Clinical results of conversion total hip arthroplasty after failed hemiarthroplasty

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Aim
The aim of the present study was to evaluate functional results and complications of total hip arthroplasty (THA) performed as a salvage procedure after failed hemiarthroplasty.

Patients and methods
This study reports on 25 patients who had conversion to THA following failed hemiarthroplasty: twenty (80%) cases with Austin Moore prosthesis and five (20%) cases with cemented Thompson prosthesis. There were 10 women and 15 men. Their mean age was 67.96 years (range 56–82 years); the average follow-up period was 29.3 months (range 12–36 months). The main indication for conversion included acetabular erosion with a well-fixed femoral stem in 17 patients, acetabular erosion with femoral loosening in seven patients, and one case with cemented Thompson dislocation. A standard posterior approach to the hip was used in all patients. Bone defects were evaluated and filled with a bone graft if required. The cemented total hip prosthesis was then inserted in all cases.

Results
The patients were evaluated clinically and radiologically. The Harris hip score improved from a mean of 40.2 points preoperatively to a mean of 82.36 points at the last QJ;follow-up. The complications included two cases with superficial infection and one case with an intraoperative femoral shaft fracture; cracks of the greater trochanter occurred in two cases during extraction of cemented Thompson. There were no instances of instability or loosening. At the end of follow-up, six cases (24%) showed excellent results, 17 cases (68%) showed good results, and two cases (8%) showed fair results.

Conclusion
Conversion THA appears to be an excellent management strategy for failed hemiarthroplasty, and can lead to reliable pain relief and functional improvement. THA is an effective salvage procedure, but it is technically more difficult than routine primary hip arthroplasty.

Keywords:
failed hemiarthroplasty, result of conversion, total hip arthroplasty

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Introduction

Hemiarthroplasty is a type of conservative surgery in that only one side of the joint is replaced, preserving bone stock for future, more extensive procedures if necessary. Technical pitfalls at the revision of failed hemiarthroplasties have been described [1–5]. However, there is little on the clinical outcome of such a revision. Inevitably, some hemiarthroplasties fail and require revision for pain, impaired walking ability, leg length discrepancy, or a combination of those. The rate of operation varies from 5 to 24% among patients treated by hemiarthroplasty [6].

The treatment of displaced intracapsular fractures in patients who are mobile, socially independent, and otherwise fit is controversial.

A prospective randomized comparative study of ORIF, hemiarthroplasty, and total hip replacement has shown that patients treated with total hip replacement have better morbidity and pain relief after 1 year and 13 years [7]. Cossey and Goodwin [8] have shown that conversion to total hip replacement for symptomatic failed hemiathroplasty allow patients to have a pain-free and functionally acceptable lifestyle.

Acetabular cartilage erosion manifests as groin or buttock pain and is a common indication for conversion of hemiarthroplasty to total hip arthroplasty (THA).

In addition, femoral stem loosening and resultant osteolysis associated with prosthesis may occur. There are many reports on the results and causes of failure of hemiarthroplasty [9–12].

The aim of the present study was to evaluate the functional results and the complications associated with conversion of failed hemiarthroplasty to THA.

Figure 1

(a) This radiograph was taken 1.5 years after Austin Moore was performed for a femoral neck fracture in a 61-year-old man. With acetabular erosion, HHS was 50 points and modified femoral offset was 5 cm. (b) Radiograph 2 years after conversion surgery to segmental THA with a modified femoral offset of 7.5 cm and HHS of 90 points. (c) Profile view showing good abduction. HHS, Harris hip score; THA, total hip arthroplasty.

Patients and methods

Twenty-five patients were operated for conversion of failed hemiarthroplasty to THA between 2007 and 2010 at the Damanhour National Medical Institute. The inclusion criteria were patients suffering after hemiarthroplasty for fracture neck femur conversion performed

for infection, avascular necrosis of the femoral head, pathological fracture, cases with a history of deep vein thrombosis, and cases with an ipsilateral fracture of the lower limbs not be included in this study.

There were 15 men and 10 women ranging in age from 56 to 82 years (average 67.96 years). Patients were analyzed for symptoms before conversion to THA.

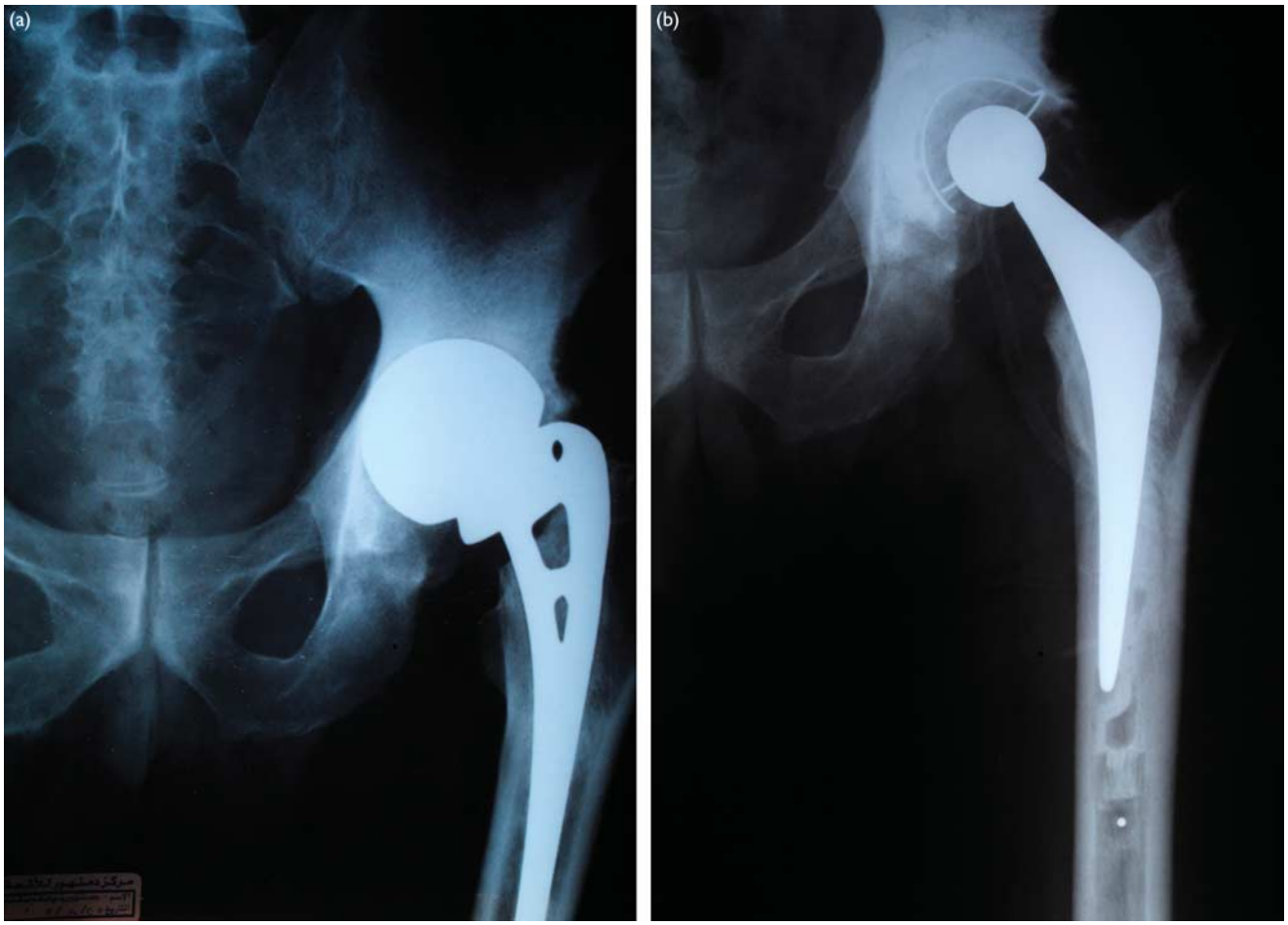
The conversion arthroplasty was performed for acetabular erosion without aseptic prosthesis loosening in 17 patients (Fig. 1) and acetabular cartilage erosion with prosthesis stem loosening in seven patients (Fig. 2). Of 17 patients with acetabular erosion, four had acetabular bone loss with protrusion of the head of the prothesis medial to the kholer line. The presenting symptoms were groin and buttock pain in 17 patients, thigh pain in four patients, and both groin and thigh pain in three patients; one patient had cemented Thompson dislocation. All the patients presenting with thigh pain had loosening of the stem at radiographs. In terms of the type of prosthesis, the Austin Moore (20 cases, 80%) and cemented Thompson (five cases, 20%) were used. The interval between hemiarthroplasty and onset of pain was 6 months to 5 years (average 2.8 years). Of the 25 patients, 14 had moderate pain and 11 had severe pain. Table 1 lists the patients' characteristics.

Preoperatively, patients were screened for possible sepsis before surgery. Laboratory evaluation included complete blood count, differential count, erythrocyte sedimentation rate, and c-reactive protein level. Radiographic examination of anteroposterior and lateral views was carried out routinely.

A standard posterior approach to the hip was used in all patients. In all cases of Austin Moore removal, no difficulty was encountered. Dislocation and extraction of the cemented Thompson prosthesis was difficult in three cases. Intraoperative complications developed in these three cases; cracks of the greater trochanter occurred in two cases and femoral shaft fracture occurred in one case, which was managed by internal fixation with broad dynamic compression plate and screws (Fig. 3).

After removal of the prosthesis, evaluation was carried out for the femoral and acetabular bone loss. Acetabular grafting with an autogenous ipsilateral bone graft was used for four cases (16%) with acetabular erosion. Cemented prosthesis was used in all cases.

Figure 2



(a) A 61-year-old man with acetabular erosion and aseptic loosening in addition to a failed Austin Moore prosthesis; his HHS was 50 points. (b) Thirty months postoperatively with THA, HHS was 90 points. HHS, Harris hip score; THA, total hip arthroplasty.

Postoperatively, all patients received prophylactic antibiotics (third-generation cephalosporins) that were administered routinely in all cases for 5 days parenterally and then orally until the stitches were removed on day 12. Low-molecular-weight heparin (clexane) was used in all cases for 7–10 days.

Static quadriceps exercises of knee and ankle mobilization were started on the day of surgery. In cases with no gross acetabular or femoral reconstruction, mobilization was started from the second day postoperatively on a walker and was continued for 3 weeks, then on a crutch for 3 more weeks, and then without aid depending on the patient's condition. No weight bearing was allowed until union in patients with cracks of the upper end femur and femoral shaft fracture.

Table 1 Patients' demographic data

	N (%) (*N*=25)
Age (56–82)	25 (100%)
Group I (56–65)	13 (52%)
Group II (66–75)	9 (36%)
Group III (77–82)	3 (12%)
Sex	
Male	15 (60%)
Female	10 (40%)
Acetabular erosion	17 (68%)
Acetabular erosion + aseptic loosening	7 (28%)
Dislocation	1 (4%)
Groin pain	17 (68%)
Thigh pain	4 (16%)
Both groin + thigh pain	3 (12%)
Prosthesis	
Austin Moore	20 (80%)
Thompson	5 (20%)
Complaint	
Pain + antalgic gait	21 (84%)
Pain + antalgic gait + LLD	4 (16%)

LLD, leg length discrepancy.

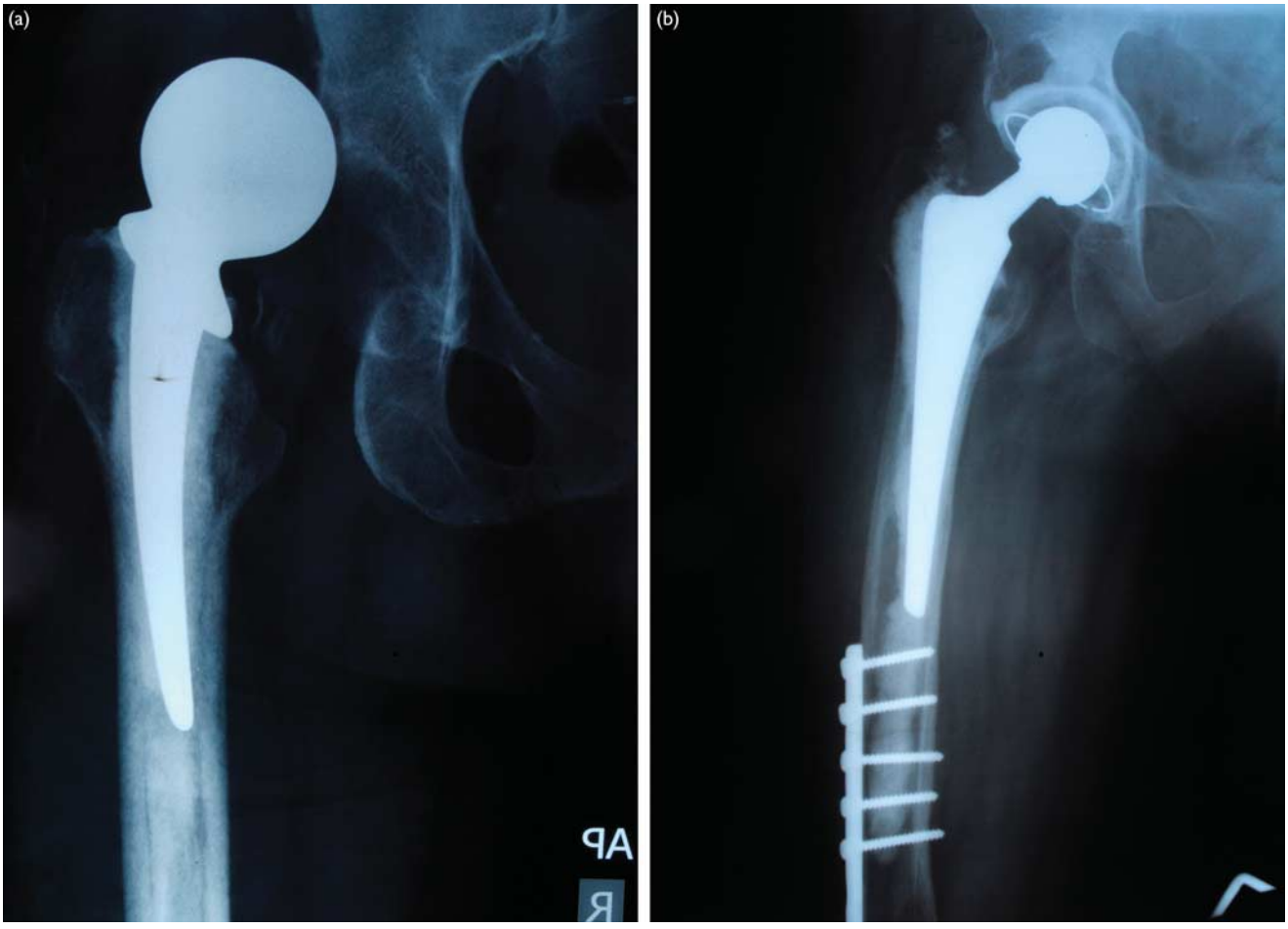
Assessment of results

All patients were evaluated both clinically and radiologically.

Clinically

Preoperatively, postoperatively, and at the time of the last follow-up, the Harris hip score [13] was used for evaluation.

Figure 3



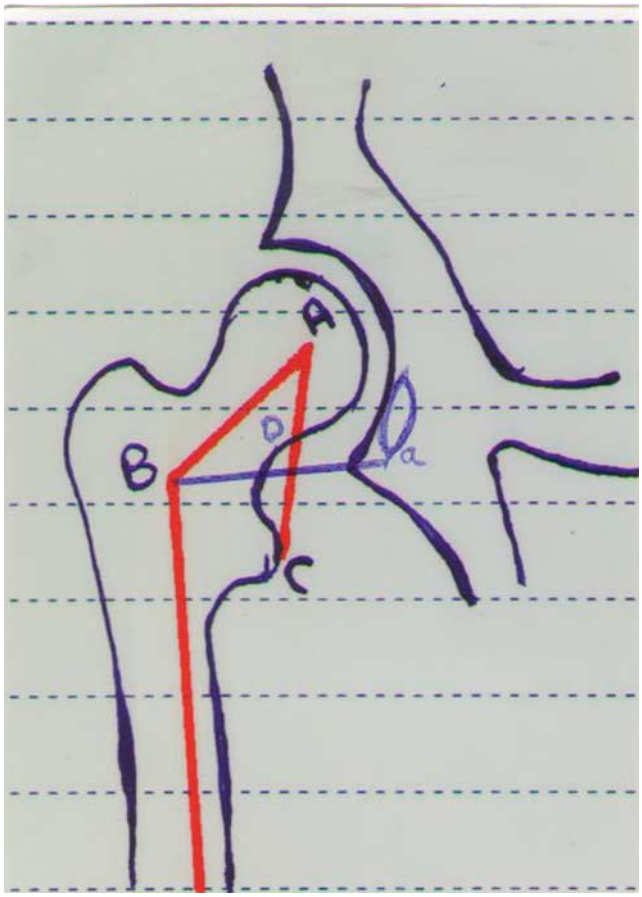
(a) A 65-year-old woman with a cemented Thompson dislocation. (b) Twenty-nine months following conversation to cemented THA, an intraoperative femoral shaft fracture that occurred during extraction of prosthesis was managed with IF by broad dynamic compression plate + screws. The Harris hip score was 80 points. THA, total hip arthroplasty.

Radiologically

The following parameters were assessed

(1) *Modified femoral offset*: The femoral offset is a part of the abductor lever arm. Shortening of the femoral offset would affect the abductor mechanism and lead to an increased joint reaction as more force is required by the abductor muscles, limping, and bony impingement [14]. Original femoral offset is the distance from the center of the femoral head to the axis of the distal part of the stem. As the sizes of the heads of hemiarthroplasty and THA were evidently different, the points of the lower edge of the tear drop were used instead to measure the modified femoral offset to facilitate comparison (Fig. 4).
(2) *Neck shaft angle*: This yields an index for the varus position of the endoprosthesis.
(3) *Modified vertical height of the femur*: This represents the amount of shortening or lengthening produced by the endoprosthesis (Fig. 4).
(4) Postoperative radiographs were obtained after surgery, at 3, 6 and 12 weeks, at 6 months, and annually thereafter; the circumference of the acetabulum was considered in three zones of DeLee and Charnley [15] and the proximal femur in the seven zones described by Gruen *et al.* [16].
(5) The radiographs were analyzed for the presence of cement–bone radiolucent lines, wear of the acetabular cup, femoral cement fractures, and component orientation for the diagnosis of loosening.

Figure 4



Angle B represents the neck shaft angle, a–B represents the modified femoral offset, and c–D represents the modified vertical height.

Results

All patients were evaluated both clinically and radiologically at the time of the last visit. The average follow-up period was 29.3 months (range 12–36 months).

Clinically, at the time of the last follow-up, the Harris hip score [13] was used for evaluation. The Harris hip score at presentation ranged from 10 to 55. Harris hip scores improved in all cases. There was an overall improvement from a mean of 40.2 preoperatively to a mean of 87.92 postoperatively at the 1-year follow-up and to 82.36 points at the last follow-up (3 years). Fifteen patients (60%) reported no hip pain and 10 patients (40%) reported slight pain at the last follow-up. Twenty-one (84%) patients were able to walk without support and four (16%) were able to work with the support of one arm (Table 2).

Harris hip scores were affected by the indication for conversion arthroplasty (Table 3).

At the 1-year follow-up, 16 patients (64%) showed excellent results and nine patients (36%) showed good results; at the end of follow-up, six patients (24%) showed excellent results, 17 patients (68%) showed good results, and two patients (8%) showed fair results (Table 4).

Postoperative wound complications were observed in two patients with superficial infection, which cured completely after debridement, suction irrigation, and 2 weeks of intravenous antibiotics (Fig. 5). No deep vein thrombosis or neurovascular complications were encountered during the follow-up period.

In this study, the range of the neck shaft angle was 95–125, with a mean of 110° varus position of the prosthesis seen in six cases (24%); after conversion to THA, the range of the neck shaft angle was 125–140°, with a mean of 135°.

Preoperatively, the modified femoral offset ranged between 3.5 and 5 cm, with a mean of 3.54 cm. Postoperatively, femoral offset ranged between 5 and 7.5 cm, with a mean of 4.5.

The mean original vertical height was 4.52 cm (range 5–7.5 cm); postoperatively, it ranged from 6 to 8.7 cm, with a mean 6.3.

For all patients, both anteroposterior and lateral views were assessed. There were no signs of loosening of either femoral or acetabular components at the end of follow-up.

Discussion

THA is often carried out after failure of hemiarthroplasty. For the evaluation of operative difficulties, functional results and complications associated with conversion of hemiarthroplasty to THA this study were determined. In

Table 2 Cases data and results of conversion after failed hemiarthroplasty

Number	Sex	Age	Indication for conversion	Prosthesis	Complication	Preoperative HHS	Postoperative HHS	At last follow-up
1	F	56	Protrusion with acetabular erosion	Cemented Thompson	–	40	90	80
2	M	63	Aseptic loosening + thigh pain	AM	–	25	90	85
3	M	58	Acetabular erosion + groin pain	Cemented Thompson	Crack at greater trochanter	35	95	92
4	M	65	Acetabular erosion + groin pain	AM	–	35	92	90
5	M	63	Acetabular erosion + groin pain	AM	–	35	90	80
6	M	64	Acetabular erosion + groin pain	Cemented Thompson	Crack at greater trochanter	35	95	90
7	F	57	Protrusion with acetabular erosion	AM	–	45	92	90
8	M	59	Acetabular erosion + buttock + groin pain	AM	–	55	80	80
9	F	65	Dislocation	Cemented Thompson	Intraoperative femoral shaft fracture	10	90	80
10	M	61	Acetabular erosion + aspetic loosening	Cemented Thompson	–	50	95	90
11	F	66	Protrusion with acetabular erosion	AM	–	50	80	80
12	M	75	Acetabular erosion + groin pain	AM	Superficial infection	55	90	85
13	F	67	Acetabular erosion + groin pain	AM	–	45	90	85
14	M	68	Protrusion with acetabular erosion	AM	–	45	92	90
15	M	66	Aspetic loose thigh + groin pain	AM	–	35	85	80
16	M	74	Acetabular erosion + groin pain	AM	–	35	90	80
17	F	69	Aspetic loose thigh + groin pain	AM	–	35	80	80
18	F	71	Aspetic loose thigh + groin pain	AM	Superficial infection	50	95	82
19	F	70	Aspetic loose thigh + groin pain	AM	–	45	80	80
20	M	72	Acetabular erosion + buttock pain	AM	–	35	92	80
21	F	75	Aspetic loosening + groin pain	AM	–	35	90	80
22	M	82	Acetabular erosion + groin pain	AM	–	35	80	70
23	F	77	Acetabular erosion + groin pain	AM	–	45	95	80
24	M	80	Aspetic loosening + groin pain + erosion	AM	–	50	80	70
25	M	76	Acetabular erosion	AM	–	45	80	80

AM, Austin Moore; HHS, Harris hip score.

Table 3 Harris hip score in relation to indication

Indication	Preoperative	1-year follow-up	Last follow-up
Acetabular erosion ($N=17$)	42.7 ± 7.7	90.18 ± 5.15	83.76 ± 5.73
Aseptic loosening ($N=4$)	35 ± 7.07	83.75 ± 7.01	81.25 ± 2.16
Dislocation ($N=1$)	10 ± 0.0	90 ± 0.0	80 ± 0.0
Acetabular erosion + loosening ($N=3$)	43.34 ± 6.24	83.3 ± 6.095	76.7 ± 4.7

Table 4 Functional results after conversion

Results	1-year follow-up	3-year follow-up
Excellent	16 (64%)	6 (24%)
Good	9 (36%)	17 (68%)
Fair	–	2 (8%)
Total	25 (100%)	25 (100%)

this study, significant functional improvement was observed in all patients after conversion, but the procedures were associated with considerable intraoperative difficulties, especially in cemented hemiarthroplasty, and postoperative complications. When hemiarthroplasty is used in mobile, independent patients, it frequently requires conversion to total hip replacement. Those whose hemiarthroplasties are not converted often have chronic hip pain, with reduced mobility [7].

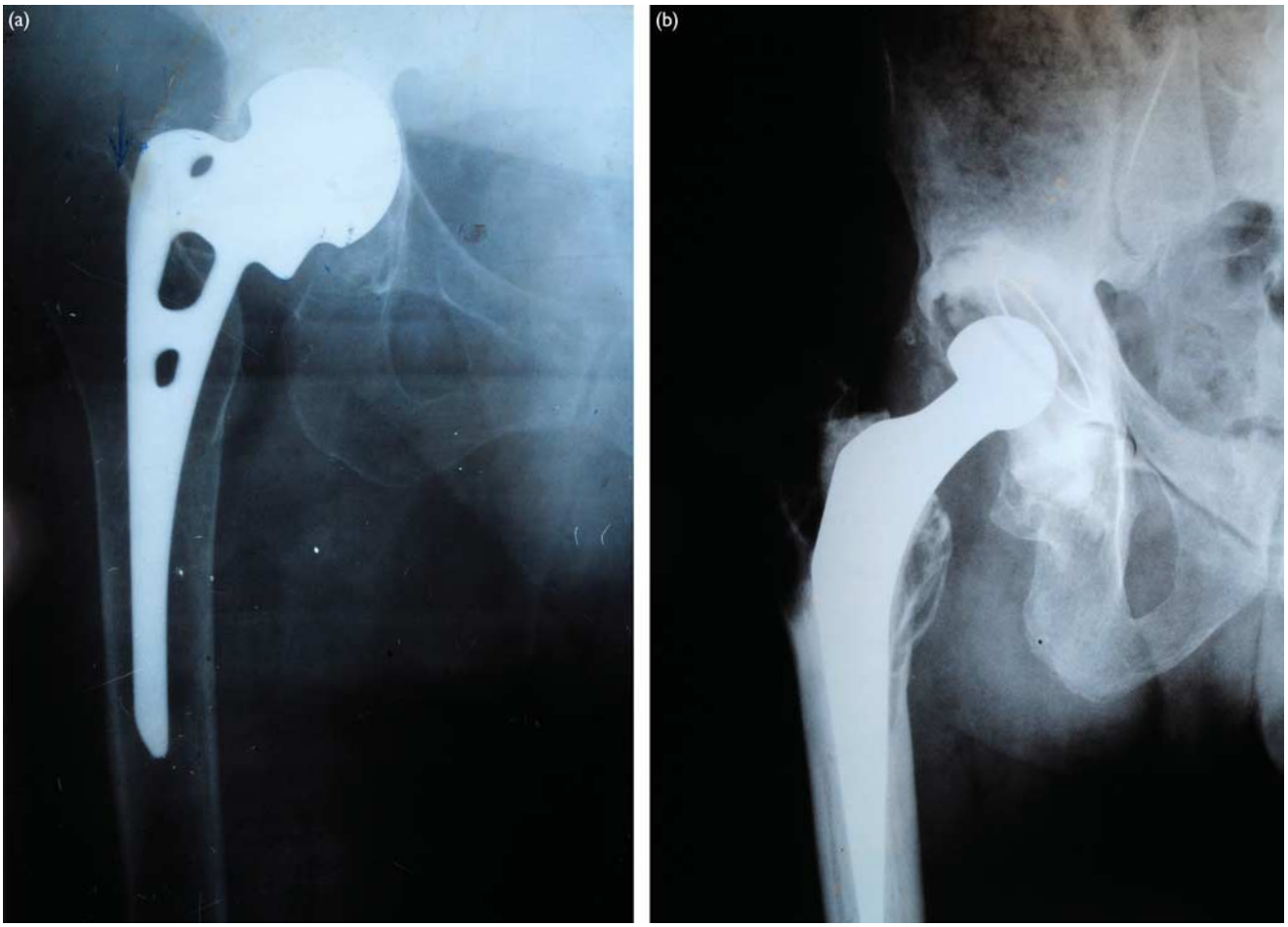
Groin pain is one of the most common indications for revision after previous hemiarthroplasty [8,17,18]. Pain is usually because of articular cartilage degenerations in the acetabulum, loosening of the prosthesis in the proximal femur, or a combination of both. These pathological processes are exacerbated by many factors including incongruencies between the femoral head and the acetabulum, the use of cement, excessive neck length, impaction at the time of injury, physiological young active patients and shear forces between the prosthesis and the cartilage [18–20].

In this study, an interesting intraoperative finding was that the articular surface of the actabulum appeared to be degloved from subchondral bone.

Sierra and Cabanela [21] reported results from 132 conversion THA after previous hemiarthroplasties carried out for femoral neck fractures. They reported lasting pain relief, no pain, or mild pain in 86% of the patients, whereas 14% of the patients had moderate to severe pain at an average follow-up of 7.1 years. In this study, 15 patients (60%) had no hip pain and 10 patients (40%) had slight pain at the last follow-up of 3 years, which is in agreement with Cossey and Goodwin [8].

Hofmann *et al.* [22] showed that the relatively poor performance of cemented femoral components inserted after the removal of hemiarthroplasty stem may have been because of several reasons: extensive resorption of the endosteal bone while the stem was loose and additional damage that may have occurred during revision, particularly while removing the bone struts that fill fenestrated stems or during the removal of bone

Figure 5



(a) A 71-year-old female patient with failed Austin Moore 28 months postoperatively presented with groin and thigh pain because of acetabular erosion and aspetic loosening; the preoperative HHS was 50 points. (b) Thirty months postoperatively, she had good range of motion and an HHS of 82 points. HHS, Harris hip score.

cement [4]. Dupont and Charnley [1] and Sarmiento and Gerard [23] showed that toggling of the prosthesis may produce a thick fibrous membrane that is adherent to the surrounding bone and may not be completely removed at the time of revision.

No loosening was found in this study, and this is different from 14.6% progressive loosening reported by Amstutz and Smith [4]. This may be because of the cementing technique used and the improved stem design. In this study, the follow-up period was short, and a further evaluation of this group may be required in the future.

There was no mortality in this work, and this is similar to that of Siplia *et al*. [6], who reported that conversion arthroplasty did not appear to increase mortality.

The reported intraoperative and postoperative complications of conversion arthroplasty were high and this indicates the difficulties of this surgery in elderly patients [4,24,25]. Amstutz and Smith [4] reported results of 41 patients who underwent conversion arthroplasty; there were five intraoperative proximal femoral fractures, two perforations of the medial cortex with stem protrusion, two cases of instability, two patients with infection, three patients with deep venous thrombosis, and six patients with progressive loosening. Cossey and Goodwin [8] reported on 46 patients who underwent conversion arthroplasty; there was no loosening and no dislocation, and two patients had a superficial infection and three patients were dead at the time of study, which is in agreement with this study. One patient had a femoral shaft fracture that was managed with broad dynamic compression plate and screws, two patients had a superficial infection that was managed with debridement plus suction irrigation and intravenous antibiotics for 2 weeks, and two patients developed cracks of the greater trochanter of the femur after extraction of cemented Thompson. The incidence of complications in this study was comparable to those in other studies [4,21,23,26] (Table 5).

The time of revision surgery affected the results; when revision is done as early as the patients started to complain and radiological data is available and not to wait until patient become crippled the results are much more better as this patients has a higher preoperative Harris hip score and much improving score postoperative which may be due to better muscle condition which facilitate mobility after revision surgery, this also is matched with

Table 5 Complication after conversion total hip arthroplasty for failed hemiarthroplasty

Number	References	Number of patients	Dislocation	Intraoperative femoral shaft fractures	Intraoperative greater trochanter	Sepsis	Actabular loosening	Femoral loosening
1	Sarmiento and Gerad [23]	80	3	–	2	1	1	4
2	Amstutz and Smith [4]	41	2	5	–	6	–	6
3	Llinas *et al.* [26]	99	–	–	3	–	5	4
4	Shartkey [18]	45	–	–	–	–	–	1
5	Sierra and Cabanela [21]	132	–	12	4	2	6	13
6	Current study	25	2	1	2	2	–	–

the results of Phillips [24]. This is in agreement with the results reported by Amstutz and Smith [4].

Of the different radiological measurements, the modified medial femoral offset was the best indication of the patients' clinical condition and one of the factors affecting the Harris hip score. This was also confirmed in the study of McGrory *et al.* [14], who reported that increasing femoral offset at THA resulted in an increased range of motion, better mechanical advantage for the abductors, and decreased instability because of better soft tissue tension. This will consequently lead to an increase in the Harris hip score.

Rogmark and colleagues reported that when choosing between THA and hemiarthroplasty, it has to be kept in mind that THA yields a better functional outcome in active, independent elderly individuals, but has a higher rate of dislocation. Hemiarthroplasty results in fewer dislocations, a shorter operating time, and less need for blood transfusions, but there is a risk that acetabular erosion may limit the life of the implant [27].

After improvement in Harris hip scores, conversion arthroplasty seems to be a very effective way to eliminate pain. Also, the patients' level of activity and mobility improved; a similar observation has been reported by many authors [6,7,28,29].

In this study, 92% of patients had either excellent or good results at the last follow-up (mean 29.3 months), which is considerably higher than that reported by Squires and Bannister (70%) [7]. This may be attributed to the different life styles and activity levels of the populations of this age group.

Conclusion

Conversion THA for a failed hemiarthroplasty can consistently lead to reliable pain, better function, and mobility as close as possible to the preinjury level; hemiarthroplasty should not be used in physically active patients, even in elderly patients.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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