Original Research Paper

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"SURGICAL MANAGEMENT OF SUBTROCHANTERIC FEMORAL FRACTURES BY PFN AND DCS - A COMPARATIVE STUDY"

Dr Virendra K Bhasme	Associate Professor, Department of Orthopaedics, Karnataka Institute of Medical Sciences, Hubballi.
Dr Madhuchandra Ramanand	Associate Professor, Department of Orthopaedics, Karnataka Institute of Medical Sciences, Hubballi.
Dr Arun C Raj*	Junior Resident, Department of Orthopaedics, Karnataka Institute of Medical Sciences, Hubballi. *Corresponding Author

ABSTRACT

Background: The treatment of Subtrochanteric fractures continues to be a challenge in orthopaedic trauma, especially in geriatric population. Among the various surgical technique- Proximal Femoral Nail (PFN) and Dynamic Condylar Screw (DCS) are the ideally sought implants for fixation.

Aims and objectives: This study was designed to assess the clinical, functional and radiological outcomes and complications of femoral subtrochanteric fractures treated with PFN and DCS

Methodology: This is a prospective observational study of 35 cases of subtrochanteric femoral fractures admitted to KIMS hospital, Hubballi, Karnataka. These 35 cases then randomized into two groups of PFN and DCS. All patients were followed up with radiographs for every 4 weeks for 3 months and on 6th month and outcome was assessed using modified Harris Hip Score.

Results: In our study, mean duration of hospital stay was found to be 11.23 ± 3.038 days in PFN group and 14.08 ± 2.178 days in DCS group and mean time for union was 14.91 ± 3.006 weeks in PFN group and 17.33 ± 2.871 in DCS group. Good to excellent results were seen in 81.82% of subtrochanteric fractures in PFN group and 53.85% in DCS group.

Conclusion: From this study, we conclude that, functionally there were no significant difference between DCS and PFN but, PFN has advantages in terms of faster surgical procedure, less blood loss, shorter hospital stays and less time for union. However, in complex subtrochanteric fractures DCS definitely a reliable and a backup implant.

KEYWORDS : subtrochanteric fractures, intramedullary nailing, plate osteosynthesis, dynamic condylar screw

INTRODUCTION

The sub-trochanteric region is mostly exposed to high stresses during the day-to-day routine activities. The axial loading forces that act through the hip joint which creates a large moment arm, with significant lateral tensile stresses and medial compressive loads. In addition to the bending forces, the muscular forces acting at the hip also create torsional effects that leads to significant rotational shear forces and during normal activities of daily living, up to 6 times the body weight is transmitted across the subtrochanteric region of the femur. The thickness of cortical bone in sub-trochanteric region is more and its vascularity is less, which can produce healing disturbances. This fracture is difficult to manage because of the above-mentioned reasons and is associated with many complications affecting fracture healing like mal-union, delayed union, non-union and implant failure[1]. The subtrochanteric region is cortico-diaphyseal, rather than the more rapidly healing cancellous bone which predominates in the intertrochanteric region. Due to these specific anatomical features conservative treatment is not preferred, and if there are no absolute contraindications and if the patient can tolerate the surgery, then surgery is the treatment of choice[2]. The goal of operative treatment is restoration of normal length and angulation to restore adequate tension to the abductors[1].

The two primary options for treatment of subtrochanteric fractures are intramedullary fixation and extramedullary fixation[1]. The extramedullary implants which included in the treatment of subtrochanteric fractures include, condylar blades plates, proximal femoral locking plates and dynamic condylar screw (DCS) and intramedullary implant includes mainly cephalomedullary nails[3]. The purpose of our study was to draw conclusions between plate osteosynthesis, DCS in particular and Proximal Femur Nail (PFN) in terms of it functional and clinical outcome.

OBJECTIVES OF THE STUDY

1. To assess the clinical, functional and radiological outcomes of femoral subtrochanteric fractures treated with Proximal Femur Nail and Dynamic Condylar Screw.
2. To assess the complications associated with the surgical management of femoral subtrochanteric fractures.

MATERIALS AND METHODS

This was a prospective observational study carried out at the Department of Orthopaedics, KIMS, Hubli, Karnataka, India. Total 35 patients were studied, consisted of 27 males and 8 females, whose age-group ranged from 30 to 74 years. Patients were classified according to Seinsheimer's classification based on antero-posterior view with traction and internal rotation taken at the time of admission.

Inclusion Criteria:

- Subtrochanteric fractures. (Seinsheimer Type 1-5)
- Those who are willing for surgery and to participate in the study.
- Those who are medically fit for surgery.
- Age more than 18 years and less than 75 years

Exclusion Criteria:

- Open fractures
- Pathological fractures
- Associated with neck of femur fractures
- Not willing for surgery
- Patients with distal neurovascular deficits

All patients were operated on the fracture table under spinal anaesthesia, after the routine preoperative assessment. Standard PFN and DCS surgical procedures are carried out by senior orthopaedic surgeon.

Postoperative Protocol

- Routine postoperative protocol and chest physiotherapy.
- Hip and knee mobilization from the first postoperative day.
- Weight-bearing increased in a graded manner.
- Perioperative deep vein thrombosis (DVT) prophylaxis with enoxaparin.
- Suture removal on 12th postoperative day
- Regular follow-up with periodical X-rays.

Patients were evaluated clinically and radiologically at every 4 weeks for 3 months, on 6th month and at 1 year. During follow-up, the functional outcomes based on pain, function, deformity, and range of motion were assessed using Harris hip score. Collection of data was per the proforma with consent from patients.

RESULTS

Our study consisted of 35 cases of subtrochanteric fractures surgically treated with Proximal Femoral nail and Dynamic Condylar Screw in the Department of Orthopaedics, KIMS Hubli, Karnataka India between December 2019 - December 2021.

In our study maximum age was 74 years for PFN group and 65 years for DCS group and the minimum was 35 years and 30 years for PFN and DCS group respectively with an average age of 53.40 years and 48.39 years for PFN and DCS. The number of male patients in our study were 27 of which 16 belonged to PFN group and 11 in DCS and of total 8 females 6 in PFN and 2 in DCS. In PFN 10 cases were right sided and 12 were left sided, In DCS 7 were right sided and 6 were left sided.

The most common mode of injury in our study was Road traffic accident accounting for 18 cases of which 5 were under DCS group and remaining 13 were under PFN group. 9 cases had a history of slip and fall in which 5 and 4 cases were operated with PFN and DCS respectively. 8 cases were because of fall from height of which 4 cases each were operated with PFN and DCS.

Out of 35 cases, 5 Cases were Type II B, 6 were Type II C, 10 were Type III A, 4 were Type III B, 5 were Type IV and 5 rest were Type V of Seinsheimer's classification.

Table 1: Fracture Pattern

Type Of Fracture (Seinsheimer's)	PFN		DCS	
	Number of cases	Percentage	Number of cases	Percentage
Type I	00	0	00	0
Type II	07	31.81	04	30.78
Type III	09	40.91	05	38.46
Type IV	03	13.64	02	15.38
Type V	03	13.64	02	15.38
Total	22	100	13	100

All patients were operated on an elective basis and surgery was done within a mean period of 5 days following admission to hospital with a range of 3-10 days. The delay was due to the non-availability of Operation Theatre, due to concurrent management of associated injuries and time taken for medical fitness for surgery due to comorbidities. Duration of surgery was found to be in the range 70-110 min with an average duration of 93.64 min for PFN group and a range of 80-120 min with an average of 101.15 min for DCS group. Duration was found to be more in type IV and type V subtrochanteric fractures, due to difficulty in achieving anatomical reduction. The mean blood loss in PFN group was 256. 82 ml and in DCS group was 357.69 ml and mean duration of surgery was found to be 256.82 min and 357.69 min for PFN and DCS group respectively.

Table 2: Intraoperative details

	PFN	DCS
Mean duration of surgery	93.64 min	101.15 min
P- value	0.044	
Mean Blood Loss(ml)	256.82 ml	357.69 ml
P- value	0.000	

Of the 22 cases operated with PFN, closed reduction was done in 12 cases and in remaining 10 cases, closed reduction was tried initially and later fracture site was opened for better reduction. In DCS group open reduction was performed in all 13 cases.

The complications encountered during surgery were mainly due to difficulty in achieving anatomical reduction, due to which a total of 4 cases had varus malreduction in PFN group and 1 case in DCS.

Table 3: Complications

Complication	PFN		DCS	
	Number of cases	Percentage	Number of cases	Percentage
Varus Malreduction	4	18.18	1	07.69
Surgical Site Infection	3	13.64	2	15.39

In our study we had 3 cases of surgical site infection in PFN group and 2 cases in DCS group which required wound debridement and intravenous antibiotics for 3 weeks period. No other complication like Deep Venous thrombosis, systemic infection, fat embolism etc. have been reported.

1 Patient had delayed union in PFN group during 6 months follow up, which ultimately resulted in implant failure due to breakage of the Nail. This occurred dure to early weight bearing by the patient due noncompliance to post op advises. However, union was achieved late with heavy callus formation and excellent functional outcome.

1 patient from DCS group has developed non-union during 6 months follow up and had broken Implant with a shortening of 1 cm. This patient was managed by Open Reduction and Internal Fixation with reverse DFLP and bone grafting was done after distal femoral traction to correct the limb length discrepancy. Two patients in PFN group and 1 patient in DCS group has developed hip stiffness which was due to prolonged immobilization and insufficient motivation for physiotherapy. One patient had Z effect and was treated by removal of the proximal most derotation screw since radiological union was achieved already.

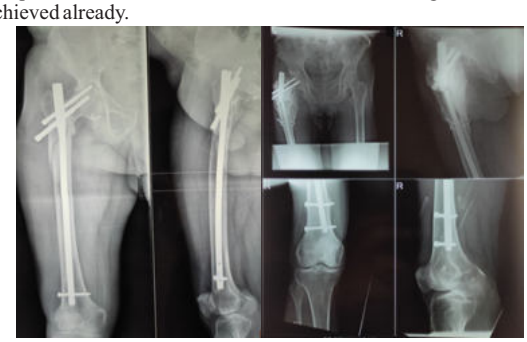

Figure 1: Xray showing Z EFFECT

Figure 2: Broken implant 24 weeks follow up

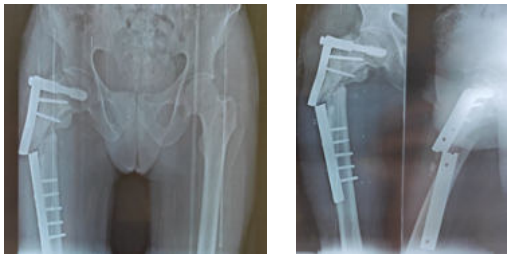

Figure 3: DCS, at 8 weeks follow up

All patients were advised for non-weight bearing mobilization with the help of walker and active physiotherapy from post-op day 2 itself.

The average duration of hospital stay following surgery was 11.23 days ranging from 7 – 19 days for PFN group and average duration of stay was 14.08 for DCS group ranging from 11-19 days.

The average duration of follow up was 9 months ranging from 4 months to 12 months.

Radiological union was said to be achieved on the evidence of obliteration of fracture lines and trabecular continuity between the two fragments on anteroposterior and lateral x-rays in at least three cortices.

Table 4: Radiological Union

	PFN	DCS
Percentage	**100%**	**92.31%**
Mean time for Union	14.91	17.33
Standard Deviation	3.006	2.871
Standard Error	0.641	0.829
P- value	0.029	

All patients in PFN group achieved union by at least by 4.5 months except 1 case which took 8 months for union with implant failure. Among DCS group all patients achieved union by at least 5.5 months except 1 case which had non-union on 6 months follow-up with broken implant, which was later operated with Reverse DFLP.

Functional outcome was assessed in 22 cases of PFN and 13 cases of DCS group. Excellent results were noted in 9 cases, good outcome in 9 cases and fair outcome in 2 cases and poor outcome in 2 cases in PFN group. In DCS group Excellent results were noted in 2 cases, good outcome in 5 cases and fair outcome in 5 cases and poor outcome in 1 case.

Table 5: Functional Outcome

Results	PFN		DCS	
	Number of cases	Percentage	Number of cases	Percentage
Excellent	9	40.91	2	15.39
Good	9	40.91	5	38.46
Fair	2	09.09	5	38.46
Poor	2	09.09	1	07.69
P value	0.262			

DISCUSSION

It has been a great challenge for orthopaedic surgeons to achieve satisfactory results in case of subtrochanteric fractures since ages. It still remains a controversial topic as to which is the best implant. The main system of implants widely used now are the intramedullary interlocking nails and the plate screw systems each with its own advantages and disadvantages. Intramedullary fixation has advantages over extramedullary implants as it is more of a biological fixation with less devascularization, less bleeding, less surgical duration and early functional recovery.

Herscovici et al[4], in a retrospective study compared the functional outcomes of intramedullary and extramedullary implants and observed that functional results and complications rates were almost similar, but the advantages of intramedullary implants over extramedullary devices were in terms of less bleeding and faster surgical duration. In addition, the eccentrically plating is prone to fatigue breakage due to their mechanical load-sharing effect. When the intramedullary devices cannot be used for technical reasons, the dynamic condylar screw provides a reasonable alternative. Nungu et al.[5] felt that the DCS is able to tolerate bending loads well. They however recommended the reconstruction of a good medial support.

In our study of 35 patients with subtrochanteric fractures the mean age was 50.9 years, which was similar to a study conducted by Lei-Sheng Jiang et al[6] where the average age of patients was 53years. In our study there was a male predominance, with 77.14% of the patients being males and 22.86% patients being females. In a study conducted by Wei Ting Lee et al[7], a male preponderance was seen with 21 men out of 26 total cases. We also observed that the mechanism of injury in majority our patients was following road traffic accidents with 51.43% of cases sustaining fracture following RTA and 25.71% of cases following accidental slip and fall and remaining 22.86% following fall from height. A study conducted by Subramanyam Yadlapalli et al[8] also showed similar results.

In our study we achieved 100% union in PFN group with a range of 12 – 24 weeks with a mean of 14.91 ± 3.01 weeks, whereas in DCS group there was a single case of non-union with implant failure resulting in a union rate of 92.31% with a range of 14 – 22 weeks with a mean of 17.33 ± 2.87 weeks with p value 0.029 which was statistically significant. In the study by Kachewar et al.[9], union rate in PFN group was 16 weeks and DCS group was 19 weeks. Similarly in a study by Kulkarni SG et al.[10], the union time among PFN group was found to be 12.03 weeks and 16.95 for DCS group, which was comparable to our study.

In our study we observed that 81.82% of cases in PFN group had "good" to "excellent" Harris Hip Score, S.V. Yadikar et al[11] in their study had 92% of cases with "good" to "excellent" results. In DCS group 53.85% of cases had "good" to excellent Harris Hip Score. The functional outcome in the study by Kachewar et al.[9], was "excellent" for the majority of the patients treated with PFN. On the other hand, the functional outcome for the majority of the patients treated with DCS was "good". Similar results were obtained in the study of Chaturvedi et al[12]. However, in our study there was no statistical significance in terms of functional outcome with a p value of 0.262.

In our study in PFN group, 4 patients (18.18%) had varus malreduction, however all patients achieved union but of those, 2 patients had poor functional outcome. There were 3 cases (13.64%) of surgical site infection in the PFN group along with 1 case of implant failure. 2 cases showed z effect, backing out of lag screw and medialization of the derotation screw. Surgical site infection was managed by thorough debridement and IV antibiotic for 2 weeks. Among the cases treated with PFN all cases union was achieved except for one case which showed delayed union and has taken 24 weeks for radiological union. In a study by B Kanthimathi et al.[13], it was observed that the rate of implant breakage in PFN was 4%. They observed a complication rate of 20%.The inherent instability of the fracture pattern and the difficulty to achieve medial buttressing is considered as a cause of failure in PFN fixation.

In our study among the DCS group, 1 patient had implant breakage with non-union during follow-up on 6th month, which was re-operated with reverse DFLP with bone grafting. 3 patients in DCS group had limb length discrepancy compared to PFN group which had only one case of LLD. 1 patient (7.69%) had varus malreduction and 2 cases (15.39%) had surgical site infection which was managed by debridement and IV antibiotics, which responded well. The implant failure in DCS group can be attributed to varus malreduction at the time of surgery, medial comminution and distraction at the fracture site which would have caused high stress at the plate screw interface, eventually leading to plate breakage. We could have avoided this complication by achieving a perfect reduction and primary bone grafting.

The terms of successful outcome in subtrochanteric fractures can be attributed to a good understanding of fracture anatomy & biomechanics, good preoperative planning and accurate instrumentation.

CONCLUSION

Both PFN and DCS are reliable implants in managing subtrochanteric fractures. Due to unique anatomical location subtrochanteric fractures are exposed to a great deal of muscle forces and stress while weight bearing that can often lead to implant failure, non-union or mal-union, especially if proper reduction and posteromedial buttress is not achieved. It was found that, functionally there were no significant difference between DCS and PFN, However, it was found that PFN proves to be a reliable implant in terms of faster surgical procedure, less blood loss, shorter hospital stays and less time for union. Also, osteosynthesis with the Proximal femoral nail offers the advantages of high rotational stability of the head-neck fragment and has the advantage of collapse at fracture site and is biomechanically sound as it's an intramedullary device, which allows earlier weight bearing mobilization with less local and general complications. In complex subtrochanteric fractures, especially Type IV and Type V fractures, DCS can be definitely considered as a backup plan or as a reliable implant that can be used as an alternative to PFN.

It should also be noted that, subtrochanteric fracture offers great challenge to treating orthopaedician, with numerous Intramedullary and Extramedullary implants in the market. Our results indicates that there is a necessity of a careful surgical technique and certain modifications that are specific to the individual fracture pattern in order to reduce the incidence of complications. Above all, anatomical reduction of fracture fragments and achieving proper posteromedial buttress along with right instrumentation is the key for restoring near normal function of the limb.

REFERENCES

1. McLaurin, T. M., & Lawler, E. A. (2004). Treatment modalities for subtrochanteric fractures in the elderly. Techniques in orthopaedics, 19(3), 197-213.
2. Zhou, Z. B., Chen, S., Gao, Y. S., Sun, Y. Q., Zhang, C. Q., & Jiang, Y. (2015). Subtrochanteric femur fracture treated by intramedullary fixation. Chinese Journal of Traumatology, 18(06), 336-341.
3. Kregor, P. J., Obremskey, W. T., Kreder, H. J., & Swiontkowski, M. F. (2005). Unstable pertrochanteric femoral fractures. Journal of orthopaedic trauma, 19(1), 63-66.
4. Herscovici Jr, D., Pistel, W. L., & Sanders, R. W. (2000). Evaluation and treatment of high subtrochanteric femur fractures. American Journal of Orthopedics (Belle Mead, NJ), 29(9 Suppl), 27-33.
5. Nungu, K. S., Olerud, C., & Rehnberg, L. (1993). Treatment of subtrochanteric fractures with the AO dynamic condylar screw. Injury, 24(2), 90-92.
6. Jiang, L. S., Shen, L., & Dai, L. Y. (2007). Intramedullary fixation of subtrochanteric fractures with long proximal femoral nail or long gamma nail: technical notes and preliminary results. ANNALS-ACADEMY OF MEDICINE SINGAPORE, 36(10), 821.
7. Lee, W. T., Murphy, D., Kagda, F. H., & Thambiah, J. (2014). Proximal femoral locking compression plate for proximal femoral fractures. Journal of orthopaedic surgery, 22(3), 287-293.
8. Rao, D. V., Kumar, C. S., Sangepu, A., & Yadlapalli, S. (2015). A study of management of subtrochanteric fracture femur by proximal femoral Nailing. Journal of Evolution of Medical and Dental Sciences, 4(66), 11528-11535.
9. Kachewar, V. B., Pundkar, G. N., Bute, B. D., & Wankhade, U. G. (2020). Comparative study of the clinical and radiological outcome of subtrochanteric fracture femur fixed by dynamic condylar screw (DCS) and long proximal femur nail (PFN). Indian Journal of Orthopaedics, 6(4), 311-315.
10. Kulkarni, S. G., Sekhri, A., Malve, S. P., Kulkarni, M. G., Kulkarni, V., & Prajapati, N. (2015). Intramedullary Nailing Versus Dynamic Condylar Screw for Subtrochanteric Femur Fractures. Journal of Trauma, 10(4), 10-5.
11. Yadkikar, S. V. (2015). Prospective study of proximal femoral nail in management of trochanteric and subtrochanteric fractures of femur. management, 3(10), 17.
12. Chaturvedi, B., Banerjee, S., & Ali, S. I. (2015). Study of internal fixation of subtrochantric fracture of femur with dynamic hip screw, dynamic condylar screw and proximal femoral nail. International Journal of Scientific and Research Publications.
13. Kanthimathi, B., & Narayanan, V. L. (2012). Early complications in proximal femoral nailing done for treatment of subtrochanteric fractures. Malaysian Orthopaedic Journal, 6(1), 25.