

Comparison between Dynamic Hip Screw and Proximal Femoral Nail in Patients with Pertrochanteric Fractures

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ABSTRACT

Objective: To compare dynamic hip screw and proximal femoral nail in patients with pertrochanteric fractures in terms of frequency of infection and union. **Study Design:** It was a randomized controlled trial. **Settings:** This study was carried at Department of Orthopedic Surgery, DHQ Teaching Hospital Faisalabad-Pakistan. **Duration:** 1 year from March 2017 to March 2018. **Methodology:** This study involved 60 patients belonging both genders having age between 20-70 years undergoing pertrochanteric fracture surgery. By random division of these patients, two treatment groups were made; Group-A (n=30) patients underwent fracture fixation with DHS while those in Group-B (n=30) were treated with proximal femoral nailing. Outcome variable was frequency of infection (diagnosed clinically upon appearance of any two of the following signs within 4 weeks after operation; redness around the wound, serosanguinous discharge and fever >100°F) and union (clinical and radiological) at 12 weeks follow-up that was noted for making comparison between the two groups. A written informed consent was taken from all the participating patients. **Results:** The mean age of the patients was 54.80±8.57 years. There was a female predominance with male to female ratio of 1:1.4. The frequency of union was significantly higher (86.7% vs. 46.7%; p=0.001) while the frequency of infection was significantly lower (0.0% vs. 30.0%; p<0.001) in patients managed with PFN as compared to conventional practice of DHS regardless of patient's age and gender. **Conclusion:** Proximal femoral nail was found superior to DHS in terms of significantly higher frequency of union and decreased risk of infection in patients with pertrochanteric fractures regardless of patient's age and gender which advocates preferred use of proximal femoral nail in future practice provided the necessary hardware and surgical skills are available.

Keywords: Pertrochanteric Fracture, Union, Infection, Dynamic Hip Screw, Proximal Femoral Nail.

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INTRODUCTION

Proximal femur metaphyseal fractures involving region between the shaft and the femoral neck are called pertrochanteric fractures. These fractures are also described as intertrochanteric fractures¹. Pertrochanteric fracture of the proximal femur is the most common fracture of the femur, and its incidence is rising due to increased life expectancy and osteoporosis throughout the Globe.² The lifetime risk of pertrochanteric fractures at 50 years of age is estimated to be 5.6% for men and 20% for women.^{1,2} In elder age, pertrochanteric fractures of the proximal femur occurs very commonly.³ With the advanced age in populations, it is expected that its incidence will rise even more.² Loss of independence, high rates of morbidity and mortality are associated with these fractures.^{3,4,5} Almost all cases need surgical fixation and at present there are lots of options for fixation of these fractures.³ The Dynamic Hip Screw (DHS) is one of such devices that allow controlled dynamic sliding of the lag screw over the barrel of the side plate and allows dynamic compression while weight-bearing to stabilize the femur so that it may undergo remodeling and proper fracture healing. Without any association with major complication, sound bone healing is allowed by DHS.⁶ Though in treating fractures of proximal femur, this device is taken as gold standard yet numerous new devices are also available in

the market with improved outcomes.³ Proximal femoral nail (PFN) is the latest and the best implant for unstable intertrochanteric femoral fractures. Potential advantages of this cephalomedullary device are efficient load transfer and shorter lever arm which results in less transfer of the stress & less implant failures with added advantage of rotation control. Intramedullary location limits sliding, so less deformity and shortening. Less soft tissue dissection, shorter operative time, and lesser blood loss are also the upsides of PFN.^{7,8}

A number of recent studies comparing DHS with PFN reported that the frequency of radiological union was higher with PFN while the risk of post-operative infection was lower than DHS which favor its preferred use in future orthopedic practice. However, there was controversy among the existing studies (Table 5 & 6).⁹⁻²⁴ Present study was necessitated by existing controversy and unavailability of locally published such material.

METHODOLOGY

Study Design: It was a randomized controlled trial.

Settings: This study was carried at Department of Orthopedic Surgery, DHQ Teaching Hospital Faisalabad-Pakistan.

Duration: 1 year from March 2017 to March 2018.

Sample Size: Sample size of 60 cases (30 in each group) was calculated with 80% power of test, 95% significance level while

taking expected frequency of union to be 83.0% with PFN and 44.0% with DHS in patients with pertrochanteric fractures.⁸

Inclusion Criteria: Patients having pertrochanteric fracture belonging to both the genders with ages in the range of the 20-70 years were included in this study.

Exclusion Criteria: Patients with pathological fractures, poly trauma patients and those with documented infection were excluded.

Data Collection Procedure: After taking all necessary lab tests besides a fitness certificate from anesthetist, the patients were prepared for surgery. Patients were divided into two random groups. Patients in Group-A underwent fracture fixation with DHS and those in Group-B were fixed with PFN. Patients were explained both the procedures. Informed written consent for study was taken before doing the procedure. Patients were taken care in the immediate postoperative period and were discharged after patients were stable. In OPD their follow up was made and patients were evaluated for infection (diagnosed clinically upon appearance of any two of the following signs within 4 weeks after operation; redness around the wound, serosanguinous discharge and fever >100°F) and union both clinically (defined as absence of pain or tenderness and ability to walk without aid at three month post-operatively) and radiologically (defined as solid bridging callus connecting the fracture fragments on both sides on both AP and lateral views at three month post-operatively).

Mean±sd has been used to present numerical variables like age. Percentage and frequency have been used to present categorical variables like gender, fracture union and post-operative infection. To compare the frequency of post-operative infection and fracture union between the groups Chi-square test was applied taking p-value≤0.05 as statistically significant. All the procedures were performed by a single surgical team utilizing single operative technique to minimize bias.

RESULTS

The patients had mean age of 54.80±8.57 years. Female to male ratio of patients was 1.4:1 as there were 35 (58.3%) female and 25 (41.7%) male patients as given in Table 1.

Table 1: Participant's demographic characteristics

Characteristics	Participants n=60
Age (years)	54.80±8.57
40-55 years	33 (55.0%)
56-70 years	27 (45.0%)
Gender	
Female	35 (58.3%)
Male	25 (41.7%)

difference was statistically insignificant

Comparison of both the study groups was made in terms of mean age (p=0.929) and distribution of various groups based on age (p=0.795) and gender (p=0.432) as given in Table 2.

Table 2: Demographic characteristics of study groups Independent sample t-test and chi-square test, observed

Characteristics	PFN (n=30)	DHS (n=30)	P value
Age (years)	54.90±8.28	54.70±8.99	0.755
40-55 years	17 (56.7%)	16 (53.3%)	0.795
56-70 years	13 (43.3%)	14 (46.7%)	
Gender			
Male	14 (46.7%)	11 (36.7%)	0.432
Female	16 (53.3%)	19 (63.3%)	

Independent sample t-test and chi-square test, observed difference was statistically insignificant.

9 (15.0%) patients acquired post-operative infection while 40 (66.7%) patients had fracture union at 12 weeks follow-up as give in Table 3. The frequency of union was significantly higher (86.7% vs. 46.7%; p=0.001) while that of infection was significantly lower (0.0% vs. 30.0%; p<0.001) in the PFN group in comparison with DHS group as presented in Table 4. Similar significant difference was observed across age and gender groups.

Table 3: Frequency of Post-Operative Infection and Union in Study Sample at 12 weeks follow-up

Outcome	Frequency (n)	Percent (%)	
Union	Yes	40	66.7
	No	20	33.3
Infection	Yes	9	15.0
	No	51	85.0

Table 4: Frequency comparison between Infection and Union between the Groups postoperatively

Outcome	PFN (n=30)	DHS (n=30)	P value	
Union	Yes	26 (86.7%)	14 (46.7%)	0.001*
	No	4 (13.3%)	16 (53.3%)	
Infection	Yes	0 (0.0%)	9 (30.0%)	≤0.001*
	No	30 (100.0%)	21 (66.7%)	

Chi-square test, *statistically significant difference was observed

DISCUSSION

Most commonly faced fractures by the orthopedic surgeons are hip fractures having present annual rate of 250,000 in the US.^{1,2} Over the globe, it is expected that by the year 2025, the rate of hip fractures will be at its peak to the tune of 2.6 million and by the year 2050 it will be 4.5 million due to increased life expectancy. It was shown by Gallagher et al.²⁵ that the risk of hip fracture is doubled after every 10-years of age, above the age of fifty years. Restoration within possibly shortest time, treatment without complications, bringing back the level of independence prior to injury is the goals of treating pertrochanteric fractures. In each & every case, the responsibility of formulating and executing timely effective

treatment plan in a comprehensive way is given to the surgeon. The purpose behind this is maximizing clinical results in patients of pertrochanteric patents both throughout their life and at injury time.^{1,3,25} Dynamic hip screw has always remained conventional implant for the stabilization of fractures among patients with pertrochanteric hip fractures. However, the advent of PFN has revolutionized pertrochanteric fractures with established benefits of increased stability, decreased operative blood loss and early mobilization. Recent studies claimed fracture union rate to be higher while the risk of infection to be lower with PFN but the available evidences had controversy that necessitated present study (Table 5 & Table 6).

Table 5: Review of existing literature on frequency of union

Author	Population	Union (%)	
		PFNA	DHS
Kumar et al. ^[9]	Indian	100.0%	96.00%
Gourishankar et al. ^[10]	Indian	100.0%	98.00%
Gill et al. ^[11]	Indian	100.0%	100.0%
Karn et al. ^[12]	Nepalese	100.0%	100.0%
Mulay et al. ^[13]	Indian	100.0%	98.00%
Yadav et al. ^[14]	Indian	100.0%	100.0%
Walia et al. ^[15]	Indian	100.0%	100.0%
Naikwade et al. ^[16]	Indian	99.03%	94.24%
Gupta et al. ^[17]	Indian	98.75%	99.17%
Khateeb et al. ^[18]	Indian	98.04%	98.04%
Naushad et al. ^[19]	Indian	97.10%	82.90%
Basavaraj et al. ^[20]	Indian	97.06%	94.11%
Yeganeh et al. ^[21]	Iranian	96.66%	85.19%
Pundkar et al. ^[22]	Indian	92.00%	100.0%
Jonnes et al. ^[23]	Indian	86.70%	80.00%
Kregor et al. ^[8]	American	83.00%	44.00%
Suranigi et al. ^[24]	Indian	40.00%	32.00%
Present Study	Pakistan	86.70%	46.70%

Table 6: Review of existing literature of frequency of infection

Author	Population	Infection n (%)	
		PFN	DHS
Pathania et al. ^[26]	Indian	6.66%	33.33%
Mulay et al. ^[13]	Indian	6.00%	14.00%
Harisudhan et al. ^[27]	Indian	0.00%	13.33%
Walia et al. ^[16]	Indian	0.00%	11.10%
Sridhar et al. ^[28]	Indian	8.33%	10.53%
Mittal et al. ^[29]	Indian	0.00%	6.66%
Mallikarjun et al. ^[30]	Indian	0.00%	6.66%
Ujjal et al. ^[31]	Indian	0.00%	6.60%
Naikwade et al. ^[16]	Indian	0.97%	5.77%
Kumar et al. ^[9]	Indian	2.50%	4.35%
Ranjeetesh et al. ^[32]	Indian	0.00%	4.00%
Mayi et al. ^[33]	Indian	0.00%	3.13%
Sharma et al. ^[34]	Indian	1.00%	2.00%
Gupta et al. ^[35]	Indian	0.00%	1.25%
Rohra et al. ^[36]	Indian	0.00%	1.25%
Sahin et al. ^[37]	Turkey	0.00%	1.16%
Matre et al. ^[38]	Norway	0.40%	0.80%
Present Study	Pakistan	0.0%	30.0%

Our results are similar to Pathania et al.²⁶ who reported comparable mean age of 58.20±6.7 years with male to female ratio of 1:1. Similarly, in comparison with PFN, they also showed significantly higher frequency of infection with DHS (33.33% vs. 6.66%; p<0.05) as compared to PFN. Mulay et al.¹³ in 2015 (14% vs. 6%; p<0.05) and Harisudhan et al.²⁷ in 2014 (13.3% vs. 0%; p<0.05) also reported likewise difference in infection between PFN and DHS. Walia et al.¹⁶ (2013) reported similar mean age of 52.1±6.8 years with female predominance (m:f, 1:1.5) in Indian population of such patients. They too showed significant difference in the frequency of infection between DHS and PFN (11.1% vs. 0%; p<0.05). In a similar study, Mallikarjun et al.³⁰ (2014) observed mean age of 58±5.7 years with much higher female predominance (1:2.3) in Indian population. In comparison with PFN, a significantly higher frequency of infection with DHS (6.66% vs. 0%; p<0.05) was also noted by them. Sridhar et al.²⁸ (2014) also reported similar mean age of 56.21±8.4 years with relative male predominance (52.38% vs. 47.62%). They however observed insignificant difference in the frequency of infection between DHS and PFN (10.53% vs. 8.33%; p>0.05).

Our results are also comparable to those of Kregor et al.⁸ who had likewise presented significant difference in the frequency of fracture union between PFN (83.00% vs. 44.00%) and DHS. Jonnes et al.²³ also reported similar frequency (86.70%) of fracture union with PFN. Suranigi et al.²⁴ reported much lower frequency of 32.00% for fracture union with DHS.

In local population, current study is first of its kind and has confirmed the supremacy of PFN over DHS in terms of significantly increased frequency of fracture union and lower frequency of postoperative infection irrespective of patient's gender and age. Hence, the hypothesis established at the start of study is well proved and PFN is definitely better than DHS in terms of post-operative infection and fracture union. It can be thus advocated that in future practice proximal femoral nail should be preferred over DHS in patients with intertrochanteric fractures to increase the likelihood of union. We also observed increased frequency of females among such patients which might be attributable to post-menopausal osteoporosis as majority of these cases were from old age group. In the light of this evidence, it can be suggested that minerals replacement should be given to females visiting orthopedic outdoors to minimize the risk of pertrochanteric fracture in later life.

CONCLUSION

Proximal femoral nail was found superior to DHS in terms of significantly higher frequency of union and decreased risk of infection in patients with pertrochanteric fractures regardless of patient's age and gender which advocates preferred use of proximal femoral nail in future practice provided the necessary hardware and surgical skills are available.

LIMITATIONS

Failure to compare the frequency of various complications like hardware failure, peri-prosthetic fractures etc. was biggest limitation of this study.

SUGGESTIONS / RECOMMENDATIONS

These are also very important and must be considered prior to routine adoption of PFN in clinical practice. Such a study is highly recommended in future research.

CONFLICT OF INTEREST / DISCLOSURE

None.

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AUTHORSHIP CONTRIBUTION

Muhammad Khurram Habib	Data collection for analysis besides searching literature on the topic for writing up manuscript
Rana Dawood Ahmad Khan	Critical Review
Allah Rakha	Literature Review