

USEFUL TECHNIQUE FOR ALLOGRAFT BONE HARVEST

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SUMMARY – Although regarded as a gold standard, harvesting of autologous bone graft is associated with donor site morbidity and a number of complications. An alternative is allograft with limited availability as the main shortcoming. Femoral heads as allografts are now routinely obtained during total hip arthroplasty. A small but valuable amount of pure cancellous bone graft of high quality can be obtained in addition. An additional harvest site is the proximal metaphyseal region of femur. We present a simple, useful and inexpensive technique for one harvest that can be performed utilizing ordinary instruments.

Key words: *Allografts; Bone transplantation; Arthroplasty, replacement, hip*

Introduction

The need for bone graft or substitutes is increased, especially within spine fusion, revision hip arthroplasty, treatment of fractures and tumors in addition to reconstructive surgery¹⁻⁴. Autologous grafts are an excellent choice and are considered as a gold standard⁵. However, harvesting of autologous bone graft is associated with morbidity and a number of complications, increased surgery time and finite availability⁶. These shortcomings avert surgeons from using autologous bone grafts. An alternative is allograft, which is commonly the first option with similar osteoconductivity and to a lesser extent even the osteoinductivity compared with autologous grafts^{5,7}. Therefore, allografts are a quality and safe alternative and can overcome the main downfalls of the autologous bone grafts, which include donor site morbidity and finite amounts of material^{8,9}. Allografts can be obtained from cadavers (heart-beating and non-heart-beating donors) with the limits of availability of ideally suited candidates and a greater risk of specimen contamination^{10,11}. Al-

ternatives are femoral heads that are now routinely obtained from living donors as allografts during total hip arthroplasty (THA)¹²⁻¹⁶. However, besides harvesting femoral heads only, pure cancellous bone graft can be harvested in addition. An additional harvest site is the proximal metaphyseal region of femur. A small but invaluable amount of pure cancellous bone graft of high quality can be obtained from that specific region in a simple manner utilizing ordinary instruments. In this paper, we present a simple, safe and efficient procedure of harvesting cancellous bone graft during THA.

Materials and Methods

Although best suited for the modified direct lateral approach to the hip described by Delimar *et al.*, this technique can be utilized during THA regardless of the approach used and position of the patient¹⁷. THA is performed in a usual manner by the operator's preference and is carried on routinely till the advent of entering in the femoral medullary canal, before the broaching and preparation for the femoral component to be placed. During the initial entering the femoral medullary canal, the entering chisel is used. Although not designed for harvesting bone grafts, entering chisel has a shape that is perfectly suited for that purpose.

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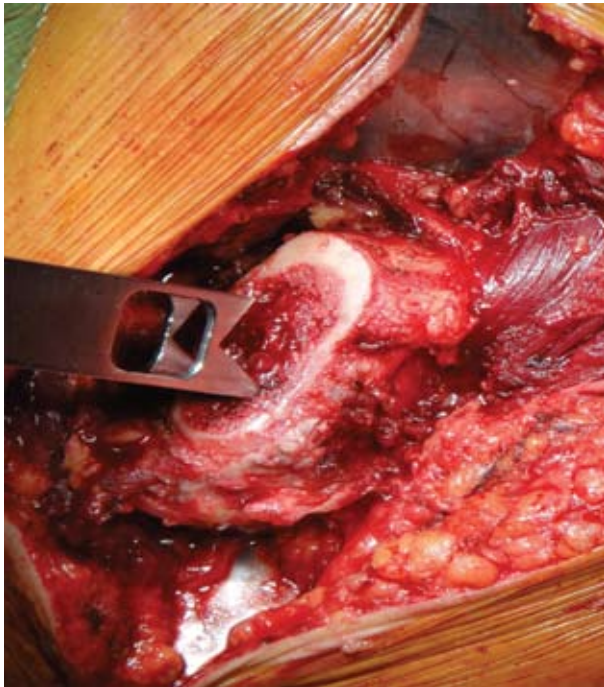


Fig. 1. Initial positioning of the entering chisel on the femoral stump.

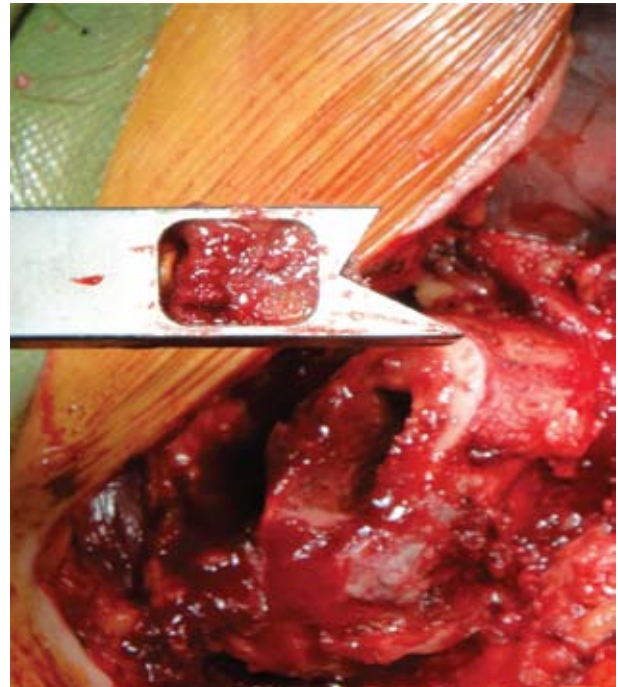


Fig. 2. Entering chisel is engaged; cancellous bone graft is obtained during its course.

Entering chisel is a hollow chisel made of medicine steel and rectangular in cross-section. Entering chisel has to be positioned correctly on the femoral stump for maximizing graft harvest and avoiding complica-

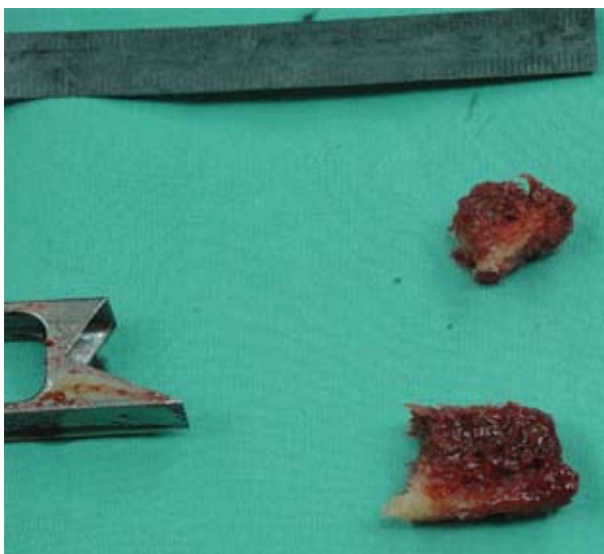


Fig. 3. Pure cancellous bone graft is obtained (3 cm³); note the rectangular shape of the entering chisel.

tions. It has to be positioned in parallel to the longitudinal axis of femur, in close proximity of the lateral cortex of greater trochanter, accommodating posterior inclination of trochanter in relation to diaphysis (Fig. 1). After correctly placing the entering chisel, a couple of steady hammer blows are delivered for entering in the femoral medullary canal. During its course to the femoral medullary canal, cancellous bone is harvested (Fig. 2). The volume of the graft obtained depends on the size of the proximal femur and the condition of the cancellous bone in that specific location. Although the amount of harvested graft may vary, generally 3 cm³ to 5 cm³ can be obtained (Fig. 3). Aerobic and anaerobic microbiological swabs are obtained and the harvested cancellous bone graft is packed in a plastic bag or suitable glass container and stored in quarantine freezer at -80 °C.

It is pointed out that the rotational as well as bending maneuvers while the entering chisel is still in medullary canal are forbidden because they impose great risk of iatrogenic fracture of the femur. If more bone graft is required, the entering chisel can be passed second time fulfilling all the conditions regarding its placement.

Results and Discussion

This technique is incorporated in the routine THA. The site of cancellous bone harvest is always affected and discarded during THA, so additional damage is not inflicted by bone harvest. This limits donor site morbidity, which is clear advantage over either anterior or posterior iliac crest bone graft or reamer irrigator aspirator (RIA) procedures, which are associated with additional morbidity and complications^{6,18,19}. Infection, hematoma/seroma, fracture, hypertrophic scar, chronic donor site pain and sensory disturbances are all reported as complications of iliac crest bone graft procedures^{6,18,20-22}. Although safer in respect to the morbidity caused, RIA procedures must be executed in a meticulous manner and still pose a risk of femoral neck, femoral diaphyseal and trochanteric fractures, cortex breach of the femur and hypertrophic scar formation^{6,18,19,23-25}. Our technique can be done with the usual instruments compared with the use of RIA, thus decreasing the cost of the procedure¹⁸. As with the iliac crest bone grafts and intramedullary canal of long bones, pure cancellous bone is harvested, so there is no need for further processing, such as soft tissue removing. This technique is time sparing because it can be carried out in up to 5 minutes compared with 30-40 minutes reported for obtaining iliac crest bone grafts or procedures with RIA¹⁸. A limitation of the technique is a relatively small amount of bone graft obtained, but it is harvested in addition to femoral head, thus offering rationalization of bone graft consumption, especially for the procedures that require small amounts of bone substitutes. Theoretical dangers of this technique exist and include iatrogenic fractures of the femoral shaft and greater trochanter, as well as penetration of femoral cortex by the entering chisel, but these are attributable to the specific THA procedure and the technique by itself does not inflict a substantial additional risk. The event of iatrogenic fracture of greater trochanter is possible with inaccurate and poor positioning of the entering chisel during initial placement on the femoral stump. Iatrogenic spiral fracture of femoral shaft may occur while putting the patient's lower leg in excessive external rotation or by maneuvering with the chisel while in medullary canal. Bending and especially rotational maneuvers carry a high risk of iatrogenic fracture and should be avoided by all means. Penetration of

femoral cortex is a great concern in case of inaccurate orientation of the entering chisel during initial approach to the medullary canal. In order to improve the surgeon's orientation, intraoperative x-ray can be used, but we found K-wire inserted through cancellous bone to medullary canal to be extremely helpful and sufficient in correct orientation.

In the authors' opinion, utilizing allografts is a convenient alternative to autologous bone graft with the advantage of shorter operative time and decreased donor site morbidity. The technique described allows for obtaining a valuable amount of cancellous bone graft of high quality from the proximal metaphyseal femur during routine THA. It has a potential role in the treatment of fractures, non-unions and tumors, especially in the hand and foot, where large amounts of graft are not needed. This technique is simple, useful and can be performed with the ordinary instruments.

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Sažetak

KORISNA TEHNIKA UZIMANJA HOMOLOGNOG KOŠTANOG PRESATKA

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Korištenje autolognog koštanog presatka se smatra zlatnim standardom, ali pribavljanje istog je povezano s brojnim komplikacijama, ponajviše pobolom na mjestu uzimanja. Zamjenska metoda je korištenje homolognog koštanog presatka s glavnim nedostatkom ograničene dostupnosti. Danas je uzimanje glave bedrene kosti kao homolognog transplantata dio rutinskog postupka tijekom ugradnje totalne endoproteze kuka. Tijekom ovog postupka moguće je dodatno uzeti i relativno mali ali vrijedan presadak čiste spongiozne kosti visoke kvalitete. Dodatno mjesto s kojeg se uzima homologni koštani presadak je proksimalna metafiza bedrene kosti. U ovom članku predstavljamo jednostavnu i korisnu tehniku uzimanja koštanog presatka iz proksimalne metafize bedrene kosti uz korištenje uobičajenog instrumentarija.

Ključne riječi: *Transplantacija, homologna; Koštana transplantacija; Artroplastika zgloba kuka*