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ORIGINAL STUDY

Does harvesting of iliac bone grafts with an acetabular reamer reduce complication rate ?

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Autogenous bone grafts are often used in orthopaedic surgery. One of the well-known techniques to obtain the grafts from either the anterior superior or posterior iliac spine uses a classic acetabular reamer. This retrospective study searches for the frequency of complications and discomfort in a population of 78 patients after this kind of bone graft harvesting. Data were collected by means of mail questionnaires. All possible major and minor complications such as haematomas, infections, pain and sensory alterations were investigated. We had no major complications. We only found minor sensory and pain complications. We were able to procure large amounts of cancellous bone graft through this method. This method of cancellous grafting reduces the rate of major complications, but there is no difference in the occurrence of postoperative pain as compared with standard techniques. The minor sensory complications are comparable with other methods of iliac spine harvesting. When performing iliac spine bone harvesting procedures,good knowledge of the nerve anatomy is of prominent importance.

Keywords : bone graft ; bone graft harvesting ; iliac crest ; acetabular reamer.

INTRODUCTION

Autogenous bone grafts are widely used both in trauma and orthopaedic surgery. Especially in treatment of delayed union or non-union of fractures, grafting is a reliable treatment to achieve bone healing. The anterior superior and posterior iliac spines are widely used donor sites because of their easy access. Numerous surgical techniques to obtain the grafts have been described. One of these techniques was used during hip arthroplasty for the first time in Kantonsspital Chur (Switzerland) and was described by Sanders and DiPasquale (*15*) and also by Dick (*7*) in 1986. Using a classic acetabular reamer, the surgeon was able to harvest copious amounts of cancellous bone graft from the anterior or posterior iliac spine. Compared to other accepted surgical procedures, some advantages of this technique should be the possibility to harvest large amounts of bone grafts with a minimal risk of postoperative bleeding, little postoperative pain at the donor site and ease of performance (*10, 15, 17*). However, complications are still possible such as nerve injury, haematomas, arterial injury, and postoperative infection.

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Table I. — A review of donor sites used in this study

	Left	Right	Total
Anterior	33	45	78
Posterior	8	2	10
Total	41	47	88

Table II. — Patient Demographics

Patients	N = 78	50 males : (64.1%)
		28 females : (43.9%)
Age	Average 46.4 years	Males : 43.9 years
		Females : 50.8 years
Operations	N = 88	Unilateral : 78
		Bilateral : 10

Table III. — A review of the indications for bone grafting

Avascular necrosis	Hip Humeral head	N = 15 N = 2	18.6% 2.5%
Osteotomy	Tibia	N = 2	2.5%
Revision	Total hip prosthesis	N = 4	5.0%
Fracture	Humerus	N = 7	8.6%
	Tibia	N = 7	8.6%
	Radius	N = 5	6.5%
	Femur	N = 4	5.0%
	Fibula	N = 1	1.2%
	Cuboid	N = 1	1.2%
	Calcaneum	N = 12	15.5%
Arthrodesis	Subtalar	N = 2	2.5%
Non-union	Radius	N = 1	1.2%
	Tibia	N = 17	21.0%

Although many studies describe high donor site morbidity in autogenous bone graft harvesting, very few focus on the morbidity using the acetabular reamer for harvesting bone grafts. Based on the already known complications, as reported in other studies, we tried to assess the frequency of discomfort in patients after this method of bone graft harvesting (*2, 3, 6, 8, 11, 12, 14, 16*).

MATERIALS AND METHODS

Eighty patients were selected for the study on the incidence of donor site complications. Two patients could not be located leaving 78 patients (50 males and 28 females) and 88 donor sites available for this study. The anterior superior iliac spine was mostly used. The posterior iliac spine was only harvested in 10 patients (table I). Seven of these patients needed large amounts of cancellous bone grafts for a complex tibial fracture. Another patient needed grafts to heal an infection of a calcaneus fracture, treated before by means of grafts from the anterior iliac crest. Ten of the patients needed a second reconstructive operation where bone grafts were also needed. All operations were performed between November 1994 and January 2002 by the same surgeon using the same technique. The average age of our population was 46.4 years at the time of bone harvesting (table II). A review of the indications is shown in table III.

Mail questionnaires, mainly composed of multiple choice questions were distributed to 78 patients. By means of an annexed letter, we explained the purpose of our study and we asked to send the results back. The questionnaire inquired about the type, distribution, severity and duration of symptoms present at the moment they received the letter. There were also questions about specific regions of sensitivity loss at the donor site. The patient could indicate on an anatomic drawing of the donor site the exact location of numbness or pain. By comparing the region on the drawing with the answers given we were able to check the results. The severity of persisting pain after surgery was evaluated on basis of a "visual analogue scale" that was included in the questionnaire. The time elapsed since the operation averaged 20.8 months, ranging from 6 months to 51 months.

Surgical technique

The patient was positioned supine on the operating table. A pillow was placed under the ipsilateral buttock to expose the anterior superior iliac spine. A slightly curved incision was made over the outer boarder of the spine, starting 2 cm behind the anterior superior spine. After cleavage of the subcutaneous tissues, the iliac crest was exposed. Splitting of the abductor origin from the iliac crest started 20 mm posterior to the anterior superior iliac prominence. Electrocautery close to the bone was used to release the hip abductors in one layer. Two sharp Hohmann retractors were used to expose the outer surface of the most prominent part of the iliac spine.

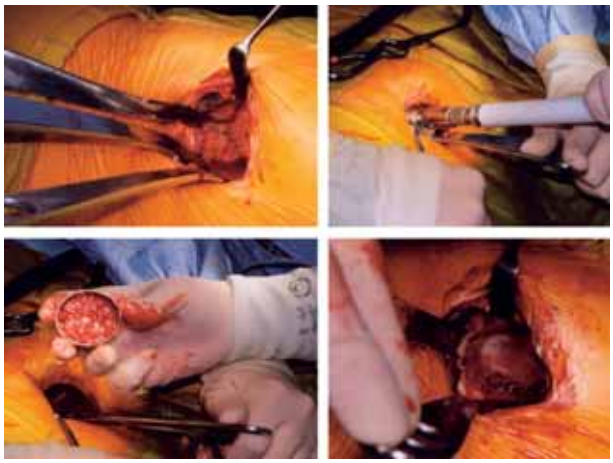

Fig. 1. — Operating technique

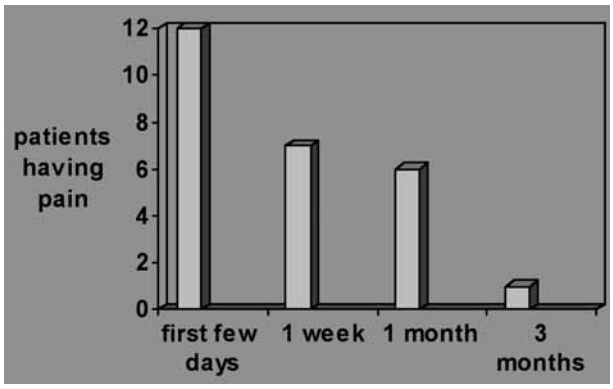

Fig. 2. — Patients with pain related to time interval after surgery.

This part of the spine was usually a little more prominent than the more anterior part. A 44-mm standard acetabular reamer was used to drill a semicircular hole in the outer table. The underlying cancellous bone was harvested by means of this reamer. Penetration of the inner table of the iliac bone was avoided at any time. Using the same acetabular reamer, a second or even a third hole was made adjacent to the first drill hole. The insertion of the external oblique abdominal muscle onto the crest was preserved (fig 1).

After wash out of the wound and meticulous haemostasis of all small bleeders (*5*), Spongostan swabs (Johnson and Johnson) were used to fill up the created holes in the outer table of the iliac spine and the wound was closed over one suction tube.

RESULTS

Our clinical study included 78 patients with 88 graft harvests. All possible major and minor complications were noted from the patient records and further investigated by questionnaires. We particularly inquired about pain, neurological injury, difficulty climbing stairs and inability rising from the sitting position. Further we looked for herniation of abdominal contents, vascular injuries, deep infections and haematomas, iliac wing fracture, urethral injury and peritoneal perforation.

None of the patients in the study suffered from problems of herniation over the crest, a rare complication caused by damage of the attachment of the abdominal wall muscles. Also vascular injuries and deep haematomas or deep infections did not occur in our population. Therefore, no patient had a revision on account of severe peri-operative complications.

Iliac wing fractures or sacroiliac instabilities are major complications, rarely appearing after anterior or posterior iliac spine harvesting. In our study, no patient complained of pain that could point to such pathology. Ureteral injury caused by damage deep in the sciatic notch and peritoneal perforation did not occur in our study.

In 29.5% (26 of 88) of the performed harvests, the patients still complained of pain at the donor site at the moment of the study, persisting even after 51 months in one. The severity of pain in the seven patients experiencing pain one month after surgery could be evaluated on basis of a “visual analogue scale” that was included in the questionnaire (fig 2). All patients still experiencing pain, indicated they never or rarely had to take analgesic drugs. Overall 70% of the patients had postoperative pain during less than one month.

There were 23 cases of minor neurological injuries diagnosed in the 88 performed operations (= 26.1%). Twenty different patients (17 anterior spines and 3 posterior spines) mentioned a feeling of numbness in a part of the distribution area of a specific nerve. Two of the patients who had posterior harvesting had already had a prior anterior

Table IV. — Minor neurological injuries

Nerve	Region of innervation	Injury
Lateral femoral cutaneous nerve	Large area on the lateral aspect of the thigh	9
Lateral cutaneous branch of the iliohypogastric nerve	Gluteal region more posteriorly than the lateral cutaneous branch of the subcostal nerve XII	7
Lateral cutaneous branch of the subcostal nerve XII	Gluteal area just below the anterior iliac crest	1
Ilioinguinal nerve	Large area of the groin	0
Superior cluneal nerves	Large area of the buttocks	3

harvesting. In nine cases, the neuralgia was localised in the area of the lateral femoral cutaneous nerve, and in seven other cases part of the iliohypogastric/subcostal nerve region was indicated. Three patients who had a posterior harvesting, complained of numbness and pain with physical contact in a lmited part of the buttocks.

One patient complained of specific pain in the gluteal area just below the anterior iliac crest (table IV). Thirteen patients had discomfort at one side wearing a belt and in 7 cases there was an inability to lie on the side of the graft.

Eighteen patients had difficulty climbing stairs or rising from the sitting position. These complications are caused by stripping of the outer table muscles, primarily the gluteus medius and maximus. Twelve of them had undergone posterior bone harvesting.

DISCUSSION

The surgical harvesting of autogenous bone graft from the anterior superior or posterior iliac spine is not without complications. Despite a number of possible major and minor complications, the iliac spine remains by far the most common donor site (*11*). This retrospective study reviews the frequency of complications following a surgical procedure, performed by the same surgeon using the same surgical skills and technique. Looking at the results of this study, donor site pain (29.5%) and minor neurological injury (26.1%) are the two most frequent complaints.

No patient needed daily intake of analgesics. Figure 2 moreover demonstrates that the pain is a temporary problem, resolving after several months without any surgical intervention (the longer the postoperative time, the fewer the complaints of pain at the donor site). This is confirmed in literature where no long lasting pain problems are mentioned.

Five sensory nerves are at risk while harvesting bone grafts from the anterior or posterior iliac crest. Anteriorly these are the lateral femoral cutaneous nerve, often presenting as a “meralgia paraesthetica”, the lateral cutaneous branch of the iliohypogastric nerve, the ilioinguinal nerve and finally the lateral cutaneous branch of the subcostal nerve XII. Posteriorly the superior cluneal nerves are liable to injury where they pierce the lumbar dorsal fascia and lie over the posterior iliac spine. Postoperative bleeding, infection and herniation of abdominal contents are rare complications, and did not occur in our population, possibly because we used a suction tube and spongostan swabs (Johnson and Johnson), we preserved the insertion of the external oblique abdominal muscles and avoided perforation of the inner table.

It is obvious that only small branches of the main sensory nerve were damaged : most of the patients describe numbness and dysaesthesia in only a limited part of the region innervated by one of the specific nerves (table IV).

According to Ahlmann *et al* (*1*) the posterior approach for harvesting bone from the iliac spine is much safer, but it almost always requires repositioning the patient. Some authors state that there is a safe area from 3-8 cm posterior to the anterior superior spine of the iliac crest. The more posterior the incision, the more the lateral cutaneous subcostal T-12 nerve is at risk. Our incision started 2 cm from the anterior superior spine, which is probably the reason why we only had one patient with lateral cutaneous subcostal nerve damage. The lateral cutaneous branch of the iliohypogastric

nerve lies more posterior and is almost never transsected in anterior harvesting.

The wide variance in nerve anatomy is also of importance. The lateral femoral cutaneous nerve has two important variants, either medial or posterior to the anterior superior iliac spine ; the posterior variant is at risk when harvesting bone anteriorly and most problems are seen indeed in the area of the lateral femoral cutaneous nerve. It is probably best to inform the patient about this complication.

We think that with good knowledge of the anatomy, nerve damage can be minimised. Nerve variance on the other hand remains a problem. The incision in relation to the anterior superior spine of the iliac crest should probably lie between 2 and 6 cm backwards.

In spite of the fact that all the data were collected by means of a questionnaire and without clinical examination, it seems to be clear that graft harvesting with an acetabular reamer was associated with a reduction in the incidence of herniation, peritoneal perforation and postoperative bleeding or infection. Other advantages of this technique include the procurement of copious amounts of bone graft and the ease of performance (limited assistance is necessary). However, as opposed to previous findings (*3*), this study shows that there is probably no significant reduction in postoperative pain or injury to the nerves. Equivalent and even lower incidences of these complications were described in other studies (*2, 3, 11, 13, 14*). Therefore it is important to inform the patients about possible numbness and temporary pain. In spite of these complaints, sixty-five patients would agree with a similar surgery if necessary in the future.

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