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Original Research Article

A comparative study between hemiarthroplasty with bone cement and hemiarthroplasty with bone graft impaction for treatment of fracture neck femur in elderly patients

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ABSTRACT

Background: The effectiveness of cementing and graft during hemiarthroplasty for fracture neck of femur in elderly individuals is debatable. Although cementing provides an excellent initial fix, there is incidence of hypotension during surgery. On the other hand, periprosthetic fractures have been linked with high costs. A femoral head can provide an autologous bone graft to fill the femoral bone's medullary cavity, lowering complications related to cemented bipolar hemiarthroplasty.
Methods: At Indira Gandhi institute of medical sciences, Patna a prospective study was carried out from April 2021 to March 2023. The study comprised patients who had fractured their neck femurs. Patients were separated into two groups of 30 each. Group A had bipolar partial hip replacement using the femoral head as a graft, while group B had cemented bipolar partial hip replacement. Functional outcomes were contrasted between 2 groups.
Results: After a year, 22 of the patients (73.3%) in the bone graft group had excellent outcomes, while 8 (26.6%) had favorable outcomes. Within group B (Cementing group), ten individuals (33.3%) had outstanding results, ten individuals (33.3%) had good outcomes, eight individuals (26.6%) had satisfactory results, and two individuals (6.6%) had bad outcomes. The findings were statistically significant ($p<0.05$). The practical outcome of cementing bipolar versus one's with bipolar bone graft differed significantly.
Conclusions: A procedure called bipolar partial hip replacement with the femoral head used as a graft of bone is a superior choice to surgery for fracture neck-femur in elderly people compared to cemented bipolar partial hip replacement.

Keywords: Bone graft, Cemented graft, Bipolar, Partial hip replacement

INTRODUCTION

Femoral neck fractures are a growing concern in our aging population, often accompanied by severe co-morbidities and high mortality rates.[1] Fractures are anticipated to double over the following 20 years and three times by 2050, as life expectancy increases.[2] Femoral neck cracks are more prevalent in women (40-50% risk) than in men (13-22% risk).[3] Epidemiologic investigations identify multiple indicators of risk for a risk factor for femoral neck fractures include a BMI<18.5, lack of light, low activity, smoking, and a family history of fractures caused by osteoporosis. Fractures in the 7th decade are more prevalent in women with osteoporosis and after menopause, often caused by minor torsional trauma (slipping). In the 1800s, Sir Astley Cooper believed that a fracture occurs first, followed by a fall. The primary cause of this break is an easy fall that shifts force through the larger trochanter to the femoral the neck.[4] Another process is leg external

rotation, which causes greater pressure upon the joint capsule as well as the iliofemoral ligament.[5] Intracapsular fractures of the femoral neck make up roughly half of hip fractures. The low connection rate is attributed to the angiogenic detrimental characteristics of intracapsular synovial fluid (SF), which can also cause femur head necrosis and delayed segmental necrosis. Improved healthcare and longer life expectancy have led to a significant increase in this kind of fracture.

The primary cure for displaced femoral neck fractures is surgery, with partial hip replacement being a common procedure in elderly patients. A procedure called hemiarthroplasty can be either cemented or uncemented. The debate over whether to cement partial hip replacement remains ongoing.[3] While cementing a prosthesis can improve first fix in osteoporosis bone, it could raise the risk of prosthetic joint infections (PJI), bone marrow and fat embolism, during surgery hypotension, as well as deep vein blood clots compared to uncemented implants.[6,7] Aseptic loosening is the primary cause of late clinical rejection in established hip arthroplasty. Several follow-up studies have provided information on the scope and clinical significance of this issue.[8-10] Aseptic loss was identified in hip arthroplasties with prothesis migration, fractures/subsidence. Femoral components with a radiolucent line at the bone-cement interface indicated aseptic loosening. Possible loosening that was aseptic was defined as an arthroplasty with a radiolucent path at the interface between the cement and bone that was greater than 50% but not complete.

Uncemented implants may lead to complications like shielding from stress and increased risk of periprosthetic fracture. Research indicates that cemented hemiarthroplasty improves functional outcomes and lowers the risk of residual pain. In some studies, uncemented implants are as effective as cemented implants in treating displaced femoral neck fractures. However, uncemented hemiarthroplasty leads to a higher postoperative rate of prosthesis loosening.

When via an uncemented implanted, the femoral canal can be grafted with a natural cancellous bone graft from the head of the femur. This is a cost-effective way to make the implant press fit without introducing foreign materials. While bone grafts have been studied for various purposes, their use in primary partial hip replacement has never been investigated. Autologous bone grafts have the lowest risk of rejection.[7] We plan to investigate functional recovery after bipolar partial hip replacement using femoral head autologous cancellous graft, which is commonly available during primary partial hip replacement. Currently, there is limited study investigating using femoral head as bone graft to stabilize femoral stem prosthesis as substitute to cemented bipolar hemiarthroplasty. We are conducting a study that will contrast the functional results between cemented bipolar partial hip replacement and bipolar via bone grafts.

Objectives

The investigation aimed at assessing pain relief, flexibility in motor, Harris hip score is used for functional recovery for both cemented bipolar and bipolar with bone graft. The study aims to examine implant-related challenges and reoperation rates after bipolar with bone graft procedures and cemented bipolar. To contrast intraoperative time, loss of blood, and issues.

METHODS

The present prospective research was conducted in Indira Gandhi institute of medical sciences in Patna from April 2021 to March 2023. The study included all patients with fracture neck femur who visited this tertiary care hospitals' emergency departments or as casualties. Patients were divided into two groups using block randomizing them. Patients in group A had bipolar hemiarthroplasty with a femoral bone graft, while those in group B underwent cemented bipolar hemiarthroplasty surgery.

Patients were only scheduled for surgery once they met medical requirements. Preoperative antibiotics via IV were administered an hour before surgery. The patient received a proctolysis enema the day before to empty their bowels. The first (Senior) Author carried out all necessary procedures using the norm aseptic precautions, with assistance from the remaining three authors.

Procedure

All operative procedures, regardless of group, were carried out sideways, with the patient resting on its side that was unaffected. Moore's Approach (Southern exposure) was applied to all patients using the posterolateral approach. A fenestrated bipolar prosthesis was used. For cement groups, cement was pushed through the femoral canal by hand, and the remaining cement was used to the prosthesis stem. A femur head was extracted, and cartilage removed from the bone graft group. The head of the prosthetic is cut into pieces and inserted into the canal serving as a barrier. A bone cancellous graft is then packed into the femoral canal and fenestrae in the prosthetic stem. Finally, the prosthesis is inserted. The temperature, pulse, blood pressure, and breathing rate were all monitored after surgery. Patients were examined every six weeks, three months, six months, and twelve months, and functional outcomes were assessed using the modified Harris hip scoring system.

Statistical analysis

The sample size was determined with G* power software. Using an effect size of 0.8, a 10% level of significance, and 80% power. The overall sample size for each of the groups was 30. Patients enrolled in the research were tracked for a year. Data was put into MS excel

spreadsheets and examined with the Windows version 22 of the SPSS software. The Mann-Whitney U tests were used to evaluate functional results between both groups. An independent-sample t-test was employed to compare the loss of blood and operational time. The test known as the Chi-square test was employed to contrast differences between the two groups.

RESULTS

From 2021 to 2023, 60 elderly individuals with fractures to the displaced femur neck undergone partial hip replacement at our facility. The mean age for those in group A (bone graft) was 60.04 years, while group B (cemented bone) was 65.36 years. The study included 34 (57%) female patients and 26 (43%) male patients.

Table 1: Baseline information from individuals.

Frequency of individuals	Group A	Group B
Age (in years)	60.04±2.5	65.36±3.0
Total number of cases	30	30
Sex	Male: 10;	Male: 16
	Female: 20	Female: 14

The bone graft group had an average surgery time of 90 minutes and a total blood loss of 194.59 milliliters, while the Cemented group had a mean of 116.2 minutes and blood loss of 298 milliliters. There were substantial variations between the two categories.

Table 2: Analysis among two groups.

Variables	Group A	Group B	P value
Duration of surgery (min)	90±8.5	116.2±15.3	<0.0001
Mean of amount of blood loss (ml)	194.5±25.7	298±47.5	<0.00001
Mean duration of weight bearing (days)	24±5.8	4.27±2.3	0.00001

In group A, 26 individuals (83.3%) reported no pain, while 4 (13.3%) experienced mild pain. At a year monitoring, group B had 16 individual (53.3%) with no pain, 12 individual (40%) with slight pain, and 2 individual (6.67%) with mild pain.

Table 3: Pain analysis among groups.

Variables	Group A	Group B
No pain	26	16
Mild pain	4	2

DISCUSSION

Fractures within the hip are more prevalent among the aged. Osteoporosis, multiple medical conditions, and minor trauma can lead to more fractures and complicate medical care. Cemented hemiarthroplasty is typically performed on older patients with osteoporotic bone stock to ensure a firm fix for the prosthesis to the bone. Uncemented prostheses are preferred for patients of excellent bone quality and younger age. However, both have known issues that have been extensively recorded in literature. This study compared bone grafting of the head of the femur to cemented hemiarthroplasty. Currently, there is limited literature on this topic. Previous investigations have examined cemented hemiarthroplasty to uncemented hemiarthroplasty. In this research, we use autogenous bone transplants from the femoral head instead of cement, which is regarded as to be the gold standard for bone substitute due to its minimal immune-mediated rejection, finish histocompatibility, and superior osteoconductive, osteogenic, and osteo-inductive properties.[7,8]

There are numerous advantages of employing a femur head autograft, such as less post-operative thigh pain, limp, after surgery infections, and a reduced likelihood of prosthesis loosening. A tight fit for the prosthesis stem encourages bone integration.

Studies have shown that in primary total hip replacement, acetabular deficiency can be successfully treated with bone grafts from the femoral head. Thomas et al found that using grafts in hip replacement can effectively manage acetabular defects, resulting in positive outcomes for 26 out of 30 patients. This is due to the improved bone stock and stability of the component of acetabular.[13] The bone graft group had an average surgery length of ninety minutes and a total blood loss of 194.59 milliliters, while the cementing group had a mean of 116.2 minutes and blood loss of 298 milliliters. There were significant differences among the groups. In another study by Eknath et al it was found that bone graft surgery had an average length of 84 minutes and blood loss of 188.95 milliliters, while cemented hemiarthroplasty had a mean length of 101.2 minutes and blood decrease of 288 milliliters.[14] In a study by Figved et al the uncemented group had a blood loss of 300ml in 70.2 minutes, while the cemented group had a blood loss of 390ml in 82.6 minutes. The cement cohort had a longer surgical time than the uncemented group (95 minutes vs. 80 minutes).[15]

Figved et al found one case (0.9%) of intraoperative periprosthetic fracture in cemented group and two (1.9%) in the graft group.[15] Khan et al found three cases of iatrogenic periprosthetic fractures in graft patients.[16] The research we conducted found no cases of intraoperative periprosthetic fractures in either the cemented or bipolar

with bone graft groups. Figved et al found in the cemented group, there was only one instance of an infection superficially (0.9%).[15] The research we conducted found one case of deep infection in the cemented group, but none in the bone graft group. In our study, 26 patients (83.3%) reported no thigh pain in the group receiving bone grafting, while 4 patients (13.3%) experienced pain. In the cemented group, only 10 individuals (33.3%) reported no thigh pain, while nearly 20 patients (77%) experienced ongoing thigh pain, which was statistically significant. Additional research comparing both the cemented and graft groups observed no differences in ongoing thigh pain.

CONCLUSION

Individuals who went through the procedure called bipolar partial hip replacement using the femoral head as a bone graft reported less discomfort than those who went through cemented bipolar hemiarthroplasty. Bipolar hemiarthroplasty with bone graft had a lower infection rate than cemented bipolar hemiarthroplasty. Patients who went through bipolar hemiarthroplasty had shorter surgery times and less blood loss. Using autologous femoral heads for bone grafts is a cost-effective and non-invasive alternative to bone cement. Additionally, the known hazards of cementing are reduced. Revision procedures are simpler in the bone transplant group due to enhanced bones stock located in the femoral region, compared to the cemented bipolar group where removing the implant is more difficult. Our research concluded that hemiarthroplasty with a femoral head bone graft is an improved option for therapy for elderly individuals.

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