form of highly accurate stereotactic surgery, whether frameless or otherwise. The same is true for all oil- or petroleum jelly–based marker materials, although this fact may not be widely appreciated. The reason is that these markers cause a chemical shift artifact. This artifact will vary depending on the static field strength, the FOV, and the gradient strengths used. With a 1.5-T, 10 mT/m, 250-mm-FOV sequence, such chemical shifts will cause a malpositioning of 2–3 mm in the frequency-encoding direction. Chemical shift in the section-select direction may also be substantial in certain circumstances. For these reasons, oil-filled markers (or, even more critically, oil-filled stereotactic frames) should never be used in highly accurate stereotactic procedures such as functional neurosurgery.

The polymer may have some use in multimodal imaging, as it is visible on CT scans (–380 HU). It would not be easy, however, to introduce a radioactive compound to make the marker visible with nuclear medicine techniques. The ease with which this solid material can be cut into the necessary shapes (eg, "R," "L," "U," or "D" to indicate right, left, up, or down, respectively) would make it especially suitable to help ensure that no axis inversions or rotations occur when images are transferred from one hardware or software system to another.

This marker material has advantages over others in terms of its stability and off-the-shelf availability and the ease with which it can be fashioned into unique shapes. It has a role in helping to identify structures when different coils, sequences, and FOVs are used in MR imaging and also to help localize small nodules or pain centered at a particular point. The polymer, oil-based, and petroleum jelly–based marker materials all cause chemical shifts that result in substantial spatial malpositioning. None of these materials should therefore be used when high levels of spatial accuracy are necessary (eg, functional neurosurgery). ■

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Modified Technique for Fluid Aspiration from the Hip in Patients with Prosthetic Hips[1]

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A modified technique was used for diagnostic aspiration of fluid from the hip in 185 patients who had previously undergone total hip arthroplasty. The aspiration needle was advanced past the lateral aspect of the shaft of the prosthesis and into the dependent portion of the joint. Fluid was successfully aspirated in 181 of 185 patients; thus the dry-tap rate was 2.2% (four of 185 patients). The modified technique was simple, could be performed quickly, and was effective for sampling joint fluid in patients with hip prostheses.

THERE are a number of indications for placing a needle within the joint cavity of the hip after total joint replacement. Several different fluoroscopically guided techniques have been described for placing the needle within the joint (1–5). Many of these techniques involve use of approaches in which the needle is angled, which can be problematic for fluoroscopic guidance. We evaluated a modification of a previously described technique (4,5) that is simple to perform and is easily guided with fluoroscopy. This technique allows access to the pseudocapsule in patients who have previously undergone total hip replacement.

Materials and Methods

We reviewed hip aspiration records obtained between 1992 and 1995 at our institutions. A total of 185 hip aspirations had been performed in patients who had previously undergone total hip arthroplasty. All aspiration procedures were performed with the same technique, which is described here.

The patient was placed supine and the extremity of interest was internally rotated, using sandbags to hold the foot and leg in place. After the course of the superficial femoral artery was palpated and marked, fluoroscopy was performed to define the superolateral aspect of the neck of the femoral component. The skin overlying this location was marked and prepared in a sterile fashion. After dermal infiltration with local anesthetic (1% lidocaine), a needle was directed vertically down to the superolateral aspect of the neck of the prosthesis (Fig 1). Typically, the sensa-

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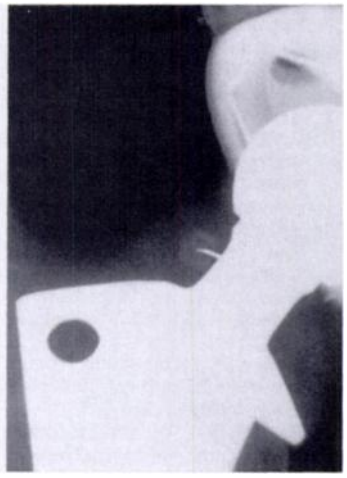

Figure 1. Spot radiograph of a 63-year-old patient who had undergone total hip arthroplasty. Aspiration was performed to rule out infection. Radiograph shows that the needle is positioned correctly, superolateral to the neck of the femoral component.

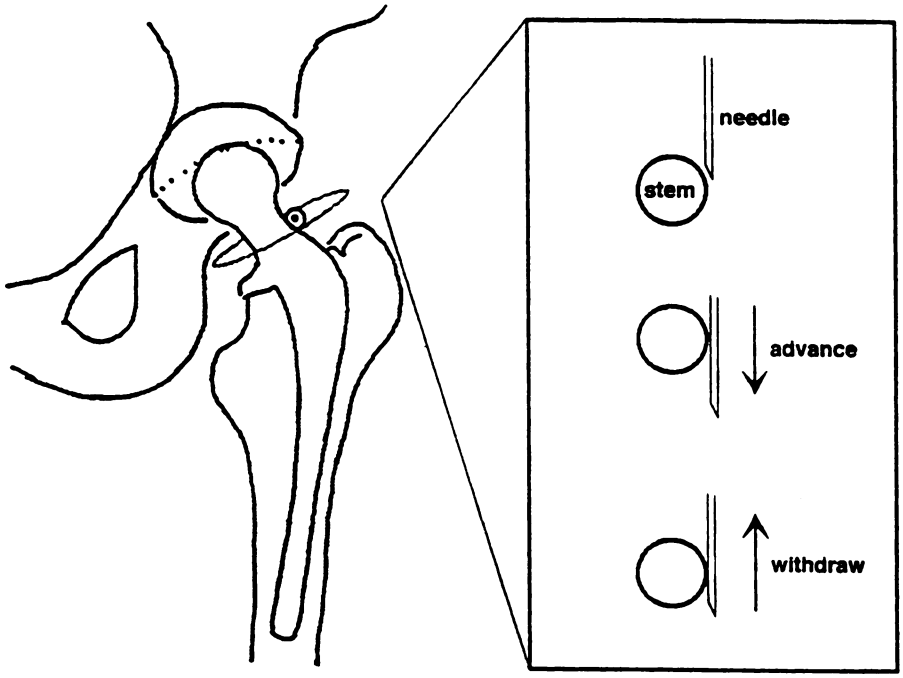

Figure 2. Diagram of needle placement for patients who have undergone total hip arthroplasty. Left portion of the diagram shows a vertically oriented needle at the superolateral margin of the neck of the femoral component. Right side of the diagram shows a sectional view at the level of the needle and stem. The bevel is turned inferomedially to face the stem. The needle is advanced past the stem and is subsequently withdrawn while suction is maintained with a 10-mL syringe. Synovial fluid, located dependently, will be aspirated when the needle reenters the pseudocapsule.

tion of metal against metal was encountered when the needle tip touched the shaft of the prosthesis. As the needle tip touched the prosthesis, the bevel of the needle was turned inferomedially by pointing the notch on the stylet in an inferomedial direction. This turn allowed the needle to easily slide past the prosthesis (Fig 2).

The needle was advanced beyond the superolateral margin of the neck until the hub of the needle touched the skin or 1.5–2.0 cm, depending on the size of the patient. Once the needle was advanced, a 10-mL syringe was attached to the needle and gentle negative pressure was applied. The needle was slowly withdrawn until synovial fluid was encountered, which confirmed the intraarticular location of the needle tip at that point.

Results

Diagnostic aspiration with the modified technique yielded fluid for analysis in 181 of 185 patients; thus the dry-tap rate was 2.2% (four of 185 patients). Saline solution was not injected into the joint in any patient. Contrast material also was not injected into the joint, as touching the shaft of the prosthesis physically was used to confirm the intraarticular location of the needle. In all four patients with dry tap, clinical and radiographic follow-up of more than 6 months documented that no infection was present in the hip joint. Most aspirations were accomplished with a single needle pass.

Discussion

There are a number of instances when a needle needs to be placed into the hip joint in patients who have previously undergone hip joint replacement. Needle placement is necessary in cases of arthrography in the hip (1,2), diagnostic injection of anesthetic material to help confirm the hip as a source of pain (6,7), and differentiation of prosthetic loosening from infection before revision (8–10). Investigators have recently found that when intraarticular injection of a local anesthetic causes relief of pain in patients who have undergone arthroplasty, the hip is the likely source of the patients' symptoms (7).

A number of approaches can be used to access the hip joint. A lateral approach has been described (3), and this method avoids the neurovascular structures. As the needle is not parallel to the beam of the image intensifier, however, the depth and exact position of the needle tip are difficult to estimate. Another approach is to orient the needle along the direction of the femoral neck and angle it up toward the femoral head. One disadvantage of use of the oblique orientation is that if the obliquity of the needle is excessive, the needle tip will encounter the anterior lip of the acetabulum rather than the femoral neck. It is difficult to determine just how deeply the needle tip is located when it is in the oblique position. Another technique is to direct the needle to the middle of the neck of the prosthesis and advance the needle until it contacts the shaft of the prosthesis (4,5). Our technique is a modification of this approach, with the needle being advanced beyond the shaft and into the dependent portion of the pseudocapsule that surrounds the prosthesis. In both of these techniques, internal rotation of the extremity is performed to improve visualization of the neck of the prosthesis.

In patients who have previously undergone total hip arthroplasty, possible infection is a major concern if the initial symptoms include increasing hip pain. The main differential diagnoses are component loosening and infection, and these entities can be difficult to distinguish. Radiographic changes such as periprosthetic lucencies can be seen in association with both conditions, and normal radiographic findings do not exclude infection. Laboratory evidence of infection is often confusing in patients who have undergone total hip arthroplasty, as there is usually a slight elevation in the erythrocyte sedimentation rate, and white blood cell counts can be inconclusive. In these patients, the most direct approach is to sample the synovial fluid for stain and culture.

Placement of a needle into a joint will not always yield synovial fluid. In one series, the dry-tap rate was 13%, and in 4.4% of patients no fluid was aspirated even after 10 mL of saline solution was instilled into the joint (9). Several ma-

neuvers of the extremity have been described that help improve the yield of fluid (8). With the technique described herein, the needle is directed to the posterior dependent portion of the pseudocapsule. To our knowledge, we had a lower rate of dry tap than has been previously reported.

Contrast material can be injected into the joint both to help confirm the intraarticular location of the needle and to evaluate for possible loosening. In our practices, aspiration is ordered not to help evaluate for possible loosening but rather to help check for infection. We therefore do not routinely inject contrast material. In our four patients with dry tap, we directed the needle so that it came into contact with the femoral shaft so we could be confident that the needle was placed intraarticularly. Nonbacteriostatic saline solution can be injected and reaspirated to obtain fluid for culture. We have not used this procedure, however, and in our four patients with dry tap, no infections were found.

It is conceivable that as the needle penetrates the posterior pseudocapsule, an adjacent extraarticular fluid collection could be encountered and mistaken for synovial fluid. If the presence of an adjacent fluid collection is suspected, fluid can be aspirated as the needle touches the lateral edge of the prosthetic shaft but before the needle is advanced; if the joint yields fluid, then the needle does not need to be advanced. In most cases, the likelihood is low of the presence of an adjacent fluid collection immediately posterior to the pseudocapsule, and the needle can be advanced without concern.

One potential complication of this technique can occur when the pseudocapsule is penetrated. If infection is present within a joint, the infection could be spread by the needle to the surrounding soft tissues. When a joint infection is encountered in our practices, the referring orthopedic surgeon takes the patient to surgery and at a minimum irrigates and débrides the area; usually the prosthesis is removed. The surgeon uses a posterior approach, and the tissues that may possibly be infected are therefore explored after joint infection is documented by means of the aspiration.

Radiologists are occasionally asked to perform diagnostic hip aspiration in patients who have previously undergone total hip arthroplasty. The technique presented here is an effective method for entering the hip joint. The procedure is accomplished quickly once the skin has been prepared. We believe this technique is easier to perform than using an oblique orientation for needle approach to the joint. ■

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