CHAPTER 44

APPROPRIATE ENVIRONMENT AND SURGICAL CONSIDERATIONS FOR BONE BIOPSY

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The evaluation of osteomyelitis has undergone a great number of advances, allowing the physician options in the diagnostic process. While many diagnostic examinations can provide additional insight, the true measure remains the microscopic evaluation following bone biopsy, revealing the characteristic inflammatory changes of the bone and marrow. Bone biopsy techniques have progressed over time, ranging from simple rongouring to excisional biopsy. The use of trephines is a well-accepted procedure for bone procurement, assuming the proper techniques are used and the proper expectations realized. The authors are currently investigating the efficacy of trephine and/or needle biopsy for suspected osteomyelitis in the office or in-patient room without the need for an operating room procedure. This procedure is best indicated for the neuropathic patient with an ulcer probing to bone, in which osteomyelitis is suspected until ruled out by biopsy or alternative methods.[1] In the patient in which the probability of osteomyelitis was greater than 50%, biopsy and long-term antibiotic therapy was the most cost-effective treatment plan as compared to other alternatives.[2]

The diagnosis of osteomyelitis and therapeutic plan consists of two main components, microbiologic and histologic evaluation. Attempts to culture sinus tracts and superficial wounds in identifying the infecting organism in patients with confirmed osteomyelitis proved to be inadequate. Cultures revealed the infecting organism in <50% of aerobic cultures and often revealed no anaerobic organisms.[3,4] Removal of bone via percutaneous needle biopsy for culture revealed 50% of osteomyelitic bone was positive for the infecting organism.[5] The lack of positive cultures may be due to an inadequate surgical sample or secondary to the use of antibiotics prior to biopsy. The only definitive manner in which to obtain accurate cultures of the infecting organism is to perform an open biopsy.[3] The use of trephines was again questioned regarding the reliability of cultures, and was shown to be inadequate. The use of 2 mm and 7 mm trephine biopsy showed no difference in the histologic evaluation of bone when evaluated for surface density of bone and percentage of trabecular bone volume.[6] Two important issues must be addressed when determining the size of the trephine to be used, stress risers and isolation of osteomyelitic bone. The use of smaller trephines will result in less cortical disruption, and therefore weaken the bone to a lesser degree, allowing for lower incidence of fracture postoperatively. This is beneficial in the midfoot and rearfoot where accommodation to decrease weight-bearing stress is more difficult.

The use of a larger trephine allows more room for error in obtaining infected bone at a cost of increased stress risers. Trephine and needle biopsies are commonly performed in the metatarsal heads prior to bone resection in cases of suspected osteomyelitis, in an attempt to maintain the weight-bearing parabola of the forefoot.

The access to the suspected osteomyelitic bone is a second very important consideration. Biopsy directly through an ulcer will greatly increase the ability to access the infected bone, but theoretically may seed an infection in uninfected bone. Ellipsing an ulcer and then performing a biopsy, or biopsying through a non-cellulitic adjacent incision have both been recommended to prevent the introduction of bacteria.[5,7] In the patient with a chronic ulcer that probes to bone, the probability for osteomyelitis is very high, and biopsy is often performed with trephines through the ulcer. The previously reported contraindication of lidocaine due to its bactericidal nature is inconsequential due to the low concentrations used in the foot and lower leg, and therefore may be used if necessary for a proximal block.[8]

PROCEDURE

A five-minute betadine foot prep is performed prior to the initiation of the procedure, and sterile gloves and instruments are maintained throughout the procedure. An incision is made adjacent to the ulcer. Blunt dissection is performed to isolate bone. An appropriately sized trephine or Jamshidi needle is then introduced and a sample of bone removed. The bone is sent for histologic evaluation and culture. The incision is reapproximated and a sterile dressing applied. A postoperative dressing change is performed at postoperative day two, and on subsequent days.

A second alternative in the face of a chronic non-healing ulcer, which is not acutely infected, is to incise through the ulcer to bone and spread adequate soft tissue to directly access the bone (Figs. 1-3). A trephine or needle is then introduced to obtain the sample of bone, which is then sent for pathologic evaluation. This procedure is the more likely of the two to be performed in the treatment room or in-patient hospital room to diagnose osteomyelitis prior to any resection or initiation of long-term antibiotic therapy.

The ability for the physician to diagnosis or rule-out osteomyelitis without incurring the high cost of an initial operating room procedure is beneficial in many ways. The patient is susceptible to less stress and potential complications and a lower morbidity is associated with the patient having a procedure done locally without systemic anesthesia. Bone is obtained for both culture and microscopic evaluation to provide a basis for the initial empiric antibiotic therapy, but the lack of growth on culture can not exclude aerobic or anaerobic organisms. If deemed necessary, an open procedure can be performed at a later date in the operating room for removal of infected bone by complete excision following the initial diagnosis or treatment via intravenous antibiotics.

The use of the proposed procedure is most beneficial in suspected cases of midfoot and rearfoot osteomyelitis, as opposed to complete resection, which may leave the patient incapacitated. Evaluation of osteomyelitis is a difficult task to undertake and this is an attempt to provide a less invasive procedure for the initial diagnosis to provide fewer complications and an earlier return to function.

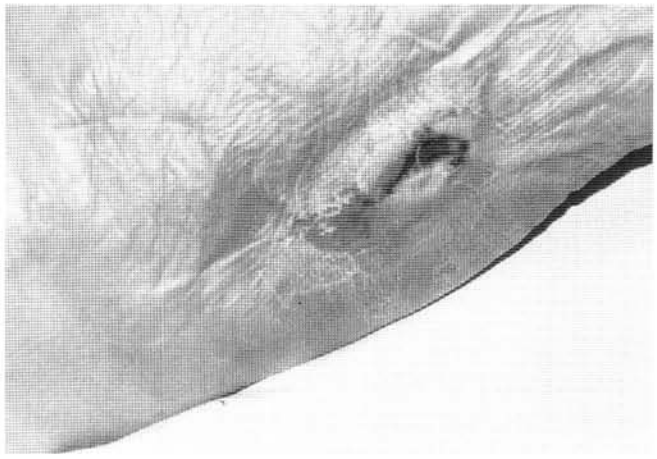

Figure 1. Chronic non-healing ulcer with exposed bone in a neuropathic patient.

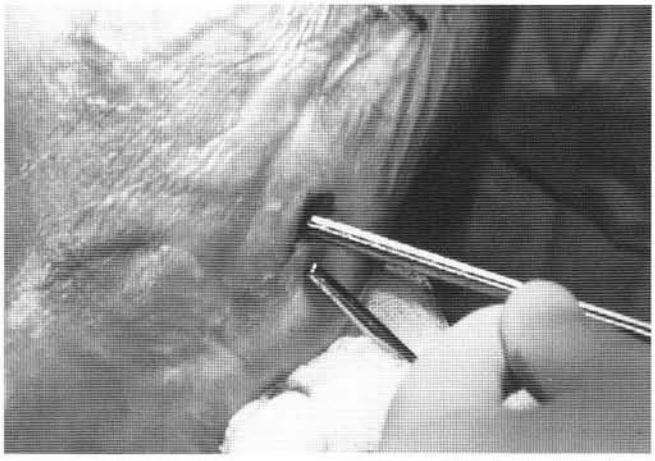

Figure 2. Trephine bone biopsy performed through an ulcer.

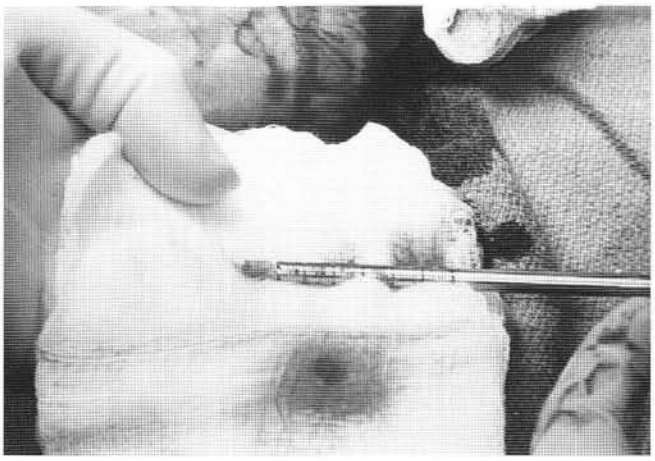

Figure 3. Bone specimen removed to be sent for histologic and microbiologic evaluation.

REFERENCES

1. Newman LG, Waller J, Palestro CJ, et al.: Unsuspected osteomyelitis in diabetic foot ulcers: diagnosis and monitoring by leukocyte scanning with indium in 111 oxyquinolone. *JAMA* 266(9):1246-1251, 1991.
2. Mushlin AI, Littenberg B: Diagnosing pedal osteomyelitis: testing choices and their consequences. *J Gen Int Med* 9:1-7, 1994.
3. Perry CR, Pearson RL, Miller GA: Accuracy of cultures of material from swabbing of the superficial aspect of the wound and needle biopsy in the preoperative assessment of osteomyelitis. *J Bone Joint Surg* 73(5):745-749, 1991.
4. Mackowiak PA, Jones SR, Smith JW: Diagnostic value of sinus tract cultures in chronic osteomyelitis. *JAMA* 239(26):2772-2775, 1978.
5. White LM, Schweitzer ME, Deely DM, et al.: Study of osteomyelitis: utility of combined histologic and microbiologic evaluation of percutaneous biopsy samples. *Radiology* 197:840-842, 1995.
6. Moore RJ, Durbridge TC, Woods AE, et al.: Comparison of two bone trephine instruments used for quantitative hisomorphometry. *J Clin Pathol* 42:213-215, 1989.
7. LeFrock JL, Joseph WS: Bone and soft-tissue infections of the lower extremity in diabetics. *Clin Pod Med Surg* 12(1):87-103, 1995.
8. Schwietzer ME, Deely DM, Beavis K, et al.: Does the use of lidocaine affect the culture of percutaneous bone biopsy specimens obtained to diagnose osteomyelitis? An in vitro and in vivo study. *AJR* 164:1201-1203, 1995.

ADDITIONAL REFERENCES

Howard CB, Einhorn M, Dagan R, et al.: Fine-needle biopsy to diagnose osteomyelitis. *J Bone Joint Surg* 76:311-314, 1994.

Jacobson IV, Sierling WL: Microbiology of secondary osteomyelitis: value of bone biopsy. *SAMT* 72:476-477, 1987.

Lodor BG, Calderone DR, Sharp J, et al.: Surgical considerations for hematogenous osteomyelitis. *J Foot Ankle Surg* 34(4):347-353, 1995.

Newman LG: Imaging techniques in the diabetic foot. *Clin Pod Med Surg* 12(1):75-86, 1995.

Sexton DJ, McDonald M: Osteomyelitis: approaching the 1990s. *Med J Aust* 153:9196, 1990.

Waldvogel FA, Medof G, Swartz A: Osteomyelitis: a review of clinical features, therapeutic consideration and unusual aspects III. *N England J Med* 282:316-322, 1970.

Stapp MD: Bone biopsy and cultures: recommendations in suspected osteomyelitis. In Camasta CA, Vickers NS, Carter SR, eds. *Reconstructive Surgery of the Foot and Leg Update 95*. Tucker, GA: Podiatry Institute Publishing;1995:286-291.