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TOTAL HIP ARTHROPLASTY FOLLOWING FAILED FIXATION OF PROXIMAL HIP FRACTURES

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ABSTRACT

Background: Most proximal femoral fractures are successfully treated with internal fixation but a failed surgery can be very distressing for the patient due to pain and disability. For the treating surgeon it can be a challenge to perform salvage operations. **Aim of the work:** The study was conducted to assess the results and complications of total hip arthroplasty after mechanical failure of internally fixed proximal hip fractures. **Patients and Methods:** In a prospective study, 21 hips in 20 patients (13 males and seven females) with complications of operated hip fractures as indicated by either established nonunion or fracture collapse with hardware failure were analysed. Mean age of the patients was 52 years (range 44 years to 68 years). Nine hips were treated for femoral neck fracture, 10 for intertrochanteric (I/T) fracture and two for subtrochanteric (S/T) fracture of the hip. Uncemented THA was done in 7 hips, cemented THA in nine hip joints and hybrid THA in five hips. **Results:** The average duration of follow-up was 20 months range (6months-2.5 years) . The mean duration of surgery was 125 min and blood loss was 1200 ml. There were one dislocation post operatively. This was managed conservatively. There was one superficial infection. Only one patient required a walker while four required walking stick for ambulation. The mean Harris Hip score increased from average 32 pre-operatively to average 82 postoperatively at one year interval. **Conclusion:** Total hip arthroplasty is an effective salvage procedure after failed osteosynthesis of hip fractures. Most patients have good pain relief and functional improvements inspite of technical difficulties and high complication rates than primary arthroplasty.

KEYWORDS: Failed internal fixation, hip arthroplasty, hip fractures, THA.

INTRODUCTION

Stable trochanteric femoral fractures can be treated by internal fixation methods with union rates as high as 100% when optimal implant and good reduction have been achieved. Failure rates have been reported in literature due to comminution, osteoporosis and suboptimal fixation.[1] Functional disability and pain are the end result of failed fixation of trochanteric femoral fractures. Failure rates may be due to failure of the device (3-12%); device penetration in (2% and 12%), nonunion (2-5%) and malunion with varus deformity in (5-11%). Certain unstable fracture patterns have been reported to have failure rates as high as 56%.[2-6] Revision of internal fixation for nonunited trochanteric fractures of the femur has been reported to have good results in younger patients with good bone stock.[6-9]

Total hip arthroplasty is considered as a salvage procedure for older patients, patients with poor bone stock, avascular necrosis of the femoral head, associated with damaged acetabular articular cartilage . There are many technical difficulties during conversion hip arthroplasty such as extraction of implants, bone deformity, bone loss, poor bone quality and associated trochanteric nonunion.[10-12] Management of failed internal fixation of proximal hip fractures includes revision osteosynthesis or conversion total hip arthroplasty (THA). The purpose of this study is to evaluate the short term functional outcome, technical difficulties, complications associated with hip arthroplasty performed after failed fixation of proximal hip fractures.

Patients and Methods

All patients included in this study have given informed written consent for participating in the research before operation. This prospective study was conducted at AL Azhar University Hospitals, after approval of our ethical committee for research in accordance with the ethical standards laid down in the 1964 declaration of Helsinki and its later amendments.

Between 2012-2015, 21 hips [Table 1] in 20 patients (13 females and seven males) with a mean age of 52 years (range, 44 to 68 years) were treated with hip arthroplasty, after failed fixation of proximal hip fractures, as established by nonunion or implant failure.

Records of the patients were retrieved from our computer database.

Table 1: all patients data.

Mean Age (range)	**52 (44-68) years**
Sex	Male: 7
	Female: 13
Side affected	Right: 10
	Left: 11
Implant in first operation	*DHS: 10
	**PFN:5
	***DCS: 1 Reconstruction nail 5
Mean duration between first operation and salvage	22 (9-36) months
Type of prosthesisfixation method)	Cement less: 7
	Cemented: 9
	Hybrid: 5
Stem used	Standard stem: 13
	Long stem: 8
Bearing surfaces	Metal on polyethylene : 21

*(dynamic hip screw) **(proximal femoral nail) ***(dynamic condylar screw)

The type of fracture was intertrochanteric in 10 hips, subtrochanteric in 2 hips and neck femur fractures in 9 hips. The implants used to treat these fractures primarily were: Dynamic Hip Screw in (DHS: 10 cases), proximal femoral nail in (PFN: 5 cases) (Fig 1d&1e), dynamic condylar screw in (DCS: 1 case) and reconstruction nail (Recon. Nail 5). The mean time from primary fixation to the salvage arthroplasty was 22 months (range, 9 to 36 months).

Intraoperative cultures did not grow organisms in 19 hips and positive in 2 hips were operated on in two stages. One stage revision was done in 19 hips with aseptic failure (Figure 2B and 2C), and two stages in 2 cases where infection was the cause of nonunion and implants failure (Figure 3 A). The **inclusion criteria** of patients included in this study were either one or a combination of the following.

Nonunion and or loss of fixation with avascular necrosis of the femoral head, Screw penetration of the acetabulum, Chondrolysis or hip incongruity.

Exclusion criteria

Patients with implant failure with normal acetabulum were **excluded** as bipolar prosthesis was done, also cases with active infection not done until debridement and cure of infection at least nine months after skin closure and no sinuses then second stage was done for them after laboratory investigations to ensure no microbial activity.

The selection of the implant type depended on patient age and bone quality with intraoperative evaluation according to bone stock after removal of implant. Hybrid prosthesis was used in 5 hips (Cementless stem and cemented cup), cementless prosthesis was used in 7 hips (Figure 2C&2D), and cemented prosthesis in 9 hips and (Figure 4B). A 28 mm metal head was used in all cases. In cemented stem the principle of Patterson.[13] was used to avoid cement extrusion through the screw holes which may cause subsequent fracture through this stress riser.

Details of the patients of failed proximal hip fractures where conversion THA is performed.

Out of 21 hip fractures where conversion THA was done, 10 were intertrochanteric fractures, nine were fracture neck of femur and two were subtrochanteric fractures. In all cases primary reduction and fracture fixation was done within three weeks of sustaining the fracture. Four out of 20 cases had two surgeries (Figure 1B&1C) before conversion THA was done.

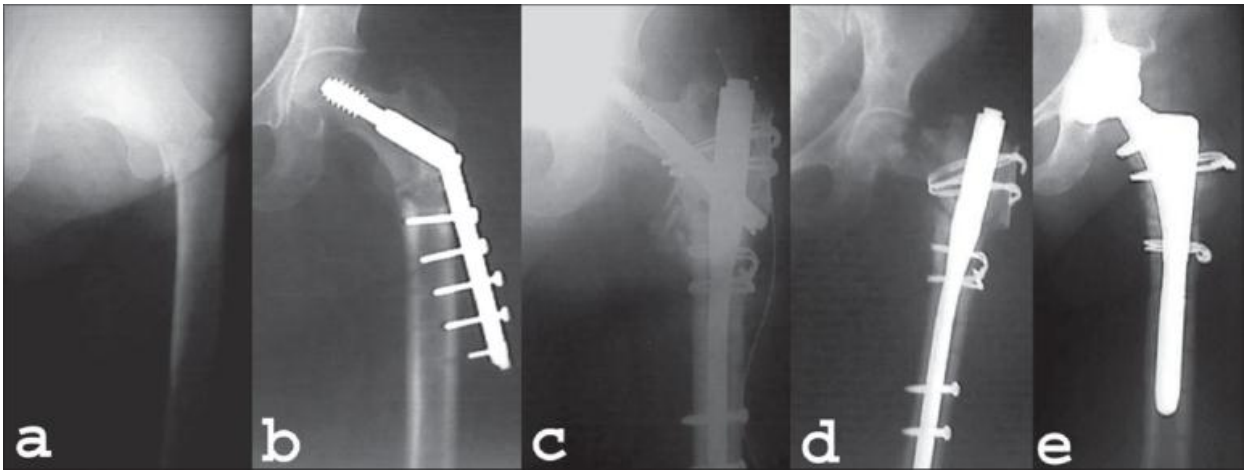

Figure 1: 58yrs old lady with subtrochanteric fracture of her left hip. (a) AP radiograph of 58yrs old lady with subtrochanteric fracture of her left hip. (b) Fracture was fixed with DHS which pulled out in 4 months time. (c) DHS was removed and refixation was done with proximal femoral nail. (d) Lag screw of PFN cut through (e)cementless total hip arthroplasty with circlage trochanter and proximal femur.

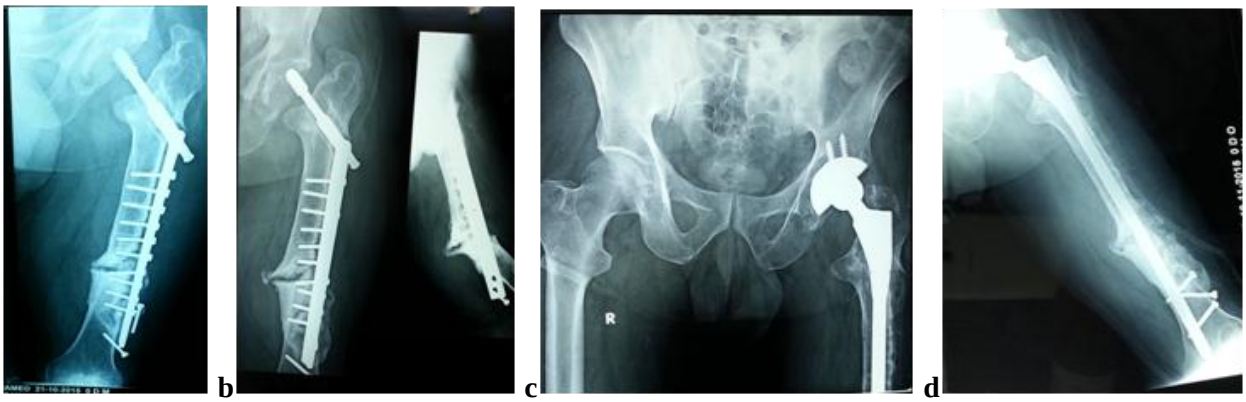

Figure 2: male patient 68 year Inter trochanteric fracture left hip and fracture distal third femur was fixed with Long DHS A&B post operative fixation after 1 year- C&d total hip arthroplasty long stem uncemented with distal locked screws.

a **b**

Fig, (3): female patient 58 year with malunited subtrochanteric fracture was internally fixed with DHS. A) Malunited subtrochanteric after removal of the implant , B) cemented total hip Arthroplasty done as 2nd stage.

Fig. 4 : Female patient 68 years with intertrochanteric fracture was fixed with DHS. A) preoperative X-ray with implant failure; B) postoperative X-ray with cemented THR; C) postoperative dislocation 3 days postoperative; D) X-ray after closed reduction.

All patients underwent preoperative detailed clinical examination and evaluated for medical co-morbidities. Patients' medical history, operative notes, discharge summaries and previous and fresh radiographs were reviewed. Occult infection as a cause of failure is always considered and a complete preoperative blood count with differential determination of erythrocytes sedimentation rate and C-reactive protein was done.

Surgical procedure

Total hip arthroplasty was performed by a team headed by the same surgeon. Cemented or uncemented THA was done as decided by the operating surgeon according to the age of the patient and according to condition of bones as seen in preoperative radiographs and also per-operatively. Cementless THA was the preferred choice. Physiological age and patients' level of activity were a major determinant. Younger and active patients were advised uncemented THA. In patients with defect in acetabulum, grafting and cemented THA was done. Uncemented THA was performed in 7 hips, cemented THA in nine hips and hybrid THA in 5 hips. An attempt was made to incorporate the previous scar in the incision but if not possible fresh incision was made. Transtrochanteric approach was used in those cases where trochanter was fractured or avulsed (n=11). Intraoperative specimen was sent for gram stain and AFB stain (in all cases) to rule out any infection. Implants were removed and bony defects in femur and acetabulum assessed. Autograft was used in five hips to fill up the bony defect in the acetabulum. Replacement was done using standard technique and stability was checked before the closure of the wound. Failed subtrochanteric and intertrochanteric fractures were more challenging and difficult than femoral neck fracture. There was abnormal position of trochanter mass because of rotation defect and malunion of upper femur in frontal and sagittal plane. There was difficulty in intraoperative identification of limb length due to loss of usual landmarks such as lesser trochanter. Removal of fracture screws sometimes required use of a trephine and bridging the last screw hole with a longer stem. While implanting cemented stems screw holes were closed with either bone grafts or by assistant's finger. But there was some cement extrusion from the medial side. Attention was paid to maintain the integrity of abductor mechanism. Trochanter if detached was reattached with tension band wiring technique of Charnley (n=12).

Active assisted exercises were started during the first postoperative day and according to patient condition, ambulation started on second or third day in case of cemented THR. Patients were first ambulated with a walker, then with a stick and gradually progressed to ambulation without any support according to their recovery, in case of cemenless THR ambulation was allowed after 6 weeks. Antibiotics were started on the day of surgery with first dose given preoperatively and continued till the third postoperative day and anticoagulant low molecular heparine (clexan) subcutaneous and shifted to oral anticogulant according to the protocol. Dressing was changed on the third postoperative day and at the time of discharge on the fifth day. Stitches were removed on the 14th day of the surgery.

Thereafter patient was reviewed at six weeks, three months, six months and at one year and yearly thereafter. Follow-up proforma was filled at every visit and clinical and radiological results were recorded at each visit.

The cement grade of the femoral stem was evaluated according to the criteria reported by Barrack, Mulroy, and Harris.[14] Radiological loosening of the acetabular component was classified according to the criteria of DeLee and Charnley[15] and those proposed by Hodgkinson.[16] An acetabular component was considered to be loose if a continuous radiolucent line was evident in all three zones, or if the acetabular component migrated. Migration of an acetabular component was defined by a change in the opening angle of more than 8° or a difference in the component position of > 3 mm when comparable radiographs were compared. Fixation of the cementless femoral component was evaluated according to the criteria described by Engh.[17,18] and was classified as “bone ingrowth”, “stable fibrous” or “unstable”. Loosening of the cemented femoral component was evaluated according to the criteria described by Harris et al.[19,20] and was graded as “definite” “probable”, “possible” or none. Harris Hip score was used to evaluate the patients (table 2).

RESULTS

The median duration between the primary surgery for fixation of fracture and THA was nine months (range 3 months – 8 years). The mean operating time for hip arthroplasty operation was 125 min (range 95 min to 210 min) which included the time to remove the retained hardware such as screws or barrel plates. The mean estimated blood loss was 1300 ml. In one patient difficulty was encountered in removing the screws from the plate and the screw heads had to be cut to remove the plate and extricate the screws. two patients had intraoperative complications. In one patient the proximal femoral canal got fractured during reaming and was treated with circlage wires.and the other patient had fracture of the greater trochanter and wiring was done. Uncemented THA was performed in 7cases, cemented THA in nine cases and hybrid THA was performed in five cases. Trohanteric wiring was done in 12 patients. All surgeries were performed in single stage.except two hips were done in two stages due to positive culture so removal of D.H.S was done and after 6 months repetition of Lab investigation that was revealed clearness of infection.

One patient had postoperative complication in the form of dislocation of the hip during rehabilitation. the dislocation was early. the dislocation was anterior, observed on the third postoperative day and was subsequently reduced under general anesthesia (GA) and

maintained with careful and protected physiotherapy. There was no further dislocation afterwards.

Infection was seen in one patient. The superficial infection in one case was treated with antiseptic dressings and antibiotics only.

Four patients developed medical complications such as paralytic ileus (n=2), urinary tract infection (n=1), congestive heart failure (n=1). All recovered over a period of time. There was no intraoperative or postoperative mortality.The average duration of follow-up was 20 months (Range 6months-2.5 years). There was no mortality. The patients were followed up at the time of removal of skin stitches, two weeks, six weeks, three months, six months, one year and then every year. There was dramatic pain relief in all the patients with four patients reporting moderate and three reporting mild pain. One patient was using a walker whereas four were using a walking stick for ambulation. The mean Harris Hip Score increased from average 32 preoperatively to 82 postoperatively at one-year interval. We did not find any difference clinically between cemented and uncemented hips as regards to pain and function.At the end of follow up after two years, eight hips had excellent results (38.5%); ten with good results (47.5%), two hips (9.5%) with fair results and one hip (4.5%) had poor results(Fig. 5). When comparing the mean HHS in cases with cemented stem (7 stems) and cases with cementless stem (13) there was no significant difference & (Table 2)

RADIOGRAPHIC RESULTS

Radiographs were available for all patients at least 7 months postoperatively. In no cases were component malpositioning or aseptic loosening detected. Stable nonprogressive radiolucent lines were found around the cup in one case and around the stem in another case with THA prosthesis. Clinically, the patients were asymptomatic in both cases.

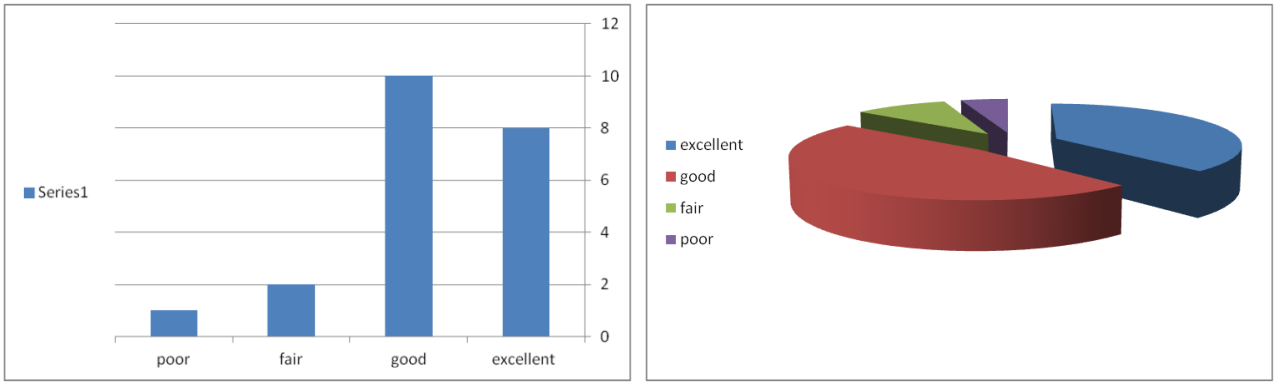

Fig 5 show the results according to number of hips operated

Table 2: Results according to Harris Hip Score.

Results	Mean score (points)		Postoperative score (number of patients %)			
Harris hip score	Preoperative	Postoperative	Excellent	Good	Fair	Poor
	32 points	82 points	8(38.5%)	10(47.5%)	2(9.5%)	1(4.5%)
Complications	Dislocation			Infection		
	1 patient			Superficial (1case)		

DISCUSSION

Although most fractures of the proximal femur are treated with a favorable outcome, a complication can result in ongoing hip pain and disability. The reported failure rate with internal fixation for intertrochanteric fracture is in the range of 3-12% with device penetration (2-12%), nonunion (2-5%) and malunuion causing varus deformity (5-11%).(21) In displaced intracapsular hip fractures 20-36% of patients initially treated with reduction and internal fixation required revision within two years usually because of nonunion or avasular necrosis.(8) Parker. also showed a reoperation rate of 40% for displaced femoral neck fracture treated with internal fixation.[22]

Total hip arthroplasty is generally accepted as the most successful salvage procedure for failure of these fixation devices.1 Hip arthroplasty dramatically alleviated pain and improved function in the majority of these patients, for whom other salvage techniques would have been difficult or had been tried and had failed. The operation allowed most patients to regain function that otherwise had been lost, which is the hallmark of an effective salvage procedure.

The surgeon who is faced with failed internal fixation of a proximal hip fracture should always consider occult infection as a potential cause of the failure. Our current protocol involves a complete preoperative blood count with differential determination of the erythrocyte sedimentation rate and C-reactive protein level. If there

is evidence of infection, all hardwares are removed, irrigation and debridement is performed and the arthroplasty is performed in a staged fashion after the intravenous administration of organism-specific antibiotics. In our series there were only two hips of infection as a cause of failure of internal fixation and the operations were performed on two stages six months later after taking appropriate specific antibiotic, and complete lab investigation prove clearance.

Failed internal fixation devices, frequently with broken screws, must be removed from the femur. Special instruments for the removal of broken screws can simplify this process. The surgery takes a longer time because the internal fixation device must first be removed. The surgeon must dissect through the old scars to expose the internal fixation device. This also causes increased blood loss. The ununited head and neck fragment or fragments usually are in a deformed position and must be mobilized before being excised.

Many specific problems may occur during conversion of failed internal fixation of intertrochanteric fractures to hip arthroplasty. The anatomy of the proximal femur usually is distorted, especially if the reduction of the hip fracture is imperfect, or if there is communition of the medial bony buttress. The bone quality usually is poor as a result of preexisting osteoporosis, which further decreases as a result of disuse after the failure of internal fixation. The greater trochanter either is not solidly healed or can be fragmented again during hip arthroplasty, thus affecting the abduction function, which leads to an increased dislocation rate and can adversely affect the ambulatory function. In our series there were one dislocation, which was managed conservatively. Mabry, showed a dislocation rate of 9% for secondary total hip arthroplasty.[23] A high dislocation rate (6% for total hip replacement and 12% for hemiarthroplasty) has been demonstrated in other series in which THA was performed for the treatment of nonunion at the site of a femoral neck fractures.[24] Proper reattachment of trochanter with either tension band wiring or trochanteric plate is necessary for the stability of the hip and proper functioning of the abductor mechanism.

One difficulty encountered in intertrochanteric fractures is containment of cement when it was being pressurized into the femoral medullary canal. The lag screw hole can be closed by the assistant's thumb, by firmly packed gauze, by a surgical glove inflated with saline or by fashioning a bone plug from the femoral head.13 For the screw holes, one could apply direct finger pressure, use gauze or, screws that were cut short to close the holes over the lateral cortex when cement is injected.[25]

Complication rates in conversion THAs are more than that seen in primary THAs. Infection rates generally increase in already operated areas and with additional hardware.[26] The combined reported complications from published series are deep infection rate of 3.8%, periprosthetic fracture rate of 6.2%, dislocation rate of 11.4%, early implant failure rate of 1.5% and a reopertaion rate of 10.9%.9,[17–22] These complication rates are higher than we would normally see in an osteoarthritic population undergoing primary THA. In our series also there was an Infection seen in one patient (5%). it was superficial infection in one case which was treated with antiseptic dressings and antibiotics only and dislocation rate of 5% which is comparable to other studies of a similar nature.

Several authors have found salvage THA for failed intertrochanteric fractures to be more difficult with a higher potential for complications than salvage THA for failed femoral neck fracture. Despite this finding, Haidukewych and Berry(1) reported relatively few complications and good pain relief and function in their large series of salvage THA after failed IT fractures. By contrast, McKinley and Robinson[27] reported poor outcomes in their series of salvage THA for failed subcapital fractures. Our subanalysis of salvage THA for failed internal fixation for intertrochanteric fractures and intracapsular neck fracture did not demonstrate any difference in complication rate or clinical outcome. The majority of our patients had good pain relief and marked functional improvement. In a few patients with residual hip pain, the most common apparent cause was trochanteric nonunion or trochanteric bursitis. Hip arthroplasty performed after failed internal fixation of proximal hip fractures is technically more difficult than routine primary THA.

CONCLUSION

Total hip arthroplasty is an effective salvage procedure after failed osteosynthesis of hip fractures. Most patients have good pain relief and functional improvements inspite of technical difficulties and high complication rates than primary arthroplasty.

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