International Journal of Research in Orthopaedics
Mandalia MH et al. Int J Res Orthop. 2020 Jul;6(4):699-703
http://www.ijoro.org

Original Research Article

DOI: http://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20202560

Retrospective study for the results of proximal femoral nailing in subtrochanteric fractures

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Received: 22 March 2020
Revised: 07 June 2020
Accepted: 08 June 2020

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ABSTRACT

Background: Subtrochanteric fractures are prevalent in young and old age groups and one of the most notorious to achieve a stable fixation which allows early union and mobilization. This was a retrospective study to analyse the outcomes of proximal femur nailing in subtrochanteric fractures and assess the functional outcome, radiological union and compare that with studies of other modalities.
Methods: This was a retrospective study of 40 patients with sub trochanteric fractures classified by Sienshiemer classification and operated by proximal femoral nail implant. Clinical evaluation was done by Harris hip score.
Results: The average union time in our study was 5.12 months lower than some of the union rates of series with other implants (AO blade plate 7.7%). The conducive environment provided by proximal femoral nail (PFN) allows early mobility, independence to the patient and lessens the complications due to the bed ridden state and decrease the time in returning to work.
Conclusions: Our study suggests that PFN being and intramedullary implant gives stable fixation and early union as compared to extramedullary implants with less blood loss and less complications.

Keywords: Subtrochanteric fracture, Proximal femur nail, Seinsheimer classification

INTRODUCTION

In the 21st century the focus has shifted from anatomical fixation to biological fixation of fractures.[1]

Subtrochanteric fractures typically occur in the proximal femur between inferior aspect of lesser trochanter and distance of about 5 cms distally or the centre of isthmus of femoral shaft.

These fractures of femur are one of the most difficult fractures to treat. They represent challenges to achieving stable fixation and appropriate reduction regardless of age, these fractures differ significantly from femoral shaft fractures and more proximal femoral fractures in mechanisms, treatment and complications.[3-5]

Management of this fracture is difficult because this zone of femur is subjected to maximum amount of mechanical stress, tensile and compressive stresses can exceed several multiples of body weight (causing failure of implants), cortical bone (slow healing), associated communition, short proximal fragments which are deformed by hip flexors and abductors makes reduction of fracture difficult. Inspite of great advances made in the field of trauma in last 50 years management of this fracture has always remained subject of debate. There are several internal fixation options for managing these fractures that generally fall into

two categories: some form of intramedullary fixation or some form of plating.

The benefits of proximal femoral nailing (PFN) as an intramedullary implant as per the literature are indirect fracture reduction hence preserving fracture hematoma and decreasing chances of non union, lesser complications like blood loss, infection and early mobilization.[5] Intramedullary position of nail acts as mechanical barrier and prevents excessive collapse (controlled collapse) and prevents medialization early.[6] Short lever arm provides more force for bending due to intramedullary position. Because of rigid construct it acts as load bearing system and thus can be used in unstable type of proximal femoral fracture also where posteromedial continuity cannot be restored. The antirotation screw in addition to the neck screw provides excellent rotational stability. There is an inbuilt anteversion of the neck screw which helps to prevent retroversion deformity. Also, the anterior bowing and the anteroposterior angle of 6º is anatomical and helps in easy entry of the nail. The laboratory testing elucidated the mechanical performance of the nail in vitro highlighting the advantages and weakness in the design. None of the nails were superior in all tests when compared to PFN.[7]

Intramedullary position of implant holds proximal and distal parts in aligned position, restores, limb length and allows fracture to heal in good environment. In comminuted fractures also allows transmission of weight from proximal bony fragment to distal bony fragment (maintaining alignment) thus allows weight to be transmitted through natural bony course. Thus, increases implant life.

The primary aim of the study was to assess the results of proximal femoral nail of subtrochanteric fractures, to assess the functional outcome, radiological union and compare the same with other studies which have used a different modality of treatment.

METHODS

This was a retrospective study done on 40 patients with subtrochanteric fractures of femur operated with PFN at Dr. M. K. Shah medical college and research centre, Ahmedabad, from July 2016 to November 2019, with follow up of 6- 36 months.

The data was collected by interviews, follow up at intervals of 1, 2, 4 and 6 months, clinical examination and analyzing case papers.

Inclusion criteria

All patients above 18 years and closed fractures were included.

Exclusion criteria

Conservatively treated patients, pathological fractures, periprosthetic fractures and patients with vascular injuries were excluded.

Instruments used were reamers, guide pins, PFN –long, standard instrument set and jig. Seinsheimer classification for the subtrochanteric fracture.[2]

Surgical steps

Patient were given spinal or epidural anesthesia and shifted to a radiolucent fracture table in a supine position with perineal post. Operative leg was slightly adducted and put on traction. Opposite limb was put in a full abduction as to give space for the C-arm in between the legs. Reduction was achieved by traction and internal rotation primarily and adduction or abduction as required. Reduction was checked in a C-arm with anterior-posterior and lateral view. A 5 cm incision was taken above the tip of the greater trochanter and deepened to the gluteus medius muscle. Tip of the greater trochanter palpated and minimal muscle attachment was cleared off. Entry point is taken on the tip of the greater trochanter AP and lateral position. Total time of surgery and blood loss was noted intra operatively.

Post operative protocol

Quadriceps physiotherapy, strengthening exercises, SQE and calf pumping are started as soon as the patient is out of anaesthesia, followed by knee and ankle mobilization on post op day 2. Sutures were removed on 12th post operative day. Patients were advised to walk non weight bearing walking as soon as tolerable usually after suture removal. Partial weight bearing walking was started once further collapse is not expected radiologically around 8 weeks. Full weight bearing walking was allowed after assessing for radiological and clinical union. Patient was discharged around patient oriented discharge.[5] Patient is asked to come for follow up 1, 2, 3 and 6 months from the date of surgery. At each follow up patient is assessed clinically as per Harris hip score (Harris, traumatic arthritis of hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end result study using a new method of result evaluation-1969 JBJS). X-rays AP/LAT view of hip with femur were taken. The analysis of statistical data was done using Microsoft Excel (2010 version).[8]

RESULTS

All the cases were treated with intramedullary fixation-PFN. In this study all the patients involved were above 20 years of age. The age distribution was from 20 to 87 years of age. In younger and adult injury was caused by high velocity. Out of the two young adults who had a low velocity trauma one was of very poor socioeconomic strata and the other was a chronic alcoholic. In elderly age group

low velocity trauma causes this fracture (weakened osteoporotic bone may be the cause). Most of the patients (approx. 82.5%) in our study were males.

Table 1: Age or mode of injury.

Age (in years)	No. of patients (%)	Type	
		High velocity	Low velocity
20-50	25 (62.5)	23	2
>50	15 (37.5)	4	11
Total	40 (100)		

Table 2: Distribution of patients as per etiology.

Cause	Number	Percentage
Road traffic accident	18	45
Fall	19	47.5
Beaten by opposite party	3	7.5
Total	40	100

Most common cause of injury in our study was fall down closely followed by road traffic accident.

Associated injury

Overall, 22.5% of the patients had Associated injuries. 17.5% of patients had associated injury in form of fracture shaft femur, distal end radius and calcaneum fractures etc. five percent of the patients had other system injuries both of them had head injuries. Right extremity was more involved in our study.

Associated medical co morbidities

In our study 5 (12.5%) patients had hypertension and 4 (10%) had diabetes. One of them had both diabetes and hypertension (also had old Ca breast and asthma) had to be admitted in ICCU post operatively. These groups belonged to elderly age group mostly.

Table 3: Distribution of patients as per Seinsheimer classification.

Classification		Number	Percentage
I		-	0
II	A	3	7.5
	B	8	20
	C	3	7.5
III	A	11	27.5
	B	2	5
IV		9	22.5
V		4	10
Total		40	100

Overall, most common patterns were type II (two part fracture). Subtype IIIA (L.T. being the third part) was the most common individual pattern. Least common pattern seen was type I (un displaced).

Anesthesia

In this series most common mode of anaesthesia given was spinal 36 (90%) of the patients with 3 (7.5%) patients operated under epidural and 1 (2.5%) under general anesthesia.

Operation time

Average time of surgery in our series for PFN was 72.25 minutes.

Blood transfusion

Fifteen (37.5%) patients were given blood transfusion. Majority 12 of them because their preoperative haemoglobin was less (most of them were old patients with associated medical problems) and 3 of them were poly-trauma patients who presented with hypotension.

Union

The average radiological union time in our series is 5.12 months with 2 non-unions. The average full weight bearing walking time is in our series 4 months. Two patients had non union at the end of 9 months followup.

Table 4: Associated procedure.

Procedure	Number	Percentage
Encirclage	2	5
Inter fragment screw	2	5
Bone grafting	1	2.5

In PFN nail 2 patients with long spiral fracture encerclage wiring was done to hold fragments by opening fracture site. In one patient bone grafting was done because of delayed union (Table 4). There was shortening of more than 1 cm in 9 patients (22%) (Table 5).

Table 5: Limb length.

Procedure	Number	Percentage
Shortening <1 cm	8	20
Shortening >1 cm	9	22.5
Lengthening	2	5
Normal	21	52.5

Table 6: Harris hip score.

Results	Number	Percentage
Excellent	17	42.5
Good	9	22.5
Fair	9	22.5
Poor	5	12.5

Complications

Infection occurred in 2 cases, non-union in 2 cases, backout of screws in 2 cases and breakage of screws in 2 cases.

DISCUSSION

In comparison with pertrochanteric fractures, subtrochanteric fractures are generally associated with a slightly higher failure rate. The reasons for this include the greater intrinsic instability of the subtrochanteric fractures, demanding more stabilization, more difficult fracture reduction because the proximal fragment has the tendency to anteflex relative to the distal fragment, owing to psoas muscle activity; and shorter distance from locking screw hole to fracture.[9] Non-surgical treatment of subtrochanteric fractures has no or little place due to the high rates of non-unions, malunions due to inability to control muscle forces pulling the fracture fragments in different directions, as well as the morbidity and even mortality associated with the prolonged immobilization.[10]

Demographic data

Mean age of the present study population was 47 years and 62.5% of them were younger than 50 years. Male predominance was seen in number of cases and most of them belonged to age group of 20-50 years mainly because of more active life and so are more exposed to high velocity trauma. The mode of injury in young (92%) is due to a high velocity trauma. The fractures in older population were due to low velocity injuries (80%). This infers that majority of elderly present with low energy osteoporotic fractures.

Seinshemer's classification

Fractures were classified in the current study according Seinshemer's classification which now is most commonly used classification. Most common type was the II accounting for 35% of fractures followed by III accounting for 32.5% fractures.

Outcome variables

Variables like injury operation interval and operative time and methods and so are subjected to fluctuation. The study stated that fixation with proximal femoral nail takes less time as compared to fixation with other intramedullary and extramedullary devices but results of our study show that there is no significant difference between the two groups in terms of mean duration of surgery.

Reviewing the literature, it was seen in different series the time taken for surgery was variable and dependent on number of factors like the type of fracture, bone structure of the patient, the skill of the operating surgeon etc. and not solely on the implant used.

Variables like injury operation interval are subjected to fluctuation. As many of these fractures, are due to high velocity trauma, associated injuries also affected various factors like post operative mobilization and weight bearing irrespective of the modality and reduction of fracture and thus the final outcome.

Initially due to close procedure PFN was preferred but in few cases where fracture was mini-opened good results were obtained (cases with encirclage).

Inspite of inaccurate anatomical reduction (seen on X-rays) very good functions were seen in proximal femoral nails.

Associated co-morbid medical conditions like hypertension have ill effects on the final outcome of the patients. They caused an increase in the injury-operation time initially and longer rehabilitation thereafter.[11] There were 2 mortalities in our study. One patient died because of causes unrelated to surgery (chronic epileptic). The other was a female patient who had multiple medical conditions (diabetes mellitus, hypertension and metastatic Ca breast), presented with subtrochanteric fracture. PFN was done which backed out, reoperated by a hemiarthroplasty 15 days later. Patient had infection and died of multiple complications.[12]

Distal locking was always done and patient was mostly allowed bedside hip and knee bending on the 2nd post operative day (if not contraindicated by associated problems) and very good patient compliance was seen. Patients were normally discharged after 3rd post operative day. Prolonged immobilization and non weight bearing (>9 months) seen in other implants causes significant joint space narrowing.[13] 2 cases of infection was observed in the study of which only one was deep.

In few cases with communition in subtrochanteric fracture encerclage were done to increase the contact at the fracture site, thus increasing the chance of union of fracture. The amount of blood loss during operation was less because the femoral head is not reamed and the fracture site is not exposed compared to other intramedullary implants like Gamma nail or extra medullary implants like dynamic hip screw.[9,14]

The average union time in our study was 5.12 months lower than some of the union rates of series with other implants (AO blade plate 7.7%).[15] There were 2 non unions (5%) in our study. Non union rate of 28%, 10% for angled plate have been reported by Rahme et al and Erhan et al respectively.[15,16] The fixation of subtrochanterric fractures with intramedullary nail is significantly stronger and more rigid than dynamic condylar screw and dynamic hip screw (other extramedullary screw plate devices).[17] Preservation of fracture hematoma, controlled collapse and less chance of post operative infection aids early fracture union in PFN.

Most of the patients were operated within 5 days. The patients operated early had a better outcome than those in whom surgery was delayed.[4] Thus the favourable environment provided by PFN allows early mobility, independence to the patient and lessens the complications due to the bed ridden state and decreases the time in returning to work.[18]

CONCLUSION

The study results conclude that PFN (intramedullary implant) has proved to be better implant than extramedullary implant; PFN is a closed method, thus preserves the fracture hematoma yields early healing and less mean radiological union time in comparison to extramedullary implants; it is a quick procedure in the hands of experienced surgeon who has overcome the 'learning curve' with small incision significant less amount of blood loss and minimal preoperative complications. The observations of the study found significantly low infection rates and few immediate post operative complications in PFN; being a minimally invasive technique and operated mostly under spinal anesthesia PFN can be used effectively in elderly patients with multiple pre-existing illness.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Mandalia MH, Kubavat HL, Trivedi N. Retrospective study for the results of proximal femoral nailing in subtrochanteric fractures. Int J Res Orthop 2020;6:699-703.