



International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(1): 352-358
© 2020 IJOS
www.orthopaper.com
Received: 04-11-2019
Accepted: 08-12-2019

Dr. Sunil S
Assistant Professor, Department
of Orthopedics, Vydehi Institute
of Medical Sciences and Research
Centre, Bengaluru, Karnataka,
India

Dr. KT Rajasekhara
Senior Consultant, Fortis
Hospital, Bengaluru, Karnataka,
India

Functional outcome of total hip arthroplasty after failed hemiarthroplasty

Dr. Sunil S and Dr. KT Rajasekhara

DOI: <https://doi.org/10.22271/ortho.2020.v6.i1g.1888>

Abstract

Background: The long term follow up results of hemiarthroplasty (unipolar or bipolar) for fracture neck of femur are not promising due to high incidence revision. The objective of this study is to provide useful information on the mode of failure of hemiarthroplasty in those who required revision, and the magnitude and complications of conversion total hip arthroplasty.

Materials and Methods: Twenty two cases, 14 women and 8 men, average age 61 years (range 42-75 years) of failed hemiarthroplasty were converted to total hip replacement between June 2011 and January 2015. Thigh pain was the main presenting complaints in the majority of the patients (10 out of 22). Two patients had infection and were operated with staged procedure. All acetabular and the majority (86.5%) of femoral components used in our series were uncemented.

Results: After an average follow-up of 41 months (Range, 13-86 months) Harris hip scores improved from 36.4 (range 28-42) preoperatively to 84.7 (range 69 to 98) postoperatively. We had 19 patients with no hip pain and 3 patients with slight pain. Also, at the last follow up 19 (86.3%) patients were community ambulators without support while 3 (13.6%) needed minimal support of cane. Range of motion improved significantly and was essentially normal in all. Postoperative complications included persistent groin pain in 2 patients, superficial infection in one, and sciatic nerve neuropathy in one patient which recovered completely in one year. In the last follow-up of conversion total hip prosthesis, there was no radiolucency in either femoral or acetabula components.

Conclusion: Total hip arthroplasty can be reliable in eliminating groin pain following failed hemiarthroplasty and modular bipolar hemiarthroplasty is recommended in middle aged patients with fracture neck of femur and in elderly patients with active life style with femoral neck fractures, primary total hip arthroplasty has better results.

Keywords: Hemiarthroplasty, total hip arthroplasty, femoral neck fracture

Introduction

Hemiarthroplasty is an operation in intra capsular displaced femoral neck fractures, especially in elderly patients, as only one site of joint is replaced, preserving bone stock in case of a possible future need for total hip prosthesis ^[1].

But the longevity of this prosthesis is not long enough and the patient starts to complain and may become a handicapped person because of pain and inability to bear weight on this limb ^[2]. These complaints start at a variable interval after the operation, the patient may complain of mild groin pain up to inability to bear weight. The pathologies responsible for these complaints are variable e.g acetabula wear with or without protrusion, stem loosening, low grade infection and periprosthetic fracture. Conversion of hemiarthroplasty is usually mandatory to restore a painless mobile hip ^[3].

The revision rate following hemiarthroplasty, in the treatment of femoral neck fractures, has been reported as 10 –19% after 3 years of follow-up and 16-26% after 7 years of follow-up ^[4-9]. Following hemiarthroplasty, pain, loss of function, loosening and infection are the most common reasons for conversion total hip prosthesis ^[1, 10-12].

While Dupont and Charnley ^[13] reported 96% successful results following conversion total hip prosthesis, Amstutz and Smith ^[14] and Stambough *et al.* ^[15] reported 15% revision rate. Llinas *et al.* ^[1] reported that the acetabular components of converted hemiarthroplasties were at a lower risk of developing radiolucent lines ($P > 0.01$) when compared with primary total hip prosthesis. In contrast, the femoral components of patients in this group were at a

Corresponding Author:
Dr. Sunil S
Assistant Professor, Department
of Orthopedics, Vydehi Institute
of Medical Sciences and Research
Centre, Bengaluru, Karnataka,
India

significantly higher risk of loosening compared with primary total hip prosthesis ¹($P < 0.001$).

Although Delamarter and Moreland ^[11] reported that they did not have any revision of primary total hip prosthesis in 27 femoral neck fractures in 3.8 years of follow-up, other authors reported revision rates of 4 – 42% ^[10, 12, 16].

In this study, we aimed to assess the mode of failure of hemiarthroplasty in those who required revision, and the magnitude and complications of conversion total hip arthroplasty.

Patients and Methods

From June 2011 till June 2015, a total of 22 patients who had conversion of their failed hemiarthroplasty to a total hip replacement in HOSMAT Hospital were analysed prospectively.

Those patients who had been operated with hemiarthroplasty for diagnosis other than fracture neck of femur was excluded. All patients were evaluated clinically and radiologically with review of serial follow-up radiographs if available to identify the possible cause of failure. Investigations conducted in clinic included a septic screen (full blood count, ESR, CRP) and plain anteroposterior and lateral X-rays of the symptomatic hip.

Treatment strategies prior to conversion were also reviewed. All the patients received perioperative antibiotic prophylaxis. Radiological examination assessed abnormal position of the prosthesis, inadequate contact with the calcar, descent of the prosthesis into the femur, radiolucencies around the prosthesis and protrusio acetabulae (medial migration of the prosthetic head beyond Kohler's line) Change in component position or progression of lucent lines were reported in serial follow-up radiographs according to the zones of Gruen *et al.* ^[17] for the femur and De Lee and Charnley ^[18] for the acetabulum. We used the criteria of Olsson ^[19] for diagnosis of loosening. Distance between lesser trochanter and prosthesis collar was used to measure femoral component subsidence as compared to first postoperative X-ray.

Harris hip score ^[20] was used for functional evaluation both pre- and postoperatively.

The main reasons for conversion to total hip arthroplasty were acetabular erosion in 5 patients (22.7%), stem loosening in 8 patients (36.3%), both loosening of stem and acetabular erosion in 2 patients (9%), 4 patients (18.1%) with femoral shaft fracture, 2 (9%) patients with deep infection and 1 patient (4.5%) with protrusio acetabula. The mean time from primary operation to appearance of symptoms in this group of patients was 19 months (range 2-96 months), 11 months for femoral loosening (range 5-46 months) and 28 months for acetabular erosion (9-96 months).

The mean time interval from appearance of symptoms to revision surgery for this group of patients was 54 months. (4.5years).

A standard posterior approach to the hip was used in all patients. At operation the condition of the articular cartilage and the acetabulum, the stability of the prosthesis in the proximal femur and any other associated pathological conditions found were documented by the surgeon.

Intraoperatively, stability was examined by observing for dislocation while the hip is being put through the full range of motion possible and by observing for displacement while applying traction to the limb. If the stability was questionable, we attempted to suture the posterior soft tissues more tightly. Posterior soft tissue repair was performed in all patients using 2-0 Ethibond.

Patients revised for infection had a two stage revision. A transfemoral approach was used in 5 patients, 2 patients with acetabular erosion, 2 with a fractured stem and one with infection. Acetabular grafting with autogenous morsellised ipsilateral iliac bone graft was used for two patients with acetabular erosion with use of cemented cups. Cemented prostheses were used in 3 patients, Cementless in 19 patients. Low-molecular-weight heparin (Bemiparin sodium subcutaneously 3500 U once daily) was used for deep venous thrombosis prophylaxis. For antibiotic prophylaxis IV Ceftriaxone + Sulbactam was given after tissue culture was taken intra-operatively, and was continued for 2 – 3 days depending on the culture results.

Static quadriceps exercises and knee and ankle mobilization were started on the day of surgery. Fifteen patients were allowed to walk with tolerable weight bearing with walker or crutches on the day after surgery. 4 patients with periprosthetic fractures were kept on non-weight bearing crutch walking until the radiological evidence of fracture union, whereas 2 patient with acetabular reconstruction using autogenous morsellised ipsilateral iliac bone grafts were allowed to walk partial weight bearing for first 3 weeks. Results were evaluated using Harris Hip Score ^[20]. The preoperative Harris Hip Score were obtained from hospital records. Postoperative scores were obtained at each follow-up visit and telephonic interview. All the patients were available for follow-up.

Results

Of the 22 patients revised, there were 14 women (63.6%) and 8 men (36.4%) with a mean age of 61 years (range 32 to 79 years) at the time of conversion to total hip arthroplasty. The mean period of follow up was 41 months (range 18 to 86 months).

Pain with either antalgic gait [groin pain (5), thigh pain (8) or both (2)] or leg length Discrepancy (5) was the chief presenting complaint. Other presenting complaints are shown in (Table I).

Table 1: Patients' Complaints

Complaints	N = 22	%
Pain		
Pain+ Antalgic gait	6	27.2
Pain+ LLD	9	40.9
Pain+ antalgic gait+	4	18.2
LLD	3	13.6

LLD = leg length discrepancy

The mean time interval from appearance of symptoms to revision surgery for this group of patients was 54 months. (4.5years). Seven Austin Moore and 15 Bipolar Prostheses had been implanted for fracture neck of femur in cases that was revised in our series. All the bipolar prostheses that was revised was of the mono block type. No patient who had undergone Modular Bipolar Prosthesis for fracture neck of femur had come for revision. Pain was the leading sign in all patients. The mean follow up period after conversion total hip prosthesis was 41 months. (3.5years).

The overall Harris score improved from a mean of 38.4 preoperatively to a mean of 87.7 at one year follow up and to 84.7 points at the last follow-up. Pain scores showed marked improvement. We had 19 patients with no hip pain and 3 patients with slight pain. Also, at the last follow up we had 19 patients walking unaided and 3 patients needed minimal support of cane. Range of motion improved significantly and

was essentially normal in all.

From the radiological examination (Table 2) it was determined that the femoral components (45%) had more than 2 mm radiolucent lines in Gruen zones I, IV and VII. Assessment of the acetabulum revealed protrusion in one case and some degree of cartilage erosion in the five, which was also detected during surgery.

Table 2: Plain X-ray (AP/LAT) results

	n	%
Femoral loosening (translucent lines) _50% around prosthesis	10	45
No calcar contact	2	9
Acetabula erosion	5	23
Protrusion	1	5
Periprosthetic Fracture	4	18

In the last follow-up controls of conversion total hip prosthesis there were no radiolucent lines in either acetabular or femoral components. Radiological evaluation showed good bony in growth and stability of all the femoral components. None of the acetabular component showed migration, loosening, wear, or osteolysis at last follow-up.

Operative findings at the time of conversion showed loosening of the prosthesis and acetabular cartilage degeneration as the main pathological processes leading to

failure of the hemiarthroplasty (Table 3).

Table 3: Operative findings at conversion

	n	%
Femoral loosening	9	41
Acetabular cartilage degeneration	6	27
Femoral loosening and acetabular cartilage degeneration	3	14
Periprosthetic fractures	4	18

Bone defects were detected during the operation in the femur in 2 patients (9%), in the acetabulum in one patient (4.5%) and cancellous allografts and calcar replacing long stem prosthesis were used for coverage of these defects.

Harris hip scores were affected by the indication for Total hip arthroplasty (Table 4).

Table 4: Harris Hip Score in relation to indication

Indications	Preoperative	Last follow-up
Acetabular erosion (N = 5)	49.6	88.1
Femoral loosening (N = 8)	41.2	85.5
Acetabular erosion +loosening (N = 2)	26.3	84.8
Femoral fracture (N = 4)	23.3	89.0
Infection (N = 2)	44.0	70.7
Protrusion acetabuli (N =1)	37.6	81.0



Fig 1: CASE 1



Fig 2: CASE 2



Fig 3: CASE 3



At last follow-up we had 13.6% excellent results and 72% good results, 9% fair results and 4.5% poor result at the end of follow-up. (Table 5)

Table 5: Functional results after conversion arthroplasty

Functional result	Last follow-up No	Last follow-up %
Excellent	3	13.6
Good	16	72.7
Fair	2	9.0
Poor	1	4.5

The mean leg length discrepancy was 11 mm seen in four patients. (Range from 10 mm to 12 mm). Complications occurred in 4 patients (18%). One patient had early wound infection which cured completely after debridement, suction-irrigation and 6 weeks of intravenous antibiotics. One patient had incomplete sciatic nerve lesion which recovered completely at one year follow-up. Two patients had persistent groin pain. (Table 6). We had no loosening at the last follow-up. Also, neither instability nor mortality was reported.

Table 6: Complications in relation to the indications for Conversion arthroplasty

Indication	Wound infection	Groin pain	Neural deficit	Total
Acetabular erosion	0	1	0	1
Femoral loosening	0	0	0	0
Acetabular erosion +loosening)	0	0	0	0
Neuropaxia	0	0	1	1
Infection	1	0	0	1
Protrusion acetabuli	0	1	0	1
Total	1	2	1	4

Discussion

There are a number of controversies concerning methods for the treatment of displaced fractures of the femoral neck in the elderly. Hemiarthroplasty is a conservative operation in intracapsular displaced femoral neck fractures, used particularly in elderly patients, as only one side of joint is replaced, preserving bone stock in case of a possible future need for total hip prosthesis [1].

The goal of treatment of displaced femoral neck fractures is to return the patients to their pre-injury functional state as rapidly as possible and to minimize the need for further operation [21]. Austin Moore and Thompson hemiarthroplasty have fulfilled these criteria for decades [22, 23]. With increasing demands being placed on the prosthesis by fitter and more physically demanding patients, a group of these patients would develop early onset groin and thigh pain leading to a marked decrease in their quality of life [24].

Pain following hemiarthroplasty is usually due to one of two pathological processes: articular cartilage degeneration in the acetabulum or loosening of the prosthesis. These pathological processes are exacerbated by many factors including incongruence between the femoral head and the acetabulum, excessive neck length, impaction at the time of injury, cementation of the prosthesis, physiologically young active patients and shear forces between the prosthesis and the cartilage [22, 25, 26]. Conversion total hip prosthesis is indicated after hemiarthroplasty to relieve pain, which may be due to loosening, acetabular cartilage erosion, protrusion, or infection, and to improve function [1, 4, 10, 14].

In addition, failure on the femoral side may be due to extensive resorption of the endosteal bone while the stem of the hemiarthroplasty was loose as seen in our cases, or due to damage of the endosteal bone during revision [19].

Furthermore, toggling of the stem may produce a thick fibrous membrane that is adherent and might not be completely removed at revision, with its remnants compromising the subsequent cemented fixation. Also, it had been suggested that fragments of such a fibrous membrane are metabolically very active, producing Prostaglandin E2, collagenase and Interleukin1b, all of which may contribute to resorption of adjacent bone [27, 28].

Bipolar Arthroplasty was introduced to improve the long-term outcome of hemiarthroplasty as a result of less wear of the metal-cartilage interface by providing another interface (metal-polyethylene) inside the bipolar head. However, recent studies comparing bipolar to unipolar hemiarthroplasty show little difference between the two with regard to morbidity, mortality, or functional outcome [29].

D'Arcy and Devas [9] reported these problems in 26% of their patients with hemiarthroplasty. Holmberg *et al.* [8] and Swiontkowski [30] reported 16% and 20% revision rates, respectively, during 7 years of follow-up after hemiarthroplasty.

Sikorski and Barrington [5] reported a 19% revision rate after 2.5 years follow-up and Johnston *et al.* [7] reported 16.7% revision after 2 years follow-up. Kofoedh and Kofod [31] reported 37% revision, due to acetabular erosions in 106 femoral neck fractures, in a 2-year follow-up period.

Failure of bipolar hemiarthroplasty has been reported to occur at different rates, depending on type of prosthesis. Various studies have reported clinical failure rate from 19% to 37% and revision rate from 7% to 21% [32-34].

Nishii *et al.* [35] reported significantly more wear in young active patients after bipolar hemiarthroplasty. In other study, a histological and biochemical comparison of interface membranes around femoral components of bipolar end prosthesis and total hip prostheses showed significantly large amounts of polyethylene debris in the bipolar group [36]. These findings suggest that Modular Bipolar or primary THA should, perhaps, be considered in more active young patients with displaced femoral neck fractures.

The problems we observed in the painful hemiarthroplasty cases in our series and the time interval between hemiarthroplasty and conversion total hip prosthesis correlated well with the above-mentioned previous reports.

In our study group of failed hemiarthroplasty 22% patients complained of groin pain, 36% of thigh pain and 9% had both. This is probably due to the thin femoral stem of the mono block bipolar prostheses used in majority of our cases which led to more frequent toggling effect and loosening of stem leading to thigh pain.

The treatment of symptomatic hemiarthroplasty involves removal of the prosthesis and conversion to a total hip replacement and Cossey and Goodwin noted that conversion to Total hip Arthroplasty would give satisfactory results [36]. Preoperative clinical and radiological assessment is mandatory to diagnose the condition of abductor muscles, bone deficiency, bone quality, presence of cortical shell and state of greater trochanter. Removal of the old implant has three steps;

1. Removal of the stem whether cemented or cementless.
Complete removal of cement.
2. Removal of soft tissue membrane that surrounds the loose implant.

The results of conversion total hip prosthesis are not clear from the literature since they are related to the type of primary surgery. Amstutz and Smith [14] 12 and Stambough *et al.* [15] reported a 15% revision rate in a 3-year follow-up of 42 cases and a 6-year follow up of 32 cases, respectively.

Our study showed significant improvement in functional status of patients irrespective of the indication for conversion surgery. There are few reports about results of conversion of hemiarthroplasty.

Sharkey *et al.* has reported 45 patients with groin or buttock pain after hemiarthroplasty who underwent revision surgery to Total Hip Arthroplasty; groin or buttock pain was successfully relieved in 40 (89%) patients. Of 31 patients with bipolar hemiarthroplasty in that study, 5 had persistent pain after conversion. They found no difference in incidence of refractory groin pain between unipolar and bipolar groups. After 2 years of follow up the Harris Hip score had improved from 37 to 87 [33].

Sierra and Cabanela [38] reported results from 132 converted Total Hip Arthroplasty after previous hemiarthroplasty done for femoral neck fractures. They reported durable pain relief- 86% had no or mild pain, whereas 14% had moderate to severe pain at an average follow-up of 7.1 years. In that study,

they included 13 bipolar endoprosthesis converted for a loose femoral stem with or without acetabular symptoms. One of those had loosening at final follow-up. Conversion (after Austin Moore prosthesis) provided complete resolution of the symptoms in 41 of 46 patients reported by Cossey *et al.* [37]. Amstutz and Smith [14] and Sarmiento and Gerard [39] reported significant improvement in pain after conversion of failed endoprosthesis.

Several authors have reported 7% to 64% incidence of complications after conversion of hemiarthroplasty to Total Hip Arthroplasty [38]. In the series of 132 conversion arthroplasties, Sierra and Cabanella [38] reported 45% rate of major perioperative complications. The incidence of dislocation after isolated acetabular revision has been reported between 18% and 19% [40, 41]. Amr Mohamad Abdelhady Sharaf reported a complication rate of 28.5% after conversion total hip arthroplasty [42].

Diwanji *et al.* [43] reported a complication rate of 20% after conversion total hip arthroplasty for failed bipolar hemiarthroplasty. And an average harris hip score of 85 at final follow up Hammad and Abdel-Aal reported no loosening in their series of conversion to hip arthroplasty in 47 patients after an average follow-up of 44 months. With an harris hip score of 86 at final follow up [32]. OF Bilgen *et al.* [44] did not have any revisions and the mean Harris hip score was 85.9 after conversion total hip prosthesis in 3 year follow up.

In our series with a mean follow up period of 41 months, the complication rate was 18%, but we did not have any revisions and the mean Harris hip score was 84.7 We did not detect any radiolucent lines or loosening, which may be the result of the brevity of the follow-up period and of implantation of the prosthesis with proper grafting of the bone defects without using cement.

Table 7: Our study compared favorably with other studies in literature

Case series	Average Follow up	Major Complications	Harris hip score
Sharkey <i>et al</i>	2 years	Nil	87
Sierra & Cabanella	7.1 years	45%	
Amr Mohamad Abdelhady Sharaf	2.9 years	28.5	
Diwanji <i>et al.</i>	7.2 years	20%	85
Hammad and Abdel-Aal	3.8 years	Nil	86
O F Bilgen <i>et al.</i>	3 years	Nil	85.9
Our series	3.5 years	Nil	84.7

The reason for lower loosening in our series is as a result of better cementing technique and choice of implants (hydroxyapatite coated) and stem design. Our series differs from these studies in one respect i.e. all acetabular components and the majority (86.5%) of femoral components used in our series were uncommented and this was probably the reason for lower loosening rates. We did not have even a single case of dislocation after Conversion to Total Hip Arthroplasty. This is probably because of good posterior soft tissue repair and evidence of contracture of capsule following hemiarthroplasty and our rehabilitation protocol.

Promising results have been reported following the use of Total Hip Replacement for displaced femoral neck fracture. [10-12, 16] and also Modular Bipolar Hemiarthroplasty

Greenough and Jones [12] reported a mean Harris hip score of 81 after primary total hip replacement but found a 42% revision rate over a 5-year follow-up period. Delamarter and Moreland [11] reported excellent results without any revision

in their 27-case study.

Taine and Armour [16] found a 4% revision rate, during a 4-year follow-up period, in a series of 163 patients with primary replacement.

Lee *et al.* [45] had 94% success rate of primary THR after 10 years and 89% after 15 years follow up.

Modular bipolar prostheses system is overall a good alternate to a total hip arthroplasty or hemiarthroplasty in indicated cases. It has the theoretical advantage of revision to a Total hip arthroplasty by simply replacing the bipolar head and cementing a acetabular socket should acetabular protrusion occur.

Modular implants have three theoretical advantages

1. The head size may be increased to reduce the risk of dislocation,
2. The neck length may be adjusted to accommodate optimal soft tissue tension and leg length, and
3. A worn head may be replaced.

The Modular stem unit provides a great deal of modularity with its different sizes. The offset of the neck as well as the head can be altered in modular bipolar prostheses allowing easier dislocation, limb length correction and placing of acetabular socket while revision to total hip arthroplasty.

Hodgkinson *et al.* showed in 82.6% cases the Modular bipolar prostheses behaved as a bipolar with good results [46]. Gaine *et al.* had a 70 to 80% intraprosthesis motion in flexion extension in weight bearing following modular bipolar prostheses for fracture neck of femur [47]. Benterud *et al.* showed 96% good to excellent results in Harris Hip score following modular bipolar prosthesis [48].

Conclusion

It is not easy to choose between Hemiarthroplasty (unipolar or bipolar), Modular Bipolar Prosthesis and Total Hip Prosthesis for the treatment of displaced fracture of the femoral neck.

Conversion of Hemiarthroplasty to Total Hip Replacement is challenging surgery, due to general condition of the elderly patients and the surgical techniques used to do the operations safely. Preoperative planning, wise choice of implants and meticulous surgical steps decrease complications and give best results.

Taking into account the reported results of Hemiarthroplasty, Conversion of Total Hip Prosthesis and Primary Total Hip Prosthesis, we found that in selected patients, primary total hip prosthesis results in better long-term success especially elderly patients with active life style and Conversion of Total Hip Arthroplasty for a failed bipolar arthroplasty is an excellent management strategy that can consistently offer reliable pain relief and functionally acceptable lifestyle. Uncommented components have offered promising early results on both acetabular and femoral side.

References

1. Llinas A, Sarmiento A, Ebramzadeh E, *et al.* Total hip replacement after failed hemiarthroplasty or mould arthroplasty. Comparison of results with those of primary replacements. J Bone Joint Surg. Br. 1991; 73:902-907.
2. Warwick D, Hubble M, Sarris I *et al.* Revision of failed hemiarthroplasty for fractures at the hip. Int. Orthop. 1998; 22:165-168.
3. Clayer M, Bruckner J. The outcome of Austin Moore hemiarthroplasty for fracture of the femoral neck. Am J Orthop. 1997; 26:681-684.

4. Skinner P, Riley D, Ellery J *et al.*: Displaced subcapital fractures of the femur: A prospective randomized comparison of internal fixation, hemiarthroplasty and total hip replacement. *Injury*. 1989; 20:291-293.
5. Sikorski JM, Barrington R: Internal fixation versus hemiarthroplasty for the displaced sub capital fracture of the femur. A prospective randomized study. *J Bone Joint Surg. Br*. 1981; 63:357-361.
6. Söreide O, Mølster A, Raugstad TS: Internal fixation versus primary prosthetic replacement in acute femoral neck fractures: a prospective, randomized clinical study. *Br J Surg*. 1979; 66:56-60.
7. Johnston CE, Ripley LP, Bray CB. Primary endo prosthetic replacement for acute femoral neck fractures. A review of 150 cases. *Clin Orthop*. 1982; 167:123-130.
8. Holmberg S, Kalen R, Thorngren KG. Treatment and outcome of femoral neck fractures: an analysis of 2418 patients admitted from their own homes. *Clin Orthop*. 1987; 218:42-52.
9. D'Arcy J, Devas M. Treatment of fractures of the femoral neck by replacement with the Thompson prosthesis. *J Bone Joint Surg. Br*. 1976; 58:276-286.
10. Lu-Yao L, Keller RB, Littenberg B, *et al.* Outcomes after displaced fractures of the femoral neck. A meta-analysis of one hundred and six published reports. *J Bone Joint Surg. Am*. 1994; 76:15-25.
11. Delamarter R, Moreland JR. Treatment of acute femoral neck fractures with total hip arthroplasty. *Clin Orthop*. 1987; 218:68-74.
12. Greenough CG, Jones JR. Primary total hip replacement for displaced sub capital fracture of the femur. *J Bone Joint Surg. Br*. 1988; 70:639-643.
13. Dupont JA, Charnley J. Low-friction arthroplasty of the hip for the failures of previous operations. *J Bone Joint Surg. Br*. 1972; 54:77-87.
14. Amstutz HC, Smith RK. Total hip replacement following failed femoral hemiarthroplasty. *J Bone Joint Surg. Am*. 1979; 61:1161-1166.
15. Stambough JL, Balderston RA, Booth RE *et al.* Conversion total hip replacement: review of 140 hips with greater than 6-year follow-up study. *J Arthroplasty*. 1986; 1:261-269.
16. Taine WH, Armour PC. Primary total hip replacement for displaced sub capital fractures of the femur. *J Bone Joint Surg. Br*. 1985; 67:214-217.
17. Gruen T, McNeice G, Amstutz H. "Modes of failure" of cemented stem-type femoral components: a radiographic analysis of loosening. *Clin Orthop*. 1979; 141:17-27.
18. De Lee G, Charnley J. Radiological demarcation of cemented sockets in total hip replacement. *Clin Orthop*. 1976; 121:20-32.
19. Olsson S. Loosening and femoral neck resorption 5 years after CAD hip replacement. *Acta Orthop Scand*. 1987; 58:491-493.
20. Harris W. Traumatic arthritis of the hip after dislocation and acetabular fracture: treatment by mold arthroplasty. *J Bone Joint Surg*. 1969; 51-A:737-755.
21. Dorr L, Glousman R, Hoy A *et al.* Treatment of femoral neck fracture with total hip replacement versus cemented and non- cemented hemiarthroplasty. *J Arthroplasty*. 1986; 1:21-28.
22. Gingras M, Clarke J, Evarts CM. Prosthesis replacement in femoral neck fracture. *Clin Orthop*. 1980; 152:147-152.
23. Kofoed H, Kofoed J. Moore prosthesis in the treatment of fresh femoral neck fracture. Critical review with special attention to secondary acetabular degeneration. *Injury*. 1983; 14:531-540.
24. Squires B, Bannister G. Displaced intra capsular neck of femur fracture in mobile independent patients: Total hip replacement or hemiarthroplasty. *Injury*. 1999; 30:345-348.
25. Andersson G, Müller-Nilsen J. Results after arthroplasty of the hip with Moore prosthesis. *Acta Orthop Scand*. 1972; 43:39-44.
26. Kaltsas D, Klugman. Acetabular erosion: A comparison between the Austin Moore and Monk hard top prosthesis. *Injury*. 1986; 17:230-236.
27. Goldring S, Schiller A, Roelke M *et al.* The synovial-like membrane at the bone-cement interface in loose total hip replacement and its proposed role in bone lysis. *J Bone Joint Surg*. 1983; 65-A: 575-584.
28. Goodman S, Fornasier V, Kei J. The effects of bulk versus particulate ultra-high molecular weight polyethylene on bone. *J Arthroplasty*. 1988; 3:S41-46 (suppl).
29. Raia FJ, Chapman CB, Herrera MF, Schweppe MW, Michelsen CB, Rosenwasser MP. Unipolar or bipolar hemiarthroplasty for femoral neck fractures in the elderly? *Clin Orthop Relat Res*. 2003; 414:259-65.
30. Swiontkowski MF: Intra capsular fractures of the hip. *J Bone Joint Sur. M Am*. 1994; 76:129.
31. Kofoed H, Kofoed J: Moore prosthesis in the treatment of fresh femoral neck fractures. A critical review with special attention to secondary acetabular degeneration. *Injury*. 1983; 14:531-540.
32. Hammad A, Abdel-Aal A. Conversion total hip arthroplasty: Functional outcome in Egyptian population. *Acta Orthop Belg*. 2006; 72:549-54.
33. Sharkey PF, Rao R, Hozack WJ, Rothman RH, Carey C. Conversion of hemiarthroplasty to total hip arthroplasty: Can groin pain be eliminated? *J Arthroplasty*. 1998; 13:627-30.
34. Gowen M, Wood DD, Ihrie EJ, McGuire MK, Russell RG. An interleukin 1 like factor stimulates bone resorption *in vitro*. *Nature*. 1983; 306:378-80.
35. Nishii T, Sugano N, Masuhara K *et al.* Bipolar cup design may lead to osteolysis around the uncommented femoral component. *Clin Orthop*. 1995; 316:112.
36. Kim KJ, Rubash HE. Large amount of poly ethylenedebriis in the interface tissue surrounding bipolar endo prostheses. Comparison to total hip prostheses. *J Arthroplasty*. 1997; 12:32.
37. Cossey A, Goodwin M. Failure of Austin Moore hemiarthroplasty: Total hip replacement as a treatment strategy. *Injury*. 2002; 33:19-21.
38. Sierra RJ, Cabanela ME. Conversion of failed hip hemiarthroplasty after femoral neck fractures. *Clin Orthop*. 2002; 399:129.
39. Sarmiento A, Gerard FM. Total hip arthroplasty for failed end prosthesis. *Clin Orthop* 1978; 137:112.
40. Jones CP, Lachiewicz PF. Factors influencing the long term survival of 211 uncommented acetabular revisions. Read at the Annual meeting of the American Academy of Orthopedic Surgeons. Feb 13-17: Dallas, TX, 2002.
41. Paprosky WG, Woeden SH. Acetabular revision without femoral exchange- Is there a correlation with instability? Read at the Annual meeting of the American Academy of Orthopaedic Surgeons; Feb 13-17: Dallas, TX, 2002.
42. Amr Mohamad Abdelhady Sharaf. Total hip replacement

- after failed hip hemiarthroplasty; Pan Arab J Orth. Trauma, 2004, 2(8).
43. Diwanji SR, Kim SK, Seon JK *et al.* Clinical Results of Conversion Total Hip Arthroplasty after Failed Bipolar Hemiarthroplasty; J Arthroplasty. 2008; 23:7.
 44. Bilgen O, Karaeminogullari O, Kulekcioglu A: Results of Conversion Total Hip Prosthesis Performed Following Painful Hemiarthroplasty; the Journal of International Medical Research. 2000; 28:307-31.
 45. Lee PB, Berry DI, Harmsen WS *et al.* Total Hip Arthroplasty for the treatment of an acute fracture of femoral neck: Long term results. J Bone Joint Surg. [Am]. 1998; 80-A:70-75.
 46. Hodgkinson JP, Meadows TH, Davies DR, Hargadon EJ. A radiological assessment of inter prosthetic movement in the Charnley-Hastings hemiarthroplasty. Injury. 1988; 19(1):18-20.
 47. Gaine WJ, Sanville PR, Bamford DJ. The Charnley-Hastings bipolar prosthesis in femoral neck fractures - a study of dynamic motion. Injury. 2000; 31(4):257-63.
 48. Benterud JG, Kok WL, Alho A. Primary and secondary Charnley Hastings hemiarthroplasty in displaced femoral neck fractures and their squeal. Ann Chir Gynaecol. 1996; 85(1):72-6.