

Case Report

Sonographic Diagnosis of an Arterioarticular Fistula Following Knee Arthrocentesis

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Received 22 February 2005; accepted 10 May 2005

ABSTRACT: An arterioarticular fistula is an unusual complication of knee arthrocentesis. We describe the sonographic findings immediately following a failed clinical attempt at knee arthrocentesis that resulted in an arterioarticular fistula. Spectral Doppler analysis confirmed the jet of blood into the hemarthrosis. Knowledge of anatomy and application of standard technique is necessary to minimize the complications of arthrocentesis. © 2006 Wiley Periodicals, Inc. *J Clin Ultrasound* 34:207–209, 2006; Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/jcu.20186

Keywords: arterioarticular fistula; knee; arthrocentesis; Doppler hemarthrosis

Arthrocentesis is commonly performed to aspirate a joint effusion and to evaluate for septic arthritis. Potential complications of this procedure include infection and injury to neurovascular structures.¹ Occurrence of the latter is largely dependent on operator experience and technique. Knowledge of anatomy, including that of vascular structures, is essential to minimize injury to the surrounding structures. We present a case of an arterioarticular fistula diagnosed with sonography after an attempted aspiration of a suspected knee effusion.

CASE REPORT

An 81-year-old woman presented with left knee pain that had increased over the past several months and more recently had become signifi-

cantly worse. The patient denied any trauma to the knee, but her history was significant for a left lateral meniscus tear and a left knee Baker's cyst diagnosed by a prior MRI, as well as for pseudogout shown by a previous arthrocentesis 2 weeks earlier. The patient was taking coumadin for 2 prior episodes of a cerebrovascular accident, and on admission, her international normalized ratio was 3.5. There were no clinical signs of infection.

Upon admission to the emergency room, the patient's knee pain became so severe that she was unable to walk. She stated that the pain was much worse with movement, that her knee had buckled under her several times, and that she was unable to bear weight. Examination revealed left knee swelling, tenderness at the joint line, increasing pain with flexion, but no focal erythema or warmth. A working diagnosis of pseudogout arthritis and a knee joint effusion was entertained at that time, and aspiration of the left knee by the clinical service, using an antero-medial approach without image guidance, was attempted.² After multiple unsuccessful attempts at left knee aspiration, the patient was referred to radiology for image-guided arthrocentesis.

A radiology consult was obtained to determine the feasibility of fluoroscopically guided aspiration of the left knee joint. Because of the concern of a soft tissue abnormality that would not have shown on fluoroscopy, the musculoskeletal radiologist decided to evaluate the knee with sonography before attempting fluoroscopically guided aspiration. Sonography was performed within 1 hour of the failed arthrocentesis using an HDI 5000 scanner with a 12–5-MHz linear-array transducer (Philips-ATL, Bothell, WA). Sono-

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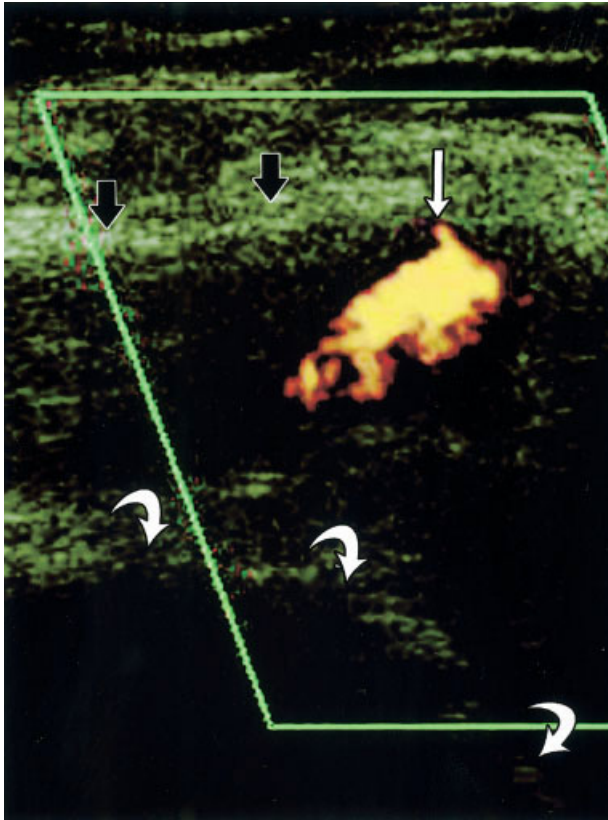


FIGURE 1. An 81-year-old anticoagulated woman with an acute hemarthrosis of the left knee after an unsuccessful arthrocentesis attempt. Power Doppler sonogram of the knee puncture site shows the pulsatile arterial jet from the arterioarticular fistula (straight white arrow) into the hemarthrosis, between knee joint capsule (black arrows) and femoral cortex (curved white arrows).

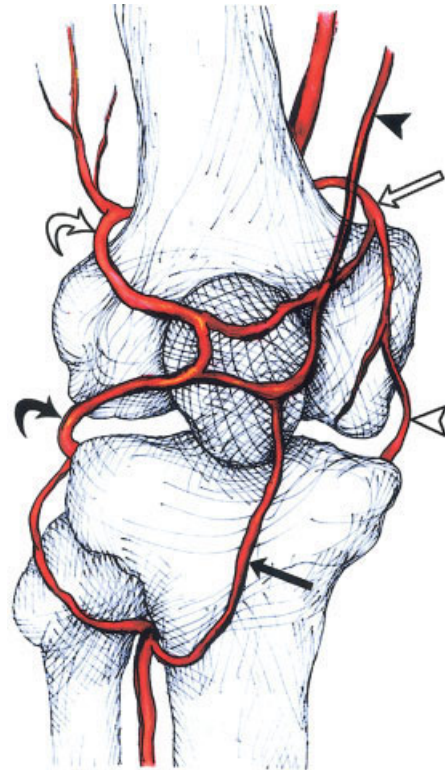


FIGURE 3. Artist's rendition of the arterial anastomoses around the anterior aspect of the right knee. Note the anterior tibial recurrent artery (straight black arrow), the articular branch of the descending genicular artery (black arrowhead), the superior lateral geniculate artery (curved white arrow), the inferior lateral geniculate artery (curved black arrow), the superior medial geniculate artery (white arrow), and the inferior medial geniculate artery (white arrowhead).

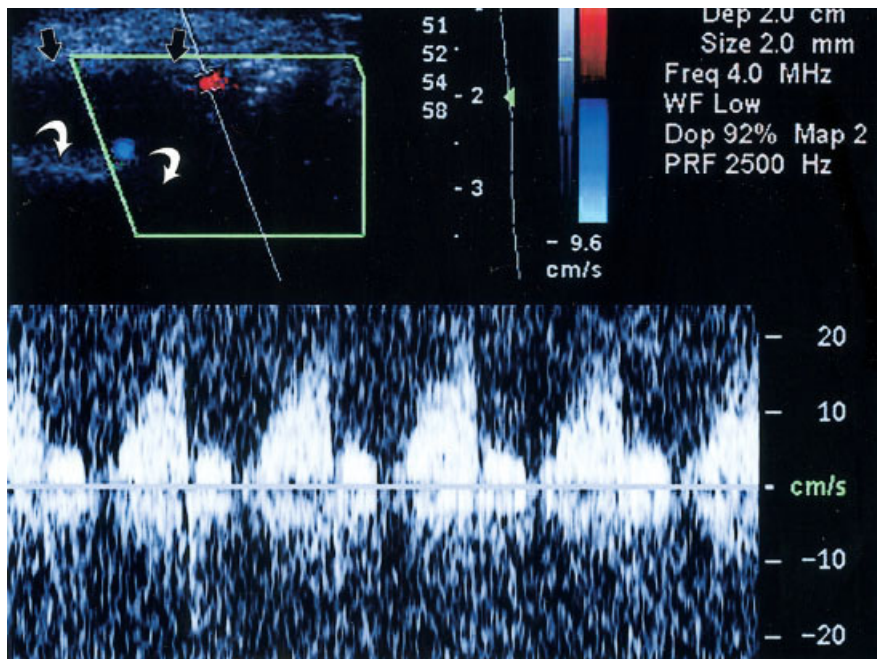


FIGURE 2. Duplex sonogram at the site of the fistula demonstrates the pulsatile pattern of flow from the fistula. Curved white arrows indicate the femoral cortex; black arrows delineate the knee joint capsule. Note the bidirectional flow at the site of the Doppler sampling window.

grams of the suprapatellar bursa in the sagittal and axial planes revealed a large knee joint effusion. Mildly echogenic heterogenous partially compressible material filled the joint, and distended the suprapatellar bursa and filled both medial and lateral knee joint recesses. Power Doppler sonography of the anteromedial aspect of the knee directly over the recent puncture site demonstrated flow into the knee joint (Figure 1), which was confirmed as pulsatile arterial flow via Duplex-sonography (Figure 2).

A vascular surgeon was consulted, and the diagnosis of an acute hemarthrosis of the left knee was made according to history, imaging findings, and clinical examination. The patient was treated conservatively via administration of fresh frozen plasma, temporary cessation of coumadin, and application of a compressive bandage. By the next day, her international normalized ratio had fallen to 1.5, and although the knee remained swollen she was in less discomfort. Sonography performed at this time showed no evidence of active bleeding, and the patient was discharged to a nursing home facility.

DISCUSSION

Many clinicians perform diagnostic arthrocentesis of the knee in the outpatient setting. Different approaches of knee arthrocentesis have been described, including anteromedial and anterolateral puncture adjacent to the patella of a flexed knee with the patient sitting. Another approach is a medial or lateral puncture with the patient supine and the knee extended, with the needle advanced in a coronal oblique plane for retropatellar placement.²⁻⁶ In each situation, the needle is advanced toward the patellofemoral joint. With the medial or lateral approaches, gentle pressure from the operator's hand on the opposite side of the patella often opens up the patellofemoral joint as the needle tip is placed within the joint.⁴ With sonographic guidance, the needle tip can be advanced directly into the medial or lateral recesses or the suprapatellar recess,⁵ avoiding the patellofemoral joint and theoretical cartilage injury.

Although the anteromedial approach^{2,6} has been widely used, Jackson et al² found the lateral approach more successful in a series of 240 knee injections in patients with no clinical knee joint effusion. In addition, Roberts et al⁷ found that the medial plica and a medial patella fat pad could cause difficulty with an intra-articular needle. With the supine patient, the contralateral knee may occasionally make access more limited when using the medial approach. Knowledge of the ante-

rior knee arterial anatomy further suggests that a lateral approach may be preferred.

Arterial supply of the anterior knee includes branches of the superior and inferior lateral geniculate arteries, the superior and inferior medial geniculate arteries, the articular branch of the descending geniculate artery, and the anterior recurrent tibial artery (Figure 3). These arteries form a complex patellar anastomosis. Of note, the articular branch of the descending genicular artery and the anterior recurrent tibial artery are positioned at the medial border of the patella. This may be important when determining a medial versus lateral approach for knee arthrocentesis, particularly in a patient with disordered coagulation.

Arterioarticular fistula, an abnormal communication between an artery and a synovial joint, usually follows a penetrating injury. The natural history of an arterioarticular fistula is one of self-tamponade, due to the defined volume of a joint. In our patient, repeated aspiration attempts from a medial approach are believed to have caused vascular injury and formation of the arterioarticular fistula, although the presence of blood in the knee joint was never documented. The patient's symptoms improved after cessation of coumadin, suggesting that disordered coagulation was a factor in the development of the fistula.

ACKNOWLEDGMENT

We would like to thank Robert W. Jacobson, MFA, for his suggestions and for providing us with Figure 1.

REFERENCES

1. Newberg AH, Munn CS, Robbins AH. Complications of arthrography. *Radiology* 1985;155:605.
2. Jackson DW, Evans NA, Thomas BM. Accuracy of needle placement into the intra-articular space of the knee. *J Bone Joint Surg Am* 2002;84:1522.
3. Freiburger RH, Pavlov H. Knee arthrography. *Radiology* 1988;166:489.
4. Angell FL. Fluoroscopic technique of double contrast arthrography of the knee. *Radiol Clin North Am* 1971;9:85.
5. Fessell DP, Jacobson JA, Craig J, et al. Using sonography to reveal and aspirate joint effusions. *AJR Am J Roentgenol* 2000;174:1353.
6. Zurlo JV, Towers JD, Golla S. Anterior approach for knee arthrography. *Skeletal Radiol* 2001;30:354.
7. Roberts WN, Hayes CW, Breitbach SA, et al. Dry taps and what to do about them: a pictorial essay on failed arthrocentesis of the knee. *Am J Med* 1996;100:461.