Surgical Management of Displaced Intracapsular Neck of Femur Fractures: Reconstructive Orthopedic versus General Orthopedic Surgeries

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ABSTRACT

Background: Femoral neck fractures are considered one of the most common fractures that orthopedic surgeons face in their practice because of increasing life expectancy worldwide. The displaced intracapsular neck of femur fractures are constitute 53% of all hip fractures, with 33% undisplaced and 67% displaced [3] .The main treatment option for displaced intracapsular neck of femur fractures involves replacement of the femoral head and neck with a prosthesis, which prevents complications of internal fixation and allows immediate weight bearing, early return of pre-fracture activity, and improved quality of life in elderly patients.

Method: This study, which was conducted retrospectively between Aug 2018 and Feb 2023, involved patients aged above 70 years with comorbidities who were diagnosed to have displaced intracapsular neck of femur fracture and underwent cemented bipolar hemiarthroplasty prosthesis which was Taperloc® Complete Hip system by Zimmer Biomet company at Jordanian Royal Medical Services hospitals and compare the complication of treatment between two group of patients who operated by orthopedic and trauma surgeons(who finished a five years of residency in orthopedic and trauma program) vs reconstructive orthopedic surgeons (fellowship-trained arthroplasty surgeons with three years' experience) . Data collection by blinded assessor for these patients, included for the most common intraoperative and postoperative complications such as intraoperative periprosthetic fracture (IPF), intraoperative bleeding, postoperative blood transfusion, infections and dislocation of the prosthesis rates, by using:

1. Patient file records;
2. PACS radiology system archives for preoperative, postoperative and follow-up X-rays;
3. Operative notes; and
4. Anesthesia notes.

Results: A total of 283 patients had enough data to be included in this study. The ages ranged between 70 and 103 years. All patients had displaced intracapsular neck of femur fracture operated with bipolar hemiarthroplasty prosthesis which was Taperloc® Complete Hip system by Zimmer Biomet company at Jordanian Royal Medical Services hospitals. Reconstructive orthopedic surgeons performed surgery for 96 cases (33.92%) and general orthopedic surgeons performed surgery for 187 cases (66.07%).

Statistical analysis for intraoperative and post-operative complications showed no significance difference between reconstructive and general orthopedic surgeons except the duration of the surgeries and blood loss which is less in reconstructive surgeon's cases.

Conclusion: We conclude that there is no significant difference statistically between a reconstructive orthopedic surgeon and a general orthopedic and trauma surgeon in the surgical management of displaced intracapsular neck of femur in patients, except for the intraoperative blood loss and the duration of the surgery. We also believe that further research is required, taking additional parameters into account.

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INTRODUCTION

Femoral neck fractures are considered one of the most common fractures that orthopedic surgeons face in their

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practice because of increasing life expectancy worldwide and also because of the rising number of elderly people, who are mostly female [1]. According to the Swedish National Hip Fracture Register, the incidence of hip fracture is predicted to increase from 1.66 million in 1990 to 6.26 million by 2050, resulting in significant health and financial burdens [2]. Intracapsular neck of femur fractures are most common hip fractures that constitute 53% of all hip fractures, with 33% undisplaced and 67% displaced [3].

Surgical intervention is the preferred course of treatment, because it has better outcomes than conservative treatment in terms of duration of stay in hospital, mobilization, and return to an independent lifestyle [4]. Treatment of hip fractures could involve internal fixation, which aims to maintain the undisplaced fractures from displacement and maintain fracture reduction for displaced fractures until the fracture is healed. However intracapsular neck of femur fractures usually affects elderly patients, which leads to failure of internal fixation because of avascular necrosis, nonunion, and poor quality of bone. According to a meta-analysis by Lu Yao [5], failure of internal fixation results in a reoperation rate of 35%, with decreased positive outcome and increased morbidity and mortality.

The main treatment option for displaced intracapsular neck of femur fractures involves replacement of the femoral head and neck with a prosthesis, which prevents the complications of internal fixation and allows immediate weight bearing, early return of pre-fracture activity, and improved quality of life in elderly patients [6, 7].

In our study, reconstructive orthopedic surgeries and general orthopedic and trauma surgeries were compared in terms of the results of surgically treating displaced intracapsular neck of femur fractures.

METHODS

This study, which was conducted retrospectively between Aug 2018 and Feb 2023, involved 283 patients aged above 70 years with comorbidities such as diabetes mellitus, hypertension , ischæmic heart disease and heart failure who were diagnosed to have displaced intracapsular neck of femur fracture and underwent bipolar hemiarthroplasty prosthesis which was cemented Taperloc® Complete Hip system by Zimmer Biomet company manufactured by Biomet Orthopedics Warsaw, Indiana, USA at Jordanian Royal Medical Services hospitals and compare the complication of treatment between two group of patient who operated by orthopedic and trauma surgeons(who finished a five years of residency in orthopedic and trauma program) vs reconstructive orthopedic surgeons (who finished the orthopedic residency program and finished three years fellowship training in reconstructive orthopedic surgery i.e. arthroplasty of the joints) in accordance with the Intracapsular Femoral Neck Fractures Surgical Management Algorithm [8] (Fig 1). Data collection by blinded assessor for these patients, including for the most common intraoperative and postoperative complications such as intraoperative periprosthetic fracture, intraoperative bleeding, postoperative blood transfusion, infections, dislocation of the prosthesis rates and patients, required revision surgery, by using

1. Patient file records;

2. PACS radiology system archives for preoperative, postoperative and follow-up X-rays;

3. Operative notes; and

4. Anesthesia notes.

Statistical analysis was done in the Jordanian Royal Medical Services by comparing the results of the surgical management of displaced intracapsular neck of femur fracture between orthopedic and trauma specialty (general orthopedics) and reconstructive orthopedics sub-specialty. These cases are usually handled after stabilizing the

patient's comorbidities within 48 hours and are treated by specialists. Analyses of comparisons of the operation times and the postoperative infection rates were also performed.

All patients were operated through a direct lateral approach with lateral position and received antibiotics and venous thromboembolism prophylaxis and inserting drain. Postoperatively, full weight bearing was allowed with the help of physiotherapists.

Data were analyzed by using statistical package for social sciences (SPSS) version 21. Chi square, t-test , Fisher exact test , the mean ,SD and effect size were applied to find the significance of association and /or differences between the complications of treatment between two group of patient who operated by orthopedic and trauma surgeons vs reconstructive orthopedic surgeons P value less or equal 0.05 was considered significant at 0.05 level.

RESULTS

A total of 283 patients had enough data to be included in this study. The ages ranged between 70 and 103 years. All patients had displaced intracapsular neck of femur fracture operated with bipolar hemiarthroplasty prosthesis which was Taperloc® Complete Hip system by Zimmer Biomet company. Reconstructive orthopedic surgeons performed surgery for 96 cases (33.92%) and general orthopedic surgeons performed surgery for 187 cases (66.07%).

All patients were operated through a direct lateral approach with lateral position with repairing the capsule and received prophylactic antibiotics first generation cephalosporin (cefazolin) and venous thromboembolism prophylaxis 4500 IU of innohip.

When comparing the duration of surgery between the surgeons, it can be seen from Table I that reconstructive surgeons perform faster than general orthopedic surgeons by about 20 minutes , because the patients group of reconstructive orthopedic surgeon (M=72.01 min, SD= 10.28) compared to the patients group of general orthopedic surgeon (M=95.05 min, SD= 18.09) demonstrated significantly, t (281)= - 11.54, p= < 0.00001, with alpha level < 0.05 , two tailed hypothesis, effect size by Hedges' g = 1.45.

The complications were classified into intraoperative and postoperative types and compared, as summarized in Table II, III and IV. Blood loss during operations done by general orthopedic surgeons was more (M = 447.49 cc, SD = 159.24) whereas blood loss during operations done by reconstructive orthopedic surgeons was about (M= 336.93 cc, SD = 84.02) demonstrated significantly, t (281) = -6.36, p <0.00001, with alpha level < 0.05, two tailed hypotheses, effect size by Hedges' g= 0.8. Vascular injury was found in three cases in the general orthopedic surgeon group versus in one case in the reconstructive orthopedic surgeon group, Fisher exact test static value is 1, the result is not significant at p <0.05, P = 1.

Intraoperative iatrogenic fractures revealed no difference between the groups, the chi- square static is 0.26 and p value = 0.606987.

The postoperative complications described in Table III comprised; dislocations of prostheses rates with no significant differences in results between the two groups of surgeons, the chi- square static is 0.2.65 and p value = 0.103772. While the infection rates the chi- square static is 0.37 and p value = 0.541913, the result is not significant at p <0.05.

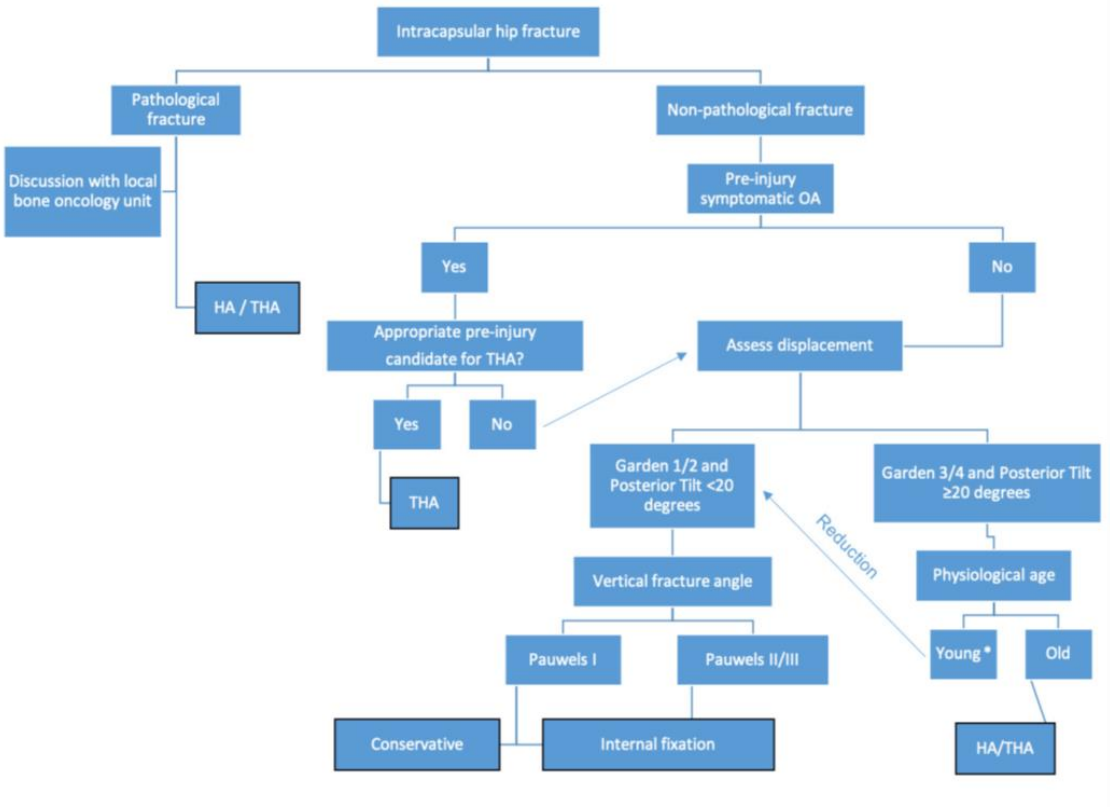

Fig. 1

Table I: Average Time of Duration of Surgery

	Reconstructive	General
Duration of surgery (average)	72.01 min	95.05 min
SD	10.28	18.09
P-value	<0.00001[a]	

[a] t-test for two independent mean two-tailed hypothesis

Table II: Intraoperative blood loss

	Reconstructive	General
Blood Loss (average)	336.93 cc	447.49 cc
SD	84.02	159.24
P-value	<0.00001[a]	

[a] t-test for two independent mean two-tailed hypothesis

Table III: Intraoperative Complications

	Reconstructive	General	P-value
Iatrogenic fracture cases (rate)	7 (7.3%)	17 (9.1%)	0.607[a]
Neurovascular injury cases (rate)	1 (1.0%)	2 (1.0%)	1[b]

[a] Chi-square test

[b] Fisher exact test

Table IV: Postoperative Complications

	Reconstructive	General	P-value
Dislocation cases (rate)	1 (1.0%)	9 (4.8%)	0.1038[a]
Infection cases (rate)	4 (4.2%)	11 (5.9%)	0.542[a]

[a] Chi-square test

DISCUSSION

Femoral neck fracture (AO/OTA 31–B1-3) is an orthopedic surgical challenge because of vascular supply to the head of femur. The blood supply to the head of femur comes in a retrograde manner, mainly in this age group through the lateral epiphyseal artery, which is a branch of the medial femoral circumflex artery. There is a high risk of nonunion and avascular necrosis with these fractures because of the disruption of the arterial blood supply to the head of femur due to the fracture [9, 10].

Therefore, solutions such as total hip replacement or hemiarthroplasty are required because of the high risk of nonunion in elderly patients, with the aim to get the patients to their baseline functions and to start early mobilization [11, 12].

In the United Kingdom, 92% of elderly patients have surgery if they have a displaced intracapsular femoral neck fracture [13], according to the Jordanian Royal Medical Services. Between hemiarthroplasty and internal fixation for displaced fractures, internal fixation has higher complication rates of between 10 and 45% [14–16] and revision surgery; 4% after hemiarthoplasty due to dislocation of the prosthesis or periprosthetic fractures and 11% after internal fixation of displaced fractures due to failure of fixation and nonunion and avascular necrosis [17], and also, the functional outcomes are better after hemiarthoplasty compared to internal fixation in this age group [18].

Regarding intraoperative blood loss, the hemoglobin (Hb) level was identified preoperatively and at 24 hrs postoperatively and referring to the operative notes and anesthesia charts giving us how much was the estimated blood loss by how much in the suction bottle and how much they used wash by normal slain and how much soaked abdominal gauze. One unit of packed red cells transfusion was given if the Hb level was <9 g/dL, or if there were clinical symptoms including lightheadedness, orthostatic hypotension, and/or tachycardia. The average blood loss mentioned in the literature is 275 cc (100 cc–450 cc) [24]. In our study, the blood loss average was 336.93 cc in cases done by reconstructive surgeons and 447.49 cc in cases done by general orthopedic surgeons, which was found to be significant with a P-value <0.00001 by t-test for two independent mean two-tailed hypotheses.

Also, the intraoperative periprosthetic fracture is a known intraoperative complication with hemiarthroplasty surgery. Intraoperative periprosthetic fracture is classified by Vancouver classification [21, 22]. The overall risk of intraoperative periprosthetic fracture was 7.1% in the literature [23], whereas in this study the risk of intraoperative

periprosthetic fracture was 8.4%. The study involved a total of 24 patients, with 7 patients done by reconstructive surgeons and 17 patients done by general orthopedic surgeons with no significant analysis. All patients had Vancouver type B1 were treated in same surgery by cables.

In the literature, dislocation rates after hemiarthroplasty surgery for the displaced intracapsular neck of femur fracture ranged from 0 to 5%, [27, 28]. In our study, the overall dislocation rate was 3.53%. In the reconstructively treated patients the dislocation rate was 1%, and in the general orthopedically treated patients the dislocation rate was 4.81%. But with the short follow up duration can't give us the actual dislocation rates

The infection rate in this study was 5.3%, with the follow up duration this is early infection rates, with 15 cases from 283 patients. 4 cases (4.17%) were done by reconstructive surgeons and 11 cases (5.88%) by general orthopedic surgeons. There was superficial surgical site infection, which was treated by removal of alternate stitches, daily wound dressing, and antibiotic therapy according to culture and sensitivity tests. According to the literature, the following infection rates were reported: 1% by Sicand et al. [19], 4.7% by D'Arcy et al. [20].
The only significant differences in this study were the duration of the surgery and the blood lost intraoperatively. Patients operated by general orthopedic surgeons experienced an increased duration by about 31.94% (95 versus 72 min), and there was increased blood loss mostly because of the longer duration of the surgery (P value <0.00001). Reconstructive surgeons regularly face and use the direct lateral approach of the hip for elective total hip arthroplasty, making them more familiar with the approach and faster than general orthopedic surgeons.

The result of this study is consistent with other studies. Woolson et al. compared the duration of surgery in patients undergoing hemiarthroplasty surgery by either a specialized surgeon or a surgeon still in training [27]. But due to the retrospective structure of this study give a selection bias for the patients

Limitations and recommendations

Several limitations of this study need to be considered. The main one is the retrospective nature of the study, which made it difficult to find the selection criteria of patients to be operated by general orthopedic or reconstructive orthopedic surgeon which imposes the risk of selection of patient's bias. Second, we believe that there are other factor that should be considered while making the comparison is the surgeon's level of experience. Third, it is not apparent which stages of the operation were actually carried out by junior general orthopedic surgeons or at what stages the senior general orthopedic surgeons may have actively intervened if they was assisting in the surgery. Fourth, the study had limitation in the duration of the follow-up period for the patients in both groups to get the actual dislocation rates of the prosthesis and infection rates. Therefore, in terms of future research to be prospective randomized blinded trial which will remove patient's selection bias with longer follow up duration

Conflict of interest statement

No conflict of interest exists.

Funding

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Ethical approval

Ethical approval was obtained from the local institutional Ethics Committee number 14,4/2023 dated by 5th of June 2023.

CONCLUSION

We conclude that there is no significant difference between a reconstructive orthopedic surgeon and a general orthopedic and trauma surgeon in the surgical management of displaced intracapsular neck of femur in elderly patients, except for the intraoperative blood loss and the duration of the surgery. We also believe that a prospective randomized blinded trial research is required and taking additional parameters like longer follow up duration into account

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