Acta Neurochir (Wien) (2006) 148: 1071–1074
DOI 10.1007/s00701-006-0864-8

Acta Neurochirurgica
Printed in Austria

Clinical Article

Evaluation of donor site pain after anterior iliac crest harvesting for cervical fusion: a prospective study on 50 patients

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Received November 2, 2005; accepted June 21, 2006; published online August 25, 2006

Summary

Background. Autologous anterior iliac crest bone graft is still widely considered the gold standard for anterior cervical fusion after discectomy or corporectomy. Postoperative pain at the donor site is one of the main disadvantages to this technique. This prospective study aimed to evaluate pain at the donor site, after careful, standardised bone harvesting.

Methods. From March 2003 to March 2004, a prospective study was performed in a single neurosurgical department on 50 patients who underwent anterior iliac crest bone harvesting using a standard and careful surgical technique. During a one year follow-up, patient donor site pain was assessed with a Visual Analogous Scale (VAS) at 2, 7 and 60 days from surgery and finally, by a telephone interview, at one year.

Findings. The duration of time in hospital ranged from 4 to 9 days. On the 2nd day after surgery, pain, according to the VAS score, was recorded as being >7 by 4 patients (8%), 5–7/10 by 27 patients and >5/10 in 19 cases. On the 7th day after surgery, none of the patients reported any VAS > 7, 1 patient's VAS score was 6/10 and 49 patients had a VAS < 5. At 2 month follow-up, 45 patients were completely without pain (VAS 0) and the remaining 5 had a VAS < 5. At one year, 46 patients reported no pain (one patient was lost to follow-up); three continued to have pain <5 in VAS scale.

Conclusions. After harvesting of bone from the iliac crest, using a standardised approach based on anatomised principles, most patients do not experience persisting pain at the donor site.

Keywords: Bone graft; cervical fusion; donor site pain; iliac crest.

Introduction

When cervical discectomy or corporectomy is performed, bicortical or tricortical grafts from the anterior iliac crest are used to promote fusion. Their benefits, as compared with allografts, include greater capacity for incorporation, osteoconduction and osteo-inductions [3, 10, 11, 13, 17, 20, 28, 31]. Their main disadvantage is postoperative pain at the donor site, a longer stay in hospital and patient dissatisfaction [11, 13, 14, 17, 25, 27]. Several methods to diminish these complications have been described [2, 6, 11, 12, 14–16, 24, 26, 31] and alternative grafts are being developed [11, 21, 29]. To provide a standard for comparison of different techniques we report the rate of the donor site morbidity that occurred after a standard and precise surgical method was used to harvest the graft.

Methods and materials

Over one year (March 2003 to March 2004), 50 consecutive patients, with cervical disc herniation, spondylosis and/or degenerative or traumatic cervical instability at one or more levels, underwent single or multiple cervical fusion with autologous iliac crest bone. Demographic and follow-up information included gender, date of surgery, site and side of bone graft harvested, size of the bone graft, number of cervical levels treated, severity of pain assessed by a analogue scan, i.e. pain frequency and duration, (VAS score), numbness, ambulatory status, interference with ability to work and patient satisfaction, (Table 1). All patients graded their pain intensity according to the VAS score (0 = no pain; 10 = most severe pain) at 2, 7 days and 2 months after surgery. Follow-up one year later was carried out by telephone interview.

Procedure for harvesting bone

Before the skin incision, the patients received 2 g of Amoxicillin/Clavulanate intravenously and Marcain/Epinephrine solution was injected thoroughly into to the involved areas (neck and iliac crest). In order to avoid injury to the lateral femoral cutaneous nerve and avulsion of the iliac spine itself, a short (<6 cm) skin incision was made, parallel to the anterior iliac crest starting from at least 2 cm supero-laterally from the Anterior Superior Iliac Spine (ASIS) (Fig. 1). The skin was retracted, and the dissection proceeded down to the superior border of the iliac

Table 1. *Demographic and clinical data*

	Gender	Age	Radiculopathy
Monoleveld: 12	6M–6F	34–63	10
Multileveled: 38	24M–14F	39–71	31

Fig. 1. Intra-operative pre-incision photograph showing position and extent of incision

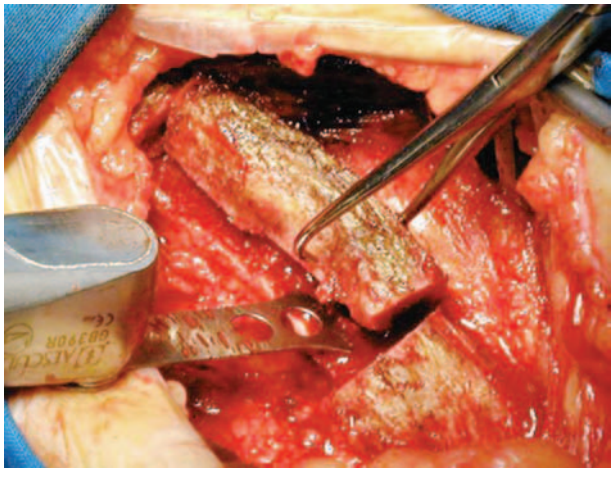

Fig. 2. Operative photograph showing tricortical bone harvesting from the ilium using the single-bladed oscillating bone saw for cervical multileveled strut

crest with strictly limited use of the electrocautery. Care was taken to cut through the fascia avoiding the muscles. The inner and outer bone surfaces were exposed using subperiosteal dissection, and a bone graft of the measured size was harvested from the ilium using a single-bladed oscillating bone saw for tricortical (Fig. 2) or, more rarely, bicortical bone. After meticulous haemostasis and application of intra-operative iodine solution, the medial and lateral periosteum, along with the fascia of the abdominal muscle, were repaired over the defect in the iliac crest. The subcutaneous tissue was then approximated and the skin incision closed with a running subcuticular stitch. No drainage was used.

Results

Fifty patients underwent anterior cervical fusion using iliac bone crest. All were available for follow-up, except for one patient.

Post-operative donor site pain evaluation (Fig. 3)

VAS estimation on the 2nd day: pain at the donor site was referred to being >7 by 4 patients, 5–7/10 by 27 patients, and <5/10 by 19 patients.

VAS estimation on the 7th day: none of the patients indicated a VAS > 7, 1 patient's VAS score was 6/10 and 49 patients reported a VAS < 5.

VAS estimation 2 months after surgery: 45 patients were without pain (VAS 0) and the remaining 5 had a VAS < 5.

After a one year follow-up (carried out by telephone interview): 46 patients had no pain (VAS = 0) while a frequent discontinuous local impeding nuisance (approximately estimated as VAS = 1) was repeatedly described by three patients. One patient living abroad was not included in the one year check-up.

The duration of hospitalization was from 4 to 9 days (mean 5.06) and depended on many factors: the use of antibiotics when plating was performed, pain impeding walking (leading to use of narcotic and non narcotic analgesics) and early complications. The use of analgesics was not consistently related to the VAS scale and for this reason, the duration of use of analgesics was not used in the evaluation of pain. No stress fracture of the iliac spine occurred and no visceral herniation occurred.

One patient had a superficial infection which was managed conservatively. One patient had a haematoma

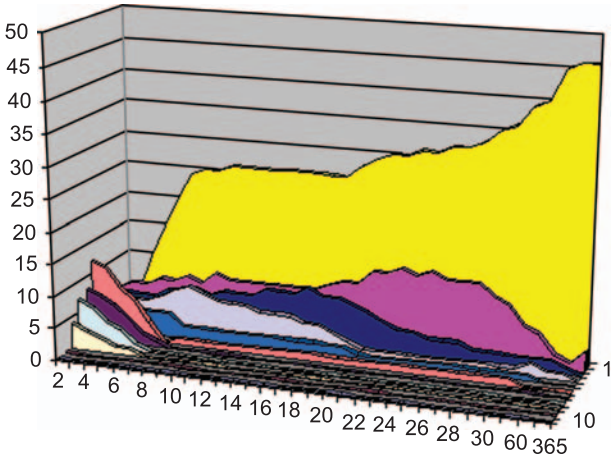

Fig. 3. Illustrative charts showing time-evolution of pain following VAS. 10; 9; 8; 7; 6; 5; 4; 3; 2; 1; 0

which resolved without drainage. Five patients had anterolateral thigh numbness which disappeared at the 2nd follow up. These patients were included in the analyses of pain only when this was reported. Cosmetic local deformity was always considered limited or imperceptible by the patients themselves.

Discussion

In the debate about whether or not to perform fusion after anterior cervical spine surgery, the occurrence of complications at the donor site is an important factor. Reported rates of complication after harvesting bi- or tricortical iliac bone range from 2.8 to 39%. Local pain is generally considered the main drawback of the procedure [2, 13, 14, 17, 27]. Our review of the literature on the causes and the potential measures to prevent donor site pain provided the rationale for our technique.

Neuro-anatomic and neuro-physiopathological considerations

There is evidence that the main causes of donor site pain included signals from intact nociceptors adjacent to a nerve injury site, bone micro or macro-fractures, haematomas and infections [1, 4, 5, 8, 17, 22, 23, 26, 30].

Nerve preservation

The *lateral femoral cutaneous nerve* (a sensory branch of the lumbar plexus) carries somesthesic sensibility from the lateral surface of the thigh. It crosses the ilium oblique and usually passes under the inguinal ligament medial to the ASIS. Placing skin incision at least 2 cm dorsal to the ASIS, reducing dissection along the inner iliac wall and performing gentle iliac muscle retraction are the means for minimizing the risk of post-operative donor site pain [1, 5, 17–19, 21, 22, 30].

The *ilioinguinal nerve* passes between the abdominal wall muscles and overlies the iliac muscle distally in the supero-medial thigh. Reduction of electrocauterization and iliac muscle retraction and avoidance of entrapment should prevent these injuries [1, 5, 17, 19].

The *lateral cutaneous branch of the subcostal nerve* may lie as close as 8 cm from the anterior superior iliac spine. This nerve is very vulnerable to injury when harvesting bone from the anterior iliac crest. Damage to this nerve may cause numbness in the region just below the anterior iliac crest and/or pain. Short incisions, with reduced muscle retraction and limited use of electric cauterization are helpful to prevent injury [1, 5, 7, 17, 19, 22].

Avoidance of other complications (microfractures, haematoma, muscle fibers injury, hernia, infection)

A bladed oscillating bone saw should be used instead of a gouge, chisel or other breaking device, in order to diminish microfractures. These may cause instability leading to further fractures while walking and/or cause severe injury to peripheral nociceptive fibers [8, 23]. On the other hand, staying distant from iliac spine prevents major fractures [8, 23]. Careful haemostasis and moderation in using electrocautery help to avoid pain, swelling and cosmetic dissatisfaction [5].

Avoidance of muscle stripping protects nervous and vascular muscular terminations and accurate suture of muscle and fascia prevents fluid collection and visceral herniation.

Intra-operative iodine application, attention to inspective technical rules and the administration of antibiotics are used to reduce infection.

Alternative for donor procedure on the iliac crest

Mesh donor site reconstruction, a technique that is supposed to fill the iliac crest contour and to reduce pain, is associated with extra cost and prolonged surgery [11, 16, 31] as are other methods of reconstruction using rib autograft and/or plate [9, 11, 12, 15]. Reconstruction with bone morphogenetic materials is not yet clinically available.

Conclusion

A careful standard technique, using a skin incision, <6 cm long, parallel to the anterior iliac crest, starting at least 2 cm supero-lateral to the ASIS, and minimised muscle retraction, limited use of electric cauterization, accurate haemostasis and the use of oscillating bone saw is followed by little or no persisting pain at the donor site in most patients undergoing cervical fusion.

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Comment

This is an open label prospective study on the incidence and severity of pain at the donor site after anterior iliac crest harvesting for cervical fusion. The topic is of interest: iliac crest autograft still presents the best osteo-inductive, osteoconductive and nonimmunogenic properties, despite the evolution of allograft and other spacers. The AA evaluated the presence of pain after a careful correct surgical technique for harvesting, avoiding nerve, soft tissues and bone injuries. Pain was evaluated utilising a VAS. They conclude that their accurate technique results in little or no persisting pain at donor site; this encourages the use of anterior iliac crest harvesting for cervical fusion.

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