Original Article

Femoral Nail and Hip Screw in Fractures of Femur

Comparison of Functional Outcome of Proximal Femoral Nail (PFN) and Dynamic Hip Screw (DHS) in Intertrochanteric Fractures of Femur under Spinal Anesthesia

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ABSTRACT

Objective: To evaluate and compare the post-operative functional outcome of patients of intertrochanteric fractures of femur undergoing either dynamic hip screw (DHS)or proximal femoral nail (PFN) fixation presenting under spinal anesthesia in tertiary care hospital.

Study Design: Randomized controlled trial study.

Place and Duration of Study: This study was conducted at the Department of orthopedic, Unit I and Department of Anesthesia Mohi-ud-Din Teaching Hospital Mirpur AJK from March 2016 to April 2017.

Materials and Methods: One hundred and fifty male and female patients fulfilling inclusion criteria presenting in orthopedic department. Their bio-data was recorded followed by an objective assessment of the intertrochanteric fracture of femur. Seventy-five patients underwent fixation with proximal femoral nail and 75 patients underwent fixation with dynamic hip screw by lottery method. Patients were objectively assessed first at 2 weeks post-operatively and then at 4 weekly intervals for up to 24 weeks for functional outcome in terms of Kyle's criteria for good to excellent results.

Results: Mean age of patients in dynamic hip screw group and proximal femoral nail group was 61.29±11.94 and 59.10±13.61 years respectively. In Group A, 25(33.34%) patients mode of injury was trauma due to road traffic accident and 50(66.64%) patients mode of injury was fall at home whereas in Group B 28(37.34%) patients had trauma due to road traffic accidents and 47(62.66%) were injured due to fall. Functional outcome was assessed by using Kyle's criteria. At 8^{th}, $12^{th,}$ $20^{th}$and 24^{th} week good to excellent functional outcome was significantly high in Group B as compared to Group A patients. (8^{th} week: 26.67% vs. 44%, 12^{th} Week: 36% vs. 52%, 20^{th} Week: 85.33% vs. 100%, 24^{th} Week: 92% vs. 98.66%) while at 16^{th} week functional outcome was although high in Group-B patients but it was not statistically significant. (16^{th} Week: 81.34% vs. 89.34).

Conclusion: Proximal femoral nail is far better implant in terms of post-operative functional outcome as compared to dynamic hip screw for treating intertrochanteric femoral fractures. i.e. (Kyle's Criteria at 24^{th} Week: DHS: 92% vs. PFN: 98.66%).

Key Words: Functional outcome, Dynamic hip screw, Proximal femoral nail, Spinal anesthesia

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INTRODUCTION

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Hip fractures are extreme and disabled injuries that primarily affect the elderly following a decline, with substantial social and quality of life implications. Risk factors include ageing, female sex, white breed, neurological disability, malnutrition, physical activity decreased, osteoporosis and trauma1. The risk factors include: In recent decades, the frequency of intertrochanteric femoral fractures has dramatically increased as the life expectancy has increased.[1,2] Gulberg et al[3] estimated that by 2025 the overall hip fractures will be 2.6 million and by 2050 an overall of 4.5 million. In 1990 26% of all hip fractures occurred in Asia, compared to 37% in 2025 and 45% in 2050, 40% in Asia.

Intertrochanteric fractures are generally known as Boyd and Griffin Type-I fractures, which range from larger to lesser trochanters along the crossroads. The fractures of

type II are comminuted. Form III is just distal to or at a lesser trochanter and form IV is trochanter and proximal shaft fractures. Type I and Type II are stable, and type III and Type IV fractures are unstable.[4] A failure to repair fracture with re-displacement or the collapse of parts is the primary complication of unstable intertrochanteric fracture. Dynamic hip screws, dynamic compression screws, and proximal femoral nail are the options for surgery.[5]

At the beginning of the 1990s intramedullary devices for the fixation of intertrochanteric fractures were created. These instruments provide many biomechanical and biological advantages compared with the traditional dynamic hip vessel.[7-9] There are many distinct advantages for the intramedullary devices. The implant itself provides a buffer for the proximal fragment to be lateral translation.[2] Its intramedullary position makes the implant more resistant to binding pressure, since it connects the nail and a lag screw.[3] The intramedullary unit offers a shortened distance from a shorter lever arm between the weight bearing axis and the implant.[4] The bending load is passed into the intramedullary nail of an intramedullary unit, which is resisted by its touch to the medullary duct.[5]

MATERIALS AND METHODS

This randomized controlled trial was conducted at Department of orthopedic, Unit I and Department of Anesthesia Mohi-ud-Din Teaching Hospital Mirpur AJK from 1st March 2016 to 30th April 2017. A total of 150 patients were included. They were divided in two each groups; each group comprised 75 patients. Group A treated with dynamic hip screw and group B treated with proximal femoral nail. Radiological diagnosis for both male and female intertrochanteric femoral fracture Type I, II, III, and IV (Boyd & Griffin Classification) in accident or fall intertrochanteric femoral fractures, ASA-1 (normal healthy patient) and II (mild, clinically non-functional systemic disease) patients. Hip fracture cases with no prior operation. Written consent of patients notified. The exclusivity requirements were 1) patients who were not eligible for surgery; 2) patients who had compound and/or pathological fractures; 3) who were admitted for reoperation; 4) patients who did not have written consents to surgery; 5). After obtaining ethical approval from the Ethics Committee, the study of research population was carried out according to the ethical guidelines after receiving written informed approval. Information obtained from all patients, including history, general and clinical test results. Besides routine pre-anesthetic examinations, initial hip joint x-rays were performed. Two groups of the 150 patients, 75 each were split. In a sitting or lateral decubitus position in the 25 G quince spinal needle of 0.5% hyperbaric bupivacaine 1.5 to 2mL, both patients had been spinal anesthesia with strict Aseptic controls. Proximal femoral nailing has been used in patients under group A, and DHS has been used in patients under groups B. Dynamic hip screw or PFN implants were randomly chosen by the surgeon. The cases included in our analysis were dealt with as quickly as possible. Using an X-ray AP goniometer on an unaffected side, the neck wafer angle and the lateral side plate length of the lateral plate were calculated to allow the shaft distal to the fractures to buy a minimum of 8 cortices. All patients were treated using early mobilization, manual veal compression and elastic stuffing methods in our research. Day 1 ankle and veal exercises were promoted and the weight of the second postoperative bearing was adjusted depending on the patient's physical condition. Each drain was taken 24 hours. On the third and 6th day of the operation, the injuries were inspected. On the 11th day, stitches were taken off. One monthly interval to the fracture union was followed up and another one year at a 6 months interval. The data was entered and analyzed through SPSS-20.

RESULTS

The mean age was 60.20±12.81 years. Whereas mean age of patients in Group-A (dynamic hip screw) and GroupB (proximal femoral nail) was 61.29±11.94 and 59.10±13.61 years respectively (Table-1).In GroupA, there were 53(70.66%) male and 22(29.34%) female patients. Whereas in GroupB, 47(62.66%) were male and 28(37.34%) were female patients. In GroupA, 25(33.34%) patients mode of injury was trauma(due to road traffic accident) and 50(66.64%) patients mode of injury was fall (at home) whereas in Group-B 28(37.34%) patients had trauma and 47(62.66%) were injured die to fall. In both treatment groups large majority of patients presented with fall as their mode of injury (Table 2). Assessment of fracture shows that there were 47 patients who had TypeI (Group-A=21, Group-B=26), 85 patients had TypeII (Group-A=45, Group-B=41), 13 patients had TypeIII (Group-A=6, Group-B=7) and only 4 patients had Type-IV fracture (Group-A=3, Group-B=1). According to this criterion, at 2nd week post-operative none of the patients had fair to excellent outcome in both treatment groups (Table 3). In Group-A 20(26.67%) and in Group-B 33(44%) patients had good to excellent outcome according to Kyle's criteria at 8th postoperative week. In terms of p-value patients in Group-B had good outcome as compared to Group-A patients as greater number of patients had good to excellent outcome at 8th week post operatively i-e p-value=0.026 (Table 4). In Group-A 61(81.34%) and in Group-B 67(89.34%) patients had fair to excellent outcome according to Kyle's criteria. In Group-B greater number patients had good outcome as compared to Group-A patients at 16th week post operatively. But this difference of good outcome in terms of Kyle's criteria was not statistical (Table 5). In

GroupA, 69(92%) and in GroupB, 74(98.66%) patients had excellent to good outcome according to Kyle's criteria. In GroupB greater number patients had better to excellent outcome as compared to GroupA patients at 24th week post operatively. But this difference of good outcome in terms of Kyle's criteria was statistically significant i.e. p-value=0.050 (Table 6).

Table No.1: Descriptive statistics for age of patients (n=150)

Age	Group A (40-90 years)	Group B (40-80 years)
Mean±SD	61.29±11.94	59.10±13.61

Table 2: Fracture classification (Boyd and Griffin type) of patients

Fracture classification	Group A		Group A	
	No.	%	No.	%
I	21		26	
II	45		41	
III	6		7	
IV	3		1	

Table 3: Objective assessment of patients in treatment groups at 2nd week

Kyle's Criteria (Good to Excellent)	Group A		Group A	
	No.	%	No.	%
Yes	-	-	-	-
No	75	100.0	75	100.0

Chi square=22.57 P-value=0.026

Table 4: Objective assessment of patients in treatment groups at 8th week

Kyle's Criteria (Good to Excellent)	Group A		Group A	
	No.	%	No.	%
Yes	20	26.67	33	44.0
No	55	73.33	42	56.0

Chi square=22.57 P-value=0.026

Table 5: Objective assessment of patients in treatment groups at 16th week

Kyle's Criteria (Good to Excellent)	Group A		Group A	
	No.	%	No.	%
Yes	61	81.34	67	89.34
No	14	18.66	8	10.66

Chi square= 1.918 P-value= 0.166

Table 6: Objective assessment of patients in treatment groups at 24th week

Kyle's Criteria (Good to Excellent)	Group A		Group A	
	No.	%	No.	%
Yes	69	92.0	74	98.66
No	6	8.0	1	1.34

Chi-Square= 3.476 P-value= 0.050

DISCUSSION

Intertrochanteric fractures are most commonly seen in the elderly population more so in patients with osteoporotic bones. The elderly people also have the risk of medical conditions like diabetes mellitus and ischemic heart disease. Non-operative treatment for fractures in previous clinical practice showed.

Complications such as pneumonia, bedsores, and venous thrombus, and the mortality rate was up to 15%-20%. In recent years, with the development of technology and better pre-operative care, the intertrochanteric fractures are seldomly treated non operatively. There are two methods for surgical fixation, one is extra medullary which is DHS and other is intramedullary which is PFN.[10-13] Reportedly there are cases of delirium 44% adjuvant disorders 22% panic attacks 17 % depression 11% and psychosis 6% in post-operative cases. Other risk factors are older age, longer time of surgery, infections, blood transfusion and deranged serum electrolytes.[14]

Dynamic hip screw is extra medullary fixation system and was first used in clinical practice in 1967; it was considered a major treatment for intertrochanteric fractures.[15-18] The side plate of the DHS can slide within the screw and cause compression on the fracture end. The discrepancies in DHS are that a large operative incision, exposure is large, and more bleeding. The biggest shortcoming is that DHS lacks effective internal support and poor anti-torsional strength, especially for unstable intertrochanteric fractures; the femur calcar loses holding power and the armor plate must take on more power, which causes many complications[19-21], such as femoral head cut out, breaking the plate, or displacement of fractures. Many clinical studies show that DHS should be used for stable fracture patterns and is not the ideal method for treating unstable intertrochanteric fractures.[22-25]

Proximal femoral nail is a new generation of intramedullary internal fixation systems. The screw blade replaced two screws to increase pressure and counter rotation action.[26-28] Compared to DHS, PFNA has its advantages; firstly, the bearing axis of PFN is closer to the hip joint, and the arm of force is significantly shorter. Thus, it can directly pass load to the femoral shaft, causing compression and improve the stability of the construct. Secondly, PFN is a minimally invasive system that does not cause opening of fracture hematoma and soft tissue sleeve and thus protects the biological environment around the fracture. Relative to DHS, PFN is an intramedullary device with a helical blade rather than with a screw; this allows a better purchase in the femoral head to limit cut-outs due to various deviation and rotation. In terms of reoperation, present results show that PFN had evidence of superiority to DHS. PFN represented the core of bone operation and minimally invasive surgery, and was

favored for fracture recovery. PFN was designed to minimize the risk of these implant-related complications, and preliminary results suggested that this goal might have been achieved. Additionally, PFNA has other advantages, such as easy operation, short exposure time, and it does not involve reaming, thereby avoiding the occurrence of internal blood loss and maintaining low operative risk. Thirdly, the design of the screw blade locked technique is suitable for elderly patients with osteoporosis. Additionally, implantation of the screw blade is not necessary to ream the marrow in patients, which avoids bone loss. Postoperative follow-up revealed that there were fewer complications in the PFNA group than in the DHS group. Fourthly, the design of the gamma nail is hollow, and a small incision is needed to place a guide pin into the marrow cavity. Moreover, the gamma nail was designed as an eversion angle at 6 degrees, which allows it to insert conveniently at the top of the greater trochanter of the femur. The end-point locked hole is locked dynamically or statically. Finally, the extended sharp end and socket design of the gamma nail allows it to be inserted conveniently during surgery and avoids gathering forces in one position so as to reduce the incidence of broken nails and re-fracture with pointed nails.

Historically, general anesthesia has been the gold standard for major hip surgery; however, total hip arthroplasty is now commonly being performed under spinal anesthesia. Recent data shows that the comparable benefits of neuraxial anesthesia with general anesthesia, such as less blood loss and decreased transfusion requirements, lower rates of thromboembolic events, and reduced rates of surgical site infection. Major benefits of spinal anesthesia in recovery phase includes better postoperative pain control, less bleeding, early mobilization and fewer chances of deep vein thrombosis.

CONCLUSION

Both dynamic hip screw and proximal femoral nail remained the implant of choice for the stable intertrochanteric fractures. In the more unstable types of fracture, the PFN has distinct advantages over DHS and should be the preferred implant for fixation since it had better overall functional outcome, less operative time and less blood loss. The mobilization time (i.e. weight bearing time) was significantly less in PFN compared to DHS. PFN should be preferred in cases of severe osteoporosis as it has got inherent stability and being intramedullary there is no question of screw cutout which is a very common complication in osteoporotic fractures treated with DHS. By observing our outcomes we prefer PF.N as the best choice implant for Intertrochanteric fractures especially in unstable type as it is superior in terms of stability, blood loss, duration of surgery, post-operative functional recovery and early union.

Author's Contribution:

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