Autologous donor site morbidity after posterior iliac crest bone harvest. Comparative analysis of two surgical techniques

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ABSTRACT

Introduction: The autologous bone graft harvested from the posterior iliac crest for spinal fusion presents osteogenic, osteoinductive and osteoconductive advantages; however, its disadvantages include a limited amount of available material and an incidence of donor site complications ranging from 8% to 39%, including donor site pain, neurovascular injury and pelvic fractures. **Objectives:** To compare the posterior iliac crest corticoancellous harvest using a chisel-gouge approach versus a curette approach; to evaluate intra-operative and post-operative complications; to quantify the harvested bone; to grade donor site pain. **Materials and Methods:** Prospective randomized study in 34 consecutive patients for posterolateral fusion of the thoracic and lumbosacral spine; 26 women and 8 men, between 15 and 79 years of age. Subjects were divided into two groups. Group 1: curette approach; and Group 2: chisel-gouge approach. The evaluation included: the amount of bone harvested, the time required and complications. **Results:** Group 1: 19 patients, 14 women and 5 men. The procedure lasted an average of 9.94min, and the harvested material averaged 9.26g. Denis Pain Scale scores at the first follow-up survey: 13 patients scored 1; 5 scored 2; 1 scored 3. Denis Pain Scale scores at the third follow-up survey: 15 patients scored 1; 2 scored 2; 1 scored 3. Group 2: 15 patients, 12 women and 3 men. The procedure lasted an average of 8.6min, and the harvested material averaged 9.26g. Denis Pain Scale scores at their first follow-up: 10 patients scored 1; 2 scored 2; 3 scored 3. At the third follow-up, all patients scored 1. **Conclusions:** We observed that the posterior iliac crest graft harvested using the chisel-gouge approach is faster, provides more graft and results in less pain at 60 days.
Key words: Graft; autologous; arthrodesis, pain.
Level of Evidence: II

Morbilidad de la zona dadora de injerto óseo autólogo de cresta ilíaca por vía posterior. Análisis de dos técnicas quirúrgicas

RESUMEN

El injerto óseo autólogo tomado de cresta ilíaca posterior para artrodesis de columna presenta ventajas: es osteogénico, osteoinductor y osteoconductor, y sus desventajas son ofrecer una cantidad limitada y las complicaciones del sitio dador (8-39%), como dolor de la zona dadora, lesión neurovascular y fracturas de pelvis. Los objetivos de este estudio fueron comparar la toma de injerto cortico-esponjoso de cresta ilíaca posterior mediante técnica con escoplo gubia frente a la toma con cureta; evaluar las complicaciones intraoperatorias y posoperatorias; cuantificar la cantidad recolectada y graduar el dolor en la zona dadora. **Materiales y Métodos:** Estudio prospectivo aleatorizado de 34 pacientes consecutivos para artrodesis posterolateral de columna torácica y lumbosacra (26 mujeres y 8 varones, de entre 15 y 79 años de edad). Se los dividió en dos grupos: grupo 1, cureta y grupo 2, escoplo gubia. Se evaluaron el peso obtenido, el tiempo requerido y las complicaciones. **Resultados:** Grupo 1: 19 pacientes (14 mujeres y 5 hombres). Se requirieron, en promedio, 9.94 min para obtener 9,26 g. En el primer control, 13 pacientes presentaron un valor 1; 5, un valor 2 y uno, un valor 3. En el tercer control, 15 tuvieron un puntaje 1; 2, un puntaje 2 y 2, un puntaje 3. Grupo 2: 15 pacientes (12 mujeres y 3 hombres). Se tomaron 11,26 g en 8,6 min. En puntaje de dolor en el primer control fue: 10 pacientes con un valor 1; 2, con un valor 2 y 3, con un valor 3, todos tuvieron un puntaje 1 en el tercer control. **Conclusiones:** La toma de injerto de cresta ilíaca posterior utilizando escoplo gubia es más rápida, recolecta más injerto y provoca menos dolor a los 60 días.
Palabras clave: Injerto; autólogo; artrodesis, dolor.
Nivel de Evidencia: II

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INTRODUCTION

The autologous bone graft harvested from the posterior iliac crest for spinal fusion presents osteogenic, osteoinductive and osteoconductive advantages; however, its disadvantages include a limited amount of available material and the donor site complications.[1,2] The use of non-structural bone graft harvested from the iliac crest through a posterior approach is a well known technique that was described more than 50 years ago.

Like all medical procedures, this harvesting procedure is not without complications. Relevant studies have indicated complication rates ranging from 8% to 39%,[2,3] including donor site pain, neurovascular injury and pelvic fractures.[2]

Donor site pain is due to the injury inflicted on the sensory endings of several cluneal nerves, injury which may result from the size of the incision and the traction of tissues (Figure 1).[1-8]

The purposes of our study were: 1) to compare the iliac crest corticocancellous harvest using a chisel-gouge approach versus a cancellous harvest using a curette approach; 2) to evaluate both approaches intra-operative and post-operative complications; 3) to quantify the harvested bone in search of differences between both techniques; and 4) to grade donor site pain.

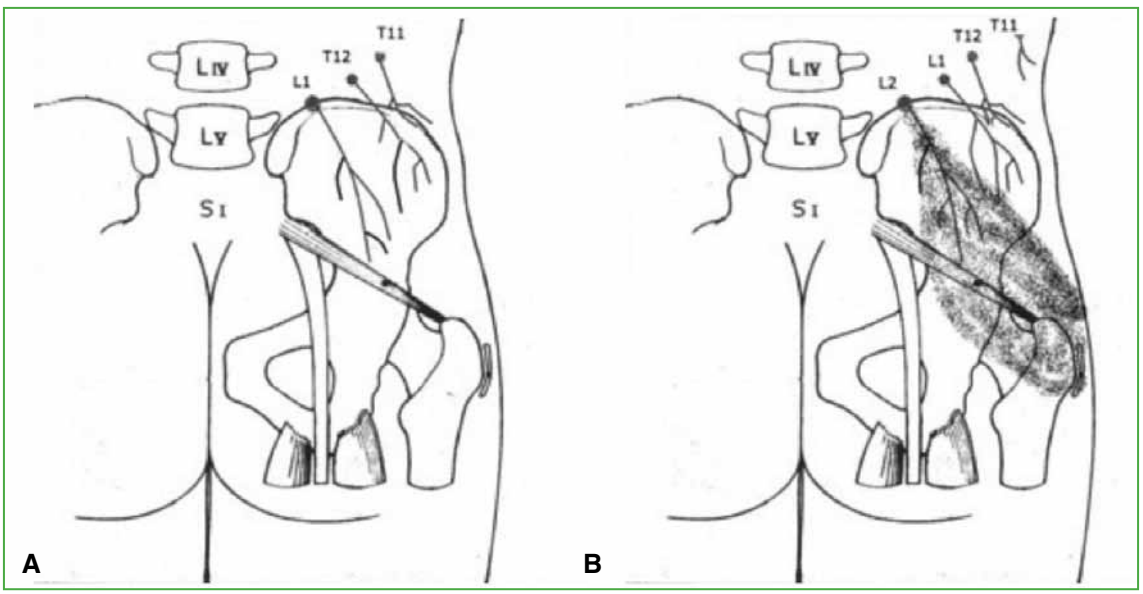

Figure 1. A. Cluneal nerve variations and anatomical relationships. B. The shaded area is where the pain associated to the damaged cluneal nerves in experienced.

MATERIALS AND METHODS

We conducted a prospective, randomized, blind study, during a 12-month period, in order to compare the morbidity of the posterior iliac crest donor site. The trial population consisted of 34 consecutive patients for posterolateral fusion of the thoracic and lumbosacral spine: 26 women and 8 men, ranging from 15 to 79 years of age (average age, 52.4 years).

Inclusion criteria were: primary surgery for posterior approach fusion; segment located between L1 and L4; and ability to comply with a telephone follow-up. Patients with history of iliac trauma or surgeries, scoliosis, tumors, and infections were excluded.

In all patients, the graft was harvested by a surgeon other than primary surgeon, using the double incision technique with two different approaches: the curette approach (Figure 2) and the chisel-gouge approach (Figure 3). Patients were randomly allocated into the different approach groups through a raffle conducted minutes before the graft harvest. The raffle consisted of 40 paperboard pieces, 20 labeled “option 1” and 20 labeled “option 2”, from which a nursing assistant picked one at random.

Figure 2. Types of curettes used for iliac crest bone harvesting.

Figure 3. Chisel-gouge used for iliac crest bone harvesting.

The material obtained through the iliac crest harvest was weighed on a digital scale (Figure 4) and apart from the graft from the local bone.

The procedure was timed from the beginning of the osseous procedure until the completion of the cancellous bone harvest. We detailed the encountered intraoperative complications associated with the technique.

Figure 4. Digital scale used to weigh the bone graft harvested from the iliac crest and the local bone.

For the postoperative follow-up, a clerical assistant, who, like the patient, had no knowledge on which approach had been used, collected data via a telephone survey at days 15, 30 and 60 from all patients, and at days 90 and 180 from the patients who had complained from pain in the first follow-up controls. We evaluated pain by the Denis scale (Table 1) and the donor site complications (infection, scarring, etc.).

The data collected were analyzed through the EpiInfo system, using tests for unpaired data (Pearson's chi-squared test).

RESULTS

Group 1 (curette)

The group consisted of 19 patients: 14 women and 5 men, with a mean age of 52.06 years.

The osseous procedure lasted an average of 9.94min (range, 5-15min), and the harvested material averaged 9.26g (range, 4-16g)

Denis Pain Scale scores: 1) at the first follow-up survey 13 patients scored 1, 5 scored 2, and only 1 scored 3; 2) at the second follow-up survey 14 patients scored 1, 4 scored 2, and the same patient remained with a score of 3; 3) at the third follow-up survey 15 patients scored 1, 2 scored 2, and 1 scored 3 (Table 2). Only two patients (cases 11 and 12) continued with the follow-up, as they scored 2 at the 90-day evaluation; one of them (case 12) scored 1 at the 180-day evaluation.

Table 1. Denis pain scale

P1: No pain
P2: Occasional, minimal pain with no need for medication
P3: Moderate pain, occasional medications, no interruption in work or activities of daily living
P4: Moderate to severe pain, occasional absence from work, significant change in activities of daily living
P5: Constant severe pain, chronic medications

Table 2. Pain in Group 1 (curette)

Patient	Pain		
	1	2	3
2	2	3	1
5	1	1	1
8	2	1	1
10	1	1	1
11	2	2	2
12	3	1	3
15	1	2	1
16	2	2	1
17	1	1	1
19	1	1	1
24	1	1	2
26	1	1	1
28	1	1	1
29	2	1	1
30	1	1	1
31	1	1	1
32	1	1	1
33	1	1	1
34	1	2	3

At the first evaluation, two patients had wound discharges: serous (case 2), and serosanguineous (case 8). There was no type of wound discharge recorded at the following evaluations.

Patient 8 presented with wound dehiscence only at the first evaluation.

Group 2 (chisel-gouge)

The group consisted of 15 patients: 12 women and 3 men, with a mean age of 52.4 years. The osseous procedure lasted an average of 8.6 min (range, 3-19min), and the harvested material averaged 11.26 g (range, 6-21g).

Denis Pain Scale scores: at the first follow-up survey 10 patients scored 1, 2 scored 2, and only 3 scored 3; 2) at the second follow-up survey 13 patients scored 1, 2 scored 2, and no patient scored 3; 3) at the third follow-up survey all patients scored 1 (Table 3).

Table 3. Pain in Group 2 (chisel-gouge)

Patient	Pain		
	1	2	3
1	3	1	1
3	1	2	1
4	1	1	1
6	3	1	1
7	2	1	1
9	1	1	1
13	1	1	1
14	1	1	1
18	3	2	1
20	1	1	1
21	2	1	1
22	1	1	1
23	1	1	1
25	1	1	1
27	1	1	1

At the first evaluation, one patient (case 1) had a purulent wound discharge, with a culture positive for with a *Staphylococcus aureus* positive culture. The patient underwent surgical cleaning and was administered specific antibiotic therapy. At the second evaluation, the patient had a serous discharge and presented no wound discharge at the following evaluations.

The groups results showed some differences in terms of the time required for each approach: 1.35min (P>0.05) and 2g (P>0.05) both in favor of Group 2; these differences are not statistically significant.

A similar analysis results from comparing the pain evolution of the three main evaluations: Group 1 averaged 1.37, 1.32, and 1.32 while Group 2 averaged 1.47, 1.20, and 1, at the first, second and third evaluations respectively (P>0.05) (Figure 5).

No differences were detected with respect to the other known morbidities associated with graft harvesting.

DISCUSSION

Autologous grafts provide high osteoinduction and osteoconduction, and have low immunogenicity, and for these reasons is the method of choice for most spinal surgeons, particularly for long fusions, where local bone graft may be scarce.[1,2,7]

Donor site pain is not exclusive to the posterior approach, which is also the most common discomfort associated with the anterior graft harvest;[1] another residual symptom, although less frequent, is sensory loss with a maximum peak at month 6.[2]

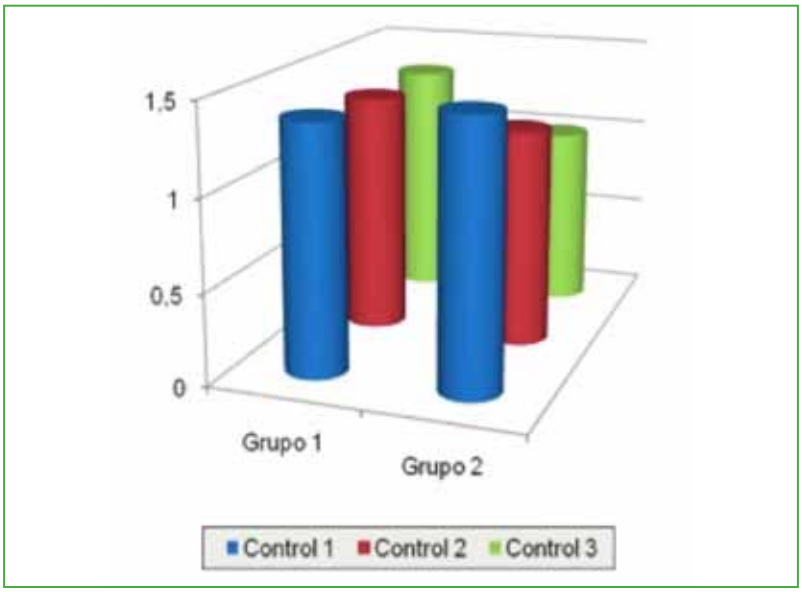

Figure 5. Postoperative pain evolution of both groups in each evaluation.

Delawi *et al*.,[4] in a study on the donor site incidence in patients who underwent posterior spinal fusion due to spine fractures, found pain is more prominent in fusions that included L3 or extended below this level compared to fusions cranial to L3. These authors concluded that the donor site pain may be overestimated, as pain may be associated with the close proximity to the lumbar surgery.

There are several techniques for posterior iliac crest bone harvesting. In our practice, we use two different approaches to harvest the material, each one of them supported by different theoretical arguments.

The harvest with curette results in less damage inflicted on the periosteum, and thus is thought to cause less pain. This approach requires uncovering only a few square centimeters from the cortex of the posterolateral iliac spine to allow for the harvest of exclusively cancellous material after creating a surgical window with a gouge. In addition, this approach may decrease the occurrence of other known complications, such as vascular injury, bone injury, etc. The disadvantage is a potential smaller graft, as less graft material may be harvested.[5]

The iliac crest bone graft harvest used in Group 2 (chisel-gouge approach) is a classic technique where the gluteus muscles are disinserted and a chisel gouge is used to harvest cancellous chip grafts. The rate of neurovascular complications and iliac lesions may be higher. Although this approach may result in more damage inflicted on the periosteum, it provides more graft material.[2,4]

CONCLUSIONS

We observed that the posterior iliac crest graft harvest using the chisel-gouge approach is faster (1.35min faster on average), provides more graft (2g more on average) and results in less pain at 60 days. This data shows a trend towards significance.

No difference was found with respect to the presence of surgical wound discharge and its scarring between both groups.

Conflict of interests: Authors claim they do not have any conflict of interest.

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