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Functional Outcomes of Pertrochanteric Fractures Managed with Dynamic Hip Screw: A Prospective Observational Study

Running title: Functional Outcomes of Pertrochanteric Fractures

Author details: A. Rajeswari[1], Deepthi Papireddy[2], Varakuti Santhi Swaroop[3], Deety L Venkatesh[4,*]

1. MS Orthopedics, Assistant Professor, Department of Orthopedics, ACSR Govt Medical College, Nellore, Andhra Pradesh 524004, India; +91 7729941979; arjun.bhagyaraj@gmail.com
2. MS Orthopedics, Assistant Professor, Department of Orthopedics, ACSR Government Medical College, Nellore, Andhra Pradesh 524004, India; +91 8142703070; deepu.papireddy@gmail.com
3. MS Orthopedics, Assistant Professor, Department of Orthopedics, ACSR Government Medical College, Nellore, Andhra Pradesh 524004, India; +91 9441428197; gmcatp.santhi@gmail.com
4. DNB Orthopedics, Associate Professor, Department of Orthopedics, Sri Venkateswara Medical college, Tirupati, Andhra Pradesh 517507, India; +91 9160441079; venkateshdeety@gmail.com

Corresponding Author:

Deety L Venkatesh

Associate Professor, Department of Orthopedics, Sri Venkateswara Medical college, Tirupati, Andhra Pradesh 517507, India

Contact Number: +91 9160441079

Email ID: venkateshdeety@gmail.com

Abstract

Background:About half of all hip fractures brought on by low energy mechanisms are pertrochanteric fracture (PTFs). There are several risk factors, such as osteoporosis, female gender, growing age, and abnormal gait. Thus, this study aimed to analyze the functional outcome of the patients with PTFs who underwent dynamic hip screw (DHS) implant.

Materials and Methods:This prospective observational study involved 30 adult patients with PTFs who underwent surgery with DHS implant in the Department of Orthopedics of a tertiary care institute. The patients were followed-up at 6-weeks, 1-month, 3-months, and 6-months. Postoperatively, and at each follow-up, clinical and radiological examination was performed. Moreover, at the end of the study, functional outcome was assessed with Harris Hip Score (HHS).

Results:The study population had female predominance (50%) with half of the patients belonging to the age group of 60-70 years. Trivial trauma (93.33%) was the most common injury with Boyd and Griffin type 2 (43.33%) being the most common fracture type. The duration of fracture union was 10.46 ± 2.43 weeks and complete union was observed in 28 (93.33%) patients. Assessment with HHS revealed excellent and good functional outcome in

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18 (60%) and 6 (20%) patients, respectively.

Conclusion:In patients with PTFs, DHSprovides stable construct and facilitates early mobilization and weight bearing to the patients.

Key Words: *Pertrochanteric fractures, Dynamic hip screw, Harris hip score, Boyd and Griffin type*

I. Introduction

Pertrochanteric fractures (PTFs) account for roughly half of all proximal femoral fractures, with death rates ranging from 4.5% to 22%. These fractures have been connected to functional impairment, decreased mobility, and loss of independence.[1]The primary goal of treating these fractures is to achieve a stable fixation. The fracture geometry and stability, bone quality, comminution, implant choice, and surgical technique are some of the elements that affect the stability of fixation.[2]

The most effective course of treatment for most hip fracture cases is surgery.[3] Surface implants like dynamic hip screws (DHS) and proximal femoral locking plates are available for the stabilization of these fractures. Gamma nails and proximal femoral nail (PFN) are intramedullary implants.[4]

Pugh and Massif modified sliding hip screw techniques to create the DHS in the 1950s.[5,6] DHS is still the preferred implant due to its successful outcomes and low risk of non-union or hardware failure.[7] The dynamic compression permits the weight-bearing forces to stabilize the femur, allowing it to undergo remodeling along with proper fracture healing.[8] The two most major issues associated with DHS are uncontrolled collapse and lag screw cut-out (with or without varus collapse). Others include proximal fragment uncontrolled lateralization and shaft medialization.[9] This also causes severe limb shortening, fracture collapse, and implant failure, which increases the rate of reoperation.[10]The Standard Harris Hip Score (HHS), a validated tool, is used to evaluate a patient with hip pathology both before and after the surgery. It has been used for several studies to assess the results of total hip replacements.[11]Hence, the present study analyzed the functional outcome of the patients with PTF who underwent surgery with DHS implant.

II. Materials and Methods

This prospective observational study was conducted in theDepartmentofOrthopedics of a tertiary care institute over a period 18 months (December 2020 to May 2022). The study commenced after approval of the protocol by the Institutional Ethics Committee and obtaining written informed consent from the patients.

Patients aged over 20 years, of either sex, with basicervicalfracture of femoral neck, BoydandGriffin'stype1,type2andtype3fracture, RussellTaylortype1Afracture, and underwent DHSfixation were included in the study. While, the patients with compoundand pathologicalfractures were excluded.

The complete data were collected from the patients in a case record form including

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demographic data, history of illness, detailedclinicalexamination including associated injuries andrelevantinvestigations.

Pre-operatively, routine hematologicalinvestigations, and imaging (X-raypelviswithbothhips-APviewandproximalfemur as well as X-rayoffracturedhip-lateralview) were performed. In allthepatients,intraoperativedetailswerenotedintermsofmethodof reduction,iffracturewas temporarily fixedwithK-wires,duration ofsurgery,lengthofincision,radiationexposure,implantused,andqualityofreduction. Spinalanesthesiawasgiven, and C-arm withfracturetablewereusedforallthepatients.

Postoperatively, the patientswerefollowed-upat6-weeks,1-month,3-months,and6-months. The patients were allowed to flex the knee from Day 2 andphysicalambulationwas initiatedon Day 8. Thepatientswerecoveredwith prophylacticantibiotics. At 6-weeks, the patients were evaluated both clinically and radiologically, and partial weight bearing was allowed with the help of a walker. At 3-months, the patients werereviewedbothclinicallyandradiologicallyforplacement of implant position, compression at the fracture site, range ofmovements, tenderness, and shortening. At6-months,radiologicalassessmentwas performed to assess the healing of fracture. Clinically, range ofmovements,tenderness,shortening,andany fixeddeformities were assessed.Allpatientswere advisedtowalkwithfullweightbearing.

At 9- to 12-months, functional outcome was assessed with HHS.Atotalscorebelow70, 70to80, 80to90, and90to100points wasconsideredapoor, reasonable, good, and excellent outcome, respectively.

Statistical analyses

Descriptive statistics were used. The categorical and continuous variables are represented as frequency (percentage) and mean (standard deviation, SD), respectively.

III. Results

A total of 30patients were enrolled. The mean age of the study population was 69.89 ± 65.14 years (range: 61 – 85 years). Half of the patients were in the age group of 60-70 years with female predominance (50%). Most of the injuries were due to trivial trauma (93.33%) and involved right side (63.33%). Diabetes mellitus and hypertension were the most common comorbidities (Table 1). B&GType2 (43.33%) and basicervical neck of femur fracture (30%) were the most frequent fracture types (Table 2).

The mean length of incision was 7.23 ± 0.89 cm. Degree of angle plate, and number of holes on side plate were 135.23 ± 4.47^0, and 5.38 ± 0.66, respectively. The mean operative time and blood loss were 63.54 ± 15.38 min and 267.51 ± 60.72 ml, respectively (Table 3).

The mean duration of hospital stay and follow-up were 13.06 ± 4.78days and 8.89 ± 1.26 months, respectively. Of 30 patients, 28 (93.33%) had complete union, while two (6.67%) had non-union with coxa vara due to screw cut through. Most of the patients had fracture union in 10-weeks (33.33%) with a mean of 10.46 ± 2.43 weeks (range: 8 – 17-weeks).

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Though all the patients experienced shortening, it was minimal (0 – 1 cm) in most of the patients (60%) (Table 4). Overall, 12 (40%) patients had short limb gait and six (20%) patients used a cane on ipsilateral side for walking. Despite the advice to avoid squatting or sitting on the floor cross-legged, two patients were squatting and sitting on the floor cross-legged.

Assessment of functional outcome with HHS revealed excellent (60%) and good (20%) outcome in majority of the patients (Table 5). Figure 1 illustrates radiological changes during the study period.

IV. Discussion

In this study, we analyzed the functional outcome of patients with PTF in whom fracture was reducedwith DHS using HHS. In unstable PTFs, DHSs increase the stability of the fracture site by sliding of the proximal fragment and impaction of the fracture site and hence, promote the bone union. The moment arm is reduced because of the impaction of the proximal fragment, which also reduces the weight-bearing stress and enhances fracture site stability.[12] Over the years, the DHS has been the implant of choice for the fixation of ITFs, but they have been found to be more suitable for more stable fracture patterns as opposed to unstable types, where the results have not been good and are associated with complications such as uncontrolled collapse, lag screw migration leading to varus collapse at the fracture site, and screw cut out due to failure to slide.[4]

The standard HHS, a validated tool for assessing the functional capacity, has always been the most popular scoring method used to evaluate a patient with hip pathology both before and after surgery.[11]

Union of the fractures was seen in most patients whereas only two patients suffered from non-union of the fractures. The majority of the fractures healed within 10 weeks (60%). There was one case which required more than 16 weeks for the union of fracture. The shortening of 0-1 cm is commonly observed in the present study. Majority of patients in this study had excellent outcome postoperatively.

A study was conducted in 32 patients who had ITFs and no patient had any postsurgical complications. The maximum number of patients had good results according to HHS. Only nine patients had excellent outcome.[13] The similar outcome was observed with HHS where maximum patients had good outcome.[4] Another study conducted in 70 patients with ITFs had several complications in the study populations. Of 70 patients, two had non-union. The majority of the patients had equal limb length. There was less than 1 cm difference in limb length in 13 patients, and six patients had more than 1 cm limb length discrepancy. Approximately 52% (n=36) of the 70 patients in our study had excellent functional outcome, while 31% had good outcome.[14] There was no limb length discrepancy in majority patients. Only 10% of patients had >1 cm limb length discrepancy. The full weight bearing within 10-14 weeks was seen in 50% of the patients. The excellent outcome was seen in majority of the patients.[15] Similar results were observed in other research.[16,17] Although DHS has a steep learning curve and better fracture site exposure, failures in unstable ITFs have been

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reported, which are primarily caused by posterolateral wall fractures.[13] Since some studies included only patients with unstable ITFs and some had mixed population, the discrepancy in final functional outcome in different studies can be anticipated.

It is observed that most of the patients included in this study were females and aged between 60-70 years. The most common comorbidity observed was diabetes mellitus. The most fractures were due to trivial trauma and involved right sided. Similar demographic data was observed in the other studies.[14-16] As observed in the literature, ITFs are more common in elderly patients; however, growing mechanization and the increased number of road traffic accidents lead to greater incidence of these fractures in younger individuals. Thus, a bimodal age distribution is observed.[14] The female preponderance is seen as there is increased incidence of postmenopausal osteoporosis.[16] The common comorbidities observed overall were hypertension and diabetes.[14-16]

Although this study was conducted with sound methodology, there are certain limitations, including the study population was not differentiated between stable and unstable fractures, and local complications other than non-union were not taken into consideration.

V. Conclusion

DHS for the management of PTFsof the femur provides stable construct and facilitates early mobilization and weight bearing to the patients in order to prevent complications due to prolonged recumbency, especially in the elderly age group.

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Competing interest:

There is no Competing interest.

Authors contribution:

All authors in our study contributed to the data collection of the patients.

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Table 1. Demographic and clinical parameters

Characteristics		n (=30)	%
Age (years)	<60	2	6.66
	60–70	15	50
	70–80	11	36.66
	80–90	2	6.66
Sex	Male	12	40
	Female	18	60
Mode of trauma	RTA	2	6.66
	Trivial trauma	28	93.33
Side of Injury	Right	19	63.33
	Left	11	36.66
Comorbidities	Diabetes mellitus	14	46.66
	Hypertension	12	40
	IHD	4	13.33

Table 2. Fracture types

Fracturetypes	n (=30)	%

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B&GType1	3	10%
B&GType2	13	43.33%
B&GType3	5	16.66%
Basicervicalneckof femurfracture	9	30%

B&G type: Boyd and Griffin's type

Table 3. Intra-operative findings

Meanoperativetime	63.54 ± 15.38 min
Meanlengthofincision	7.23 ± 0.89cm

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Degreeofangleplate	135.23 ± 4.47^{0}
Number of holes insideplate	5.38 ± 0.66
Bloodloss	267.51 ± 60.72 ml

Table 4. Radiological outcome

Characteristics	n (%)
Radiological outcome	
Union	28 (93.33)

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Non-union		2 (6.67)
Unionin weeks	8	9 (30)
	10	10 (33.33)
	12	4 (13.33)
	14	4 (13.33)
	>16	1 (3.33)
Amountofshortening (cm)	0-1	18 (60)
	1-2	9 (30)
	>2	3 (10)

Table 5.Functional outcome

HHS	**n (=30)**	**%**
Excellent	18	60
Good	6	20
Fair	4	13.33
Poor	2	6.67

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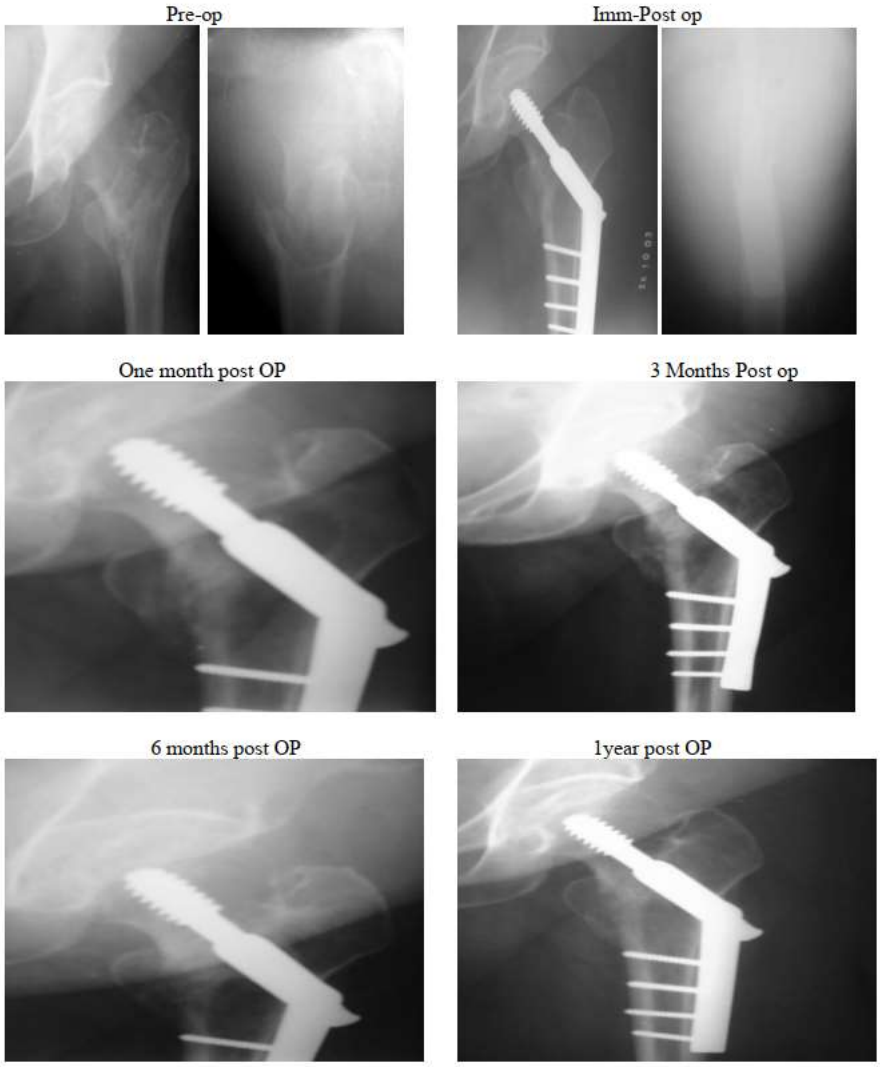

Figure 1.Radiological changes during the study period