Injury to the lateral femoral cutaneous nerve during harvest of iliac bone graft, with reference to the size of the graft

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In patients who underwent autogenous iliac bone grafting we studied prospectively injury to the lateral femoral cutaneous nerve (LFCN) in relation to the size (length, depth, width) of the graft. We also examined the neurological deficit, by questioning them about numbness and/or pain in the lateral thigh.

The risk of injury was significantly higher in those in whom the depth of the graft was more than 30 mm. With regard to the length of the graft the incidence of nerve injury was 20% when the graft was 45 mm long or more, 16% when it was between 30 mm and 45 mm long, and 8% when it was less than 30 mm long. We should inform patients of the possibility of such injury, and take size into consideration when harvesting grafts from the ilium.

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Injury to the lateral femoral cutaneous nerve (LFCN) causes numbness, burning, itching, and pain, known as meralgia paraesthetica, over the lateral aspect of the thigh. It has been reported after harvesting of anterior iliac bone graft, laparoscopic repair of an inguinal hernia, and in renal transplantation.

It is recommended that an incision should be terminated 15 to 20 mm posterior to the anterior superior iliac spine (ASIS) in order to avoid injury to the LFCN. Many studies have shown that harvesting of iliac bone graft carries a risk of meralgia paraesthetica. Although the LFCN usually emerges from the lateral border of the psoas major muscle and crosses the ilium towards the ASIS, its course is variable.

The neuropathy which occurs after harvesting iliac bone graft suggests that the nerve may be vulnerable because of variations in its anatomical course or location. It occasionally runs across the iliac crest 2.0 cm posterior to the ASIS and may be injured at this site during exposure of the crest. In some cases, it crosses close to the iliacus muscle along the iliac crest and may be damaged by ligation, electrocautery or retraction through the iliacus muscle.

Based on a clinical investigation, it has been reported that harvesting iliac bone graft causes injury to the LFCN in about 10% of patients. The size of the bone graft which is harvested may also influence the incidence of injuries to this nerve. When a large piece of the iliac bone is removed, the incision may be long and the iliacus muscle widely retracted. Thus, the risk will increase with increasing size of the graft. In this study we have investigated this injury in patients who underwent iliac-bone grafting and have related the incidence of injury to the size of the graft.

Patients and Methods

We prospectively examined 212 patients (144 men and 68 women) who underwent harvesting of iliac bone graft between 1993 and 2000. This represented all patients who had harvesting of bone graft from the anterior ilium, except those undergoing surgery to the hip, since their wounds involved the lateral aspect of the thigh. The mean age of the patients was 43.1 ± 14.8 years (10 to 77). The types of operation were spinal interbody fusion in 174, fusion of a pseudarthrosis or other, surgery for ununited fractures in 34, and other surgery in four. Of the spinal fusions, 50 were performed on the cervical spine, 119 on the lumbar spine, and five on the thoracolumbar spine. When the bone graft was taken, the incision overlying and parallel to the iliac crest terminated at least 2 cm posterior to the ASIS. The length of the incision, which ranged from 3 to 9 cm, was determined by the length of bone graft which was required. After subperiosteal stripping of the iliacus muscle it was retracted to expose the ilium. Graft was obtained using an osteotome, either as a tricortical block incorporating the crest (Fig. 1a), as a bicortical block preserving the crest (Fig. 1b), or as the inner table of the ilium (Fig. 1c). The graft from 176 patients involved both the inner and the outer tables, and that from 36 only the inner table.

The size (length, depth, and width) of the graft was...
recorded. The length was measured along the iliac crest and the depth on the inner table from the crest to the margin of the harvested bone (Fig. 2). The patients were classified according to the length of graft and divided into three groups as follows: less than 30 mm (group a), between 30 and 45 mm (group b), and 45 mm and more (group c). The small size is usually used for a one-level cervical interbody fusion and for fusion of a pseudarthrosis, the medium size for lumbar interbody fusion or a two-level cervical fusion, and the large size for a thoracolumbar interbody fusion or a three- or four-level cervical fusion. The patients were also divided into two groups according to the depth of the graft: less than 30 mm (group 1), or 30 mm or more (group 2). For the width of the graft, there were two types, one in which both the inner and the outer tables were harvested, and the other in which only the inner table was harvested.

Local sensory changes were recorded. We used the pin-prick test to determine neurological deficit and questioned the patients about numbness, itching, burning, and/or pain on the lateral aspect of the thigh. Patients with sensory changes were re-examined four weeks after surgery and those with meralgia paraesthetica for more than one year. The relationship between the size of the graft and the incidence of sensory changes was studied.

For statistical analysis, an unpaired Student t-test and chi-squared test were used. A p value of less than 0.05 was considered to be statistically significant.

Results

There were 51 patients in group a, 136 in group b, and 25 in group c, and 82 in group 1 and 130 in group 2. Thus there was a total of six groups (Table I). With regard to the depth of the graft, the incidence of meralgia paraesthetica was 7% in group 1 and 27% in group 2. This difference was statistically significant (p = 0.004). With reference to the length of the graft, the incidence of meralgia paraesthetica was 8% in group a, 16% in group b, and 20% in group c. This difference was not statistically significant (p = 0.534). The incidence in the six groups is shown in Table I. There was a statistically significant difference in the six groups (p = 0.0108).
Thus, of 212 patients who underwent harvesting of iliac bone graft, meralgia paraesthetica was noted in 41 (19%) after surgery. It was found in 31 (22%) of the 144 men, and in 10 (15%) of the 68 women. There was no statistically significant difference with regard to gender (p = 0.240). Of 176 patients with grafts from both the inner and outer tables, the condition was found in 39 (22%), and of 36 patients with grafts from only the inner table, it was found in two (6%). There was a statistically significant difference between patients whose grafts involved both the inner and outer tables and those in whom only the inner table was involved (p = 0.0281). Of the 41 patients who had meralgia paraesthetica, eight recovered spontaneously within four weeks. Of the remaining 33 patients, 29 have been followed up for more than one year and the symptoms have resolved in 15.

In the patients who suffered from this condition, the mean length of graft was 37 ± 10 mm (20 to 70), and the mean depth was 33 ± 8 mm (15 to 40). In patients who did not suffer from it, the mean length was 34 ± 12 mm (15 to 70), and the mean depth 29 ± 11 mm (10 to 50). There was a statistically significant difference between the patients with and without meralgia paraesthetica with regard to the depth of graft (p = 0.0154), but there was no statistically significant difference with regard to the length (p = 0.213). The mean age of the patients who suffered from meralgia was 43 ± 12 years (21 to 70), and in those who did not it was 43 ± 15 years (10 to 77). There was no statistically significant difference between the ages of patients with and without meralgia.

### Discussion

The incidence of LFCN injury in patients undergoing harvesting of iliac bone graft may be 10%.

Laurie et al. reported that five of 60 patients (8.3%) had hyperaesthesia or anaesthesia over the distribution of the LFCN in the thigh. However, incidences of between 1.7% and 31% have been reported. Cockin reviewed 118 cases in which iliac bone grafts were taken and found two cases of meralgia paraesthetica. However, a clinical study, investigating donor site morbidity in 261 cases, reported local sensory changes in 56. This variation in the incidence is probably related to differences in the size of the grafts which were harvested. Thus, the type of surgery being undertaken determines the incidence of meralgia paraesthetica.

The condition occurred in about 19% of our cases despite the fact that the grafts were harvested in the routine manner. This may indicate that some of the LFCNs which are damaged have an abnormal anatomical course or location. In a macroscopic anatomical study, Nathan dissected 60 LFCNs and found that two (3.3%) did not pass under the inguinal ligament, but crossed directly over the iliac crest. Dibenedetto et al. examined 72 cadavers, and reported that in 11% the LFCN lay within 1 cm of the ASIS. Murata et al. studied the anatomy of this nerve in formalin-embalmed cadavers. Of the 205 nerves studied, four (2.0%) passed more than 20 mm posterior to the ASIS, and 18 (8.8%) crossed the iliacus muscle within 30 mm of the iliac crest at a point 5 cm posterior to the ASIS. These data suggest that about 2% of patients who undergo harvesting of anterior iliac bone graft have a high risk of nerve injury during the subperiosteal stripping of the iliacus muscle, and 8.8% have a risk of nerve injury by direct ligation, electrosurgery or retraction through the iliacus muscle. We suspect that pressure on the nerve during minor retraction of iliacus occurred in the eight patients in our series who recovered spontaneously within four weeks and that ligation, electrocautery or marked retraction of the nerve through iliacus occurred in the other 33. Furthermore, considering the anatomical variation of the LFCN, 2% have an abnormal nerve which crosses the iliac crest more than 2 cm posterior to the ASIS. This means that four or five patients in our series of 212 patients had such an abnormality. These patients may have suffered direct injury during exposure of the iliac crest.

We have shown that the risk of nerve injury is significantly higher in cases in which graft which is deeper than 30 mm is harvested. As for the length of the graft, the incidence was 20% when the graft was 45 mm long or more, 16% when it was 30 mm or more, and 8% when it was less than 30 mm long. When harvesting iliac bone grafts of small size (less than 30 × 30 mm), the incidence of meralgia paraesthetica is only 6%. Surgery in which grafts of large size are harvested carries a high risk of injury to the LFCN. We should therefore inform patients of the possibility of such injury, and carefully consider the size of graft which is required, before harvesting.
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References