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Original Research Article

Cementless bipolar hemiarthroplasty for displaced fracture neck of femur with modular hydroxyapatite coated stem in elderly with cardiopulmonary co-morbidities

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ABSTRACT

Background: Bipolar hemiarthroplasty is one of the common procedures done for fracture neck of femur in elderly. Debate about Cemented or cementless is still on. Cementing increases perioperative mortality by causing significant hemodynamic changes or embolization. Patients with cardiopulmonary complications are at higher risk of cementing complications. We report our series of 31 cases of fracture neck of femur with cardiopulmonary diseases operated over 2 years with modular cementless bipolar hemiarthroplasty.
Methods: 31 elderly patients with cardiopulmonary co-morbidities (age=75 to 97 years) with displaced femoral neck fractures were operated between January 2011 to December 2013. Cementless bipolar hemiarthroplasty using hydroxyapatite coated stem was done by single surgeon using same implant in all the patients through anterolateral approach. Clinical and radiological follow-up was done with mean follow up of 54 months (36-72 months).
Results: Total 31 cases with cardiopulmonary comorbidities were operated. The average follow up was 54 months. No intraoperative mortality was seen. 3 patients had splitting of femur during canal preparation. 1 patient died due to cardiac arrest in the post-operative period. 1 patient had surgical site infection. 3 patients had hemodynamic abnormalities and 1 patient had significant limb length discripency (1.5 cm). 2 patients died in the follow up because of comorbidities. 27 patients reached to pre-injury status with average harris hip score of 86 at final follow up.
Conclusions: Cementless bipolar hemiarthroplasty with hydroxyapatite coated stem is a good option for femoral neck fractures in elderly patients with cardiopulmonary complications without risking the harmful effects of cementing.

Keywords: Cementless, Elderly, Fracture neck femur, Hemiarthroplasty

INTRODUCTION

Femoral neck fractures in elderly people are associated with impaired mobility, increased morbidity and mortality with subsequent loss of independence. With the reversing age pyramid and the high prevalence of osteoporosis, femoral neck fractures assume a major public health concern. Prosthesis as Arthroplasty was introduced by Judet at al for various hip pathologies.[1] Hemiarthroplasty is one of the most commonly done procedure for fracture neck of femur in elderly with satisfactory results.[2-5] A wide variety of cemented and cementless versions of hemiarthroplasty are being used worldwide with debate about advantages between the two still going on.[2-21] With cardiopulmonary complications, due to cementing and difficulty in revision cementless prosthesis are being increasingly used.[14-16] However Osteoporotic bone in elderly makes it difficult for the

prosthesis to hold in cementless prosthesis and increases the incidence of complications like periprosthetic fractures.[17,18] However modern hydroxyapatite coated stems have made use of cementless hemiarthroplasty possible even in weaker osteoporotic bones. [19]

METHODS

This is a prospective cross sectional study conducted at Post Graduate department of Orthopaedics SKIMS Medical College Srinagar, Jammu and Kashmir, India. between January 2011 to December 2013 after approval from ethical committee. All the elderly patients above 75 years of age with cardiopulmonary co-morbidities who presented with displaced fracture neck of femur and who met the inclusion criteria were operated by single surgeon through anterolateral approach. Similar modular bipolar prosthesis with hydroxyapatite coated stem was used in all the patients.

Inclusion criteria

- Patients with displaced fracture neck of femur (Garden type iii and iv) with age more than 75 years
- Patients with cardiopulmonary complications.
- Patients who were physically active before surgery (community ambulators) and mentally alert.

Exclusion criteria

- Patients less than 75 years old.
- Patients with no cardiopulmonary co-morbidities.
- Patients with Dorr type C and D proximal femoral anatomy.

All the surgeries were done in either Spinal or combined spinal-epidural anesthesia. The stability in the axial and rotational plane was assessed before definite insertion of the femoral stem. For DVT prophylaxis patients were kept on physical (ankle pumps) and chemical prophylaxis during their hospital stay. All the patients were put on intravenous antibiotics for 2 days after surgery, followed by oral antibiotics for further 3 to 5 days.

We started bedside sitting and standing on the 1st postoperative day (POD), toe touch with walker was started on 2nd POD and walking in the room and hospital corridor with partial weight bearing was allowed on 5th POD, with progression to full weight bearing at 6 weeks in most of the patients.

Patients were reviewed postoperatively at 2 weeks, 6 weeks, 3 months, 6 months, 12 months, and then yearly. Patients were clinically and radiographically evaluated at each follow-up.

Harris hip scores and pain scoring with the visual analog scale were used as clinical outcome measures. Radiological evaluation included standard anteroposterior and lateral radiographs was done preoperatively then at first POD,3 months, 6 months, 12 months. Thereafter yearly X rays were done for evidence of stem subsidence, lysis, or loosening, acetabular erosion, protrusion or heterotopic ossification figure 1a to 2d.

RESULTS

Total 31 patients with 17 male and 14 female patients were included in the study. The range of age group varied from 75 to 97 years with mean age of 83 years. All the patients had one or multiple cardiopulmonary comorbidities with or without other comorbidies as shown in Table 1.

Table 1: Number of patients with different cardiopulmonary comorbidities.

Cardiopulmonary Comorbidities	No of Patients
Hypertension	22
Patients on pacemaker	05
Cardiac dysrhythmia	09
Previous open heart surgeries	03
Patients with PTCA done	05
COPD	09
Asthma	03
Interstitial Lung disease	02
Multiple cardiopulmonary comorbidities	17
Other comorbidities	12

The average bleeding per patient was about 235 ml as shown in Table 2.

Table 2: Intra-operative bleeding (average bleeding = 235 ml).

Intraoperative bleeding in ml	No of patients
100-200	6
201-300	15
301-400	6
401-500	2
501-600	2

Mean operative time was about 33 minutes as shown in Table 3.

Table 3: Operative times (mean operative time=33 minutes).

Operative time (minutes)	No of patients
30-34	21
35-39	5
40-44	3
45-50	2

3 patients had splitting of femur while preparing the canal. We didn't observe any significant intra-operative hemodynamic changes in our study as shown in Table 4.

Table 4: Intraoperative complications.

Intra operative complications	No of patients
Splitting of femur	3
Neurovascular injury	0
Excessive bleeding	0
Significant hemodynamic abnormality	0
Death	0
cardiopulmonary complications	0

No intra operative deaths were reported. One patient reported back to the hospital 10th day after surgery due to cardiac complications and died on 12th post-operative day. 3 patients developed electrolyte imbalance in the post-operative period as shown in Table 5.

Table 5: Immediate post-operative complications.

Complications	No of patients
Wound infection	1
Hemodynamic abnormalities	3
Deep vein thrombosis	1
Dislocation	0
Limb length discrepancy (more than 1.5 cm)	1
Death (12th post op day)	1

One patient had significant limb length discrepancy, I patient had groin pain and 2 patients died in the follow up due to comorbidities, one in 2nd and other in the 3rd year of follow up Table 6.

Table 6: Delayed post-operative complications.

Complications	No of Patients
Significant limb length discrepancy (1.5 cm)	1
Dislocation	0
Infection	0
Heterotrophic ossification	0
Significantly decreased range of motion	0
Thigh pain	0
Groin pain	1
Periprosthetic fracture	0
Death (due to comorbidities)	2

Table 7: Post-operative physiotherapy and mobility status.

Day	No of patients
Bed side turning on 1st POD	28
Standing on 1st POD	28
Walking With toe touch on 2nd POD	28
Corridor walking on 5th POD	27
Walking with full weight bearing on 6th week	27
Pre-injury mobility status on final follow up	27

26 patients (84%) achieved pre-injury mobility status after surgery as shown in Table 7.

All the patients were put on DVT prophylaxis with low molecular weight heparin and DVT pumps from the day of admission and continued to the day of discharge. Post operatively elastic stockings were applied on both lower limbs in all the patients. After discharge patients were put on oral aspirin for 1 month. One patient reported with hip pain on 58th month of follow up. X ray showed acetabular changes and THR was done for the same without changing the femoral component. No case of periprosthetic fracture, dislocation, heterotrophic ossification, osteolysis or significant subsidence was seen in present study.

One patient developed surgical site infection for which duration of injectable antibiotics and hospital stay was prolonged for 3 extra days. Patients recovered well. One patient had symptoms of DVT on first hospital visit which was confirmed by Doppler ultrasound.

Patient was put on warfarin and responded well. 26 (84%) patients were back to the preinjry status at final follow up (average 54 months). 2 patients were regularly using walking stick and 3 patients died during the study. 4 patients (13%) were using walking stick only during long walks and steer climbing just for protection purpose. The average Harris hip score at final follow up was 84.5.

Figure 1a: Left side fracture neck of femur.

Figure 1b: Immediate post op X ray.

Figure 1c: 12-Month post of x ray.

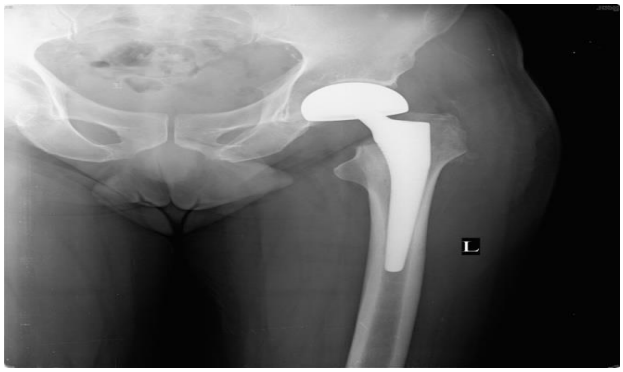

Figure 1d: 48-Month post op x ray.

Figure 2a: Left side neck femur fracture.

Figure 2b: Immediate post op x ray.

Figure 2c: 60-month post op x ray.

DISCUSSION

The main aim of treatment in elderly with fracture neck femur is early mobility to prevent dangerous complications like DVT and chest infection. Most commonly performed surgery for neck of femur fracture in elderly to achieve early mobility is hemiarthroplasty. Cemented hemiarthroplasty has advantage of early post-operative mobility because it provides early stability. Controversy exists in literature about advantages of cemented over cementless hemiarthroplasty and vice versa. [17-21]

A large number of studies have shown definite advantages of cemented prosthesis with respect to early mobility, infection rates, periprosthetic fractures, implant loosening and subsidence. However, in most of these studies the results are compared with older cementless prosthesis. Cementing of femoral stem increases the perioperative mortality due to cardiopulmonary complications like fat embolism, cardiac arrhythmias, hemodynamic abnormalities and even sudden death.[23-25,] All the deaths that have been reported in the perioperative period have been due to cardiopulmonary causes.[23] Cementing increases chances of fat embolism and also causes bone cement implantation syndrome (BCIS) which manifests as hypoxia, hypotension, and unexpected loss of consciousness, bradycardia and even cardiac arrest. BCIS is thought to be due to toxic effects of methyl methacrylate rather than due to embolic effect of cementing. Other complications can be acute pulmonary hypertention, pulmonary oedema, cardiac dysarrythmia and hypothermia.[26-28] Elderly people with cardiopulmonary co-mobidities and other co-morbidities have very limited physiological reserve and are more prone to develop such complications during cementing .[29] All the complications are independent of the amount of cement used. Christie J et al with the help of transesophageal echocardiography have shown increased embolic cascades during cementing. We didn't see any significant intra-operative hemodynamic change in any patient in our study.[23] Many studies have shown statistically significant increase in mortality in cemented hemi arthroplasty as compared to uncemented hemiarthroplasty.[17,18] Muirhead-Allwood also reported

more reoperation rates in cemented group as compared to uncemented group.[17] One patient died 12 days after surgery in our study .

This Patient had uneventful intra and postoperative period and was discharged on 5th post op day, however reported back to our hospital with dysarrythmia and died in ICU due to cardiac arrest. 2 patients also died in the follow up due to underlying co morbidities. One of the methods to control harmful effects of cementing is by using modern cementing techniques however they can only control the risk upto certain extent but not eliminate it.[30] Less operating time, less bleeding and less need of post-operative blood transfusions are undisputed advantages of cementless hemiarthroplasty over cemented hemiarthroplasty.[3] The average time of surgery was 33 minutes (30-50 minutes), the average blood loss was 235ml (132-600 ml) and average blood transfusions needed were 1.3. Lesser surgery time in our study was because all the cases were done by a very experienced surgeon

Elderly people with fracture neck of femur with cardiopulmonary co morbidities are different cohort from those undergoing elective THR. Severe co morbidities have to be taken into consideration while determining the treatment plan.[25] In developing countries with limited ICU and CCU facilities it is always a risk to select the type of surgery that will precipitate the already compromised cardiopulmonary system.

However the debatable point in elderly people with weaker bone stock is whether cementless stem will hold in the weaker osteoporotic bones as most of the studies have shown increased complications like periprosthetic fractures, dislocations, subsidence etc with cementless hemiarthroplasty. However, in most of such studies the comparative results are with older prosthesis. On the contrary many studies have shown better results with rest to perioperative mortality and similar results with rest to functional out come in comparative studies between cemented hemiarthroplasty and cementless hemiarthroplasty with porous coated or modular hydroxyapatite coated stems.[19] With porous or hydroxyapatite coated stems osteointegration occurs even in weaker osteoporotic bones as reported by many authors.[31-33] In present study we observed that with improved stem designs even in osteoporotic bones tight fit can be achieved though we excluded patients with Dorr type C and D femoral canals. These stems have larger diameters, allow proximal and distal fixation and hydroxyapatite coating allows press fit and good osteointegration.

Hip pain and thigh pain has been reported in a number of studies in cementless hemiarthroplasty though mostly in older prosthesis.[11,12,17,18] However several studies have also shown no significant difference with respect to hip and thigh pain between cemented and cementless hemiarthroplasty.[34] With average follow up of 54 months we reported only one case case of significant hip pain in the follow up due to acetabular erosion which was converted to THR.

Prolonged use of walking aids is another drawback with cementless hemiarthroplasty reported in literature.[17.] We in our study prolonged full weight bearing by 6weeks. However by 3 months after surgery 26 out of 31 had reached pre injury activity level. Two patients continue to use walking stick because of physiological weakness. We believe it is better to go for a procedure with prolonged recovery time than to do a procedure with negative effects on cardiopulmonary system in patients with already compromised system

Functional evaluation with Harris Hip score at average 54 months (83.5) follow up was comparable with other studies by Yousuf Ozturukman et al, Marya et al and Hutt JRB et al.[31-33] Many studies have shown good results with cementless total hip arthroplasty for fracture neck femur in elderly using hydroxyapatite or porous coated stems.[35-41] However due to high risk patients and limited ICU facility in our set up we opted for bipolar hemiarthroplasty and achieved satisfactory results.

CONCLUSION

Cementless bipolar hemiarthroplasty with hydroxyapatite coated stems is a good procedure for femoral neck fractures in elderly with cardiopulmonary complications with definite advantages over cemented hemiarthroplasty with respect to perioperative complications, surgery time, and blood loss. Results with respect to stability of implant, thigh pain, periprosthetic fractures and HHS are satisfactory and comparable to the latest literature on cemented hemiarthroplasty.

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