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Internal Fixation vs. Dual Mobility Hip Arthroplasty in Unstable Pertrochanteric Fractures in Geriatric Patients

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Abstract

One of the most common fractures of the hip in the elderly is the pertrochanteric fracture and usually is a result of low-energy trauma; it accounts for up to 48% of all hip fractures. To compare the functional outcome of internal fixation and dual mobility THA in the treatment of unstable pertrochanteric fractures in elderly. This prospective study included twenty patients with unstable pertrochanteric fracture femur presented to Al-Zahraa University Hospital in the period between December 2019 to March 2021, they were categorized into two groups, group I treated with Internal Fixation Devices and group II treated with Dual Mobility (DM) total hip arthroplasty, patients were examined at least 6 months after the operation. The final result of the group I was satisfactory in 70% of patients and unsatisfactory in 30% of patients but, in group II the result was satisfactory in 80% of patients and unsatisfactory in 20% of patients. From our results we can conclude that despite increased blood loss and operative time, arthroplasty for extra capsular pertrochanteric fractures of the upper end of femur did not increase mortality or morbidity and appeared to provide functional improvement at a low cost compared to internal fixation.

Keywords: Internal fixation, Dual mobility hip arthroplasty, Unstable pertrochanteric fractures, Geriatric patients.

1. Introduction

One of the most common fractures of the hip in the elderly is the pertrochanteric fracture and usually is a result of low-energy trauma; it accounts for up to 48% of all hip fractures.[1] These fractures are associated with high rates of morbidity and mortality, mechanical complications, and additional financial charges to patients and their families [2]. The management of unstable pertrochanteric fractures in geriatrics is a challenge because it is not easy to reduce unstable fractures anatomically [3]. Immediate mobilization and early weight bearing of these patients is utmost important to protect them from possible complications of long-lasting immobilization such as atelectasia, deep venous thrombosis, pulmonary embolism

and bed sores [4]. Partial weight bearing is usually not enough for immediate mobilization and full weight bearing is mandatory due to frail conditions of such elderly patients. Moreover, it is very important to avoid secondary operations to the maximum extent in this patient group [5].

Internal fixation may be associated with non-anatomically reduction of fracture fragments, long time of bed rest, extended protected weight-bearing, bone fragment necrosis, and secondary reduction loss due to unstable fixation in poor quality bone [6]. Operative management of pertrochanteric fractures consists of many methods either by open reduction and internal fixation with nails or plates, or by external fixator or by arthroplasty [7].

In a trial to find a best option, some studies showed that arthroplasty in its various forms was a better treatment option for pertrochanteric fractures especially in osteoporotic bone, unstable, or complex patterns of fractures with early weight bearing and better functional outcomes. However, the complications of prosthesis dislocation, loosening, and difficult reduction of the trochanters were main problems with the arthroplasty option [8]. Dual-mobility (DM) cups were designed to combat the risk of instability and decrease the risk of THA dislocation based on the large-diameter head concept [9].

2. Patients and Methods

A prospective study was done in the period between December2019 to March 2021 at Al-Zahraa University Hospital on 20 patients suffering from unstable pertrochanteric fractures and managed with Internal Fixation Devices or cemented Dual Mobility (DM) total hip arthroplasty to evaluate the functional and the radiological results. Patients were randomly assigned by computer generated random number into of the medius tendon is left temporarily attached to the intact femur until the trochanter can be mobilized and this allowed complete mobilization of the gluteus minimums. Anterior exposure was two groups (10 in each group). This study was conducted as a randomized controlled trial (parallel group study with 1:1 randomization) and conducted at orthopedic department of Al-zahraa University Hospital from 6 months to 1 year according to sample size. Cases who are found eligible to associate in the study are asked to sign a written informed consent, with all the details included and verbally explained. The study included patients 60 years old or older with unstable pertrochantric fracture.

2.1 Ethical considerations & Study approval:

Before starting the study and in accordance with the local regulation followed, the protocol and all corresponding documents was declared for Ethical and Research approval by the council of orthopedic department, Al-Zahraa University, Hospital.

2.2 Intervention

A standardized questionnaire was used to collect personal information, trauma modality, comorbidities and AO/OTA classification of fractures. In the internal fixation group (group A): Fixation by DHS, PFN or Gamma nail was achieved under C-arm imaging in a supine position. Removal of suction drains 48 hours postoperative and rehabilitation of the patients actively in bed. The hospital stay after surgery was around 2 weeks and the time to activities of full weight bearing was about 10 weeks.

In the arthroplasty group (group B): Through the posterior hip approach in the lateral decubitus position of the patients we used a modified trochanteric slide osteotomy to expose the hip joint. The osteotomy was carried out from the tip of the trochanter to the base of the vastus tubercle using osteotome. A small portion improved by flexion and external rotation of the hip. Releasing of ligamentum teres and capsular attachments of femoral head and neck to be removed from the acetabulum. According to the

manufacturers' recommended technique implants were then placed. Encouragement of the patients to perform active rehabilitation in bed one day after operation but kept out exaggerated hip adduction and rotation. Patients were recommended to do moderate flexion of both hips and knees using a pillow between the legs in their positioning. Inside the hospital they are allowed to bear weight partially. The time of hospital stay after surgery was around 2 weeks and tolerated full weight bearing was around 4 weeks. Administration of the first-generation cephalosporin and an aminoglycoside just before anesthesia and continued postoperative for 2 days. Anticoagulants and non-steroidal anti-inflammatory drugs were given according to its indications. Patients were followed up closely and finally, patients were evaluated functionally according to HARRIS HIP SCORE (HHS).

2.3 Statistics analysis:

Analysis of data was done using SPSS (statistical package for social science version 20). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage. The HARRIS HIP SCORE (HHS) was used to assess the results of hip surgery.

3. Results

Table 1: Comparison between two groups according to demographic data and clinical characteristics

Demographic data	Group I (n=10)		Group II (n=10)		Total (n=20)		Test value	p-value
	No.	%	No.	%	No.	%		
Sex								
Female	5	50.0%	4	40.0%	9	45.0%	*FE*	0.653
Male	5	50.0%	6	60.0%	11	55.0%		
Age								
Mean±SD	68.10±3.28		61.70±1.64		64.90±4.14		5.520	<0.001**
Range	63–74		60–65		60–74			
Affected side								
Left	4	40.0%	7	70.0%	11	55.0%	*FE*	0.178
Right	6	60.0%	3	30.0%	9	45.0%		
Fracture type								
31-A2	10	100.0%	10	100.0%	20	100.0%	0.000	1.000
ASA scoring (patients' physiological status)								
ASA2	7	70.0%	10	100.0%	17	85.0%	FE	0.060
ASA3	3	30.0%	0	0.0%	3	15.0%		

Using: Chi-square test; p-value>0.05 NS and t-Independent Sample t-test; Fisher's Exact p-value>0.05 NS; *p-value <0.05 S; **p-value <0.001 HS

Table 2: Comparison between two groups according to type of implant.

Type of implant	Group I (n=10)		Group II (n=10)		Total (n=20)		Test value	p-value
	No.	%	No.	%	No.	%		
DHS	5	50.0%	0	0.0%	5	25.0%	20.000	<0.001**
PFN	3	30.0%	0	0.0%	3	15.0%		
Gamma Nail	2	20.0%	0	0.0%	2	10.0%		
Dual Mobility THA	0	0.0%	10	100.0%	10	50.0%		

Using: Fisher's Exact; **p-value <0.001 HS

Table 3: Comparison between two groups according to Operation time (min).

Operation time (min)	Group I (n=10)	Group II (n=10)	Total (n=20)	Test value	p-value
Mean±SD	57.50±13.59	97.00±23.48	77.25±27.55	-4.605	<0.001**
Range	40–80	65–130	40–130		

Using: Mann-Whitney test; **p-value <0.001 HS

Table 4: Comparison between two groups according to Intra operative blood loss (ml) and post-operative blood transfusion

Intra operative blood loss (ml)	Group I (n=10)		Group II (n=10)		Total (n=20)		Test value	p-value
Mean±SD	174.00±75.12		757.50±248.90		465.75±348.74		-7.097	<0.001**
Range	100–350		450–1200		100–1200			
Post-operative blood transfusion								
No	9	90.0%	7	70.0%	16	80.0%	FE	0.264
Yes	1	10.0%	3	30.0%	4	20.0%		

Using: Mann-Whitney test; and Fisher's Exact **p-value <0.001 HS

Table 5: Comparison between two groups according to post-operative complications.

Post-operative complications	Group I (n=10)		Group II (n=10)		Total (n=20)		Test value	p-value
	No.	%	No.	%	No.	%		
Chest infection	1	10.0%	0	0.0%	1	5.0%	4.286	0.369
Decrease Hb level	0	0.0%	2	20.0%	2	10.0%		
Hip pain	0	0.0%	1	10.0%	1	5.0%		
Wound infection & Decrease Hb level	1	10.0%	1	10.0%	2	10.0%		
No	8	80.0%	6	60.0%	14	70.0%		

Using: Fisher's Exact; p-value>0.05 NS

Table 6: Comparison between two groups according to Harris Hip Score.

Harris Hip Score	Group I (n=10)	Group II (n=10)	Total (n=20)	Test value	p-value
Mean±SD	83.80±8.95	85.50±9.43	84.65±8.99	-0.413	0.684
Range	68–96	66–96	66–96		

Using: t-Independent Sample t-test; p-value>0.05 NS

Table 7: Comparison between two groups according to Level of Harris Hip Score and Ambulation (at 6th month)

Level of Harris Hip Score	Group I (n=10)		Group II (n=10)		Total (n=20)		Test value	p-value
	No.	%	No.	%	No.	%		
Excellent	3	30.0%	4	40.0%	7	35.0%	0.476	0.924
Good	4	40.0%	4	40.0%	8	40.0%		
Fair	2	20.0%	1	10.0%	3	15.0%		
Poor	1	10.0%	1	10.0%	2	10.0%		
Ambulation (at 6th month)								
Community	6	60.0%	7	70.0%	13	65.0%	0.220	0.639
Indoors	4	40.0%	3	30.0%	7	35.0%		

Using: Fisher's Exact; p-value>0.05 NS

Table 8: Comparison between two groups according to Complications (after 6 months).

Complications (after 6 months)	Group I (n=10)		Group II (n=10)		Total (n=20)		Test value	p-value
	No.	%	No.	%	No.	%		
Hip pain	1	10.0%	2	20.0%	3	15.0%	4.410	0.492
Lag screw breaking out	1	10.0%	0	0.0%	1	5.0%		
Leg discrepancy	0	0.0%	1	10.0%	1	5.0%		
Preprosthetic fracture	0	0.0%	1	10.0%	1	5.0%		
Z-effect of tow lag screw	1	10.0%	0	0.0%	1	5.0%		
Wound infection	0	0.0%	0	0.0%	0	0.0%		
No	7	70.0%	6	60.0%	13	65.0%		

Using: Fisher's Exact; p-value>0.05 NS

Figure 1: Parts a & b show pre- and postoperative radiographs of a 69 years old male patient with pertrochanteric right femoral fracture type 31-A2 treated by DHS (Group1). Parts c & d show follow up radiographs at 6th month.

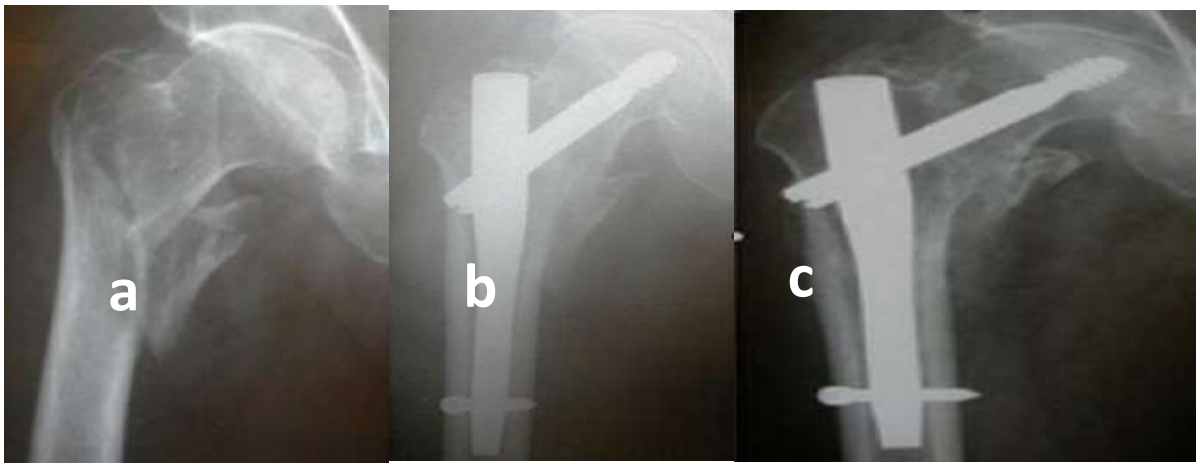

Figure 2: Parts a & b show pre- and postoperative radiographs of a 71 years old female patient with pertrochanteric right femoral fracture type 31-A2 treated by Gamma nail (Group1). Part c show follow up radiographs at 6th month.

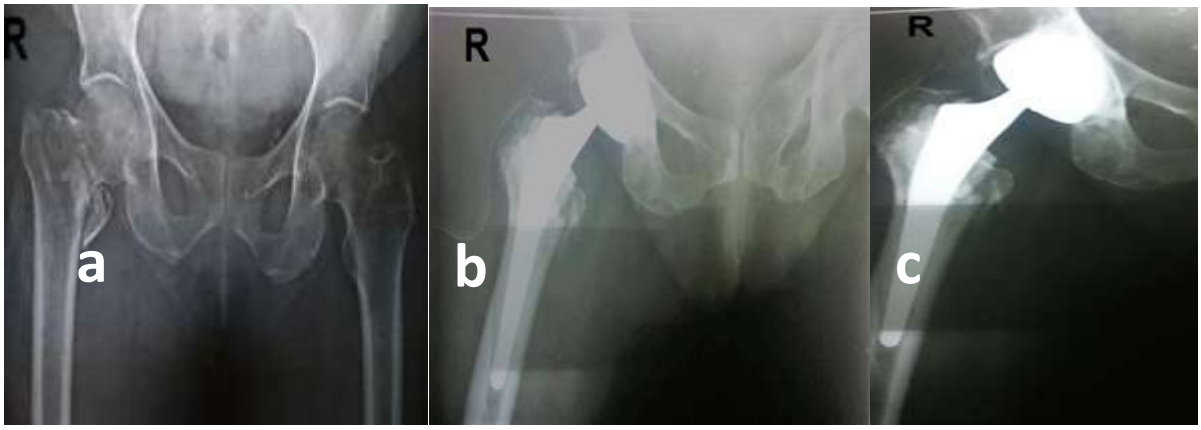

Figure 3: Parts a & b show pre- and postoperative radiographs of a 65 years old female patientwith pertrochanteric right femoral fracture type 31-A2 treated by Dual mobility THR (Group2).Part c show follow up radiographs at 3th month.

4. Discussion

This prospective research was carried out in the period between December 2019 to March 2021 at Al-Zhraa University Hospital on 20 patients with unstable pertrochanteric fractures type 31 A2 according to AO classification and managed with Internal Fixation Devices or cemented Dual Mobility (DM) total hip arthroplasty to analyze the functional and the radiological findings.

The follow up of the cases was for short term results focusing mainly on lifestyle changes and failure of implants or dislocation of the prosthesis. The clinical outcome was rated according to the Harris Hip Score with the use of criteria for pain, function, lack of deformity and motion range.

The type of treatment was less essential than the major causes of mortality, which were a high ASA score, a lack of preoperative autonomy and malnourishment. Among factors that can to some extent be controlled, time to surgery and number of transfusions were associated with poor prognosis.

Internal fixation has the benefit of less intraoperative blood loss, with decreased risk of infection wound.

Rates of mechanical problems were identical throughout both techniques of treatment, and are hard to manage, demanding arthroplasty after internal fixation failing or implant replacement following arthroplasty failing (dislocation, fracture, etc.), both of which are invasive procedures demanding blood loss and transfusion. In literature, each procedure has its own set of problems that occur at different rates. Chan and Gill10 reported few complications in a population similar to the present series and 1-year cumulative mortality rate of 31.5%. The mean age of the patients was 84.2 years (range, 73-99 years) of 55 consecutive cemented arthroplasty in 54 elderly patients with intertrochanteric fractures. Berend et al.11 reported fewer positive outcomes, a 12% dislocation rate despite the anterior approach, with 76% 3-year mortality in a group of 34 patients, and a 3% infection rate.

Jia-bao Ju et al. (2019), in fourteen randomized clinical trials including a total of 1067 participants aged 65 and above were included for qualitative synthesis and meta-analysis to compare hip replacement with intramedullary nail in the management of elderly patients with unstable intertrochanteric femur fracture. They found the meta-analysis indicated that the hip replacement group benefited more than the intramedullary nail group in terms of the bearing load time. While the intramedullary nail was superior to arthroplasty regarding the intraoperative blood loss (WMD 58.36, 95% CI 30.77 to 85.94, $P < 0.0001$) [12].

Internal fixation is also associated with frequent complications, especially mechanical (cut-off, disassembly), sometimes requiring secondary arthroplasty and early mortality.

Hélin et al.13, reported 6.6% mechanical failure required revision by total hip replacement, in the series of 45 patients with unstable pertrochantric fractures fixed by titanium PFNA™ nail.

Hassan khani et al. (2014), followed up and prospectively studied 80 elderly patients with complex unstable intertrochanteric fracture and treated them by DHS and hip arthroplasty. They found that arthroplasty (total, hemi, or bipolar) is an alternative treatment in elderly patients with unstable intertrochanteric fractures and can provide good and satisfactory clinical outcomes associated with low complication and mortality rates. Functional outcomes were higher with arthroplasty group but no statistically significant difference between both groups [14].

Benefits of using DMC in reducing risk of dislocation was very much clear in this study as there was 0 % of dislocation confirming the results obtained in 2013 by Mukka et al. found that cemented DMC for hip revisions caused recurrent hip

prosthetic dislocation or as a primary treatment in patients with a high risk of instability in 34 patients (21 females, 13 males) treated between 2009 and 2012, and they suggested the use of DMCs in risk patients (muscle weakness, primary surgery with osteoarthritis, neuromuscular disorders, dementia, psychiatric disorders and revision surgery). They concluded that these cups could give the needed early hip stability (minimal of 6 months follow-up), even when these operations are performed in a county hospital with a relatively low caseload for such procedures [15].

In January 2018, Rashed et al conducted a study on 32 active middle-aged patients "mean age was 66.4 ± 5.9 years" with fracture neck of femur which were managed with DMC and their results stated that the mean HHS improved over the follow up period and there were no dislocations encountered in this series [16].

Amr Khairy Mahmoud, et al. (2020), studied 20 patients with proximal femoral fractures with high risk of dislocation treated by dual mobility THAs either as primary hip arthroplasty or after failed internal fixation. The follow up of the patients was 2 years with total complications rate 5%. They concluded that the efficacy of Dual mobility cups in preventing hip arthroplasty instability with good clinical results [17].

A retrospective study by Henri Favreau et al. (2020), during a 10-year period of study, 3830 extra capsular proximal femoral fractures were managed surgically, 47 of which (1%) showed subsequent fixation failure requiring surgical revision. The THAs revision used dual mobility cups. The complications rate was 22%: 10% infection, 2.5% superficial scar, 7% periprosthetic fracture, 2.5% greater trochanter non-union and surgical revision rate was 12.5%. Implant dislocation rate was zero in a population at high risk of complications [18].

5- Conclusion

From our results we can conclude that despite increased blood loss and operative time arthroplasty for extra capsular pertrochanteric fractures of the upper end of femur did not increase mortality or morbidity and appeared to provide functional improvement at a low cost compared to internal fixation. Only risk factors logically influence the latter. Outcome seemed more related to preoperative autonomy and dependence, nutritional status and pattern of unstability of the fracture. However, Dual Mobility THA give predictable results compared to internal fixation in unstable pertrochanteric fractures in geriatrics with long life expectancy due to reduced risk of revision operation of failed internal fixation and long survival rate of the prosthesis.

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