Mod Rheumatol (2007) 17:235–238
DOI 10.1007/s10165-007-0571-1

ORIGINAL ARTICLE

Yuichi Mochida · Izumi Saito · Yasushi Akamatsu
Naoya Taki · Naoto Mitsugi · Tomoyuki Saito

Clinical and radiological results of non-cement impaction bone-graft method of total hip arthroplasty for rheumatoid arthritis

Received: December 19, 2006 / Accepted: February 16, 2007

Abstract We performed total hip arthroplasty using the non-cement impaction auto-bone-grafting method with the resected femoral head for acetabular protrusion that is not combined with the destruction of acetabular rim or dysplasia of the hip joint. Ten patients (eight women and two men) with rheumatoid arthritis who showed acetabular protrusion underwent total hip arthroplasty using this method. All patients were able to walk with full weight within 5 days after surgery. The short-term results of our cases were very good. The postoperative periods of the radiographic-bone incorporation of the grafting bone were 2 months after surgery in four joints, 3 months after surgery in four joints, and 4 months after surgery in three joints. There were no cases that showed any migration or radiolucency around the acetabular component at the time of follow-up. Our operative technique is simple and easy, and it is a useful method for the treatment of protrusion in patients with rheumatoid arthritis.

Key words Bone graft · Rheumatoid arthritis · Surgical technique · Total hip arthroplasty

Introduction

In rheumatoid arthritis, joint arthritis usually begins with small joints such as those in fingers and toes. The occurrence of arthritis in hip joints is relatively low in frequency; however, if it happens, activities of daily living will be strongly obstructed and the affected joint often will need a total hip arthroplasty.

Y. Mochida (✉) · I. Saito
Department of Chronic Intractable Disease Center, Yokohama City University Medical Center, 4-57 Urafune-cho, Minami-ku, Yokohama 232-0024, Japan
Tel. +81-45-261-5656; Fax +81-45-262-1718
e-mail: U1Mochida@aol.com

Y. Akamatsu · N. Taki · N. Mitsugi · T. Saito
Department of Orthopaedic Surgery, Yokohama City University Medical Center, Yokohama, Japan

In contrast to secondary osteoarthrosis, although the femoral head is commonly destroyed or sometimes disappears in many cases of rheumatoid arthritis, the rim of the acetabulum is usually preserved even if the acetabulum shows some degrees of protrusion. Several surgical methods using the bone-grafting technique have been described for cases of protrusion of the acetabulum,[1–4] but the method of the bone grafting should be carefully considered because each method has some limitations or expected adverse effects. The use of an auto-bone graft from other lesions such as the pelvic wing creates additional surgical sites that may cause postoperative pain or infection. For the use of allograft, there still remains the latent risk of infection with unidentified micro-organisms.[5,6] The use of a new form of artificial bone such as hydroxyapatite is a recent phenomenon, but the incorporation of the granules of hydroxyapatite may need a longer period when compared with auto-bone grafting.[7,8]

To avoid the use of allograft and artificial bone, we performed total hip arthroplasty using the non-cement impaction auto-bone-grafting method with the resected femoral head for acetabular protrusion that is not combined with the destruction of the acetabular rim or dysplasia of the hip joint. In this article, we report the detailed surgical technique and the short-term results of our cases.

Materials and methods

Ten patients (eight women and two men) with rheumatoid arthritis who showed acetabular protrusion underwent total hip arthroplasty using the non-cement impaction auto-bone-grafting method for acetabular components in all cases.

The acetabular components of the total hip arthroplasty that were used in this series were as follows: Implex porous elliptical cup (Kobayashi Medical, Osaka, Japan) in seven joints, Trident AD acetabular system (Stryker Orthopaedics, Mahwah, NJ, USA) in one joint, and RingLoc acetabular series (Biomet, Warsaw, IN, USA) in three joints. Most

of the acetabular components were securely fixed with two or three supplemental bone screws.

The Implex porous elliptical cup presents not a round but an oval-shaped viewing from the lateral. This oval shape, which provides a radius of an equatorial plane, is 1 mm longer than the radius of a pole direction to obtain rim fixation. The Trident AD acetabular system has a step structure (normalization) that has a 1-mm longer radius than the radius of the cup to provide secure rim fixation. The RingLoc acetabular series has fins at the rim of the cup to obtain rigid rim fixation and also stability for the rotational forces against the cup.

When there surgery is indicated, we use our algorithm in total hip arthroplasty for rheumatoid arthritis, with attention to the rim fixation in particular (Fig. 1). During surgery, two technical points are the most important in reaming of the acetabulum. First, surgeons should not break an acetabular rim during the reaming of the acetabulum to obtain rim fixation. It is also recommended that careful attention be paid not to break an acetabular rim during the procedure of excision of soft tissue around the acetabular rim because an acetabular rim in rheumatoid arthritis tends to become thin. Second, surgeons should ream the acetabular rim with a decided cup abduction angle, because if the surgeon moves the angle of the reamer, it is difficult to obtain a perfect shape of the rim. The acetabular rim should be reamed shallow circumferentially only inside the rim, with the decided cup abduction angle to obtain precise fitting of the rim of the implant to the reamed site (Fig. 2). After reaming, it is also important to resect all synovial tissue and the soft tissue in geodes in the acetabulum. Then multiple small drilling holes are made in the acetabulum using a Kirschner wire to provide local blood flow from the pelvic bone for early bone remodeling and incorporation of the grafting bone.

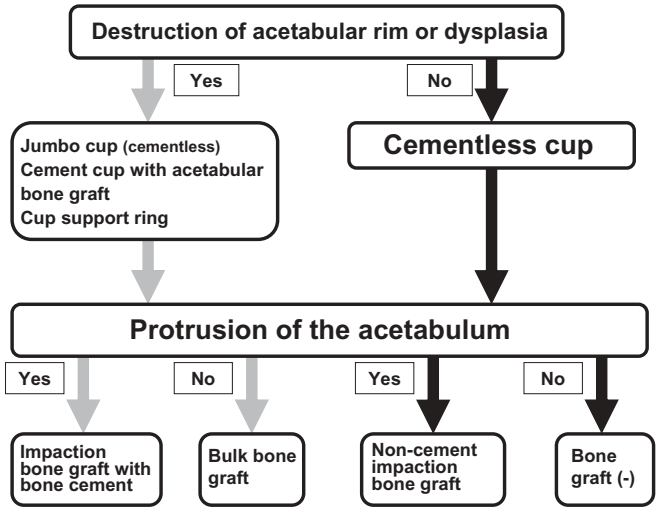

Fig. 1. Surgical algorithm showing the selection of the system of total hip prosthesis with the method of bone grafting

With regard to the preparation methods of grafting bone, the resected femoral head is fined using a bone mill with holes 3 mm in diameter. In the cases of severe protrusion or remarkable destruction and resorption of the acetabulum, we add extra bone that is supplied from the pelvic wing or artificial bone such as hydroxyapatite granules if necessary. For the methods of impaction bone grafting, the trial head of the hemi-arthroplasty prosthesis is used. A trial head with a size smaller than the diameter of the acetabulum is used for the impaction of the grafting bone until rigid compression of the bone is obtained (Fig. 2). After the impaction technique is employed, the acetabular component is inserted and fixed with supplemental screws, if necessary. All patients were allowed to transfer from the bed to the wheelchair on the first postoperative day. If satisfactory rim fixation of cup was obtained during the surgery, full weight bearing was also allowed on the first day after the surgery.

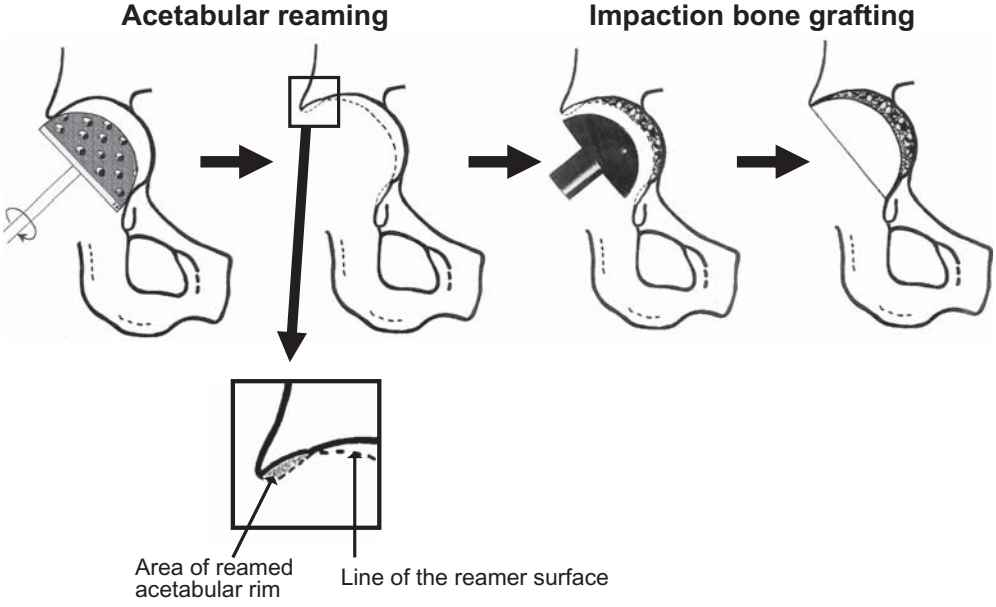

Fig. 2. Detailed surgical technique of acetabular reaming and impaction bone grafting

Results

The average age of patients at the time of surgery was 62 years (range 50–73 years). The average period after surgery at the time of final follow-up was 44 months (range 27–65 months). All patients showed good recovery from the surgery and did not show any complications in the perioperative period. All patients were able to walk with full weight within 5 days after surgery. No patient was lost during follow-up.

The postoperative periods of radiographic incorporation of the grafting bone were 2 months after surgery in four joints, 3 months after surgery in four joints, and 4 months after surgery in three joints. There were no cases that showed any migration or radiolucency around the acetabular component at the time of follow-up.

Discussion

In patients with rheumatoid arthritis, there are several types of radiographic changes of hip joint destruction such as acetabular protrusion, ankylosis, and severe destruction of the femoral head, acetabulum, or both. According to the existing joint destruction, the surgeon should select the optimum implant and method of bone grafting, if needed, for total hip arthroplasty. In our institution, the surgical treatment, including the method of bone grafting and the kind of system used for total hip prosthesis, is decided according to our surgical algorithm, as shown in Fig. 1.

For the treatment of the protrusion of the acetabulum in total hip arthroplasty for patients with rheumatoid arthritis, there are several choices of method of acetabular reconstruction; for example, bone grafting using block bone or sliced bone or tipped bone,[5,9,10] the use of artificial bone such as hydroxyapatite,[11] the use of support ring or mesh,[2] and filling with cement. Although many authors reported good results of these methods, each method has some disadvantages. For example, the periods of the bone union or incorporation are relatively late with the use of block or sliced bone graft. If the surgeon chooses bone grafting with the use of block or sliced bone, there still remains the risk of osteonecrosis, non-union, or collapse of the grafting bone. Hooten et al.[12] reported the results of microscopic examination from two postmortem cases of revision arthroplasty. The specimens showed that the bulk allografts were encapsulated in fibrous tissue even when both hips were functioning well and radiographs showed healing of graft to host bone without collapse. When using hydroxyapatite, rigid osteoincorporation may need a longer period. On the other hand, the use of autologous bone is thought to show earlier bone incorporation when compared with the other methods and has no risk of undetected infection. On the basis of these advantages, surgeons should use autologous bones as much as possible.

Although there are several reports on morselized cancellous bone grafting for acetabulum for rheumatoid arthritis,[3,13,14] in most of the reported cases, cemented cups with impaction bone grafting for acetabular protrusion were used. Rosenberg et al.[3] reported the results for 36 primary cemented hip arthroplasties in 31 rheumatoid arthritis patients with acetabular protrusion, which were reconstructed with autologous morselized bone grafts. The survival rate for their series at 12 years was 90%. Only a few authors reported the results of morselized cancellous bone grafting for the acetabulum with the use of uncemented cups,[9,14] but no other report has documented the detailed surgical technique as documented in this article.

The advantages of our method are the relatively simple surgical technique, the rapid incorporation of the grafting bone, and the early weight bearing if secure rim fixation of the component was obtained. In our series, all patients showed radiographic bone incorporation of the grafting bone within 4 months of surgery. All patients were allowed full weight bearing within 5 days after surgery, but no case showed any evidence of cup migration or radiolucency around the acetabular component at the time of follow-up. A 57-year-old woman with rheumatoid arthritis showed destructive changes in the hip joint. Although the flattening of the femoral head and protrusion of the acetabulum were recognized in the preoperative radiograph, the acetabular rim was preserved. During surgery, the resected femoral head was fined using a bone mill and grafted into the site of the protrusion of the acetabulum. The bone incorporation in the radiograph was recognized at 2 months after surgery. In the radiograph at 2 years and 7 months after the surgery, there was no evidence of cup migration or radiolucency around the acetabular component (Fig. 3).

Although our method showed good short-term results, there still remain several difficulties. For example, in the cases of quite severe destruction or disappearance of the femoral head and severe protrusion of the acetabulum, the amount of grafting bone is sometimes insufficient. If additional graft bone is needed, the surgeon has to use other auto-, allo-, or artificial bone to fill the void space of the acetabulum. The use of auto-bone graft creates additional surgical sites. There is risk in the use of an allograft in terms of unidentified micro-organisms. The use of artificial bone may need a longer period for bone incorporation. Additionally, our method provides the implantation of the acetabular component to a location near the original acetabulum.

Conclusion

1. The short-term results of non-cement impaction bone-graft method for acetabular protrusion in total hip arthroplasty were very good.
2. Our technique is simple and easy, and it is a useful method for treatment of protrusion in patients with rheumatoid arthritis.

Acknowledgments No funds were received in support of the research presented in this article.

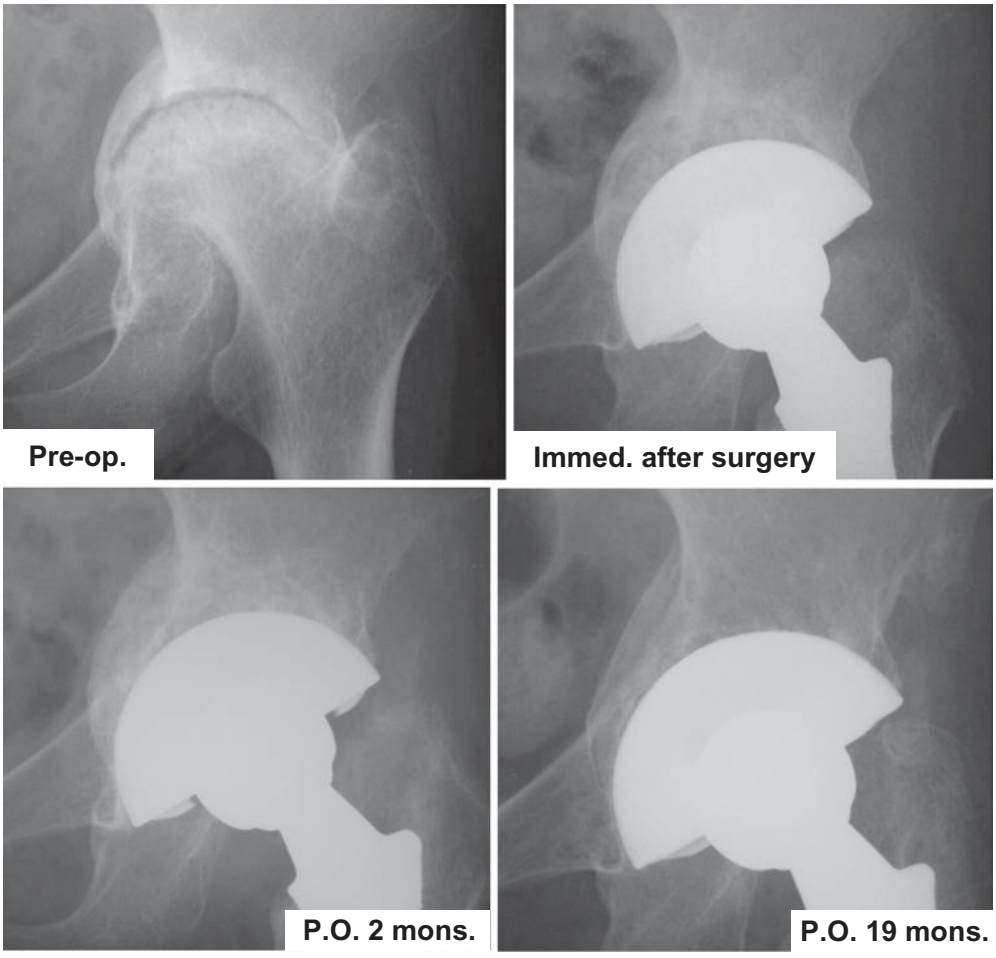

Fig. 3. A 57-year-old woman with rheumatoid arthritis showed destructive changes in the hip joint. The bone incorporation was recognized at 2 months after the surgery. In the radiograph at 2 years and 7 months after the surgery, there was no evidence of cup migration around the acetabular component

References

1. Berry DJ, Lewallen DG, Hanssen AD, Cabanela ME. Pelvic discontinuity in revision total hip arthroplasty. J Bone Joint Surg Am 1999;12:1692–702.
2. Mibe J, Imakiire A, Watanabe T, Fujie T. Results of total hip arthroplasty with bone graft and support ring for protrusio acetabuli in rheumatoid arthritis. J Orthop Sci 2005;1:8–14.
3. Rosenberg WW, Schreurs BW, de Waal Malefijt MC, Veth RP, Slooff TJ. Impacted morsellized bone grafting and cemented primary total hip arthroplasty for acetabular protrusion in patients with rheumatoid arthritis: an 8- to 18-year follow-up study of 36 hips. Acta Orthop Scand 2000;2:143–6.
4. Matsuno H, Yasuda T, Yudoh K, Yonezawa T, Nakazawa F, Murata T, et al. Cementless cup supporter for protrusio acetabuli in patients with rheumatoid arthritis. Int Orthop 2000;1:15–8.
5. Regis D, Dorigo E, Modena M, Corallo F, Bartolozzi P. Acetabular reinforcement rings and bone allografts in the reconstructive treatment of periprosthetic bone loss. Chir Organi Mov 2002;4: 217–24.
6. Kwong FN, Ibrahim T, Power RA. Incidence of infection with the use of non-irradiated morcellised allograft bone washed at the time of revision arthroplasty of the hip. J Bone Joint Surg Br 2005; 11:1524–6.
7. Voor MJ, Arts JJ, Klein SA, Walschot LH, Verdonschot N, Buma P. Is hydroxyapatite cement an alternative for allograft bone chips in bone grafting procedures? A mechanical and histological study in a rabbit cancellous bone defect model. J Biomed Mater Res B Appl Biomater 2004;2:398–407.
8. Tamai N, Myoui A, Tomita T, Nakase T, Tanaka J, Ochi T, et al. Novel hydroxyapatite ceramics with an interconnective porous structure exhibit superior osteoconduction in vivo. J Biomed Mater Res 2002;1:110–7.
9. Johnsson R, Ekelund L, Zygmunt S, Lidgren L. Total hip replacement with spongious bone graft for acetabular protrusion in patients with rheumatoid arthritis. Acta Orthop Scand 1984;5: 510–3.
10. Heywood AW. Arthroplasty with a solid bone graft for protrusio acetabuli. J Bone Joint Surg Br 1980;3:332–6.
11. Oonishi H, Iwaki Y, Kin N, Kushitani S, Murata N, Wakitani S, et al. Hydroxyapatite in revision of total hip replacements with massive acetabular defects: 4- to 10-year clinical results. J Bone Joint Surg Br 1997;1:87–92.
12. Hooten JP, Jr, Engh CA, Heekin RD, Vinh TN. Structural bulk allografts in acetabular reconstruction. Analysis of two grafts retrieved at post-mortem. J Bone Joint Surg Br 1996;2: 270–5.
13. Schreurs BW, Thien TM, de Waal Malefijt MC, Buma P, Veth RP, Slooff TJ. Acetabular revision with impacted morselized cancellous bone graft and a cemented cup in patients with rheumatoid arthritis: three to fourteen-year follow-up. J Bone Joint Surg Am 2003;4:647–52.
14. Kinzinger PJ, Karthaus RP, Slooff TJ. Bone grafting for acetabular protrusion in hip arthroplasty. 27 cases of rheumatoid arthritis followed for 2-8 years. Acta Orthop Scand 1991;2:110–2.