
Procedures in Family Practice

Arthrocentesis

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Aspiration of the synovial joints is an important part of the diagnostic and therapeutic armamentarium of the physician and may provide vital information that can be obtained in no other way. As with any other technique in medicine, skill and safety in the aspiration of joints can be acquired only through careful study and continued practice in arthrocentesis. When appropriate preparations and precautions are observed, obtaining fluid from synovial joints is safe, relatively pain free, inexpensive, and extremely beneficial to the patient.

Arthrocentesis, the aspiration of fluid from a synovial joint, is important in the diagnosis and treatment of several types of arthritis. Diagnostic arthrocentesis obtains synovial fluid for analysis, whereas therapeutic arthrocentesis is performed to relieve pain by reducing intra-articular pressure, to drain septic or crystal-laden fluid, or to inject medication. While the potential uses of therapeutic arthrocentesis will be summarized, the primary focus of this paper will be to outline the indications, potential complications, contraindications, and technique of proper joint aspiration. Arthrocentesis, when properly performed, is safe and cost effective. Thus, whenever consideration

occurs as to its potential benefits, diagnostic joint aspiration should almost always be accomplished.

Indications

The usual indications for arthrocentesis are listed in Table 1. In the patient with an unexplained synovial effusion, joint aspiration with subsequent synovial fluid analysis may provide vital data in establishing the diagnosis.¹ This information is essential in the diagnosis of septic (bacterial or mycotic) arthritis, crystal-induced inflammation (gout, pseudogout), and joint hemorrhage, and is often helpful in evaluating other conditions. When septic arthritis is suspected, arthrocentesis should be performed before initiating antimicrobial therapy. If joint infection is confirmed, additional and repeated joint aspirations are required to drain the involved joint, evaluate the response to therapy, and determine that synovial-fluid cultures become sterile during treatment.²

While all clinicians agree that septic joints must be properly drained, considerable differences of

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Table 1. Indications for Arthrocentesis

<p>Diagnostic arthrocentesis</p> <ol style="list-style-type: none"> 1. Unexplained arthritis with synovial effusion 2. Suspicion of septic arthritis 3. Suspicion of crystal-induced arthritis 4. Evaluation of therapeutic response in septic arthritis <p>Therapeutic arthrocentesis</p> <ol style="list-style-type: none"> 1. Drainage of septic arthritis 2. Relief of elevated intra-articular pressure 3. Injection of medications

opinion exist with respect to other potential indications for therapeutic arthrocentesis and joint injection. Aspiration of an effusion reduces intra-articular pressure and is usually accompanied by symptomatic improvement, irrespective of the cause of the increased synovial fluid, which might be from trauma, crystals, or infection. Historically, a number of substances have been advocated for injection into joints to treat the rheumatic diseases. These substances have included lactic acid, oil, nitrogen mustard, thiotepa, salicylates, phenylbutazone, gold salts, glucocorticoids, and other compounds.³ At this time, except for intra-articular corticosteroid injections in carefully selected patients, these modalities have been abandoned, or at least are not widely advocated because of complications, lack of efficacy, or unacceptable side effects.

The judicious installation of corticosteroids into a carefully selected inflamed joint may be accompanied by significant benefit and safety for the patient.⁴ The specific indications, rationale, and precautions for therapeutic joint injection exceed the scope of this paper. It should be remembered, however, that the injection of corticosteroids into a joint is neither curative, nor specifically indicated for any type of joint inflammation. Repeated injections of the same joint generally should be avoided. If an initial injection had limited duration of effect or value, it is unlikely that further repeated injections will be beneficial. In addition, the joint should be placed at rest for at least several days, and in some cases for a few weeks after corticosteroid installation. In general, the same precautions identified for diagnostic arthrocentesis

should be considered and employed during therapeutic arthrocentesis.

Potential Complications

Iatrogenic joint infection is the major risk of arthrocentesis. Needle penetration into a synovial joint space may introduce infectious organisms from the skin surface or equipment into the joint. The possibility of initiating such an infection is enhanced when the overlying skin is not properly cleaned, when sterile technique is not employed, and when the aspirating needle and syringe may be contaminated. Also, patients with local soft tissue or systemic infections have increased potential risk of physician-induced joint space infection. With proper technique, however, the risk of inducing joint infection is low^{5,6} and approximates only one to two infections per 25,000 arthrocenteses. Other potential complications, which generally result from improper needle insertion into the joint space, include tendon injury or rupture and injury to nerves and blood vessels.

Contraindications

There are no absolute contraindications to diagnostic arthrocentesis. However, suspected or proven septic arthritis is an absolute contraindication to intra-articular corticosteroid injection. While the potential for introducing infection into a joint by performing arthrocentesis through a localized area of infection such as cellulitis is widely recognized, the possibility for initiating articular infection during joint aspiration in patients with generalized bacterial sepsis is not always appreciated. Most septic joints are infected by organisms seeded hematogenously rather than by surface penetration.⁷ A small amount of blood, which may carry infection, is almost invariably introduced into the residual synovial fluid, even with reasonably atraumatic arthrocentesis technique. Local or systemic infection, however, is by no means an absolute contraindication to arthrocentesis and certainly should not preclude proper investigation of a potentially septic joint. If a bleeding disorder

is present or suspected, the appropriate coagulation tests should be evaluated prior to arthrocentesis and clotting abnormalities corrected, if possible, to minimize hemarthrosis.

The relative contraindications to joint injection should be considered prior to steroid injection,⁸ such as multiple previous steroid injections, intra-articular fracture, juxta-articular osteopenia, joint instability, and inability or unwillingness of the patient to rest the joint after corticosteroid injection. After review of the indications, together with the potential complications and contraindications, each patient must be individually evaluated to determine whether the potential information or therapeutic outcome justifies the risks associated with arthrocentesis.

Technique

A basic goal in arthrocentesis is to penetrate the synovial membrane and enter the joint space in a sterile, painless, and atraumatic manner. An important aspect of proper technique in arthrocentesis is the careful preparation and comfort of the patient during the procedure. An anxious or frightened patient may contribute appreciably to difficulty in entering the joint, which in turn leads to frustration for patient and operator alike.

The patient should receive a clear explanation from the physician describing the indications for the arthrocentesis, the steps of the procedure, and the realistic potential benefits and complications. The patient should be reassured that arthrocentesis is a safe procedure and need be no more painful than venipuncture if the procedure is properly performed. Arthrocentesis should be done with the patient in a comfortable and stable position, with adequate light and with the necessary materials accessible for the aspiration and study of the synovial fluid.

The appropriate needle size should be carefully considered before attempting to enter the joint and will differ depending on the joint involved and potential pathology present. Performing arthrocentesis with a needle of insufficient bore to allow aspiration of a thick or viscous synovial fluid makes aspiration of joint contents difficult or impossible.

When a heavy concentration of crystals, cellular debris, or pus is present, aspiration is much easier with an 18- or 19-gauge needle. Most synovial fluid will flow reasonably easily through a 20- or 22-gauge needle, although occasionally even smaller needles are necessary to enter the joints of the hands and feet. Knowledge of anatomy, clear understanding of the appropriate entry site, and proper technique on the part of the operator contribute more to reducing the discomfort of the patient than actual needle size.

After collecting the needed materials and prior to cleansing the skin, the entry site is selected and marked. The anatomical landmarks of the joint to be aspirated should be clearly understood. Frequently, it is useful to refer to roentgenograms of the intended joint and perhaps an atlas of joint anatomy to insure that needle placement is appropriate. Fortunately, in most situations, an affected joint will have an uninvolved contralateral joint that may be examined with less discomfort to the patient, which will provide better understanding of the optimal entry site. The arthrocentesis site differs with each joint and may vary among individual patients. Usually the extensor surface of the joint, where the synovial membrane is relatively superficial in relation to the body surface, is the most appropriate entry location and is comfortably away from arteries, veins, and nerves. After the injection site is identified, it may be marked with either vector arrows some distance from the point of penetration, or by indenting the skin over the injection site with a needle cover or retracted ball point pen.

Once the appropriate and necessary materials have been assembled and the entry site selected, the injection locus should be vigorously and scrupulously disinfected. Initial cleansing with soap may be necessary. The skin surface is then scrubbed with an iodine preparation such as Betadine and lastly rinsed with sterile alcohol. Sterile drapes, gloves, and masks are not always required by experienced operators; however, compulsive attention to sterile technique is necessary, and error on the side of conservatism is indicated, particularly with inexperienced operators and in training situations.

The use of local anesthesia at the injection site should be carefully considered. Occasionally, a tightly distended knee or other large joint can be

aspirated without local anesthesia quickly and easily without undue distress or discomfort for the patient. However, when a joint with a tight mor-tise, such as the elbow or ankle is entered, or when the operator is not experienced, the use of 1 per-cent lidocaine to raise a skin weal and to infiltrate the fibrous capsule of the joint at the entry site is indicated to reduce patient discomfort. Some operators have found the anesthesia needs of the patient to be well served by spraying the area with ethyl chloride immediately prior to the aspiration.

The techniques for needle entry into specific joints are described below. The major tendons, ligaments, and neurovascular structures should be avoided. After introduction into the joint, the needle should be reasonably freely movable, the patient should be essentially pain free, and the synovial fluid should be aspirated without great resistance. Occasionally, there may be a piece of fibrin, debris, or a redundant synovial fold that obstructs free flow of synovial fluid into the needle. Manipulation of the needle within the joint space or reinjection of a small amount of the fluid previously aspirated into the syringe may be necessary to alleviate such an obstruction. When an aspirating syringe is full, it is proper to remove the filled syringe, leave the needle in the joint space, and reattach an additional syringe to drain the joint fluid completely. In general, when a joint aspiration is accomplished, it is appropriate to withdraw all of the synovial fluid that can be removed easily. In an inflammatory arthritis, the joint fluid usually reaccumulates rather rapidly, but maximal symptomatic benefit can be achieved by removing the most synovia possible. A complete joint aspiration usually provides adequate material to obtain the necessary studies.

If the arthrocentesis is being performed for diagnostic purposes, the synovial fluid should be properly processed immediately after it is removed from the joint. The fluid should be distributed as follows: (1) in a sterile tube for culture for aerobic and anaerobic bacteria and fungi, and possibly be placed directly onto agar plates if gonococcal arthritis is suspected, (2) on slides for Gram and other appropriate stains, (3) on a wet mount slide for examination for crystals by polarized light microscopy, (4) in EDTA or heparinized tube for white blood cell count with differential, (5) in a fluoride tube for obtaining the glucose

level, and (6) in clean, clear glass tubes for visual inspection and other studies that may be indicated.

Techniques for Specific Joints

Detailed descriptions of the aspiration of each specific joint exceeds the scope of this review. Excellent, detailed resources are found elsewhere.⁹ In general, all of the peripheral joints of the body, such as the acromioclavicular joint, the sternoclavicular joint, and in certain instances the temporomandibular joints as well, are amenable to arthrocentesis. While superficial joints such as the knee are readily accessible to needle aspiration, others such as the hips are deep or anatomically difficult to enter for the inexperienced operator. The facet joints of the spine are not only located deeply within the body but also are situated structurally in such a way that it is impossible at the practical level to consider introducing a needle into these joint spaces. Specific approaches to particular joints are identified below.

Knee

The knee joint has the largest synovial cavity in the body and is the easiest to enter with a needle. If the knee is one of several joints involved with synovial inflammation, it is the ideal joint to aspirate. When a large effusion is present, the joint capsule is distended, and the synovial space can be entered from virtually any position without difficulty. When only a small effusion is found, it still can be retrieved readily if the patient lies supine with the knee fully extended and the lower extremity is allowed to naturally rotate outward. The optimal needle entry site is on the medial surface of the knee 1 or 2 cm medial to the inner border of the patella at, or just distal to, the proximal edge of the patella (Figure 1).

After insertion, the needle is directed laterally and slightly posteriorly between the patellar groove of the femur and the patella. The joint space should be entered easily and the synovial fluid aspirated without difficulty. On occasion, a thickened synovium or villus projection may occlude the opening of the needle, and, therefore, it may be necessary to reposition or rotate the needle to facilitate fluid aspiration. The same basic

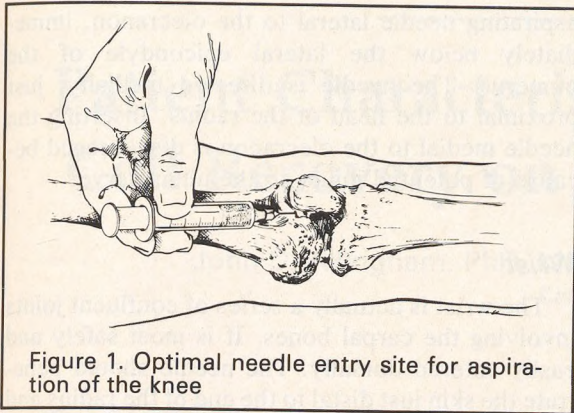


Figure 1. Optimal needle entry site for aspiration of the knee

approach may be made laterally, although in most patients the space between the patella and the femoral surface is considerably narrower. If it is impossible to enter the knee medially or laterally because of flexion deformity, large osteophytes, or patellar ankylosis, the knee joint may be approached between the condyles of the femur adjacent to the inferior patellar tendon. Even when a large popliteal cyst is present, aspiration of synovial fluid by a posterior approach is discouraged to avoid injury to the large popliteal vessels and nerves. If the suprapatellar joint space is distended with synovial fluid, then a needle may be inserted immediately proximal to the patella to retrieve fluid without the need to invade the patellofemoral articulation.

Ankle

The ankle mortise provides considerably less space to enter than the knee. The anteromedial approach is usually advisable, and prior anesthesia with lidocaine is helpful. The needle entry is made at a point approximately 1 cm anterolateral to the medial malleolus, just medial to the extensor pollicis tendon. The needle tip must be directed slightly laterally through the ankle joint capsule, and then

will be freely movable between the cartilaginous surfaces in the joint.

Tarsal and Tarsometatarsal Joints

The joints of the hind- and mid-foot are almost always very difficult to enter and should be reserved for a more experienced operator, if possible. In any case, a roentgenogram of the joint to be penetrated should be available, and the anatomy of the region should be reviewed. Local anesthesia is usually necessary; these joints should be entered from the dorsum of the foot. Free fluid is frequently not recovered in these joints, even when clear inflammation is present. Fluoroscopic guidance may be helpful when approaching these articulations.

Toes

Aspiration of the metatarsophalangeal joints or interphalangeal joints is usually best accomplished from a medial or lateral approach. Traction on the toe in question may facilitate entrance of a small-bore needle into the joint. Local anesthesia is indicated, and the role of an assistant to provide traction and stabilization of the affected member can be vital.

Hip

The hip joint is often the most difficult joint in the body to enter. Because it is frequently impossible to aspirate fluid from the hip, even when the joint capsule is penetrated, it is advisable to involve an experienced operator in either the supervision or actual performance of the procedure. The patient should lie supine with the hip in maximal extension and internal rotation. The traditional entry site is anterior with the entrance being made 2 to 3 cm below the anterior superior spine of the ilium and a similar distance lateral to the femoral pulse. The needle is then angled toward the joint until bone is reached. The capsular ligaments are fibrous and thick, and the needle may meet some resistance in this area. In addition, particular attention must be paid to avoid the vascular and neural structures in the anterior groin region.

The lateral approach to the hip joint presents some technical difficulties but is probably safer

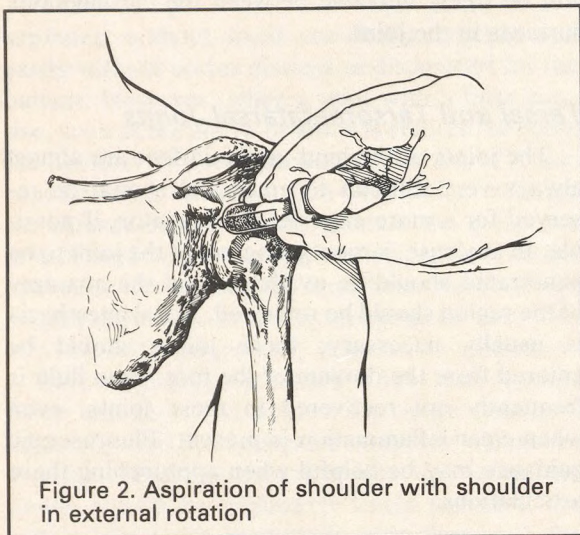


Figure 2. Aspiration of shoulder with shoulder in external rotation

because once the skin is penetrated, only muscle overlies the joint capsule. Aspiration using the lateral approach is done with a spinal needle at least 3-in long, with the entry being made just anterior to the greater trochanter and following the femoral neck into the joint capsule. Surgical entry of the hip joint is often required for appropriate diagnostic and therapeutic efforts.

Shoulder

Aspiration of the shoulder is usually accomplished most easily with the patient sitting and the shoulder in comfortable external rotation (Figure 2). The joint is entered just medial to the head of the humerus and can be reached either from an anterior or posterior approach. The needle should enter the joint space easily. If bone is encountered, the operator should pull back and redirect the needle at a slightly different angle rather than force entry.

Elbow

The capsule of the elbow joint tends to be distended most tightly when the elbow is fully extended. An effusion, if present, is usually most easily detected on the extensor surface lateral to the olecranon process of the ulna. When held at 90°, the elbow may be entered by inserting the

aspirating needle lateral to the olecranon, immediately below the lateral epicondyle of the humerus. The needle is directed medially, just proximal to the head of the radius. Inserting the needle medial to the olecranon is discouraged because of potential injury to the ulnar nerve.

Wrist

The wrist is actually a series of confluent joints involving the carpal bones. It is most safely and easily entered dorsally. The needle should penetrate the skin just distal to the end of the radius and 1 cm ulnar to the "anatomic snuff box." If bone is encountered, the needle should be repositioned until it penetrates 1 to 2 cm into a joint space.

Metacarpophalangeal and Interphalangeal Joints

These joints are most easily entered from a lateral or medial approach on the dorsal surface. A very small needle (24 or 25 gauge) should be used to avoid unnecessary trauma. Even when the synovium is bulging, synovial fluid is very difficult to obtain. The operator should be prepared to do the appropriate studies on as little as one or two drops of fluid.¹

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