

INTERVENTIONAL TECHNIQUES FOR PAIN MANAGEMENT

CHAPTER

59

JOINT INJECTIONS

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Interventional management of musculoskeletal and joint pain may include injection either into the joint space (intra-articular), around the joint space (periarticular) or within specific soft tissue structures. The choice of medication and number of injections are determined by the indication and treatment goal, that is, diagnostic or therapeutic.¹ Injections may be with corticosteroid, local anesthetics, or viscoelastic supplementation.

In this chapter we will discuss common injections into the shoulder, hip and knee joints, their indications, the various techniques including those with imaging modalities and their complications.

SHOULDER JOINT

Shoulder pain is a very common clinical problem in the general population² and is associated with high societal cost and patient burden.³ It is defined as chronic when it has been present for longer than 6 months. Common conditions that can result in chronic shoulder pain include rotator cuff disorders, adhesive capsulitis, shoulder instability, and shoulder arthritis.⁴ Persistent shoulder pain can also result from bursitis, tendonitis, impingement syndromes, avascular necrosis, other causes of degenerative joint disease, or traumatic injury. Rotator cuff disorders, adhesive capsulitis, and glenohumeral osteoarthritis are common causes of persistent shoulder pain and account for about 20% of all shoulder pain. Joint injection should be considered after failure of conservative interventions such as nonsteroidal anti-inflammatory drugs and physical therapy.³ Physical examination plays a key role in aiding with diagnosis. Imaging studies including plain radiographs, magnetic resonance imaging, ultrasonography, and computed tomography scans may be indicated either when the etiology is unclear or if findings would change the management. For example, the diagnosis of shoulder instability, and shoulder arthritis may be made with plain radiographs although magnetic resonance imaging and ultrasonography are preferred for rotator cuff disorders.

GLENOHUMERAL JOINT JOINT ANATOMY

The glenohumeral joint is a multiaxial ball-and-socket synovial joint. As the humeral head is larger than the glenoid fossa, only part of the humeral head can be in

articulation with the glenoid fossa at any given joint position, thus making it relatively unstable. The glenoid labrum is a rim of fibrocartilaginous tissue that surrounds the glenoid fossa thereby deepening the articular cavity. Additionally, it protects the bony edges and provides lubrication to the joint. The tendons of the long head of the biceps brachii and triceps brachii muscles further strengthen the labrum.⁵ The joint itself is surrounded by a thin loosely fitting capsule that attaches medially to the margin of the glenoid fossa beyond the labrum and laterally to the anatomical neck extending slightly below the shaft of the humerus. While the capsule contributes little to the overall stability of the joint, it is the ligaments and the attachment of the muscle tendons of the rotator cuff that is vital to the maintenance of structural integrity of the joint. Superiorly, the joint is supported by the capsule in conjunction with the coracohumeral ligament, anteriorly, by the glenohumeral ligaments and the attachment of the subscapularis tendon and posteriorly, by the attachment of the teres minor and infraspinatus tendons. Inferiorly, however, the capsule is thin and weak and contributes little to the stability of the joint.⁵ The inferior part of the capsule is subjected to considerable strain as it is stretched tightly across the head of the humerus when the arm is elevated. The tendon of the long head of the biceps brachii muscle is situated in the intertubercular groove, and then becomes intracapsular. It is particularly prone to injury at the point where it arches over the humeral head and at the junction of bony cortex with articular cartilage.⁵

INDICATIONS

Indications for glenohumeral joint injection include osteoarthritis, adhesive capsulitis, and rheumatoid arthritis. Patients with glenohumeral osteoarthritis present with gradual onset of pain and loss of motion. Adhesive capsulitis, also known as frozen shoulder, typically occurs after prolonged immobility of the arm.⁶ Clinical presentation includes diffuse shoulder pain with the inability to abduct at the shoulder more than just a few degrees in any direction. Shoulder examination reveals diffuse pain with palpation and reduced active and passive range of motion in all planes. Adhesive capsulitis can be associated with diabetes and thyroid disorders. Remarkably, findings on radiography will often be normal.⁶

TECHNIQUE

The accuracy of blind injections has been shown to vary significantly and may be as low as 30%. Both ultrasound guidance (USG) and fluoroscopy markedly improve the accuracy to 65% to 90% depending on the approach. The USG resulted in fewer attempts and shorter procedure duration compared to fluoroscopy.⁷

The glenohumeral joint can be injected from an anterior or posterior approach. Rutten et al. compared the anterior and posterior approaches and did not find any advantage of either approach.⁷ However, in a cadaveric study, Chung et al. found that the anterior stabilizing structures of the glenohumeral joint are often traversed by the needle when the anterior approach is used, which may cause distortion of the healthy anatomic structures.⁸ Thus a modified anterior approach or injection into the rotator cuff interval has been described to avoid injury to the subcoracoid bursa, subscapularis muscle and tendon or the inferior glenohumeral ligament.^{9,10} In the blind technique, it is recommended that for easy access of the joint the patient be comfortably seated with his arm at the side, and the shoulder externally rotated for the anterior approach (i.e., palm facing out or forward). By externally rotating the arm, more anterior articular surface of the humeral head is exposed. Additionally, it ensures that the long head of the biceps tendon is removed from the injection tract. On the contrary, internal rotation of shoulder is preferred in posterior approach with the forearm across the body and the ipsilateral hand touching the contralateral elbow.^{3,11}

Blind Anterior Approach: The needle should be placed just medial to the head of the humerus and 1 cm lateral to the coracoid process. The needle is directed posteriorly and slightly superiorly and laterally to avoid the cephalic vein, brachial plexus and axillary artery located medial to the coracoid. When the needle hits the bone (humeral head), it should be withdrawn slightly into the joint space (Figs. 59-1 and 59-2).^{3,11,12}

Blind Posterior Approach: The needle should be inserted 1 to 2 cm inferior and medial to the posterolateral corner of the acromion and directed anteriorly in the direction of the coracoid process^{3,11} (Figs. 59-3 and 59-4).

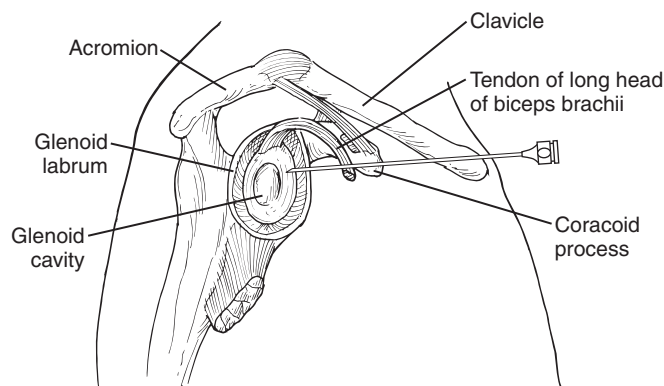


FIGURE 59-1 Illustration showing the glenohumeral joint anatomy and the needle direction for the anterior approach. (Reprinted with permission from Elsevier.)

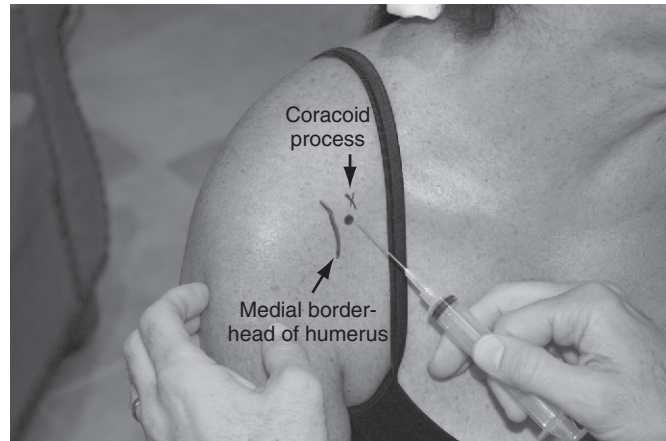


FIGURE 59-2 Glenohumeral joint injection—the anterior approach. (Reprinted with permission from Elsevier.)

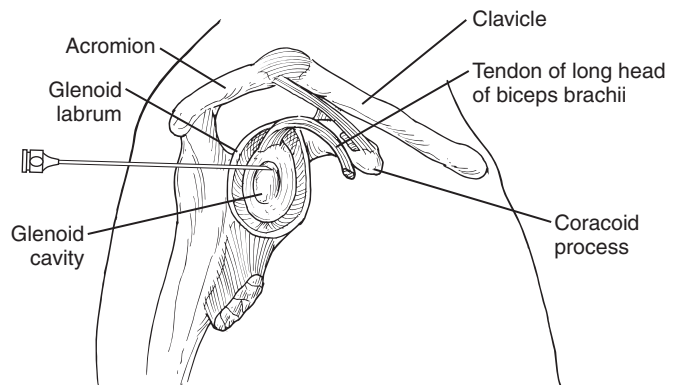


FIGURE 59-3 Illustration showing the glenohumeral joint anatomy and the needle direction for the posterior approach. (Reprinted with permission from Elsevier.)



FIGURE 59-4 Glenohumeral joint injection—the posterior approach. (Reprinted with permission from Elsevier.)

Fluoroscopically Guided Anterior Approach: The injection is performed with the patient supine and the shoulder slightly externally rotated. After the skin is prepped and draped, the injection site is infiltrated with local anesthetic. A 22-gauge needle is directed in the AP view under fluoroscopic control

at the junction of the middle and lower thirds of the medial part of the humeral head.¹³ If resistance to injection is encountered, the needle tip is most likely in the cartilage and should be redirected by rotating or slightly withdrawing it away from the humerus. The needle should not be withdrawn more than few millimeters, otherwise the needle tip will be in the subacromial-subdeltoid bursa. If needle manipulation does not yield the desired result, the needle should be gently directed medially, while exercising caution not to advance the needle into the glenoid labrum. Contrast material may be injected to confirm intraarticular placement with spread of contrast between the glenoid and the humerus.

Fluoroscopically guided injection into the rotator cuff interval. The rotator cuff interval has been described as a triangular space on the superomedial aspect of the humeral head.¹⁰ It is a right triangle, the base of which is formed by the superior border of the subscapularis muscle up to the anterior border of the glenohumeral joint, the height is formed by the lateral border of the coracoid process from the superior border of the subscapularis tendon to the edge of the supraspinatus tendon, and the hypotenuse is formed by the inferior border of the supraspinatus tendon. The apex of the triangle is at the intersection of the base, and the hypotenuse is represented by the bicipital groove. Within this triangle are the biceps tendon, glenohumeral capsule, coracohumeral ligament, and glenohumeral ligament. This triangle serves as a site for glenohumeral joint injection.

External rotation of the humerus may avoid injection into the long head of the biceps tendon. However, if patient cannot tolerate it, the arm may be in neutral position (i.e., palm facing the thigh). The fluoroscopy tube is positioned perpendicular to the table, and the point of entry is marked over the upper medial quadrant of the humeral head close to the articular joint line. With intermittent fluoroscopy, we then advance the needle parallel to the x-ray beam or with a slight medial angulation until it came in contact with the humeral head. Injection of contrast may be used to confirm the intra-articular position of the needle.¹⁰

Fluoroscopically Guided Posterior Approach: The injection is performed in prone position with the symptomatic shoulder slightly raised until the glenohumeral joint is seen tangentially. After the skin is sterilely prepped and draped, the injection site is infiltrated with local anesthetic. With the shoulder in a neutral position or slightly internally rotated, the needle is aimed at the inferomedial quadrant of the humeral head and advanced vertically under fluoroscopic guidance to the cartilage of the humeral head.^{8,14}

Ultrasound-Guided Posterior Approach: The patient is positioned either lying obliquely prone on the contralateral shoulder or sitting upright with the back to the physician and the ipsilateral hand on the contralateral shoulder there by internally rotating the shoulder. The injection may be performed with a 7.5- to 14-MHz linear array transducer. After the skin and transducer are sterilely prepared and drape, the injection site is infiltrated with local anesthetic. The probe is positioned at the myotendinous junction of the infraspinatus muscle inferior to the spine of the scapula. The larger size and the superior location of the infraspinatus muscle and its longer tendon differentiates it from the teres minor muscle. The lateral humeral head, posterior glenoid rim and medial triangular shaped labrum should be identified as hyperechoic areas. The needle is inserted

in-plane, that is, from lateral to medial, parallel to the long axis of the transducer and advanced in the joint between the humeral head and the posterior glenoid labrum. Upon piercing the ligament, a “pop” or loss of resistance will be felt. After negative aspiration, the joint should be injected. However, if resistance is felt, the needle should be repositioned as it is most likely in the cartilage.^{15–18}

Ultrasound-Guided Rotator Cuff Interval Approach (Modified Anterior Approach): The transducer is placed cephalad to the greater and lesser tuberosities of the humerus with visualization of the intra-articular course of the biceps tendon between the supraspinatus and subscapularis tendons (Fig. 59-5). The superior glenohumeral ligament is visualized between the biceps and subscapularis tendon while the coracohumeral ligament is between the biceps and supraspinatus tendons. The needle is advanced in-plane between the biceps tendon and the subscapularis tendon.^{15–18}

ACROMIOCLAVICULAR JOINT INJECTION

JOINT ANATOMY

The acromioclavicular joint is a synovial joint between the small, convex oval facet on the lateral end of the clavicle and a concave area on the anterior part of the medial border of the acromion process of the scapula (Fig. 59-6). The articular surfaces are such that the joint line is oblique and slightly curved. This joint curvature permits the acromion, and thus the scapula, to glide forward or backward over the lateral end of the clavicle. This movement of the scapula keeps the glenoid fossa continually facing the humeral head.⁵ The joint contributes to total arm movement in addition to transmitting forces between the clavicle and the acromion. The acromioclavicular joint has a capsule and the upper aspect of the joint is strengthened by the superior acromioclavicular ligament. The major ligamentous structure stabilizing the joint and binding the clavicle to the scapula is the coracoclavicular ligament. Although this ligament is placed

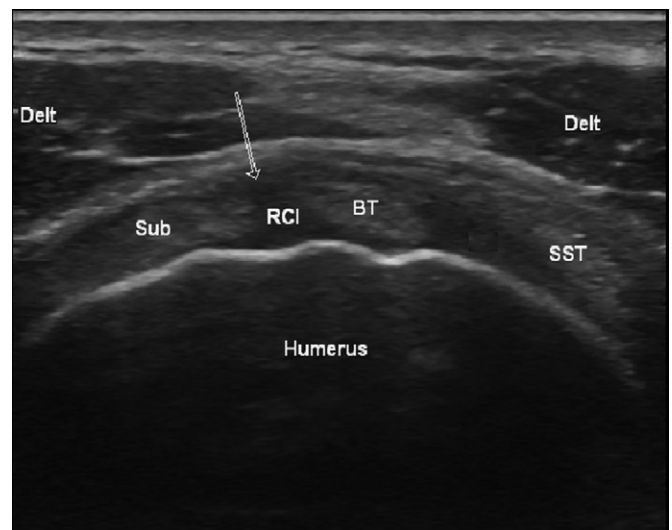


FIGURE 59-5 Sonogram showing the rotator cuff interval (RCI) approach as delineated by the arrow. BT, biceps tendon; Sub, subscapularis; SST, supraspinatus tendon; Delt, deltoid.

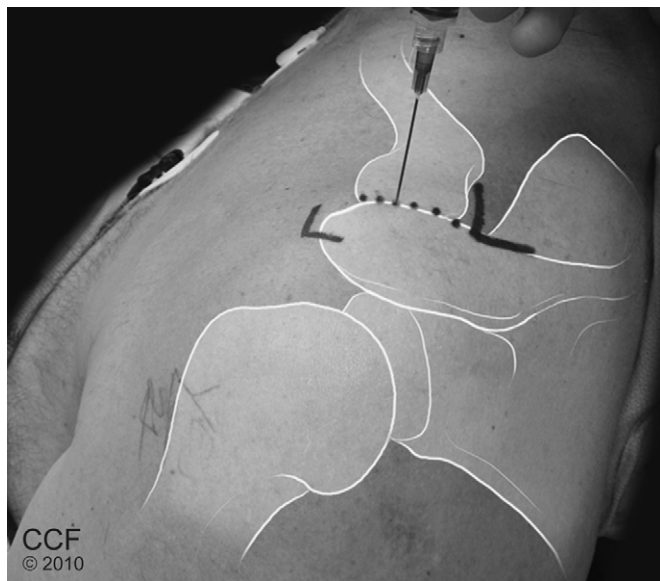


FIGURE 59-6 The acromioclavicular joint. (Reprinted with permission from Cleveland Clinic.)

medially and is separate from the joint, it forms the most efficient means of preventing the clavicle from losing contact with the acromion.⁵

INDICATIONS

Indications for injection of the acromioclavicular joint include osteolysis of the distal clavicle and osteoarthritis.³ Osteolysis of the distal clavicle is a degenerative process that results in chronic pain, particularly with adduction movements of the shoulder and is typically seen secondary to traumatic injury or in persons who perform repetitive weight training involving the shoulder. Osteoarthritis also may develop in the acromioclavicular joint and typically develops secondary to previous trauma or injury. History and physical examination are important in making the diagnosis of osteolysis of the distal clavicle or osteoarthritis. In each condition, patients usually have insidious onset of pain. On physical examination, there is tenderness to palpation of the acromioclavicular joint, and pain with active or passive adduction (reaching the arm across the body) of the shoulder. Pain can be exacerbated by having the patient hold the opposite shoulder and pushing the elbow toward the ceiling against resistance. Radiographs of the acromioclavicular joint will confirm the diagnosis of osteolysis or osteoarthritis.³ Acromioclavicular joint injections can be used for diagnostic or therapeutic purposes. As a diagnostic tool, a local anesthetic is injected into the joint to confirm the origin of pain. In some cases, it may be difficult to differentiate pain from acromioclavicular joint pathology from other shoulder pathology, particularly rotator cuff impingement syndrome.

TECHNIQUE

The acromioclavicular is a small diarthrodial joint with a variable anatomy regarding inclination of the articulating bones. This, in addition to arthritic changes, especially local osteophytes may alter the three dimensional perception of

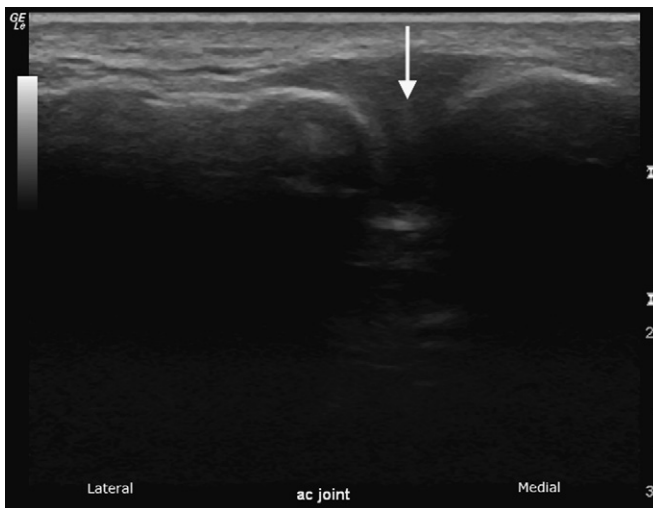


FIGURE 59-7 Long axis sonogram showing the acromioclavicular joint (arrow). It is the gap between the clavicle medially and the acromion process laterally.

the acromioclavicular joint with palpation. Accuracy of blind needle placement for acromioclavicular joint injection was found to be about 40%.¹⁹ However, in a cadaveric study by Partington et al. involving 24 subjects, acromioclavicular joint injection was successful in 67% (16 shoulders), although half involved other structures.²⁰ In another cadaveric study by Pichler et al., a total of 76 acromioclavicular joints were injected with a methylene blue and subsequently dissected to distinguish intra- from periarticular injection. The overall frequency of periarticular injection was 43% (33 of 76). Twenty subjects were further injected with fluoroscopic guidance with 100% accuracy.²¹

Blind Approach: Patients are placed in the supine or seated position with the affected arm resting comfortably at their side. To identify the acromioclavicular joint, palpate the clavicle distally to its termination at which point a slight depression can be felt at the joint articulation. The needle is inserted from the superior and anterior approach into the acromioclavicular joint and directed inferiorly. Injection of the acromioclavicular joint should be carried out by positioning the needle almost perpendicular to the joint.

Fluoroscopic Approach: With fluoroscopy the patient is positioned supine and the image intensifier should be placed in an anteroposterior direction and the needle is advanced with intermittent fluoroscopy.²¹

Ultrasound Approach: The acromioclavicular joint can be visualized using a high frequency linear ultrasound transducer. The transducer should be placed vertically over the superior aspect of the acromioclavicular joint area and adjusted until the joint space is visualized (Fig. 59-7). Using an in-plane technique, a needle is advanced into the joint space. After injection, the intra-articular placement may be verified by noting widening of the joint space.²²

HIP JOINT

In the National Health Interview Survey by the Centers for Disease Control and Prevention in 2006, knee pain was reported by 18% of respondents, and hip pain by 7% of respondents. The most common cause of hip pain in people

over the age of 50 is osteoarthritis of the hip joint. Other causes of hip pain include inflammatory arthritides such as rheumatoid arthritis and psoriatic arthritis, and trauma, infection, and avascular necrosis. True intra-articular hip pathology typically presents as pain localized to the groin, exacerbated by internal rotation.

Evaluation of hip pain is particularly challenging as the hip joint cannot be palpated and it is important to be aware of referred pain from a hernia, back (spinal stenosis), or from trochanteric bursitis. Intra-articular hip injections are a valuable tool from both diagnostic and therapeutic perspectives. Aspiration of joint fluid for analysis is commonly done for diagnostic purposes. Therapeutic joint injections typically with a combination of local anesthetic and corticosteroids are used to provide analgesia and improve functionality.

HIP: INTRA-ARTICULAR INJECTION ANATOMY

The hip is a ball-and-socket joint that exhibits a wide range of motion in all directions. The femoral head articulates with the pelvis to form the hip joint. The greater and lesser trochanters of the femur function as sites for muscle attachment. The spherical acetabular socket covers most of the femoral head except for the acetabular notch inferomedially where it is deficient. This deficient portion of the acetabulum is transversed by the acetabular ligament. The anatomic relationship between the femur and the acetabulum, with the acetabular cup oriented anterolaterally relative to the pelvis and the femoral neck directed posteriorly, contributes to the overall stability of the joint.¹² A thin layer of hyaline cartilage covers the surfaces of both the femoral head as well as the acetabulum allowing smooth movement of the joint. Just like the ball and socket joint of the shoulder, the hip joint also has a labrum, which is a circular layer of cartilage that surrounds the outer part of the acetabulum. This deepens the socket, thereby providing more stability. The joint capsule is a thick ligamentous structure with circular and longitudinal fibers that surround the entire joint and is lined by a synovial membrane. The head of the femur fits into the acetabulum, where it is held firmly by a thick capsule, which is divided into thickened layers forming the iliofemoral, pubofemoral, and ischiofemoral ligaments. The iliofemoral ligament connects the pelvis to the femur in the front of the joint. It is Y-shaped and stabilizes the hip by limiting hyperextension (Fig. 59-8). The pubofemoral ligament connects the pubis to the femur while the ischiofemoral ligament strengthens the posterior aspect of the capsule by attaching to the ischium and between the two trochanters of the femur. There are numerous muscles that attach to or cover the hip joint including gluteals, quadriceps, hamstrings, iliopsoas, and the groin muscles.

INDICATIONS

Intra-articular hip injections are performed for diagnostic and therapeutic purposes. Arthrocentesis of the hip is performed to diagnose the presence or absence of pyarthrosis. Intra-articular injection of the hip is used to determine the likelihood of achieving pain relief after hip arthroplasty. Therapeu-

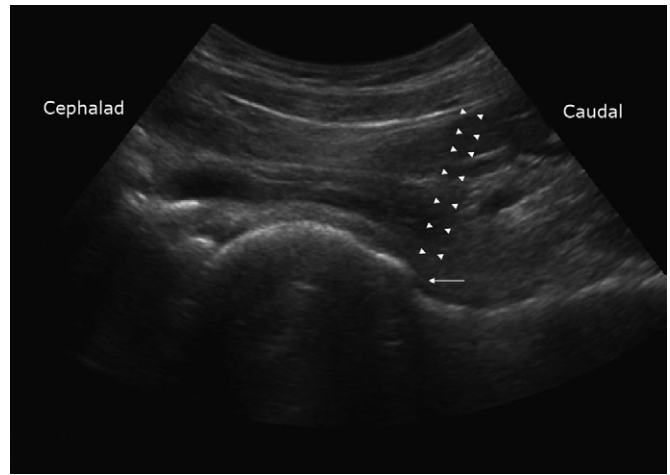


FIGURE 59-8 Long axis sonogram showing the needle path (arrow heads) towards the junction of the femoral head and neck (arrow).

tic hip injections, although less commonly performed than knee injections, are usually indicated for the treatment of arthritic symptoms in patients who are not considered good surgical candidates.²³

TECHNIQUE

Intra-articular hip injections are challenging because the joint cannot be easily palpated as well as its proximity to the femoral nerve, artery, and veins anteriorly. The anterior and lateral approaches are the most commonly used techniques. However, neither technique can be reliably used without radiologic guidance although the lateral approach is thought to be safer than the anterior approach. There was 60% success rate with the anterior approach and 80% success with the lateral technique. There was danger of injury to the femoral nerve in the anterior approach where there was actual impaling or contact of the nerve in 27% of anterior injections or were within five millimeters of the femoral nerve in 60% of attempts. Additionally, the anterior approach resulted in greater likelihood of injury to both the femoral artery and the lateral femoral cutaneous nerve than the lateral approach.²⁷ Thus image guidance is typically recommended either with fluoroscopy or with ultrasonography. Although fluoroscopy facilitates intra-articular needle placement under direct visualization and confirmation of correct placement with contrast injection, it requires additional equipment, and exposes both the operator and the patient to ionizing radiation. It also fails to visualize important neurovascular and soft-tissue structures.²⁴

Fluoroscopic Anterior Approach: Fluoroscopy is used to visualize anatomical landmarks including the anterior superior iliac spine and the pubis. The femoral artery is palpated half-way between these points and the femoral nerve is about 1 cm lateral to the artery. The needle entry site is lateral to this point to avoid femoral nerve injury. Skin is prepped and draped and local anesthetic infiltrated into skin. The needle is advanced toward the junction of the femoral head and neck just inferior to the acetabular

lip. An arthrogram is then performed to confirm the placement of the needle inside the hip joint.²⁵

Ultrasound Approach: In general, a low-frequency transducer is preferred as it allows for better depth penetration and wider field of view especially in obese patients. Patient is positioned supine with the hip neutral or slightly internally rotated. The anterior–superior iliac spine (ASIS) is palpated, and the transducer is oriented in a sagittal plane with the superior end just medial to the ASIS. While maintaining this orientation, the transducer is moved medially until the femoral head is visualized as a hyperechoic rounded surface. The transducer is then rotated into the transverse plane and moved medially to visualize the femoral nerve and vessels. After confirming the position of the neurovascular structures, the transducer is moved back to the anterior hip joint in the sagittal plane. The inferior end of the transducer is then rotated laterally while maintaining the superior portion on the femoral head to obtain a long-axis femoral head-neck view. The skin at the inferior end of the transducer is marked and the area is prepared in the usual sterile manner, and local anesthesia is injected. A 22-gauge spinal needle is advanced under direct ultrasound visualization to the junction of the femoral head and neck. A slight increase in resistance is appreciated as the needle reaches the iliofemoral ligament. A “pop” is felt as the needle passes through the ligament to enter the joint. Intraarticular placement is verified by visualizing the needle tip and injecting 1 to 2 ml of local anesthetic while observing the capsular distention with ultrasound. Fluid appears anechoic on ultrasound, and therefore as the hip is injected, the relatively hyperechoic iliofemoral ligament and anterior hip capsule can be visualized separating away from the femoral neck and head. In contrast to local anesthetic, corticosteroid crystals are hyperechoic and can be clearly visualized spreading between the femoral head-neck junction and the overlying capsule.²⁴

HIP: GREATER TROCHANTERIC BURSA INJECTION

Greater trochanteric pain syndrome (GTPS), previously known as greater trochanteric bursitis, is a very common condition resulting in pain over the greater trochanter.⁶ The incidence of greater trochanteric pain is reported to be approximately 1.8 patients per 1000 per year²⁶ with the prevalence being higher in women and patients with coexisting low back pain, osteoarthritis, iliotibial band tenderness, and obesity. Symptoms include pain in the lateral hip radiating along the lateral aspect of the thigh to the knee and occasionally below the knee. Physical examination reveals point tenderness over the greater trochanter. Most cases of GTPS are self-limited with conservative measures, such as physical therapy, weight loss, and nonsteroidal anti-inflammatory drugs. Other treatment modalities include bursa or lateral hip injections performed with corticosteroid and local anesthetic. More invasive surgical interventions have anecdotally been reported to provide pain relief when conservative treatment modalities fail.²⁷ Corticosteroid injections can provide considerable relief in most patients who fail to respond to conservative treatment as well as a greater chance of long-term recovery compared with patients who had not had an injection.²⁶

ANATOMY

The trochanteric bursa is located over the lateral prominence of the greater trochanter of the femur. Three bursas (two major and one minor) surround the greater trochanter. Major bursas are the subgluteus medius bursa (posterior and superior to the proximal edge of the greater trochanter) and the subgluteus maximus bursa (lateral to the greater trochanter). The minor bursa is the subgluteus minimus bursa (above and slightly anterior to the superior surface of the greater trochanter).⁶

INDICATIONS

Indications for greater trochanteric bursa injection include acute and chronic inflammation associated with osteoarthritis, rheumatoid arthritis, repetitive use, and other traumatic injuries to the area.²⁸ Imaging studies indicate that the pain can be from gluteus minimus or medius injury or inflammation of the bursa itself. It is often idiopathic but may result from running, local trauma, and gait disturbances. The pain can be severe, radiate to the buttock or anterior thigh, and be exacerbated by standing or sleeping on the affected side. Patients often describe “hip” pain; however, true intra-articular hip pain usually radiates to the groin. Trochanteric bursitis only rarely is caused by infection. On examination, palpation over the greater trochanter reproduces the pain.⁶

TECHNIQUE

Fluoroscopically guided trochanteric bursa injections are not associated with better clinical outcomes compared with injections guided by anatomic landmarks alone in patients with greater trochanteric pain syndrome.²⁶

Blind Approach: The patient should be in the lateral decubitus position with the affected side up. It is recommended to flex the hip 30 to 50 degrees and flex the knee 60 to 90 degrees to improve patient comfort as well as for stabilization of the hip. The greater trochanter is identified by palpating the femur proximally from the mid-shaft until the bony protrusion is felt. The point of maximal tenderness or swelling is identified and marked. A 22- or 25-gauge, 3.5-inch spinal needle is inserted perpendicular to the skin. In very obese patients, a longer needle may be required. The needle should be inserted directly down to bone and then withdrawn 2 to 3 mm before injecting.²⁸

Fluoroscopic Approach: The patient is placed in the lateral position with the affected side up. The most painful area is marked over the anticipated site of the bursa. Using fluoroscopy, a 22-gauge 3.5-inch spinal needle should be advanced into the bursa over the greater trochanter. 0.5 to 1 ml of contrast may be injected to confirm intrabursal spread.²⁶

Ultrasound Approach: Ultrasonography made greater trochanteric bursa injection even easier. A lateral approach is generally used as with the blind approach. A high-resolution or low-resolution transducer can be used depending on body habitus and the needle can be introduced either in plan or out of plane towards the burse site and injection is made under real-time sonography.²⁹

KNEE JOINT

Osteoarthritis of the knee is the most common form of arthritis and the major cause of disability and reduced activity in people older than 50 years. Thirty percent of people older than 50 years have radiographic evidence of osteoarthritis of the knee, which increases up to 80% after age 65. While men have more knee osteoarthritis before age 50, its incidence increases in postmenopausal women such that by age 65, the prevalence is twice as high in women as in men.³⁰

KNEE: INTRA-ARTICULAR INJECTION ANATOMY

The knee joint is the largest joint in the body and consists of four bones, namely the femur, the tibia, the fibula, and the patella, and an extensive network of ligaments and muscles. The knee joint is made up of two functional joints, the femoral-tibial and the femoral-patellar joint.²⁸ The main movements of the knee joint occur among the femur, patella, and tibia, which are each covered by articular cartilage designed to decrease the frictional forces as movement occurs between the bones. The patella lies in the intercondylar groove at the distal end of the femur. A thick ligamentous joint capsule lined by synovial membrane surrounds the entire knee joint, which secretes synovial fluid to reduce friction and facilitate movement. The frictional forces are additionally reduced by the infrapatellar fat pad and bursae. The primary stabilizers of the knee are the anterior and posterior cruciate ligaments, the medial and lateral collateral ligaments, and the capsular ligaments.²⁸ The medial collateral ligament is a band that runs between the inner surfaces of the femur and the tibia. It resists valgus forces acting from the outer surface of the knee. The lateral collateral ligament traverses from the outer surface of the femur to the head of the fibula and resists varus forces from the inner surface of the knee. The cruciate ligaments are so called because they form a cross in the middle of the knee joint. The anterior cruciate ligament (ACL) travels from the anterior of the tibia to the posterior the femur and prevents the tibia moving forward. It is one of the most important structures in the knee, and is most commonly injured in twisting movements. Injury to it may require extensive surgery and rehabilitation. The posterior cruciate ligament (PCL) travels from the posterior surface of the tibia to the anterior surface of the femur and in doing so wraps around the ACL. Each knee joint has two crescent-shaped cartilage menisci. These lie on the medial and lateral borders of the upper surface of the tibia and are essential components, acting as shock absorbers for the knee as well as allowing for correct weight distribution between the tibia and the femur.

INDICATIONS

Indications for knee joint injection include delivery of viscoelastic supplementation for advanced osteoarthritis as well as corticosteroid for other noninfectious inflammatory arthritides such as rheumatoid arthritis, gout, or

calcium pyrophosphate deposition disease.²⁸ At present, there is no evidence that medical intervention alters the rate of deterioration of the articular surfaces of an affected joint. Most current therapies are directed toward minimizing pain and swelling, maintaining joint mobility, and reducing associated disability.

TECHNIQUE

While intra-articular knee injections are not complicated procedures, it could be difficult to assess whether the tip of the needle is in the joint space or in intra-articular soft tissue structures.³¹ In a cadaver study, Esenyel et al. evaluated the accuracy of intra-articular needle placement using four different approaches: the anteromedial (AM), anterolateral (AL), lateral midpatellar (LMP), and medial midpatellar (MMP) in 156 knees of 78 fresh cadavers. Accuracy rate was the highest (85%) in the AL injection and lowest in the MMP (56%). However, the results were not statistically significant when compared to AM and LMP approaches.³² In a series of 240 consecutive knee injections in patients without clinical knee effusion, the lateral midpatellar approach led to intra-articular injection in 93% of cases and was more accurate than the anteromedial or anterolateral approaches.³³ In a survey to determine the preferred approach for knee arthrography, 64% reported using the lateral approach.³⁴ Various approaches have been described in the literature for knee injections (Fig. 59-9).

Midpatellar Approach: The patient is positioned supine with the knee extended and a pillow or roll beneath the popliteal fossa. For the lateral midpatellar approach, lines are drawn along the lateral and proximal borders of the patella. The needle is inserted into the soft tissue between the patella and femur near the intersection point of the lines, and directed at a 45-degree angle toward the middle of the medial side of the joint. Medial midpatellar approach; the needle enters the medial side of the knee under the middle of the patella (midpole) and is directed toward the opposite patellar midpole.

Anterior Approach (Infrapatellar): The knee is flexed 60 to 90 degrees, and the needle is directed either medially or laterally to the inferior patellar tendon and cephalad to the infrapatellar fat pad. This technique is useful when the knee cannot be extended. Also, it avoids injury to the articular cartilage.

Suprapatellar Approach: This approach is more common in large effusion as the suprapatellar pouch will be expanded. However, it is rarely done nowadays especially with the introduction of ultrasound-guided suprapatellar recess injection.

Fluoroscopic Approach: Fluoroscopic guidance may be indicated in obese patients or when it is expected to have difficulty accessing the intra-articular space.

Ultrasound Suprapatellar Approach: Patient is positioned supine with the knee flexed 20 to 30 degrees and is supported by a pillow in the popliteal space. A linear-array high-resolution transducer is placed longitudinally such that it is parallel to the tendon of quadriceps femoris muscle. The distal femur, the superior pole of the patella, suprapatellar fat pad and the suprapatellar recess can be visualized. Minimal pressure should be applied on the transducer to avoid compressing the suprapatellar bursa. The transducer

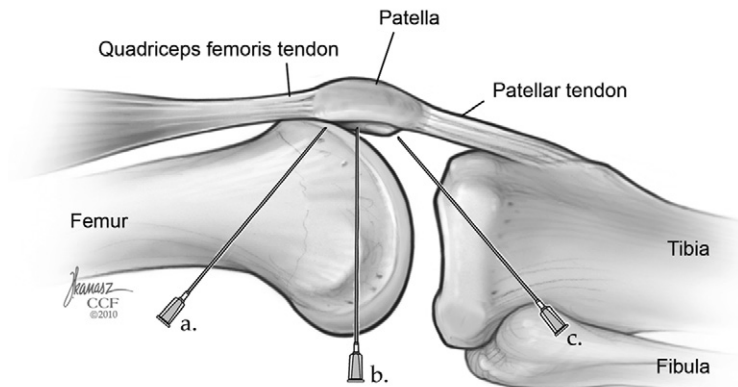


FIGURE 59-9 Illustration demonstrating various portals for knee joint injection. A, Suprapatellar approach. B, Midpatellar approach. C, Infrapatellar approach. (Reprinted with permission from Cleveland Clinic.)

is then rotated to the axial plane, and tendon of quadriceps femoris, suprapatellar fat pad, and the suprapatellar bursa should be reidentified.³¹ The largest dimension of the synovial recess is identified and is the target for the injection. After the skin is sterilely prepped and draped, a 22-gauge, 3.5-inch spinal needle is advanced in-plane to the suprapatellar recess. Aspiration of synovial fluid confirms proper needle placement. During the injection, a fluid jet may be visualized distending the suprapatellar recess.

Ultrasound Infrapatellar Approach: The infrapatellar approach is more commonly performed blindly with surface landmark technique as described above. The authors prefer the suprapatellar recess approach as ultrasound-guide infrapatellar approach is technically difficult.³¹

COMPLICATIONS

With use of proper technique and patient selection musculoskeletal injections are safe, comfortable, and a valuable tool in the management of musculoskeletal pain. Adverse effects from either the technique or the medications used are rare.^{6,30} Infection, the most serious complication, is extremely rare. The risk of septic arthritis from intra-articular injections is less than 0.03%.⁶ However, it is strongly recommended to follow strict aseptic technique and avoiding injections in patients with suspected cellulitis, infectious arthritis or bursitis, bacteremia, or in severely immunocompromised patients.⁶ The risk of hyperglycemia in patients with diabetes is also very small and transient, even for longer-acting corticosteroid preparations. Risk of hemarthrosis is small even in those taking antiplatelet or anticoagulation agents, although it is recommended that these agents be discontinued prior to elective injections. The role

of repeated intra-articular corticosteroids in osteoarthritis is controversial due to reports of steroid-induced arthropathy developing after multiple injections.³⁰ Intra-articular corticosteroid injections do not lead to the progression of osteoarthritis. Postinjection inflammation is caused by intra-articular injection of corticosteroid crystals causing synovitis and can mimic septic arthritis, however, septic arthritis usually differs in timing and duration, occurring later than postinjection inflammation and lasting much longer.⁶ It is a rare complication that begins shortly after the injection and usually subsides within a few hours, rarely continuing for 2 to 3 days. Treatment is conservative and includes ice at the site of injection and oral analgesics until the reaction abates. In a few patients, it may be severe enough to require joint aspiration again to relieve the pain.³⁰ Capsular (periarticular) calcifications at the site of the injection have been reported in rare cases on radiographs taken after treatment. They usually disappear spontaneously and have no clinical significance. Careful technique and avoiding leakage of the steroid suspension from the needle track to the skin surface prevent or minimize these problems. Additionally, it is recommended that small amounts of local anesthetic or normal saline be used to flush the needle before it is removed to reduce this complication.³⁰ Other rare complications may include localized subcutaneous or cutaneous atrophy (2.4%), depigmentation (0.8%), localized erythema and warmth (0.7%), and facial flushing (0.6%).⁶

REFERENCES

Access the reference list online at <http://www.expertconsult.com>.