Indian Journal of Basic and Applied Medical Research; December 2020: Vol.-10, Issue- 1, P.319 - 327
DOI: 10.36848/IJBAMR/2020/16215.55785

Original research article

Extracapsular upper end femur fracture fixation with extramedullary devices versus intramedullary devices

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ABSTRACT

Background : This study is undertaken to study extracapsular proximal femur fracture fixation using intramedullary and extramedullary devices.

Material and Method: In our study we did perspective study in 60 patients to evaluate results of open reduction and internal fixation with Dynamic Hip Screw (DHS) and closed reduction and internal fixation with Ender's nail and Proximal Femur Nail (PFN).

Observation: Operative treatment in form of internal fixation permits early mobilization but non union rate is higher in Ender's nail. Union occurs earlier than extra medullary procedure due to advantage of axial devices, closed procedure and lesser chances of infection. Implant back out and shortening was higher in Ender's nail and less common with PFN. Infection rate is higher in DHS.

Conclusion: Early weight bearing with internal fixation like PFN than Ender's nail poses advantage of intramedullary device. In our study PFN had better union rate, early mobilisation, less infection as compared to DHS and Ender's nail.

Key Words: Proximal Femur Fracture, Extra capsular, Intramedullary, Extramedullary, Dynamic Hip Screw, Ender's Nail, Proximal Femur Nail.

INTRODUCTION

Extracapsular proximal femur fractures are big challenge in traumatology. Patient of all age group are affected. With the modern method of treatment and awareness of healthy living, average life expectancy of Indian population has increased almost double fold 35 year to 66.09 years. Increasing life expectancy, sedentary life style and increasing traffic on road, lack of observing traffic rule have resulted in increased incidence of high velocity trauma resulting remarkable increased incidence of fractures. The conservative management has disadvantage of long hospital stay, prolonged recumbence joint stiffness, bed sore, malunion, delayed union and cardiopulmonary complications.

New concept for treatment of Extracapsular proximal femur fracture is anatomical reduction and internal fixation. Many newer devices are available for treatment of proximal femur fracture like extramedullary device and intramedullary device. In this study, DHS used as extramedullary device and PFN and ENDER's NAIL used as intramedullary device for treatment of Extracapsular proximal femur fractures according to Boyd and Griffin classification. In this study 60 patients of Extracapsular proximal femur fractures treated by extramedullary device and intramedullary device.

AIMS AND OBJECTIVES:

- Evaluation of results following close/open reduction and internal fixation with Proximal Femoral Nail in Extracapsular proximal femoral fractures.

- Evaluation of result following open reduction and internal fixation with Dynamic Hip Screw in Extracapsular proximal femoral fractures.
- Evaluation of result following closed reduction and internal fixation of Ender's in Extracapsular proximal femoral fractures.
- Comparative evaluation of results of extramedullary devices and intramedullary devices in Extracapsular proximal femoral fractures.

CLASSIFICATION

Intertrochanteric Fracture

(1) Evan's Classification (1949) based on stability of fracture pattern.

(a) Stable intertrochanteric fracture :

A stable intertrochanteric fracture is one when reduced has cortical contact without a gap medially and posteriorly. Medial cortex of proximal fragment and distal fragment are not communited. This contact prevents displacement into varus retroversion of proximal fragment of fracture when patient put his weight on that limb.

(b) Unstable intertrochanteric fracture :

There is communition of posteromedial cortex. The displaced lesser trochanter fragment and its size is a key to decide the instability of interotrochanteric fracutre.

(2) Boyd and Graffin Classification (1949)

(a) Type I : Fracture that extend along the interotrochanteric line from greater trochanter to lesser trochanter.

(b) Type II : Communited fracture, main fracture along interotrochanteric line with multiple fractures in cortex.

(c) Type III : Communited fracture basically subsrochanteric with at least one fracture line passing across the proximal end of shaft just distal part of the lesser trochanter.

(d) Type IV : Communited multiplaner fracture extending into proximal shaft of femur. Provides an idea of treatment option and permits a more accurate.

The Boyd and Griffin classification of trochanteric fractures :

Type 1 (top life), Type II (top right), Type III (bottom left), Type IV (bottom right).

BIOMECHANICS:

Biomechanics of the proximal femur :

Forces applied to the hip during ambulation produce stresses in the proximal femur because of the combined effects of axial, bending and torsional loads.

Normally the proximal femur is loaded so that the medial cortex is compressed and the lateral cortex is under tension.

Forces on the hip are:

- Compressive forces generated by gluteus medius.
- Body weight
- Joint reaction force
- Bending stress
- Shear stress
- Torque transmitted by the shaft (neck is offset from shaft which is the main cause of bending forces).
- Hip is a kind of first degree lever with unequal level arms.

MATERIAL AND METHODS

Total 60 cases were evaluated clinically and radiological, findings were corded in the Proforma and patients were given first aid by skin / skeletal traction till the definitive management. Patient were divided at random basis, patients were managed by open reduction and internal fixation with DHS and close / open reduction with PFN and closed reduction with Ender's nail. Cases were followed and evaluated at 6 weeks interval for 6 months, the results were evaluated observed and recorded radiological and functionally as per criteria's laid down by Harris hip score.

Additionally, in view of the Indian context, a number of other parameters significant to the daily Indian lifestyle, such as ability to squat and sit cross legged, etc. have also been considered and included as parameters of the study.

Preoperative Assessment :

Fracture patterns were classified as Type I, II, III, IV (Boyd and Griffin).

Functional Evaluation (Hip Joint Evaluation System by Harris - 1969)

The Harris score evaluates patients on the basis of four criteria namely pain, function, motion and absence of deformity. Pain and functional capacity constitute the major concern for patients operated in the region of hip and are accordingly assigned the heaviest weight age. Correction of deformity and joint motion, the other two criteria assume lesser importance from the rehabilitative point of view and are hence given a lesser score.

Based on this reasoning out of a maximum possible 100 points used to assess the functional results of patients the following division of scores is practiced for different components :

Pain	44
Function	47
Range of motion	5
Absence of deformity	4
Total	100

Harris Score on Followup

	Function						
	Gait					Activities	
Pain	Limp	Support Used	Distance Walked	Stairs	Shoes	Sitting	Enter Pub. Transport
Total Harries Score							
Overall Rating							

SCORING :

Total Harris Score	Rating
80 - 100	Excellent
50 - 80	Good
< 50	Poor

RESULT :

Table 1

Age distribution of study patients

Age (in complete years)	Intertrochanteric		Subtrochanteric		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
< 40	3	5%	7	11.66%	10	16.66%
40 - 49	4	6.6%	8	13.33%	12	20%
50 - 59	5	8.33%	3	5%	8	13.33%
60 - 69	13	21.66%	3	5%	16	26.66%
> 70	10	16.66%	4	6.66%	14	23.33%
Total	35		25		60	

X^2 = 10.89, p = 0.027 highly significant difference between intertrochanteric and sub trochanteric fracture regarding age distribution.

Maximum number of patients of intertrochanteric fracture is in 60-90 years (21.66%) and minimum number of patients of intertrochanteric fractures is in < 40 years (5%).

Maximum number of patients of subtrochanteric fracture is in 40-49 years (13.33%) and minimum number of patients of subtrochanteric fracture is in 50-69 years (10%).

Table 2

Sex distribution of study patients

Sex	Intertrochanteric		Subtrochanteric		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Male	24	40%	17	28.33%	41	68.33%
Female	11	18.33%	8	13.33%	19	31.66%
Total	35		25		60	

X^2 = 0.3, p = 0.90 no significant difference between intra trochanteric and subtrochanteric fracture regarding sex distribution.

Total number of male patients in our study are 41 (68.33%) and female are 19 (31.66%) male patients are more vulnerable in proximal femur fracture.

Table 3

Devices used in proximal femur fracture patients

Age (in complete years)	Intertrochanteric		Subtrochanteric		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
PFN	11	18.33%	9	15%	20	
DHS	12	20.00%	8	13.33%	20	
Ender's nail	12	20.00%	8	13.33%	20	
Total	35		25		60	

$X^2 = 0.14$, $p = 0.933$ no significant difference between intra trochanteric and subtrochanteric regarding PFN, DHS, ENDER'S Nail.

Table 4

Mode of injury in extracapsular proximal femur fracture patients

Mode of injury	Intertrochanteric		Subtrochanteric		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Simple fall	28	46.66%	8	13.33%	36	60.00%
RTA	7	11.66%	17	28.33%	24	40.00%
Total	35		25		60	

$X^2 = 24.3$, $p = 0.00098$ highly significant difference between intertrochanteric and subtrochanteric fracture regarding mode of injury.

Subtrochanteric fracture are more present in RTA (28.33%) intertrochanteric fracture are more present in simple fall (46.66%).

Table 5

Union seen in extracapsular proximal femur fracture patients for different devices

	Interotrochanteric			Subtrochanteric			Total	
	PFN	DHS	Enter's Nail	PFN	DHS	Ender's Nail	Frequency	Percentage
Non-union	0	0	1	1	1	2	5	8.33%
Union	11	12	11	8	7	6	55	91.66%
Total	11	12	12	9	8	8	60	

Nonunion rate higher with ender's nail in intertrochanteric and subtrochanteric fracture.

Table 6

Shortening found inextracapsular proximal femur fracture patients for different devices

	Interotrochanteric			Subtrochanteric			Total	
	PFN	DHS	Enter's Nail	PFN	DHS	Ender's Nail	Frequency	Percentage
No shortening	11	12	10	8	6	4	51	85%
Shortening	0	0	2	1	2	4	9	15%
Total	11	12	12	9	8	8	60	

Shortening is more associated with Ender's nail (6 patients) in proximal femur fracture.

Shortening is more associated with DHS in subtrochanteric patients than PFN.

Table 7

Complications inextracapsular proximal femur fracture patients for different devices

Complication	PFN	DHS	Ender's Nail	Total
Infection	1	4	3	8
Implant back out	1	2	8	11
Implant break down	1	1	-	2
Bed sore	-	-	3	3
Total	3	7	14	25

Complications rate is higher in ender's nail > DHS > PFN in proximal femur fracture.

Table 9

Walking status in extracapsular proximal femur fracture patients for different devices

	Interotrochanteric			Subtrochanteric			Total	
	PFN	DHS	Enter's Nail	PFN	DHS	Ender's Nail	Frequency	Percentage
Walk with support	0	1	6	2	6	4	19	31.66%
Walk without support	9	11	7	9	2	3	41	68.33%
Total	11	12	12	9	8	8	60	

Walk without support higher in PFN in proximal femur fracture.

Walk with support higher in Ender's nail in proximal femur fracture.

Walk without support higher in intertrochanteric fracture with DHS (11) while less (2) in subtrochanteric fracture.

Table - 10

Mean day for Cross Leg Sitting in extracapsular proximal femur fracture patients for different devices

Cross leg sitting	PFN	DHS	Ender's Nail
Mean	71 days	100 days	98 days
Standard deviation	19.2	13.1	12.9

ANNOVA TEST (F Test) = 9.91 At degree of freedom 50 at 95% confidence limit, highly significant difference observed between PFN, DHs Ender's Nail in case of cross leg sitting.

DISCUSSION

The aim of management accordingly has drifted to achieving early mobilization, rapid rehabilitation and quick return of individuals to promorbid home and work environment as a functionally and psychologically independent unit.Operative treatment in the form of internal fixation permits early rehabilitation and offers the best chance of functional recovery, and hence has become the treatment of choice for virtually all fractures in extracapsular proximal femur fracture. Amongst the various types of implants available i.e. fixed nail plate devices, sliding nail / screw plate and intramedullary devices, the compression hip screw is most commonly used but recently techniques for closed intramedullary nailing have gained popularity. PFN, DHS and Ender's nail implants and compare the result in these groups.

The mean age in our study was found to be 48 years in subtrochanteric fractures and 59 years in intertrochanteric fractures. Subtrochanteric fracture is high velocity trauma need more energy for fracture while intertrochanteric fracture is low velocity trauma need low energy for fracture. So intertrochanteric fracture is more common in old age patient who is more osteoporotic and subtrochanteric fracture occurs in your age patient.

The rate of union of all fracture with PFN was as early as 3 month to 5 month. Whereas DHS two part fracture united in 3 month two 5 month but subtrochanteric and communited fracture took more time. In Ender's nail rate of union of intertrochanteric fracture was 3.5 months to 6 months and subtrochanteric fracture took 4 monthto 6.5 month those found in other similar studies. Intramedullary devices ar enclosed procedure in which fracture hematoma is not disturbed which increased the rate of union while extramedullary devices are open procedure in which fracture hematoma is disturbed. Intramedullary devices are load bearing and axial devices while extramedullary devices are load shearing and eccentric devices due to this more amount of load transferred by intramedullary device than extramedullary devices which increased rate of union. Chance of infection are more an extramedullary devices than intramedullary devices, which also decreased rate of union.Intramedullary devices are more stable fixation than extramedullary devices Though the nonunion rate is higher in Ender's nail but union which occurs they are early than extramedullary due to advantage of intramedullary device like load bearing axial devices, closed procedure and less infection.

We found that full weight bearing walking (walking without support) was earliest for PFN (33 days) similar to other studies. Full weight bearing walking was most delayed for ender's nail (72 days) similar to other studies. Mobilization depends on medial continuity and communition of fracture. We start early mobilization in two part fracture and stable fixation (maintain medial continuity). In PFN partial weight bearing starts as early as 3 days and full weight starts as early as 25 days to 55 days. PFN is stable axial load bearing device in which maximum load transmitted by device and only few load transmitted by fractured bone which allow early mobilization. In DHS

mobilization starts late than PFN because DHS is eccentric load shearing device in these device load more transmitted by fracture site than device due to these early weight bearing may produce chances of non union or implant failure. In Ender's nail no locking system available so early mobilization may produce implant back out, collapse of fracture, loss of reduction etc. These complication delay the mobilization in Ender's nail.

The varus deformity at complete followup was least PFN (5%) and varus deformity at complete followup was found to be highest for Ender's nail (30%) similar to other studies. In DHS varus deformity occurs due to loss of medial continuity and osteoporosis. If DHS used in communited subtrochanteric fracture, collapse occurs and loss of alignment varus deformity occurs. In osteoporotic patient due to cut through of Richard Screw causes of varus deformity. In PFN chances of varus deformity is less because PFN is a stable devices which have to proximal screw one compressive screw and one anti rotation screw which prevent collapse and two distal locks on static and one dynamic which provide rotational stability, if we need collapse of fracture static screw should be removed.

In our study complication like implants back out, shortening etc are higher with ender's nail which is comparable with other similar study and which is less common associated with PFN.We studied that chances of infection are higher in extramedullary devices than intramedullary device because extramedullary devices are open procedure, due to these soft tissue trauma higher than closed procedure of intramedullary device. In old age, patients immunological status decreased which also increased risk of infection. We found that implant failure occurs more when medical continuity is not maintain and with these unstable fixation patient starts walking. We found that shortening more occurs due to uncontrolled collapse, which is occurs because of no locking system in ender's nail. We found that complication like bed sore are higher with ender's nail in which mobilization is late.

CONCLUSION:

Operative management for extracapsular proximal femur fracture is the best treatment, which provides early rehabilitation and functional recovery. The preferred implant is still a matter of debate.

The claimed advantage with intramedullary devices is that a smaller exposure is required than extramedullary devices, it therefore has advantage of lesser blood loss, shorter operating time and less morbidity. There may also be mechanical advantages, because the shaft fixation is nearer to the centre of rotation of the hip, giving a shorter lever arm and a lower bending movement on the device.

We found that in Boyd and Griffin type III and type IV fractures Proximal Femoral Nail has better results as compared to others (Dynamic Hip Screw and Ender's Nail).

Five patients in our study have nonunion out of which three patients have been treated by ender's nail. Incidence of infection was found to be lesser in Proximal Femoral Nail and higher with DHS.

We found that proximal femoral nails prove to be more useful in difficult fractures with a subtrochanteric extension or reversed obliquity and for high subtrochanteric fractures, where other forms of fixation are less stable.

Early weight bearing is the mainstay of treatment in internal fixation, which has delayed in ender's nail and earliest in PFN in our study.

Complication like shortening, varus deformity, implant back out etc. are more associated with ender's nail used in proximal femur fracture than others devices in our study.

In our study PFN had better union rate early mobilization less infection rate, less loss of stabilization and is therefore a better implant for extracapsular proximal femur fracture compared to both DHS and ENDER's NAIL.

The final choice depends upon the skill of surgeon and the type of fracture and also the facilities available.

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Date of Submission: 21 November 2020
Date of Publishing: 15 December 2020
Author Declaration: Source of support: Nil, Conflict of interest: Nil
Ethics Committee Approval obtained for this study? YES
Was informed consent obtained from the subjects involved in the study? YES
Plagiarism Checked: Urkund Software

DOI: 10.36848/IJBAMR/2020/16215.55785