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Case study

The patient-reported outcome of chronic pain after the harvest of anterior iliac bone for anterior cervical arthrodesis

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ABSTRACT

Background: Anterior cervical fusion (ACF) with autologous iliac bone graft is a traditional surgical method, but high rate of chronic pain (30%) at the anterior iliac crest presents a considerable hindrance to harvesting iliac bone. The memory of acute pain may become fainter as time progresses, and the incidence of chronic pain may not be as high as previously reported. The primary objective was to show the patient-reported outcome of chronic pain in the anterior iliac crest.
Methods: Telephone surveys were conducted for patients with single-level ACF (group-S; $n = 72$; M:F = 52:20; median age, 53 years), multiple-level ACF (group-M; $n = 61$; M:F = 40:21; 56 years) using autologous iliac bone, and single-level ACF with a stand-alone cage (group-C; $n = 53$; M:F = 38:15; 51 years). Logistic regression analysis was performed to determine the risk factors, and the variables included group, age, gender, postoperative period and satisfaction with the surgical outcome.
Results: There was no chronic pain in 87% of the patients, with no difference among the groups ($p = 0.52$). During the acute postoperative period, patients remembered no pain in 38/72 (53%) patients of group-S, 25/61 (41%) of group-M and 42/53 (79%) of group-C ($p < 0.001$). Female gender ($p = 0.027$; OR, 2.68; 95% CI, 1.12–6.41) was the risk factor for chronic pain.
Conclusions: Iliac bone harvest may not cause chronic pain in 87% of patients, and the memory of acute pain was faded in 40–50% of patients. Female gender was a risk factor for chronic pain. This information should be considered before harvesting iliac bone.

1. Introduction

Anterior cervical arthrodesis is a common surgical option for degenerative cervical disease. To treat arthrodesis, the intervertebral spaces need to be filled with autologous bone, allogenic bone or bone material [1,2]. Autologous bone grafts are easily available at a low cost and harbor high osteoinduction, osteoconduction and osteogenesis potential compared with the other materials [3]. Although autologous bone offers several advantages over alternative grafting materials, the reported high rate of chronic pain (30%) is a considerable hindrance to the use of autologous iliac bone grafts [4–7]. Although the use of a cage filled with allogenic bone or bone material can be used to replace autologous iliac bone grafts [8–10], there are still some cases in which use of autologous iliac bone is necessary [2,8]. Therefore, harvesting autologous iliac bone may be inevitable for some patients in the face of the high rate of complications reported for other methods. However, the reported incidence of chronic pain associated with autologous iliac bone harvest was lower in recent papers compared with previous ones [1,3,5,6,12–16]. Patients' memory of acute/subacute pain resulting from the harvest of iliac bone may become faint as time progresses, and the incidence of chronic pain may not be high as previously reported. In this regard, we surveyed current anterior iliac crest problems in patients who had previously undergone

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anterior cervical arthrodesis to treat degenerative cervical disease or ossification of the posterior longitudinal ligament (OPLL). The primary objective of the present study is to show the patient-reported outcome for chronic pain in the anterior iliac crest. The secondary outcomes were to identify risk factors for chronic pain and to determine the patient-reported outcomes for walking difficulty, sensory disturbance, overall discomfort and cosmetic problems.

2. Materials and method

After approval was granted by the institutional review board (H1506-062-679), a telephone survey was conducted with 311 consecutive patients who underwent anterior cervical arthrodesis surgery at least 6 months previously to treat degenerative cervical spine disease or OPLL between April 2010 and June 2015. The surgeries were performed at a single institute by three senior spine surgeons with more than 5 years of surgical experience. An independent researcher who was blinded to the patients' information, surgical methods and outcomes performed the surveys. When the first telephone contact failed, three more attempts were made on different days (with at least a 2-days interval between attempts). During the study period, harvests of anterior iliac bone for single-level anterior cervical discectomy fusion (ACDF) with a plate/screw system were performed in 103 patients (group-S); anterior iliac bone was harvested for multiple-level ACDF or anterior cervical fusion (ACF) after corpectomy with a plate/screw system for 96 patients (group-M). A stand-alone cage filled with bone material or allogenic bone mixed with autologous bone marrow aspirated from the anterior iliac crest was used in 112 patients for single-level ACDF (group-C). Of the possible participants, 186 (59.8%) responded to the survey (Table 1). The survey included questions related to iliac bone harvest and current/postoperative pain, walking difficulty, sensory disturbance, overall discomfort and cosmetic problems (Table 2, supplemental Table 1). The items for the survey were selected from the literature and modified [1,3,10,12–17] (supplemental Table 1). Pain intensity was assessed with a numeric rating score (NRS, 0–10), and a score $\geqslant 1$ was considered to indicate pain. The other parameters were assessed on a 5-point scale (Score: 1, not at all; 2, a little; 3, neutral; 4, a lot; 5, very much). Therefore, higher scores indicated a more negative response. In addition, current satisfaction with the surgical outcome (scored on a 5-point scale: 5, not at all; 4, a little; 3, neutral; 2, a lot; 1, very much) and quality of life were surveyed with the EuroQol-5 Dimension (EQ-5D), a health-related quality of life (HRQoL) assessment tool that is widely used in the health and medical care sector. The outcomes range from 'health worse than death', represented with a score of −1, to 'perfect health', represented with a score of 1 [18,19]. We applied a weighted model based on Korean HRQoL estimates [20]. The patients were grouped according to the size of the iliac bone graft: iliac bone harvest for single-level arthrodesis (group-S; $n = 72$; M:F = 52:20; median age, 53 years) and iliac bone harvest for multiple-level (more than 2 levels) arthrodesis (group-M; $n = 61$; M:F = 40:21; median age, 56 years). A group treated with a stand-alone cage (group-C; $n = 53$; M:F = 38:15; median age, 51 years) was used as a control. The response rate was 69.9% (72/103) for group-S, 63.5% (61/96) for group-M and 47.3% (53/112) for group-C. A different researcher reviewed the medical records of the patients who responded to the survey to determine whether any perioperative complications were associated with the iliac bone harvest.

2.1. Surgical strategy

For single-level cervical degenerative disease, most of the patients were included in the prospective randomized controlled trials (IRB No. 1305-068-497; 0804-044-004; clinical trials No. NCT 01011569; NCT02030899). In those trials, arthrodesis with an autologous iliac bone graft and a plate/screw system or stand-alone cage were randomly performed for single-level ACDF [8]. In group-S, three areas of autologous cortical iliac bone (three cortical bone) were harvested from the left iliac crest after a 2-cm skin incision was made. For patients with stand-alone cage arthrodesis (group-C), a 2-mm skin incision was made at the iliac crest, and bone marrow was aspirated from the iliac crest and mixed with allogenic bone or allomaterial and used to fill in the cage. For group-M, three areas of autologous cortical iliac bone were harvested after a 3- to 5-cm skin incision was made at the iliac crest, and the cervical spine was stabilized with an autologous iliac bone graft and a plate/screw system after discectomy or corpectomy. An oscillating saw was used to harvest three areas of cortical iliac bone in group-S and -M, and all wounds were closed in a layer-by-layer fashion with a closed-suction drain (Fig. 1). Patients were encouraged to walk from the day of surgery, and the drain was removed 1–2 days after surgery. Patients with a stand-alone cage may be regarded as a control group because the 2-mm skin incision represents minimal intervention at the iliac crest.

2.2. Statistical analysis

First, the patients were grouped into three groups, and comparisons among the groups were performed. Age and follow-up duration did not show a normal distribution based on the Shapiro–Wilk test and the histograms. Hence, age, follow-up duration and the variables that were measured with a Likert-type scale were summarized using medians [min, max], and their distributions among the groups were tested using the Kruskall-Wallis test. A categorical variable was summarized using frequency (%) and tested using the chi-square test or exact test. The post hoc analysis was performed using Bonferroni's method.

Second, to identify the risk factors for chronic pain, a logistic regression analysis was performed. The considered variables were

Table 1
Patient characteristics.

		Group-S ($n = 72$)	Group-M ($n = 61$)	Group-C ($n = 53$)	p-value
Age (years) Median [min, max]		53 [23,86]	56 [36,78]	51 [32,81]	0.57*
Sex (M:F)		52:20	40:21	38:15	0.67†
OPLL (%)		7 (9.7)	20 (32.8)	4 (7.5)	<0.001†
Operation level	1	72	0	50	
	2	0	52	3	
	3	0	7	0	
	4	0	2	0	
Duration since surgery (months)		21.67 [6,63]	35 [6,60]	40.50 [6,56]	0.22*

* Kruskall-Wallis test.
† Chi-square test.