

A modified rephine harvest technique for ICGG in anterior cervical discectomy and fusion (ACDF) procedures has shown improvement over traditional graft harvest with respect to pain and patient satisfaction. The purpose of this study was to assess patient outcomes to validate the clinical impression of reduced perioperative and long-term pain and dysfunction.

Studies of traditional techniques report high complication rates in patients undergoing either anterior or posterior iliac crest bone graft (ICBG) harvest.¹⁻¹⁰ Less invasive techniques have been shown to reduce perioperative complications and pain, but continue to pose a significant challenge for the surgeon.¹¹ Open orthopedic literature still advocates a traditional approach for anterior harvest, but less invasive techniques available for spine surgery, little long-term data are available regarding pain, and complications of those less invasive techniques are available.

Rate-site complications and pain make traditional bone graft harvest a serious concern for patient and surgeon alike. The reported incidence of persistent pain and wound problems has influenced many suggestions to abandon autologous graft harvest altogether. The perception that bone graft harvest is the worst part of the surgical experience is pervasive in the lay literature, and patients often fear it.

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Conclusion. Trehpine graft harvests were all satisfied by graft-site symptoms, and no patient was impaired by graft harvest. No VAS was 0.20/10. No patient was satisfied by graft harvest. This technique eliminates perioperative complications of dissection, elevation, and cortical disruption. Outcome using this technique eliminated perioperative complications in this study group, and reduced pain in both perioperative and long-term assessments. Compared to historical outcomes, this technique graft harvests were significantly improved relative to traditional approaches, and significantly improved relative to open techniques.

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Methods. Sixty-eight patients undergoing anterior cervical discectomy and fusion (ACDF), using allolograft spacers, underwent ICBG harvest using a 3.5 mm trephine by a minimally invasive approach. Perioperative complications, pain incidence and Visual Analog Scale (VAS) were analyzed. Thirty consecutive patients were subsequently surveyed for long-term follow-up regarding pain, function, and satisfaction.

Results. No perioperative ($0-6$ weeks) graft-site complications were reported, and no treatment required for graft-site complications. No patient reported clinically significant graft-site pain ($>3/10$). At long-term follow-up (mean 45 months) no patients reported pain $>3/10$ at their graft-site, and the mean relative pain was $<1/10$.

Conclusion. There were no reoperations, fractures, wound dehiscence (infection), hematoma, fracture, wound dehiscence) occurred. There were no complications related to the graft site.

Trehione Technique for Iliac Crest Bone

CLINICAL CASE SERIES

Graft Harvest

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Figure 2. Instruments useful for trephine harvest. The Craig Needle Biopsy set works through a graft harvest. The Craig Needle Biopsy set useful for trephine harvest. The Craig Needle Biopsy set includes a T-handle (E) for the trephines.

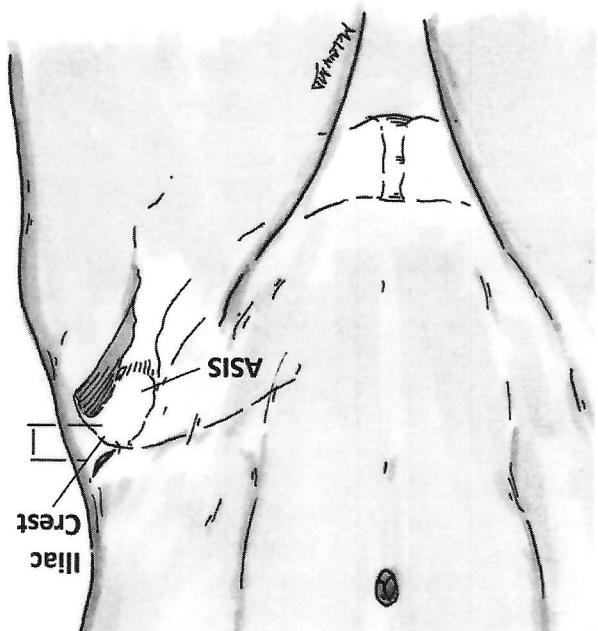
The diagram shows five medical instruments arranged on a white background. Instrument A is a long, straight, tapered bone graft rod. Instrument B is a shorter, curved bone graft rod. Instrument C is a bone grafting gun with a handle and a tapered tip. Instrument D is a bone grafting needle with a sharp, tapered end. Instrument E is a bone grafting blade with a long, thin, straight edge.

bone from the anterior iliac crest through a 3.5 mm cortico-tomy, using a 1.0 cm stab-wound incision. The anterior iliac spine to avoid the lateral femoral cutaneous nerve and theoretical risks of fracture, (Figure 1). After was centred appoximatively 3.0 cm dorsal to the anterior superior iliac spine to the lateral femoral cutaneous nerve and the incision, applied just above or below the iliac crest, passing a 1.0 cm diameter soft-tissue protector through the soft tissues down to the periosteum, a 3.5 mm corticotomy was created with a high speed burr, centred between the outer and inner tables of the crest. The working-sleeve of Craig Needles Biopsy set was then docked over the cortical defect in the iliac crest, (Figure 2A-E). The 3.0-mm bone-cutting technique was inserted through the working-sleeve and advanced 2 to 3 cm into the trabecular bone of the ilium on a single pass. The trabecular bone was withdrawn and discarded, whereas the working-sleeve was anchored in place. By changing the orientation of the working-sleeve with each pass, four or more autograft cores were extracted through the same cortical perforation (Figure 3). Once adequate trabecular graft was obtained, the working-sleeve was irrigated with bacitracin irrigation, small threads of bone wax provided hemostasis. The wound was closed with a single stitch and dressed with a band-aid.

Bone Graft Harvest Technique

interbody spacer were excluded from this review. Patients undergoing corpectomy, reconsrtuction with a fabricated spacer, biological augmentation, or anterior and posterior procedure were excluded.

Figure 1. One-cm stab-wound incision is typically placed 1 cm above or below the crest and 3 cm dorsal to the ASIS.



All patients treated between January 2004 and December 2010, who underwent ACDP for spondylosis or disc herniation at one, two, or three levels, with documented radiculopathy, myelopathy, or both, were reviewed. All patients included were between 18 and 69 years of age, with radiicular pain as a primary indication for surgery, and had completed a minimum of 12 weeks conservative treatment before surgery, unless neurological symptoms of radiculopathy, weakness, or cord compression required more urgent treatment. Preoperative imaging demonstrated herniated disc or spondylosis at the involved levels. Patients were treated with a left-sided anterior surgical approach, microdiscectomy, resected with structures allograft spacer and plate fixation. Patients undergoing autograft

Patients

This study analyzed graft-site complications and pain in a single-center cohort of patients undergoing anterior ICBG harvest for ACD. Outcomes for fusion rate, neck pain, and arm pain were assessed to insure that they were comparable to those commonly reported in the literature, but were not analyzed for this report.

METHODS

We assessed perioperative graft-site pain and wound complications in 68 consecutive patients, then analyzed a subgroup of 30 patients in a follow-up survey to assess long-term outcome, pain, and patient satisfaction. We examined two hypotheses: first, that this technique would provide autograft ICBG with a low incidence of post-operative site pain and complications; and second, that this outcome would reduce or eliminate graft-site symptoms in long-term follow-up.

A consecutive subgroups of 30 patients was surveyed for long-term follow-up. When asked whether they had residual long-term pain or complications, at a mean follow-up 45.6 months (24-96). When asked whether they had residual

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at any time in the perioperative period (0%) (Table 1). There were no late episodes of hematomas, infection, drapage, or delayed healing. There were no iliac wing fractures or tenderness, and no femoral cutaneous nerve injuries. No additional graft-site procedures were required or performed. All patients expressed satisfaction with the graft harvest aspect of their surgery.

Perioperative pain assessments and wound status reports were available in all 68 patients. There were no graft-site infections, hematomas, wound dehiscence recorded in any patient. Mild postoperative graft-site pain (3/10) was noted at follow-up in one patient (1.6%); that patient required no treatment and pain resolved to 0/10 at long-term follow-up.

Periodic Review of Compliance and Plan Following

RESULTS

Long-term follow-up data regarding overall satisfaction and persistence of graft-site pain was obtained through a clinical survey of a subset of the original cohort. Because the incidence of pain and complications in our cohort were significantly different from that seen in historical comparisons, a long-term follow-up study was undertaken.

Long-term Follow-up

Perioperative data regarding patient-assessed pain, wound examination and inspection, and complications were analyzed. Postoperative evaluations at the time of 6 week and 12 week follow-up and clinical review.

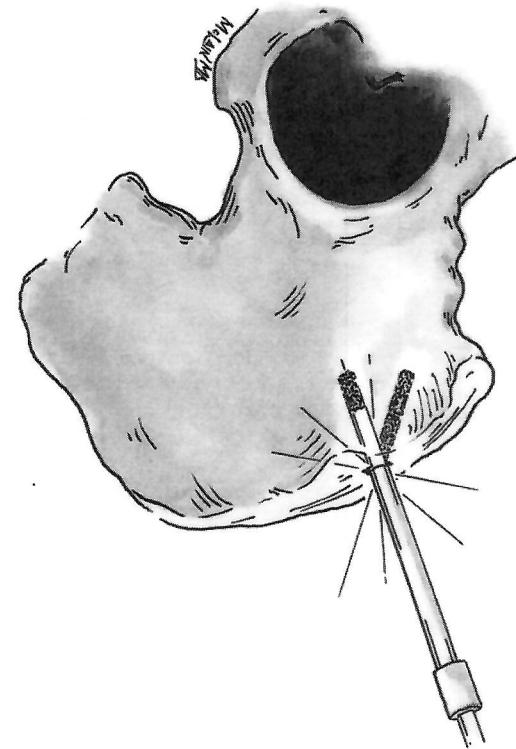
Perioperative Follow-up of Graft-site Complications
Sixty-eight consecutive patients undergoing tracheal harvest for ACD were identified for retrospective chart review. All surgeries were carried out in a single center under a uniform perioperative protocol. All cases that met inclusion criteria

Services were implemented with an internal cervical plate.

Graft Application
Trabecular autograft was sufficient to augment one, two, and three-level anterior interbody fusions of cervical levels between C-2-3 to C7-T1; 1.0 to 1.5 cc of graft was obtained for each level. Millerd allograft spacers (*Musculoskeletal Transplant Foundation, Edison NJ*), were packed with trabecular autograft bone, filling the central cavity of each allograft spacer tightly. After inserting the spacer, operated levels were instrumented with an anterior cervical plate.

Graft Application

Figure 3. Orientation of bone harvest trochar allows multiple cores to be taken through a single corticotomy site. Two to three cores of different trabecular bone can be obtained depending on the number of passes made.



complications, requiring additional surgery or increased hospital stay, irrespective of ^{28,29} Goutte *et al.*, reported that 21.1% of their patients had persistent pain ≥ 2 years after surgery, and that 9.9% required chronic analgesics for graft-site pain. ³⁰ Similar results have been reported by other authors. ^{26,31-33} Schnee *et al.* reported that 2.8% of their patients experienced persistent severe pain after tricorpectal ICGB harvest, 5.6% suffered superficial infection and/or wound dehiscence, and that four (2.8%) required additional surgery for graft-site complications. ³⁴ Other complications include pelvic fractures, visceral herniation through large graft defects, difficulty ambulating, and chronic drainage from the wound. ^{31,34,35}

As to overall satisfaction, 29 of the 30 patients (97%) said they would have the surgery again. One patient who would not have surgery again had no graft-site complications (0/10), but was bothered by persistent axial neck pain. None of the patients would have declined the surgery based on their graft-site experience.

At long-term follow-up, 83% claimed good-excellent relief of radicular pain (60% 0/10, and 23% 1-3/10 residual pain). Twenty-seven of 30 patients said that they were completely (18) or Very Satisfied, and 2 were Satisfied. One was Not Very Satisfied, rating their neck pain 3 of 10, but felt significantly impaired by their neck symptoms.

DISCUSSION

This surgical technique appears in the otolaryngology and plastic surgery literature as a source of autograft for small bone and facial reconstruction, but is not presented in the spine literature.¹² The need for autograft bone in interbody fusion for single-level cervical fusion in healthy nonsmokers can be debated.^{13,14,15-18} In multilevel procedures, however,²⁻⁵ autograft has demonstrated superiority in several studies.^{16,19-23} Particularly when synthetic spacers are used,²⁴⁻²⁶ Biologics are expensive, and bone morphogenic protein (BMP)—used successfully in the thoracic and lumbar spine—has proven unsuitable in cervical surgery.²⁷

Despite the advantages of autograft, graft-site pain and complications with traditional harvest lead many surgeons to avoid autologous harvest for fusion. Studies have reported a 10% to 20% incidence of minor and a 6% to 8.6% incidence of major iliac crest graft-site

DISCUSSION

TABLE 1. Rephrase harvest technique relative to historical controls

- Trephine graft harvest used successfully in spinal applications.
- Trephine graft harvest, has not been studied in other fields, less invasive options reduce morbidity, and long-term pain.
- Patients undergoing ACD, augmented with trephine graft harvest, experienced no perioperative graft-site complications and reported no significant perioperative pain ($>3/10$).
- At long-term follow-up (mean 45 months) no patients reported pain >3/10 at their graft-site, (mean VAS 0.20/10), no impairment, and all were satisfied with their graft harvest.
- Trephine graft harvest minimizes soft tissue dissection, perioseptal elevation, and cortical bone loss.

→ Key Points

CONCLUSION

This study is dependent on historical controls for comparison, and subject to biases of patient selection and technique. A controlled trial, although desirable, would require randomizing one patient subgroup to a traditional procedure without complicating rate than seen in our retrospective review. Existing studies available for comparison have been carried out using different outcome measures or harvest techniques, and comparison between open harvest studies is difficult.

LIMITATIONS

There are several reasons trephine harvest should be better tolerated than traditional open techniques: Trephine harvest is carried out through a stab-wound incision, with no periosteal stripping, and no removal of cortical bone. Wider exposure disrupts nociceptive endings that abound in the periosteum.⁴⁷⁻⁴⁸ The iliac cortex is punctured, not cut, and hemorrhage through this small corticotomy is minimal. There is little bleeding, so hematoma is unlikely, and was not seen in our patients. There is no retraction needed, limiting the risks of wound healing problems or femoral cutaneous nerve injury. The corticotomy required is little larger than that for marrow aspiration, and the risk of fracture is theoretical, and not seen here or reported in the literature.

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disruption, reducing persistent pain.

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