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ORIGINAL ARTICLE

Functional outcomes of proximal femoral nail versus dynamic hip screw in intertrochanteric fracture.

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ABSTRACT… Objective: To compare the functional and radiological outcomes of Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) treatments for patients with unstable intertrochanteric fractures. **Study Design:** Comparative study. **Setting:** Trauma Centre, Hayatabad Medical Complex Peshawar. **Period:** May 2020 to June 2022. **Methods:** The study comprised 150 patients aged over 40 years old and had Type 2 intertrochanteric fractures, as classified by Boyd and Griffin. Radiographs, functional assessments, and demographic information were collected and patients were followed for up to two years at regular intervals. **Results:** The mean age of patients was 70 years. The PFN group had significantly shorter surgery duration (57.47 minutes) compared to the DHS group (85.30 minutes), less blood loss (74 ml vs. 195 ml), and a shorter hospital stay (6.5 days vs. 11.8 days). Early weight bearing was achieved faster in the PFN group, with mean times to partial and full weight bearing of 3.12 and 8.45 weeks, respectively, compared to 5.52 and 12.32 weeks in the DHS group. Radiological union at three months was significantly better in the PFN group. Complications were fewer in the PFN group, with notable differences in screw cutout, migration, and backout rates. Pain levels were lower in the PFN group at three and six months post-operatively. **Conclusion:** PFN demonstrated superior outcomes in terms of reduced surgical time, blood loss, hospital stay, and faster weight-bearing capabilities compared to DHS. Radiological and functional outcomes also favoured PFN, making it a preferable option for treating unstable intertrochanteric fractures.

Key words: Dynamic Hip Screw, Functional Outcomes, Proximal Femoral Nail.

INTRODUCTION

In elder people the most common type of hip fractures are Intertrochanteric type. It often occurs during fall on ground.[1] The frequency of these fractures has risen markedly in recent decades, aligning with the increasing elderly population and higher osteoporosis rates. This trend is anticipated to persist, mirroring broader demographic and health trends. The prevalence of intertrochanteric fractures varies by region. Hip fractures globally will reach to limit of 2.6 millions by year 2025 and by 2050 it will reach around 4.5 millions as reported by Gulberg et al.[2] In Asia, these fractures represented 26% of all hip fractures in 1990, with projections showing an increase to 37% by 2025 and 45% by 2050.[3]

In current orthopedic practice, intertrochanteric fractures are frequently encountered. Several treatment methods have been developed, all aiming to achieve stable fixation to facilitate early patient mobilization. Early mobilization is crucial as these patients typically cannot endure significant weight-bearing restrictions.[4] Given the high morbidity and mortality associated with severe fractures, the primary treatment goal is to ensure stable fixation and enable early mobilization. The effects of the fracture are often worsened by coexisting medical conditions such as diabetes, hypertension, and pulmonary, renal, and cardiac disorders. Elderly patients are particularly at risk for severe complications like hypostatic pneumonia, catheter-associated sepsis, cardiorespiratory failure, and pressure ulcers. These risks necessitate prompt surgical intervention to allow for early rehabilitation and mobilization.[5]

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Dynamic Hip Screw (DHS) treatment is the gold standard for treating these fractures; it has advantages and disadvantages like any other surgical method.[6] The Proximal Femoral Nail (PFN) is frequently regarded as the best alternative in terms of minimizing the distance between the hip joint and the implant, based on biochemical stability.[7,8] The PFN aids in early weight bearing in cases of unstable intertrochanteric fractures and aids in withstanding bending stress at the point where the nail intersects the lag screw in the intermedullary area.[9,10]

OBJECTIVE

To compare DHS and PFN following intertrochanteric fracture in term of functional and radiological outcomes.

METHODS

After taking approval from ethical review board of institution by Letter No: 1933/HMC/QAD/2024 (Date: 13/6/2024), prospective observation study was conducted at Trauma Centre, Orthopaedic Department, Hayatabad Medical Complex, Peshawar, from May 2020 to June 2022. It initially included 150 patients with unstable intertrochanteric fractures, all aged over 40 years.

Participants were over 18 years old, of both sexes, and had Type 2 intertrochanteric fractures (classified by Boyd and Griffin) that were less than two weeks old. The exclusion criteria included pathological fractures, polytrauma, open fractures, and comorbidities that hindered rehabilitation, such as stroke. To avoid bias, 75 patients were assigned to Group A (PFN treatment) and 75 to Group B (DHS treatment).

Patients demographics, radiographs, and functional assessments using walking ability grades at for duration 2 years were noted. The set point included 3 weeks, 6 weeks, 12 weeks, 1 year, and 2 years.

The demographics of the patients, radiographs, and functional evaluations utilizing walking ability grades during a two-year period were recorded. Three weeks, six weeks, twelve weeks, a year, and two years were among the fixed points. Under regional anesthesia, every surgery was carried out by orthopedic specialist. Using closed manipulation on a traction table guided by an image intensifier, fracture reduction was accomplished. Implants were measured using anteroposterior radiographs of the normal side. The blood loss was computed with the approach of Brecher et al. The on-board physiotherapist recommended a standardised procedure for post-operative rehabilitation.

Radiography was used to evaluate fracture union. The definition of malunion was varus angulation more than 10 degrees.

Visual analogue scale (VAS) and Haris Hip Score (HHS) was employed to assess the functional ability of patients post operative at regular interval.

Data analysis was performed SPSS version 23 with p-value of less than or equal to 0.05 was considered statistically significant.

RESULTS

A total of 150 patients in all, ranging in age from 50 to 90 years old, with a mean age of 70. There was an average surgical delay of three days, with a range of two to six days. Tables-I and II provide perioperative and clinicodemographic details about the patients. In PFN and DHS, the failure rate of closed reduction was n=2 (2.6%) and n=4 (4.2%), respectively. The incisions in the PFN group were much shorter (mean 6.19 cm vs. 12.85 cm, $p < 0.0001$). With a p-value of less than 0.001, the mean radiographic exposure, or fluoroscopy, was 47.535±9.444 minutes in the PFN group and 57.761±8.277 minutes in the DHS group. PFN patients had shorter surgeries ($p < 0.0001$), and the length of PFN patients increased with fracture instability.

With a p value of less than 0.001, the mean blood loss was 74 ml (PFN) as opposed to 195 ml (DHS). Blood transfusions were necessary for eleven DHS patients, but not for any PFN patients.

A summary of post-operative parameters has been presented in Table-III. Early weight-bearing periods and shorter hospital stays (mean 6.5 vs.

11.8 days, p < 0.0001) were seen in the PFN group. All patients were fully weight-bearing with assistance by weeks 12 and 14. At 16, 20, and 24 weeks, there was no discernible difference in the groups' ability to walk without assistance.

The PFN group showed a superior radiological union at three months (mean 0.774 vs. 0.097, p < 0.0001). However, no significant differences were observed at six or twelve months. By one year, all fractures had healed, although eight patients in the DHS group developed varus deformity. The PFN group reported less pain at three and six months.

Tables-IV and V provide a comprehensive overview of post-operative problems. As seen in Table 6, functional results, as determined by the Harris Hip Score, were more favourable for PFN in the early follow-ups, albeit the differences vanished after a year.

Clinicodemographic	DHS (n=75)	PFN (n=75)
1. Mean Age (in years)	68.8 (56–89)	68.6 (54–79)
2. Sex (M/F)	27/48	21/54
3. Mode of Injury		
a) Domestic Fall	59	46
b) Road Traffic Accident	14	25
c) Others	2	4
4. Side of Injury		
a) Right	35	25
b) Left	40	50
5. AO Type	38	40
a) 31 A2	37	35
b) 31 A3		

Table-I. Comparison of patient's demography between PFN and DHS group.

Perioperative Comparison		DHS	PFN	t-value	p-value
Closed reduction		71	73		
Open reduction		4	2		
Average size of incision (cm)	Mean (SD)	12.853 (2.532)	6.194 (2.256)	16.4295	<0.0001
Duration of surgery (minutes)	Mean (SD)	85.296 (6.729)	57.470 (5.661)	7.925	<0.0001
Blood loss (ml)	Mean (SD)	195.90 (57.093)	73.516 (49.646)	14.284	<0.0001
Radiographic Exposure (minute)	Mean (SD)	47.535 (9.444)	57.761 (8.277)	−18.309	<0.0001
Difficulty of entry point		2	4		
Trochanter lateral cortex fracture		1	3		
Improper position of Richard's screw		5	–		
Drill bit breakage		1	–		
Failure to achieve closed		4	2		
Reduction		–			
Greater Trochanteric Splintering		–	2		
Failure to give two cervical screws		–	3		
Guide wire breakage		1	–		
Improper reduction		–	3		
Bone grafting		4	–		

Table-II. Perioperative comparison between PFN and DHS groups.

Parameters		DHS	PFN	t-value	p-value
Length of hospital stay in days	Mean (SD)	11.741 (2.489)	6.41 (2.473)	121.159	<0.0001
Period of immobilization in days (Till patient is pain free)	Mean (SD)	10.323 (1.301)	4.193 (0.872)	25.985	<0.0001
Partial weight bearing in weeks	Mean (SD)	5.532 (0.851)	3.119 (0.641)	9.303	<0.0001
Full weight bearing in weeks	Mean (SD)	12.320 (0.709)	8.445 (0.746)	23.007	<0.0001
Radiological union 3 months	Mean (SD)	0.097 (0.301)	0.774 (0.990)	−3.189	0.0023
6 months	Mean (SD)	0.613 (0.495)	0.903 (1.011)	−1.304	0.197
12 months	Mean (SD)	0.194 (0.401)	0.129 (0.499)	0.662	0.511

Table-III. Post-operative parameters.

Complication	DHS	PFN	Secondary Procedures
Infection (superficial)	6	0	Local debridement + Antibiotics according to Culture and Sensitivity
Varus Malunion	8	3	–
Myositis	0	1	–
Hip and knee stiffness	6	2	Physiotherapy
Screw cutout Screw migration Screw Backout Prox. screw breakage Cortical Screw Breakage	4 1 1 – 2	2 – – 1 –	Total Hip Replacement Total Hip Replacement United uneventfully United uneventfully Revision with longer plate
Z effect	0	1	–
Rev. Z effect	0	1	–
Breakage of nail	0	1	Reoperated with long PFN
Pain (HHS PAIN SCORE) None(44) Mild(30) Moderate(20) Severe(10) Bed ridden(0)	 30 25 14 6 0	 37 28 09 1 0	 – – N S A I D N S A I D –

Table-IV. Comparison of Post-Operative complications and secondary procedures between DHS and PFN groups

Variables:		DHS	PFN	t-value	P-value
Mean shortening of the femoral neck (mm)	Mean (SD)	8.701 (1.343)	3.412 (1.034)	27.024	<0.0001
Mean shortening of the femoral shaft (mm)	Mean (SD)	9.961 (0.728)	5.901 (0.602)	37.221	<0.0001
Femoral neck-shaft angle (as compare to opposite side)	Mean (SD)	14.612 (1.891)	8.806 (1.641)	11.678	<0.0001

Table-V. Comparison of femoral neck and shaft shortening, and neck-shaft angle between DHS and PFN Groups

DISCUSSION

The way intertrochanteric fractures were treated was significantly changed in the 1950s with the introduction of Dynamic Hip Screws (DHS). On the other hand, it increases the risk of complications such as hemorrhage, fracture shortening, collapse, and mechanical failure [13]. Inadequate reduction, misplaced lag screws, and fracture instability are frequently the causes of fixation failures in osteoporotic bones.[14] The Proximal Femoral Nail (PFN), which was first introduced in the early 1990s and has since gained widespread acceptance, offers a physiologically and biomechanically more stable alternative.[15]

Compared to DHS, PFN's shorter lever arm lowers the chance of femoral neck collapse since weight transfer takes place nearer the medial axis of the nail. Compared to DHS, it takes more power to start hip screw sliding in its medial column position.[16] The mean patient age in our research was seventy years. These results are in line with previous RCTs[17,18] that compare DHS with PFN for unstable fractures and report mean ages ranging from 69 to 75 years.

The PFN group needed far less incisions (mean 6.19 cm) than the DHS group (mean 12.85 cm) ($p < 0.0001$), which is consistent with other research reporting the less invasive nature of PFN (19, 20, 21). The mean surgery times varied substantially ($p < 0.0001$), with PFN taking 57.47 minutes and DHS 85.30 minutes (22). Comparable results were found by Jonnes C. et al., who found that PFN took 90.6 minutes and DHS took 105.3 minutes ($p = 0.04$).[22]

In our study, the PFN group experienced much reduced blood loss throughout the surgery ($p < 0.0001$), which is consistent with numerous other randomized controlled studies (19, 23, 24, 25, 26). Patients with PFN (18–24) consistently had shorter hospital stays, according to other studies as well as ours. Significantly earlier partial weight bearing (mean 3.12 weeks vs. 5.52 weeks, $p < 0.0001$) and complete weight bearing (mean 8.45

weeks vs. 12.32 weeks, $p < 0.0001$) were attained by the PFN group. The PFN group's early weight bearing is consistent with research by Peivandi et al. and Jonnes C. et al.[22,26]

Radiological union at 3 months favored the PFN group ($p < 0.0001$), consistent with our study (28). However, Jonnes C. et al. and S.K. Venkatesh Gupta et al. reported no significant differences[22,27], while Shiraz S. et al. supported our findings of superior PFN outcomes.[28] Pain levels at 3 and 6 months were lower in the PFN group, aligning with other studies.[18-25] The PFN group experienced fewer complications like screw cutouts and mechanical failures, consistent with findings by Jonnes C. et al. and Peivandi et al.[22,26]

Early functional outcomes favored PFN, but Harris Hip Scores at 1 year were comparable between groups, aligning with Shiraz S. et al. and Kyavater BS et al.[27,28] While Jonnes C. et al. and Zou J. et al. found no statistically significant differences, their studies support the overall trend observed in other research.[22,28]

CONCLUSION

PFN demonstrated superior outcomes in terms of reduced surgical time, blood loss, hospital stay, and faster weight-bearing capabilities compared to DHS. Radiological and functional outcomes also favoured PFN, making it a preferable option for treating unstable intertrochanteric fractures.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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2	Shafi ul Haq	Manuscript writing, Data analysis, Data collection, Final drafting.	
3	Majid Hussain	Proof reading, Final drafting, Conceptualization.	
4	Muhammad Qasim	Final drafting, Data analysis.	