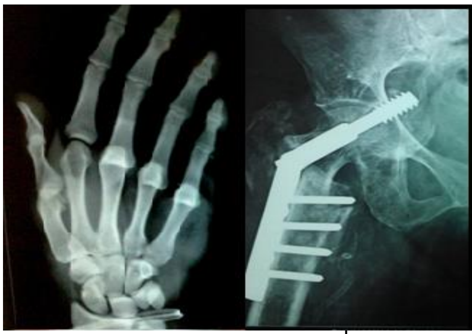

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A comparative study between DHS and PFN for the treatment of intertrochanteric fractures

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Abstract

Background: The incidence of intertrochanteric fractures has been increasing significantly due to the rising age of modern human populations. Generally, intramedullary fixation and extramedullary fixation are the 2 primary options for treatment of such fractures. The dynamic hip screw (DHS), commonly used in extramedullary fixation, has become a standard implant in treatment of these fractures. Proximal femoral nail (PFN) and Gamma nail are 2 commonly used devices in the intramedullary fixation. Although the effects of PFN and DHS in treatment of intertrochanteric fractures have been reported, the results and conclusions are not consistent. In View of these conditions, this study is taken up to compare the results of DHS and PFN in the management of intertrochanteric fracture.

Methods: The present study has been conducted at SSMC, Tumkur during the period June 2017 to June 2019. 40 patients with intertrochanteric fractures treated with DHS & PFN fixation were selected for the present study.

Results: The patients were evaluated based on intra operative and post-operative complications, duration of surgery, and blood loss during surgery, post-operative functional and anatomical results and time of complete weight bearing.

Conclusions: We conclude that PFN is a better alternative to DHS in the treatment of intertrochanteric fractures but is technically difficult procedure and requires more expertise compared to DHS. Operative time, radiation exposure, blood loss and intraoperative complications is less in case of PFN when compared to DHS.

Keywords: Intertrochanteric fracture, proximal femoral nail (PFN), dynamic hip screw plate (DHS)

Introduction

The incidence of intertrochanteric fractures has been increasing significantly due to the rising age of modern human populations [1, 2]. Generally, intramedullary fixation and extramedullary fixation are the 2 primary options for treatment of such fractures. The dynamic hip screw (DHS), commonly used in extramedullary fixation, has become a standard implant in treatment of these fractures [3, 4]. Proximal femoral nail (PFN) and Gamma nail are 2 commonly used devices in the intramedullary fixation. Previous studies showed that the Gamma nail did not perform as well as DHS because it led to a relatively higher incidence of post-operative femoral shaft fracture [5, 6].

PFN, introduced by the AO/ASIF group in 1997, has become prevalent in treatment of intertrochanteric fractures in recent years because it was improved by addition of an anti-rotation hip screw proximal to the main lag screw. However, both benefits and technical failures of PFN have been reported [7, 9].

Although the effects of PFN and DHS in treatment of intertrochanteric fractures have been reported, the results and conclusions are not consistent [10, 15].

In View of these conditions, this study is taken up to compare the results of DHS and PFN in the management of intertrochanteric fracture.

Methods

Patients admitted to SSMC, Tumkur form June 2017 to June 2019 diagnosed with intertrochanteric fracture were prospectively observed and included in the study group. Out of total 40 cases, 20 cases of intertrochanteric fractures were treated with DHS (Group A) and 20 cases were treated with PFN (Group B).

Inclusion criteria

- Inter trochanteric fractures in adults & elderly.
- Closed intertrochanteric #

Exclusion criteria

- Subtrochanteric fractures
- Compound fractures
- Pathological fractures
- Fractures in children

All the patients with Intertrochanteric # of femur who were admitted to SSMC, Tumkur were assessed clinically and were hemodynamically stabilized. Radiographs of pelvis with both hips (Anteroposterior view) and full femur (Anteroposterior view and lateral view) were taken for all the admitted patients. Traction was applied to the fractured limb and immobilized till surgery. Basic surgical profile was done and anaesthesia fitness was obtained for all selected patients. Surgery was done over a fracture table in supine position under image intensifier (C-ARM) control Using Standard Technique.

Operative procedure (DHS)

Patient positioning

Use of fracture table allows good roentgen graphic control and enables manipulation of leg, with patient lying in supine position.

Prepare the skin over the hip and square off the lateral aspect of the hip from the iliac crest to the distal thigh with towels and drapes. Drape the C-arm separately.

Reduction of fracture

After positioning the anaesthetized patient supine on the fracture table, taking care to avoid undue pressure or tension on any part of the body. Closed reduction of fracture is performed, generally obtained with traction in neutral or slight external rotation. The reduction is checked by anteroposterior and lateral views under image intensifier with special attention to cortical contact postero-medially.

Exposure

Mid lateral incision is done a little distal to the tip of greater trochanter along the shaft of the femur to the extent needed for fixation of implant. After splitting the fascia-lata, the vastus lateralis is cut along the attachment of the muscle to the femur using L shaped incision. A periosteal elevator is used to clear the lateral surface of proximal femur.

Insertion of guide PIN

With the 135 degrees angle guide, under image intensifier, the guide pin inserted 2cm below the flare of the greater trochanter, midway between the anterior and posterior cortices. The guide pin should be in the center or inferior, in anteroposterior x – ray and in center or slightly posterior in lateral x-ray. The length of the guide pin lying outside the bone is measured for depth calculation.

Reaming of the femur

The triple reamer, which serves the function of reaming for the screw (8mm) and barrel (13 mm) and for the barrel plate junction. Reaming is performed around the guide pin until the correct depth is reached.

Derotation screw

In unstable trochanteric fractures, an additional stabilizing pin may be used to prevent rotation of proximal fragment during insertion of the lag screw.

Tapping of the femur

With a screw lock tap to facilitate the setting of lag screw especially in young patients within firm cancellous bone. In osteoporosis bone tap 1-2 cm less to allow the screw to engage firmly into the sub articular bone.

Insertion of lag screw and plate

The correct length of lag screw is determined with the measuring gauge. This measurement allows for 5 mm of compression. If more compression is desired, a shorter screw is used the appropriate plate and lag screw are assembled onto the insertion wrench and inserted into the reamed hole over the guide wire. The centering sleeve is removed and the side plate is advanced onto the lag screw. The plate is then clamped to the femur and then fixed securely. The compression screw must be left in place to prevent disengagement of screw plate assembly. The wound is finally closed in layers over a suction drainage system after securing homeostasis.

Tip apex distance

It is the distance between the tip of the lag screw and subchondral bone of centre of the femoral head in both A.P & lateral views. Normally it should be < 25 mm. (Figure NO. 1)
Figure 1: Pre op and Post Op X-rays (DHS)

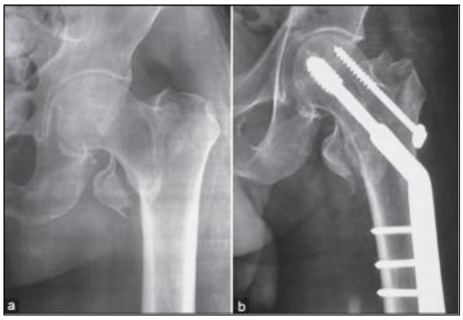

Fig 1: Pre op and Post Op X-rays (DHS**)**

Operative procedure (PFN)

Patient positioning

Patient lying supine on Albee‘s fracture table allows good roentgen graphic control and enable manipulation of leg and application of traction.

Reduction of fracture

After positioning the anaesthetised patient supine on fracture table, taking care to avoid undue pressure or tension on any part of the body, closed reduction of fracture is performed. The Uninjured limb is held in well leg holder so that it remains out of the way by putting it in 90 – 90 ° leg holder. Reduction is achieved by aligning distal fragment to flex and externally rotated proximal fragment by rotating the foot of effected extremity.

Procedure

A Slightly curved lateral incision is made from the level of trochanter proximally for about 6 to 9cm. The length of incision varies with the size of the patient. Under fluoroscopic guidance, a 3.2mm pin is inserted into the tip of greater trochanter, taking care to centre it on both antero posterior and lateral views. The pin is then driven 5cm into proximal femur. An alternative to this method is to use an awl, under fluoroscopic guidance to provide the opening. The awl should be inserted up to the point of largest outer diameter under fluoroscopic guidance and then removed. A guide wire is then inserted into proximal fragment.

The 9mm end cutting reamer is used above fracture site after the position of guide wire is verified by fluoroscopy. The cannulated manipulator for proximal fragment is then introduced over guide wire. Using the cannulated manipulator fracture is reduced and guide wire is passed into distal fragment. Now distal fragment is reamed with 9mm reamer.

The reaming process is continued at 0.5 mm increments until 1mm more than the selected nail size is reached and the proximal fragment entry point is widened with entry point widener. The selected nail is then assembled to jig and passed over the guide wire and pushed manually by rocking movements and the terminal position is hammered to the desired level and anteversion is adjusted by comparing with opposite hip or setting the anteversion of 15º. Skin is marked opposite to inferior hole of drill guide. Skin, fascia are incised and drill sleeves are inserted until they reach lateral femoral cortex and checked by image intensifier. Now a 3.2mm guide pin is inserted through inferior drill sleeves and checked under image intensifier so that it should be 4mm above the calcar and inferior in the neck. If not the position of nail is adjusted. Now sleeves are placed in proximal hole and guide pin is inserted and the final position of guide pins is checked under image intensifier before drilling**.** (Figure No. 2)

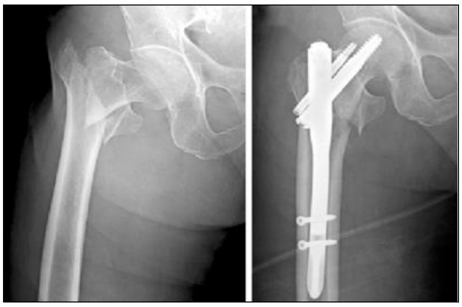

Fig 2: Pre op and Post op X-rays (PFN)

Follow-Up

All patients were followed up at 2 weeks interval till fracture union, at 12 weeks & at 6 months post operatively. 4 patients failed to attend the first follow up & were lost for further follow up (2 cases of DHS and 2 cases of PFN). At each follow up radiographs of upper femur and hip were taken to assess the fracture union, implant failure & screw cut out.

Results

The results of the treatment of intertrochanteric fractures were assessed by HARRIS HIP SCORE system. Trochanteric fractures are classified according to Boyd and Griffin Classification.

Table 1: Type of Fractures

Type of fracture	No. of cases	Percentage
Type 1	10	25 %
Type 2	20	50 %
Type 3	10	25 %
Type 4	0	0
Total	40	100 %

Table 2: Intra-operative Details

Intraoperative Details	PFN	DHS
Mean radiographic exposure (No. of times)	80	45
Mean duration of operation (In minutes)	95	80
Mean blood loss (In ml)	220	310

Table 3: Intra-operative complications of DHS

Complications	No. of Cases	Percentage
Improper positioning of Richard screw	4	20 %
Varus angulation	2	10 %
Drill bit Breakage	1	5 %

There were comparatively minimal intraoperative complications encountered during DHS fixation. Reduction was comparatively easier as open reduction was performed in all the cases. However difficulties in reduction were encountered in cases that were delayed and in case of comminuted fractures.

Table 4: Intra-operative complications of PFN

Complications	No. of Cases	Percentage
Failure to achieve closed reduction	5	25 %
Fracture of lateral cortex	1	5 %
Fracture displacement by nail placement	2	10 %
Failure to put derotation screw	1	5 %

Table 5: Delayed complication – DHS

Complications	No. of Cases	Percentage
Hip stiffness	1	5 %
Knee stiffness	1	5 %
Non – union	0	0
Shortening > 1 cm	1	5 %
Varus malunion	2	10 %
Implant failure	0	0

Table 6: Delayed complication – PFN

Complications	No. of Cases	Percentage
Hip stiffness	2	10 %
Knee stiffness	1	5 %
Non – union	0	0
Shortening > 1 cm	0	0
Varus malunion	0	0
Implant failure	0	0

Analysis

Table 7: Assessment of results

		PFN	DHS
Mean time for full weight bearing (in weeks)		9.8	13.6
Mobility after surgery (6 weeks post- operatively)	Independent	13	11
	Aided	4	6
	Non - Ambulatory	1	1
Mean range of movements (6 weeks post operatively)	Hip Joint (0-110 degree)	16/18	17/18
	Knee Joint (0-120 degree)	16/18	17/18

Functional results

In our series of 40 patients 3 cases were lost for follow up and 1 case expired due to associated medical problems. Functional results was assessed by taking the remaining 36 cases into consideration. 18 Cases of DHS and 18 Cases of PFN.

Table 8: Functional assessment of DHS patients

Functional Result	No. of cases	Percentage
Excellent	9	50 %
Good	6	33.3 %
Fair	2	11.1 %
Poor	1	5.6 %

Table 9: Functional assessment of PFN patients

Functional Result	No. of cases	Percentage
Excellent	12	66.6 %
Good	4	22.2 %
Fair	1	5.6 %
Poor	1	5.6 %

Discussion

Intertrochanteric fracture is the fairly common fracture occurring in general population. It has been proved from time to time that there is no one common solution to the problem.

Before the introduction of suitable fixation devices in the 1960s, treatment of proximal femoral fractures was mainly no operative consisting of prolonged bed rest in traction. Complications of prolonged immobility following hip fracture are: Increased risk of dementia and confusion, constipation, bed sores, orthostatic pneumonia, deep vein thrombosis, pulmonary embolism, muscle weakness, orthostatic hypotension and joint contractures.

To avoid these complications and for rapid mobilization and restoration of function, majority of fractures should be treated operatively. Restoration of mobility in-patients with unstable fractures ultimately depends on the strength of surgical construct. There are multiple factors and variables, which affects the biomechanical strength of repair. Surgeon independent variables are bone quality, fracture pattern and stability. Whereas surgeon dependent variables are quality of fracture reduction and choice and placement of implant, varieties of implants have been used to fix these fractures. With better understanding of biomechanics of trochanteric fractures there has been development of better implants.

In our study, intertrochanteric fracture was common due to slip & fall, age ranged between 60 to 100 years, mean age of 68.5 years. Females were common, contributing to 65.3%. Right sided fractures were common accounting for 65%. Type II Boyd and Griffin fractures were common, consisted of 50 %. Type I and Type III were 25 % each. Mean frequency of radiation exposure was 80 and 45 times, mean duration of operation was 95 and 80 minutes, mean blood loss was 220 ml and 310 ml for PFN and DHS respectively. Mean time of full weight bearing was 9.8 weeks and 13.6 weeks in PFN and DHS respectively. All patients were mobile at the end of 6 weeks with or without walking aid except for one case in PFN and one case in DHS. 13/18 and 11/18 cases of PFN and DHS had independent mobility.

Conclusion

We conclude that PFN is a better alternative to DHS in the treatment of intertrochanteric fractures but is technically difficult procedure and requires more expertise compared to DHS. Operative time, radiation exposure, blood loss and intraoperative complications is less in case of PFN when compared to DHS.

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