Total hip arthroplasty for fused hips: clinical and radiological outcome

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Background
Hip fusion restricts most of daily-living activities, and patients request takedown of their fusion hoping to improve gait and function and relieve pain from adjacent joints.
Patients and methods
We retrospectively reviewed 27 fused hips (22 patients) converted to total hip arthroplasty between 2001 and 2013. A total of 19 male and three female patients had hip fusion for an average of 17 years (range: 6–32), with mean age at conversion of 34 years (range: 22–55). The etiology of fusion was surgical arthrodesis in seven, ankylosing spondylitis in 12, post-traumatic in four, dysplasia in two, and idiopathic in two hips. Posterolateral approach was used in all patients with intraoperative imaging to guide in-situ neck osteotomy and ensure correct positioning of the cup. A total of 18 hips were uncemented, with ceramic-on-ceramic bearing used in 11.
Results
Patients were followed for a mean of 96 months (range: 36–168). Center of rotation was restored to within 0.5 cm in 24 hips. Limb-length discrepancy averaging 1 cm (range: 0.5–2 cm) was noted in six patients. Harris hip score improved significantly from 46 (range: 20–56) to 78 (range: 42–97) at the last follow-up with a mean flexion range of 85° (65–120°). Abductor lurch with positive Trendelenburg sign was present in eight hips. All but two patients were satisfied with the result. One cup was aseptically loose, making for 96% implant survival. Complications also included two cases of heterotypic ossification, one partial sciatic nerve palsy that later recovered, and one hematoma formation. No dislocations or wound infections were reported.
Conclusion
Successful takedown of hip fusion is possible with improved function and gait and low complication rate.

Keywords:
arthrodesis, conversion, fusion, hip, total hip arthroplasty

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Introduction

Hip ankylosis may follow several hip pathologies such as inflammatory arthropathies particularly ankylosing spondylitis, hip infection including tuberculosis, hip dysplasia, and post-traumatic cases [1,2]. Surgical arthrodesis has also been used for long to treat end-stage hip disease. This was especially recommended for monoarticular disease in younger patients to provide pain relief on the expense of motion [3–6]. A solid, correctly positioned hip fusion can provide long-term results comparing favorably with those of arthroplasty [2,5].

However, many patients no longer accept the limitations of a fused hip. In addition, with the recent advances in hip arthroplasty, surgical techniques, implants, and new bearing surfaces, arthrodesis has been disapproved even for the younger population [1,7]. Moreover, owing to the altered biomechanics, long-term follow-up studies have shown the high incidence of spine, knee, and contralateral hip problems [7–10].

Many patients may request takedown of their fusion hoping to improve gait and function and relieve pain from adjacent joints [7,10]. However, the conversion arthroplasty is not an easy straightforward surgery, with a lot of potential complications [11–13]. Meticulous preoperative planning and a long experience with primary and revision surgeries are mandatory for a good result [14].

In this study, we retrospectively reviewed cases of conversion arthroplasty done at our institute. The main

purpose is to present our surgical technique and report the outcome and potential complications of such difficult cases.

Patients and methods

We retrospectively reviewed cases of fused hips converted to total hip arthroplasty (THA) at our institute during the period between 2001 and 2013. Patients' data were collected prospectively, and only cases with complete follow-up records for at least 3 years were included. A total of 22 patients with 27 fused hips (five bilateral cases) were available for review. Local ethical committee approval was obtained before patient inclusion in the study.

A total of 19 male and three female patients had hip fusion for an average of 17 years (range: 6–32), with mean age at conversion of 34 years (range: 22–55). The etiology of fusion was surgical arthrodesis in seven, ankylosing spondylitis in 12, posttraumatic in four, dysplasia in two, and idiopathic in two hips.

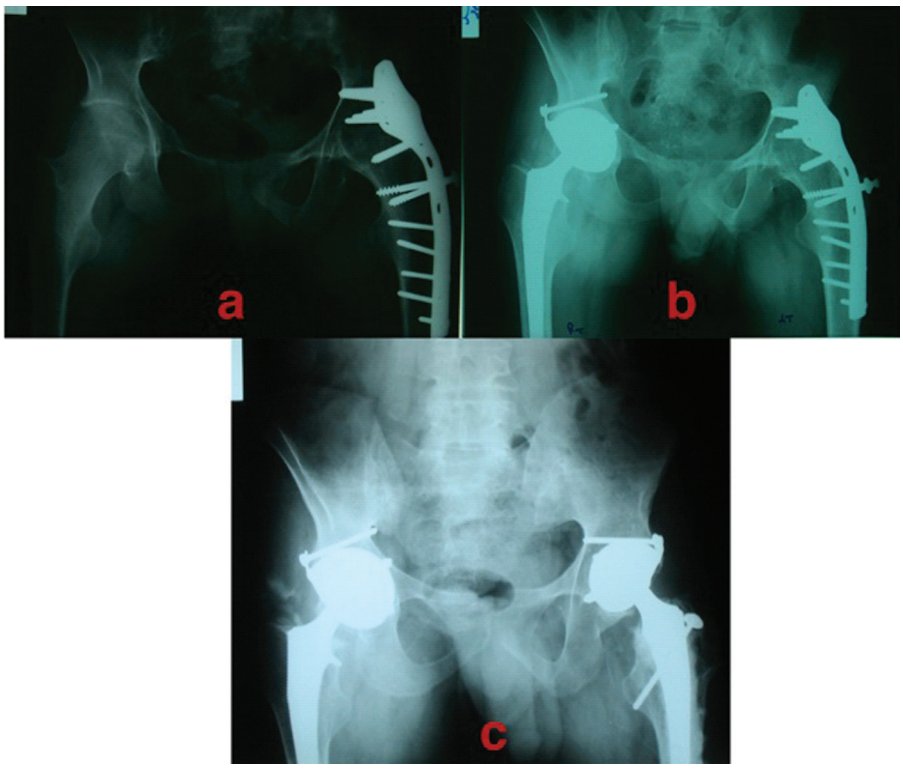
Patients' expectations and reason(s) for requesting the takedown of their fusion were discussed and documented in a written consent. Patients asked for the conversion arthroplasty for low back pain in 14 (64%) cases, knee pain in eight (36%), contralateral hip pain in three (14%), and painful failed arthrodesis in one (5%) case.

Surgical technique

Patients were positioned in the lateral position on an ordinary orthopedic table with the pelvis rigidly supported to ensure neutral position of the pelvis. This was sometimes difficult owing to spinal deformities, pelvic obliquity, and fusion in abnormal positions. Intravenous antibiotics were administered within 60 min of skin incision.

Posterolateral approach was used for all patients, with none of them needing trochanteric osteotomy. Retained hardware (e.g. cobra plates) from previous surgeries was first removed and intraoperative cultures obtained (Fig. 1). The short external rotators were cut and the posterior capsule partially excised to expose the femoral neck. Double in-situ neck osteotomies with resection of a bone block were usually done to mobilize the femur anteriorly and create a space for acetabular exposure (Fig. 2). The saw was directed as horizontally as possible under fluoroscopy guidance to avoid damaging the anterior column. Femoral head was

Figure 1



A 27-year-old male patient with rheumatoid arthritis. (a) Surgical fusion was done at the age of 20 years to relief pain from left hip disease. The right hip is now painful with a narrow joint space. (b) The right side was operated first with a cementless dual-mobility total hip arthroplasty. (c) 6 months later, conversion of the left hip fusion was done with a hybrid dual-mobility implant. The cobra plate was removed and the trochanter refixed using 4.5-mm screws.

usually removed in piecemeal fashion using osteotomes or the acetabular reamers.

Anatomical landmarks of the acetabulum are then identified for correct reamer placement including the acetabular labrum, transverse acetabular ligament, and the inferior acetabular margin with the obturator foramen. Intraoperative fluoroscopy was used routinely to double check the position of the reamer before reaming was started. A drill hole in the floor and a depth gage were used to determine the floor thickness and the required depth of reaming. Correct positioning of the trial cup is then rechecked with fluoroscopy especially in cases with spinal deformities and pelvic obliquity.

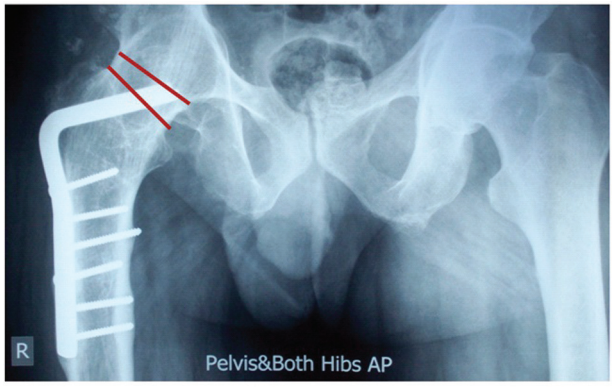
The femur is then broached, and the femoral trial stem is inserted. Soft tissue releases were performed in cases with high fused hips and to correct any soft tissue contractures present. Reduction of the hip was then performed, soft tissue tension and limb length were checked, and stability was tested.

Abductor musculature was assessed intraoperatively regarding its thickness, atrophy, and color and graded as poor (4/27), moderate (8/27), or good (15/27). Further damage of the abductors should be avoided including vigorous anterior retraction or subperiosteal elevation from the ilium.

The wound was closed in layers over a suction drain that was usually removed 24–48 h after surgery. Partial weight bearing, as tolerated, started on second postoperative day, progressed to full weight bearing at 4 weeks. Intravenous antibiotics were administered for 2 days postoperatively, and oral antibiotics were continued for 5 more days. Low-molecular-weight heparin was administered for all patients for 4 weeks. Indomethacin prophylaxis against heterotopic bone was used for all patients for 6 weeks together with a proton pump inhibitor.

Noncemented implants were used for most cases (18 hips), whereas four were cemented and five had hybrid fixation. Ceramic-on-ceramic bearings were used in 11 hips. A total of 15 hips had large-diameter heads (32 and 36 mm), whereas dual-mobility cups were used twice (Fig. 3). No constrained implants were used.

Figure 2



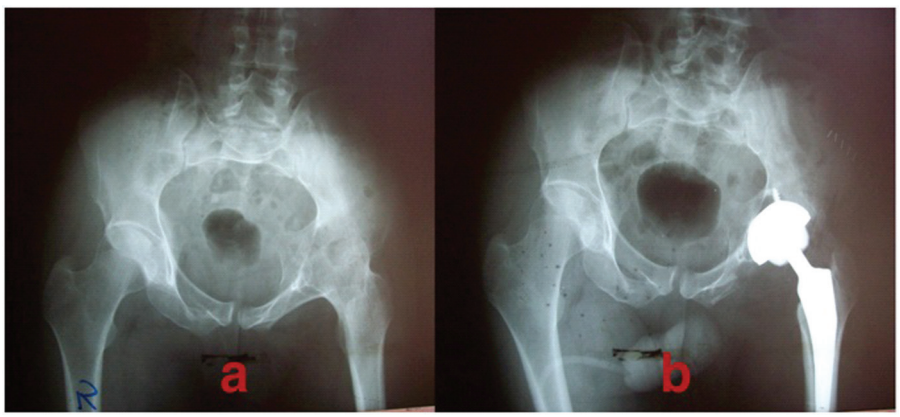
A 33-year-old male patient with posttraumatic hip fusion. Planning of the double-level neck osteotomy to allow for anterior femoral retraction and create a space for acetabular reaming.

Follow-up

Radiographs (pelvis – anterioposterior; hip – anterioposterior and lateral) were obtained post-operatively to assess implant's position, limb length, and offset.

Detailed clinical and radiological examinations were carried out during the follow-up visits at 1, 3, and 6 months; 1 year; and then annually. Pain scores,

Figure 3



A 25-year-old male patient with idiopathic left hip fusion for 8 years. (a) Note the pelvic obliquity and flexion deformity. (b) Cementless ceramic-on-ceramic total hip arthroplasty was done using large-head articulation (32 mm).

flexion range, abductor muscle power, patient gait, and function were assessed at each visit. Radiographs were examined for signs of wear, osteolysis, and loosening.

Functional outcome was assessed using the Harris hip score [15] starting from the 6-month visit. Patient satisfaction after the conversion was categorized as complete, semisatisfied, or unsatisfied.

Statistical analysis

SPSS 18 software package was used for data analysis (SPSS Inc., Chicago, Illinois, USA). Categorical data were presented as frequency and percentage and were analyzed using χ^2-test. Continuous data were presented as mean and SD and were analyzed using unpaired *t*-test. Outcomes including Harris hip score, flexion range, and Trendelenburg test were compared with age at conversion (>50 years or ≤50 years) and type of hip fusion (spontaneous or surgically fused). *P* value less than 0.05 was considered statistically significant.

Results

Patients were followed-up for a mean of 96±30 months (range: 36–168). Functional outcome was graded excellent in six patients, good in 12, fair in seven, and poor in two patients. Harris hip score improved significantly from 46 (range: 20–56) preoperatively to 78 (range: 42–97) at the last follow-up.

Pain from the spine was significantly improved after conversion (12 patients totally and two partially relieved). Improvement of ipsilateral knee pain was also evident, with only two of eight patients with continuing complaints. One of these had an advanced knee osteoarthritis (OA) and required knee replacement 4 months after the conversion arthroplasty.

Abductor lurch with positive Trendelenburg sign was present in eight hips. All patients with poor intraoperative abductor muscle grading had a severe limp postoperatively and required a cane for walking. Range of flexion increased gradually over the first 6 months to reach a mean of 85 degrees (range: 65–120). Neither the patient age at conversion nor the type of fusion had significant influence on the functional score, hip flexion range, or postoperative limp.

Center of rotation was restored to within 0.5 cm in 24 hips. Two dysplastic cases and one post-traumatic case had high-lying fusion, and cups were placed in a high hip center. The mean preoperative limb length discrepency (LLD) improved from 2.5 cm (range: 1–4) to 0.5 cm (range: 0–2) with successful equalization of leg length in 16 patients. Residual LLD averaging 1 cm was noted in the other six patients. Using image intensification, none of the cups had an abduction angle more than 50°.

All but two patients were satisfied (complete or semisatisfied) by the outcome of the conversion. The first patient was disappointed because of continuing abnormal gait with severe abductor lurch. This patient had fusion since early adolescence and poor abductor muscle function. Although this was explained preoperatively, the patient had high expectations that were unmet. The other patient had aseptic loosening of a cementless cup 3 years after implantation with liner wear and pelvic osteolysis. Revision was done with impaction allograft and a cemented cup.

Complications also included one case with iatrogenic partial sciatic nerve palsy. This patient had ankylosing spondylitis, and although great care was taken and the dissection kept toward the femoral side of the joint, he had postoperative drop foot. Fortunately, this injury totally recovered in 6-month duration.

Despite the use of medical prophylaxis, two patients had postoperative heterotypic bone formation. However, they were of low grade and did not affect the range of hip motion.

No dislocations or wound infections were reported in our series; however, we had a single case of postoperative hematoma formation. This was drained surgically with uneventful wound healing thereafter.

Discussion

Hip fusion provides adequate pain relief for various end-stage hip pathologies. However, this comes at the expense of motion, restricting most of daily-living activities. These limitations are especially evident in cases with polyarticular disease leading to a severe negative effect on the patient's quality of life [3]. In addition, altered biomechanics of the neighboring joints particularly if the hip is fused in an awkward position also lead to degeneration and pain in the spine, knee, and contralateral hip [7–10,16].

Long-term follow-up studies of patients with hip fusion report that approximately 10–20% of them eventually request conversion of their fusion in a THA [3,4,7]. However, conversion surgery is guarded with several complications and has inconsistent reported results [12,13,17–25]. Careful preoperative planning and perfect surgical execution are important for a good

outcome. In this study, we tried to report our surgical experience and the functional and radiological results of these difficult arthroplasty cases.

Several approaches have been proposed. Though they provide good exposure, lateral transtrochanteric approaches have the disadvantages of difficult reattachment of the trochanter, nonunions, heterotopic bone formation, hardware problems, and the further damage they do to the abductor mass [17]. We prefer the posterolateral approach; it provides a very good exposure of the acetabulum and the proximal femur particularly when bone defects are present (e.g. in cases of dysplasia). The sciatic nerve identified and protected at the beginning of dissection is also believed to decrease the incidence of its injury. Our reported case of partial nerve injury had later total recovery indicating an indirect stretch from restoring the limb length.

The problem of creating a space for acetabular reaming is perfectly solved by removing a block of bone with the double-level neck osteotomy. Great care should be taken with the direction of the proximal osteotomy, and fluoroscopy guidance is needed to avoid breaching the anterior acetabular wall. We find fluoroscopy also crucial to check the cup position before final implantation. This avoids faulty cup insertion in a high, lateralized, or vertical position especially in cases with dysplasia or severe pelvic obliquity.

Correction of soft tissue contractures and equalization of leg length are of great importance to improve postoperative gait and function. However, this is not always achievable, especially in cases with severe pelvic obliquity and structural spinal deformities. Using of the anatomical hip center for cup implantation guided by intraoperative images, achieved leg-length equality in 73% of our cases.

Abductor muscle function is another important factor in preventing postoperative limp and prosthesis stability. However, this is difficult to assess preoperatively, and even electrophysiological studies are inconclusive [26]. We find intraoperative examination of the abductor mass the most valid method to predict for postoperative limp, and we recommend using large-diameter articulations or dual-mobility cups in cases with poor abductors. Patients should be counseled for this particular item before embarking on the conversion surgery. Postoperative limp may be, severe and the unrealistic patient may be extremely disappointed.

Despite good pain relief, patients' functional scores are variable among the available literature. The functional outcome of THA over previous arthrodesis has been viewed to be more similar to that of revision THA than that of primary THA [10,13,23]. Using matched primary and revision THA control cohorts, Richards and Duncan [10] reported statistically significant lower scores in conversion arthroplasty cases compared with primary THA. Moreover, despite equivalent scores, they also reported higher patient satisfaction for the revision THA group, which again emphasizes the role of patient expectations.

Different factors have been also reported to affect the patient outcome, including age and type of fusion. Some reports suggest better function in those having spontaneous fusion [14,23], mainly owing to a better-quality abductor musculature. However, such correlation was not detected in our patient group.

The reported postoperative complication rate varies widely from 11 to 54% [10,13,20,25]. Careful surgical technique and routine use of intraoperative fluoroscopy led to a relatively low complication rate (18.5%) in our series. In addition, avoiding the use of trochanteric osteotomy prevented the related complications and decreased the rate of heterotopic ossification formation. Concerning implant survival, we had a high success rate of 96% at mean of 8 years using revision surgery as the endpoint. A single case of aseptic loosening was related to polyethylene wear and osteolysis.

Strengths of our study are the relatively large number of patients in a single institution, prospective collection of data, and the long follow-up. The major limitations of our study include heterogeneity of the fusion etiologies and lack of a control group.

Conclusion

Successful takedown of hip fusion is possible with improved function and gait and low complication rate. However, preoperative counseling of patients should keep the patients' high expectations tempered to a realistic level. The use of intraoperative fluoroscopy is strongly recommended to avoid complications and overcome component malpositioning.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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