

Original research article

A Study on Short Term Functional Outcome of Patients with Fracture Neck of Femur Treated by Three Fully Threaded Cancellous Screws

**Dr Thomas George¹, Dr Manesh Stephen², Dr Ahmed Shaheel Sultan³,
Dr A M Georgekutty⁴**

¹Senior Resident, TD Medical College Alappuzha , Kerala

²Assistant Professor, TD Medical College Alappuzha , Kerala

³Senior Resident, TD Medical College Alappuzha, Kerala

⁴Professor of Orthopedics, TD Medical College Alappuzha, Kerala

Corresponding author: Dr A M Georgekutty

Email : drgekollam@yahoo.co.in

Abstract

A total of 26 patients with average age of 45 years was treated with fully threaded cannulated cancellous screws. Out of the 26, 20 (77%) were males and 6 (23%) were females. The average timing of surgery 32.6 hrs following the incident (range 32.6 +/- 11.34hrs) with a range of 18 to 76 hrs . There was no significant limb length discrepancy noted in immediate postop and follow up period. Incidence of infection non-union avascular necrosis was comparable with partially threaded group in previous studies. Harris Hip Scores was found to be fair to excellent except in 5 cases (3 had non-union neck of femur and other 2 with avascular necrosis of femoral head). Average femoral neck shortening was 3.6+/_ 3.06 mm and 1.98+/- 1.68 mm respectively which was significantly less as compared to partially threaded groups.

Key words: fracture neck of femur, fully threaded cancellous screw fixation, femoral neck shortening.

Introduction

Treatment of intracapsular fracture neck of femur (#NOF) in young and active individuals is osteosynthesis and not arthroplasty. Treatment of fracture neck of femur is anatomical reduction with closed manipulation or open reduction and fixation with fixed angled devices like Dynamic hip screw (DHS) or partially threaded cannulated cancellous screws¹. Conventional hardware for surgical fixation of intracapsular neck fracture is partially threaded cannulated cancellous screws. This conventional treatment with partially threaded (16mm) screws has some undesirable outcome such as femoral neck shortening and varus collapse of neck shaft angle (NSA), this leads to weak abductor mechanism of hip joint leading to altered gait pattern and reduced quality of life, despite good anatomical reduction and fixation in addition to incidence of non-union and avascular necrosis (AVN) of femoral head.

HYPOTHESIS:

In this study we hypothesized that use of fully threaded cannulated cancellous screws will decrease incidence of femoral neck shortening and varus collapse of femoral neck shaft angle which results in relatively good clinical outcome.

AIMS & OBJECTIVES:

The study was conducted to assess the short term functional outcome of patients with fracture neck of femur treated by three fully threaded cannulated cancellous screws in terms of non-union, avascular necrosis of femoral head, femoral neck shortening and varus collapse of neck shaft angle

METHODS & METHODOLOGY:

Study design – Prospective observational study.

Study population - Patients between the age group 25 to 65 with intra capsular neck fracture (AO/OTA type 31B1/31B2/31B3) treated with three fully threaded cannulated cancellous screws during the period of January 2019 to march 2020 in Government T.D medical college, Alappuzha were included in study. Patients suffering from any bone and joint disease, pathological fracture poly trauma (head, chest and abdomen), pelvis fracture were excluded from study

Sample size: 26

All patients satisfying the inclusion criteria were treated with three fully threaded cannulated cancellous screws after good anatomical reduction in anterior posterior and lateral views on image intensifier. Radiological and clinical follow up was carried out with plain X-rays (AP and lateral view) immediate postop, 1, 3, 6 and 12 months. Radiographic analysis was performed to assess femoral neck length in AP (X), lateral (Y) and neck shaft angle (Θ) and results are compared with the sound normal side. Incidence of non-union and avascular necrosis of femoral head was noted and compared with the incidence of same in patients treated with conventional partially threaded screws of previous studies. Harris Hip Score used for clinical evaluation during the follow-up period with assessment of gait at 3, 6 and 12 months. Statistical analysis

Data were entered in Microsoft Excel Software, and analysed using STATA software version 12 (manufactured by StataCorp LP, College Station, Texas). The continuous variables such as age, timing of surgery, X shortening, Y shortening, Neck shaft angle are expressed as mean and standard deviation. Independent variables were summarized as proportions. One-way ANOVA test was done for comparing categorical variables with continuous variables like timing of surgery. Chi-square/Fisher's exact test was used to find association between categorical variables such as complications and age groups, FNS.

OBSERVATIONS AND ANALYSIS:

26 patients with mean age of the study 45 yrs (45.35 with SD 12.149) with range of 26 to 65 yrs.

20 (76.9%) are males and 6 (23.1%) are females. Age distribution Fig 1. Mechanism of injury Fig. 2. Right side is more involved than left side with frequency of 16 (62%) and 10 (38%) respectively. Distribution of fracture based on Garden and Pauwell classification Fig 3.

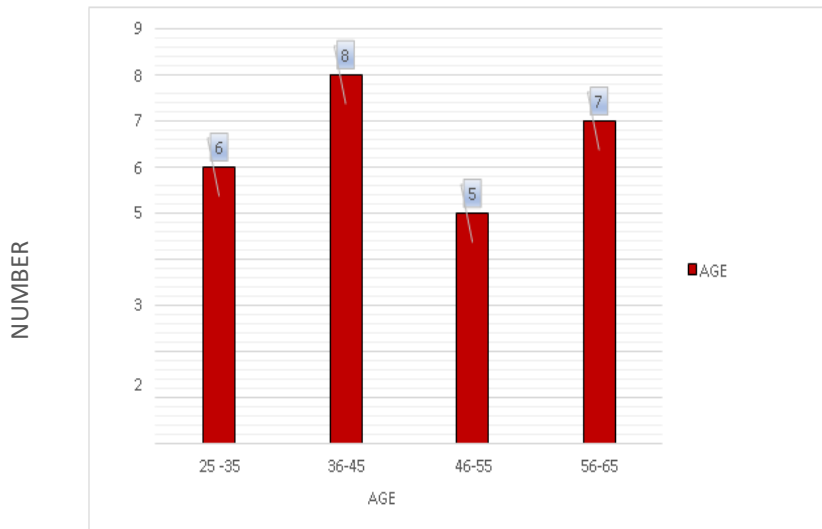


Figure 1: Age Distribution of the Study Population

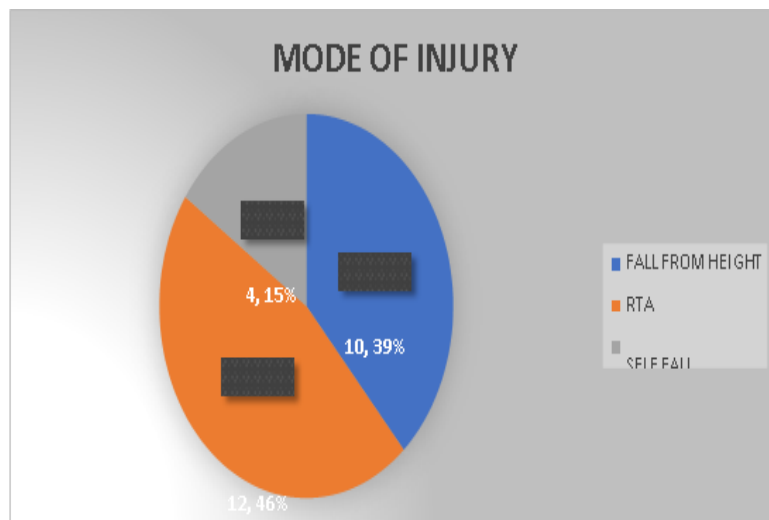


Figure 2: Mode of injury

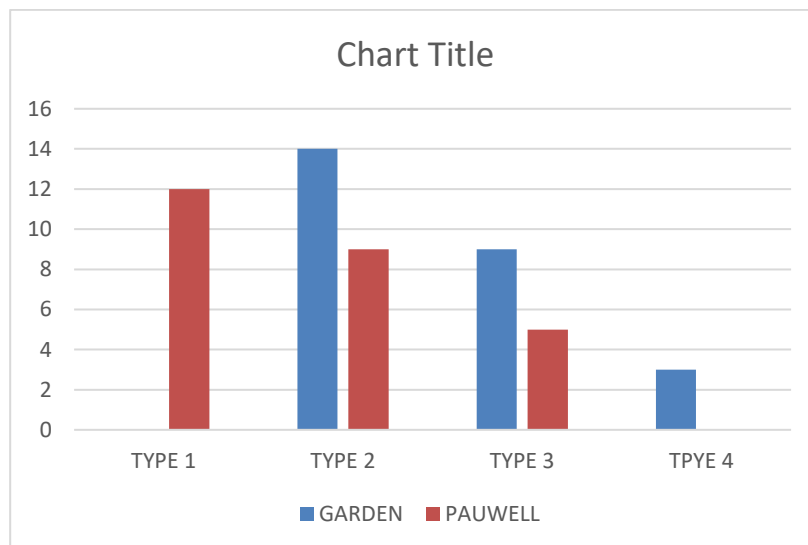


Figure 3: Garden and Pauwell fracture distribution

Incidence of infection, nonunion, AVN, FNS summarized in Table 1. Mean femoral neck shortening in AP view (x) was 3.64 with SD 3.06 and that of lateral view (y) was 1.98 with SD 1.69. Only 2 cases (7.7%) had severe femoral neck shortening more than 10 mm, 65.4% (17) cases had femoral neck shortening less than 5mm, 7 cases had moderate shortening (5 to 10 mm) in AP radiograph as compared to opposite side. In lateral view 24 cases (92.3%) had shortening of less than 5mm, 2 cases had moderate shortening (5 to 10mm) and no one had severe (>10mm) shortening in comparison with sound side. Mean surgery timing was 32.6 hrs with SD of 11.34 hrs. Mean neck shaft angle (NSA) was 129 with SD 6.166. Only 2 cases had neck shaft angle less than 120 degree (varus collapse). There was no significant association between age and nonunion of femoral neck with p value > 0.5 (0.834). 65% (17) had normal gait, 31% (8) had trendelenburg gait and only 1 (4%) had antalgic gait during followup.

TABLE 1. DISTRIBUTION OF STUDY SUBJECTS BASED ON COMPLICATIONS

COMPLICATIONS	NUMBER	PERCENT
INFECTION	2	7.6%
NON UNION	3	11.5%
AVASCULAR NECROSIS	5	19.2%
FEMORAL NECK SHORTENING >10MM	2	7.6%
TOTAL	12	

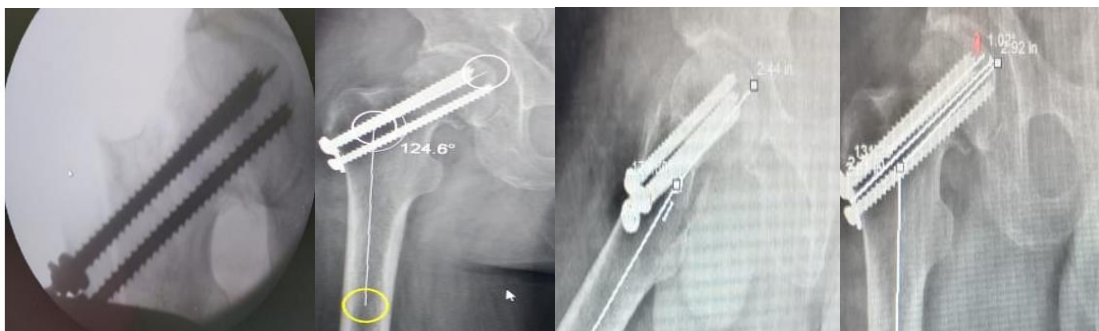


Figure 4: Intraop , follow up xray of case 3 with measurements

Harris hip score was excellent in 9 cases (35%), good in 9 (34%), fair in 7 (27%) and poor in 1 case. There is no significant association between femoral neck shortening in AP (x) and lateral (Y) view with age, p value 0.103 and 0.181 respectively (> 0.05%). There is no significant association between timing of surgery and femoral neck shortening in AP (x) and lateral (Y) view with age with p value 0.837 and 0.550 respectively (> 0.05%). There was no significant association between Garden's or Pauwel's type with non-union neck of femur with a p value > 0.05 (0.780) and > 0.05 (0.618) respectively. There was no significant association between Pauwel's type of fracture and femoral neck shortening in AP and lateral view with a p values 0.029 and 0.011 (<0.05) respectively. There was no significant association between Garden's type and Pauwel's type with neck shaft angle (NSA) with a p value > 0.05 (0.341) and > 0.05 (0.618) respectively. There was no significant association between femoral neck shortening in AP and lateral view and non-union with p value > 0.05 (0.855 and 0.778). There was significant association between ORIF and non-union as fisher exact test showed a p value < 0.05 (0.046). There is no association between ORIF and AVN of hip and FNS. There is significant

association between FNS and Gait pattern with P value > 0.05 (0.046) .2 of the patients with severe shortening $> 10\text{mm}$ had Trendelenburg gait, one with moderate (5 to 10mm) shortening had antalgic Gait. There was significant association between FNS and Harris Hip Score with p value < 0.05 {0.016 and 0.003 respectively in AP (x) and lateral view (y)}

There was significant association between non-union and Hari's Hip Score (HHS) with p value < 0.05 (0.027) non-union femur has lower Haris Hip Score (HHS). There was significant association between non-union and gait with a p value < 0.05 (0.022). All of them were found to have Trendelenburg Gait .There was significant association between Hari's Hip Score and AVN of femoral head with a p value < 0.05 (0.002) and cases of AVN has lower HHS. There was significant association between AVN and gait pattern with a p value < 0.05 (0.027). There are 5 cases of non-union all of them had Trendelenburg Gait. Femoral neck shortening has significant correlation with low HHS with a p value < 0.05 {0.016 (x) and 0.003 (y)}. There was no association between neck shaft angle and Haris Hip Score with a p value > 0.05 (0.479). There was no association between neck shaft angle and gait pattern with a p value > 0.05 (0.459). Timing of surgery has no associatioin with non-union and AVN (p value 0.389 and 0.476). There was no incidence of screw pull out.

Discussion

The calculated sample size was 30 but 26 samples were obtained for study during the prescribed study period. Due to Covid 19 pandemic clinical and radiological follow up were difficult. 26 samples which satisfied inclusion criteria were selected from 32 cases. Mean age of the study population was 45 yrs with a range of 26 to 65 yrs. The study included majority of males (20) than females (6). RTA (12) was the most common mode of injury. Most common Garden's type of fracture is type 3(14) and Pauwels type 1 (12) . Mean surgery timing was 32.6 hrs with SD of 11.34 hrs. 16 cases were treated by closed reduction and either mini incision or percutaneous screw fixation and rest 10 by open reduction with Smith Petterson approach and percutaneous or mini incision screw fixation. Mean follow-up period 11 months with minimum of 6 months and maximum of 18 months. **INCIDENCE OF COMPLICATIONS (NON UNION, AVN & INFECTION)** .In our study 2 out of 26 (7.7%) had been complicated with infection managed by wound debridement and antibiotic according to pus culture and sensitivity with retaining implant insitu. Methicillin sensitive staphylococcus aureus was the culprit organism. The infections were controlled with wound debridement and antibiotic and wound healed well in both cases. 3 out of 26 cases (11.5%) were complicated with non-union. All of them have painless limping with Trendelenburg gait. Only 2 cases (7.7%) were reported to have avascular necrosis (AVN) of femoral head during short followup period. They were characterised by reduced joint space with increased radiodensity and fragmentations. Both of them have altered gait pattern (Trendelenburg). They have characteristic pain in the groin with limping during followup. Both are under now clinical follow up. In 2005 D S Damany et al ² analysed Eighteen studies involving 564 fractures of relevant published studies from 1966 to May 2003. The overall incidence of non-union was 50/564 (8.9%) and AVN was 130/564 (23.0%). In 2015 G P Slobogean et al have published results of 1558 femoral neck fractures from 41 studies included in the meta-analysis. The total pooled incidence of avascular necrosis (AVN) was 14.3%, and the total incidence of non-union was 9.3%. The total incidence of mal-union was 7.1%, implant failure was 9.7%, and surgical site infection was 5.1%. In our study incidence of non-union is 11.5 % (3/26), 2 cases were complicated by postoperative infection (7.7%) and incidence of avascular necrosis of femoral head was 7.7% (2/26). All the results were comparable even though AVN incidence is low due to shorter followup period and non-union is bit higher, though comparative statistics results are not significant with p value > 0.05 .In 2014 G P Slobogean et al ³ in metaanalysis of 41 studies pooled data 1558 cases,

reported Non-union 9.3%, AVN 14.3%, Infection - 5.1%, 7.7%, Implant failure 9.7%, 2005 D S Damany², there was a higher incidence of non union and AVN following displaced than undisplaced fractures. 2014 G P Slobogean³ showed displaced fractures were more likely to undergo reoperation and to result in AVN or non-union. But in our study, there is no significant association between Garden's type and non-union neck of femur with a p value > 0.05 (0.780). In 2019 Léo Nanty et al⁴ studied 75 patients with # NOF, of which 9 (12%) experienced AVN. Impaction was significantly associated with AVN (p = 0.02; relative risk, 4.38). Femoral neck impaction was a significant risk factor for AVN after screw fixation of Garden I fractures. But we have not included this variable in our study. In our study, mean femoral neck shortening in AP view (x) is 3.64 with SD 3.06 and that of lateral view (y) is 1.98 with SD 1.69. Only 2 cases (7.7%) had femoral neck shortening more than 10 mm. 65.4% (17) cases had femoral neck shortening less than 5mm, 7 cases had moderate shortening (5 to 10 mm) and 2 cases had severe shortening (>10mm) in AP radiograph as compared to opposite side. In lateral view 24 cases (92.3%) had shortening of less than 5mm, 2 cases had moderate shortening (5 to 10mm) and no one had severe (>10mm) shortening in comparison with sound side. Mean neck shaft angle (NSA) was 129 with SD 6.166. Only 2 cases had neck shaft angle less than 120degree (varus collapse). In 2018 Yoram A. Weil⁵ conducted a study in 24 out of 38 patients with FNF treated with FTS and 41 patients treated previously with PTS (control group). Patient demographics and major complication rates were similar in the two patient groups. Average FNS was significantly smaller in the FTS group than in the PTS group. Average FNS (2.3 ± 3.5 vs 6.23 ± 4.5 mm, p < 0.01). There was a tendency towards a more valgus reduction in the PTS (137° vs 134°, p = 0.08). There was a significantly smaller number of FTS patients with moderate (5–10 mm) or severe (> 10 mm) FNS. This study proves that use of FTS improves the radiographic results following FNF fixation using cannulated screws.

SUMMARY & CONCLUSION

From this study it concludes that treatment of neck of femur is a challenging area with non-union and avascular necrosis of femoral head, there is no role for conservative management. From this prospective observational study of 26 patients treated with 3 fully threaded screws, we concluded that the incidence of complications and their risk factors are comparable with conventional studies regarding partially threaded screws. Apart from this it observes that there is significant difference in femoral neck shortening and varus collapse as compared to classical partially threaded group and there is no screw pull out and implant failure. Hence use of fully threaded group has better radiological and functional outcome (gait & Harris Hip Score) than partially threaded study group.

LIMITATIONS OF STUDY

Number of cases (sample size) studied (26) is less than the expected or calculated sample size (30). Short duration of the study period (18 months). Covid 19 pandemic affected during the follow up period

It requires long term cohort study with adequate sample size to overcome limitations of our study.

ETHICAL CONSIDERATION

The study was conducted only after the approval of Institutional Ethics Committee (IEC). Informed written consent was sought from each participant of the study.

References

1. Jiong Mei : A brief history of internal fixation of femoral neck fracture, *Zhonghua Yi Shi Za Zhi* 2014 Mar;44(2):101-5
2. D S Damany, Martyn J Parker, Adrian Chojnowski Complications after intracapsular hip fractures in young adults. A meta-analysis of 18 published studies involving 564 fractures; *Injury*. 2005 Jan;36(1):131-41.
3. G P Slobogean, S A Sprague, T Scott, M Bhandari, Complications following young femoral neck fractures: *Injury* 2015 Mar;46(3):484-91.
4. Léo Nanty, François Canovas, Thibaut Rodriguez, Patrick Faure, Louis Dagneaux Femoral neck shortening after internal fixation of Garden I fractures increases the risk of femoral head collapse: *Orthop Traumatol Surg Res* 2019 Sep;105(5):999-1004.
5. Yoram A Weil, Feras Qawasmi, Meir Liebergall, Rami Mosheiff, Amal Khoury Use of fully threaded cannulated screws decreases femoral neck shortening after fixation of femoral neck fractures: *Arch Orthop Trauma Surg*. 2018 May;138(5):661-667
6. Loizou CL, Parker MJ :Avascular necrosis after internal fixation of intracapsular hip fractures; a study of the outcome for 1023 patients..*Injury*. 2009 Nov;40(11):1143-6.