



Surgical Tip: A Minimally Invasive Mini Open Technique for Harvesting Iliac Crest Bone Graft

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Level of Evidence: Level V, expert opinion.

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Bone graft is frequently used to augment fusion in foot and ankle procedures.¹³ Autologous cancellous graft remains the gold standard to be used in these procedures, with the trabecular nature of cancellous bone affording it a high surface area. In addition, it contains the osteoinductive and osteogenic properties ideal for a graft material.^{7,10,11} Numerous sites for harvesting autologous bone graft have been described in the literature, with the calcaneus and distal or proximal tibia being the most frequently used in foot and ankle procedures. These locations are limited, however, by the volume of available graft and questionable osteoinductive properties, with Chiodo et al⁶ demonstrating notably greater amounts of active hematopoietic marrow in iliac crest bone graft (ICBG) than are seen in the extremities. Although ample bone graft can be harvested from the iliac crest, the literature has extensive evidence of the morbidity associated with ICBG harvesting. Complications include seroma, hematoma, infection, fracture, hernia, chronic pain, numbness, nerve injury, and cosmetic deformity.^{1-5,8,9,12,14,15,17} In the tibia and calcaneus bone graft, trephines have been demonstrated to allow successful harvest of bone graft through small incisions with little morbidity.¹⁶ We present a minimally invasive procedure for harvesting cancellous bone graft from the iliac crest in an effort to minimize the potential complications associated with ICBG harvesting.

Technique

The patient is positioned in the supine position allowing for both the iliac crest harvest and the fusion to be completed in one procedure. The anterior-superior iliac spine (ASIS) is palpated and marked. This is followed by a line marking the iliac wing. The patient is then prepped and draped with a windowed drape to allow for an appropriate exposure of the iliac crest.

A 1.5-cm full-thickness skin incision is made in line with the lateral rim of the iliac crest starting about 2 to 3 cm posterior to the ASIS and extending posteriorly. This should

avoid injury to the lateral femoral cutaneous nerve, although care should always be used during the operative approach. The surgeon opens the fascia (aponeurosis of the external oblique muscle) using the cautery directly over the palpated crest and elevated subperiosteally starting at the outer table and working medially. Once this is completed, the medial and lateral extents of the iliac rim are palpated. A small opening is made in the fascia at the medial and lateral rim, respectively, and small Hohmann retractors are slid down the inner and outer tables, which allow better definition of the direction of the tables and iliac wing.

A bone graft harvesting trephine (Acumed, Hillsboro, OR) is attached to a mini driver and aligned with the direction of the iliac wing. The size of the trephine is either 8 mm or 10 mm based on the size of the patient's iliac crest. Using the Homan retractors as directional guides, the surgeon uses the trephine to breach the cortical bone of the iliac crest perpendicular to the rim. The trephine is advanced into the iliac wing in one pass 2.5 cm deep to maximize harvest of cancellous bone. Care is taken when using the trephine to ensure that if the inner or outer table is encountered during the harvest, the trephine is advanced no further. The trephine is removed and the premorcellized graft is extracted using the plunger into a small bowel. Additional passes can be made depending on the amount of bone graft required (Figure 1). The same entry point is used for each pass allowing 2 additional morcellized cores of graft to be extracted (Figure 2). One pass is directed anteriorly and the second posteriorly (Figure 3) with care taken to avoid breaching the tables of the iliac wing. It is our experience that 10 cc of cancellous graft can easily be obtained using the limited open technique (Figure 4).

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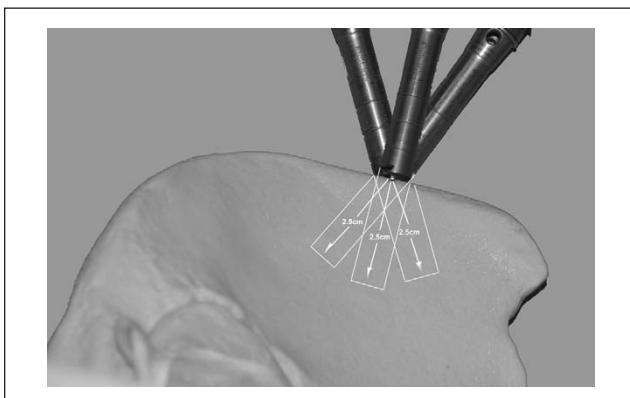


Figure 1. Lateral view of the iliac wing illustrating the trajectory of the trephine using the same entry point with 3 passes.

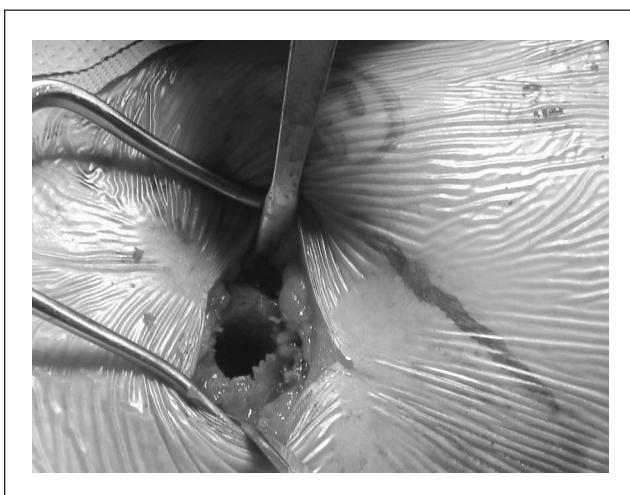


Figure 2. A single entry point into the iliac wing is shown after 3 passes with the trephine were made.

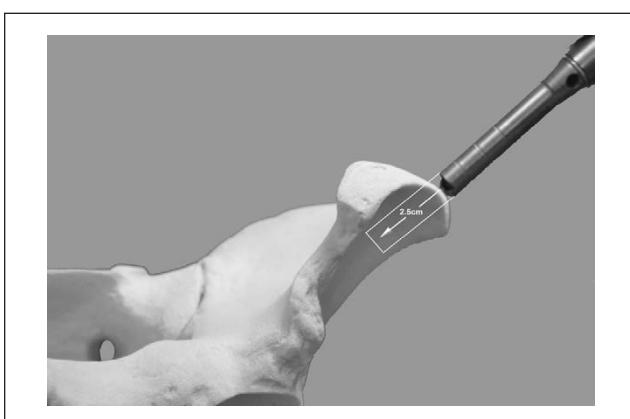


Figure 3. Anteroposterior view of the iliac wing illustrating the trajectory of the trephine. The trajectory is parallel to the inner and outer tables.



Figure 4. View showing 10 cc of cancellous bone graft obtained with 3 passes of the trephine through the iliac crest.

Once an adequate amount of graft is harvested, the deep fascial layer is closed with 0 vicryl suture and the skin is closed with standard layered closure. Local anesthetic agent can be infiltrated prior to incision and after closure for pain control.

Discussion

Numerous procedures around the foot and ankle require bone graft augmentation to assist healing. In certain situations, local graft harvest from the ipsilateral extremity cannot be used due to harvest site location corresponding to the proposed surgical site or because greater volume and better quality of graft are required than is available regionally. In these cases we use a mini open technique for safe, rapid, and effective harvest of ipsilateral iliac crest cancellous graft. With this minimally invasive approach, there is decreased soft tissue and bony trauma and lower risk of morbidity often associated with open graft harvest from the iliac crest. Although this is a tissue-sparing procedure, the 2.5-cm window affords adequate visibility to use the anatomic landmarks in order to avoid an erroneous starting point or breach of inner or outer table.

To date we have used this procedure in 17 patients. None have experienced complications related to the harvest. All patients at follow-up have been satisfied with their surgery and, when asked about pain related to their harvest site, have not complained. More patients will be required to have an adequate sample size to accurately assess patient satisfaction, complications, and pitfalls encountered during this technique.

Declaration of Conflicting Interests

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