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SUBTROCHANTERIC FRACTURE FEMUR TREATED WITH PFN- A SERIES OF 25 CASES

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Abstract:

Introduction: Subtrochanteric femoral fractures have been variously defined, but most authors limit the term to fractures between the lesser trochanter and the isthmus of the diaphysis. Subtrochanteric femur fractures have demanded special consideration in orthopaedic traumatology, given the high rate of complications associated with their management. The combination of compression, tensile, and torsional stresses in the region has challenged orthopedists with problems of delayed union, and nonunion resulting in loss of fixation, implant failure, and iatrogenic devascularization of the operative exposure. Only recently has a better understanding of fracture biology, reduction techniques, and biomechanically improved implants has allowed subtrochanteric fractures to be addressed with some success.

Material and Methods: Total of 25 consecutive cases of subtrochanteric femur fracture satisfying the inclusion criteria admitted in GSL Medical College Rajahmundry during June 2011 and October 2013 and were treated with a long PFN.

Results: Duration of hospital stay was comparable to past studies. Mean operation time in our study was 60-120 minutes. We did not come across any implant related complications compared to the 11% seen in the study by Menezes et al. As compared to DHS group of Parker et al (35 days hospital stay) the average hospital stay in our series was 17 days.

Conclusion: Long PFN is a good implant for subtrochanteric fracture of the femur. The advantages include minimal exposure (closed technique), better stability, less hospital stay and early mobilization.

Key Words: Subtrochanteric fracture femur, Proximal Femoral Nail.

Introduction:

Subtrochanteric femoral fractures have been variously defined, but most authors limit the term to fractures between the lesser trochanter and the isthmus of the diaphysis[5]. Subtrochanteric femur fractures have demanded special consideration in orthopaedic traumatology, given the high rate of complications associated with their management. The combination of compression, tensile, and torsional stresses in the region has challenged orthopedists with problems of delayed union, and nonunion resulting in loss of fixation, implant failure, and iatrogenic devascularization due to operative exposure.

In 7th and 8th decades of the twentieth century these fractures were popularly treated by ORIF using fixed angle blade plates. However they were having various postoperative complications as mentioned above including implant failures.

Only recently has been a better understanding of fracture biology, reduction techniques, and biomechanically improved implants has allowed subtrochanteric fractures to be addressed with some success.

In 1996, the AO/ASIF developed the proximal femoral nail (PFN) as an intramedullary device for the treatment of subtrochanteric femoral fractures. Use of PFN has helped to provide solution to the various problems associated with the treatment of subtrochanteric fractures with ORIF using fixed angle blade plates.

Gadegone WM et al. (2006), published the results of a prospective study of 100 patients with a pertrochanteric, intertrochanteric or high subtrochanteric fracture, or a combination of fractures, (December 2002 - December 2005) treated with a PFN. They emphasized the necessity of a careful surgical technique and modifications that are specific to the individual fracture pattern in order to lessen complications. They concluded that osteosynthesis with the PFN offers the advantages of high rotational stability of the head-neck fragment, an unreamed implantation technique and the possibility of static or dynamic distal lock[6].

In our present study we report here the results of a prospective study carried out at our institute on 25 consecutive patients who had suffered a subtrochanteric fracture between June 2011 and October 2013 and were treated with a long PFN. The main purpose of our study was to reiterate the utility of PFN in the management of subtrochanteric fractures.

Material and Methods:

Total of 25 consecutive cases (18males and 7 females) of subtrochanteric femur fracture satisfying the inclusion criteria admitted during June 2011 and October 2013 and were treated with a long PFN.

Inclusion Criteria:

1. Acute subtrochanteric femur fractures in patients aged from 18 years onwards
2. Pathological subtrochanteric femur fractures

Exclusion Criteria:

1. Open fracture
2. Cases infected in the preoperative period
3. Fractures in patients below the age of 18 year

In our study we used Harris Hip score for assessing the results.

Observation: Age Distribution

18 yrs-30 yrs	8
30 Yrs-50 Yrs	7
50 Yrs- 70 Yrs	9
More than 70	1

Patients were distributed across all age groups.

However, we came across only one patient above the age of seventy years

Case distribution according to Seinsheimer Classification:

Type	Type 1	Type 2 A	Type 2B	Type 2 C	Type 3A	Type 3B	Type 4	Type 5
No. of cases	0	4	5	6	5	4	1	0

We did not come across any Type 1 and Type 5 cases. Cases were distributed across all other types uniformly.

Duration of surgery:

Duration in minutes	No .of. cases
0-60	1
60-120	20
>120	4

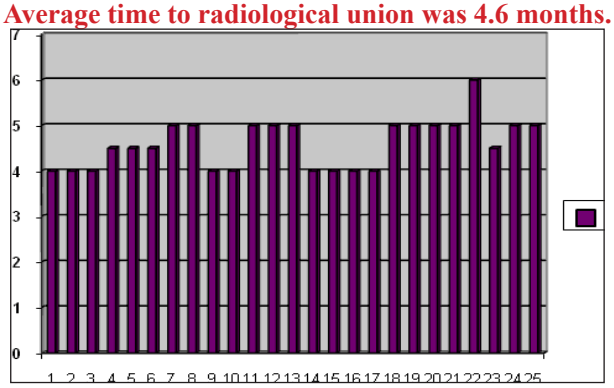
The operating time for 80% cases was between 1 to 2 hours. Operating time decreased with increasing familiarity of the implant system.

Postoperative Independence of Ambulation:

Post-op Duration	8 weeks	12 weeks	20 weeks
Walked independently	3	16	23
Waked using crutches	15	6	1
Walked using walker	7	3	1

Average time to radiological union

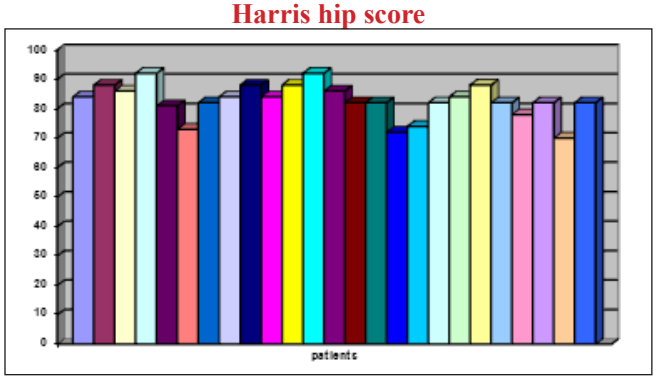
Average time to radiological union was 4.6 months.



Functional Outcome:

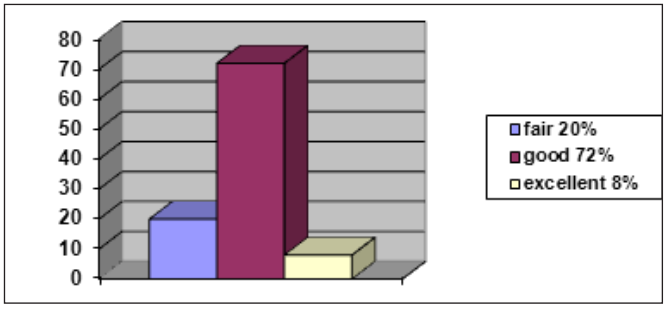
Duration Post-op	6 weeks	6 months	1 year
Attended Follow-up	28%	52%	16%
Able to Squat	20%	60%	80%
Able to walk	90%	94%	100%
Can rise from chair	40%	52%	90%

Harris hip score



Graph showing Harris hip scores of 25 patients

Functional outcome:



According the total score obtained 2 patients outcome was excellent, 18 patients were good and 5 patients had fair result

Complications:

Infection	1
Implant related	None
Medical/anesthetic complication	1
Limb length discrepancy	4

Discussion:

Boyd and Griffin in 1949 called attention to subtrochanteric fractures as a variant of peritrochanteric fractures and noted their higher incidence of unsatisfactory results after operative treatment. They defined a subtrochanteric fracture of femur as a fracture occurring between the lesser trochanter and a point 5 cm distal to it.[5] Based on this definition Fielding classified the subtrochanteric fracture in 3 groups. However, the advent of high speed motor vehicles, the scenario changed totally. The age of involvement, and the fracture pattern changed significantly showing a bimodal age distribution. Younger age group involved mainly the males with high velocity trauma and varied fracture pattern. The older age group had osteoporotic females with low velocity trauma. This required another classification to include the entire variable fracture pattern. Seinsheimer Classification proved to be better in this regard. The major complications associated with subtrochanteric fracture femur are Nonunion and implant failure. This is irrespective of the fixation method. The main cause of this failure includes:

1. Unique anatomical and biomechanical features of this region.
2. Thinner cortex as compared to that of remaining femoral shaft.
3. Starts from cancellous bone of GT and extend to diaphysis with thick cortex.
4. Causes implant failure due to high medial compressive and lateral tensile stresses occurring at this level.
5. Failure to restore posteromedial continuity of femoral cortex lead to increased stresses on implant leading to fatigue failure.

The method of ORIF using fixed angle blade plates involved extensive muscle stripping around fracture site causing avascularity, loss of fracture hematoma leading to delayed/nonunion, prolonged surgery time inviting postoperative infections and finally required perfect reduction, particularly restoration of posteromedial cortical continuity failure of which resulted in implant failure.

Closed reduction of the fracture preserves the fracture hematoma, an essential element in the consolidation process (McKibbin 1978)[13]. Intramedullary fixation allows the surgeon to minimize soft tissue dissection thereby reducing surgical trauma, blood loss, infection, and wound complications (Leung et al. 1992, Radford et al. 1993)[12, 18].

In 1996, the AO/ASIF developed the proximal femoral nail (PFN) as an intramedullary device for the treatment of subtrochanteric femoral fractures. The PFN is a short intramedullary nail designed with an additional antirotation screw. It is an implant based on the experience with the gamma nail. In addition to the advantages of intramedullary nail, it has several other favorable characteristics: pre-drillings is not necessary, can be dynamically locked, has high rotational stability, and mechanical stress concentration on the implant-bone interface is low.

The Indian versions of PFN are now available and have been used in our study[18,6]. It is available in two varieties, the standard and the long cannulated. The standard PFN consist of a 240 mm long nail. The distal part of the nail is available in 9,10,11 and 12 mm diameter and its proximal part is 14mm in diameter. However, due to increased reported incidences of stress fractures at the distal tip of short PFN in recent past[(6) (18)], we preferred to use long PFN in all our cases.

The long PFN comes in lengths of 340, 380,400 and 420 mm and is side specific. They are cannulated nails with diameter of distal part as 9mm, 10mm, 11mm and 12mm[20]. Its proximal part is 15mm in diameter. The angle between the two parts measures 11 degrees and is situated at 13 cm from the top of the nail. Two screws can be inserted through the proximal part, an 8.4 mm neck screw and a 6.5 mm anti-rotation screw. The PFN nail has been shown to prevent the fractures of the femoral shaft by having a smaller distal shaft diameter which reduces stress concentration at the tip. Due to its position close to the weight-bearing axis the stress generated on the intramedullary implants is negligible.

The PFN implant also acts as a buttress in preventing the medialisation of the shaft. The entry portal of the PFN through the trochanter limits the surgical insult to the tendinous hip abductor musculature only, unlike those nails which require entry through the piriformis fossa. The stabilizing and the compression screws of the PFN adequately compress the fracture, leaving between them a bone block for further revision should the need arise.

In 2015, we are now reporting a prospective study on 25 consecutive patients of subtrochanteric fracture (June 2011 - October 2013) treated with a PFN. Duration of hospital stay was comparable.

Mean operation time in our study was 60-120 minutes on an average. Initially when we were new to the procedure, the operating time was longer; however with increasing familiarity with the procedure the operating time reduced significantly.

Open reduction was required in five cases and in one of them we also used circlage wire to hold the comminuted fragment reduced.

We did not come across any implant related complications as compared to the 11% complications seen in the study by Menezes et al[14].

As compared to DHS group of Parker et al (35 days hospital stay) the average hospital stay in our series was 17 days.

Table 11: Comparison with previous studies

Christian Boldin (2003)[3]: The fracture healed - 55 patients. Maximum consolidation time - 5months, in 3 Z-effects seen- 3 cases. Since 1999 used a lateral ring on the hip pin to prevent Z effect.	Current study (2011): Clinical& radiological union– 25 (100%) Average consolidation time -4.6 months. Z-effect - 1 case at 6 month follow up.
Daniel F.A.Menez (2005)[14]: Failure of fixation 3 of 155 patients- (2%), femoral shaft fracture - 1 (0.7%). Implant cutout at 3 weeks postop-1 Treated with a hemiarthroplasty. Z effect – 1 Delayed fracture healing -1 One patient had a total hip replacement 3 months post-operatively. Reoperation rate (implant removal)- (12%) A stress fracture of the femoral neck -1 femoral malrotation -2 patients (1.3%) Fixation failure rate - 2% Femoral shaft fracture - 1 (0.7%).	Current study (2011) : Z-effect - 1 case at 6 month follow up. However, it did not come in the way of union. Our series has a lesser number of patients and the follow up durations are not comparable. However until most recent follow-up we did not perform any reoperations. Problem with Jig in positioning the screws was noted in five cases. Open reduction was performed in 5 case and in one of these cases Circlage wiring was performed. We did not come across any cases of femoral shaft fracture.

Table 12: Comparison of Functional Outcome

Functional Outcome: Comparison						
	Proximal Femoral Nail (n = 105)			**Proximal Femoral Nail (n = 25)**		
	6 Weeks	**4 Month**	**12 Months**	**6 Weeks**	**4Months**	**12Months**
	(Ekstrom et al.)[20]			**(Current Study)**		
Follow up						
Patients (n)	83	75	64	25	14	4
Walking 15 m						
Yes	88%	93%	90%	90%	94%	100%
No	12%	7%	10%	10%	6%	0%
Rising from a chair						
Yes	27%	48%	52%	40%	52%	96%

Walking 15 meters were comparable to the study by Ekstrom et al [20].

Our study included rising from squatting as a parameter.

The results may not be comparable as Ekstrom et al treated all proximal femoral fractures as compared to only subtrochanteric fractures in our study.

This study has clearly demonstrated the advantage of using long PFN in the treatment of subtrochanteric fractures in Indian patients. Fractures united in all cases and postoperative functional outcome was satisfactory. A larger study with PFN purely in subtrochanteric fractures would be more relevant to our series for comparison.

Conclusion:

Long PFN is a good implant for subtrochanteric fracture of the femur. The advantages include minimal exposure (closed technique), better stability, less hospital stay, early mobilization and most important high rate of union.

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