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PEDICLE BONE GRAFTING VERSUS TRANSTROCHANTERIC ROTATIONAL OSTEOTOMY FOR IDIOPATHIC OSTEONECROSIS OF THE FEMORAL HEAD – FOUR PATIENTS WITH BOTH PROCEDURES –

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ABSTRACT

The clinical and radiographic results of vascularized pedicle iliac bone grafting (PBG) and Sugioka's transtrochanteric anterior rotational osteotomy of the femoral head (ARO) for idiopathic osteonecrosis of the femoral head were compared. Four male patients with bilateral osteonecrosis of the femoral head were treated with PBG in the first hip and with ARO in the second. All patients had stage 2 or 3 involvement according to Ficat's classification. Average age at the time of PBG and ARO was 42 and 43 years, respectively. Average follow-up of PBG and ARO was 7.5 and 5.7 years. At final follow-up, the average Harris hip scores of PBG and ARO were 73 and 85, respectively. Collapse was observed in 3 PBG hips and in 1 ARO hip. Three patients were more satisfied with the ARO procedure than with the PBG treatment, and one patient was undecided. ARO was considered better surgical treatment than PBG from both a clinical and radiological perspective.

Key Words: Osteonecrosis of the femoral head, bone graft, osteotomy, surgical treatment

INTRODUCTION

Because conservative treatments for idiopathic osteonecrosis of the femoral head are often unsuccessful,[1, 2] surgical treatment, such as core decompression,[3,4] strut bone grafting,[5] pedicle bone grafting,[6] transtrochanteric rotational osteotomy,[7,8,9] and endoprothesis and total hip replacement is often considered.[10,11,12] For the early stage of idiopathic osteonecrosis of the femoral head, we used vascularized iliac pedicle bone graft (PBG) for surgical reconstruction of the femoral head from 1984 until 1993. Total hip arthroplasty or endoprosthesis was selected for the patients with advanced osteoarthritis. Early clinical and radiographic results were satisfactory.[13] However, more than 4 years after PBG, clinical scores were still good but osteoarthritic changes were observed in about half of the patients.[14] Therefore, Sugioka's transtrochanteric anterior rotational osteotomy (ARO) was performed, starting in 1989. Preliminary good results of transtrochanteric ARO for idiopathic osteonecrosis of the femoral head were obtained. Tech-

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nical considerations were the most important factors used in selecting patients for ARO.[15]

The purpose of this paper is to report the clinical and radiographic results of 4 patients treated with PBG and ARO on respective hips for idiopathic osteonecrosis of the femoral head.

MATERIALS AND METHODS

Between 1984 and 1996, 28 patients (33 hips) received vascularized iliac pedicle bone grafts (PBG) and 110 patients (118 hips) received transtrochanteric rotational osteotomy (ARO) for idopathic, alcohol-associated and steroid-induced osteonecrosis of the femoral head at Nagoya University Hospital. Four of these patients were bilaterally treated with both PBG and ARO in one hip each.

The indications for PBG were Stage 1 and Stage 2 (according to Ficat[6]). When collapse was present, it was no more than 2 mm. Subchondral necrotic lesions on the articular surface constituted more than two third of the surface area using the anterior posterior (AP) view of conventional radiographs or tomographs.

The indications for ARO were Stages 1 to 3 according to Ficat. When collapse was present, it was no more than 5 mm. Subchondral necrotic lesions on the articular surface constituted more than one thirds of the surface area using the lateral view of conventional radiographs or tomographs.

Operative technique

A 5 × 1.5 × 1.5 (5 × 1.5 × 1.5) cm piece of iliac bone was harvested from the iliac crest as a vascularized graft, using the deep circumflex iliac artery and vein with fatty tissue and fascia. The iliac bone was trimmed to an appropriate size. Small pieces of bone graft and the PBG were examined under an image intensifier to confirm sufficient depth of grafting.[13] ARO was performed following the original method.[7] All patients were evaluated clinically by Harris hip score and radiographically after surgery at intervals of 6 months, 1 year and then annually.

RESULTS

All clinical and radiographic results of PBG and ARO are summarized in Tables 1 and 2. Overall clinical and radiographic results of ARO were better than those of PBG in any year after surgery. Osteoarthritic changes were not observed in 3 ARO hips but marginal osteophytes were observed; osteoarthritic changes were observed in 2 PBG hips. These osteoarthritic changes developed within five years of the operation. All patients needed one cane when they walked for a long distance. Three of 4 patients with PBG complained of mild to moderate hypesthesia in their thigh due to lateral femoral cutaneal nerve irritation related to surgery. One hip was treated with total hip arthroplasty 7.4 years after operation because of severe hip pain. Three patients were more satisfied with ARO than PBG.

CASE REPORTS

Case 1

A forty-seven year-old male suffered from right hip pain. Radiographs indicated alcohol-associated osteonecrosis of bilateral femoral heads (Fig. 1). PBG was performed in the right hip, and 1.5 years later ARO was performed in the left hip. At final follow-up the Harris hip score

Table 1. Data of pedicle bone grafting

Case	Age	Side	Interval	F/U	Initial Stage	Final Stage	Initial Score	Final Score	Pain	Subjective
1	47	R	3.4	8.6	3	4	78	50	+	U
2	48	L	0.9	7.5	2	3	71	65	+	U
3	31	R	0.6	6.3	2	2	80	62	+	U
4	40	L	1.1	7.4	2	4	74	40	+	U

Side: operated side; R: right, L: left; Interval; interval years between the two operations; F/U: follow-up (years); Initial Stage; radiographic stage before operation; Final stage; radiographic stage at final follw-up; Initial score; Harris hip score before operation, Final score; Harris hip score at final follw-up; Pain: hip pain; +: painful, –: not painful; Subjective: subjective opinion; E: enthusiastic, S: satisfactory, U: unsatisfactory, N: not decided

Table 2. Data of anterior rotational osteotomy

Case	Age	Side	Interval	F/U	Initial Stage	Final Stage	Initial Score	Final Score	Pain	Subjective
1	50	L	3.4	5.2	3	3	74	90	-	S
2	49	R	0.9	6.6	3	4	71	78	+	S
3	31	L	0.6	5.7	2	2	80	66	+	U
4	41	R	1.1	5.3	2	2	74	85	-	S

Side: operated side; R: right, L: left; Interval; interval years between the two operations; F/U: follow-up (years); Initial Stage; radiographic stage before operation; Final stage; radiographic stage at final follw-up; Initial score; Harris hip score before operation, Final score; Harris hip score at final follw-up; Pain: hip pain; +: painful, –: not painful; Subjective: subjective opinion; E: enthusiastic, S: satisfactory, U: unsatisfactory, N: not decided

was 50 with hip pain 8.6 years after the PBG operation and 90 without hip pain 5.2 years after the ARO operation. The right hip collapsed and advanced to stage 4 and the left hip was stage 3 (Fig. 2A). He was more satisfied with the left hip operation than the right.

Case 2

A forty-eight year-old male suffered from bilateral hip pain. Radiographs indicated steroid-induced osteonecrosis of the bilateral femoral heads for sympathetic ophthalmia 2 years before the onset of hip pain (Fig. 3). PBG was performed in the left hip, and 10 months later ARO was performed in the right hip. At final follow-up the Harris hip score was 65 with hip pain 7.5 years after the PBG operation and 78 without hip pain 6.6 years after the ARO operation. The left hip collapsed and advanced to stage 3. The right hip collapsed and advanced to stage 4 (Fig. 4). He was more satisfied with the ARO operation than PBG.

Case 3

A thirty-one year-old male suffered from bilateral hip pain. Radiographs indicated alcohol-associated osteonecrosis of the bilateral femoral heads (Fig. 5). PBG was performed in the right hip, and 7 months later ARO was performed. At the final follow-up the Harris hip score 6.3 years after the PBG operation was 62, and 5.7 years after the ARO operation was 66. Bilateral

hips stayed at stage 2 (Fig. 6). He expressed no preference for either operation. Nephrotic syndrome relapsed 3 times after surgery. He was treated with pulse steroid therapy and maintenance steroid therapy of 10 mg prednisolone per day.

Case 4

A fifty year-old male suffered from bilateral hip pain. Radiographs indicated idiopathic osteonecrosis of the bilateral femoral heads (Fig. 7). PBG was performed in the right hip, and 1.1 years later ARO was performed. At the final follow-up the Harris hip score 7.4 years after the PBG operation was 40 and 5.3 years after the ARO operation was 85 without hip pain. The right hip collapsed 3 years after operation, advanced to stage 4 and converted to total hip arthroplasty 7.4 years after PBG (Fig. 8). The left hip did not collapse but marginal osteophyte was observed. He was more satisfied with ARO than PBG.

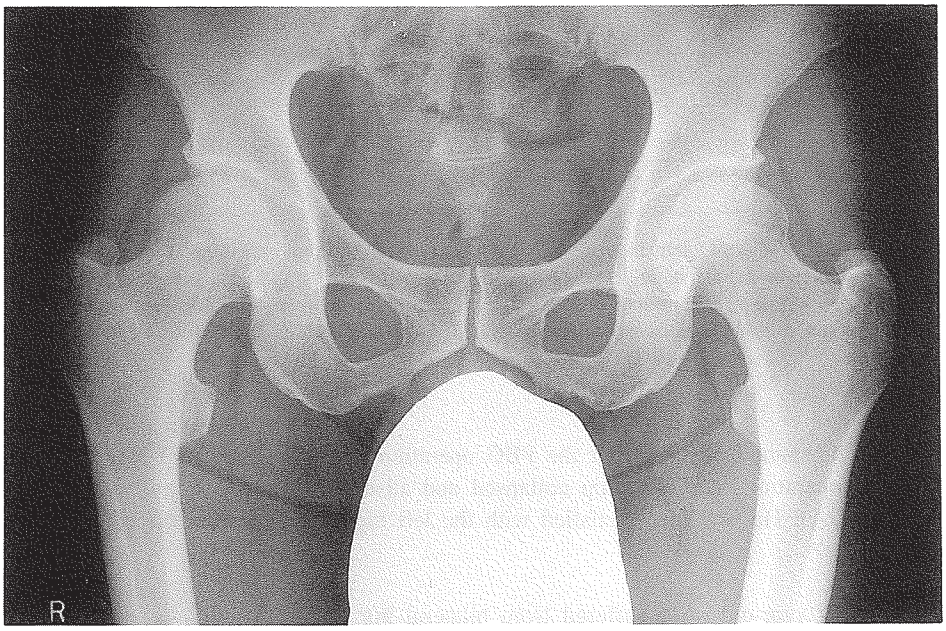

Fig. 1: A 47-year-old male. Antero-posterior radiograph at first consultation. Right hip showed stage 3 avascular necrosis of the femoral head. Left hip was asymptomatic at the first consultation.

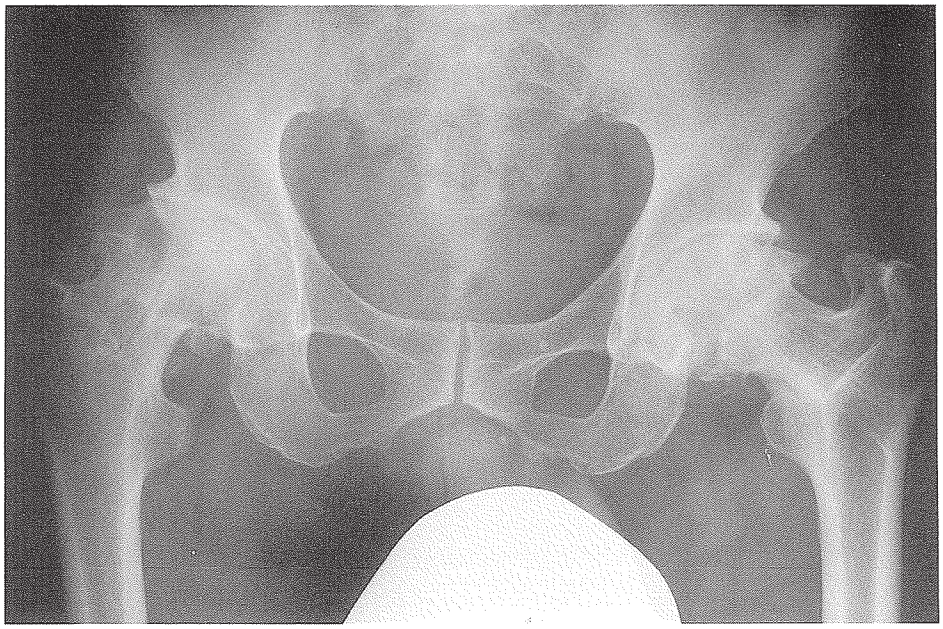

Fig. 2: Antero-posterior radiograph at final follw-up. 8.6 years after pedicle bone-grafting of right hip progression to Stage 4 was seen. Left hip was stage 3, 5.2 years after ARO.

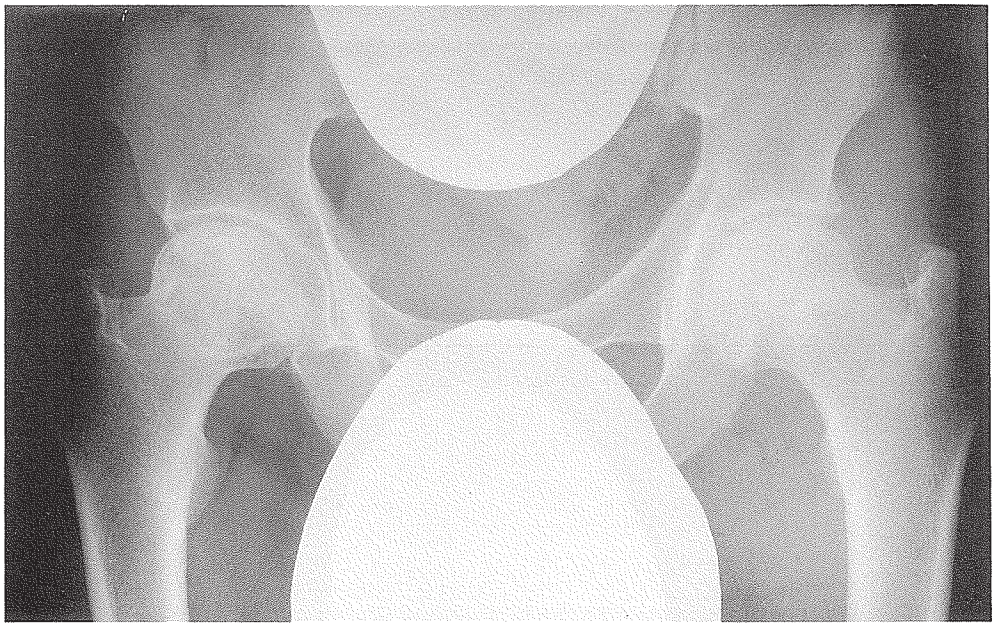

Fig. 3: A 48-year-old male. Antero-posterior radiogram at first consultation. Left hip showed stage 2 avascular necrosis of the femoral head. Right hip showed stage 3 avascular necrosis of the femoral head.

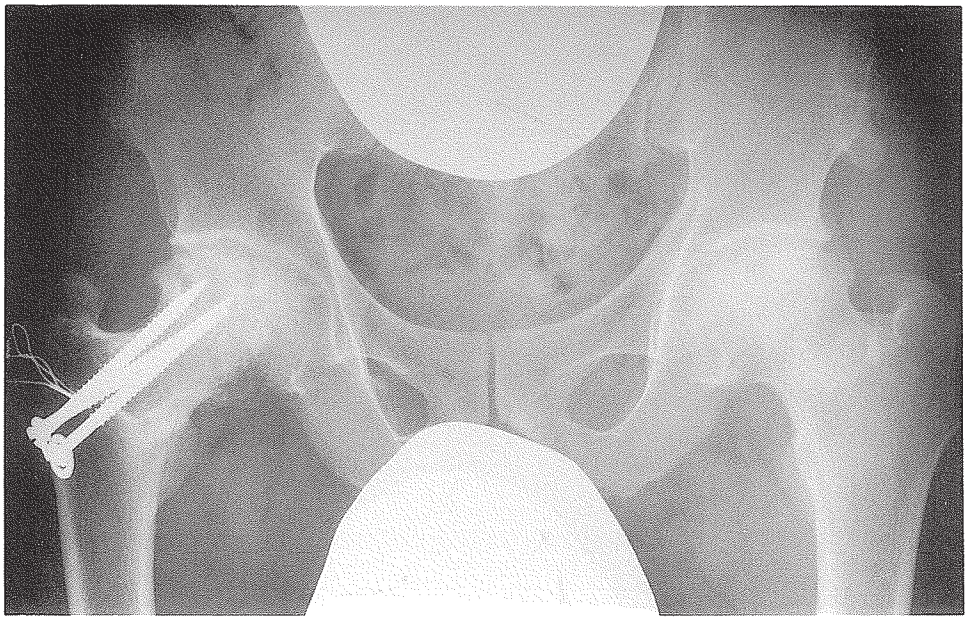

Fig. 4: Antero-posterior radiograph at final follw-up. 7.5 years after pedicle bone-grafting of left hip progression to Stage 3 was seen. Right hip was stage 4, 6.6 years after ARO.

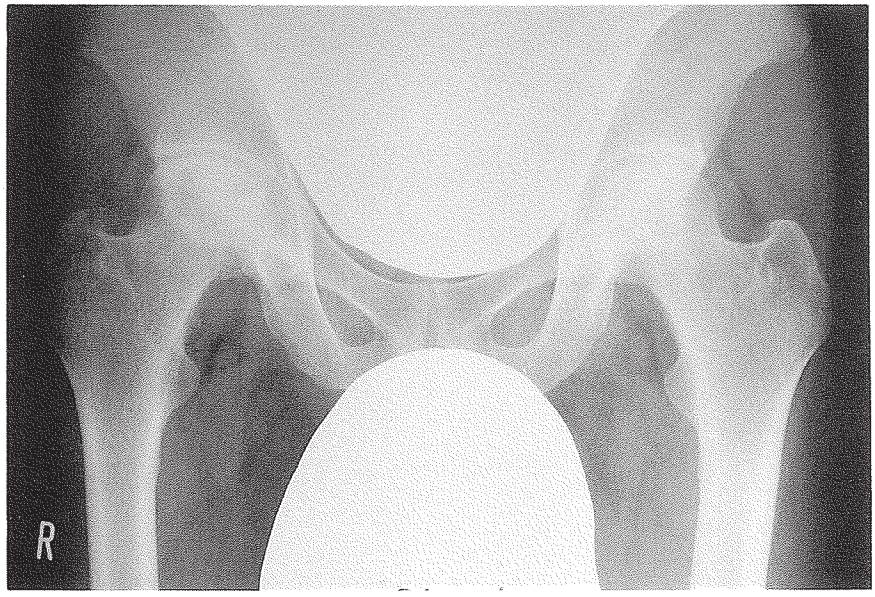

Fig. 5: A 31-year-old male. Antero-posterior radiogram at first consultation. Bilateral hips showed stage 2 avascular necrosis of the femoral head.

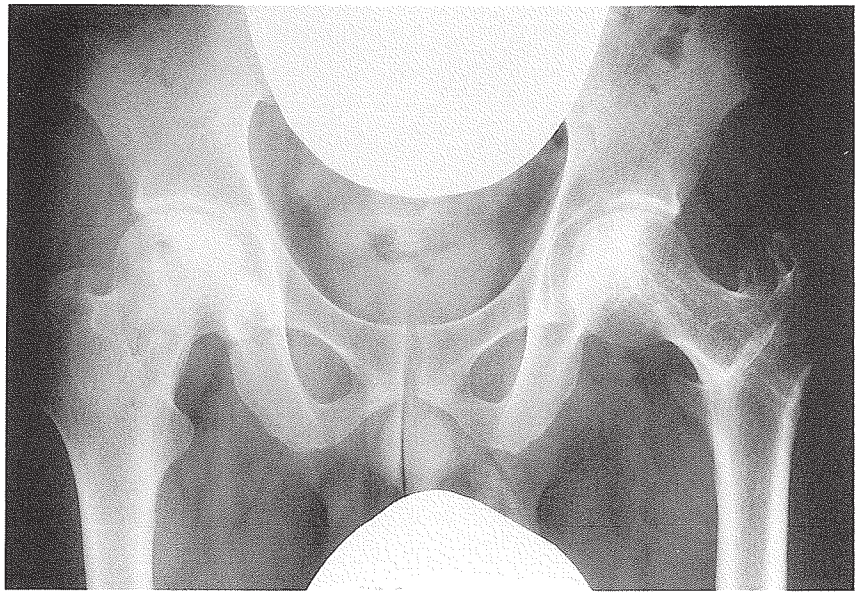

Fig. 6: Antero-posterior radiograph at final follow-up. 6.3 years after pedicle bone-grafting of right hip no progression was seen. Left hip was also stage 2, 5.7 years after ARO.

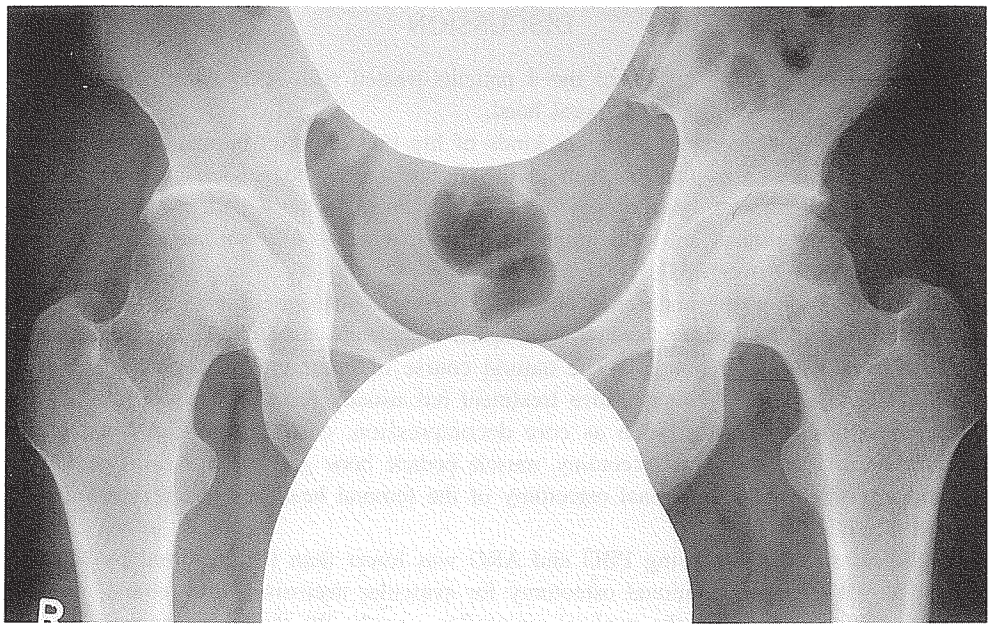

Fig. 7: A 50-year-old male. Antero-posterior radiograph at first consultation. Bilateral hips showed stage 2 avascular necrosis of the femoral head.

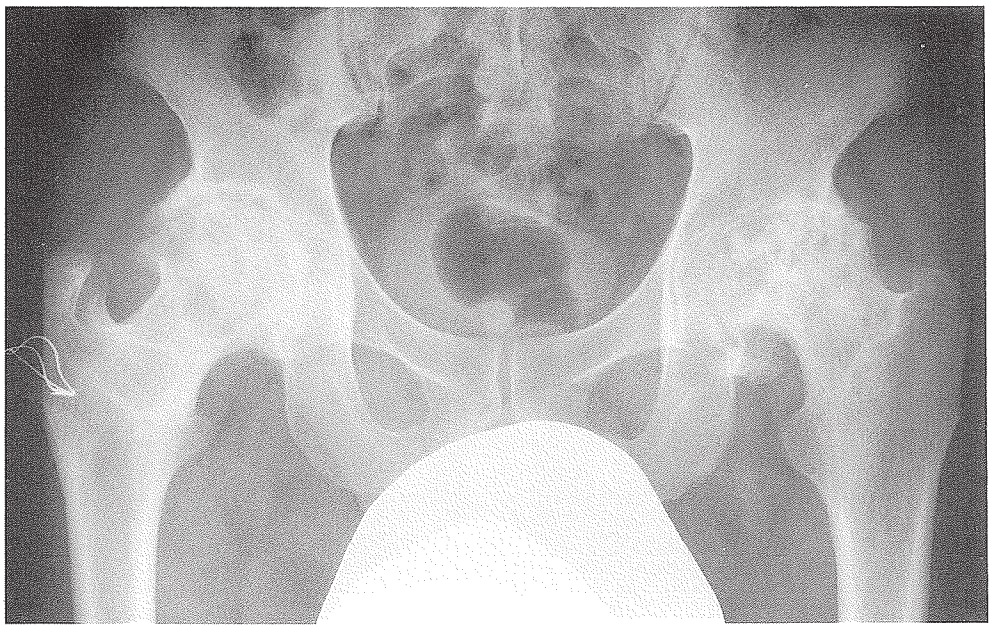

Fig. 8: Antero-posterior radiograph at final follow-up. 7.4 years after pedicle bone-grafting of left hip progression to Stage 4 was seen. Right hip was stage 2, 5.3 years after ARO.

DISCUSSION

Clinical and radiographic results of the 4 patients treated with ARO were better than PBG for idiopathic osteonecrosis of the femoral head.

It is very difficult to compare different kinds of hip operations in human patients based on hip indications alone. Other factors, such as the disease stage and gender, must be taken into account as well. By chance, both operations were performed in the 4 patients. ARO was better than PBG based on clinical and radiographic results in three of four patients. Subjective opinion also favored ARO over PBG.

Artificial joints for young and active patients are very troublesome due to early aseptic loosening.[17] However, if the femoral head has collapsed completely, total hip replacement should be considered even for young patients. The natural course of nontraumatic avascular necrosis of the femoral head is poor[1,2] Nonoperative treatment has usually been unsuccessful.

Joint-preserving operations, such as core decompression, corticocancellous bone grafting, intratrochanteric varus or valgus osteotomy, muscle pedicle bone graft, vascularized pedicle bone graft, and transtrochanteric rotational osteotomy of the femoral head have been reported but are still controversial.[18,19,20]

Our clinical success rate using PBG and ARO was lower than that reported by Masuda et al.[12] and Sugioka.[18] With rotational osteotomy for avascular necrosis of the femoral head, it is technically difficult to sustain the medical circumflex vessels. We therefore conclude that clinical results may be influenced not only by genetic differences,[4] but also by the techniques used and indications for surgical treatment.

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