

## Conversion Arthroplasty in Management of Failed DHS Trochanteric Fractures Fixation

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### Abstract

**Background:** Failed internal fixation of intertrochanteric (IT) hip fractures presents a significant challenge in the elderly, osteoporotic population. Conversion total hip arthroplasty (cTHA) and hemiarthroplasty (cHA) are both accepted salvage operations for failed IT fracture fixation, though limited clinical data exist regarding the optimal treatment between these procedures.

**Aim of Study:** The aim of the present study was to provide adequate data that hip arthroplasty to salvage the failed internal fixation of failed intertrochanteric fractures.

**Patients and Methods:** The present study was conducted on thirty two patients with failed DHS fixation of trochanteric fractures had been treated in Beni-Suef University Hospital, Beni-Suef Health Insurance Hospital and other private hospitals during the period from April 2013 to January 2015. All patients in the present study were evaluated for; fitness for surgery, measures to exclude infection and pathological fracture and musculoskeletal evaluation (The patients hip were evaluated clinically and radiologically both preoperatively and postoperatively).

**Results:** Patients' age ranged between 50-70 years old. The mean age was 60 years old. The entire mean scores preoperatively and at the last follow-up for all the 30 patients were summated. It showed an improvement of 60.87 points (from 13.79 to 74.66). Pre-operatively Harris hip scored ranged from 1.1 to 43 and ranged post-operatively from 54 to 94 points. This wide variation was due to the different patients' demographics, levels of activities and associated medical co-morbidities.

**Conclusion:** Although hip arthroplasty to salvage the failed internal fixation of failed intertrochanteric fractures is a technically challenging procedure requiring experience, special instruments and implants, however, surprisingly it is associated with low orthopaedics complications and a high rate of patient's satisfaction and pain relief.

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**Key Words:** *Bipolar cementless – Conversion hip arthroplasty – Intertrochanteric fracture – Total hip arthroplasty.*

### Introduction

**FRACTURES** of the proximal aspect of the femur are becoming more prevalent as the population ages [1]. Femoral intertrochanteric fractures account for most of these fractures. Although the primary treatment options of these common injuries are variable, the salvage procedure for failed internal fixation often remains conversion to bipolar or total hip arthroplasty [2].

Treating intertrochanteric fractures with a DHS may be associated with various complications, such as loss of reduction, nonunion and malunion with varus deformity of the femoral neck, marked shortening of the affected limb, or screw cutout

[3].

Patients are usually markedly disabled and except for infrequent patients with prohibitively severe medical problems, reoperation usually is considered. Treatment options include prosthetic replacement and revision internal fixation. In younger patients, and active older patients with good remaining bone stock and a well-preserved hip, revision internal fixation and bone grafting have been advocated with also liability for failure

[4].

Revision fixation may entail also a period of restricted weight bearing that is difficult in the elderly. Hip arthroplasty offers the advantage of early weight bearing and mobilization. It also offers the prospect of improving the biomechanical condition of the hip in malunited trochanteric fracture

cases. The main concerns are of dislocation, infection, and failure of the implant secondary to aseptic loosening and fracture [5].

Many of the complications of internal fixations can be avoided by performing hemiarthroplasties [6]. Hemiarthroplasty is a frequently employed alternative, as it gives stability and allows immediate full weight bearing [7]. Bipolar hemiarthroplasty was introduced to address the complications of unipolar implants like acetabular wear, protrusion, loosening and dislocation or already established acetabular condral defects. Patients were ambulated full weight bearing on the first postoperative day, so there were no recumbency related complications (eg- bedsores, chest complications, etc) in our patients [8].

Rodop et al., in their study which was done on the use of bipolar hemiarthroplasty for intertrochanteric fractures, obtained excellent to good results after a follow-up of 12 months. Thus, the results of this modality of treatment look promising, especially in view of the variable results of osteosynthesis in this group [9].

Frequently, however, the patients have poor bone quality, a damaged femoral head due to previous internal fixation, damaged articular cartilage, or limb-shortening, any of which can compromise the chance of achieving a good clinical result. Because of these problems, replacement of the hip has been used as a salvage technique. There are a number of specific technical hurdles to successful hip arthroplasty in this setting, including the presence of failed internal fixation devices, bone deformity, bone loss, and poor bone quality [5-14].

To our knowledge, only a few and a relatively small reports on this form of treatment is present in the current literature. Most of these reports, reported statistically significant improvement and a good functional outcome especially regarding high level of pain relief together with few serious orthopedic complications. Therefore, the aim of the present study was to provide adequate data on hip arthroplasty to salvage the failed internal fixation of failed intertrochanteric fractures.

### Patients and Methods

The present study was observational study conducted on thirty two patients with failed DHS fixation of trochanteric fractures had been treated in Beni-Suef uNiversity Hospital, Beni-Suef health insurance hospital and other private hospitals during the period from April 2013 to January 2015. The mean follow-up period was 11 months (range; 3-

21 months), two patients were lost in first two months postoperative and excluded from final outcome. The study was approved by the Research Ethics Committee at Faculty of Medicine Cairo university. An informed consent was provided by all study participants at the beginning of the study.

Patients above 50 years of age with failed previous internal fixation of intertrochanteric fractures indicated by fracture nonunion, lag screw cutout, fracture collapse with hardware failure and/or femoral head or acetabular cartilage osteoarthritis or damage were included in the present study. While, Patients proven to have infection or pathological fractures were excluded.

All patients in the present study were evaluated for; fitness for surgery (done using the American Society of Anesthesiologists (ASA) physical status scale), measures to exclude infection and pathological fracture (history taking, clinical and radiographic evaluation directed towards exclusion of infection and/or pathological fractures also, all patients had routinely preoperatively complete blood count with differential leucocytic count, erythrocyte sedimentation rate and C-reactive protein evaluation) and musculoskeletal evaluation. The patients hip were evaluated clinically and radiologically both preoperatively and postoperatively. Clinically through Harris hip score [15] and a questionnaire asking about 3 items: Percentage satisfaction, ability to be independent in activities of daily living (as going to toilet) and the need for further operation to improve the results. Radiologically through pre and postoperatively radiographs to a pelvis and both hips anteroposterior and hip lateral.

*Surgical approach:* In all patients spinal and epidural anaesthesia was used. Lateral position was used in all patients. The same skin incision was used with only cephalic extension. We used the direct lateral approach in all except one case in which postoperative dislocation happened. In some cases we used the trans-trochanteric approach in which the greater trochanteric fragment is raised with its soft tissue attachment. Exposure of the acetabulum was one of the challenging surgical steps as usually the malunited or the ununited head and neck fragment were in deformed positions. In most cases a cemented long stem femoral component was needed to bypass the cortical defects created by the screws of the removed implants. In only 2 cases, calcar replacement prosthesis was needed to build up for the proximal femoral deficiency. In most cases due to poor bone quality a

cemented cup was used. Semi-constrained and fully constrained cups were used in a limited situations in which the surrounding soft tissue and

musculature was very poor affecting the prosthesis stability. Fixation of the greater trochanter was done by Cerclage wiring, Screws and Plate.

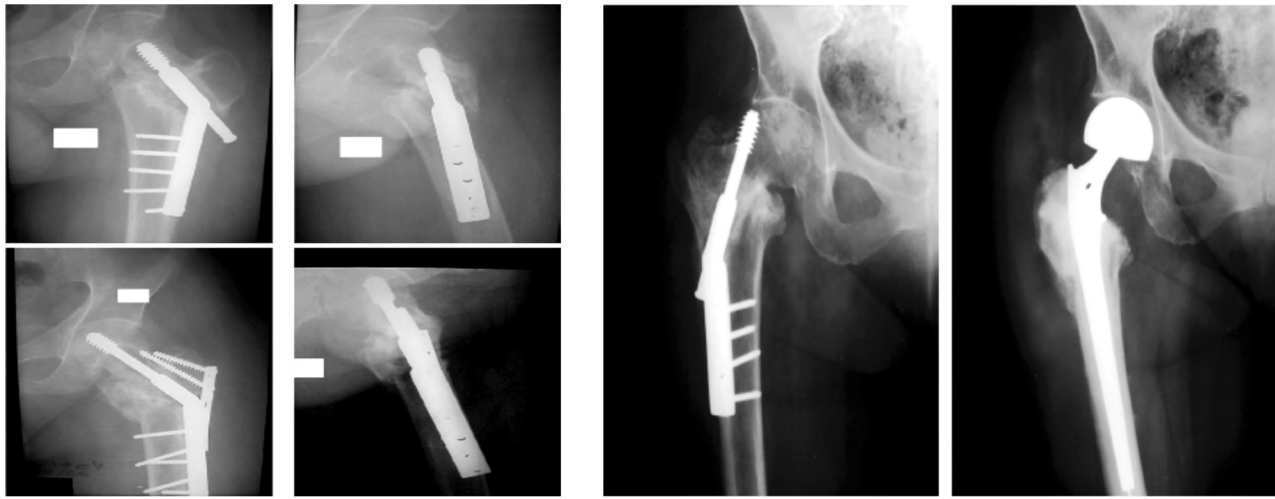


Fig. (1) (A): Anteroposterior and lateral radiographs of a 38-year-old man showing successful union after revision of internal fixation of a failed primary fixation. (B): Anteroposterior radiographs of a 77 year-old woman with a cemented calcar-replacement bipolar prosthesis done for a nonunion and failed fixation of an intertrochanteric fracture.

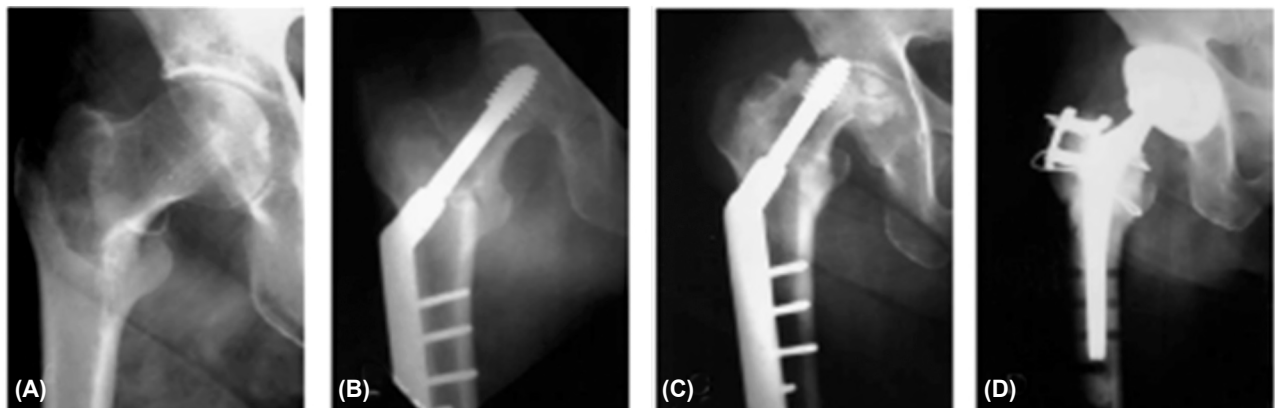


Fig. (2): (A): AP radiographs 59-year-old man suffering from a stable intertrochanteric fracture which was internally fixed using DHS. (B): The fracture healed, but it was complicated by (C): Avascular necrosis of the femoral head. The acetabulum also was eroded by the exposed tip of the lag screw. (D) A hybrid total hip arthroplasty was performed. The greater trochanter was cracked during the broaching of the medullary canal and was repaired with a cable-grip device. The cemented femoral stem did not extend beyond the most distal screw hole. The oval shadow distal to the stem tip was the centralizer (made of radiolucent polymethylmethacrylate).

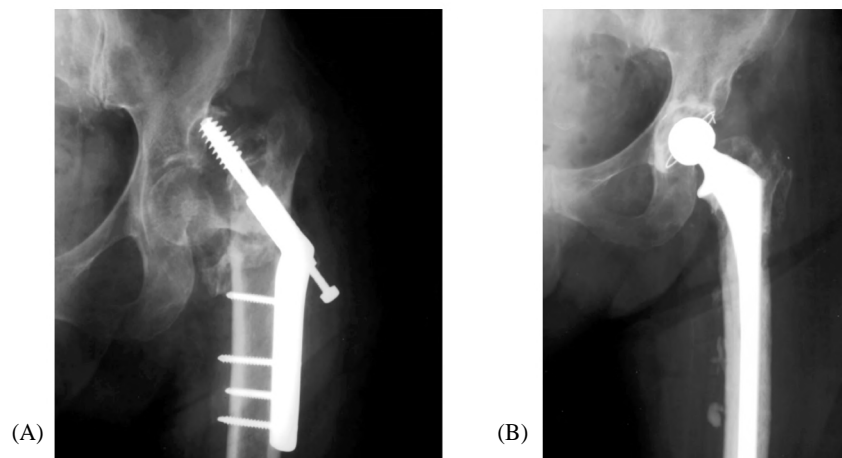


Fig. (3): (A,B): AP radiographs of the hip of 82 year old woman with failed fixation of an intertrochanteric hip fracture. The acetabulum was eroded by the hip screw, which had cut out of the femoral head. THA with cemented long-stem prosthesis was used.

**Statistical analysis:**

We statistically analysed our results using ANOVA test and independent *t*-test to compare the effect of different factors; age, BMI, number of previous operations and type of fractures; on our final outcome.

**Results**

Table (1) shows that patients' age ranged between 50-70 years old. The mean age was 60 years old.

Table (2) shows the entire mean scores preoperatively and at the last follow-up for all the 30 patients were summated. It showed an improvement of 60.87 points (from 13.79 to 74.66). Pre-operatively Harris hip scored ranged from 1.1 to 43 and ranged post-operatively from 54 to 94 points. This wide variation was due to the different patients' demographics, levels of activities and associated medical co-morbidities.

Table (1): Showing age distribution.

Age group	Number	Percentage
50-55	7	21.75
56-60	10	31.25
>60	15	47
<b>Total</b>	<b>32</b>	<b>100</b>

Table (2): Showing the mean pre and postoperative (at the last follow-up) Harris hip scores.

Category	Maximum Score	Mean Pre-op Score	Mean Post-op Score
1- Pain	44	6	39.2
2- Function	47	4.9	27.9
3- Range of motion	5	1.29	3.7
4- Deformity	4	1.6	3.86
<b>Total</b>	<b>100</b>	<b>13.79</b>	<b>74.66</b>

Table (3): The distribution according to the prosthesis used and types of acetabular components.

Types	Number
Bibolarhemiarthroplasty	12
- Total hip:	18
Cementless cup	3
Cemented cup	15

Table (4): The distribution according to the acetabular components.

Types	Number
Cementless	3
Cemented	15
Non-constrained	10
Semi-constrained	4
Anti-luxation ring	1
Sizes	1
45/46	6
47/48	7
49/50	9
51/52	2
53/54	5
55/56	

Table (5): Comparing the different studies mean HHS and complications.

Study	Number of cases	Mean HHS (last follow-up)	Orthopaedic Complications
Hammad et al., (2008) [11]	32	84	1 Fracture 1 Dislocation 3 DVT
Cho et al., (2010) [13]	18	82 in THA 68 in HA	1 Infection 4 Fracture 1 Dislocation
D'Arrigo et al., (2010) [6]	21	81	1 Infection 1 Fracture
Thakur et al., (2011) [14]	15	83.01	1 DVT
Our study (2015)	32	74.66	1 Infection 4 Fractures 4 Dislocation

Table (6): Showing the different studies demographics.

Study	Number	Mean age	Sex	BMI
Haidukewych et al., (2003)[4]	60	78	>f	
Hammad et al., (2008) [11]	32	64	>f	
Cho et al., (2010) [13]	18	Above 70	>f	
D'Arrigo et al., (2010) [6]	21	75.8	>f	
Thakur et al., (2011) [14]	15	80.6	>f	-
Mortazavi et al., (2012) [5]	69	73	>f	Normal
Our study (2015)	32	66.9	>f	Obese

**Discussion**

Management of failed trochanteric fracture fixation is challenging. Various options include revision internal fixation with or without bone grafting and conversion to either hemi or total hip arthroplasty. Patients after failed fixation of trochanteric hip fractures are in pain with severely restricted function [4]. Revision fixation may entail a period of restricted weight bearing that is difficult in the elderly [6]. Hip arthroplasty offers the advantage of early weight bearing and mobilization. It also offers the prospect of improving the biomechanical condition of the hip in malunited tro-

chanteric fracture cases. The main concerns are of dislocation, infection, and failure of the implant secondary to aseptic loosening and fracture [5-14, 16].

In the present study, we evaluated the results of a thirty-two patients who were operated upon after failed internal fixation of intertrochanteric fracture femur (AO type 31-A) in Beni-Suef university hospital, Beni-Suef health insurance hospital and other private hospitals during the period from April 2013 to January 2015. The mean follow-up period was 10 months (range; 3-21 months), with two patients lost in the first three months post operative, and excluded from final outcome.

The mean age in our study was 61.9 years old (range; 50-70 years) which was considered lower than most western papers [5,7,13]. However, this was slightly higher than a study conducted by Hammad and his colleagues in Mansoura and Assiut universities (mean; 64 years) [11]. We correlated this to the lower life expectancy of the Egyptian population as compared with other western populations.

We noticed a statistically significant difference preoperatively ( $p$ -value=0.037) and postoperatively ( $p$ -value 0.001) in relation with different age groups denoting a better outcome with younger age groups than in older groups.

Seventeen patients had a BMI more than 30, with two patients being morbidly obese. These two morbidly obese females had the lowest HHS postoperatively (54 and 59 points) with one of them having a periprosthetic fracture both intraoperatively and 3 months postoperatively. These two cases shared in lowering our mean HHS.

When correlating this factor to the final outcome, we found no statistically significant difference in the HHS preoperatively ( $p$ -value 0.037), however, it was statistically significant postoperatively ( $p$ -value 0.001). This denotes a better outcome in patients with lower BMI after the operation only. When reviewing the literature we only found that Mortazavi in 2012 was the only one to mention the BMI of his patients (normal with BMI 27.2) but didn't correlate it to his results [5].

Although dealing surgically with complex types of intertrochanteric fractures (Evans reversed obliquity and AO type 3) are more technically challenging and require more experience as they are associated with more comminuted fragments and sometimes bone loss requiring reconstruction or special type of femoral prosthesis, we found no

statistically significant difference between the results of arthroplasty in different types of fracture (AO type 1,2 and 3) ( $p$ -value 0.13). We attribute this to the improved types of prosthesis available that allows for replacement of proximal bone deficiencies as well as by passing the proximal bone defect as allowing diaphyseal stable fixation.

When studying the effect of the number of previous surgeries done for trials of internal fixation and relating it to our final outcome. We found no statistically significant differences between patients who had previous one or two trials of internal fixation prior to our operation ( $p$ -value 0.57). We also attribute this to the improved designs of the prosthesis available as we found that we used of long stem prosthesis in all cases done after the second failed trial.

Choice of the surgical approach is crucial. A variety of approaches were used in literature. Haidukewych and his colleagues used several approaches; anterolateral approach in 33 cases, transtrochanteric approach in 23 and only 4 were performed through a posterior approach. The reason behind this variety was not emphasized [4]. D'Arrigo used a direct lateral approach to all cases and reported a good functional outcome with no cases of postoperative hip dislocation as well as only one complication of a femoral fracture during preparation of the femoral canal [6]. In most recent study conducted by Mortazavi and his group studying the rates of dislocation after failed internal fixation of hip fractures in one hundred fifty-four hips, they concluded that the use of direct lateral approach is one of the major factors responsible for the absence of the postoperative dislocation recommending its use [5]. Also they added that the use of greater trochanteric osteotomy may facilitate the exposure in certain case mentioning that they used it in 15 patients (our of 71 hips) with prior intertrochanteric fractures. In our study, the direct lateral approach was our preference.

We had only one case done through a posterior approach which suffered postoperative dislocation. The others 3 cases with postoperative dislocation another one was opened using a trans-trochanteric approach elevating the nonunited greater trochanter fragment, the last two were opened using the direct lateral approach.

Usually the ununited head-and-neck fragment or fragments usually are in a deformed position rendering the hip dislocation and exposure of the acetabulum a very difficult step. In some cases in which the head and neck fragments were in a severe

retroverted positions; cutting the neck insitu was done. This requires careful soft tissue dissection and proper exposure of the neck. In other cases when the exposure of the neck was difficult we used the method advised by Buly leaving the hardware in place while the dislocation of the femoral head is performed [15].

On the acetabular side (Table 12-B), replacement was done for all cases and this was consistent to the most recent study conducted by Mortazavi [5]. This was also supported by the conclusion drawn by Cho and his colleagues in their comparison between bipolar and total hip arthroplasty concluding a better functional outcome and pain relief with THA [13]. Haidukewych reported acetabular replacement in 32 out of 60 patients stating that total hip arthroplasty was performed routinely if the acetabular cartilage was found to be markedly damaged at the time of surgery, and it also was done at the surgeon's discretion in some cases in which the acetabular articular cartilage was of good quality [15].

Cemented cups were used in our study (17 patients); 12 standard types, 4 semi-constrained and one anti-luxation ring. On the other hand, 15 cementless cups were used in relatively young patients (12 Bipolar, 3 THR). The choice of the type of the acetabular cup depended on the bone quality, patient factors and the soft tissue support. Semi-constrained cups were used in the two morbidly obese patients, patient with history of ipsilateral hemiplegia and a chronically dislocated hip with poor surrounding musculature. Anti-luxation ring was used after posterior hip dislocation.

On the femoral side, Haidukewych and Mortazavi reported the use of calcar-replacement implants in almost 60% and 86% respectively to make up for bone deficiency and to restore limb length [5,8]. Moreover, Haidukewych reported the use of the long-stem implants in 50% of patients to bypass cortical defects left at the site of failed fixation devices [8]. On the other hand, Zhang and his colleagues had reported the used standard stems in all cases with no fractures reported [9]. In our study we used long stem in about 50% (15 out of 30 patients) of the cases and in only 2 patients calcar replacement was required due to proximal femoral deficiency. Although most of the recent paper relayed on cementless fixation for long stem implants this was not applicable in our cases partly due to financial reasons.

Mortazavi and his colleagues had showed the conversion from failed internal fixation of inter-

trochanteric fractures requires more operative time, blood loss and higher rates of transfusion as compared with conversion from failed internal fixation of neck fractures. They related this to several issues; in femoral neck salvage procedures, hardware removal can be readily performed because fractures are fixed with pins or screws while in intertrochanteric salvage procedures, the removal of failed nails and side plates involves a more extensive dissection and sometimes requires special instruments for the removal of broken screws. In patients with trochanteric fixation nails, heterotopic ossification at the previous site of nail insertion makes nail removal difficult. In addition, in the failed intertrochanteric fractures, the nonunited head, neck, and trochanteric fragments usually are in a deformed position and must be mobilized before being excised. This process requires careful dissection to avoid damaging nearby neurovascular structures and muscles [5]. Our mean operative time and blood loss was comparable to other studies, 154 minutes and 1038ml. In the intertrochanteric group, Mortazavi reported a mean operative time of 124 minutes and blood loss of 659ml [5]. Haidukewych and his group reported a mean operative time of 240 minutes and blood loss of 1125ml [4]. Hammad had a mean operative time of 190 minutes with a mean estimated external blood loss of 1150ml [11].

Although this procedure is technically challenging and more demanding however, most papers reports low rate of orthopaedic complications.

In our study intra operative fracture was reported in 4 cases, one perforation associated with a longitudinal crack which was revised with a long stem and a cerclage wiring and three longitudinal cracks, all were managed successfully with cerclage wiring. Most of the studies reported this as the commonest complication. Zhang reported that fracture of the greater trochanter was his commonest complication attributing it to the combination of severe osteoporosis, the stress riser effect of the big hole over the proximal part of the lateral cortex [9]. Haidukewych reported 2 cases of nondisplaced proximal femoral fracture during preparation of the femoral canal; both were treated successfully with cerclagewiring [9]. Mortazavi reported 5 cases of intraoperative fractures [5].

In our study we had 4 cases of postoperative dislocation. One was lost after this event, and the other were managed as follows; closed reduction with abduction brace for 6 weeks, open reduction and anti-luxation ring due to poor surrounding soft tissue and open reduction with revision of fixation

of the displaced greater trochanteric fragment. All the previous studies in literature, except that conducted by Mortazavi, reported the occurrence of this complication and in most cases it was managed with closed reduction only [4,9,11]. Mortazavi was the only one reporting no postoperative dislocation and correlating this to several factors; the experience and expertise of the operating surgeon, the use of direct lateral approach with delicate soft tissue dissection, the use of 32- or 36-mm femoral heads rather than 28 mm and the limited external rotation these patients have [5].

We had a low rate of infection (only one case) with similar rates as compared to Mortazavistudy [5] (two in 71 hips). This was due to our proper preoperative preparation and exclusion of infection preoperatively. All patients were subjected to full history taking and examination as well as laboratory tests including complete blood count with differential leucocytic count, erythrocyte sedimentation rate and C-reactive protein evaluation. Only 4 patients had a high level of ESR as compared to their reference age population (with negative CRP). From these patients routine 5 intraoperative specimens were taken and sent to bacteriological assessment. The results were considered positive if more than two were positive and having the same organism. In all 4 patients; negative results were found and no infection was encountered in there follow up. This was supported by Haidukewych and his group who mentioned that although the preoperative evaluation was not standardized during their study period, however this is their current protocol now [4].

Concerning the outcome, although we detected an improvement in the mean HHS of 60.87 points (from 13.79 to 74.66), we found that it was slightly lower than other studies (Table 11-D). We attributed this to the lower functional HHS compared with other papers. We correlate this to the presence of two factors; the higher number of obese patients in our studies (59% obese and more with 2 morbid obese who had the lowest two HHS; 54 and 59) and the short period of follow up as we noticed that function may require a long time to reach its maximum score. The same problem was encountered in the ranges of motion that require long periods of follow-up to reach its maximum values. On the other hand, we noticed a significant change in the pain HHS score with a mean of 39 points which was much better result than other papers as we didn't report any case of severe pain. Lastly, our deformity score in our study was approaching its maximum value shortly after the operation.

The strength of our study includes being the first in statistically analyzing and relating different factors to the final outcome. However, its weakness relays in having short term follow-up period as compared with other similar papers as well as the procedure being done by a diversity of surgeons in many places.

*Conclusions:*

- 1- Conversion Hip arthroplasty is an effective salvage procedure after the failed treatment of an intertrochanteric fracture.
- 2- Although technically challenging and need experience, few serious orthopaedic complications were detected in our study. It is results in good functional outcome, pain relief and high patient satisfaction.

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## تقويم المفصل الكامل ومفصل ثنائي القطب لعلاج إخفاق المسامير الديناميكي في تثبيت كسور المدور بعظمة الفخذ

فشل التثبيت الداخلي لكسور بين التوتيين عادة ما يؤدي إلى ألم وعجز وظيفي عميق. معظم الجراحين يفضلون تغيير مفصل الورك كإجراء إنقاذي في المرضى، وغالباً ما ترتبط هذه الكسور بسوء نوعية العظام ورأس الفخذ قد تضررت بسبب التثبيت الداخلي وعادة ما يسمح تغير المفصل في وقت مبكر إلى تخفيف الألم.

درسنا نتائج هذا الإجراء في ٢٣ مريض من أبريل ٢٠١٣ إلى يناير ٢٠١٥.

وقد تم استخدام مفصل ثنائي القطب ومفصل فخذ اسمنتى طويل الجرز في معظم الحالات في دراستنا لتجاوز العيوب القشرية التي انشأتها ثقب المسامير. كما استخدمنا الفججان الأسمنتى الحقي في أغلب الحالات لسوء نوعية العظام وفي الظروف الاستثنائية فقط استخدمت كؤوس خاصة مقيدة.

وعلى الرغم من أن النتيجة لدينا كانت أقل قليلاً من الأبحاث الأخرى ولكننا نرجع هذا إلى وجود عدد كبير من المرضى الذين يعانون من السمعة المفرطة في دراستنا.

وكان لدينا دراسة رائدة في المقارنة بين مختلف العوامل التي تؤثر على النتيجة النهائية وكنا قادرين على العثور على علاقة ذات دلالة إحصائية بين عدد من العمليات الجراحية السابقة ونوع الكسر الاصلى والنتيجة.

وقد استنتجنا من ذلك أنه على الرغم من أن جراحة استبدال الفخذ بعد فشل التثبيت الداخلي لكسور بين التوتيين هي جراحة حرجة تستلزم تدريب خاص إلى أننا وجدنا أنها الانسب حيث أنها تتال رضا المرضى وتساعد على إنخفاض مضاعفات العظام وتخفيف الألم.