ISSN: 0976-3031

Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 7, Issue, 12, pp. 14769-14773, December, 2016

International Journal of Recent Scientific Research

Research Article

COMPARATIVE STUDY OF SURGICAL AND FUNCTIONAL OUTCOMES OF INTERTROCHANTRIC FRACTURES TREATED WITH DHS (DYNAMIC HIP SCREW) AND PFN (PROXIMAL FEMORAL NAIL)

Vijay sarukte*[1]., Rohit jain[2]., Ravi Bhanushali[3] and Umesh nagrale[4]

[1,2,3,4]Department of Orthopaedics, K.B.Bhabha Hospital, Bandra (w)

ARTICLE INFO

Article History:

Received 17th September, 2016
Received in revised form 21st October, 2016
Accepted 05th November, 2016
Published online 28th December, 2016

Key Words:

Intertrochantric Fractures, Pfn, Dhs, Harris Hip Score, Boyd And Griffin

ABSTRACT

Intertrochantric fractures (IT) are most frequently encountered in orthopaedic practice, but they pose big challenge in as far as treatment is considered. DHS has been the gold standard for operative management of this fracture. But recently PFN has been used extensively in various Centre. The purpose of this study is to compare the surgical and functional outcome of the patients treated with PFN and DHS and to determine their advantages and disadvantages. Methods-A prospective study of 40 patients with IT fractures of type 1 to 3 Boyd and Griffin at our institute. They were treated either with PFN or DHS. Patients were evaluated by various criteria like time for full weight bearing, union time, deformity, shortening, pain disability and were assessed by Harris hip score system. Plain AP and Lateral Radiographs of pelvis and both hips were obtained for every patients. Minimum follow up was done at 3 months and result were assesses by using Harris hip score system and Radiographs at final follow up. Result: Excellent-good clinical outcome was obtained in 80% of patients treated with DHS and PFN. Early rehabilitation and early return to work was more possible in patients. There was one case of varus deformity and one case of shortening in PFN group and 2 cases of varus deformity and 3 case of shortening in DHS group. There were 2 cases with reverse Z effect in PFN group. Post-operative infection developed in 4 patients (2 in each group). Superficial wound infection was seen in 3 cases in total of which 1 case in PFN group while 2 cases in DHS group. There was less blood loss in PFN group. Conclusion: Duration of hospital stay is significantly reduced amongst the patients operated by PFN compared with DHS and rehabilitation was also faster by starting earlier sitting and thereby reducing morbidity and burden to hospital. Consequent earlier return to normal routine life can be expected. Although overall outcome of the patients at final follow up remains almost same. Less exposure and less blood loss due to closed procedure does help in rehabilitation of the patients, fasten the recovery and thereby reducing psychiatric problems related to it.

INTRODUCTION

Intertrochantric fracture (IT) in elderly age group are associated with challenging complication to orthopaedic surgeons so these fractures need to be managed surgically and make elderly patient ambulatory as soon as possible and so as to achieve these goal two types of implants are used for fixation Dynamic hip screw (DHS) and proximal femoral nail (PFN) (Radford *et al* 1996)[1]. These implants provide secured fixation and controlled impaction of fractures with lower rate of complication. Using both of these implants excellent results have been achieved. However there remain unsolved problems in the acceptability of these implants in unstable IT fractures. Failure rate are higher upto 8 -25% with unstable fracture patterns[2] and as high as 50% in most unstable fracture [3](Medoff *et al* in 1991 and Haidukewych *et al* in 2001).

Several modifications of intramedullary hip screw have also been suggested to improve upon the outcome in these comminuted and complicated cases, medoff suggested a device based on biaxial dynamization principle for the fixation of these unstable pertrochantric fractures with fairly good results. Acrylic bone cement has also been tried in conjugation with screw plate system in older patients having unstable fracture with severe osteoprosis[4] (Wolfgang *et al* in 1982). However modification of these devices achieved only medial arch support for fracture stability but still comminution of greater trochanter being the attachment site for abductor muscle, fractures that result in the comminution or displacement are likely to affect the eventual outcome and therefore they recommend it should be reconstructed.[5] (Koval *et al* in 2001).

*Corresponding author: *Vijay sarukte*
Department of Orthopaedics, K.B.Bhabha Hospital, Bandra (w)

MATERIALS AND METHODS

Between February 2013 to june 2015 total of 40 patients with IT fractures admitted to secondary care municipal hospital in Mumbai were considered for the study. Patients in emergency were splinted, traction was given, supportive care, analgesic, iv fluids and routine radiograph AP and lateral view of the proximal femur of the involved limb was carried out. After initial management and treating their morbidities written informed consent was taken with explaination of the implants and cost. Stable patients were taken for the surgery at the earliest after the pre anaesthetic evaluation. All patients with type 1,2,3 boyd and Griffin fracture, evans all stable and unstable fracture, were included for study while type 4 boyd and Griffin and medically unfit patients were excluded.

PFN of size 250mm in 20 cases with proximal diameter 17 mm, distal diameter of 9-12 mm, neck angle 130 or 135 degree with 10 degree of anteversion was used .This nail had a radius of 3000mm in anteroposterior and 4 degree of mediolateral curvature. Proximal portion of the nail has a provision to accommodate 2 screws the lag screw is of size 7.9 mm and is available in different lengths ranging from 55mm to 115mm. there is a set screw (Hip pin) which is of size 6.5mm and is available in different lengths ranging from 55mm to 115 mm. This screw controls the rotation hence anti rotation screw. Nail of uniform length 250 mm was used in all cases. While the diameter of the nail was measured using conventional radiographs and by measuring the inner diameter of the cortex at isthmus.

Clinical details of all the patients with IT fractures were recorded in proforma prepared. After the completion of the hospital treatment patients were followed up at outpatient level at regular intervals for serial clinical and radiological evaluation till fracture union and functional recovery.

Operative technique- The patient were placed in a supine position on a fracture table with adduction of the affected limb by 10-15 degree and closed reduction of the fracture was done by gentle rotation and traction. Unaffected leg was flexed to accommodate image intensifier. IT fracture was fixed using 2 k wires which pass along the anterior cortex of greater trochanter and neck of femur to head of femur, by doing so we prevented the opening up of fracture on abduction during nail insertion. Tip of the greater trochanter was located by palpation and using image intensifier and 5 cms longitudinal incision was taken from the tip of greater trochanter. A parallel incision was made in the fascia lata and gluteus medius was split. Tip of greatertrochanter was exposed. Entry point was made lateral to the tip of greater trochanter. Guide wire was inserted from the entry point, lateral view was used to confirm guide wire was central, Reaming was done subsequently. Nail as determined on fracture geometry and preop planning and size of the cortex was inserted gently with rotatory hand movements.

With the help of aiming device guide wire was inserted in caudal area of head and neck. Final position of guide wire is in lower half of the neck in AP and centre of femoral head in lateral view. A second wire was inserted through the drill sleeve above the first one for hip pin. Derotation screw was inserted to prevent possible rotation of medial fragment, the length was measured 5 mm short of the guide wire which is put with the help of hexagonal cannulated screw driver. Position is confirmed with C arm, guide wire is removed, neck screw is then inserted the length was determined with the measuring device.

DHS- First reduction of fracture is done under C arm guidance, after which surgery is done using DHS implant system that includes lag compression screw and angulated barrel plate 135 degree. The important step in surgery is position of lag screw in neck and head. It should be in the centre in AP and lateral or posteroinferior for strong screw anchorage. Position of the screw in the head is determined by tip apex distance (TAD) which should be less than 25mm to prevent cut out or failure of the implant.

Both categories of patient were assessed post operatively at interval of 6 weeks and then once in 3 month till one year by MODIFIED HARRIS HIP SCORING SYSTEM. Post-operative patients were given i.v antibiotics for 3 days. Patient were taught quadriceps, ankle pump and gait training in stable fracture while in unstable fracture patients weight bearing was delayed.

RESULTS

In our study of 40 cases of IT fractures majority of cases were in the age group of50-60 yrs (n=10),with mean age of PFN group(15 males and 5 females) 56.6yrs and DHS group(12 males and 8 females) 58.5 yrs. Majority of the patients(elderly) had a domestic falland RTA was the cause in young patients. We had 25% cases of type 1, 50% cases type 2 remaining 25% patients with type 3 boyd and griffinIT fractures types. Majority of the patients were operated within 10 days of hospital admission (n=30) and remaining 10 were delayed due to medical problems. Average time lapse for surgery was 7.25 days. Three patients of PFN group (n=20) patients had associated injuries - 2 patients had distal end radius fracture and one patient had fracture calcaneum and were treated by conservative management in the same settings. While in the patient operated by DHS two patients were found to have head injury CT brain was done, there was no major findings on CT scan except cerebral edema and 2 cases of ipsilateral distal end radius fracture for which ORIF was done. Average length of the nail in PFN was 250mm and average size of barrel plate in DHS was 135 degree 4 hole plate. Diameter of the nail was 9mm to 12mm, In 4 cases 9 mm diameter nail used in 15 cases 10 mm diameter nail used and in 1 cases 11 mm diameter used.

Length of proximal screw (range 75mm-115mm) in 3 cases 75 mm, 2 cases 80 mm,8 cases- 85mm, 4 cases 90mm and in 3 cases 95mm was used. Anterotation screw(range 65 mm-80 mm) in 3 cases 65mm,in 2 cases 70 mm, in 8 cases 75mm and in 7 cases 80 mm screw was used.

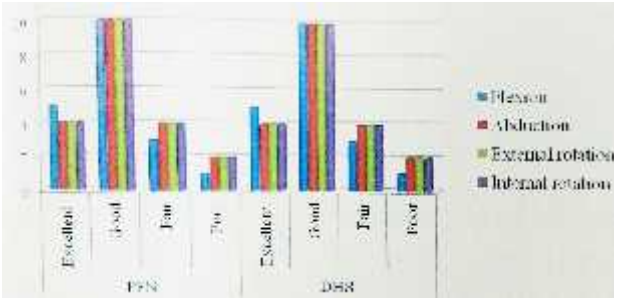
While in DHS length of Richard screw used in range of 65-75mm in length ,one case 65 mm, 2cases 70mm, 7 cases 80mm, 5 cases 85mm and in 2 cases 90 mm while in one case 95mm.

Systemic complication in both the group shown in Table no 1.
Implant related intra operative complication – in 4 cases operated by PFN, there was ill fitting jig, the holes of thejig and nails were not matching, malposition of the proximal screw, while in cases operated by DHS one case encountered

difficulty in reduction, infection due to delay in surgery. Radiological complication-among the case operated by PFN there were no cases with Z effect, 2 cases with reverse Z effect and in 1 case nail was broken between the proximal and distal lock, there were no case of Cutout of lag screw or bolt breakage. In DHS group excessive backout of Richard screw was seen in one case while no cases showed Plate breakage or cortical screw looseing.

Table no 1 comparative results of PFN and DHS group

	PFN Group	DHS Group
No of patients	20	20
Sex wise distribution	Male- 15 Female-5	Male-12 Female -8
Mode of trauma-RTA	6	8
Domestic fall	13	12
Assault	1	0
Side of injury- Right	12	9
Left	8	11
Stability pattern-Stable	8	12
Unstable	12	8
Boyd and griffin		
Type 1- 10(25%)	5	5
Type 2- 20(50%)	10	10
Type3- 10(25%)	5	5
Posted for surgery		
Within 10 days	14	16
After 10 days	6	4
Types of reduction- open	5	3
Closed	15	17
Associated injuries-head injury	0	2(50%)
Distal radius fracture	2(66.67%)	2(50%)
Fracture calcaneum	1(33.33%)	0
Total=	3	4
Mean duration of screening(sec)	80	60
Mean duration of operation(min)	90	80
Mean blood loss(ml)	120	180
Complications-chest infection	1(5%)	1(5%)
UTI	1(5%)	1(5%)
Superficial wound infection	1(5%)	2(10%)
Rotational malalignment		
External rotation	1(5%)	0
Varus deformity	1(5%)	2(10%)
Shortening	1(5%)	3(15%)
Radiological complication		
-Reverse Z effect-	2(10%)	
-Breakage of nail-	1(5%)	
- Excessive lag screw back out	-	1(5%)



Graph 1 Functional outcomes (ROM) as per modified Harris hip score in PFN and DHS

Patients were hospitalized for average duration of 3 weeks, with similar mobilization in both PFN and DHS group however early weight bearing was done in PFN group. Average duration of fracture union was 16 weeks (12-20 weeks).

Range of movement was assessed per HARRIS HIP SCORING SYSTEM, good to excellent result was found in most cases operated by both the devices. Overall 70% good range of motion in all patients.

Image no 1-Preop
PFN GROUP

No 2- post operative

No 3- preop
DHS GROUP

No 4- post operative

Complication-head penetration

Table no 2 functional outcomes (ROM) as per modified Harris hip score in PFN and DHS

ROM	PFN(TYPE 1 TO 3)				DHS(type 1 to 3)			
	Excellent	Good	Fair	Poor	Excellent	Good	Fair	poor
Flexion	5(25%)	10(50%)	3(15%)	2(10%)	5(25%)	10(50%)	3(15%)	2(10%)
Abduction	4(20%)	10(50%)	4(20%)	2(10%)	4(20%)	10(50%)	4(20%)	2(10%)
External rotation	4(20%)	10(50%)	4(20%)	2(10%)	4(20%)	10(50%)	4(20%)	2(10%)
Internal rotation	4(20%)	10(50%)	4(20%)	2(10%)	4(20%)	10(50%)	4(20%)	2(10%)

DISCUSSION AND ANALYSIS

The aim of operative treatment of IT fracture is to achieve fast rehabilitation and to get back to activities of daily living as functionally and psychological independent unit. Among the various implant system, DHS is most commonly used and remains the gold standard but recent techniques of closed intramedullary nailing have gained popularity. In the study an attempt was made to survey evaluate document and quantify our success in the management of proximal femur nail and dynamic hip screw implant and compare the results in these two groups. The study was conducted in 40 patients (20 cases by PFN and 20 cases by DHS) of proximal femoral fractures.

Most patients in our study were from 5 to 6 decade of life anddue to low energy trauma like domestic fall (home), while young patients with IT fracture sustained high velocity trauma. This was also seen in study by keneth j. koval, joseph (Zuckerman *et al* in1996)[5] and Gallanghar et al[6] who reported an eight fold increase in IT fracture in men over 80 and women over 50 yrs of age. The reason being senile osteoporosis, hip being the major weight bearing joint cannot withstand abnormal stress, inadequate local shock absorbers and protective reflexes. This fractures were common in males than females, because males have more outgoing activities and females play a more dormant role in rural setup. However in western studies female had more preponderance as suggested by Boyd and Griffin 1949[7], which were mainly due to senile osteoporosis.

Stability of IT fractures depend on integrity of posteromedial cortex and 30%mortality rate occurs in conservative line of treatment according to mervyn evans[8]. Hence urgent surgical intervention not only avoids morbidity like pneumonia, cardiorespiratory failure, decubitus ulcer but also avoids mortality.

In 1985 AO introduced four principle of fracture fixation which were expected to improve the results of fracture treatment (muller *et al* 1982). These principle were

1. anatomical reduction
2. stable internal fixation
3. preservation of blood supply
4. early active pain free mobilization of muscle and joints

Based on these principle DHS implant system was made by AO-ASIF group swiss. Its fixation is most widely used and its the time tested method[8,9](evan *et al* 1949 and sudhir babhulkar *et al*). Due to long lever arm, more soft tissue dissection, blood loss, wound infection and implant failure intramedullary PFN was introduced however it is also associated with disadvantages like protrusion of proximal screw and fracture of shaft of femur nail below its tip.

DHS works on the principle of controlled concentric collapse and was introduced by Clawson in 1964. It is based on following mechanism to minimize complication, blunt tip minimizing chances of head penetration, sliding feature for controlled collapse and impaction of fracture while maintaining the neck-shaft angle and controlled rotation, groove and key mechanism controls rotation and additional strength at nail plate junction. Its placement is away frommechanical axis, increasing moment arm and tensile stress and thus behaving as load sharing device.

PFN implants are closed to mechanical axisso less tensile stress and smaller lever arm thus acting as load bearing device. In PFN there is provision for two screw i.e antirotation screw(hip pin) and lag screwmaking it more stable (babhulkar sudhir 2006)[9]. Depth of insertion of lag screw within the femoral head is critical for maximal purchase on proximal fragment. It should be inserted within 1 cm of the subchondral bonefor optimum purchase. Anatomical and biomechanical study have shown superomedial quadrant as the weakest part and cutout is usually due to poor positioning of screws in this part.[9]

PFN is advantageous compared to other devices due to biomechanical stability, minimally invasive technique,less dissection(small incision) , less wound complication, minimal interference with the blood supply of femoral head[10], retention of fracture hematoma, early mobilization, less chance of shortening at fracture site due to controlled concentric collapse, and less incidence of varus collapse[10,11](windoff j al in 2004 and wasudeo gadegone *et al* in 2010). However steep learning curve, comminution of entry point at lateral cortex, Z effect, reverse Z effect, joint penetration and implant backout makes it unsuitable. We used nail diameter of 9mm -11mm as in indian scenario average diameter of medullary canal is found to be 9-10 mm[12](Mc Laughhlin *et al* in 1995). Lag screw (7.9mm) in PFN carries most of the load and the smaller antirotation screw (Hip pin -6.4mm) provides rotational stability. If the length of Hip pin is larger than the lag screw then hip pin will become loose and result in Z effect this might force the pin to slide into the joint and lag screw slide laterally. If shorter hip pin is used compared to lag screw i.e less than 10mm then load carried by hip pin was 8-39%, and there was no cut out from the femoral head or unacceptable placement of implant or fracture displacement (Boidin *et al* and evan *et al*)[8,13]

Reverse Z effect as described by Boidin [13] movement of hip pin occurs towards the lateral side. Mechanism of this effect is similar to Z effect but here hip pin slides back, whereas neck screw impacted to hole of nail. Lateral sliding of screw is more in PFN than gamma nail because of impaction of fracture.

In DHS fixation of the Richard screw (Lag screw) Tip apex distance (TAD) rule is applied i.e it should be less than 25mm and screw should be in center in AP and Lat views. In patients with DHS more wound complication are seen due to more exposure and more blood loss. This was seen in our study in DHS group, were suture site was infected and was resolved with antibiotics. However one case of PFN also showed infection at the distal lock. Bodoky *et al* in his study suggested use of two doses of prophylactic antibiotics to reduce wound complication[14].

PFN offers an advantage in form of rotational stability of head and neck fragment. In our study one case of varus deformity was seen due to early backing of screw while in DHS 2 case of varus deformity was seen due to pull of the muscle causing distal shaft fragment to migrate upwards. Other deformity was of shortening in DHS group, this was also seen in a series of patients by K.D.Herrington *et al* [15]and Julru p. rao[16]. PFN nail has been shown to prevent the fracture of femoral shaft by having a smaller distal shaft diameter which reduces stress

concentration at hip and thus preventing fixation failure and thereby reducing implant related post operative complication.

Rehabilitation is the key to prevent complication due to immobilization so both group were started with quadriceps drill exercise however early weight bearing was started in PFN group because of stability of implant. In a study by G.S Kulkarni [17]ambulation was started in 11-12 days and in study by B.Mall[19] was 14 days. As incision taken by PFN are small so lesser blood loss however if meticulous dissection was done in DHS group it was noted that blood loss in DHS group was also reduced significantly. The range of motion as calculated by Harris hip scoring system treated by both implant group was found to be similar, i.e good to excellent. In very few cases poor result was found this was mainly due to other associated factors mainly long interval between trauma and surgery and development of post operative infection.

Some recently introduced nail types and implant system like PFN-A (Antirotation), Intertan nail, Vero nail, Fixion nail, short PFN.Third generation of cephalomedullary nail PFN developed by AO/ASIF in 1997 to overcome the possible complication of second generation nail(Gamma nail)[10]. Addition of 6.4 mm antirotation screw helped to reduce the incidence of the implant cut out and rotation of cephalomedullary fragment[18] (Stern MB et al). Smaller diameter and fluting tip helped to reduce the stress forces below the tip of the nailand thereby reducing the incidence of low energy fractures at nail tip[9]. Stress rising of the construct also can be reduced by increasing length, small valgus angle and higher location of this angle at nail tip.[9]

Thus numerous modailities are available for proximal femoral fracture fixation however PFN appears to be a better modality considering its biomechanical properties.

CONCLUSION

In this study we aimed to evaluate whether theoretical advantages of PFN and DHS implant system could be proved in practice by a comparison of their results. We found that there was a lesser blood loss, shorter operating time and less morbidity with PFN, biomechanically sound fixation with PFN due to a shorter lever arm and lower bending movement.there was lower incidence of malrotation, deformity and wound infection with PFN. The fractures which were severely comminuted were treated by DHS device. The learning curve for treatment of fractures by DHS was smaller compared to PFN. The implant related complication were lesser in DHS group. The rate of union in both groups were similar and both implant in their own right are excellent modalities in the management of intertrochantric fractures.

Bibliography

1. Radford PJ, Needoff M, Webb JK. A prospective randomized comparison of thedynamic hip screw and the gamma locking nail. *J Bone Joint Surg Br*. 1993Sep; 75(5):789-93.
2. Medoff RJ, Maes K. A new device for the fixation of unstable pertrochanteric fractures of the hip. *J Bone Joint Surg Am*. 1991 Sep; 73(8):1192-9.
3. Haidukewych GJ, Israel TA, Berry DJ. Reverse obliquity fractures of the intertrochanteric region of the femur. *J Bone Joint Surg Am*. 2001May; 83-A(5):643-50.
4. Wolfgang GL, Bryant MH, O'Neill JP. Treatment of intertrochanteric fracture of the femur using sliding screw plate fixation. Clin Orthop Relat Res. 1982 Mar; (163):148-58.
5. Koval KJ, Zuckerman JD: Intertrochanteric fractures: In Bucholz RW, HeckmanJD, Eds Rockwood and Green fractures in adults. Vol II, 5th Ed. Philadelphia publishers, 1656-57; 2001.
6. GallangherJC, MeltonLJ, Riggs BL *et al*. Epidemiology or fractures of theproximal femur in Rocester, Minnesota. Clinical Orthop 1980; 150: 163-171
7. Griffin JB,: the Calcar Femorale Redefined. Clin. Orthop 164, 221-2 l4.1982.
8. Evans EM: The treatment of trochanteric fractures of the femur. *J Bone Joint Surg Br*,1949.31:J 90-203
9. BabhulkarSudhir S.Management of trochantric Fractures, Department of Orthopaedics,Indira Gandhi Medical College. *Nagpur, Journal of orthopaedics* October 2006 volume40: Number 4: Pg.210-218
10. Windoff J, Hollander D A, Hakmi M, Linhart w 2005, Pitfalls & complications in the use of proximal femoral nail. Lagenbecks arch surg, feb; 3901(1) Epub 2004 Apr15
11. Short proximal femoral nailfixation for trochanteric fractures, Wasudeo MGadegone, Yogesh S SaJphale Department of Orthopaedics and Traumatology, Chandrapur Multispecialityhospital, Chandrapur India, *Journal of 'Orthopaedic Surgery* 201O; 18(1):39-44
12. McLAUGf-ILIN HL, GARCIA A. An adjustable fixation device for the hip. *Am J Surg*. 1955 Apr; 89(4):867-71
13. Boidin C, Seibert F, Fankhauser F *et al*. The proximal femoral nail (PFN)-Aminimal invasive treatment of unstable proximal femoral fractures. A prospective study of 55 patients with a follow-up of 5 months. Actaôrthop Scand 2003;74: 53-58.
14. A Bodoky, U Neff.M. Herberz and F Harder: Antibiotic prophylaxis with two dose of cephalosporin in patients managed with internal fixation for a fracture of hip JBJS Vol.75,issue-1,61-65,1993.
15. Harrington KD, Johnston JO. The management of commuinated unstableintertrochanteric fractures. *J Bone Joint Surg Ain*.1973 oct; 55(7):1367-76.
16. Rao JP, Banzon MT, Weiss AB, Rayhack J.Treatment of unstableintertrochanteric fractures with anatomic reduction and compression hip screwfixation. Clin Orthop Related Res.1983 May;(l75):65-7
17. Kulkarni G:Treatment of trochantric fracture of hip by modified Richard compression and collapsing screw. *Indian Journal of Orthopedics*, vol.18no 1, 30.1984.
18. Stern MB, Angerman A.Comminuted intertrochanteric fractures treated with a Leinback prosthesis. Clin Orthop 1987; 218:75-80
19. B. Mall, Susheelkumarparhak, Vineet Malhotra: Role of dynamic compression hips screw in trochanteric fracture of femur. *Indian Journal of Orthopaedics*, Vol.33 No.3, 226-228, July 1999.