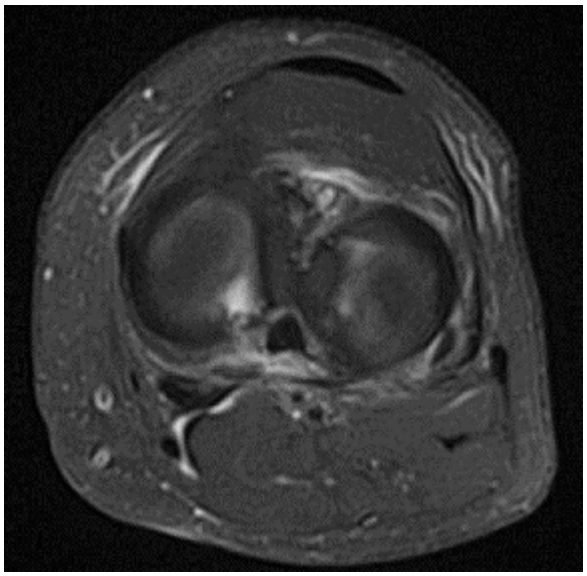
A. Bracing with physical therapy focusing on quadriceps/vastus medialis obliquus (VMO) and hamstring strengthening
B. Osteotomy
C. Osteochondral allograft transplant
D. Arthroscopy with femoral condyle microfracture

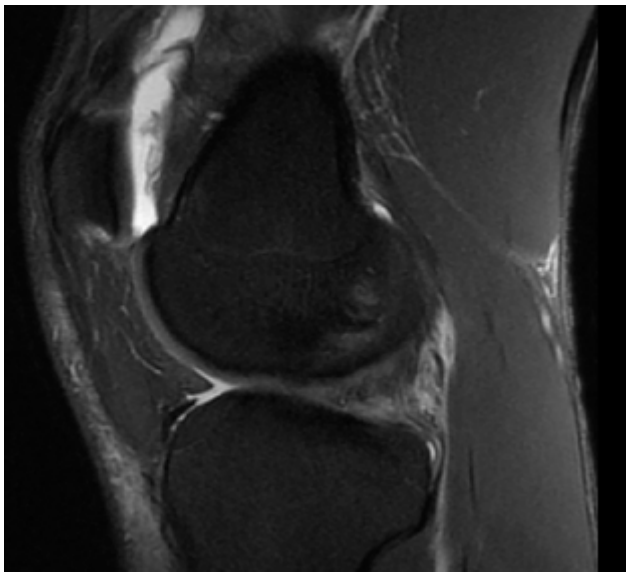
the patient has a symptomatic cartilage lesion of his medial femoral condyle, which has not responded to nonsurgical measures, and he failed a prior arthroscopy with debridement. Based on his examination and imaging, he is ligamentously stable, has normal mechanical alignment, and has intact menisci, making him a candidate for a cartilage restoration procedure. The accompanying MRI also indicates subchondral bone involvement with increased T2 signal underlying the cartilage defect. Osteochondral allograft is the only choice that addresses both the cartilage defect, as well as compromised subchondral bone. Depending on lesion size, osteochondral autograft transfer may also be considered, but this is not presented as an answer choice.

Given the radiographic finding of neutral mechanical alignment, bracing would be less effective, and the patient has already tried extensive physical therapy. Lack of malalignment also excludes tibial osteotomy as a preferred answer choice. Microfracture is best for small cartilage lesions without significant bone marrow involvement.

Correct answer : C

68- The lesion noted on the MRI scans in Figures 1 through 3 leads to what effect on tibiofemoral contact pressure?





A. Increased medial compartment contact pressures worsening in extension
B. Increased medial compartment contact pressures worsening in flexion
C. Increased lateral compartment contact pressures worsening in extension
D. Increased lateral compartment contact pressures worsening in flexion

The MRI scans reveal a root tear of the medial meniscus. Studies demonstrate that this tear pattern greatly increases the tibiofemoral contact forces. These forces, and meniscal extrusion, worsen with increasing flexion. **Correct answer : B**

69- A 45-year-old postmenopausal smoker with a body mass index (BMI) of 22 has had severe knee pain for the past year. The pain has been progressing and the patient is now only able to perform activities of daily living. Knee radiographs reveal medial compartment osteoarthritis without any involvement of the patellofemoral joint or the lateral compartment. What is the contraindication for a high tibial osteotomy (HTO) in this patient?

A. Smoking status
B. Postmenopausal status
C. BMI
D. Radiographic findings

The principal contraindications to valgus-producing HTO include (1) lateral compartment degenerative joint disease, (2) loss of a significant portion of the lateral meniscus, (3) symptomatic patellofemoral degenerative joint disease, (4) nonconcordant pain (ie, patellofemoral pain with medial compartment osteoarthritis), (5) smoking, (6) patient unwillingness to accept the anticipated cosmetic appearance of the desired amount of angular correction, and (7) inflammatory arthritis.
Correct answer : A

70- In an asymptomatic athlete, what condition represents an absolute contraindication to returning to contact or collision sports?

A. Healed one-level anterior cervical fusion
B. Congenital atlanto-occipital fusion
C. Cervical disk herniation previously treated nonoperatively
D. Spina bifida occulta

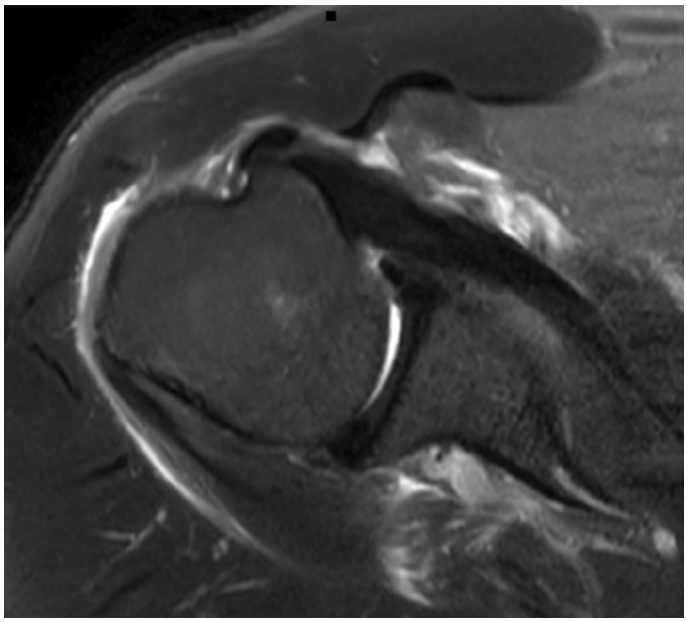
The one overriding principle regarding the return to any collision sport, as Torg and associates has described, is that the athlete be "neurologically intact, asymptomatic, and pain-free and have full strength and full cervical range of motion". Forces exerted on the cervical spine can be absorbed by the "elasticity of the intervertebral disk, the mobility of the spine itself, and the impact of absorbing capabilities of the cervical paravertebral musculature". The C1 and C2 levels (atlanto-occipital level) control movement of the skull and articulate the large motion movements. Specifically, partial or complete

congenital fusion of the atlas to the base of the occiput results in progressive cord compression by the posterior lip of the foramen magnum. It can result in sudden death.

A cervical disk herniation that was previously treated nonsurgically and is not causing cord compression in the currently asymptomatic patient is not a contraindication to return to collision sports. Spina bifida occulta is common (10-20% of healthy individuals). It is typically an incidental finding and does not result in neurologic problems. If individuals have a healed anterior, lateral or posterior disk herniation that is treated nonsurgically and they are currently asymptomatic, then there is no contraindication to participation in contact sports. If they require a diskectomy and fusion and they have a solid/healed fusion, are asymptomatic and neurologically intact with full and pain-free range of motion, then there is no contraindication to return to collision sports. An acute disk herniation, a disk herniation with associated pain or neurologic symptoms, or the presence of cord compression or loss of normal lordosis are all contraindications.

Correct answer : B

71- Based on the injury shown on the axial MRI scan of the shoulder in Figure 1, what other pathology should be closely examined for during surgery?



A. Subscapularis tear
B. Supraspinatus tear
C. Superior labral anterior-posterior (SLAP) tear
D. Bankart tear

The axial MRI scan reveals a subluxated biceps tendon. In the study by Koh and associates, 85% of patients with a biceps subluxation on MRI were found to have a subscapularis tear at the time of arthroscopy. These are not always obvious on the MRI, and close inspection of the leading edge/upper border of the subscapularis tendon at the time of arthroscopy is necessary. Although supraspinatus tears, SLAP tears, and Bankart tears can all occur in conjunction with a biceps subluxation, none have been shown to be strongly correlated with this pathology, nor as specific to this pathology.

Correct answer : A

73- Figures 1 through 4 are the MRI scans of a 24-year-old former collegiate basketball player who injured his left knee while playing recreational basketball 10 days prior to presentation. He landed from a jump awkwardly and reported that his knee gave out. He heard a pop at the time of injury and was unable to continue playing. He complains of medial and lateral knee pain and difficulty with weight bearing. On physical examination, he has a moderate effusion and his range of motion is from 10° to 80°. Ligament examination reveals a 2B Lachman, negative posterior drawer as well as negative varus and valgus stress testing. What is the diagnosis?

A. Meniscus tear
B. Anterior cruciate ligament (ACL) tear
C. ACL tear and posterior cruciate ligament (PCL) tear
D. ACL tear and medial meniscus tear

The MRI scans reveal an acute ACL rupture with pivot shift contusions in the lateral tibiofemoral compartment and a bucket handle tear of the medial meniscus. Additionally, there is likely a radial tear of the lateral meniscus at the anterior horn/body junction (Figure 4). Figure 1 shows a bucket handle tear of the medial meniscus with the posterior horn displaced anteriorly. Figure 3 shows a double posterior cruciate ligament sign. Figure 2 shows the ACL tear and Figure 4 shows the pivot shift contusions. There is no evidence of PCL injury on examination or imaging.
Correct answer : D

73- A 49-year-old marathon runner is unable to continue running at the 18-mile marker. The ambient temperature is 28°C (82°F) with a relative humidity of 80%. Concern for heat-related illness prompts immediate recooling efforts, including ice, fans and oral rehydration. What symptom should most strongly urge transfer to a hospital or other definitive treatment facility?

A. Core body temperature of 39ºC (102ºF)
B. Confusion
C. Nausea/vomiting
D. Headache

Heat illness encompasses a wide spectrum of disorders, including heat edema, cramps, heat exhaustion and heat stroke. Of these, heat stroke is the most serious and dangerous and involves the body's loss of the ability to self-regulate core body temperature. Although most heat illness findings may be nonspecific and include headache, nausea, dizziness or fatigue, the defining difference between heat stroke and other forms of heat illness is a core (i.e. rectal) body temperature of >40°C (>104°F) associated with central nervous system disturbances. While immediate and rapid cooling should be started regardless, any symptoms of neurologic dysfunction including seizures, confusion or disorientation, warrant transport of the athlete to an emergency department or other referral center.
Correct answer : B

74- A 16-year-old female basketball player sustains a re-tear of her anterior cruciate ligament (ACL) reconstruction. Her physical examination reveals a 3+ Lachman and 2+ pivot shift. Her range of motion is 10° of hyperextension to 130° of flexion. Radiographs reveal her ACL inclination angle to be 50°, tibial slope, 7°, and her physes are closed. What finding has been associated with an increased risk graft failure?

A. Hyperextension
B. Flexion
C. Tibial slope
D. ACL inclination angle

There are numerous risk factors for ACL reconstruction failure. These include increased tibial slope, younger age, higher activity level, increased preoperative hyperextension and increased preoperative instability (increased Lachman/pivot shift). In this case, the patient had increased hyperextension, and a normal tibial slope and inclination angle. Of the answer choices, hyperextension is her most identifiable risk factor for potential ACL graft failure.
Correct answer : A

75- A 20-year-old collegiate running back lowers his head to absorb a hit and is tackled to the ground. He is able to get up immediately and return to the sidelines on his own power but reports to the medical staff that he felt a burning sensation in his left shoulder, arm, and hand for 15 seconds following the hit. The feeling has since resolved. This is the first time this sensation has occurred. Examination on the sidelines reveals full and painless neck range of motion and normal and symmetric strength throughout the upper and lower extremity. What is the best next course of action?

A. Removal from the game with additional physical examination and continued monitoring of symptoms
B. Removal from the game with placement of cervical immobilization
C. Urgent MRI scan
D. Return to play without restrictions

This player has experienced a “stinger” or “burner”, which results from a transient stretch or compression of the nerves emanating from the brachial plexus. This player experienced complete resolution of symptoms quickly and had a normal physical examination immediately after the injury. As this was the player’s first stinger, he may return to the game without restriction. Multiple stingers would warrant further neurologic work-up. With a normal physical examination, cervical immobilization is not necessary.
Correct answer : D

76- Figure 1 is the radiograph of a 14-year-old girl with increasing posterior ankle pain, especially during pointe technique exercises. Nonsurgical measures such as modification, stretching, and injection have been unsuccessful. Which nerve is most vulnerable to injury during endoscopic excision of this lesion?

A. Sural
B. Deep peroneal
C. Medial plantar
D. Posterior tibial

The pathology is that of posterior ankle impingement, which is secondary to a symptomatic os trigonum. Endoscopic excision necessitates posteromedial and posterolateral ankle portals. Although plantar numbness has been described as a relatively common postsurgical complication, the neurovascular structure most commonly injured is the sural nerve.
Correct answer : A

77- A 65-year-old man presents with chronic shoulder pain and weakness after failing extensive nonoperative treatment. Physical examination shows full passive range of motion, weakness with shoulder abduction, pain on palpation of the acromioclavicular (AC) joint and with cross-body adduction. Radiographs of the affected shoulder show evidence of AC joint osteoarthritis and an MRI scan reveals a full-thickness, reparable supraspinatus tear. A preoperative diagnostic lidocaine injection transiently improves the patient's pain in the AC joint. In comparison with rotator cuff repair alone, at 2-year follow-up, distal clavicle excision for this patient's condition has been shown to

A. decrease AC joint pain.
B. improve range of motion in forward elevation.
C. have no difference in patient-oriented outcome scores.
D. decrease the need for repeat surgery.

In patients with painful AC joint osteoarthritis undergoing surgery for concomitant rotator cuff tear, several well-designed studies and meta-analyses have shown that distal clavicle excision does not improve pain, function, shoulder range of motion or decrease need for revision surgery compared with rotator cuff repair alone.
Correct answer: C

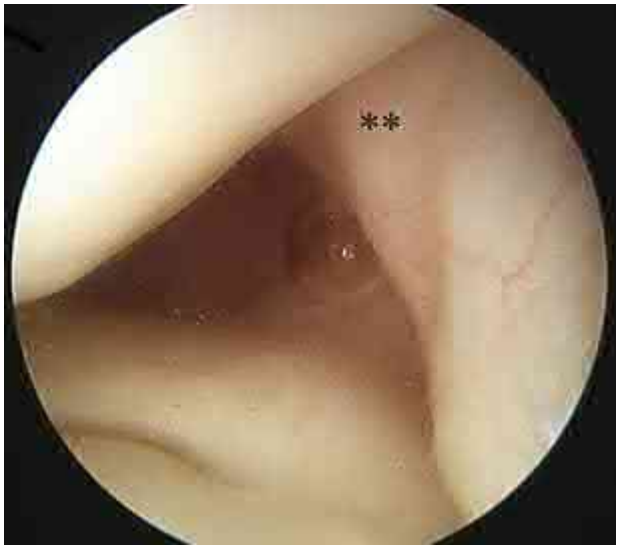
78- A 68-year-old man with a history of degenerative joint disease is taken to the operating room for a right total shoulder arthroplasty. Figure 1 is the clinical photograph of the deltopectoral incision. Excessive retraction using the Kolbel self-retaining retractor would most likely result in what functional deficit?

A. Shoulder abduction weakness
B. Shoulder external rotation weakne
C. Elbow flexion weakness
D. Wrist extension weakness

The musculocutaneous nerve enters the conjoint tendon distal to the coracoid. Excessive retraction on the conjoint tendon during the deltopectoral incision can lead to neuropraxia of the Musculo-cutaneous nerve. This would lead to biceps weakness and weakness with elbow flexion. During this approach, it is not recommended to retract with significant tension on the conjoint tendon.
Correct answer : C

78- Figure 1 is an arthroscopic view of the intercondylar notch of a right knee from an anterolateral portal. What is the main function of the structure delineated by the black asterisks?

A. Resist anterior translation during knee flexion
B. Resist posterior translation during knee flexion
C. Resist rotatory loads during knee flexion
D. Resist rotatory loads during knee extension



The structure shown is the posterolateral bundle of the anterior cruciate ligament (ACL). This bundle is optimally positioned in the knee to resist rotatory forces during terminal knee extension. "Resist anterior translation during knee flexion" best describes the anteromedial bundle. "Resist rotatory loads during knee flexion" is unlikely because the posterolateral bundle is tightest during knee extension. The posterior cruciate ligament, not the ACL, functions to resist posterior translation.
Correct answer : D

80- A 58-year-old woman returns for an evaluation of right knee pain after a twisting injury. A small pop was felt at the time of injury. Her pain is medial and she is unable to bear weight. A complete physical examination demonstrated range of motion is 0°to 125°; significant medial joint line tenderness; negative flexion McMurray; negative Lachman; stable to varus and valgus stress at 0° and 30° and negative posterior drawer. Based on her history, physical examination, and the MRI scan shown in Figure 1, what is the diagnosis?

A. Posterior cruciate ligament (PCL) tear
B. Horizontal tear of posterior horn of medial meniscus
C. Posterior root tear of medial meniscus
D. Anterior root tear of medial meniscus

The low likelihood that common symptoms associated with meniscal body injury will manifest in patients with root tears makes clinical diagnoses challenging. For instance, patients with a posterior root tear injury may experience joint line pain, but the absence of mechanical symptoms such as locking or catching is probable. Meniscal root tears are also not typically associated with an inciting traumatic event. MRI has become increasingly used in the diagnosis of meniscal root tears. Telltale signs of a root tear include the presence or absence of a ghost sign, which is the absence of an identifiable meniscus in the sagittal plane or high signal replacing the normal dark meniscal signal. The posterior meniscus is seen in sagittal MRI view in all images up to the one that shows the PCL. The posterior root of the medial meniscus attaches anterior to the posterior cruciate ligament (PCL).
Correct answer: C

81- A 30-year-old woman complains of medial knee pain 15 years after a meniscectomy. Radiographs show her affected knee to be 8° varus while her contralateral knee shows 3° varus. What is the goal of performing a high tibial osteotomy (HTO) on this patient?

A. Increase tibial slope
B. Decrease tibial slope
C. Decrease compartment pressure in medial compartment
D. Increase varus thrust moment arm

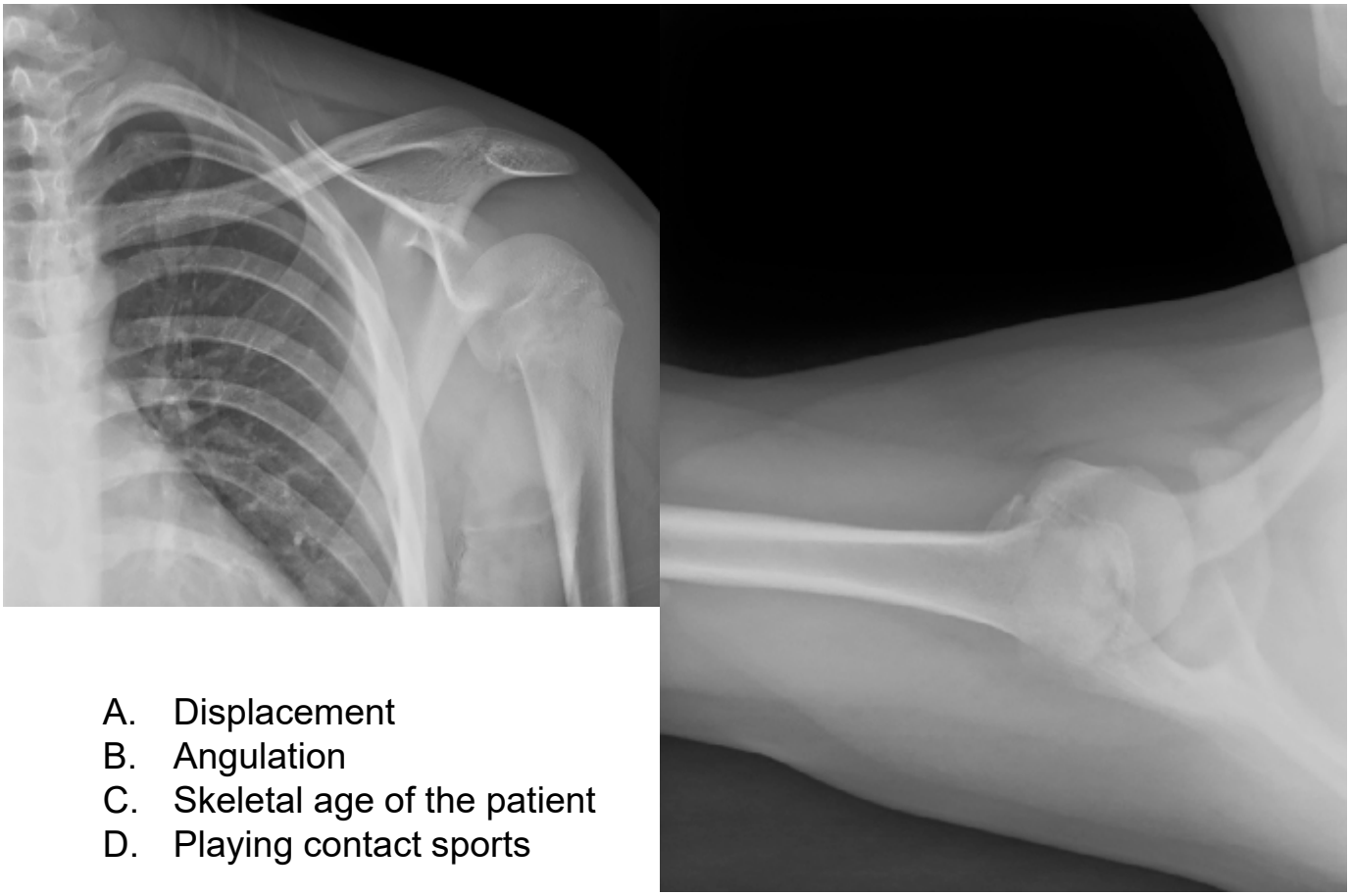
Varus and valgus deformities are contributing factors for unilateral osteoarthritis. Leg alignment is a driving force in the management of weight distribution in the knee, and the HTO is biomechanically designed to realign the weight-bearing line (WBL) in the coronal plane. HTO shifts load in the tibial plateau away from the arthritic compartment toward the healthy compartment. Reducing tibiofemoral load and decreasing thrust moment arms in the affected compartment of the knee joint lessens pain and slows progression of osteoarthritis.
Correct answer : C

82- Figures 1 through 3 are the radiographs of a 65-year-old man with long-standing shoulder pain who has had acute worsening shoulder pain over the past three months following a fall. He is unable to raise his arm in forward elevation >90° and has failed nonsurgical treatments including physical therapy. What is the most predictable way to reverse pseudoparalysis?

A. Reverse shoulder arthroplasty (RSA)
B. Superior capsular reconstruction
C. Rotator cuff repair
D. Lower trapezius muscle transfer

The radiographs reveal a high-riding humeral head with an acromiohumeral interval of 1 mm. This indicates a chronic long-standing rotator cuff tear. There is further evidence of arthritic change with grade 4 Hamada findings. The only surgery with predictable outcomes for massive tear, high-riding humeral head and severe arthritis is RSA.
Correct answer : A

83- A 13-year-old football player sustains the injury shown in the AP and axillary radiographs in Figures 1 and 2. When deciding between operative and nonoperative treatment, what risk factor is most associated with poorer outcomes with nonoperative treatment?



A. Displacement
B. Angulation
C. Skeletal age of the patient
D. Playing contact sports

The radiographs reveal a displaced proximal humerus fracture in a skeletally immature patient. There is tremendous remodeling potential, and similar outcomes are seen in both operative and nonoperative treatment. Worse outcomes are seen with older patients, as the remodeling potential decreases. In a study of 32 pediatric proximal humeral fractures, subgroup analysis of the nonoperative cases showed that, for every 1-year increase in age at initial injury, the odds of a less than desirable outcome increased by a factor of 3.81.
Correct answer : C

84- A patient is considering treatment of knee pain with bone marrow aspirate versus platelet-rich plasma. Which factor has been shown to be higher in bone marrow aspirate in comparison with platelet-rich plasma?

A. Interleukin-1 receptor antagonist (IL-1ra)
B. Platelet-derived growth factor
C. CD-40 cell surface marker
D. Matrix metalloprotease

Bone marrow aspirate has been shown to have higher concentrations of IL-1ra versus both leukocyte-rich and leukocyte-poor platelet-rich plasma. IL-1 is a potent proinflammatory cytokine. IL-1ra blocks binding of IL-1 to its receptor and therefore, serves an anti-inflammatory role.
Correct answer : A

85- A 65-year-old woman complains of right shoulder pain. She has been diagnosed with a full-thickness rotator cuff tear. She has failed nonsurgical measures including physical therapy, corticosteroid injections, and oral pain medication. She is considering platelet-rich plasma (PRP) injections to the shoulder in conjunction with rotator cuff repair. What should the patient be informed of regarding PRP injections in this setting?

A. There is good evidence to suggest that PRP injections help heal full-thickness rotator cuff tears nonoperatively.
B. The use of PRP injections during rotator cuff repair is associated with decreased pain scores.
C. There remains a lack of evidence to support the use of PRP in rotator cuff repair.
D. Leukocyte-depleted PRP is more efficacious in healing rotator cuff tears than leuckocyte-enhanced PRP.

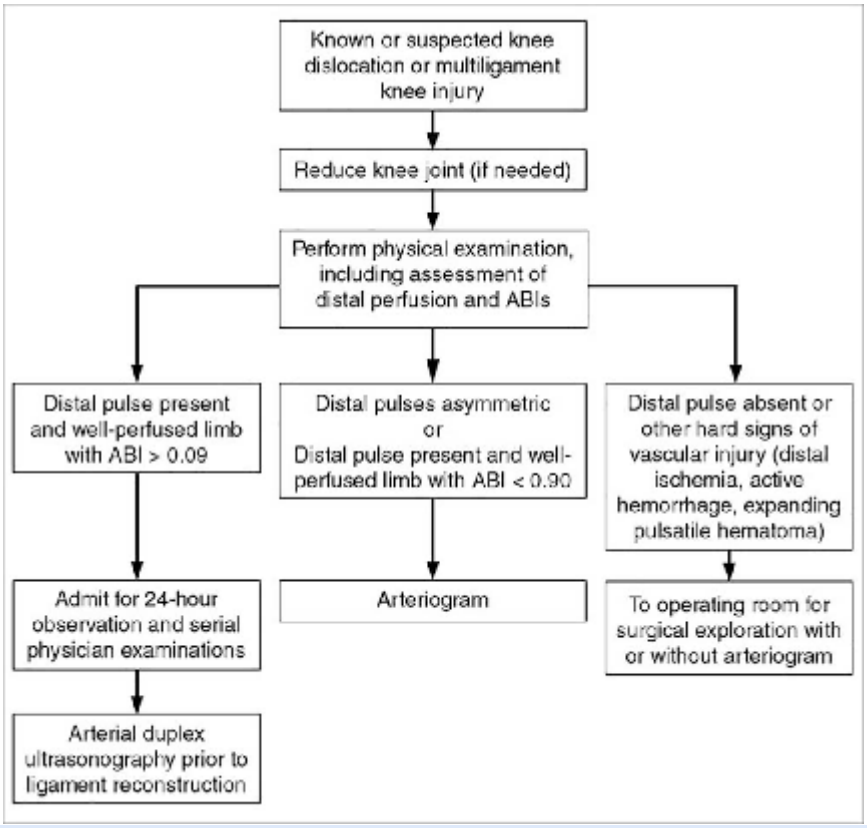
Recently, there has been much excitement and interest in the use of biologic injections for orthopaedic injuries including tendinopathies, rotator cuff tears, muscle injuries, articular cartilage lesions, sprains and osteoarthritis. PRP is a preparation of human plasma taken from a blood sample of a patient. Through centrifugation, the platelets and plasma are separated from other blood components, and the concentration of platelets is increased. It is not completely clear how PRP works; however, these platelets contain a variety of growth factors, which many believe will aid in the healing of ailments. Though various studies may show limited evidence of their efficacy, there certainly is no conclusive evidence. In particular, clinical trials on the efficacy of PRP in the setting of rotator cuff tears have shown equivocal results.
Correct answer : C

86- An 18-year-old male wrestler is injured while picking up an opponent over his head. Witnesses observed his knee buckle out from under him. He is immediately taken to the hospital. On physical examination, his knee is swollen and grossly unstable in multiple planes. Radiographs reveal a located joint without fracture. Distal pulses are palpable. What is the best next step?

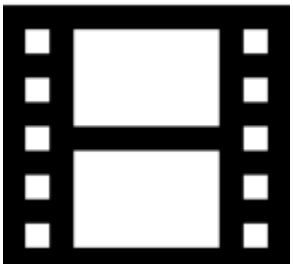
A. Measure compartment pressures.
B. Order a knee MRI scan.
C. Perform ankle-brachial index (ABI).
D. Go to surgery for urgent stabilization of the knee.

Multiple factors need to be considered in the setting of the acutely dislocated knee, but beyond the joint being located, the vascular status of the knee needs to be established to avoid an ischemic limb and possibility of amputation. While palpation for pulses certainly can be performed, an ABI should be performed first in this setting. The patient should be supine and ideally Doppler ultrasonography should be used to detect the pulse. ABI <0.9 has been demonstrated to be 100% sensitive and 100% specific for vascular injury (Mills and associates). Selective angiography can be employed if ABI measures indicate a possible injury. ABI measurements can be affected by existing distal arterial sclerosis or calcification, which would not be expected in this young patient. If pulses are absent or other hard ischemic signs are present, ABI can be foregone for operating room (OR) angiography or an equivalent study to determine the exact location of the vascular injury.
A missed compartment syndrome in the setting of a knee dislocation can be a devastating event leading to ischemia and limb dysfunction or tissue death leading to need for amputation. If a suspected compartment syndrome exists, compartment pressures can be measured directly after ABI, and if needed, compartments can be released in the OR in conjunction with vascular repair (if required). Urgent stabilization can also be done in the OR at the time of vascular repair but is not the most important priority in this setting. Angiograms can be performed in the OR to reduce warm ischemia time if ABI measures are concerning, with vascular repair if indicated. This has been superseded by CT-arteriogram in many trauma centers, which can be performed just prior to OR if indicated.

Correct answer : C



87- Figure 1 is the clinical photograph and Video 1 is the nonarthrographic sagittal plane MRI scan of a 23-year-old male active duty Marine who presents with 3 months of pain and weakness in his nondominant arm. He states that he had rapid onset of "severe" left shoulder pain, which has recently subsided followed closely by weakness in that arm. There was no antecedent trauma that he can recall. Upon further questioning, he states he had one episode of a brief cold sometime prior to the development of symptoms, but he is uncertain. On examination, he is weak in forward flexion and external rotation at 0° of abduction, but otherwise he is neurologically intact. The EMG result is abnormal. What is the best next step?



A. Physical therapy for range-of-motion and periscapular muscle treatment
B. Arthroscopic labrum repair and paralabral cyst decompression
C. Radiographs and MRI scan of the cervical spine
D. Arthroscopic transverse scapular ligament release

The patient is exhibiting a motor mononeuropathy that does not follow a radicular pattern. In the absence of a space-filling lesion, e.g., a paralabral cyst at the suprascapular notch or, more commonly, at the spinoglenoid notch (which this patient does not have on MRI), at this time, the patient's diagnosis is most consistent with neuralgic amyotrophy (NA) - i.e Parsonage-Turner syndrome. NA is reported to be quite rare, with a range of about 20 to 30 cases in 100,000 individuals. Although a hereditary form exists, it is much rarer (and severe), with most cases being idiopathic. Causes are unknown but generally it is thought to be autoimmune in nature and can be triggered by viral illness, as well as other noninfectious triggers..

Presentation is variable but most commonly affects males and nerves emanating from the upper trunk of the brachial plexus. Typically, the nerves affected are motor and usually, it is a unilateral presentation. The process is usually self-limiting within a 6-month period, but residual deficits can be seen as far out as 3 years from initial presentation. MRI is very sensitive to inflammation in the affected muscles and EMG is typically abnormal along the specific nerve affected. Typically, the best treatment in this time frame is benign neglect, with physical therapy helpful in maintaining range of motion of the affected joint (usually the shoulder) and treatment of the periscapular muscles that are usually being overused to establish function in the affected limb.

Physical examination and these supporting studies differentiate this condition from cervical radiculopathies. An arthroscopic or open decompression of the suprascapular notch may be indicated if no improvement is seen within 6 months of onset of symptoms

Correct answer : A

88- When performing an arthroscopic Bankart repair in the lateral decubitus position, a surgeon notes a patulous capsule and a very lax anterior band of the inferior glenohumeral ligament. The surgeon decides that in addition to simply repairing the torn labrum, a capsular shift should be performed. The surgeon instructs the fellow assisting to take a "nice, big bite" of the capsule in this region to tighten the capsule upon repair. Which postoperative complication is most likely a result of this maneuver?

A. Weakness with shoulder abduction
B. Weakness with shoulder external rotation with arm at side
C. Weakness with wrist extension
D. Numbness at the lateral aspect of the forearm

The axillary nerve is at most risk in this area of the glenohumeral joint as it passes adjacent to and just inferior to the 6 o'clock position. Although performing capsular shifts within and up to 1 cm from the glenoid rim is generally considered safe, taking large amounts of capsule (>1 cm) in this region in an effort to tighten the capsule can inadvertently damage the nerve as it crosses there.

The musculocutaneous nerve does not cross in this region, although it can be injured during dissection around the coracoid, such as in arthroscopic Latarjet procedures. The musculocutaneous nerve branches to the lateral cutaneous nerve and provides sensory innervation to the lateral aspect of the forearm.

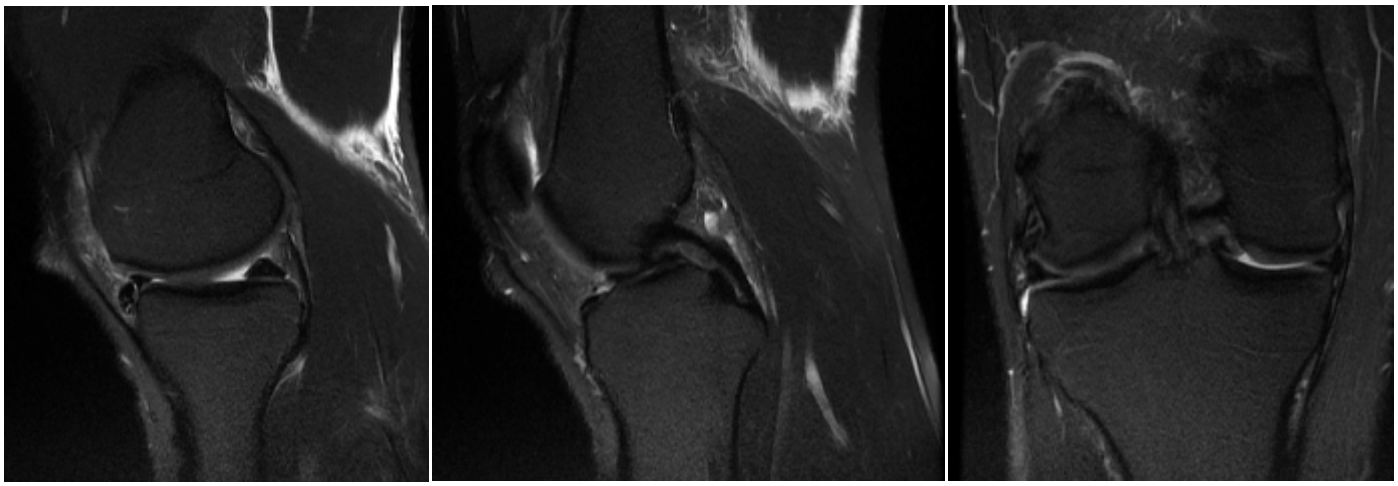
The suprascapular nerve crosses superior and posterior to the glenoid and is at greatest risk during transglenoid screw placement in the anteroposterior directions. The suprascapular nerve innervates the supraspinatus and the infraspinatus. The radial nerve courses behind the humeral shaft and can be damaged during bicortical fixation in the anterior to posterior direction in this region. A radial nerve palsy would result in wrist extension weakness.
Correct answer : A

89- Figure 1 is a representative MRI scan of a 45-year-old man who was lifting a couch 2 days ago when he felt a pop in the elbow and had immediate pain in this area. He had no problems with the elbow prior to this injury. Examination reveals full range of motion; however, he has significant bruising and swelling in the antecubital fossa. A hook test is positive. If choosing to perform single-incision surgical repair for this injury, what is the most common complication associated with this procedure?

A. Injury to the lateral antebrachial cutaneous nerve
B. Injury to the radial nerve
C. Radioulnar synostosis
D. Tendon re-tear

This patient has a complete distal biceps rupture, as evidenced by history, examination and imaging. Surgical repair is typically recommended in otherwise healthy patients to restore supination strength of the forearm. Surgical repair can be undertaken using either a single- or dual-incision approach. The single-incision approach is associated with injury to the lateral antebrachial cutaneous nerve, whereas the dual-incision approach carries an increased risk of radioulnar synostosis. Tendon retear and radial nerve injury, while possible, are less common.
Correct answer : A

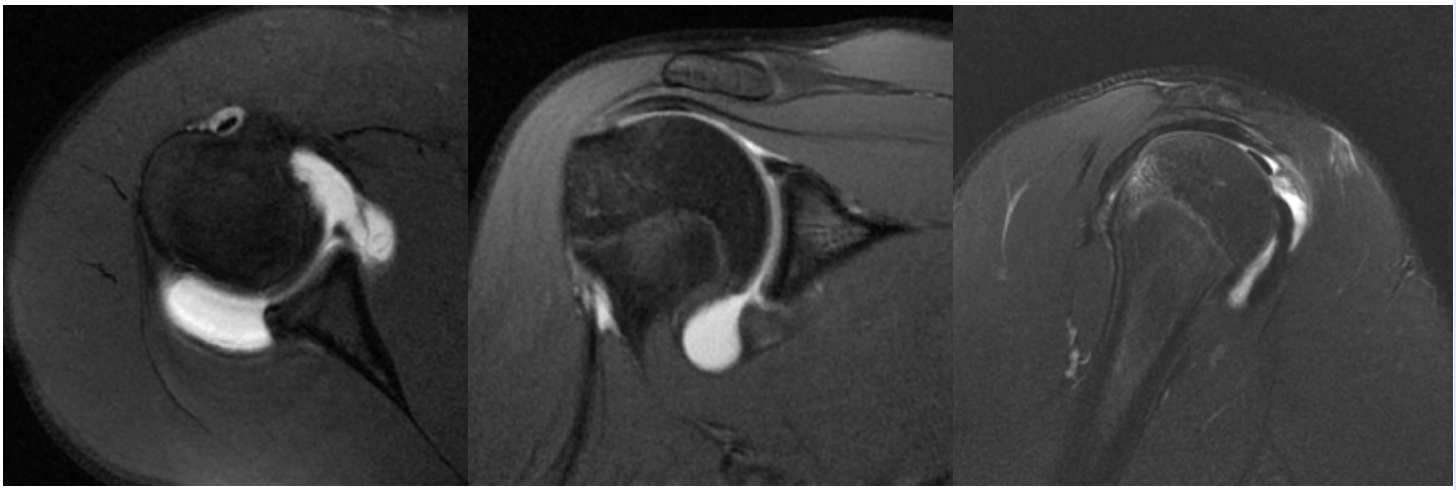
90- Figures 1 through 3 are the MRI scans of a 26-year-old man who injured his knee wrestling one day prior. He has a moderate effusion, medial knee pain and an inability to extend his knee actively or passively. What is the most appropriate definitive treatment option?



A. Physical therapy
B. Posterior cruciate ligament (PCL) reconstruction
C. Attempted meniscus repair
D. Knee aspiration and manipulation under anesthesia

The images show a bucket handle medial meniscus tear, which is likely responsible for the block to motion. Therefore, surgery should be recommended with a meniscus repair if possible. Physical therapy or knee aspiration/manipulation under anesthesia is not the best definitive treatment.
Correct answer : C

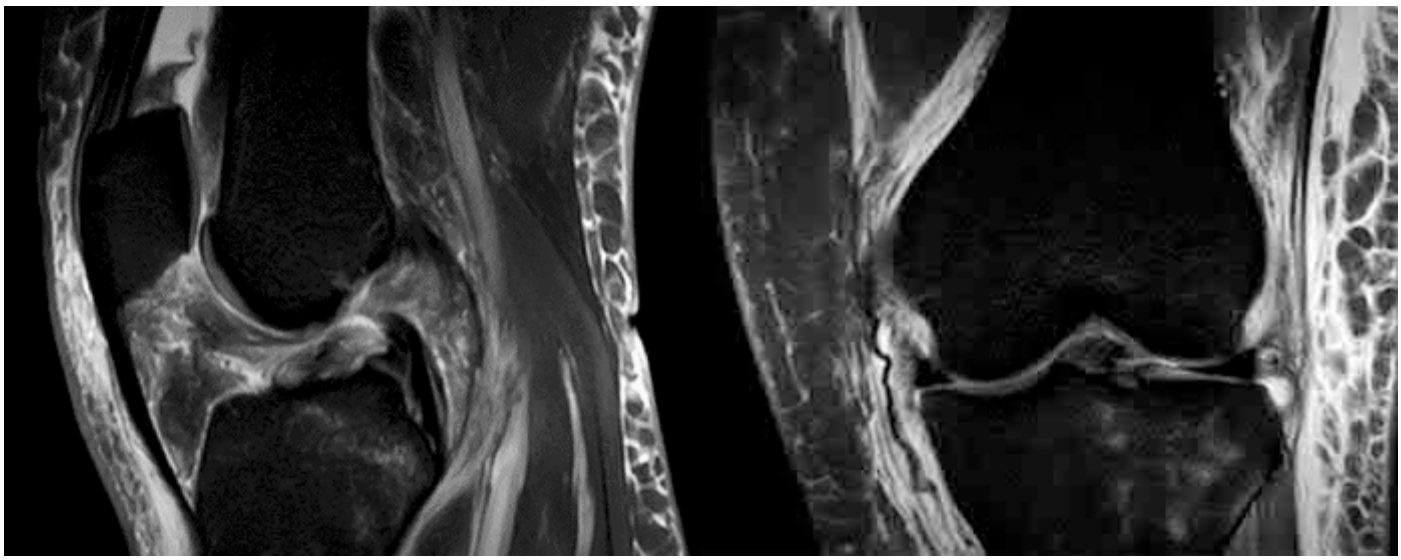
91- Figures 1 through 3 are the MRI scans of a 15-year-old boy who sustained an injury to his shoulder after a fall while playing soccer. Following completion of a month-long rehabilitation program, he is able to tolerate sports-specific drills without symptoms. The patient is eager to return to play, as it is mid-season. How should the patient be counseled?



A. Patient should not return to play mid-season and should undergo arthroscopic stabilization of the Bankart lesion.
B. Patient may return to play: however, he should be counseled on a moderate risk for recurrence.
C. Patient may not return to play this season, as the patient has evidence of significant glenoid bone loss on MRI scan.
D. Patient may return to play, however, only after a repeat MRI arthrogram confirms interval healing of the Bankart lesion.

Controversy exists regarding optimal treatment of an athlete with a shoulder instability event that has occurred during the competitive season. In the absence of large bony Bankart lesion or significant glenoid or humeral bone loss, particularly in athletes who are not involved in contact sports or throwing, return to sport may be attempted following a course of rehabilitation, provided the patient is asymptomatic following sports-specific drills. However, there is a significant risk of recurrence following nonoperative treatment in patients <20 years, and athletes should be counseled appropriately. Although motion-limiting braces may be associated with subjective improvement in stability, no studies have demonstrated a decreased rate of dislocation associated with bracing.
Correct answer : B

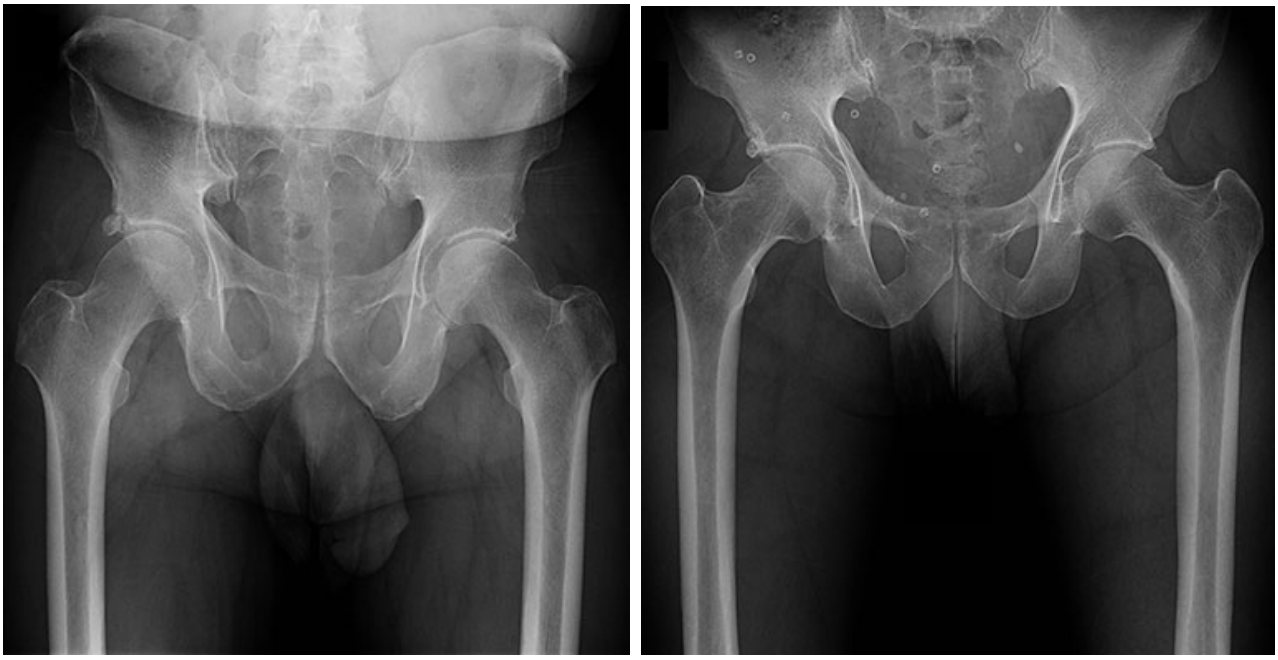
92- Figures 1 and 2 are the MRI scans of a 28-year-old woman who has left knee pain and instability 10 days after a fall while skiing. The injury occurred when her ski became stuck in deep snow. Her shoe did not pop off and she pivoted around her ski. She was unable to continue skiing. She reports pain with weight bearing and the feeling of instability. On physical examination, she demonstrates a positive Lachman, 2+ opening to valgus stress at 0° and 30° of knee flexion without an end point. Her knee range of motion is 3° to 120°, and she has a trace effusion. What is the most appropriate treatment plan?



A. Immediate anterior cruciate ligament (ACL) reconstruction and medial collateral ligament (MCL) repair
B. Immediate ACL and MCL reconstruction
C. Immediate MCL reconstruction and delayed ACL reconstruction
D. Nonoperative management of the MCL and delayed ACL reconstruction

The history and physical examination describe a patient with an acute ACL rupture and MCL tear. The images are consistent with an acute midsubstance ACL rupture and distal MCL avulsion with proximal retraction/Stener-type lesion. Distal MCL avulsions that retract proximal to the pes anserine tendons have poor healing potential, and failure to treat these injuries typically results in persistent instability that requires delayed reconstruction. The patient demonstrates range of motion from 3° to 120° and only a trace effusion. The best treatment is immediate ACL reconstruction and MCL repair.
Correct answer : A

93- What examination findings are most consistent with the pathology seen in the radiographs?



A. Pain with resisted hip flexion
B. Pain with a half sit-up, plus tenderness at the pubic ramus
C. Pain with a combination of hip flexion, adduction, and internal rotation
D. Tenderness to palpation at the greater trochanter

This patient has cam-type femoroacetabular impingement. Decreased internal rotation and a positive impingement test (forced flexion, adduction, and internal rotation) are classic findings. The lack of pain with resisted hip flexion makes hip flexor strain unlikely, and the lack of tenderness at the greater trochanter renders trochanteric bursitis unlikely. Although athletic pubalgia can be a source of long-standing groin pain, he lacks the pain with a resisted sit-up and tenderness along the pubic ramus that is frequently noted in patients with pubalgia. His radiographs reveal a focal femoral neck prominence consistent with cam impingement, although pistol grip deformities and flattening of the lateral femoral head are often present as well. His MRI scan shows a labral tear, which is common in cam impingement. Surgical treatment for cam impingement can be effective for symptomatic patients. Even among high-level athletes, open surgical dislocation of the hip has been shown to have good results. Most patients with cam impingement can be treated with arthroscopic osteoplasty and achieve results comparable to those realized with open surgical dislocation. The literature describes success in terms of athletes returning to sports (even professional athletes) to be approximately 90% after arthroscopic treatment. Byrd and Jones described 5 patients who developed transient neurapraxias that resolved uneventfully. The patients in his series who had concomitant microfracture had a 92% return to sports within the follow-up period. Cam impingement has long been thought to be associated with a history of a slipped capital femoral epiphysis. The capitis in these patients is displaced posteriorly, resulting in a prominent anterior femoral neck and decreased hip internal rotation. Pincer impingement is associated with a deep acetabulum, such as protrusion acetabula and acetabular retroversion. A patient who underwent a periacetabular osteotomy can develop a more retroverted acetabulum as well.

Correct answer : C

94- A 15-year-old football player was diagnosed with infectious mononucleosis 2 weeks ago. Today he states that he is relatively asymptomatic and would like to return to play. At what point can the patient return to full contact practice?

A. Now if splenomegaly has resolved
B. Now if treated with oral valacyclovir
C. In 2 weeks if splenomegaly has resolved
D. After a 4-week course of oral valacyclovir

Infectious mononucleosis presents with fever, pharyngitis, fatigue and lymph node enlargement. It is common among individuals in their teens and early twenties. Participation in contact activities during an acute illness with unresolved splenomegaly increases the risk of splenic rupture. Evidence-based return to play criteria recommend that a patient may return to full-contact activities 4 weeks after the onset of their symptoms with resolution of splenomegaly. An ultrasonography of the spleen can help confirm that the spleen has returned to normal size. **Correct answer : C**

95- During knee arthroscopy, you discover an irreparable complete radial tear of the medial meniscus. After partial medial meniscectomy what should be the primary concern?

A. Lateral meniscal tear
B. Accelerated medial compartment degeneration
C. Anterior cruciate ligament (ACL) tear
D. Posterior cruciate ligament (PCL) tear

Complete radial tears of the meniscus body are analogous to root avulsions from a biomechanical standpoint. The complete tears significantly decrease contact area and increase mean contact pressure. This altered weight distribution is not well handled by subchondral bone. Although meniscal loss puts more stress on the ACL and PCL, it is still not a likely mechanism for injury. Although lateral meniscal tear is possible it is not the most likely outcome.
Correct answer : B

96- A 19-year-old college runner presents complaining of bilateral leg pain during activity. There is no history of trauma, but symptoms have occurred in some degree since her sophomore year of high school. She notes pain after running for 5 to 10 minutes and localizes her discomfort to anterolateral aspects of both legs. This pain resolves within 30 to 45 minutes after running. She denies any pain, numbness or tingling in either foot. There is no pain with routine daily activities. Examination at rest is normal; specifically, there is no tenderness, swelling, masses, or edema. Plain radiographs are unremarkable. A course of anti-inflammatory medication and physical therapy is unsuccessful. The next most appropriate diagnostic study would be

A. three-phase bone scan.
B. compartment pressure measurements.
C. angiography.
D. MRI scan.

The clinical scenario describes an athlete with chronic exertional leg pain. The differential is large, and there is much overlap in clinical symptoms between different potential diagnoses. The most common overall cause would be medial tibial stress syndrome (MTSS), but in this situation, MTSS is unlikely given the location of her pain and the absence of bony tenderness,

which is typically along the posteromedial tibia in MTSS. Persistent MTSS is usually evaluated with bone scan or MRI to confirm the diagnosis and to assess for occult stress fracture. Angiography is useful primarily in cases of suspected popliteal artery entrapment, which is a dynamic exercise-related vascular phenomenon. Here, the description of pain in the anterior and/or lateral compartments, the multi-year history, and the predictable time-course for onset and relief of symptoms all strongly suggest a diagnosis of exercise-induced compartment syndrome, also called exertional compartment syndrome. MRI and bone scan are likely to be negative; definitive diagnosis can only be made through direct measurement of compartment pressures before, during and after exercise.

Correct answer : B

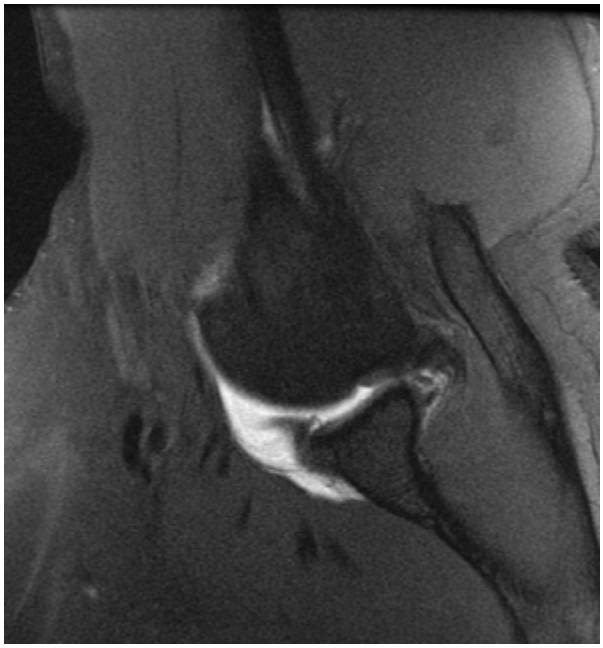
97- A 25-year-old professional soccer player presents with a chief complaint of left ankle pain. He has a history of a grade 3 lateral ankle sprain that was treated nonsurgically with rest and physical therapy approximately 4 months ago but has yet to return to play. He continues to report lateral-sided ankle pain and a mechanical snapping sensation. A current MRI scan is shown in Figure 1. What is the most appropriate treatment for this patient?

A. Lateral ligament reconstruction (Brostrom procedure)
B. Superior retinacular reconstruction with fibular groove deepening
C. Syndesmosis repair with suture button fixation
D. Diagnostic arthroscopy, synovectomy and microfracture

The patient's MRI scan reveals peroneal tendon dislocation. This is a relatively uncommon condition that tends to occur in young, athletic individuals frequently in the setting of a high-grade lateral ankle ligament sprain. The mechanism of injury is thought to be a rapid forced dorsiflexion of the foot while in an inverted position leading to reflexive contraction of the peroneal tendons. This can lead to a disruption of the superior peroneal retinaculum and subsequently peroneal tendon subluxation or dislocation. Continued subluxation may lead to longitudinal split tears, particularly within the peroneal brevis tendon. Acute injuries in recreational athletes with reducible tendons may be treated with cast immobilization. Elite athletes with an acute injury may be treated with a

primary repair of the superior retinaculum; however, chronic injuries may require a fibular groove deepening procedure to reliably stabilize the tendons.
Correct answer: B

98- The ABER (abducted and externally rotated) position in the shoulder MRI scan shown in Figure 1 can be helpful in identifying a variety of subtle pathologies including rotator cuff tears and capsulolabral injury. While in the ABER position, the humerus and glenoid are seen predominantly in what planes, respectively?



A. Sagittal and coronal
B. Coronal and axial
C. Axial and sagittal
D. Axial and coronal

While in the ABER position in the MRI machine, the MRI technician aligns the cut lines along the axis of the humerus and perpendicular through the glenoid, from superior to inferior. According to this, one might assume that the humerus would be seen in a sagittal plane and the glenoid in an axial plane. However, while the glenoid does stay fixed in an axial plane, the humerus is externally rotated, resulting in a coronal view of the proximal humerus. All of the other options do not depict the anatomic relationship of the humerus and glenoid properly while in the ABER sequence.
Correct answer : B

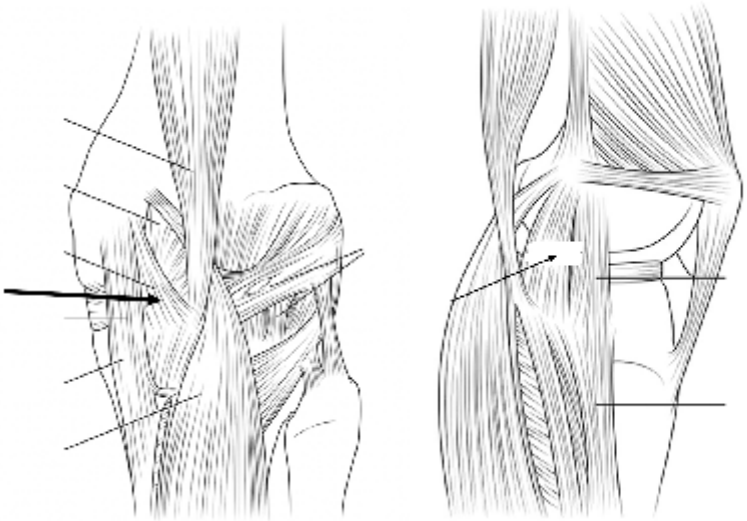
99- A 13-year-old football running back is tackled during a game. On impact with the ground, his chest is compressed between the opposing player and the turf. He experiences immediate pain, difficulty breathing, and on physical examination is tender to palpation over the sternoclavicular joint. What is the best next step?

A. Administer bronchodialator
B. Repeat examination in 15 minutes
C. Referral for radiograph with attempted closed reduction
D. Start advanced trauma life support (ATLS) protocol

The sternoclavicular joint has a low rate of injury. Usually, it is associated with motor vehicle collision or contact sports. Traumatic sternoclavicular joint injuries are classified from grade I to grade III in ascending severity. Posterior dislocation can be life-threatening, and ATLS protocol and rapid transport to the emergency department is recommended. This injury can be diagnosed by listening for upper airway obstruction or a noticeable change in voice quality as posterior dislocation of the clavicular head obstructs airflow.
Correct answer : D

100- Figures 1 and 2 are drawings of the posterior and medial aspect of the knee, respectively. What is the structure demarcated by the arrow on both images?

A. Oblique popliteal ligament
B. Popliteofibular ligament
C. Deep fibers of the medial collateral ligament
D. Posterior oblique ligament (POL)



The POL originates just distal and posterior to the adductor tubercle, giving it an origin distinct from that of the superficial medical collateral ligament, which originates just proximal and posterior to the medial femoral epicondyle. Distally, the POL has three readily identifiable arms: the superficial, central and capsular arms. The central, or tibial, arm is the largest and thickest of the three arms and forms the main portion of the POL, comprising most of the ligament's femoral attachment.
Correct answer : D
