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The need of routine histopathological examination of resected head of femur after hemiarthroplasty: An observational study

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Abstract

The neck of femur fracture is one of the commonest fracture amongst the elderly. Hemiarthroplasty is sought as the standard of treatment in these group of patients. Following surgery the resected head of femur is discarded. Though it has become a norm for routine histopathological evaluation of the head in total hip replacement but this is not the same in hemiarthroplasty. We studied 48 femoral head obtained after hemiarthroplasty in fracture neck of femur. Majority of our patients were female 28(58.33%) and the mode of injury in them was fall at home 19(67.85%) with mean waiting time for surgery 13±2.7days (Range 7.6-18.4days). We found degenerative osteoarthritis in form of Chondromalacia in 26(54.16%) patients among which males 15(57.69%) were the predominant variety presenting with a higher stage which was statistically significant in nature (P value= 0.014, χ^2 value=5.994, df=1). Avascular necrosis was seen in 11(22.91%) cases. Though we found female (6) to be more affected but it was not statistically significant (P value=0.772, χ^2 value=0.084, df=1). We found no cases of neoplasm or infection in our study. The histopathological study of the femur head didn't alter the further treatment plan of the patients. Hence we won't recommend doing a routine tissue study of the resected head in these group of patients without any prior positive history (like neoplasm) which will lead to savings over health expenses.

Keywords: Femur head, hemiarthroplasty, osteonecrosis, histopathology, chondromalacia

Introduction

With the increase in the survival age of the population there is a rise in the burden of geriatric diseases and associated orthopedic fractures. Fracture through neck of femur has been classically described as a fracture of the elderly population. The incidence of femoral neck fractures is continuously on the up rise among the aging population. The number of hip fractures is expected to increase from 1.7 million in 1990 to 6.3 million in 2050. Femoral neck fractures and intertrochanteric fractures occur in approximately equal incidence and they make up over 90% of the proximal femur fractures and the remaining 5–10% is sub trochanteric. The incidence of femoral neck fractures are only 2% in patients with age less than 50 years. After 50 years, the incidence is doubled for each subsequent decade and it is 2 to 3 times higher in women than in men ^[1]. These intracapsular fractures are historically grouped under pathological fracture because of some underlying metabolic disease in which osteoporosis being the most common entity. About 80% patients with hip fractures in India are vitamin D deficient, a risk factor for osteoporosis ^[2]. Not only elderly people but also high velocity trauma in younger generation often leads to this fracture and warrants urgent reduction with osteosynthesis. In a medically fit elderly patient with acute neck femur fracture hemiarthroplasty remains the treatment of choice ^[3]. In some young adults Total hip replacement (THR) will be a better alternative owing to their higher physical demands ^[4]. While it's somewhat imperative to send the resected head after THR for routine histopathological examination, it's not the same after hemiarthroplasty ^[5]. Controversy still exists regarding whether to send or not the samples for further study.

Many studies have concluded that pathologic study of hip arthroplasty specimens is cost ineffective because an insignificant number of findings are found by these evaluation to account for the cost of pathologic examination [6, 7]. In contrary, in a large scale study performed by surgical pathologists opined that pathologic examination was in fact cost effective and necessary for comprehensive patient care [8]. There is also very little literature support regarding finding any positive finding in the pathological study of head of femur especially after hemiarthroplasty.

We aim to narrow this literature gap by analyzing the histopathological finding of resected head of the femur in patients undergoing hemiarthroplasty for neck of femur fractures.

Material and Methods

This prospective observational study was performed in department of Orthopedics of SCB Medical College, Cuttack

during the period July 2019-July 2020. The study was approved by the Institutional Ethical Committee. Prior to the study informed and written consent was obtained from the patient. The inclusion and exclusion criteria were as follows.

Inclusion criteria

1. Patients with Fracture Neck of Femur who underwent hemiarthroplasty
2. Patients of both male and female sex were included.

Exclusion criteria

Patients who underwent

1. Revision arthroplasty
2. Primary Total hip replacement
3. Hemiarthroplasty for comminuted intertrochanteric fractures.
4. Patients who didn't give consent

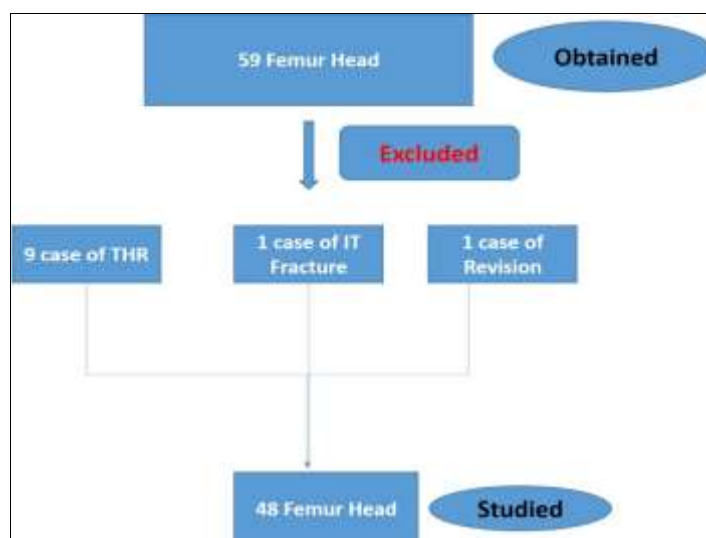


Fig 1: Algorithm for patient selection

48 patients were deemed fit under our inclusion criteria (Fig 1). Patient data including age, sex, mode of injury, time since date of injury to date of surgery, smoking history, history of Diabetes, history of antecedent hip pain were noted.

histopathological examination inside a 10% formalin jar.



Fig 2: Estimation of diameter of head by head gauge

All the patients underwent bipolar hemiarthroplasty. In all the cases the head was removed enbloc and after assessing the size using a head gauge (Fig 2) it was sent as such for



Fig 3: Head contained in 10% formalin bottle

The femoral head was removed and stored in 10% formalin (Fig 3). No patient was noted to have arthrosis either by clinical history or by radiograph. There were 20 men and 28

women with a mean age of 78.2 years (range 67-92 years). Femoral heads were measured, and the total surface area was calculated. The findings of the pathological study was grouped under Degenerative osteoarthritis (in form of Chondromalacia), Avascular necrosis, Osteopenia, Osteomyelitis and Neoplasm. The incidence of the above pathological findings were compared with in the given among two groups i.e. male and female.

Grade of Chondromalacia was classified according to Goodfellow *et al.* [9]: Stage I chondromalacia was not assessed because of formalin fixation which gives false positive results in form of artifacts. Stage II is decided by the occurrence of areas of fibrination or fissuring. Stage III is defined by the occurrence of distinct fibrination with fissuring extending to subchondral bone. Stage IV is classified by the disappearance of cartilage with exposure of subchondral bone. The entire femoral head surface was stained with black India ink, which adheres to fibrinated articular cartilage. Measuring the area of degeneration (grade 2 or greater) was accomplished by overlaying a clear plastic, spherically gridded template over the entire femoral head and summing areas of involvement. Avascular necrosis of the bone was identified at the earliest by the presence of loss of nuclear staining of marrow cells and large round and ovoid spaces filled with fat which are microscopic signs indicative of bone ischemia seen in the marrow spaces. It can be seen starting from the second day [10]. The fatty and haemopoietic marrow becomes then ghosted and the small vessels show evidence of necrosis. After 15 days the osteocytic lacunae are empty and the trabecular surface is devoid of cells

The statistical analysis was done using Microsoft Excel v 2013. The categorical data were compared using the Chi (χ^2) Square test while the Student's t-test was used for continuous variables. The level of significance was set at P value of <0.05.

Results

During the study period 59 femoral head specimens were surgically removed among which 1 was done for comminuted intertrochanteric fractures, 9 cases of Total hip arthroplasty, 1 case of revision arthroplasty. After careful exclusion a total of 48 femoral head specimens were studied during the period from July 2019 to July 2020.

In our study females were found to be affected more 28(58.33%) than the male 20(41.66%). The mean age of injury for males was 72.3±3.1 years (range 66.1-78.5 years) while it was 69.4±4.6 years (range 60.2-78.6 years). The most common mode of injury was fall at home 19(67.85%) in female while RTA was attributed as the major factor in males 12(60%). Most of the patients had their operation at 13±2.7days (Range 7.6-18.4days). (Table 1)

Table 1: Clinical profile of the patients in both groups

Variable	Value	
Sex Distribution		
Male	20 (41.66%)	
Female	28 (58.33%)	
Age Distribution		
Male	72.3±3.1 years	
Female	69.4±4.6 years	
Mode of Injury		
	Male	Female
RTA	12 (60%)	9 (32.15%)
Fall at home	8 (40%)	19 (67.85%)

Diabetes was considered as a comorbid factor only if diagnosed since last 6 month. The incidence of diabetes was more in male 14(29.1%). Prior to surgery if there was any hip pain it was noted. It was considered significant only if it is at the anterior or posterior hip joint line. Other vague pain involving the lower thigh, lower back, sacroiliac region was excluded. The antecedent hip pain was seen only in 18 of the cases among which 11 were female and 7 were male. It was more seen in case of females but it was not found to be statistically significant (p value =0.762) (Table 2)

Table 2: Variation of Antecedent Hip pain prior to the injury

Hip pain	Male	Female
Present	7	11
Absent	13	17

P value=0.762, χ^2 value=0.091, df=1, Statistically Insignificant

Most of the femoral head 26(54.16%) had some form of degenerative change in form of Chondromalacia. Males were found to have a higher occurrence of chondromalacia 15(57.69%) comparing with the females. It was found to be statistically significant (p value = 0.014). As per the grading of Chondromalacia by Goodfellow *et al.* we found 17 in grade 2 and 9 in grade 3. (Table 3)

Table 3: Distribution of degenerative change in form of Chondromalacia

Chondromalacia	Males	Females
Present	15	11
Absent	5	17

P value= 0.014, χ^2 value=5.994, df=1 Statistically Significant

Avascular necrosis of femoral head was seen in 11(22.91%) of the femoral head which was expected as it is a common occurrence after neck of femur fractures. Out of the 11 samples 5 were male and 6 were female (Table 4). This association was not statistically significant (p value=0.772)

Table 4: Distribution of Avascular necrosis in different sex

Avascular Necrosis	Males	Females
Present	5	6
Absent	15	22

P value=0.772, χ^2 value=0.084,df=1. Statistically Insignificant

None of the study samples show osteomyelitis or neoplasm in the histopathological study.

Discussion

In our study we found female 28(58.33%) to be affected more than the males. It is consistent with the findings observed by Reddy *et al.* who found 57.5% female patients in his study of 40 patients [1]. The most common mode of injury in our study was due to fall at home 19(67.85%) in females. Ahuja *et al.* did an analytic retrospective case control study of 41 patients and 41 matched volunteers and found falls due to slipping as the major factor leading to fracture neck of femur [11]. 26(54.16%) of femora head sample showed features of degenerative changes in form of chondromalacia. Among which males were the predominant group 15(57.69%). This association was statistical significant. It signifies the fact that males due to increased physical activity are more prone for cartilage loss as the age advances. We found no study comparing the occurrence of the Chondromalacia in these group of patients

Avascular necrosis (AVN) of femoral head was seen in

11(22.91%) of the femoral head. Popelka *et al.* studied 1555 patient and found onset of AVN earliest 6 hour post injury^[12]. The mean waiting time for surgery in our study was 13±2.7 days. So the occurrence of AVN was expected. The appearance of AVN in males and females groups didn't show any statistically significant association.

In our study we didn't find any occurrence of neoplasm or osteomyelitis. Davis *et al.* studied 466 femoral head out of which 4 cases had evidence of neoplasm (Multiple Myeloma, Chronic Lymphocytic Leukemia, Adenocarcinoma of Lung)^[13]. The ambiguity comparing with our study could be due to the small sample size.

As the histopathological study of the resected head of femur in fracture neck femur cases didn't alter the future treatment plan of the patients hence the routine histological study of these samples may not be advisable which could add extra burden to the already thin health care system and add extra cost either to the patient's treatment or to the government resources but its importance cannot be under estimated from academic point of view. As the sample size is small for an observational study, another study with a larger sample size may be undertaken which could provide a strong level of evidence. In that event this study will guide as a pilot study in Indian scenario.

Conclusion

The current study does not support the routine histopathological examination of resected femoral head specimens after hemiarthroplasty for a femoral neck fracture. There may be utility for histopathological examination in younger patients undergoing arthroplasty and those who have a history of cancer, or an inappropriate injury mechanism but foregoing the study when no clinical suspicion exists will result in substantial savings and help reduce the cost of health care related to hip fracture patients. Our study doesn't recommend for the routine assessment of the femoral head after hemiarthroplasty in fracture neck of femur because there was no change in the treatment of the patient after the tissue study report.

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