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Original Research Paper

COMPARATIVE ASSESSMENT OF MODIFIED PROXIMAL FEMORAL PLATE WITH DYNAMIC HIP SCREW SYSTEM: A PROSPECTIVE STUDY

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ABSTRACT

Background: DHS (dynamic hip screw) has been productive for fixation of stable intertrochanteric fractures. However, various complications have been linked with DHS use in intertrochanteric fractures.

Aim: The present study aimed to comparatively assess the modified PFLCP (proximal femoral plate locking compression plate) with a dynamic hip screw system concerning radiological and functional outcomes in Indian subjects with intertrochanteric fractures.

Methods: The study utilized PFLCP modification where screw density is increased for the trochanteric area along with the compression and locking of the screw slots with angular stable construct having the ability to achieve fracture site compression. The study included 224 subjects having intertrochanteric fractures and were randomly divided into two groups of 112 subjects each. The mean age of the study subjects was 65.64 years and the age range was 30-88 years in the DHS group. The age range and mean age in the PFLCP group were 33-88 years and 64.05 years respectively. In all subjects from both groups, functional outcomes, intraoperative blood loss, and mean surgery duration were compared and assessed with HHS (Harris Hip Scores).

Results: Mean union time in PFLCP and DHS groups was 17.4 and 18.5 weeks respectively. The study results showed a significant shortening during follow-up in 12% of subjects with 15.66 and p=0.57. The surgical site depicted postoperative discharge in 5.86 and 4% of study subjects. Implant failure was noted in 3.90 and 8% of study subjects with p=0.41. Varus collapse was seen in 33.3% and 14% of subjects with p=0.02. Mean HHS was 86.1 and 82.4 in PFLCP and DHS groups respectively with p=0.17.

Conclusion: The present study concludes that PFLCP has the potential of providing functional and radiological outcomes with equal efficacy as dynamic hip screws. The modified PFLCP technique can be used as an acceptable alternative to DHS in intertrochanteric fracture in subjects with severe osteoporosis.

Keywords: Compression plate, dynamic hip screw, Harris hip score, intertrochanteric fractures, proximal femoral locking and compression

INTRODUCTION

Intertrochanteric fractures present a commonly encountered condition in elderly subjects following traumatic exposure. Owing to fractures around the hip joint, a significant mortality rate and considerable effect on the quality of life is seen in the affected elderly subjects. Intertrochanteric fracture is usually associated with osteoporosis which presents a major healthcare burden globally.[1]

DHS/dynamic hip screw is considered a treatment choice over time for fixation in stable intertrochanteric fractures. However, it has been linked to various complications including varus collapse, shortening, and implant cutouts. PFLCP (proximal femoral locking compression plate) utilizes locking screws for achieving fixation in the proximal trochanteric region and combi-holes for femoral shaft fixation. Locked fixation decreases the friction with the periosteum of the underlying bone and promotes the natural healing process. PFLCP provides rotational and angular stability along with improved pullout strength and function as an internalized fixator.[2]

Existing literature data depicts various studies that show PFLCP as either worse, comparable or better to DHS concerning outcomes in subjects with intertrochanteric fractures. PFLCP, however, provides a fixed angular construct, it lags in leading to axial compression in the fracture site which can lead to non-union in treated cases of intertrochanteric fractures. Hence, PFLCP modification was done in 2024 by Wadhwani J et al to overcome shortcomings of conventional procedures by various changes.[3]

These changes include expansion of the proximal part of the plate for accommodation of maximum trochanteric area for fixation, increasing fixation area by increase in screw holes number in proximal region from 3 to 6, providing variable options for fixation with three compression screw slots to achieve intraoperative compression across the fracture site, three locking screw slots that gives angular stability to the construction, and 3 proximal locking screw holes of 5mm with various angles to the shaft of the plate. These angles are 95° to the first proximal locking hole, 110 to the second proximal locking hole, and 125° to the third proximal locking hole. The distal plate portion was left with a combi-hole of varying fixation length for fixing the femoral shaft.[3]

This modification of PFLCP was done to adapt the advantages of angular stable construct along with the advantage of achieving compression across the fracture site with the help of lag screws through the proximal expanded region of the plate.[4] The present study aimed to comparatively assess the modified PFLCP (proximal femoral plate locking compression plate) with a dynamic hip screw system concerning radiological and functional outcomes in Indian subjects with intertrochanteric fractures.

MATERIALS AND METHODS

The present prospective randomized clinical study was aimed to comparatively assess the modified PFLCP (proximal femoral plate locking compression plate) with a dynamic hip screw system concerning radiological and functional outcomes in Indian subjects with intertrochanteric fractures. The study was done Department of Orthopedics of the Institute. Verbal and written informed consent were taken from all the subjects before study participation.

The study assessed 224 subjects from both genders and the age range of 28-90 years with intertrochanteric fractures. The functional outcomes assessed with HHS were taken as primary study

outcomes and secondary outcomes considered were radiologic assessment. Subjects were randomly divided into two groups of 112 subjects each. The classification of the fractures was done following the AO/OTA alphanumeric classification.[5]

Subjects having post-traumatic intertrochanteric fractures in adults aged 18 years or more from either gender were assessed. The fractures included 31A2.2, 31A2.1, and 31A1 from the AO/OTA classifications. The exclusion criteria for the study were subjects with AO/OTA classifications 31A2.3 and 31A3 type, previously treated intertrochanteric fractures, open intertrochanteric fractures, and pathological intertrochanteric fractures. Standard surgical technique was used for DHS.

In the modified PFLCP procedure, after placing the subject in the supine position, a lateral longitudinal incision of 8-10cm was made from a greater trochanter tip and a standard direct lateral approach of muscle dissection was used. After attaining acceptable fracture reduction, the plate was placed across the fracture site. Via the proximal locking hole of the plate, a 2.5mm guidewire was passed followed by the passing of a 2.5mm de-rotation wire through another proximal locking hole with a locking sleeve. Fracture reduction and wire position were confirmed under fluoroscopy. This was followed by the passing of a 6.5mm compression screw via a hole in the compression plate across the fracture site. One/more compression screws were further passed based on the need. Two 5mm proximal locking screws were fixed in the proximal femoral region. A 4.5mm distal cortical screw closest to the fracture site was passed to align the plate with the bone and 2-4 of 5mm locking screws or 4.5mm distal cortical screws were used depending on the bone strength. The wound was closed in layers following a thorough wash.

All the surgeries were performed by two surgeons experienced in the field. Static quadriceps exercises were started the next day postoperatively and sutures were removed after 2 weeks of surgery followed by starting heel slide and straight leg raising exercises. Initially, subjects were asked to walk with a three-point gait utilizing a walker. Based on compliance and condition, a two-point gait was advised after 4 weeks postoperatively. Follow-up duration was 6 months minimum. At every follow-up of 1, 3, and 6 months, lateral and anteroposterior radiographs were taken for all the subjects and were assessed.

Union was taken when bridging trabeculae were seen across the fracture site in a minimum of three of four cortices in anteroposterior and lateral views. Significant shortening was taken for condition with limb length discrepancy of >2 cm.[6] The NSA (neck shaft angle) was assessed in an immediate postoperative radiograph and at a 6-month follow-up. Significant varus collapse was taken for the difference between the NSA in radiographs at postoperative and at 6-month follow-up was >10°.[7] HHS scores were used for functional assessment of the subjects at 6 months postoperatively.

RESULTS

The present prospective randomized clinical study was aimed to comparatively assess the modified PFLCP (proximal femoral plate locking compression plate) with a dynamic hip screw system concerning radiological and functional outcomes in Indian subjects with intertrochanteric fractures. The study included 224 subjects having intertrochanteric fractures and were randomly divided into two groups of 112 subjects each. The mean age of the study subjects in DHS and PFLCP groups was 65.64±12.02 and 64.05±13.82 years respectively which was statistically non-significant with p=0.53 and the age range was 30-88 and 33-88 years respectively. There were 35.7% (n=40) males and 64.3% (n=72) females in DHS and 41% (n=46) males and 59% (n=66) females in the PFLCP group with p=0.57. Cause of injury

was fall from height in 12.5% (n=14) and 10.7% (n=12) subjects from DHS and PFLCP groups respectively, RTA in 16.07% (n=18) and 12.5% (n=14) subjects respectively, and slip and fall in 71.42% (n=80) and 76.78% (n=86) subjects from DHS and PFLCP groups respectively. The distribution of study subjects in two groups was statistically comparable with p=0.93 as shown in Table 1.

It was seen that for perioperative parameters comparison in two study groups, the mean surgery duration in DHS and PFLCP groups was 74.27±11.94 and 77.30±13.01 minutes with p=0.22. Mean intraoperative blood loss was comparable with 303.19±81.86 and 319.44±80.17ml with p=0.27. Need for blood transfusion was seen in 14.28% (n=16) and 16.07% (n=18) study subjects from DHS and PFLCP groups with p=0.77. Duration of hospital stay was 5.62±3.37 and 6.02±4.14 days in DHS and PFLCP groups which was comparable with p=0.64. Mean radiological union time was 18.36±3.68 and 17.24±3.41 weeks in DHS and PFLCP groups respectively and was comparable with p=0.11. Mean HHS was 82.4±27.05 and 86.1±30.38 respectively in DHS and PFLCP groups which was non-significant with p=0.17.

Concerning functional outcomes, excellent results were seen in 50.98% (n=52) and 62% (n=62) subjects from DHS and PFLCP groups respectively. Good results were seen in 21.56% (n=22) and 20% (n=20) subjects from DHS and PFLCP groups respectively. Fair results were seen in 21.56% (n=22) and 10% (n=10) subjects from DHS and PFLCP groups respectively. Poor results were seen in 5.88% (n=6) and 8% (n=8) subjects from DHS and PFLCP groups respectively. The distribution of functional outcomes was comparable in the two study groups with p=0.43 (Table 2).

The study results showed that for postoperative complications in two study subjects, the need for revision surgery was seen in 5.88% (n=6) and 8% (n=8) study subjects from DHS and PFLCP groups respectively with p=0.73. Significant shortening was seen in 15.68% (n=16) and 12% (n=12) subjects from DHS and PFLCP groups respectively with p=0.57. Muscle wasting was seen postoperatively in 13.72% (n=14) and 12% (n=12) subjects from DHS and PFLCP groups respectively with p=0.77. Implant failure/screw cutout and postoperative discharge were comparable in the two groups with p=0.41 and 1.00 respectively. Varus collapse was significantly higher in the DHS group with 33.3% (n=34) subjects compared to the PFLCP group where it was seen in 14% (n=14) study subjects with p=0.02 (Table 3).

Characteristics	**DHS**	**PFLCP**	**p-value**
Mean age (years)	65.64±12.02	64.05±13.82	0.53
Age range (years)	30-88	33-88	
Gender			
Males	40 (35.7)	46 (41)	0.57
Females	72 (64.3)	66 (59)	
Injury cause			
Fall from height	14 (12.5)	12 (10.7)	0.82
RTA	18 (16.07)	14 (12.5)	
Slip and fall	80 (71.42)	86 (76.78)	
AO classification			
31A1.1	22 (19.64)	20 (17.85)	0.93
31A1.2	20 (17.85)	18 (16.07)	
31A1.3	18 (16.07)	12 (10.71)	
31A2.1	18 (16.07)	26 (23.21)	

31A2.2	16 (14.28)	16 (14.28)	
31A2.3	18 (16.07)	20 (17.85)	

Table 1: Demographic and disease data in two groups of study subjects

Parameters	**DHS**	**PFLCP**	**p-value**
Mean surgery duration (mins)	74.27±11.94	77.30±13.01	0.22
Mean intraoperative blood loss (ml)	303.19±81.86	319.44±80.17	0.27
Need for blood transfusion	16 (14.28)	18 (16.07)	0.77
Hospital stay duration (days)	5.62±3.37	6.02±4.14	0.64
Mean radiological union time (weeks)	18.36±3.68	17.24±3.41	0.11
Mean HHS	82.4±27.05	86.1±30.38	0.17
Functional outcomes			
Excellent	52 (50.98)	62 (62)	0.43
Good	22 (21.56)	20 (20)	
Fair	22 (21.56)	10 (10)	
Poor	6 (5.88)	8 (8)	

Table 2: Perioperative parameters comparison in two study groups

Parameters	**DHS**	**PFLCP**	**p-value**
Need for revision surgery	6 (5.88)	8 (8)	0.73
Significant shortening	16 (15.68)	12 (12)	0.57
Muscle wasting	14 (13.72)	12 (12)	0.77
Varus collapse	34 (33.3)	14 (14)	**0.02**
Implant failure/screw cutout	4 (3.92)	8 (8)	0.41
Postoperative discharge	6 (5.88)	4 (4)	1.00

Table 3: Postoperative complications in two groups of study subjects

DISCUSSION

The present study included 224 subjects having intertrochanteric fractures and were randomly divided into two groups of 112 subjects each. The mean age of the study subjects in DHS and PFLCP groups was 65.64±12.02 and 64.05±13.82 years respectively which was statistically non-significant with p=0.53 and the age range was 30-88 and 33-88 years respectively. There were 35.7% (n=40) males and 64.3% (n=72) females in DHS and 41% (n=46) males and 59% (n=66) females in the PFLCP group with p=0.57. Cause of injury was fall from height in 12.5% (n=14) and 10.7% (n=12) subjects from DHS and PFLCP groups respectively, RTA in 16.07% (n=18) and 12.5% (n=14) subjects respectively, and slip and fall in 71.42% (n=80) and 76.78% (n=86) subjects from DHS and PFLCP groups respectively. The distribution of study subjects in the two groups was statistically comparable with p=0.93. These data were comparable with the previous studies of Dhamangaonkar AC et al[8] in 2013 and Chinmoy D et al[9] in 2016 where authors assessed subjects with comparable demographics and with intertrochanteric fractures as seen in the present study.

The study results showed that for perioperative parameters comparison in two study groups, the mean surgery duration in DHS and PFLCP groups was 74.27±11.94 and 77.30±13.01 minutes with p=0.22. Mean intraoperative blood loss was comparable with 303.19±81.86 and 319.44±80.17ml with p=0.27.

Need for blood transfusion was seen in 14.28% (n=16) and 16.07% (n=18) study subjects from DHS and PFLCP groups with p=0.77. Duration of hospital stay was 5.62±3.37 and 6.02±4.14 days in DHS and PFLCP groups which was comparable with p=0.64. Mean radiological union time was 18.36±3.68 and 17.24±3.41 weeks in DHS and PFLCP groups respectively and was comparable with p=0.11. Mean HHS was 82.4±27.05 and 86.1±30.38 respectively in DHS and PFLCP groups which was non-significant with p=0.17. These results were consistent with the findings of Asif N et al[10] in 2016 and Zang W et al[11] in 2018 where perioperative parameters and fracture type distribution in intertrochanteric fractures similar to the present study were reported by the authors in their respective studies.

It was seen that concerning functional outcomes, excellent results were seen in 50.98% (n=52) and 62% (n=62) subjects from DHS and PFLCP groups respectively. Good results were seen in 21.56% (n=22) and 20% (n=20) subjects from DHS and PFLCP groups respectively. Fair results were seen in 21.56% (n=22) and 10% (n=10) subjects from DHS and PFLCP groups respectively. Poor results were seen in 5.88% (n=6) and 8% (n=8) subjects from DHS and PFLCP groups respectively. The distribution of functional outcomes was comparable in the two study groups with p=0.43. These findings were in agreement with the results of Kivi MM et al[12] in 2013 and He S et al[13] in 2018 where functional outcomes reported by the authors in their studies were correlated to the results of the present study.

It was also seen that for postoperative complications in two study subjects, the need for revision surgery was seen in 5.88% (n=6) and 8% (n=8) study subjects from DHS and PFLCP groups respectively with p=0.73. Significant shortening was seen in 15.68% (n=16) and 12% (n=12) subjects from DHS and PFLCP groups respectively with p=0.57. Muscle wasting was seen postoperatively in 13.72% (n=14) and 12% (n=12) subjects from DHS and PFLCP groups respectively with p=0.77. Implant failure/screw cutout and postoperative discharge were comparable in two groups with p=0.41 and 1.00 respectively. Varus collapse was significantly higher in the DHS group with 33.3% (n=34) subjects compared to the PFLCP group where it was seen in 14% (n=14) study subjects with p=0.02. These results were in line with the recordings in the studies of Shah MD et al[14] in 2016 and Fulkerson E et al[15] in 2006 where postoperative complications similar to the present study were reported by the authors in their studies.

CONCLUSIONS

Within its limitations, the present study concludes that PFLCP has the potential of providing functional and radiological outcomes with equal efficacy as dynamic hip screws. The modified PFLCP technique can be used as an acceptable alternative to DHS in intertrochanteric fracture in subjects with severe osteoporosis. However, this modified PFLCP technique is a newer technique that needs further exploration with a larger sample size and longer monitoring to assess the efficacy of this modification.

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