A comparative study of hemiarthroplasty for neck of femur fracture of elderly. (Bipolar, Austin Moore, cemented Thompson)

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ABSTRACT

Objective: This study was conducted to compare the hemiarthroplasties options in patients with neck of femur fractures with regards to the mortality rate and the functional outcomes.

Methods: A group of 153 elderly patients had been analyzed retrospectively, and these patients underwent 154 hemi arthroplastic surgeries for the hip joint due to neck of femur fractures between Jan 2012 and Jan 2014 (122 female, 31 male) at three hospitals; Prince Hashem bin Hussein Hospital, Prince Rasheed bin Hassan Hospital and the Royal Rehabilitation Center. All the surgeons used a direct lateral approach. The clinical records abstract form was designed to collect our study data which includes two important points; 1. The mortality and morbidity rates of the hemiarthroplasties surgeries. 2. The functional outcome of the bipolar prosthesis in comparison with the unipolar prosthesis using the Modified Harris Hip Score.

Results: The overall operative mortality rate of this study was 15%, and the mortality rate at 6 months was 44%. But the bipolar prosthesis had a 12% operative mortality rate and 30% mortality rate after 6 months of surgery. This result is statistically significant. This research showed that the patients with bipolar prosthesis have had superior hip function during the follow up and they have had better pain scores than the patients with unipolar prosthesis.

Conclusion: There was a difference in mortality rate in favor of bipolar prosthesis . Of the 52 patients who have been evaluated for up to 2 years it was found that there is a difference in functional out come in favor of bipolar prosthesis .

Key words: Bipolar, Neck of femur, Unipolar.

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Introduction

Intracapsular neck of femur fracture is a common injury in the elderly and the incidence of this fracture is increasing year after year due to improvement of life expectancy.[1,2] Although the treatment options are still controversial, joint replacement has shown that it has achieved early return to a satisfactory functional status.[3] Among joint replacement options, hemiarthroplasty has less operative time and less blood loss.[3,4] Hemi arthroplasty is a procedure in which the neck and the head are replaced by unipolar (in which the stem is

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fixed to the head) or by bipolar prosthesis (in which there is a polyethylene bearing between the head and the stem so it offers modularity). The old design of hemiarthroplasty is a unipolar prosthesis , such as Austin Moore's and Thompson's stems, this design did not offer range of motion between the head and the stem so it has less range of motion and more dislocation rate. The new design of hemiarthroplasty is a bipolar prosthesis, this design offers second articulation surface which increased range of motion, decreased the acetabular wear and decreased the dislocation rate, but the polyethylene debris may lead to osteolysis.[5,6] Therefore, it is controversial to treat these patients by unipolar versus bipolar. Developing countries still use Austin Moore's prosthesis in neck femur fractures with the presence of posteromedial cortex and cemented Thompson's prosthesis in neck of femur fractures with comminution of the posteromedial cortex.[7] This research was made to study if using bipolar prosthesis offers distinct advantages in reducing the complications of the unipolar prosthesis.

Methods

The study protocol was submitted and approved by the institution's technical and ethics review board. After the ethical community acceptance a series of 153 elderly patients had been analyzed retrospectively, and these patients underwent 154 hemi arthroplastic surgeries for the hip joint due to neck of femur fractures between Jan 2012 and Jan 2014 (122 female, 31 male) at three hospitals; Prince Hashem bin Hussein Hospital, Prince Rasheed bin Hassan Hospital and the Royal Rehabilitation Center. The three exclusion criteria were; (1)the neck of femur fractures which were caused by metastatic lesions or any malignant tumor, (2) the neck of femurs fractures in bed ridden patients,(3) the revision cases for hemiarthroplasties surgeries that had been done before the Jan 2012. All the surgeons used a direct lateral approach .The decision for the type of prosthesis was made according to the availability of prosthesis so the surgical choice was not dependent on the surgeon's or patient's wishes and was not dependent on the patient's medical condition or age. The ages of the patients were between of 65-85 year old; the ages of 45% of the patients were between of 70-80 year old, the follow up period was between 12-24 months Table I.

The clinical records abstract form was designed to collect our study data which includes two important points; 1. The mortality and morbidity rates of the hemiarthroplasties surgeries. 2. The functional outcome of the bipolar prosthesis in comparison with the unipolar prosthesis. A questionnaire was prepared to look for the patient's condition before and after the fracture according to the Modified Harris Hip Score. This score depends on the presence of pain, walking distance, walking aids, ability to perform personal and household activities.

Of the 154 hip surgeries; 91 cases had been done with bipolar prosthesis, 51 cases had been done with Austin Moore prosthesis and 10 cases had been done with cemented Thompson's prosthesis Table II. All patients who were known to be alive were asked to visit our clinic for assessment, actually 53 patients were available for complete evaluation at the end of this study.

Results

A. The mortality: In the series of our study ;the overall mortality rate was54% (83 of 153 cases); 34 deaths from the bipolar group and 49 from the unipolar group:

1. The operative mortality rate (with in the first month of the surgery) was 15 % (23 of 153 cases). This rate varies with the different age- groups and also varies with the presence of the previous medical illness Table III. The operative mortality ratesaccording to the prosthesis type were as the follow; 12% for bipolar, 17% for Austin Moor's prosthesis and 30% for cemented Thompson's prosthesis.
2. The mortality rate at 6 months was 44% (67 of 153 cases). This rate varies with the different age- groups and varies with the presence of the previous medical illness Table IV. The mortality rates according to the prosthesis type were as the follow; 30% for bipolar, 62% for Austin Moor's prosthesis and 70% for cemented Thompson's prosthesis.

B. Morbidity:

1. Infection: This study had 19 cases with different degrees of infection which varied from superficial wound infections to deep infections of the wound; 15 cases needed removal of prosthesis. The percentages of infection in relation to the prosthesis were as follow; bipolar prosthesis 5% (5 cases of 91)2 of them needed removal, Austin Moor's prosthesis 25% (13 cases of 53) all of them needed removal and 10% for cemented Thompson's prosthesis (1 case of 10).

2. Dislocation: eight cases had dislocated, two of them needed surgical reduction. The percentages of prosthesis dislocation in relation to the prosthesis were as follows; bipolar 1% (1 case of 91), Austin Moor's prosthesis 11% (6 cases of 53) and 10% for cemented Thompson's prosthesis (1 case of 10).

3. Peri- prosthetic fracture: 9 cases had of peri-prosthetic fractures; 7 cases have fractured during the surgery so it considered as an intraoperative complication (one case with bipolar and 6 cases with Austin Moore's prosthesis) and 2 cases have fractured within the first 4 months post operatively. All 9 cases died with the first 6 months.

C. The functional outcome:

70 patients were known to be alive and were asked to visit out clinic for assessment (56 bipolar cases and 14 unipolar cases) but only 52 cases were available for evaluation (39 bipolar cases and 13 unipolar cases). Pain of varying degree was seen in 12 cases of bipolar prosthesis (30 %) and in 10 cases of unipolar prosthesis (77%). The functional outcome as judged by the walked distance (with or without aid) and by the ability to perform personal and simple indoor and outdoor activities showed no reduction in 4 cases of the 39 of bipolar prosthesis group.74% of patients with bipolar prosthesis had little to moderate deterioration of function whereas 54% of patients with unipolar had sever deterioration of function. This difference is statistically significant at the 5 percent level. Table V

Table I: The age distribution, the gender and the affected side.

Table I	**Age distribution.**			**Gender**		**Laterality**	
Prosthesis	<70 year old	70-80 year old	>80 year old	Male	Female	Right	Left
Bipolar	10	49	31	14	76	38	53
Austin Moore	8	17	28	14	39	27	26
Cemented Thompson	1	3	6	3	7	4	6
Total	19	69	65	31	122	69	85

Table II: The patients evaluated till the end of the study.

Prosthesis	**Number of cases**	**Cases seen and evaluated**
bipolar prosthesis	91	39
Austin Moore's prosthesis	53	12
cemented Thompson's prosthesis	10	2
Total	154	52

Table III: The percentage of operative mortality in relation to the age, medical status and the prosthetic design.

Group	**Number of cases**	**Number of operative mortality**	**operative mortality rate**
< 70 year old	19	1	5%
70-80 year old	69	8	12%
>80 year old	65	14	22%
Previous medical illness	96	19	20%
No previous illness	57	4	7%
Bipolar prosthesis	91	11	12%

Austin Moore's prosthesis	53	9	17%
Cemented Thompson's prosthesis	10	3	30%

Table IV: The percentage of mortality in the first 6 months after surgery in relation to the age, medical status and the prosthetic design.

Group	**Number of cases**	**Number of mortality at 6 months**	**mortality rate at 6 months**
< 70 year old	19	4	21%
70-80 year old	69	22	32%
>80 year old	65	41	63%
Previous medical illness	96	49	51%
No previous illness	57	18	32%
Bipolar prosthesis	91	27	30%
Austin Moore's prosthesis	53	33	62%
Cemented Thompson's prosthesis	10	7	70%

Table V: The deterioration of function after the evaluation of the 52 cases of hemiarthroplasty.

Harris hip score	Degree of deterioration	Bipolar prosthesis		Unipolar prosthesis	
90-100	None	4	10%	1	7%
80-89	Little	12	30%	1	7%
70-79	moderate	17	44%	4	31%
< 70	severe	6	15%	7	54%
	Total	39		13	

Discussion

The intracapsular neck of femur fracture is the commonest fracture in the elderly, the treatment decision is contentious due to limited life expectancy. In order to prevent the prolonged immobilization, the replacement surgery is favored against options. Hemi arthroplasty is the optimal treatment for elderly patients with this fracture due to the short operative time, relatively, and it produces satisfactory results[6].According to other studies[7]; the unipolar hemiarthroplasty with Thompson's or Austin Moore's prosthesis is reserved for elderly patients (>80 year old) with or without comorbidities, on the other hand the bipolar prosthesis is reserved for patients with good pre injury functional status, so this has lead to selective bias which is not the case in our study because the surgical choice was not dependent on the surgeon's or patient's choice and was not dependent on the patient's condition or age, it was dependent on the availability of the prosthesis, so our study is obligatory randomized.

It is known that the mortality rate in such cases is fairly high.**(8)** In this study the overall operative mortality was 15% and this rate increased with age and co-morbidity , The unipolar prosthesis showed increased operative mortality; (17% for the Austin Moore's prosthesis and 30% for the cemented Thompson's prosthesis).The overall mortality rate increasing at 6 months was 44% , it increased with age and the presence of medical illness, also the unipolar prosthesis showed increased this mortality rate (62% for the Austin Moore's prosthesis and 70% for the cemented Thompson's prosthesis).But the bipolar prosthesis had a 12% operative mortality rate and 30% mortality rate after 6 months of surgery. This result is statistically significant. Our results disagree with a randomized trial of Carl Johan[9]who showed that the bipolar has higher mortality rate in the first year than unipolar. On the other hand our results are consistent with Bhushan M Sabins[10] and J.N.S Davison *et al* **(11)** who found that unipolar hemiarthroplasty gave rise to a higher mortality than bipolar hemiarthroplasty.

The infection rate was 12% (19 cases) and it is high for orthopedic surgery and more attention should be given to this point because it directly affects the mortality and the functional status of the patients. It seems that

the majority of infection cases and cases requiring removal of the prosthesis were the Austin Moor's prosthetic cases (one fourth of Austin Moor's prosthesis became infected).
The dislocation and the peri-prosthetic fracture were part of our concerns in this study and the rates were 5% and 6% respectively. The majority of this complication was found to occur with the Austin Moore prosthesis. And these complications directly affect the mortality at 6 months.
Comparing bipolar arthroplasty with the unipolar arthroplasty; this research found out that the patients with bipolar prosthesis had a superior hip function during the follow up, also they had better pain scores. On the other hand it was found that the use of walking aids is increased and the social performance scores is decreased in patients with unipolar prosthesis. A Cochrane review based on the seven studies published before 2010 concluded that there was not enough evidence to support the use of either bipolar or unipolar prosthesis in elderly patients with neck of femur fracture.[(12)] But the meta-analysis study of Chen Jangtao from 2014 showed that bipolar hemiarthroplasty can relatively better improve hip function.[(13)]

Conclusion

Of the 153 patients who underwent hemiarthroplasty there was a difference in mortality rate in favor of bipolar prosthesis. Of the 52 patients who have been evaluated for up to 2 years it was found that there is a difference in functional outcome in favor of bipolar prosthesis .These results are statistically significant. Also, the complication rate of Austin Moore's prosthesis should not be neglected.

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