DISCUSSION

Hip fractures in elderly patients result in implications in medicine, rehabilitation, psychiatry, and healthcare economics, and continues to be regarded as the 'Unsolved fracture'. Patients who sustain a fracture of the hip have higher reported age and/or gender-adjusted mortality rates than the general population. There is still no agreement on the optimal operative treatment of displaced subcapital fractures in the elderly. Controversy exists regarding rehabilitation, durability of internal fixation and the type of prosthetic replacement hemi or total hip arthroplasty. (82)

Closed reduction and internal fixation has been considered faster and easier to perform, with the advantages of saving the natural joint if healing will succeed. The results of meta-analysis show a revision rate of 33% for internal fixation of displaced fractures of the femoral neck, mostly because of nonunion. Osteopenia and osteoporosis are highly prevalent in elderly patients. Bone density has been shown to correlate with the intrinsic stability of the fixation of the fracture in cadaver and retrospective studies. (99, 100)

Nilsson et al. showed that 50% of the patients with healing complications were confined to a wheelchair by the time of the secondary arthroplasty. (99)

Martyn J. et al. reported in their comparative study of 692 patients with fracture neck of femur that the optimum treatment for an undisplaced femoral neck fracture is internal fixation, irrespective of the patient's age. (100)

Fixation in comparison to arthroplasty has a lower mortality, less peri-operative complications and has a better functional outcome. Secondary surgical procedures are however increased after internal fixation; they recommended hemiarthroplasty for those patients in which early mobilization is desired and in displaced fracture type. (82)

Prosthetic arthroplasty of the femoral head has been in clinical application since the 1950s. (101) Palmer et al. and Parker and Pryor in reported that a primary arthroplasty is more time and cost consuming in the initial phase but different types of arthroplasty are being used so the choice of which type is now the aim of many researches. (82)

Comparative studies between unipolar, modular unipolar, bipolar hemiarthroplasty and total joint replacement were done by many authors, in resource-poor countries; cost is one of the major factors. The unipolar prosthesis is the least expensive procedure, and total hip replacement is the most expensive. In the study done by Narayan K K and George T. from 1997 to 1999, they preferred total hip replacement believing that it offered the best functional results and from 2000, they preferred the bipolar prosthesis, because they had had three dislocations after total hip replacement. The main concern with bipolar arthroplasty is the possibility of occurrence of protrusio acetabuli so they therefore decided to use the same femoral component as used in total hip replacement, so that if protrusion occurred, only the acetabular side would need to be revised this concept is also present in the modular unipolar prosthesis. At a mean follow-up of 5 years, they had not had to do any revisions, for protrusion, it was also seen that more than a third of the patients expire within 5 years of replacement, long before any protrusion occurs. (102)

The surgical technique of hemiarthroplasty is simpler than total hip replacement. Due to a large acetabular component, dislocations are uncommon. (103)

Also, Narayan K K and George T. found that the functional results were equally good for both the total hip replacement and bipolar arthroplasty. [102]

Ong and colleagues evaluated the long-term (minimum of 36 months) outcomes of 281 patients over age 65 with displaced femoral neck fractures; these patients were treated with hemiarthroplasties, There were no significant differences in multiple outcome measures between modular unipolar and bipolar type as the extra cost of bipolar endoprostheses does not seem to warrant its use and both allow for revision to total hip arthroplasty compared to the unipolar types (Austin- Moore and Thompson). [104]

Comparative studies between conventional and minimally invasive surgery for hemiarthroplasty of the hip were done by many authors. In the study done by Felix Renken et al. comparing two different approaches to the hip joint for the implantation of a bipolar hemi-arthroplasty after fractured neck of femur, it can be stated that mobilization status is improved for the minimally invasive compared to the conventional approach, also there is less pain in the minimally invasive approach. There is no radiographic evidence that a minimal invasive technique leads to inferior implant position. [105]In the study done by Alexander Auffarth et al. they concluded that despite early postoperative differences, postoperative mobility does not seem to be greatly influenced by the choice of the approach for hip hemiarthroplasty.[106]

Operative time was significantly linked to postoperative complications.

In this respect, it can be concluded that it is not be the approach itself that determines the early postoperative result, but the routine the individual surgeon has with it.[106]

In our study, we are discussing the results of hemiarthroplasty of the hip using minimally invasive antero-lateral approach in management of fracture neck of femur in elderly patients.

The average age in the present series was 73.05 years. The average age in other series was higher. In Felix Renken et al. the average age was 87 years,[107] and in Kazuo Kaneko et al. the average age was 79.1.[108]

Males were more frequently affected than females with a ratio of 5.7:1 in this study. Other authors reported different sex ratio and higher female to male ratio as females are generally more suffering of hip fractures. Felix Renken et al. reported female to male ratio of 6.5:1, [107] Sachiyuki Tsukada and Motohiro Wakui 4.5:1[109] and the female to male ratio in A. C. Unger and colleagues was 4.3:1.[110]

The higher incidence in females can be explained by the fact that osteoporosis is more common in females (post-menopausal) due to hormonal changes and inactivity. [83] The higher life expectancy of females than males is an important contributing factor. [111, 112] Men undergoing surgery for fracture of the hip have been reported to have younger age at presentation, and poorer markers of pre-operative health status than age-matched women.

The right side was more frequently affected than the left with ratio of 3:1. This finding coincides with the observation of chan et al. where the right side was found slightly more affected. [113]

Falling on the ground and forced external rotation were found the mechanism of trauma in our series with ratio of 3:1.

According to Harris hip score, the current study had 13 out of 20 hips with excellent and good results (65 %). And 7 hips with fair and poor results (35 %). It allowed analysis of pain, different functional activities and the range of motion. [98]

In satisfactory patients (65%) of our work, the mean of pain grade was 41.15±1.72 points (out of 44 points), it was between slight to no pain. In unsatisfactory patients (35%), the mean was 31.13±4.14 (out of 44 points), it was between moderate to severe pain. The difference was statistically significant. Alexander Auffarth et al. in his comparative study between minimally invasive and conventional hemiarthroplasty found that postoperative pain was rated significantly higher by patients in the minimally invasive group within the first 4 days after the procedure .[106] . In the study done by Felix Renken et al. comparing two different approaches to the hip joint for the implantation of a bipolar hemi-arthroplasty after fractured neck of femur, they found that there is less pain in the minimally invasive approach.[105]

We found that ten patients (50%) had slight limping in 4 of them, the position of the stem was central and 6 in slight valgus. 6 patients (30%) had moderate limping, 5 of them had the prosthetic stem in slight varus, only one patient (5%) had severe limping. Limping may be as a result of muscular insufficiency or shortening. Alexander Auffarth et al. reported that limping was present in 2 (8.3%) out of 24 patients included in his series. [106]

In our study only four patients (20%) could walk unsupported, their age range from 62 to70 years old all were not complaining of associated medical diseases, seven patients (35%) used a cane for long walks; their mean age was 73.8 years. Five patients (25%) could walk using a cane most of the time, their mean age was 73.9 years, and four of them had chronic diseases. four patients (20%) could walk using one crutch; all had chronic disease. A.C. Unger et al. reported that 159 patients (88.3%) were mobilised either with a walker (61.6%) or with crutches (26.7%). Only 5 patients (3%) who were ambulatory before surgery were confined postoperatively to a wheelchair.[114] Schneider et al. achieved better results for their 3-month follow-up.[115] Only 47 (59%) of 80 patients were dependent on walking aids; the most frequent support was the walker (36%).[114]

Five patients (25%) could walk indoor only; their mean age was 79 years. Four patients (20%) could walk up to 3 blocks, all of them had chronic diseases, and mean age was 72.6 years. Eleven patients (55%) could walk up to six blocks; six of them aged 67-75 years.

Comparing these results to other studies of hemiarthroplasty, Jalovaara and Virkkunen reported in their series that 9% of their patients could walk outdoor and 38% indoor, [116] while Jensen and Holstein reported that 23.3% of their patients could walk more than 1500 meters and 16.7% up to 500 meters. [117]

Only four patients (20%) could climb the stairs normally, their age range from 60 to 70 years old. eleven patients (55%) could climb the stairs using railing; eight of them were older than 70 years. five patients (25%) could climb the stairs in any manner, their age range from80 to85 years; all of them had chronic diseases.

In our study, the mean haemoglobin level in the first postoperative day was 10.5 mg/dl (9.0–12.5). Four patients (20%) needed a blood transfusion, resulting from haemoglobin level being lower than 10 mg/dl. A.C. Unger and colleagues found that the mean haemoglobin level in the first postoperative day was 10.0 m g/dl (7.5–12.0). Seven patients (43.75%) needed a blood transfusion, resulting from haemoglobin level being lower than 8 mg/dl.[110] Sachiyuki Tsukada and Motohiro Wakui in their comparative study between minimally invasive and conventional approaches for bipolar hemiarthroplasty in fracture neck of femur found that blood loss during surgery was greater with MIS-BHA (370.1 ± 192.1 ml) than with conventional BHA (230.0 ± 114.9 ml).[109] Kazuo Kaneko et al. in their randomized comparison between a mini-incision and an ordinary incision for hemiarthroplasty in femoral neck fractures found that no difference was found between the two groups in blood loss.[108] perservation of musculature with minimal muscle injury at the surgery reduced the amount of bleeding in minimally invasive surgery.

Factors affecting the outcome:

Factors that affect the final functional outcome can be classified into:

A- Preoperative factors: these factors could be used to predict the outcome after performing the operation.

B- Operative factors: These are technical factors that affect the final outcome.

C- Postoperative factors: many factors including complications may affect the final outcome.

Preoperative factors:

At the time that a patient was included, the following variables were recorded: age, sex, weight, pre fracture living condition, walking ability, status with regard to the activities of daily living, fracture type, and time lapse. In patients with severe cognitive impairment, the living condition, walking ability, and status with regard to the activities of daily living were assessed by means of a report by a proxy (a close relative or caregiver).

1- Age

The choice of the proper method of management is much affected by age as in younger patient internal fixation is a golden rule and in elder patients primary arthroplasty is proved to be with better outcome also in such group age affects the final outcome, the relationship between the final results and age of the patients was inversely proportional. Several authors thought that above the age of 60 years hemiarthroplasty is better that internal fixation, Iorio R. et al. concluded that above the age of 60 hemiarthroplasty gave better results, higher health related quality of life. [118] Age also affects the choice of which type of hemiarthroplasty to be used in the group above 60 years as modular unipolar and bipolar types allow for revision to total hip on long term follow up which is suitable for younger patients in this age group. [103]

In our study, the age of patients range from 62-86 with mean age 73 years, the mean age for satisfactory patients was 70.38±6.58 years, while for unsatisfactory patients 78±6.19 years. There were statistical significant differences between final results and age.

2- Fracture pattern

In our study, 8 patients with garden 3 fracture neck of femur and 12 patients with garden 4 fracture neck of femur had no statistical difference in the functional out come in the postoperative evaluation of patients. We excluded garden1 and 2 from our study as many investigators agreed that internal fixation was better than arthroplasty even in old patients. (100)

3- weight

In our study body weight of the patients ranged from 65 to 100 kg; with a mean of 76 kg.

The mean weight for satisfactory patients was 73.31±6.345 kg, while for unsatisfactory patients 92±6.19 kg. There were statistical significant differences between final results and weight. The average weight in other series was lower. In Sachiyuki Tsukada and Motohiro Wakui the average weight was48.4 ± 8.2 kg.(109) Suk-Ku Han and colleagues found that the average weight in their series was 61.8 ± 12.7 kg.(119)

4- Medical status

Associated medical disease may influence the morbidity after fracture neck of femur but do not affect the functional outcome. It was found that, early rehabilitation after hemiarthroplasty was beneficial in lowering the postoperative mortality, this is also our conclusion in this study as there was no statistical significant difference between those with associated medical disease and those who were medically free concerning the functional outcome. (120)

5- Pre injury walking ability

In our study, the pre injury functional ability was found to be one of the most important factors affecting the final outcome after hip fracture 30% of the patients with satisfactory results had pre injury score-A and70 % had pre injury score B while about 14% of the unsatisfactory results had pre injury score B and 86% had C score, this result was reported by many investigators like Hershkovitz A, et al. (121)

Broos PL, et al reported that, pre-fracture function ability has a strong association with increased mortality after surgery for hip fracture. Pre-fracture residence and mobility were used as markers of pre-fracture function. Both factors as independent variables were found to be strongly associated with peri-operative mortality, even when controlling for potentially confounding variables such as age and medical co-morbidity. (122)

6- Time lapse before operation

According to Karagiannis A, et al, early surgery was associated with less pain and shorter length of stay compared to delay in surgery that was associated significantly with higher risk for in-hospital death. (123) In our series, time lapse before surgery ranges from

1-9 days with mean of 3.20 days according to the patients' general condition with statistically significant better results with early operation. According to Amer N., et al, patients who had the operation more than thirty-six and forty-eight hours after admission were less likely to return to independent living within four months. [124] Sachiyuki Tsukada and Motohiro Wakui found that the average time from admission to surgery was 3.7 ± 1.9.[109] According to A.C. Unger et al. 66.2% of patients were treated in the first 48 hours after a fracture was diagnosed. Reasons for delayed operative treatment included current anticoagulation in 16% and bad general state of health in 14% of all patients.[114]

Operative factors:

1- Approach

In our study, all patients were operated through minimally invasive anterolateral approach. Many authors prefer the anterolateral approach as many comparative studies found that this approach shows lower risk of dislocation compared to the posterior approach. Keen GS, et al, in their study reported that there was significant risk of dislocation with posterior approach, while Alexander P., et al, reported in their series that surgical approach has no effect on the incidence of dislocation. [125,126, 127]In our study the lenghth of the incision was 6-8 cm. A. C. Unger and colleagues reported that the mean skin incision length was 8 cm,[110] Kazuo Kaneko et al. reported an average skin incision of about 7 cm.[108]

2- Type of the prosthesis

In our study 13 patients 65% were treated by modular prosthesis (bipolar and modular unipolar), of which 11 patient 84.6% had satisfactory results, while the other 7 patients 35% were treated by non modular prosthesis (unipolar) and had 15.4% satisfactory results. Relation between final results and type of prosthesis is statistically significant.

3- Implant size and positioning

The choice of head and stem size should be done in the preoperative planning and confirmed intraoperativly while proper positioning of the femoral component is a very important factor influencing the final outcome including:

a- Prosthesis anteversion: excessive anteversion was the case of anterior dislocation in a single case in our series. This could be avoided by proper positioning of the stem in relation to the lesser trochanter and the distal leg.

b- Re-establishing the proper leg length: this could be achieved by using the lesser trochanter for proper leveling of the stem and checked by using the tip of the greater trochanter which must be at the same level with the center of the head of the prosthesis.

c- Proper occupation of the bone cement: Proper occupation of the bone cement in the medulla affects much the outcome and the duration before stem loosening this is assisted by inserting a plug in the medulla.

d- Centralization of the stem in the medulla: in our study seven patients (53.8%) of the satisfactory results had the stem in the central position and six patients (46.7%) of

the satisfactory with slight valgus while six patients (85%) of the unsatisfactory results had the stem in slight varus.

4- **Operative time**

The time of the operation found not to affect the final outcome but it had much influence on the risk of infection, blood loss and postoperative morbidity. In our series, the duration of the operation ranges from 50 minutes to maximum of 120 minutes with an average time of 82.6 minutes. Alexandar Auffarth et al. reported an average time of 80.4 minutes (range, 45minutes–123 minutes),[106] Felix Renken et al in their study found that the duration range from 45- 90 minutes with an average of 73.6 minutes.[107]

5- Fracture during operation

In this study single patient (5%) had intraoperative fracture of the greater trochanter and his final Harris hip score was poor. Intraoperative fractures usually occur when trying to reduce the prosthesis into the acetabulum or during the insertion of the prosthetic femoral stem especially in cementless type of arthroplasty or in unipolar prosthesis as reported in the series of cases by Anderson, et al.[128] Byung- Hak Kim et al. in their study reported that intraoperative periprosthetic fractures occurred in 2 cases 13.3%.[129] Kazou Kaneko et al. had 2 cases of intraoperative fracture 6.25% in their study.[108]

Postoperative factors:

1- **Infection**

Postoperative infection not only affects the final outcome but also increase the mortality rate. In our series, only 2 cases had superficial infection and none had deep.

The influence and incidence of infection after hip operations were found severe as reported by Merrer J, et al. The rate of infection in their study was about 6.9%, and about one third was superficial infection and two thirds deep infection. Jensen and Holstein reported 4.7 % superficial wound infection, and deep infection was 3 %. [117] Felix Renken et al. reported 1.6% superficial infection.[107] A.C. Unger et al. reported 1 case 0.6% of deep infection and revision arthroplasty was done 6 weeks later.[114]

2- Time passed postoperatively

As time passes improvement in the functional ability of the patients occur. This was apparent in the improvement of the Harris score of the patients when performed 2 weeks postoperatively and 6 month later.

3- Dislocation of the implant

Anterior dislocation happened in only one case of our series, closed reduction and traction succeeded to stabilize the hip and revision was not needed. The average time of dislocation after surgery was 19.3 days. Clinical factors significant for dislocation were male sex and mental disease. [130] While A.C. Unger , et al. reported only a single case in his series 0.6% .[114]

4- Post operative deep vein thrombosis

This occurred in only one patient thus lead to increase the hospital stay and poor functional outcome. This was also reported by Felix Renken et al. in 1 case 3.3% of their series [107]

5- Neurological complications

In the present study, no neurological complications were found. The posterior approach may be responsible for iatrogenic neurological deficit.

A.C. Unger et al. reported 1 case 0.6% femoral nerve lesion because of incorrect position of a sharp retractor.[114] Nerve injury to the posterior portions of the vastus lateralis also can occur because the femoral nerve enters the muscle proximally and medially. Division of the muscle can leave the posterolateral portion denervated.[129]

Damage to the superior gluteal nerve frequently is encountered in cases operated through a lateral approach. There is a safe area extending 3 to 5 cm proximal to the tip of the greater trochanter. If the division of the gluteus medius is limited to this area, the possibility of superior gluteal nerve injury is minimized.[129]

SUMMARY

Hip fractures are common and comprise about 20% of the operative workload of an orthopaedic trauma unit.(1) Intracapsular femoral neck fractures account for about 50% of all hip fractures.

The lifetime risk of sustaining a hip fracture is high and lies within the range of 40% to 50% in women and 13% to 22% in men.

Life expectancy is increasing worldwide, and these demographic changes can be expected to cause the number of hip fractures occurring worldwide to increase from 1.66 million in 1990 to 6.26 million in 2050.(2)

The risk factors for hip fractures can be divided into those that increase the risk of falls in the elderly and those that predispose to changes in bone mass.(20)

There is very little debate about the management of the undisplaced intracapsular hip fracture, which is almost invariably treated with internal fixation; however, only 15% of these fractures are undisplaced. The remainder are displaced and occur predominantly in elderly female patients. Despite the ubiquitous nature of these fractures there is still a surprising degree of variation in treatment. Options include reduction and fixation, unipolar arthroplasty, bipolar hemiarthroplasty, and total hip arthroplasty. Any of the arthroplasty options may be cemented or uncemented.(3,4,5)

The Hip joint can be approached in many ways and therefore many different exposures have been described. The choice of which approach to use depend on the type of surgery, what part of the hip needs to be exposed, age of the patient and surgeon's preference and expertise. (24)

Minimally invasive surgery of the hip seeks to eliminate some complications of traditional extensile exposure and also attempts to facilitate more rapid rehabilitation of patients after surgery. Traditional anterolateral approaches have divided the anterior portion of the gluteus medius and minimus and potentially jeopardized the superior gluteal nerve. These disadvantages have been associated with abductor weakness, prolonged limp and decreased patient satisfaction. To overcome these problems, a mini-incision approach was developed using the intermuscular plane between the gluteus medius and the tensor fascia lata. (25)

Minimally invasive surgery (MIS) performed through the anterolateral approach potentially leads to a reduction in operative trauma through lower blood loss with a smaller soft tissue wound, a reduction in post-operative pain, and earlier mobilization accomplished by preserving muscle insertions. Theoretically, these improvements should result in a shorter hospitalization, convalescence, and rehabilitation period, as well as an enhanced cosmetic result through smaller skin incision and atraumatic wound closure. (26)

The aim of this work is to evaluate the results of hemiarthroplasty of the hip using minimally invasive antero-lateral approach in management of fracture neck of femur in elderly patients.

This study included 20 elderly patients with femoral neck fracture. The youngest patient was 62 years and the oldest was 86 with mean age of 73. There were 17 males (85%) and 3 females (15%). Fractures in 13 patients (65%) were the result of fall, while 7 patients (35%) had just forced external rotation.

The mean time lapse for satisfactory patients was less than unsatisfactory patients. It was 2.31±0.95 and 4.86±2.48 for satisfactory and unsatisfactory patients respectively.

Only one patient (5%) had intraoperative fractures of the greater trochanter.

The shortest time of follow up was 6 months and the longest was 12.

Postoperative superficial wound infection occurred in only 2 cases and none had deep.

According to Harris Hip Score the current study included three excellent result (15%), ten good (50%), four fair (20%), and three poor (15%).

In satisfactory patients (65%) of our work, the mean of pain grade was 41.15±1.72 points (out of 44 points), it was between slight to no pain. In unsatisfactory patients (35%) the mean was 31.13±4.14 (out of 44 points),

The final outcome was affected by the age of the patients, weight, pre injury walking ability, time lapse before operation and type of prosthesis while associated medical diseases, postoperative deep vein thrombosis and postoperative infection affect the mortality of the patients not only the function outcome.