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Original Research Paper

FUNCTIONAL OUTCOME OF BIPOLAR HEMIARTHROPLASTY IN DISPLACED INTRACAPSULAR FEMORAL NECK FRACTURE IN ELDERLY IN RURAL TERTIARY HOSPITAL

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ABSTRACT:

Femoral neck fractures, one of the most common injuries in the elderly have always presented great challenges to orthopaedic surgeons. The present study was conducted in 42 elderly patients with closed displaced intracapsular fracture of femoral neck following all inclusion and exclusion criteria who were present to the Orthopaedics department from October 2019-May 2021 to evaluate functional outcome of bipolar hemiarthroplasty in displaced intracapsular femoral neck fracture in elderly who were followed for duration of 6 months at an interval of 6 weeks, 3 months and 6 months. Most of the patients were belonging to 65-69 years of age group accounting to 33.33%. Females outnumbered males accounting to 59.52% with female to male ratio of 1.47:1. Transcervical fractures outnumbered and accounted for 90.48%. There were more left sided fractures accounting for 71.43%. Most of the patients were operated within 7 days of fracture accounting for 45.24% with average hospital stay of 14.71±4.79 days. Most common mode of injury was trivial trauma i.e.92.86%. 41mm Bipolar prosthesis size accounted for maximum of 28.6%. Harris Hip Score was used to evaluate the functional outcome of Bipolar Hemiarthroplasty was noted at regular follow ups. Mean Harris Hip score at 6 weeks was 74.21±10.07, at 3 months was 77.66±10.59, at 6 months was 80.40±10.60 with upward trend in the mean score over follow up period. There was 2.38% cases of posterior dislocation noted at 1 month in Uncemented Bipolar Hemiathroplasty postoperatively, 4.76% cases of infection and 7.14% cases of lengthening, 7.14% cases of Bedsores. The final functional outcome at 6 months of follow up revealed excellent results in 13 patients(30.95%), Good in 11 patients(26.19), Fair in 12 patients(28.57%) and Poor results in 6 patients(14.29%). Our study concludes that Bipolar Hemiarthroplasty offers excellent, painless mobility and ease in rehabilitation and return to function.

Key words: Bipolar hemiarthroplasty, Elderly patients, Harris hip score, Intracapsular femoral neck fracture, Complications, Functional Outcome.

INTRODUCTION:

Femoral neck fractures, one of the most common injuries in the elderly have always presented great challenges to orthopaedic surgeons. The prevalence of these fractures has increased with improvement in life expectancy, increased incidence of osteoporosis, poor vision, neuro-muscular incoordination and changes in lifestyle leading to sedentary habits[(1)]. In the elderly with osteoporotic bones, a trivial fall is the cause of hip fractures in about 90% of cases[(2)]. The prevalence of the fracture also doubles for each decade of life after fifth decade[(3)]. Treatment of displaced femoral neck fractures in elderly has been controversial. Open reduction and internal fixation of these fractures in the elderly have poor outcome including high rate of nonunion and avascular necrosis[(1)]. Various prosthesis have been designed which can be broadly divided into two types- unipolar and bipolar. Of unipolar prosthesis, the most commonly used are the THOMPSONS and AUSTIN MOORES prosthesis. Main problems with these prosthesis were stem loosening and migration[(4)]. In modern days the bipolar prosthesis with cement is the best option wherein they can be more active[(5)]. PMMA cement offers advantages as its use as a grouting agent to replace thinning trabecular bone thus greatly simplifying rehabilitation. The Bipolar prosthesis was introduced to prevent and retard acetabular wear. These prosthesis have a 22 to 32mm head that articulates with ultra-high-density polyethylene inner liner which is covered with a polished metal outer head that articulates with acetabular cartilage. It causes less articular wear[(4)].

Advantages of uncemented femoral components is including faster implantation and potential lower risk of fat and marrow embolism compared to cemented implants. Disadvantages of uncemented implants in elderly are potential for retarded osteointegration, osteopenia and concern for fracture and in patients with wide femoral canal has mismatch of proximal/distal diameters[6,7,8]. There was no significant difference in using cemented and uncemented bipolar prosthesis[9]. The aim of the study is to evaluate the functional outcome of Bipolar hemiarthroplasty in closed displaced intracapsular femoral neck fracture in elderly.

METHODOLOGY:

This was a follow up study and conducted in 42 elderly patients with closed displaced intracapsular fracture of femoral neck reported to the Orthopaedics Department of MGIMS and Kasturba hospital following all inclusion and exclusion criteria from October 2019-May 2021. Inclusion criteria was patients of age 60 years and above, nonunited/old fracture neck of femur. Exclusion criteria was pathological fractures of neck of femur, medically unfit for surgery, Bilateral fracture neck femur, Previously operated fracture neck femur of same and opposite side, Non ambulators, those who would not complete 6 months of final follow up. Informed consent was taken at the initiation of study, in English and in regional language, after explaining the procedure in detail. Preoperative Protocol consisted of thorough history taking and clinical examination and evaluation was done and then Anteroposterior radiographs of pelvis with both hip. All study Patients were put on skin traction, given oral or parenteral analgesics to relieve pain. Adequate medical management of associated comorbid conditions like diabetes mellitus, systemic hypertension, COPD and heart diseases was initialized to optimize patient's fitness for anaesthesia. All measures were taken so that the patient could be taken up for surgery at the earliest. Operative Approach was Moore's posterior approach for all patients in Lateral decubitus position on the operating table with the affected side facing up. A curved incision taken from a point 10cm distal to posterior superior iliac spine and extended distally and laterally parallel to the fibres of gluteus maximus to the posterior margin of greater trochanter. Deep fascia was exposed over gluteus maximus, was then split in the direction of its fibres by blunt dissection. By retracting the proximal fibres of the muscle proximally, the greater trochanter was exposed after trochanteric bursa excised. Distal fibres were retracted distally and divided at their insertion over linea aspera. The sciatic nerve was not usually exposed . It was protected with the finger in the lateral part of the incision and gently retracted out of the way. The gemelli and obturator internus and piriformis tendon were divided at their insertions after tagging them for easier identification and reattachment. The posterior part of the capsule thus exposed was incised from distal to proximal along the line of neck of femur and at right angle to it, thus making a L shaped opening in the capsule. The fractured head and neck of the femur were levered out of the acetabulum and size measured using femoral head gauge. The size was confirmed using trial prosthesis by its suction fit in the acetabulum. The acetabulum was prepared by excising remnants of ligamentum teres and soft tissue. The femoral shaft was rasped using a broach(rasp) and prepared for the insertion of the prosthesis. Femoral neck if long was nibbled keeping 2 to 2.5cm of calcar above the lesser trochanter. The appropriate sized prosthesis was then inserted into the femoral shaft(reamed canal) in taking care to place in 10^0 to 15^0 of anteversion and impacted into the femur. The reduction of prosthesis done using gentle traction of the thigh. If Prosthesis became loose intraoperatively, cemented procedure were performed. In these cases, the stem was cemented in place using standard cementing technique- lavage, cleaning, drying and plugging of the canal. Absolute haemostasis obtained. After suturing the capsule, the external rotators sutured. The wound closed in layers over a suction drain, were removed at the first changing of dressing after 48hours. Post operatively, patients were kept in the ward with limbs in wide abduction with the help of abduction pillow. Adduction, internal rotation and flexion were avoided. Static exercise in bed for quadriceps and breathing exercises along with active limb movement to decrease limb edema. Ambulation started within a week with walker and progressive weight bearing. Postoperatively DVT prophylaxis was added to high risk patients according to the advice given by Physician/Anaesthetist. Patients were advised not to sit cross legged or squat. All patients were followed up monthly for first 3 months and then at 6 months. Minimum follow up of 6 months and HARRIS HIP SCORE[10] was noted and radiographs of the affected hip were taken. Final evaluation of the study was done after completion of study according to criteria.

RESULTS:

42 study participants fulfilling inclusion and exclusion criteria were selected and evaluated for associated comorbidities and operated by Bipolar Hemiarthroplasty and followed for duration of 6 months at an interval of 6 weeks, 3 months and 6 months during the study period.

Age distribution: majority of the patients were belonging to 65-69 years of age group accounting to 33.33%, followed by 60-64 years of age group accounting 26.19%, followed by 70-74 years of age group accounting 21.43%, followed by 75-79 years of age group and 80-84 years of age group accounting 7.14% each and followed by >84 years of age group accounting 4.76%. Mean age in general was 68.66 ± 7.03 with range of 60-85 years.

Gender: In the present study, females outnumbered males accounting to 25(59.52%) and males proportion was 17(40.48%). Female to male ratio in our study was 1.47:1

Fracture side distribution: There were more left sided fractures accounting for 30 cases (71.43%)

Garden classification: Patients with Type 4 of Garden classification accounted for maximum of 83.33%, followed by Type 3 for 9.52% and Type 2 for 7.14%.

Anatomical Classification: Patients with Transcervical fractures outnumbered and accounted for 90.48%, followed by Subcapital fracture for 7.14% and followed by Basicervical for 2.38%

Distribution of patients according to duration between fracture and surgery:

Duration(days)	No of patients	Percentage
<7 days	19	45.24
7-30 days	18	42.86
>30 days	5	11.90
Total	42	100
Mean±SD	13.11 ± 16.20(2-95 days)	

Table 1

Duration between admission and surgery: In our study, majority of the patients operated within 3-7 days of admission i.e. 26(61.90%) followed by more than 7days i.e. 9(21.43%) and within 3 days in only 7 patients i.e.16.67%

Mode of injury: In our study most of the patients had trivial trauma which accounted for 39 cases (92.86%) followed by road traffic accident of 3 cases(7.14%)

Distribution of patients according to comorbidities

Comorbidities	No of patients	Percentage
Asthma	4	9.52
Diabetes Mellitus	8	19.05
Chronic Kidney Disease	3	7.14
Hypertension	16	38.10
Rheumatoid Arthritis	1	2.38
Thyroid Disease	1	2.38
Ischemic heart disease	1	2.38
Lung consolidation	1	2.38

Table 2

Average hospital stay: was 14.71±4.79 days with maximum of 28 days and minimum of 4 days.

Prosthesis Size: 41mm Bipolar prosthesis accounted for maximum of 28.6% in 12 cases and least used was 53mm Bipolar prosthesis in 1 case (2.4%)

		Frequency	Percent
PROSTHESIS	37 mm	2	4.8
	39 mm	3	7.1
	41 mm	12	28.6
	43 mm	7	16.7
	45 mm	5	11.9
	47 mm	4	9.5
	49 mm	6	14.3
	51 mm	2	4.8
	53 mm	1	2.4
	Total	42	100.0

Table 3

Position of stem:

Position of stem	No of patients	Percentage
Valgus	5	11.90
Varus	6	14.29
Neutral	31	73.81
Total	42	100

Table 4

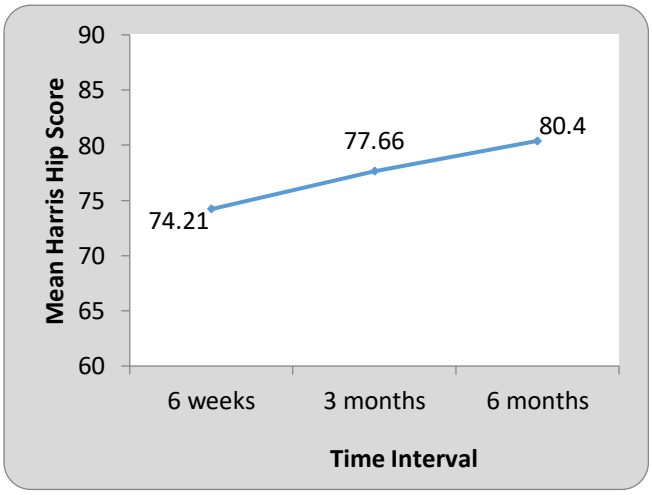
Intraoperative time and blood loss: average blood loss was 326.66 ± 109.18ml with range of 150-750ml and average intraoperative time was 63.45 ± 11.64 min with range of 45-90 min.

Harris Hip Score: used to evaluate the functional outcome of Bipolar Hemiarthroplasty which was noted at regular follow ups at 6 weeks, 3 months and 6 months. The Mean Harris Hip score at 6 weeks was 74.21±10.07 with range of 47-87. The Mean Harris Hip score at 3 months was 77.66±10.59 with range of 50-90. The Mean Harris Hip score at 6 months was 80.40±10.60 with range of 52-90. There was an upward trend in the mean score over follow up period.

	N	Minimum	Maximum	Mean	Std. Deviation
6 weeks	42	47.00	87.00	74.21	10.07
3 months	42	50.00	90.00	77.66	10.59
6 months	42	52.00	92.00	80.40	10.60

Table 5

Graph 1: Distribution of patients according to Harris Hip Score



Distribution of patients according to complications:

Complications	No of patients	Percentage
Dislocation	1	2.38
Infection	2	4.76
Lengthening	3	7.14
Other(Bed Sore)	3	7.14

Table 6

Functional outcome: In our study, the final functional outcome at 6 months of follow up using Harris Hip Score. We observed excellent results in 13 patients(30.95%), Good in 11 patients(26.19), Fair in 12 patients(28.57%) and Poor results in 6 cases(14.29%).

Distribution of patients according to functional outcome at final follow up(6 months)

Functional Outcome	No of patients	Percentage
Poor	6	14.29
Fair	12	28.57
Good	11	26.19
Excellent	13	30.95
Total	42	100

Table: 7

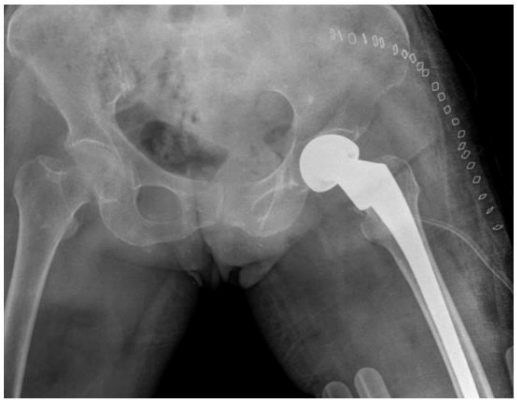
DISCUSSION:

Elderly patients with fracture neck of femur who were mobile before injury should be able to restore to their preoperative functional and ambulatory status. In active older patients especially needing early mobilization, conservative method of treatment is not

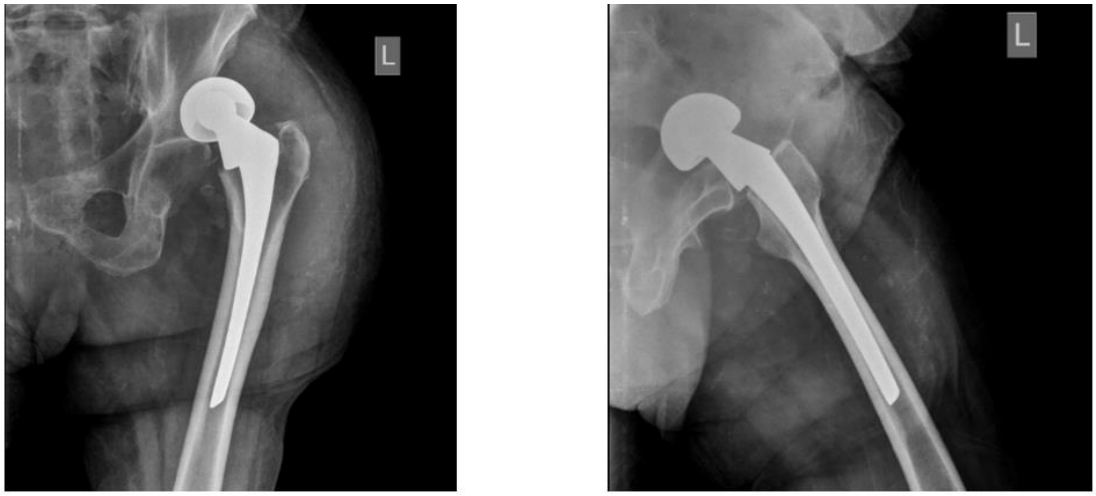
acceptable because it results in non union with unstable hip and limitation of hip movement as well as complications of prolonged immobilization like bedsores, deep vein thrombosis and respiratory infections. Result for femoral neck fracture treatment illustrated by Leighton et al[11] recommended prosthetic replacement for patients more than 60 years old having femur neck fracture. Bateman and Giliberty in 1974 introduced Bipolar hemiarthroplasty, which is a self articulating prosthesis. Advantage of Bipolar prosthesis is that erosion and protrusion of acetabulum would be less because, there is dual articulation between inner head and shell and acetabulum[12]. The Aim of present study was to evaluate the functional outcome of Bipolar Hemiarthroplasty in displaced intracapsular femoral neck fracture in elderly. 42 patients of fracture neck femur were treated using Bipolar Hemiarthroplasty, both cemented and uncemented. A concept that has been generally held by Orthopaedic surgeons is that Cemented femoral fixation is required in elderly patients because of poor bone stock[13]. However, cemented technique has also been associated with greater risk of fat embolization and hypotension[13]. Many Orthopaedic surgeons feel that stable femoral fixation can be achieved in elderly patients with cementless femoral stem[14]. The complications following the Bipolar Hemiarthroplasty is reported in varying incidences. Early surgical complications after Bipolar Hemiarthroplasty may be the origin of cascades leading to general complications and increased mortality. That is why their prevention is very important[15]. In present study, there was 1(2.38%) case of posterior dislocation noted in *(CASE 1)* 76 years old female with multiple co morbidities like right lower lung consolidation, Diabetes Mellitus, Hypertension, Chronic Kidney Disease, Asthma admitted on the same day of trauma with transcervical neck femur fracture of left side due to trivial trauma operated with Uncemented Bipolar Hemiathroplasty and postoperatively at 1 month there was posterior dislocation occurred due to sudden adduction of hip, which was managed by revision Cemented Bipolar Hemiarthroplasty immediately and later after 12 weeks she developed deep infection in wound which was managed by debridement which eventually healed with final Harris Hip Score of 72 at 6 months of follow up. In our study all cases were operated by posterior approaches. Dislocation of the Hip Hemiarthroplasty have been a concern for Orthopaedic surgeons since the advent of the procedure. Furthermore, early dislocation is associated with increased mortality rate[16]. Dislocation of the Bipolar prosthesis is a rare phenomenon. It has been reported in literature ranging from 1.1% at one year follow up to 5% at 20 years[17]. Saberi S et al[18], in his study related to the complications following Bipolar Hemiarthroplasty amongst the 150 patients at 1 year follow up reported 6.5% dislocation rate. Rajak MK et al[19], reported 3% prosthesis dislocation following Bipolar Hemiarthroplasty. Unwin et al[20], reported 6.5% of dislocation rate among all their patients with those having posterior approach being three times more likely to dislocate.

CASE 1

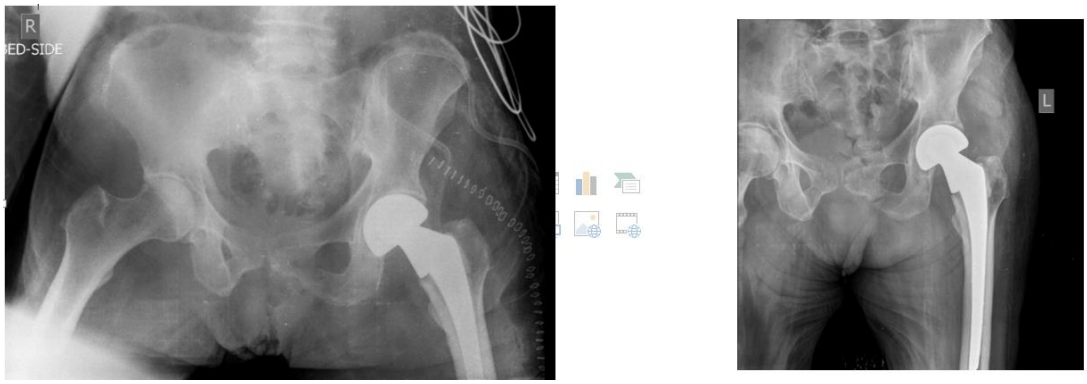
Pre-operative X-RAY



Post-operative X-RAY



Dislocation At 1 Month



Open Reduction of Dislocation with Revision Cemented Prosthesis and Drain Placement

X-RAY At 3 Months of Revision Procedure

X-RAY At 6 Months

In our study there were 2(4.76%) cases of infection out of which 1 was superficial wound infection and 1 deep wound infection. 73 year old male patient with no comorbidities observed superficial infection after 4 months of Uncemented Bipolar Hemiarthroplasty who was managed by antibiotic and dressing. Another patient, 76 year old female with multiple comorbidities including Diabetes had developed deep wound

infection after cemented Bipolar Hemiarthroplasty as a revision procedure following posterior dislocation after 6 weeks which was managed by debridement and appropriate antibiotic after culture and sensitivity and diabetic control. Naidu KA et al[21], observed superficial wound infection in 2 patients in the 1st week of operation, of which 1 patient was diabetic. Treated with proper antibiotic and dressing which resulted in prolongation of their hospital stay. The organism isolated in the above cases were Staphylococcus Aureus. Maruthi CV and Shivanna[5], observed 1 patient(2%) had a superficial wound infection in the 1st week of operation which led to the prolongation of the hospital stay treated with proper antibiotics and dressing. The organism isolated was Staphylococcus Aureus. In present study, we observed lengthening of the operated limb in 3 patients upto 1 cm(7.14%). Ponraj RK et al[9], observed in two cases had limb lengthening(1 cm). Naidu KA et al[21], reported limb length discrepancy seen in 2 patients(9.09%) of which lengthening was noted in both patients. Rajak MK et al[19], observed limb lengthening in 1(3%) patient about 1.5cm which was managed by compensatory footwear in the opposite limb. While Marya SKS et al[22], observed limb lengthening in 7% of the cases. Limb lengthening of less than 3.5cm was not significant and did not affect outcome. Patel KC et al[23], in 84% of the patient there was no limb length discrepancy. No case showed limb shortening while 16% showed limb lengthening. All the cases in our series were assessed according to Harris Hip Score and graded accordingly as Excellent , Good, Fair and Poor. In present study, we evaluated mean Harris Hip score at the end of 6 months follow up which was 80.4 points. Our findings are consistent with the study of Rajak MR et al[19],Bezwada HP et al[24], Ponraj RK et al[9], Maruthi CV and Shivanna[5].

Studies with Harris Hip Score

STUDIES	MEAN HARRIS HIP SCORE
Bezwada HP et al[24]	At 3.5 years 82 points with range of 54-92
Shukla R et al[2]	At 6 months 74.68 points At 1 year 78.24 points At 2 years 81.40
Saberi S et al[18]	At 6 months 74.5 points At 1 year 80.7 points
Maruthi CV and Shivanna[5]	At 6 months range of 35 to 94.6
Reddy YH et al[25]	At 1 year 90.36points
Rajak MK et al[19]	At 6 months 82.1 points At 1 year 83.1 points
Ebrahimpour A et al[26]	At 1 year 83.5 points
Ponraj RK et al[9]	At 6 months 84.2 points
Our study	At 6 weeks 74.21 points At 3 months 77.66 points At 6 months 80.4 points

Table 8

Studies with Functional Outcome

Study	Duration	Excellent	Good	Fair	Poor
Naidu KA et al[21]	22 cases for 6 months	31.82%	54.55%	9.09%	4.54%
Kalantri A et al[27]	30 cases for 6 months	53.33%	33.3%	16.67%	6.67%
Ponraj RK et al[9]	30 cases for minimum 6 months	23.33%	56.66%	13.33%	6.66%
Jindal RC et al[28]	30 cases for 6 months	40%	40%	6.7%	13.3%
Patel KC et al[23]	50 cases for 12 months	64%	28%	8%	0%
Bezwada HP et al[20]	248 cases for 3.5 years	10%	55%	30%	5%
Rajak MK et al[19]	30 cases for 12 months	33.33%	43.33%	16.66%	6.66%
Malhotra R et al[29]	32 cases	75%	15.6%	6.3%	3.1%
Our study	42 cases for 6 months	30.95%	26.19%	28.57%	14.29%

Table 9

CONCLUSION:

Our study concludes that Bipolar Hemiarthroplasty is a good method to manage intracapsular fracture neck femur in elderly patients . It offers excellent, painless mobility and ease in rehabilitation and return to function. The surgery is relatively easy to perform, takes less operating time and less blood loss with low complication rate.

REFERENCES:

1. Adapureddi HT, Kamareddy SB, Kumar A, Paturi SK, Anne S, Reddy JP. Prospective study of management of fracture neck of femur by Hemiarthroplasty with cemented Bipolar. Journal of Evolution of Medical and Dental Sciences. 2015; 4(98): 16309-16314.
2. Shukla R, Singh M, Jain RK, Mahajan P, Kumar R. Functional Outcome of Bipolar Prosthesis versus Total Hip Replacement in the Treatment of Femoral Neck Fracture in Elderly Patients. Malaysian Orthopaedic Journal. 2017; 11(1): 1 -5.
3. Leighton RK: Fractures of the Neck Femur. In: Bucholz RW, Heckman JD,Court-Brown CM. (eds.) Rockwood and Green's fracture in adults. 6th edition. Philadelphia, Lippincott Williams & Wilkins 2006; 1753-1791.
4. Sharoff L, Nazeer M, Unnikrishnan R. Functional outcome of cemented bipolar hemiarthroplasty in fracture neck of femur in elderly: A prospective observational study.

International Journal of Medical Research & Health Sciences. 2016; 5(2): 70-76.
5. Maruthi CV, Shivanna. Management of fracture neck of femur in elderly by hemiarthroplasty: A study. Indian Journal of Orthopaedics Surgery. 2016; 2(2): 170-180.
6. Parvizi J, Ereth MH, Lewallen DG. Thirty-Day Mortality Following Hip Arthroplasty for Acute Fracture. The Journal of Bone & Joint Surgery. 2004; 86: 1983-1988.
7. Parker MJ, Guruswamy KS, Azegami S.(2010). Arthroplasty(with and without bone cement)for proximal femoral fractures in adults. The Cochrane database of systematic reviews. 2010(6),CD001706-CD.
8. Ahn J, Man LX, Park S, Sodl J F, Esterhai JL. Systematic Review of Cemented and Uncemented Hemiarthroplasty Outcomes for Femoral Neck Fractures. Clinical Orthopaedic Related Research. 2008; 466: 2513-2518.
9. Ponraj RK, Arumugam S, Ramabadran P. Functional Outcome of Bipolar Hemiarthroplasty in Fracture Neck of Femur. Scholars Journal of Applied Medical Sciences. 2014; 2(5D): 1785-1790.
10. Harris WH. Traumatic Arthritis of the Hip after Dislocation and Acetabular Fractures: Treatment by Mold Arthroplasty. The Journal of Bone & Joint Surgery. 1969; 51-A(4): 737-755.
11. Leighton RK, Schmidt AH, Collier P, Trask K. Advances in the treatment of intracapsular hip fractures in the elderly. Injury 2007; 38: 24-34.
12. Bateman JE. Single assembly Total hip prosthesis: Preliminary report. Orthop Dig. 1974; 2: 15-19.
13. Dorr LD, Glousman R, Sew Hoy AL, et al. Treatment of femoral neck fractures with total hip replacement versus cemented and non cemented hemiarthroplasty. Journal of Arthroplasty. 1986; 1: 21.
14. Keisu KS, Orozco F, Sharkey PF, et al. Primary cementless total hip arthroplasty in octagenarians: two to eleven year follow up. The Journal of Bone and Joint Surgery. 2001; 83: 359.
15. Biber R, Brem M, Singler K, Moellers M, Sieber C, Bail HJ. Dorsal versus transgluteal approach for hip hemiarthroplasty: an analysis of early complications in seven hundred and four consecutive cases. International Orthopaedics. 2012; 36(11): 2219-23.
16. Peterson MB, Jorgenson HL, Hansen K, Duus BR. Factors affecting postoperative mortality of patients with displaced femoral neck fracture. Injury. *2006*; 37(8): 705-11.
17. Sierra, Rafael J et al. Dislocation of Bipolar Hemiarthroplasty: Rate, Contributing Factors, and Outcome. Clinical Orthopaedics & Related Research. 2006; 442: 230-238.
18. Saberi S, Arabzadeh A, Khomeisi B, Berehnegard E, Mortazavi SMJ. Early Complications Following Bipolar Hemiarthroplasty for Femoral Neck Fracture in Elderly Patients. Academic Journal of Surgery. 2014; 1(3-4): 45-48.
19. Rajak MK, Jha R, Kumar P, Thakur R. Bipolar hemiarthroplasty for intracapsular femorla neck fracturres in elderly patients. Journal of Orthopaedic Surgery. 2013; 21(3): 313-316.
20. Unwin AJ, Thomas M. Dislocation after hemiarthroplasty of the hip: a comparison of the dislocation rate after posterior and lateral approaches to the hip. Ann of the Royal College of Surgeons of England. 1994; 76(5): 327-9.
21. Naidu KA, Sunil T, Koduru SK. A clinical study of Management of intracapsular fracture neck of the femur in elderly with Bipolar Hemiarthroplasty. International Journal of Orthopaedic Sciences. 2020; 6(2): 319-325.
22. Marya SKS, Thukral R, Hasan R, Tripathi M. Cementless bipolar hemiarthroplasty in femoral neck fractures in elderly. Indian Journal of Orthopaedics. 2011; 45(3): 236-242.
23. Patel KC, Moradiya N, Gawatre P, Desai TV. Early outcome of hemireplacement arthroplasty using cemented bipolar prosthesis in fracture neck femur in elderly: A Study of 50 cases. International Journal of Orthopaedic Sciences. 2017; 3(1): 303-307.
24. Bezwada HP, Shah AR, Harding SH, Baker J, Johanson NA, Mont MA. Cementless Bipolar Hemiarthroplasty for Displaced Femoral Neck Fractures in the Elderly. The Journal of Arthroplasty. 2004; 19(7): 73-77.
25. Reddy YH, Vishnu K. A study of management of intracapsular fracture neck femur using bipolar prosthesis. Indian Archives of Integrated Medicine. 2018; 5(1): 28-35.
26. Ebrahimpour A, Zandi R, Ayazi M, Safdari F. The Outcomes of Treating Femoral Neck Fractures Using Bipolar Hemiarthroplasty. Trauma Monthly. 2017; 22(1): e61806.

27. Kalantri A, Barod S, Kothari D, Kothari A, Nagla A, Bhambani P. Hemiarthroplasty for intra-capsular fracture neck of femur in elderly patients: a prospective observational study. International Journal of Research in Orthopaedics. 2017; 3(5): 991-997.
28. Jindal RC, Gill SS, Singh M, Gautam RK. Functional Outcome of Bipolar Arthroplasty for Fracture Neck Femur in Elderly People. Indian Journal of Research. 2016; 5(11): 7-10.
29. Malhotra R, Arya R, Bhan S. Bipolar hemiarthyroplasty in femoral neck fractures. Archives of Orthopaedic Trauma Surgery. 1995; 114(2): 79-82.