

OUTCOME ANALYSIS OF VARIOUS MODALITIES OF FIXATION FOR EXTRACAPSULAR HIP FRACTURES IN ELDERLY

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ABSTRACT

Introduction: Fracture distal to the capsular attachment, that is peritrochanter area of hip called as a extracapsular hip fracture. Fracture of the proximal femur are a big challenge in traumatology. Over the past 50 years a wide variety of implants and fixation strategies have been utilized for this type of fractures. Dynamic hip screw is gold standard, proximal femoral nail longer version and proximal femoral locking compression plate is new weapon in the orthopaedic surgeons armamentarium for fixation of this challenging fractures.

Aim of Study: This study is undertaken to assess the various modalities of surgical stabilization of extracapsular hip fractures in elderly and their clinical outcome in our institute.

Material and Methods : This is a prospective study from august 2013 to September 2014. The study included 98 patients (mean age 76 years) who underwent various modalities of surgical stabilization for extracapsular hip fractures in elderly. Out of 98 patients 32 underwent Dynamic Hip Screw fixation, 38 underwent Proximal Femoral Nailing, 12 underwent Proximal Femoral Locking Compression Plating and 16 patients underwent Dynamic Condylar Screw fixation. Final clinical outcome was made using the kyle's criteria.

Results: This study evaluated implant cost, familiarity of surgeon with procedure, surgical exposure, operation time, blood loss and blood transfusion, wound complication, reoperation and mortality in every group. Group II (PFN) found better results by comparing.

Conclusion : Optimal reduction of the fracture and positioning of the nail and screw, plate and screw remains the crucial importance and should be obtained in all times. We have concluded that group II (PFN) was good and effective to treat these extracapsular fractures in elderly with highest clinical outcome.

Key words : Dynamic Hip Screw, Dynamic Condylar Screw, Extracapsular Hip Fractures, Elderly, Proximal Femoral Nail, Proximal Femoral Locking Compression Plate, Kyle's criteria

INTRODUCTION

Fracture distal to the capsular attachment, that is peritrochanteric area of hip called as a extracapsular hip fracture involving intertrochanteric and subtrochanteric area. Incidence of fracture intertrochanter among all proximal femur fracture is 50% and subtrochanteric hip fracture accounting 10-34 % of all hip

fractures.¹⁻³ In India the incidence is estimated to double by 2040. This fracture have high impact over society because making person to not perform daily activities and prone for bed ridden. Hip fractures was reported with a mortality rate ranging from 15-30% in America.⁴ These fractures may be very difficult to fix, and the risk of failure has been high regardless of the fixation method,⁵ especially

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in high subtrochanteric fracture with loss of the lesser trochanter and the medial buttress.¹⁻⁶ Fracture of the proximal femur are a big challenge in traumatology. Over the past 50 years, a wide variety of implants and fixation strategies have been utilized for the surgical stabilization of extracapsular hip fracture. The introduction of the sliding compression hip screw and side plate in the 1950 was considered a major advance over previous nail-plate devices.⁷⁻⁸ The DHS is most commonly used and still remains the "Gold Standard" for stable extracapsular hip fractures. In the early 1990s, a new fixation device was introduced that consist of a short intramedullary nail that was placed through the greater trochanter, with a large diameter proximal interlocking screw that was inserted in a retrograde fashion up the femoral neck. The proposed advantage were insertion through a so called minimally invasive incision and improved fracture fixation biomechanics.⁹⁻¹⁰ Vertical fractures in extracapsular area too can be effectively treated with DCS fixation.¹¹ The PFLCP is a new weapon in the orthopedic surgeon's armamentarium for treatment of unstable trochanteric fracture. Most of the currently available internal fixation devices can be expected to yield satisfactory result. However, each devices has its own set of advantages and disadvantages. The goal of operative treatment of extracapsular hip fracture is the stabilization of fracture and early patient mobilization, restoring the function of the limb. Although there were several reports showing benefits of PFN,¹² it was still associated with technical failures. Advantage and Disadvantage about PFN has less data available, since most previous studies are retrospective and lack a control group.¹³⁻¹⁴ Therefore, we conducted a study to asses significant differences on basis of clinical outcome between DHS, PFN, PFLCP and DCS fixation for treating extracapsular hip fractures in elderly.

MATERIAL AND METHODS

Between August 2013 and September 2014 at

Gandhi Medical College and Hamidia Hospital, Bhopal, Madhya Pradesh. We randomized 98 patients with extracapsular hip fractures (AO category 31 -A)¹⁵ to be treated with DHS/PFN/PFLCP/DCS fixation and under fluoroscopy control. Based on selection of implant design the patients were divided in four groups. Patients who underwent with DHS fixation were recruited into group I, PFN fixation recruited into group II, PFLCP fixation recruited into group III and DCS fixation recruited as group IV. There were 32, 38, 12 and 16 patients recruited in group I, II, III and IV respectively (figure 1). Patients were have age from 60-96 years and mean age was 76 years. 40 pateints were that less than 70 years and 58 patients were more than 70 years (figure 2). Sex wise males were 35 and females were 63 (figure 3). Injured side - wise right hip involved in 26 patients and left hip involved in 72 patients (figure 4).

The ethics committee of our hospital approved the study plan and informed consent was obtained from all patients before the operation. Every patient admitted in our hospital of age more than 60 years with isolated extracapsular hip fractures included in study and those with less than 60 years, history of previous fracture, multiple injuries and nonconsenting patients were excluded from study. This study enrolled patients with extracapsular hip fractures classified as AO/OTA classification¹⁵ (table 1).

Implant design was based on surgeon's choice, as he was comfortable irrespective type of fracture pattern. Preoperative parenteral antibiotics administered 1hr before surgery.¹⁶ All surgeries done under spinal anaesthesia and on traction table under fluoroscopy control. Intraoperative haemorrhage, surgical exposure, surgeon's familiarity with procedure, implant cost, implant related complications and wound related complication was observed and compared. Plain radiographs (anteroposterior and lateral view) were obtained on the first post -op day and analysed for reduction of fracture and position of implant. Total

operative time was defined as the duration of the surgery from skin incision to skin closure and compared in every group. Reduction was considered good if the cortical congruence at the calcar region was restored, and if the displacement between the fragments did not exceed 2mm in any projection, acceptable (5-10 degree varus/valgus and or ante or retroversion), or poor (>10 degree varus/valgus and or ante or retroversion). The rehabilitation programme was uniform for all. Follow up at 6 weeks, 3 months, 9 months and 1 year of period done and compared. Statistically analysis was made using the chi-square test. Clinical outcome was evaluated using Kyle's criteria¹⁷ at final follow up.

Outcome	Criteria
Excellent	No/ Minimal Limp No Pain Full ROM
Good	Mild limp Mild occasional Pain Full ROM
Fair	Moderate Limp (Using 2 Sticks) Moderate Pain Limited ROM
Poor	Wheelchair Bound Complete Bedridden Non- Ambulatory

Kyle's Criteria



Figure 1 : Groupwise distribution of patients

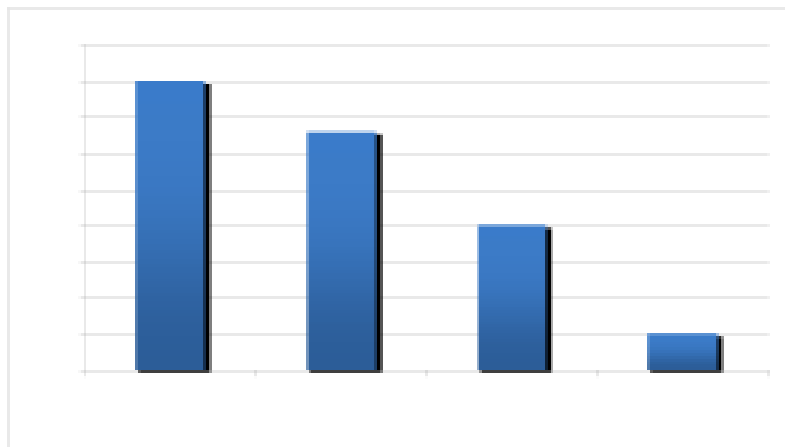


Figure 2 : Age wise distribution of patients

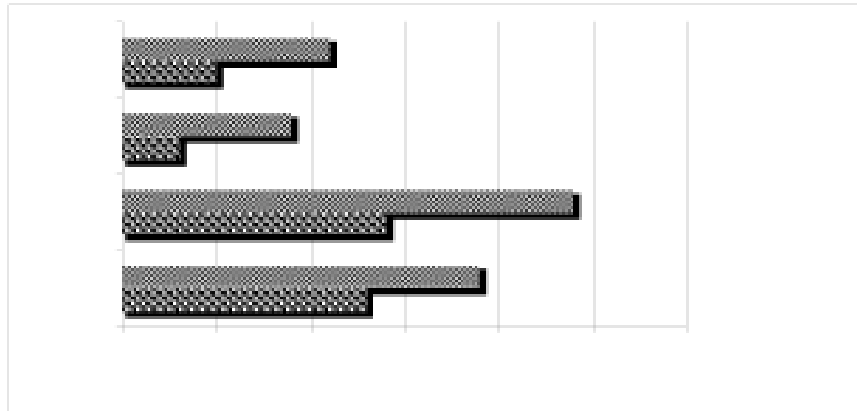


Figure 3 : Sex wise distribution of patients among all

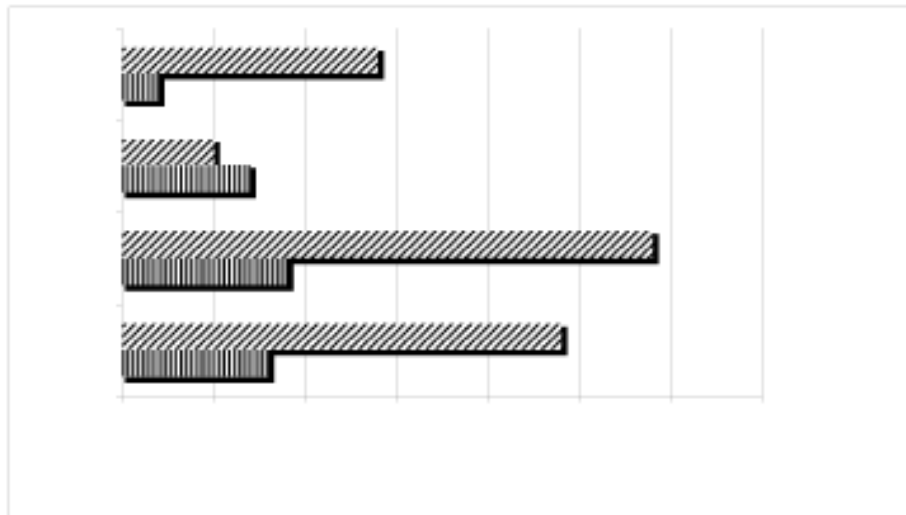


Figure 4 : Side wise distribution of Hips among all groups

Table 1
Distribution of Patients according to fracture type

Fracture Type	Group I DHS	Group II PFN	Group III PFLCP	Group IV DCS	Total
A1. 1	4	2	0	2	8
A1. 2	4	4	0	3	11
A1. 3	2	2	1	4	9
A2. 1	3	4	1	2	10
A2. 2	6	3	2	2	13
A2. 3	5	3	1	1	10
A3. 1	5	6	3	0	14
A3. 2	2	8	2	2	14
A3. 3	1	6	2	0	9
Total	32	38	12	16	98

RESULT

Randomization provided similar groups with regard to patient age, gender distribution and fracture type. According to AO classification stable fractures were 38 and unstable were 60 (See Table 1). During the follow - up five patients were lost in group I (five deaths), four in group II (3 deaths and one lost follow up), two in group III (2 deaths) and

three in group IV (2 deaths and one lost to follow - up). This study evaluated implant cost, familiarity of surgeon with procedure, surgical exposure, operation time, blood loss and blood transfusion, wound related complication, implant related complication, reoperation and mortality. Final outcome assessed on basis of kyle' criteria in all groups.

Table 2
Comparative results among groups

	Group 1 (DHS) 32	Group 2 (PFN) 38	Group 3 (PFLCP) 12	Group 4 (DCS) 16
Implant cost	Less expensive	Two to four times expensive	Five to seven times expensive	Same as DHS
Familiarity with procedure	More familiar	Less familiar	Less familiar	More familiar
Surgical exposure	Large exposure, more tissue handling	Less exposure, less tissue handling	Large exposure, less tissue handling	Large exposure, more tissue handling
Operation time	1 hour	1. 30 hours	2 hours	1. 15 hours
Blood loss and transfusion	46.88% (15/32)	31.58% (12/38)	33.33% (4/12)	56.25% (9/16)
Wound complication	21.90% (7/32)	10.50% (4/38)	16.67% (2/12)	18.75% (3/16)
Reoperation	18.52% (5/27)	8.82% (3/34)	10.0% (1/10)	38.46% (5/13)
Mortality	15.63% (5/32)	7.89% (3/38)	16.67% (2/12)	12.5% (2/16)
Clinical Outcome	74.07%	91.18%	80.0%	61.54%

Table 3
Final Outcome

	Group 1 DHS	Group 2 PFN	Group 3 PFLCP	Group 4 DCS	Total
Total follow. pts	27 (32-5)	34 (38-4)	10 (12-2)	13 (16-3)	84 (98-14)
Excellent	6	13	3	4	26
Good	12	14	5	2	33
Fair	2	4	0	2	8
Poor	7	3	2	5	17



Pre op Xray



Post op Xray



Pre op Xray



Post op Xray



Pre op Xray



Post op Xray AP view



Post op Xray Lat. View



Pre op Xray



Post op Xray



PFLCP



DCS

- 3.1 Implant cost :** Implant cost were estimated to be two- four times higher for group II (PFN), five -seven times higher for group III (PFLCP) as compare to other groups. Total operation cost increased significantly in group II and group III which was sensitive (p value < 0.05).
- 3.2 Familiarity with the procedure :** DHS has been the gold standard implant in the treatment of extracapsular hip fractures. Surgeon are using it since very long time so easy to use by everyone. PFN was introduced in 1998 so some surgeon are using it. PFLCP also introduced too late for treating this kind of fractures in elderly so only few surgeons are habitat to use it. Surgeons are more familiar with DHS/DCS rather than PFN or PFLCP.
- 3.3 Surgical exposure :** DHS/PFLCP/DCS require usually a longer incision with more tissue handling and soft tissue damage with more blood loss and wound complication as compared to PFN.
- 3.4 Operation time :** There were 98 fractures included, 38 patients with DHS fixation, 32 patients with PFN, 12 patients with PFLCP fixation and 16 patients with DCS fixation. Group I(DHS) taken less operaton time(see Table 2) from skin incision to skin closure as compared with other groups.
- 3.5 Blood loss and blood transfusion :** Blood loss was found to be more in group I (DHS) and IV (DCS) due to large tissue exposure, more tissue handling, long incision and more soft tissue injuries as compare to group III (PFLCP). No significant difference in the amount of blood transfusion between group II and III was found (see Table 2).
- 3.6 Wound related complication :**Wound complications including wound infection, delayed healing, hematoma and drainage were documented in 16 patients out of 98 patients (Table 2). Minimal wound related complication wereobserved in group II which was 10.50% and considered for PFN fixation.

3.7 Mortality : Out of total pateints, 12 patients were lost follow up due to deaths. Maximal percentage of death was observed in group III (PFLCP) which was 16.67% and minimal in group II (PFN) which was 7.89 % (p value < 0.05). (see Table 2)

3.8 Reoperation :The reasons for reoperation mainly were cut out of screw from femoral head, redisplacement of fracture, breakage of implant and nonunion. The average follow-up duration was 7.5 months (3-12 months). Maximum reoperation done in group IV which was 38.46% and minimum in group II which was 8.82%. (see Table 2)

3.9 Clinical analysis : The final clinical outcome observed at final follow up on the basis of kyle's criteria in all groups. Clinical outcome was maximum 91.18% was observed in group II (PFN) and minimum was 61.54% in group IV (DCS) (see Table 3).

DISCUSSION

While a wide range of proximal femoral fracture fixation devices have been employed over the years, the sliding hip screw and side plate, which has a blunt end to decrease femoral head penetration and screw threads to increase head purchase, became the implant of choice for fixation of intertrochanteric fracture in the latter half of the twentieth century.^{12,17-21} However, according to the study by Saarenpaa et. al,²² Sliding Hip Screw used in the treatment of Unstable trochanteric fracture have a very high failure rate with a reoperation rate of 8.2% which is unacceptable in the present day scenario.

Antegrade intramedullary nailing of intertrochanteric fracture with use of short nail through which a large screw was inserted into the femoral neck and head for interlocking was introduced by Halder in the 1980s in the form of the Gamma nail,⁹ This device was designed by Grosse and Kempf in Strasbourg, France. Early reports suggested some substantial advantage in association with this type of fixation, including a minimally invasive surgical technique, shortened

operating time, decreased blood loss, improved biomechanics, greater stability of fixation, earlier patient mobilization and short hospital stay.²³⁻²⁶ The Proximal Femoral Nail system²⁷ (PFN), developed by AO/ASIF, has some major biomechanical innovation to overcome the previously mentioned limitation of the Gamma nail. In 2003, Christian Boldin et. al²⁸ in his study concluded that PFN nail can be applied with a smaller incision with minimal tissue handling for unstable trochanteric fractures. A longer full length version of the nail was also developed and used in our study to avoid peri-implant fracture.

Yang YY et al.,²⁹ reported that functional recovery of PFLCP was better than DHS, and complication are fewer than that of DHS and other Intramedullary fixation devices in the management of unstable fractures.

DCS has traditionally been used in the treatment of unstable extracapsular hip fracture. However, various studies using this implant have contradictory results. Haidukewych et al.³⁰ noted that the DCS performed significantly better than DHS in their series of patients with reverse oblique type of unstable proximal femoral fractures. However similar study by Sadowski et al.³¹ on similar fracture pattern showed an inferior outcome with these (DHS) implants when compared with intramedullary nail.

Sliding compression hip screw have been directly compared with intramedullary fixation in many studies. The results have often been contradictory; for example some studies have demonstrated a longer operating time in association with nail fixation,³²⁻³⁷ whereas others have been demonstrated a shorter operating time in association with nail fixation.^{38,39} The only consistent differences found between the two fixation technique seem to be an increased rate of complications (particularly intraoperative and postoperative fractures) and a higher rate of reoperation in association with intramedullary nailing.^{10,32,33,40-41} The PFN has been developed as an alternative to the Gamma nail, and it seems to be associated with a lower incidence of

complication.⁴⁵ But in our study we found less reoperation rate (8.82%) along PFN group.

The optimal fixation device for extracapsular hip fracture is still controversial at present. Jones et al⁴⁶ compared the intramedullary nail (IMN), which involved gamma nail, intramedullary hip screw (IMHS), and PFN, with sliding hip screw for treatment of extracapsular proximal femoral fractures. They concluded that there was no statistically significant difference in the cut-out rate between the IMN and SHS while total failure rate and reoperation rate were greater with IMN. Parker and Handoll⁴⁷ also compared gamma and other cephalocondylic intramedullary nails with extramedullary implants for extracapsular hip fractures in adults. In their systematic review the author enrolled four studies which included PFN and Targon PF nail compared with SHS.

We enrolled studies of Pan et. al⁴⁸ and Pajarinen et. al³⁷ for analyzing blood loss and studies of Pan et. al,⁴⁸ Pajarinen³⁷ et. al, Parker et. al,⁴⁹ and Saudan et.al⁵⁰ for blood transfusion. A sensitive test was performed, which showed that, in blood transfusion, the two groups were still similar in their study. But in our study group I (PFN) and IV (DCS) have high percentage 46.88% and 56.25% respectively as compare to other group II (PFN) and III (PFLCP).

CONCLUSION

Optimal reduction of the fracture and positioning of the nail and screw, plate and screw remains of crucial importance and should be obtained at all times. A skilled surgeon may treat the demanding unstable extracapsular hip fracture with any type of fixation device, as long as he or she remembers that the fixation devices will never make up for surgical failure. Therefore improvements of treatment of extracapsular hip fracture will predominantly be in the hands of surgeon, rather than in hands of industry. Although the high drop out rate may bias the outcome when the overall recovery from the operation is assessed, it does not change the interpretation of the result when the four methods are compared, if the rate is

not much differentiating between groups.

The purpose of this study was to compare the results four implants in treatment of extracapsular hip fractures in elderly. We have concluded in our study that group II (PFN) was good and effective because it reduces surgical exposure, blood loss during operation, wound complication, mortality, chances of reoperation with highest clinical outcome.

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