Original Research Paper

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Analysis of Results of Proximal Femoral Nail(PFN) Versus Dynamic Hip Screw(DHS) in Type 2 Intertrochantric Femur Fractures

Medical Science

KEYWORDS : Dynamic Hip Screws(DHS), Intertrochantric fractures, Harris Hip Score, Proximal Femoral Nail(PFN).

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ABSTRACT

Background

Intertrochantric femur fracture is one of the most common fractures of the hip especially in the elderly with osteoporotic bones, usually due to low energy trauma like simple falls. Dynamic hip screws(DHS) is still considered gold standard for treating intertrochantric fracture by many. Not many studies compare the DHS with Proximal Femoral nail(PFN).,in type 2 intertrochantric femur fractures(Boyd and Griffith Classification).This Study was done to compare the functional and radiological outcome of PFN with DHS in treatment of type 2 intertrochanteric femur fracture.

Methods

From October 2012 to March 2015,a prospective comparative study was done where 30 alternative cases of type 2 intertrochantric fractures of hip were operated using PFN and DHS. Intraoperative complication were noted. Functional outcome was assessed using Harris Hip Score and radiological findings were compared at 3,6 and 12 months postoperatively.

Results

The average age of patients was 60 years.In our series we found that patients with DHS had increased intraoperative blood loss (150 ml),longer duration of surgery(105 min) and required longer time for mobilisation while patients who underwent PFN had lower intraoperative blood loss(73 ml),shorter duration of surgery(91 min) and allowed early mobilisation. The average limb shortening in DHS group was 9.33 mm as compared with PFN group which was only 4.72 mm. The patients treated with PFN started early ambulation as they had better Harris hip score in the early post-op period. At the end of 12th month, there was not much difference in the functional outcome between the two groups.

Conclusion

PFN is better than DHS in type 2 intertrochantric femur fractures in terms of decreased blood loss, reduced duration of surgery, early weight bearing and mobilisation,reduced hospital stay, decreased risk of infection and decreased complications

Introduction

When you submit your paper print it in two-column format, including figures and tables [1]. In addition, designate one author as the "corresponding author". This is the author to whom proofs of the paper will be sent. Proofs are sent to the corresponding author only [2].

Intertrochantric fracture is one of the most common fractures of the hip especially in the elderly with osteoporotic bones, usually due to low-energy trauma like simple falls 1.The incidence of intertrochantric femur fracture has increased significantly during recent decades and this tendency will probably continue in the near future due to the rising geriatric population and increase in the incidence of osteoporosis. The incidence of intertrochantric fracture varies from country to country. Gulberg et al. predicted that the total number of hip fractures will reach 2.6 million by 2025 and 4.5 million by 2050 2.In 1990,26% of all hip fractures that occurred in Asia were intertrochantric fractures whereas this figure could rise to 37% in 2025 and 45% in 2050 3.The goal of treatment of these fractures is stable fixation, which allows early mobilisation of the patient.These fractures are associated with substantial morbidity and mortality. Associated co morbid medical problem like diabetes, hypertension, pulmonary,renal and cardiac problems add to the insult of the fracture.Elderly patients are threatened with life threatening complications such as hypostatic pneumonia,catheter sepsis,cardio pulmonary failure and decubitus ulcer.All the circumstances mentioned above require using as urgent surgical solution for early rehabilitation and mobilisation of the patient 4.

They are also one of the most common fractures encountered in todays orthopaedic practice.Many treatment options are described aiming for stable fixation,which allows early mobilisation of the patient as they are unable to even partially restrict weight bearing 5.

DHS is still considered the gold standard for treating intertrochantric(IT) fractures by many.The advantages and disadvantages of DHS have been well established in several studies done in the past 5.Many studies compare the DHS with Gamma nail 6-8.Not many studies compare the DHS with PFN,which is preferred by many.This study was conducted to compare the functional and radiological outcome of PFN and DHS in treatment of type 2 IT fractures(Boyd and Griffith classification).

Materials and Methods

This was a prospective comaparative study conducted from October 2012 to March 2015.During this period 30 adult patients with type 2 IT of femur were selsected according to the inclusion criteria.Alternate patients who fulfilled the inclusion and exclusion criteria underwent PFN or DHS respectively

Inclusion criteria : Age >18 years

Sex-Both sexes

Type 2 (Boyd and Griffin Classification) Inertrochantric fracture

Fractures <2 weeks of duration.

Exclusion Criteria : Pathological Fractures

Polytrauma
Patients with co-morbid conditions like stroke that may hinder rehabilitation.

Standard preoperative planning was done.Radiographs of the pelvis with both hips antero-posterior view and traction –internal rotation view was obtained to confirm the diagnosis.

The length of Richard's screw was measured preoperatively on radiographs subtracting magnification.Neck shaft angle was measured to determine the angle for barrel plate. Non locking DHS plate with minimum of 6 cortices were fixed to the shaft distal to the fracture.In case of PFN,a standard length of 250 mm and 135 degrees angle nail was used in all the cases.The diameter was determined by measuring diameter of the femur at the level of isthmus on an AP Xray.All cases were operated on a single standard fracture under spinal anesthesia using standard operating techniques.C-arm was used in all cases.As a standard protocol,intravenous cefuroxime 1.5 gm was administered preoperatively and was used for 48 postoperatively. Intra-operatively the duration of surgery,the radiation exposure,intraoperative blood loss(method of Lee et al.) size of the incision and any associated complications were noted 9.

All patients in our study underwent a similar rehabilitation protocol involving mobilisation from the second postoperative day depending upon the physical condition of the patient,static quadriceps,knee and ankle mobilisation exercises.All drains were removed by 48 hours.The wounds were inspected on the 2nd post operative day.Stitches were removed between 10-14th day.Functional outcome was assessed using Harris Hip Score and radiological findings were compared at 3,6,12 months postoperatively.All patients were followed up for a minimum period of 1 year. There were no drop-outs in the study.

Statistical analysis were performed with SPSS software for Windows and $P<0.05$ was chosen to indicate statistical significance.

Results
Out of 30 patients,16 patients(53%) were males and 14 patients(47%) females.In our study,the average age was 60 years with 85 years being the maximum and 28 years being the minimum.We found that intertrochantric fractures due to trivial trauma(77%) was the most common mode of injury,followed by road traffic accidents(23%).Patients with road traffic accidents were younger while patients with trivial trauma were older.50% of the fractures occurred on the left side and 50% on right side showing no significant difference.As the surgical approach suggests,PFN requires a smaller incision(6 cm) to assess the entry site into the medullary canal compared to DHS which was found to be more than twice the length(17 cm).Sicle the distal locking was done using percutaneous stab incisions were required to complete the procedure.The duration of the surgery was calculated from the time of incision to the skin closure.The average duration of surgery for PFN was 90.6 mins,which was shorter than the average time required for DHS(105.3) (p=0.04).Following surgery,all swabs and mops with blood contamination from the surgical procedure were weighed to determine the amount of blood loss ,similar to the methods of Lee et al.9.The average blood loss in PFN was 73 ml ,while is DHS was 159 ml(p=0.001).5 out of 15 patients in DHS required blood transfusion either intra or postoperatively.Since the incision was smaller and duration of surgery was shorter in PFN,there was less tissue damage and hence lesser blood loss.

The sliding of both groups was compared at the end of 1 year on the radiographs as on the radiographs described by Hardy et al. There was an average of 4.3 mm of sliding in the PFN group as compared to 6.9 mm in the DHS group(p=0.001).10.The average limb shortening in DHS group was 9.33 mm as compared with PFN group which was only 4.72 mm(p=0.02).Even though there was more shortening in the DHS group it was not significant enough to cause any gait or functional impairment.The average hospital stay was 12.4 days(8-14 days) in case of DHS while 7.8 days(4-12 days) in case of PFN(p=0.001).Return to preinjury walking ability in DHS group was on an average of 12 weeks compared to PFN which was 8 weeks(P=0.03).

Out of 15 patients,5 patients(33%) required opening of the fracture site in DHS group.Two patients had medial comminution requiring additional bone grafting procedure from the ipsilateral iliac crest.Remaining three of them had soft tissue interposition in between the fracture fragments requiring open reduction.Two of these were underwent bone grafting.In PFN group,3 patients had jig miss match(20%),1 underwent open reduction(6.7%) and in 1 patient only one cephalic screw was placed (6.7%) and 1 patient only one cephalic screw was placed (6.7%) as the other screw couldnot be accommodated.Patients with jig miss match underwent free hand screw locking.(table 1).The average Tip Apex Distance (TAD) in DHS group was 18.3 mm(12-24 mm average).

As PFN is an intramedullary load sharing device as compared to DHS which is a load bearing,full and partial weight bearing was started at early stage for PFN patients(Table 2).

Radiological outcome was assessed at 3,6,12 months postop.At 3 months postop ,11 patients in both groups showed callus formation.4 patients in DHS group were found to have attempted callus formation with a gap.While in PFN group,2 patients who underwent bone grafting showed good intehgration of the graft while the remaining two patients showed callus formation with minimal gap.

At 6 months post-op,we found few variations and complications in both the groups.In the PFN group ,all the 15 patients showed good union of fracture while the other 2 patients who underwent bone grafting integration with union.Two patients had backing out of the proximal cephalic screw in PFN group but both of them united without any complication.Implant exit for these cases were done at 13th and 15th month respectively.In the DHS group,6 patients had collapse at fracture site and 8 patients showed solid union at the fracture site.One patient had varus malunion of 120 degress due to excessive collapse.

At 12 month postoperative, we found 13 patients in the DHS group had complete union of the fracture site with one patient continuing to have union 120 degree of varus which didnot progress.No such complications were noted in the PFN group,all the 15 patients showed good union of fracture at 12 months postop (table 3)

At the end of 3 months, we found that the functional results calculated using the Harris hip score in patients of DHS scored an average of 32.67 compared to PFN group that allowed 52.87(p=0.001).Scores increased to 67.6 and 85.4 for DHS and PFN group respectively at the end of 6

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months(p=0.001).But at the end of 12th month, the average functional scores in the DHs group increased to 89.08 as compared to PFN group which was 90.33(p=0.31).There was not much significance between two groups(table 4).

Table 1 : Intraoperative complications in each group and additional procedures carried out in each group

	DHS(n=15)	PFN(n=15)
Intraoperative complications	Open reduction-5(33.3%)	Jig mismatch-3(20%)
		Open reduction-1(6.7%)
		Solitary cephalic screw-1(6.7%)
Additional Procedures	Bone Grafting-4(26.7%)	Bone Grafting-2(13.3%)
	Bone Marrow infiltration-3(20%)	Bone marrow infiltration-2(13.3%)

Table 2 : Showing the average number of days/weeks taken for postoperative patient mobilisation in each group

Patient mobilisation	DHS(n=15)	PFN(n=15)
Active hip and knee mobilisation	4.27 days	2.33 days
Non weight bearing crutch walk	2.93 weeks	1.53 weeks
Partial weight bearing walking	7.87 weeks	3.73 weeks
Full weight bearing walking	11.80 weeks	7.93 weeks

Table 3

Follow up month	DHS(n=15)	PFN(n=15)
3rd month	ACF+Gap-4(26.7%)	ACF-11(73.3%)
	ACF-11(73.3%)	ACF-BG Integration-2(13.3%)
		ACF with Gap-2(13.3)
6th month	CAFS-6(40%)	CF-11(73.3%)
	CF-8(53.3%)	CF+BG Integrated-2(13.3%)
	United in varus-1(6.67%)	Z Effect-2(13.3%)
12th month	Complete Union-12(80%)	Complete union-13(86.7%)
	United In Varus-1(6.67%)	Z effect with union-2(13.3%)
	Re-fracture-1(6.67%)	
	Infection-1(6.67%)	

Table 4 : Average Functional Score(Harris Hip Score)

Functional Score	DHS(n=15)	PFN(n=15)
3 months	32.67	53.87
6 months	67.60	85.40
12 months	89.08	90.33

Discussion

In the last few decades treatment of intertrochantric fractures has evolved significantly.Various Methods of fixation devices has come and gone.The treatment still merits the typr of fracture and quality of bone.DHS has been the considered the gold standard of intertrochantric fracture fixation for a long time.

Historically Smitrh Peterson nail and Jewet nail were introduced in the 1930's.In 1950's and 60's Pugh and Massie modified sliding devices and dynamic hip screw were developed.Kuntscher,Zickle,Grosse,Kemph and Russell and Taylor developed Intramedullary nail with sliding hip screw,11,12,13..In the early 90's intramedullary devices were developed for the fixation of intertrochantric femur fractures.These devices had numerous biomechanical and biological advantages over original design of DHS.The advantages and disadvantages of the original design of the Gamma nail have been well established in several studies done in the past,usually by comparing the results with DHS 10,14,15

Recent data suggests intramedullary devices have been very goof with union rates upto 100% compared with other extramedullary devices which show union up to 80 % only 14,15.

Kyle et al. Has noted that increased forces are required to initiate sliding in intramedullary devices as compared to sliding hip screw with plate 16.Amongst all intramedullary devices the Gamma nail requires the largest force. The explanation lies in the barrel of the side plate,the barrel provides a free passage for the screw to slide,thus the longer the barel length the less the forces required to initiate sliding.The nail in the medullary canal provides a physical block to significant shortening of the head and neck fragments in the fractures which explains the minimum shortening in the PFN group as compared to DHS group11. Randomised post op rehabilitation study by Pajarinen et al. Comparing peritrochantric femoral fracture treated with DHS and PFN suggested that the use of PFN may allow faster postoperative restoration of walking ability when compared to DHS17.In our study patients who underwent PFN returned to preinjury walking status earlier than patients who underwent DHS.Proximal femoral nailing creates a short lever arm,which translates to a lower bending moment and a decreased rate of mechanical failure10.PFN has showed to be more biomechanically stronger because they can withstand higher static and several fold higher cyclical loading than dynamic hip screw.The implant compensates for the function of the medial column.Proximal femoral nail also acts as a buttress in preventing the medialisation of the shaft.18,19

PFN is better than DHS in type 2 Intertrochantric fractures of femur in terms of decreased blood loss,reduced duration of surgery,early weight bearing and mobilisation,reduced hospital stay,decreased risk of infection and other complications20.It is just a matter of time that PFN replaces DHS as the gold standard for type 2 intertrochantric femur fractures

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