DONOR SITE MORBIDITY AFTER HARVESTING OF PROXIMAL TIBIA BONE

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Abstract: Background. Bone-grafting procedures are common in head and neck surgery. Donor site morbidity is an important factor in deciding the site for harvest of cancellous bone. The tibia has been recommended as a harvest site. Use of the proximal tibia as a donor site is associated with few complications. Our present study used proximal tibia bone grafts to reconstruct maxillofacial defects and augment bone volume for implantation.

Methods. A retrospective study was undertaken to analyze 40 proximal tibia bone grafts in maxillofacial reconstruction. Minimal follow-up was 6 months.

Results. There were no major complications during the follow-up period. Early minor complications (15%) included temporary sensory loss and ecchymosis. Late minor complication (2.5%) was gait disturbance for 2 months. Long-term minor complication (2.5%) was an unsightly scar.

Conclusion. The procedure for proximal tibia bone graft is easy, has less operative risk, and results in a lower postoperative morbidity rate. Based on our findings, we believe the proximal tibia offers a reliable site for harvest of sufficient quantities of good-quality cancellous bone.

Keywords: proximal tibia; autogenous bone graft; morbidity

Bone grafting in the maxillofacial region has long been used in head and neck surgery. Various indications, donor sites, and techniques have been reported. Possible donor sites in the human body include the cranial bone, the symphysis of the mandible, rib, iliac crest, and tibia bone. The iliac crest is widely accepted because it provides the largest amount of cancellous bone volume. Tibia bone grafts have become the choice for autogenous bone grafting. In 1991, O’Keeffe et al1 reviewed 230 cases in which the proximal tibial metaphysis was harvested for autogenous cancellous bone graft. These investigators reported that the results of donor site morbidity were low. In 1992, Catone et al2 reported on 21 cancellous grafts procured from tibia bone grafts for various maxillofacial reconstructive procedures. The purpose of the present study is to report the results of bone grafting from the proximal tibia in the Oral and Maxillofacial Surgery Departments at Kaohsiung Medical University Hospital, China Medical College Hospital, and Chiayi Christian Hospital. The aims of this study were to evaluate the donor-site complications and morbidity in our patients.
MATERIALS AND METHODS
A retrospective review was undertaken, which included all patients receiving proximal tibia bone grafts in the oral and maxillofacial surgery departments at Kaohsiung Medical University Hospital, China Medical College Hospital, and Chiayi Christian Hospital. All patients had autogenous tibia bone grafts to reconstruct maxillofacial defects for conditions including trauma, benign tumor excision, cyst enucleation, alveolar cleft, and severe maxillary resorption. From March 1998 through July 2003, 40 autogenous bone grafts were harvested from the proximal tibia of 38 patients. Preoperatively, all patients had received radiography of the knee to prevent diseases of the knee. Intraoperative factors were noted, including the donor site, duration of surgery, volume of grafts, and recipient site. All patients were allowed to bear weight as tolerated on the donor leg beginning immediately after surgery. Postoperative disturbances, morbidity, complications, and residual sequelae were recorded with regard to the graft donor site. Radiographs were revised to assess union and trabeculation of the receipt site and donor site. All patients were followed until the donor site healed. Patients were followed up at least 6 months. Early complications were those that occurred at 3 weeks postoperatively. Late complications were discomforts that continued for 3 months postoperatively. Over a 3-month follow-up, discomforts were included in the data for long-term complications.

Harvest Technique. Patients were placed in a supine position, with the right leg elevated in a flexed position, using a towel roll placed under the knee. The area of the knee was prepared in sterile fashion using an iodine preparation and was then draped so that the entire knee, the proximal tibia, and the femur directly above the knee could be viewed. The regional anatomy was then palpated and outlined with a sterile marking pen (Figure 1). After Gerdy’s tubercle was located, the overlying soft tissue was infiltrated with 2 mL 2% xylocaine with 1:100,000 epinephrine. A 2- to 3-cm oblique incision was made, and dissection was performed in a layered fashion through the subcutaneous tissue, iliotibial tract, and periosteum. The periosteum was incised and reflected to expose the bony surface of the tibia. A cortical window was made with a small fissure bur with copious irrigation. Cancellous bone was harvested medially and inferiorly with orthopedic curettes. At the completion of marrow procurement, the periosteum, iliotibial tract, and subcutaneous tissues were closed with 4-0 resorbable sutures, and the skin was closed with 5-0 nylon sutures in a running subcuticular fashion. After surgery, the knee was wrapped in a pressure dressing with strip bandages. A pressure dressing was applied for 24 to 48 hours. Ambulation was begun during the first 24 hours, but excessive walking was avoided for the first 3 days. After the dressing was removed, the protective covering and surgical site were kept dry. Patients were instructed to avoid running or weight-bearing activities for 3 weeks.

RESULTS
A total of 38 patients underwent procurement of 40 tibia bone grafts. There were 26 men and 12 women. The average age at the time of surgery was 35 years (range, 20–45 years). Surgical defects included 15 preprosthetic augmentations, 9 cyst enucleations, 8 cases of mandibular trauma, 5 benign tumors, and 3 cleft alveolar bones. The mean follow-up for these patients was 16 months (range, 6–28 months). The average amount of noncompressed cancellous tibia bone obtained from the donor site was 16.3 mL (range, 6 to 32 mL). The average total duration of surgery was 30 minutes (range, 25–50 minutes). Most patients were able to bear weight on the donor leg immediately and were able to walk without any ambulatory assistance after surgery.
Healing was evaluated on the basis of clinical observation and questions regarding gait disturbance, pain, ecchymosis, infection, sensory loss, and scarring at the donor site (Table 1). Mild pain was reported immediately postoperatively, but this pain subsided in most patients by postoperative day 2. Ecchymosis was observed in 3 patients, and it resolved in 10 days. Three patients experienced temporary sensory loss, which disappeared in 3 weeks. Only 1 patient complained of gait disturbance, and this problem was fully resolved by the 3-month follow-up. One patient still complained of unsightly scarring at 1 year postoperatively. There were no major complications, such as profuse bleeding, tibia fractures, knee joint injury, wound infections, or long-term gait disturbance. Over a 6-month follow-up, no major complications were disclosed (Figure 2).

### DISCUSSION

Bone graft is a surgical procedure that replaces missing bone with material from the patient’s own body (autogenous bone) or with an artificial, synthetic, or natural substitute. Although several options exist for bone grafting, the gold standard remains autogenous bone graft. Fresh autogenous cancellous bone provides survival of the maximum amount of transplanted bone and number of pluripotential cells in the marrow. Therefore, autogenous bone is osteogenic, osteoconductive, and osteoinductive. Intraoral autogenous donor bone may be harvested from the mandibular symphysis, ramus area, maxillary tuberosity, and palatine tori. Intraoral bone grafting has been used for alveolar repair with extremely favorable results. However, the amount of available bone is limited.

Three extraoral anatomic sites are commonly used to procure autogenous grafts: the iliac crest, rib, and calvarium. The main arguments against the use of rib bone and costal cartilage are postoperative chest infections, pneumothorax, wound breakdown, and an unsatisfactory amount of cancellous bone. Hematoma, excessive bleeding, a long scar, and penetration of the inner table of the cranium were reported when the skull was used as a donor site. The most frequently used extraoral donor site is the iliac crest. The primary advantage of the iliac graft is its large volume that can be used for large defects of the jaw. The anterior or posterior iliac crest can provide approximately 40 mL of cortical cancellous bone but requires significant dissection of soft tissue with significant morbidity. Even the iliac crest can provide a large reservoir of bone, but this source carries with it the complications of donor site pain and scarring, risk of nerve and joint injury, and also possible growth disturbance.

Ilankovan et al suggested that an average of 26 mL of tibial bone could be harvested in adults without any major complications. Catone et al reported that an average of 25 mL cancellous bone could be harvested. These investigators also reported that bilateral proximal tibial harvesting (≤ 40 mL) was appropriate for maxillofacial procedures. Therefore, it is easy to harvest 10 to...
25 mL of cancellous bone from the proximal tibia, and this is sufficient for most sinus floor elevation procedures. In all our patients, the proximal tibial metaphysis provided an adequate volume of cancellous bone. Therefore, the tibia has been recommended as a harvest site for medium defects. Although tibial cancellous bone is easier to harvest, the amount of bone available is limited, and there is also a risk of growth disturbance. In questionable situations, preoperative radiographs should verify closure of the epiphysial plates and cessation of growth. Because of possible growth center interference, the use of the tibia as a donor site is contraindicated in children and adolescents. With the use of appropriate techniques, damage to the articulation of the knee can be avoided and postoperative gait disturbance decreased. The peroneal nerve may be in danger only if the incision is carried too far posteriorly.

Although Catone et al2 advised against using the same site for repeated harvest, we were able to procure cancellous bone grafts a second time at the same donor site if the volume procured at first harvest was low. In the long-term experience reported by Kalaaji et al,8 no operative, early, or late postoperative complications were reported (eg, hematoma, tibia fracture, or shortening the limb). Marchena et al9 reported only mild discomfort and a gait disturbance for an average of 9 to 10 days. It may be possible, especially with small graft harvesting, for the patient to bear weight immediately postoperatively. The results of the present study are similar to their findings. Our patients were walking on day 1.

Excessive blood loss, delayed wound healing, and pain lasting 2 weeks to 2 months were reported when the ilium was used as the donor site.6 Damage to the lateral femoral cutaneous nerve is a well-known complication of taking an anterior iliac crest bone graft. Hypoesthesia or anesthesis over the distribution of the lateral femoral cutaneous nerve has developed in 10.3% of cases.4 Long, and particularly adherent, scars can also be painful under belts or clothing with waistbands. Several studies6,7 have compared these 2 donor site bone grafts for morbidity, postoperative complications, and techniques; tibia bone grafts are easier and quicker to perform with less morbidity and fewer complications. The incidence of serious complications of tibial grafts is reported to range from 1.3% to 3.8%, whereas the iliac graft is associated with complications of approximately 10%.10 In the study by Sivaraja- singam et al,6 tibia bone and iliac crest grafts had similar optical densities at recipient sites over the first 3 months. However, patients who received iliac crest grafts required an average of 2 more days in the hospital. Eighty percent of patients experienced pain for 1 week, and 43% still had pain at 2 weeks.6 Ilankovan et al7 reported that the tibial procedure is easier and quicker, with less blood loss. Total scores for pain and difficulty in walking were much lower for tibial than for iliac grafts.

The technique for tibia bone grafts is less invasive, and the whole operation can be done under local anesthesia or outpatient intravenous sedation. This area is advantageous because no major neurovascular structures are at immediate risk. However, a period of training for the surgeon with a clear regional anatomic concept is necessary. The duration of the tibia harvest is shorter than the iliac bone harvest. Patients may not require hospitalization, and this decreases the cost of surgery. Patients can start weight bearing on the donor leg immediately and do not require equipment for ambulatory assistance.

CONCLUSION
A proximal tibia bone graft can provide patients with a shorter hospital stay and is a more comfortable for the patient. The same quality and quantity of cancellous bone can be obtained as in iliac crest grafts in reconstruction of maxillofacial defects. Thus, the proximal tibia metaphysis is a useful site for obtaining cancellous bone graft and is an alternative bone graft donor site for maxillofacial reconstructive procedures.

REFERENCES


