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ORIGINAL PAPER

Impact of iliac crest bone graft harvesting on fusion rates and postoperative pain during instrumented posterolateral lumbar fusion

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Abstract This study aims to evaluate the influence of bone harvesting on postoperative pain and fusion rates. Group 1 patients received iliac crest bone graft (ICBG) either alone or augmented with local bone. Group 2 received only local bone. No statistical significance was found in radiological union or in the Oswestry Disability Index scores. Visual Analogue Scale scores showed less pain in group 2. Logistic regression showed no correlation between residual pain and occurrence of fusion. Harvesting ICBG did not appear to increase fusion rates and no relation was found between radiological non-union and pain.

Résumé Le but de cette étude est d'évaluer l'influence du prélèvement de greffe sur la douleur post-opératoire et le taux de fusion vertébrale. Matériel et méthode : dans le groupe I, les patients ont reçu une greffe de crête iliaque (ICBG) soit isolée, soit en association avec de l'os prélevé in situ, le groupe II ne recevant que de l'os prélevé in situ. Résultats : il n'y a pas de différence significative du point de vue fusion radiologique et du score d'Oswestry, de même en ce qui concerne la douleur évaluée par échelle visuelle analogique. Deuxièmement, il n'y a pas de corrélation entre la douleur et la fusion. Discussion : le prélèvement de greffes ne paraît pas augmenter les chances d'une meilleure fusion et nous n'avons pas trouvé de relation entre une pseudarthrose et la douleur.

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Introduction

Autologous iliac crest bone grafting (ICBG) is considered the gold standard in lumbar spinal fusion. Its harvesting is nevertheless linked with potential complications (e.g., blood loss, vascular injury, hernia, pelvic fracture, ureteral injury and neuropathy) [2, 4, 5, 8, 14]. Serious complications are nevertheless rare. Lasting pain is the most common side effect, reported in as many as 38% of cases [7].

Although donor site pain has been studied in cases where ICBG is harvested at a distance from the main procedure [13], cases in which harvesting through the same incision during posterior lumbar surgery have rarely been the main subject in studies. In addition, retrospective data is available on the use of ICBG during spinal procedures [7]; however to our knowledge no study has looked prospectively at the influence of bone harvesting on postoperative pain and fusion rates in a controlled manner. This study aims to address this issue in patients undergoing only one- or two-level posterolateral lumbar instrumented fusion.

Materials and methods

This study included a prospective cohort of patients operated upon at a single academic unit by a single surgeon over a 36-month period. A total of 59 consecutive patients undergoing one- or two-level posterolateral lumbar or lumbosacral spinal fusion were included. From these patients, 34 (group 1) received ICBG either alone (n=25) or augmented with local bone (n=9), and 25 (group 2) received only local bone. Group 1 patients had an average age of 63 years and group 2 of 60 years. Ten patients in group 1 and four in group

2 were regular smokers. Preoperative diagnosis was spinal stenosis with degenerative spondylolisthesis (n=37), degenerative disc disease (n=11), lumbar fracture (n=2) and isthmic spondylolisthesis (n=9).

The operation included posterolateral instrumented fusion either as the primary procedure or as an adjunct to spinal canal decompression. No randomisation was carried out as far as graft harvesting was concerned. When no decompression was performed or when the amount of local bone obtained from decompression material was deemed not of sufficient quantity (i.e., less than 20 ml for one-level and 40 ml for two-level fusion), ICBG was harvested (n=34, group 1). The remaining 25 patients (group 2) did not require harvesting of ICBG as local bone was used. Additionally, 17 patients from group 1 and 16 from group 2 had bone substitutes with the aim of increasing the total volume of graft material. The graft material was harvested through the same posterior incision from the outer table of the ilium and laid between the transverse processes of the vertebrae to be fused. Suction drains were used. In all patients titanium poly-axial pedicle screws were employed (Expedium, DePuy Spine, Inc., Raynham, MA). Operating time was prospectively recorded for all cases. Non-steroidal anti-inflammatory drugs (NSAIDs) were proscribed in the perioperative period until the third postoperative month. In the postoperative period a soft lumbar support was prescribed for 3 months and active physiotherapy from the third postoperative month onwards for 6 weeks.

Patients were followed up clinically and radiologically for 1 year postoperatively. Statistical analyses were performed using Fisher's exact test, two-tailed unpaired t-test and a logistic regression. Radiological fusion was assessed using published radiological criteria [3] at 1 year by an independent observer, blinded to the type of graft used. Clinical outcome measures included the Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI) [6], both of which were recorded at 3 months and at 1 year.

Results

Radiological union at 1 year was present in 23 out of the 34 (68%) cases in group 1 and 19 out of the 25 (76%) cases in group 2. This observed difference in fusion between groups was not statistically significant (p=0.8). One haematoma occurred in a single patient in group 1, and one seroma occurred in a group 2 patient. Two patients, both in group 1, suffered symptomatic pulmonary emboli during the immediate postoperative period. All four of the aforementioned cases had otherwise uneventful recoveries.

The average preoperative ODI was 50 and 55 for group 1 and 2, respectively, while the average preoperative VAS was 8 for both group 1 and 2 (p=0.3 and p=0.9, respectively). The average ODI at 3 months was 25 in group 1 and 30 in group 2. This difference between ODI scores was not statistically significant (p=0.3). There was also no statistically significant difference (p=0.3) between the average VAS score reported at 3 months for group 1 (VAS=3.9) as compared to group 2 (VAS=4). The average ODI at 1 year was 28 in group 1 and 23 in group 2. This difference was once again not statistically significant (p=0.3). The average difference in VAS scores reported at 1 year, however, between patients in group 1 (VAS=4.5) and those in group 2 (VAS=2.8) was statistically significant (p=0.03).

A mean operating time of 250 and 255 min was recorded for group 1 and group 2, respectively. No statistically significant difference was found comparing these operative time means (p=0.82). A logistic regression showed no correlation between residual pain and preoperative diagnosis or occurrence of fusion. At 1 year only seven and four patients from group 1 and group 2, respectively, reported having no pain at all on the VAS (p=0.7). Twelve patients in group 1 and five in group 2 failed to improve their ODI by more than 15 points at 1 year. This difference was not statistically significant (p=0.3).

Discussion

In general, pain in relation with harvesting ICBG has been reported in several series. These include not only spinal patients, but also oral surgery and other orthopaedic reconstructive procedures [9]. Such studies report an incidence ranging from as little as 2.5% [15] to as much as 38% [7].

In a large retrospective study evaluating the morbidity of ICBG harvesting for several orthopaedic procedures, 67% of cases underwent posterior crest harvesting through the same incision as for lumbar spine surgery [7]. Pain was reported in 38% of these patients in the first 6 months after surgery, including those who underwent non-spinal procedures, and in 18% at a 2-year follow-up. Interestingly, 50% of the patients reporting lasting pain were those who underwent a spinal procedure. At both the 6-month (42% vs. 18%) and 2-year (21% vs. 6%) follow-up intervals the proportion of patients reporting pain at the graft site was greater for the spinal group. Nevertheless, no quantification of the pain was attempted in their study.

In another study looking at donor site morbidity following anterior spinal fusion, the authors noted that chronic pain at the anterior iliac crest occurred in 25% of patients [13]. Looking into this in more detail, the authors report that the incidence of donor site pain was substantially higher in patients who felt that the fusion procedure had not relieved their back pain. The authors suggest the presence of a possible psychological element in the perception of donor site pain.

Only a few studies have looked at the contribution of posterior graft harvesting to persistent pain following lumbar spine surgery. A study comparing harvesting using the same or a separate posterior incision in posterior lumbar surgery found that the patients in the same incision group reported less donor site pain [1]. A separate study looking at the bone harvesting technique, comparing outer table and intracortical harvesting, found that the technique itself did not appear to play a role in the overall clinical result [10]. One other study compared in a non-randomised manner clinical and radiological results of two groups of posterolateral fusion of which the first group had ICBG harvested and the other only local bone issued from the decompression material. Even though no difference was noted in the ODI, fusion rates in multilevel cases were lower in the local bone group [12], but not in single level cases. Only one study has looked prospectively at ICBG morbidity, but cervical and thoracic cases were also included along with lumbar procedures [11]. Furthermore no control group was available, and fusion rates were not studied.

In our study we found that the functional outcome was similar for both groups at 3 and 12 months. Although the perceived pain was similar at 3 months, it remained significantly higher in the ICBG group at 1 year. The hypothesis that more patients in the ICBG group could have more pain because they failed to improve their function more than the minimal clinical significant difference in ODI (widely accepted now as 15 points) [16] was also tested in our study. The results suggest that this does not appear to be the case since there was no difference in the number of 'failed surgery' cases between the two groups. It is difficult however to differentiate low back pain as a result of failed surgery from donor site pain. A larger scale prospective randomised trial would be needed to test the hypothesis that ICBG harvesting alone results in significantly higher pain levels. It is nevertheless accepted that ICBG harvesting is related to morbidity and possibly lasting pain. Efforts should be made to either improve harvesting techniques or generalise the use of bone substitutes following adequate clinical testing proving their equivalence to autologous bone.

In summary, the results from this study suggest that harvesting ICBG does not appear to increase fusion rates, but is probably linked to lasting pain. Furthermore in our results no relation was observed between radiological non-union and pain.

References

1. Bezer M, Kocaoglu B, Aydin N, Guven O (2004) Comparison of traditional and intrafascial iliac crest bone-graft harvesting in lumbar spinal surgery. Int Orthop 28:325–328
2. Catinella FP, De Laria GA, De Wald RL (1990) False aneurysm of the superior gluteal artery. A complication of iliac crest bone grafting. Spine 15:1360–1362
3. Christensen FB, Laursen M, Gelineck J, Eiskjaer SP, Thomsen K, Bunger CE (2001) Interobserver and intraobserver agreement of radiograph interpretation with and without pedicle screw implants: the need for a detailed classification system in posterolateral spinal fusion. Spine 26:538–543
4. Coventry MB, Tapper EM (1972) Pelvic instability: a consequence of removing iliac bone for grafting. J Bone Jt Surg, Am Vol 54:83–101
5. Escalas F, DeWald RL (1977) Combined traumatic arteriovenous fistula and ureteral injury: a complication of iliac bone-grafting. J Bone Jt Surg, Am Vol 59:270–271
6. Fairbank JC, Couper J, Davies JB, O'Brien JP (1980) The Oswestry low back pain disability questionnaire. Physiotherapy 66:271–273
7. Goulet JA, Senunas LE, DeSilva GL, Greenfield ML (1997) Autogenous iliac crest bone graft. Complications and functional assessment. Clin Orthop Relat Res 339:76–81
8. Hamad MM, Majeed SA (1989) Incisional hernia through iliac crest defects. A report of three cases with a review of the literature. [Review] [12 refs]. Arch Orthop Trauma Surg 108:383–385
9. Joshi A, Kostakis GC (2004) An investigation of post-operative morbidity following iliac crest graft harvesting.[see comment]. Br Dent J 196:167–171
10. Mirovsky Y, Neuwirth MG (2000) Comparison between the outer table and intracortical methods of obtaining autogenous bone graft from the iliac crest. Spine 25:1722–1725
11. Robertson PA, Wray AC (2001) Natural history of posterior iliac crest bone graft donation for spinal surgery: a prospective analysis of morbidity. Spine 26:1473–1476
12. Sengupta DK, Truumees E, Patel CK, Kazmierczak C, Hughes B, Elders G, Herkowitz HN (2006) Outcome of local bone versus autogenous iliac crest bone graft in the instrumented posterolateral fusion of the lumbar spine. Spine 31:985–991
13. Summers BN, Eisenstein SM (1989) Donor site pain from the ilium. A complication of lumbar spine fusion. J Bone Jt Surg, Br Vol 71:677–680
14. Ubhi CS, Morris DL (1984) Fracture and herniation of bowel at bone graft donor site in the iliac crest. Injury 16:202–203
15. Younger EM, Chapman MW (1989) Morbidity at bone graft donor sites. J Orthop Trauma 3:192–195
16. Zigler J, Delamarter R, Spivak JM, Linovitz RJ, Danielson GO III, Haider TT, Cammisa F, Zuchermann J, Balderston R, Kitchel S, Foley K, Watkins R, Bradford D, Yue J, Yuan H, Herkowitz H, Geiger D, Bendo J, Peppers T, Sachs B, Girardi F, Kropf M, Goldstein J (2007) Results of the prospective, randomized, multicenter Food and Drug Administration investigational device exemption study of the ProDisc-L total disc replacement versus circumferential fusion for the treatment of 1-level degenerative disc disease. Spine 32:1155–1162