

Comparitive Study of Fracture Neck Of Femur Treated With Cannulated Cancellous Screw Fixation And Hemiarthroplasty In Elderly

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Abstract : *Intracapsular fracture neck of femur have always presented great challenges to orthopaedic surgeons and remain in many ways today the unsolved fracture as far as treatment and results are concerned Intracapsular fractures are devastating injuries that most often affect the elderly. Intracapsular fractures are very rare in young individuals with normal bone. The incidence of intracapsular fractures is increasing in the modern world due to high energy trauma associated with road traffic accidents. This study aims at retrospectively analysing the functional outcome of 2 widely accepted modalities of treatment in the age group 60-75 years, in Garden's type I and II fractures, namely*

- *Cannulated cancellous screw fixation (internal fixation)*
 - *Prosthetic replacement of the femoral head (Hemiarthroplasty)*
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I. Material

Intracapsular fracture neck of femur are associated with a high incidence of non-union and avascular necrosis. Furthermore avascular necrosis is more likely to be symptomatic in the younger population. Both non-union and avascular necrosis are so devastating functionally that they affect not only the patient but also the society. An important part of rationale for prompt treatment of the fracture is preservation of the blood supply to the femoral head which is critical for a satisfactory long term result. The fracture is regarded as a vascular injury to the bone's blood supply. The degree of vascular compromise is thought to directly correlate with the displacement of the fracture which affects fracture union and leading to complications. Hence intracapsular fracture neck of femur is regarded as an orthopaedic emergency and needs to be reduced with rigid internal fixation which is believed to improve the circulation of femoral head and prevent the non-union and avascular necrosis.

The parallel-screw methods appear to set the standard with which other implants must be compared. The cannulated screws can be inserted relatively simply and atraumatically compared to other methods. Internal fixation with cannulated cancellous screws after good anatomical reduction is the optimum method of treating intracapsular fractures as it has the advantages of decreased blood loss and operative time, lower transfusion requirements and decreased length of hospital stay. Several authors have considered replacement of the femoral head as an alternative due to the frequent development of nonunion, failures of osteosynthesis and avascular necrosis of femoral head. Various designs of prosthetic replacement have been devised, the Moore type being the unipolar endoprosthesis. Bateman in 1974 reported the bipolar, or universal, endoprosthesis, an intermediate between the Moore type and total hip replacement.

The bipolar prosthesis was designed so that primary articulation would be at the inner bearing of the prosthesis and not at prosthesis – cartilage interface, thereby decreasing the amount of acetabular erosion and pain that the patient encountered. The goal of the current study is to assess the functional and quality of life scores in patients treated with hemiarthroplasty and cannulated cancellous screw fixation for intracapsular fracture of the femoral neck.

II. Review Of Literature

- A comparative study of the relative stiffness of fixation of simulated Pauwels type III femoral neck fractures fixed with either 2 or 3 cannulated screws implanted at 135 degrees, 145 degrees and 150 degrees was done. Each femur was fixed with 2 or 3 cannulated screws and tested under axial loading and anteroposterior (AP) bending. Then each femur was fatigued to 1000 cycles and tested to failure. Fourteen femurs were tested. Results showed that axial stiffness values were not statistically different at different angles. AP bending stiffness of the high-angle (150 degrees) construct was significantly higher than that of either of the other 2 constructs (for 2 screws only). Two-screw fixation appears to be adequate; adding a third screw may not be necessary¹.
- A retrospective comparative study was done between two groups of twenty consecutive patients with a femoral neck fracture who underwent internal fixation with three cannulated screws. Computer-based navigation was used to guide screw placement in one group and conventional fluoroscopy was used in the

other group. Radiographic evaluation included the measurement of screw parallelism and spread, the calibrated distance from the lesser trochanter and joint penetration. The follow-up period was two years. The rates of complications in both groups were evaluated. The navigation-assisted group had better screw parallelism and greater spread of the screws. There was a tendency for fewer reoperations and significantly fewer overall complications in the patients in whom computerized navigation was used ($p < 0.018$). The study concluded that Computerized navigation improves the accuracy of cannulated screw placement in the internal fixation of femoral neck fractures. It may provide better mechanical stability and improved fracture outcome².

- An observational study was conducted in a consecutive series of 56 patients with united fractures of the femoral neck treated with multiple cancellous screws. The latest anterior-posterior radiograph of the fractured hip was compared with that of the contralateral uninjured hip. After scanning and electronically overlapping those radiographs, femoral neck shortening was assessed. All identified patients were contacted and the Short Form-36 (SF-36) functional outcome questionnaire was administered. The shortening rate was 31% for undisplaced (14 of 45) and 27% for displaced fractures (3 of 11). The average abductor moment arm shortening was 10 +/- 4 mm. The average femur length decrease was 8 +/- 5 mm. In all other patients, abductor moment arm as well as femur length measurements were within 3 mm of the contralateral side and considered not to be shortened. Thirteen patients completed the SF-36 questionnaire (12 of 13 undisplaced fractures; all 13 with good fracture reduction). Patients with shortened fractures (8 of 13) had significantly lower Physical Functioning ($p = 0.01$) and Role Physical ($p = 0.04$) SF-36 subscores. The study concluded that femoral neck shortening after femoral neck fracture fixation with multiple cancellous screws is common and it has a significant negative impact on physical functioning³.
- Between January 1993 and January 2005, seventy-six Pauwels type-3 (Orthopaedic Trauma Association [OTA] type-31B2.3) femoral neck fractures were treated in seventy-five patients with a mean age of forty-two years. Fourteen patients were lost to follow-up. Sixty-two fractures in sixty-one patients were followed to union or revision surgery, with a mean duration of follow-up of twenty-four months. Thirty-seven fractures were treated with cannulated screws and twenty-five with a fixed-angle device. The reduction quality, accuracy of implant placement, time to surgery, influence of capsular decompression, and rates of nonunion and osteonecrosis were evaluated. Fifty-nine (95%) of the fractures had good-to-excellent reduction and three had a fair reduction. There was a nonunion of eight (14%) of the fifty-nine fractures with a good-to-excellent reduction and two of the three with a fair reduction. There was a septic nonunion of one fracture treated with a dynamic hip screw. There was an aseptic nonunion of seven (19%) of the thirty-seven fractures treated with screw fixation alone as compared with two (8%) of the twenty-five fractures treated with a fixed-angle device. Osteonecrosis occurred after treatment of seven (11%) of the sixty-two fractures. The results showed that despite timely, excellent reduction and accurate implant placement in the vast majority of cases, the nonunion rate was 19% for fractures treated with cannulated screws alone and 8% for those treated with a fixed-angle device. Although these failure rates are not significantly different, this study documents the challenging nature of this fracture pattern and the ideal fixation device remains undefined⁴.
- Boyd HB and Salvatore J.E. Suggested that "That sacrifice of head and neck and its replacement by a metallic foreign substance is not the answer for majority of patients; in over half, the best available material is in the acetabulum, and its indiscriminate removal should be avoided"⁵

In Patients with age under 60 years open reduction with internal fixation should be attempted in all fracture grades, provided an adequate timely reduction can be achieved. Fixation with three parallel cancellous screws, in most cases is the treatment of choice. Blair B, Koval K.J, Kummer F et al showed that the preferred method of internal fixation with cannulated cancellous screws is that of an inverted triangle configuration of screw placement with first screw running along the calcar, second posterosuperiorly along the neck of femur, and a third screw antero superior as an additional support. This pattern also reduces the risk of stress fractures occurring at the level of lesser trochanter⁶Carpenter et al; found that reoperation rate following internal fixation was much higher (28%) than that following either unipolar (5%) or bipolar (3%) arthroplasty¹⁰.

A meta-analysis by Lu-Yao compared unipolar with bipolar hemiarthroplasty. The same authors found the rate of reoperation for patients with unipolar were double that of patients who had bipolar. Ambulatory capacity and pain relief was better in patients with bipolar hemiarthroplasties¹¹.Bipolar replacement has higher percentage of satisfactory results, less post operative pain, greater range of movement, more rapid return to unassisted activity, fewer unsatisfactory results and no acetabular erosion. The device functioning as bipolar in all cases studied for inner bearing motion

Haidukewych GJ et al; reviewed the results and survivorship of 212 bipolar hemiarthroplasties done in 205 patients for acute femoral neck fractures between 1976 and 1985, the data showed that cemented bipolar

hemiarthroplasty done for a femoral neck fractures was associated with excellent component survivorship. Ten-year survivorship free of reoperation for any reason was 93.6% and free of revision surgery for acetabular cartilage wear 99.4%¹². In the study conducted by Maini PS, Navin Talwar, Nijhawam VK, Mainish Dhawan. They concluded that in elderly patients with displaced fracture of neck of femur are able to ambulate early after Cemented bipolar hemiarthroplasty. The complication rate is low, the component survival long and pre injury functional status is restored in majority of patients. According to Mullar CA, Bayer J, Sezarzynski E, Sudkamp NP et al. Hip arthroplasty is predominantly applied in older patients, most of them suffering from at least one medical condition at time of surgery. Hence overall physical condition of elderly patients as to be taken seriously while planning surgical treatment of femoral neck fracture. In this retrospective study, they have show that implementation of bipolar hip prosthesis constitutes an adequate treatment for elderly patients.

In a study conducted by Marya SKS, Thukral R, Chandeeep Singh. It was concluded that hip replacement hemiarthroplasty is viable treatment option in case of intracapsular fracture neck of femur in elderly patients. Intracapsular fracture neck of femur accounts for major share of fractures in elderly. The primary goal of treatment is to return the patient to his or her pre-fracture functional status. There are multiple internal fixation options (screws, dynamic hip screw plate or blade plates) and hemiarthroplasty. Open reduction and internal fixation has been shown to have high rate of revision surgery due to non-union and avascular necrosis. Hemireplacement is a viable treatment option

III. Objectives Of The Study

- To do a comparative study on the functional outcome of intracapsular fracture of femoral neck with cannulated cancellous screw fixation and hemiarthroplasty, as a primary modality of treatment with regard to
 - 1) Patient mortality and morbidity
 - 2) Need for secondary surgery

Source Of Data

Patients presenting to the Department of orthopaedics Yenepoya medical hospital (Retrospective study)

IV. Method Of Collection Of Data:

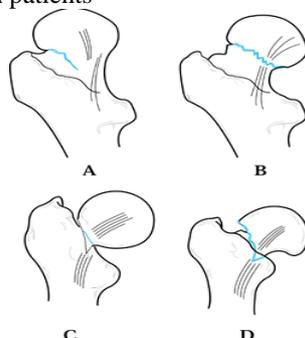
- **Sample size :**
30 Cases each satisfying the inclusion criteria

Inclusion criteria :

- 1) Patient above age of 60 years and below age of 75 years
- 2) Gardens type 1 and 2 classification
- 3) Patient who were mobile prior to the fall/fracture

Exclusion criteria :

- 1) Patients not willing for surgery.
- 2) Patients medically unfit for surgery.
- 3) Patient below age of 60 years and above age of 75 years
- 4) Gardens type 3 and type 4 classification
- 5) Patient with dementia and bed ridden patients



Garden classification of femoral neck fractures.

A: Stage I: Incomplete fracture that is abducted and impacted.

B: Stage II: Complete fracture without displacement. Note that the compression trabeculae are aligned.

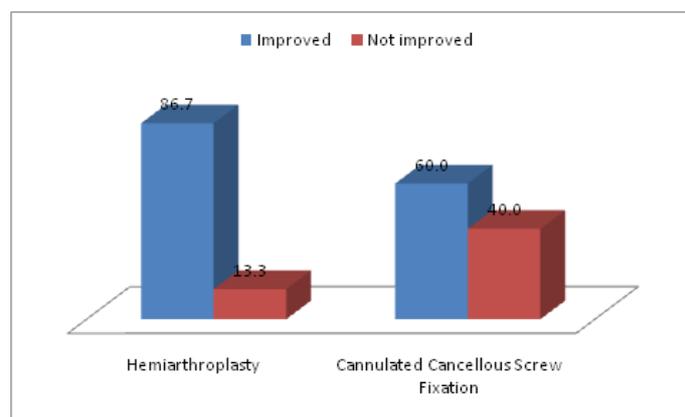
Comparative Study Of Fracture Neck Of Femur Treated With Cannulated Cancellous Screw.....

C: Stage III: Complete fracture with partial displacement. The neck is still in apposition posteroinferiorly; therefore, the fragments have rotated in opposite directions like two cogwheels. Note that the compression trabeculae are angulated.

D: Stage IV: Complete fracture with full displacement.

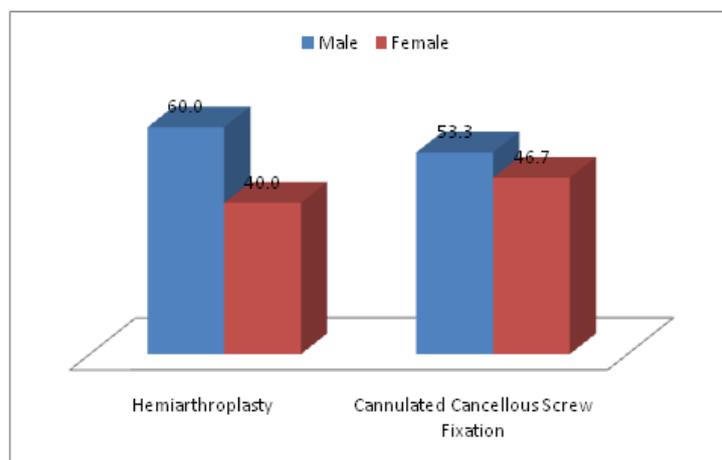
	Out come		Total
	Improved	Not improved	
Hemiarthroplasty	26 86.7%	4 13.3%	30 100.0%
Cannulated Cancellous Screw Fixation	18 60.0%	12 40.0%	30 100.0%
Total	44 73.3%	16 26.7%	60 100.0%

$\chi^2=5.455$ $p=.020$, sig



	Sex		Total
	Male	Female	
Hemiarthroplasty	18 60.0%	12 40.0%	30 100.0%
Cannulated Cancellous Screw Fixation	16 53.3%	14 46.7%	30 100.0%
Total	34 56.7%	26 43.3%	60 100.0%

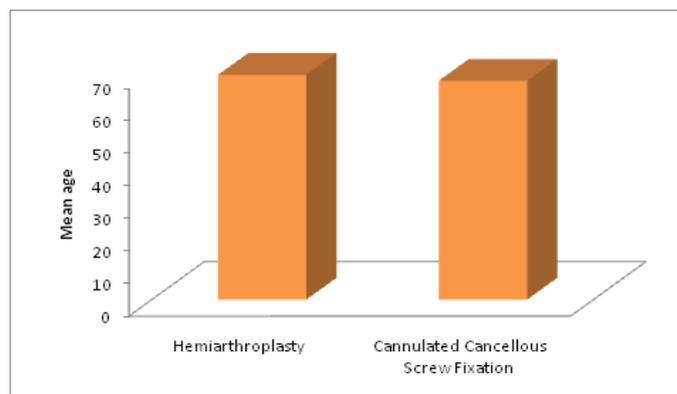
$\chi^2=.271$, $p=.602$, NS



Age

	Mean	S.D	t test p value

Hemiarthroplasty	69.3	3.7	0.955	NS
Cannulated Cancellous Screw Fixation	67.5	4.5		



V. Conclusion

The study conclusively shows that among the patients satisfying over inclusion criteria, the better primary modality of treatment is prosthetic replacement of femoral head. This treatment, although thought of by many as more radical approach as opposed to internal fixation with cannulated cancellous screw, negates the need for a second surgery, which in the elderly is a boon. The patient could be mobilised immediately after surgery which also drastically improve patient satisfaction and quality of life. Therefore we conclude that in Garden type I and II femur neck fractures in the patients between 60-75 years of age, hemiarthroplasty is the better modality of treatment.

Reference

- [1]. Walker E, Mukherjee DP, Ogden AL, Sadasivan KK, and Albright JA, Department of Orthopaedic Surgery, Louisiana State University Health Sciences Center, Shreveport, LA 71130, USA. A biomechanical study of simulated femoral neck fracture fixation by cannulated screws: effects of placement angle and number of screws. *Am J Orthop*, 2007;36.
- [2]. Meir Liebergall, Dror Ben-David, Yoram Weil, Amos Peyser and Rami Mosheiff. Department of Orthopedic Surgery, Hadassah-Hebrew University Medical School, Hadassah Medical Center, P.O. Box 12000, Jerusalem 91120, Israel. Computerized Navigation for the Internal Fixation of Femoral Neck Fractures. *The Journal of Bone and Joint Surgery (American)*. 2006;88: p1748-54.
- [3]. Zlowodzki M, Ayieni O, Petrisor BA and Bhandari M . Department of Orthopaedic Surgery, University of Minnesota, Minneapolis, MN, USA. Femoral neck shortening after fracture fixation with multiple cancellous screws: incidence and effect on function. *J Trauma*. 2008; 64.
- [4]. Frank Liporace, Robert Gaines, Cory Collinge and Haidukewych GJ. North Jersey Orthopedic Institute, 90 Bergen Street, Suite 1200, Newark, NJ 07101-1709. Results of Internal Fixation of Pauwels Type-3 Vertical Femoral Neck Fractures. *The Journal of Bone and Joint Surgery (American)*. 2008;90: p1654-59.
- [5]. Boyd H.B; Salvatore J: Acute Fracture of the femoral neck: Internal Fixation or Prosthesis? *Journal of Bone and joint surgery*. 1964; 46A: 1060.
- [6]. Blair B, Koval KJ, Kummer F – Basicervical fractures of Proximal femur, a biomechanical study of three Internal Fixation techniques, *Clin orthop*. 1994; 306: 256-263..
- [7]. Kenzora JE, Magaziner J, Hudson J, Hebel JR, Young Y, Hawkes W, et al. Outcome after hemiarthroplasty for femoral neck fractures in the elderly. *Clin Orthop* 1998;51-58.
- [8]. Harkess JW. Arthroplasty of hip. Chapter -7 in: *Campbell's operative orthopaedics*, 11th edn. : Mosby 2008:312-481
- [9]. Lu-Yao GI, Keller RB, Littenberg B, Wennberg JE. Outcomes after fractures of the femoral neck : A meta analysis of one hundred and six published reports. *J.Bone Joint Surg* 1994; 76(A):15-25.
- [10]. Carpenter JE, Myers ER, Gerhart TN, et al. Functional outcome following femoral neck fractures in elderly. *Orthop Trans* 1992;16:750.
- [11]. Haidukewych GJ, Israel TA, Berry DJ. Long term survivorship of cemented bipolar hemiarthroplasty for fracture of the femoral neck *Clin Orthop* 2002; 403: 118-126.
- [12]. Maini PS, Navin Talwar, Nijhawan VK, Manish Dhawan. Results of cemented bipolar hemiarthroplasty for fracture of femoral neck, 10 yrs study: *Indian Journal of Orthopaedics* 2006;40,3:154-156.
- [13]. Muller CA, Bayer J, Sezarzynski E, Sudlamp NP. Implantation of bipolar prosthesis for treatment of medial femoral neck fracture in elderly – *Zentralbl Chir*, 2008; 133(6):580-6.
- [14]. Marya SKS, Thukral R, Chandeeep Singh. Prosthetic replacement in femoral neck fracture in elderly; Results and Review of the Literature 2008;42;1:61-67.