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Research Article

Surgical management of intertrochanteric fracture femur by sliding hip screw and its assessment using Salvati-Wilson criteria

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Abstract

Introduction: Intertrochanteric (IT) fractures constitute a huge threat to life, untreated condition may cause a considerable change in quality of life, existing disease gets worsen and may results in mortality. Considering the complexities of treating of these fractures, present study primarily focuses on management of trochanteric fracture by sliding hip screw. This study attempts to highlight the outcome of this procedure using Salvati-Wilson criterion and does not intend to compare with any other modality of fixation.

Material and Methods: A prospective observational study conducted on fifty patients which were followed-up at intervals of two, six, twelve and twenty-four weeks post-operatively. Clinico-radiological and functional outcome at twenty-four weeks post-operatively were analyzed using Salvati-Wilson criteria.

Results: Majority of the patients were females (68%). Mean age of patients were 70.8 ± 9.19 years. No statistically significant difference was found between the Salvati-Wilson score among age group, sex, side of the fracture, screw length, and number of holes. However, significant difference was seen between Tip Apex Distance (TAD), intra and post-operative complication, partial and full bearing walk, radiological union days and AO class (p -value <0.05).

Discussion: In present study, TAD was recorded with range of 19 mm to 28 mm with a mean of 22.78 mm. Using Salvati Wilson score at six months based on pain, walking, muscle power and motion and function there were 26% excellent, 52% good, 20% fair and 2% poor cases were identified in our follow up of the fractures treated with sliding hip screw and barrel plate assembly osteosynthesis.

Conclusion: Complex intertrochanteric fractures can be treated with SHS construct with good functional outcomes as measured by Salvati-Wilson criterion.

Keywords: intertrochanteric fracture, Salvati-Wilson criteria, osteosynthesis

INTRODUCTION

Hip fractures constitute major public health disaster which may lead to disability, impacts quality of life and sometimes mortality also. Hip fractures yearly affect around 1.5 million people worldwide [1,2]. With growing number of elderlies, higher incidences of fracture are expected witnessed. The hip fractures constitute the intracapsular (cervical) and the extracapsular (involves trochanteric and subtrochanteric) fractures. Trochanteric fractures are one of the most common injuries sustained predominantly in patients over sixty years of age [3]. They are three to four times more common in women who are osteoporotic. Trivial fall being the most common mechanism of injury. Appropriate surgical intervention in early phase may help to reduce an individual to gain pre-fracture life [4]. Delays in the treatment of injuries may impact far beyond immediate clinical considerations and extends into the domains of medicine, rehabilitation, psychiatry, social works and medical economics.

Intertrochanteric (IT) fractures constitute a huge threat to life, untreated condition may cause a considerable change in quality of life, and existing disease gets worsen and may results in mortality. These fractures unite with conservative line of treatment. Unlike femoral neck fractures, there is no fear of avascular necrosis of the head and its sequel of osteoarthritis. Though intertrochanteric fractures may unite without surgical intervention, malunion with coxa vara deformity resulting in shortening of the limb is commonly seen [3]. Considering the complexities of treating of these fractures, present study primarily focuses on management of trochanteric fracture by sliding hip screw [5]. This study attempts to highlight the outcome of this procedure and does not intend to compare with any other modality of fixation. We aimed to study the clinical, functional and radiological outcome in consecutive

consented patients of sliding hip screw and its assessment using Salvati-Wilson Criteria [6]. This study will look into the therapeutic efficacy in intertrochanteric femur fracture, related overall outcomes, and complication.

MATERIALS AND METHODS

Present research is based on the prospective and observational study performed at JLN Main Hospital and Research Centre, Bhilai, Chhattisgarh, India. Patients with intertrochanteric fractures and age above eighteen years were selected for this study. Patients eligible for surgery were included, while, skeletally immature individuals, unfit for the surgery, having compound or pathological fractures and re-operation cases were excluded from the study. Patients with late presentation, with non-union or malunion bone condition and, with existing neurological deficits were not included for the study.

This study was performed during the period starting from June 1st 2018 to May 31st, 2019. To decides the appropriate sample, we considered the four years (from the year 2014 to 2017) retrospectives surgery incidences of IT fracture (3.3%). With 5% level of significance and 5% precision rate, lead to calculation of desired a sample size of 50 patients required for this study. Required demographics and clinical details of individual satisfying inclusion exclusion criteria were obtained from medical case records of the patients. All fractures were classified on the basis of AO (Arbeitsgemeinschaft für Osteosynthesefragen) classification. As a part of this study patients were followed-up at intervals of two, six, twelve and twenty-four weeks post-operatively. The cases were followed-up for both clinically and radiologically conditions of an individuals. Findings at twenty-four weeks post-operatively were used to analyze the clinical,

Table 1. Salvati-Wilson scoring system

Salvati-Wilson scoring system (Hospital for Special Surgery –hip rating system)	
Pain	0 = Constant and unbearable, Frequent strong analgesia
	2 = Constant but bearable. Occasional Strong analgesia
	4 = Nil or little at rest. With activities
	6 = Little pain at rest. Pain on activity
	8 = Occasional slight pain
	10 = No Pain
Walking	0 = Bedridden
	2 = Wheel chair
	4 = Walking frame
	6 = One stick, limited distances up to 400 yards
	8 = One stick, long distances
	10 = Unaided and unrestricted
Muscle power and motion	0 = Ankylosis with deformity
	2 = Ankylosis with good functional position
	4 = Poor muscle power, Flexion < 60 abduction < 10
	6 = Fair muscle power. Flexion 60-90 abduction 10-20
	8 = good muscle power. Flexion >90 abduction > 20
	10 = Normal Muscle power. Full range of movement
Function	0 = Bedridden
	2 = House bound
	4 = Limited housework
	6 = Most housework, can shop freely
	8 = Very little restriction
	10 = Normal activities
Grading of results Score	> 31 = excellent
	24-31 = good
	16-23 = fair
	< 16 poor

functional and radiological outcome in consecutive consented patients of sliding hip screw and its assessment using Salvati-Wilson criteria.

Clinical evaluation was done and pain, swelling, mobility, deformity, wound status, limb length and walking ability were determined on follow-up. Both early and late postoperative complications were taken into consideration. Radiographic assessment was done at each follow-up visit with considering parameters normal and stable fracture configuration, migration of lag screw, cutting out of lag screw (superior or inferior cortex), and implant failure (type of implant failure).

Though there are many scores e.g. Salvati-Wilson score, Harris hip score, modified Harris hip score, mobility hip score, functional hip score, functional recovery score and more for hip function evaluation mentioned in the contemporary literatures. We used Salvati-Wilson Score for our study as this score is simple, easy to use and practically applicable in our scenario. Salvati-Wilson Score has an advantage as it also include muscle power and range of motion. The scoring system correlated well with patient's mobility. Salvati-Wilson score was used to evaluate the functional outcome at six-months postoperatively.

Data was collected using the Microsoft excel sheet (2019) and analysis was performed using Statistical Package for Social Sciences Version 25 (SPSS-25, IBM Inc., NY US). Continuous variable were summarized as Mean \pm SD (Standard Deviation) while discrete (categorical) data presented as frequency and percentage. Values of patient numbers were presented in absolute numbers as well as percentages of the group. To compare the means of parametric data Fisher's exact test was used. Whereas, to compare the qualitative data Pearson Chi-square test was used. P-value less than five percent were considered as statistically significant.

RESULTS

The present study consists of 50 cases of intertrochanteric fracture (according to AO classification), treated in JLN Hospital and Research Centre, Bhilai from June 2018 to June 2019.

Majority of the patients were females (68%). Half of the patients were of more than 70 years of age with mean age of 70.8 ± 9.19 years (Range 37-88 years). Five out of six patients were had fracture due to trivial fall. Half of the patients classified as AO type 2. Majority of patients have the history of other non-communicable diseases like DM, IHD, and HTN etc. In the study, 62% cases were treated with five-hole barrel plate. On an average, 48.36 shots were recorded in the current study. Three out of five surgeries were done in less than 1 hour. Majority of patients were able to walk without support six months post operatively. Out of 50 patients' average TAD recorded was 22.78 mm with range 19 mm to 28 mm. Average duration of hospital stay was recorded as 9.48 days whereas 66% patients were discharged after a week. More than 50% patients were showed radiological union within or at 16 weeks of period and partial weight bearing walk commenced within or at four weeks. However, 37 patients (74%) were commenced full bearing walk within or at eight weeks of period. Only nine and 13 cases were faced some kind of intra and post-operative complications respectively. Half of the patients were having good Salvati-Wilson score whereas only 1 patient was having poor score (Table 1 and Table 2).

No statistically significant difference was found between the Salvati Wilson score among age group, sex, side of the fracture, screw length, and number of holes. However, significant difference was seen between Tip Apex Distance (TAD), intra and post-operative complication, partial and full bearing walk, radiological union days and AO class (p-value < 0.05) (Table 3).

DISCUSSION

The study assesses the management 50 patients of Intertrochanteric (IT) fracture of femur by sliding hip screw. Clinical, functional and radiological evaluation was done to assess, analyze and evaluate the data. IT fractures are common in the elderly with female preponderance,

Table 2. Patient characteristic

Narration		Count	%
Sex	Male	16	0.32
	Female	34	0.68
Age Group	<=60 Years	7	0.14
	61-70 Years	15	0.3
	>=71 Years	28	0.56
MOI	Road Traffic Accident	9	0.18
	Trivial Fall	41	0.82
Pre-Ambulatory Status	Without Support	45	0.9
	With Support	5	0.1
Number of Holes	4	17	0.34
	5	31	0.62
	6	2	0.04
Surgery Duration (mins)	<=60 Mins	30	0.6
	>60 Mins	20	0.4
Tip Apex Distance (mins)	<=25 Mins	41	0.82
	>25 Mins	9	0.18
Radiological Union	<=16 Weeks	28	0.56
	>16 Weeks	22	0.44
Complications-Intra OP	No	41	0.82
	Yes	9	0.18
Complications-Post OP	No	37	0.74
	Yes	13	0.26
Side	Left	23	0.46
	Right	27	0.54
AO Class	1	17	0.34
	2	26	0.52
	3	7	0.14
Comorbidity	Yes	42	0.84
	No	8	0.16
Screw Length	<85	19	0.38
	>=85	31	0.62
C Arm Shots	<=30	5	0.1
	31-40	14	0.28
	41-50	16	0.32
	>=51	15	0.3
Post-Ambulatory Status	Without Support	42	0.84
	With Support	8	0.16
Hospital Stay Days	<=7 Days	17	0.34
	>7 Days	33	0.66
Full Weight Bearing Walk	<=8 Weeks	37	0.74
	>8 Weeks	13	0.26
Partial Weight Bearing Walk	<=4 Weeks	26	0.52
	>4 Week	24	0.48
Salvati Wilson Grade	Excellent	13	0.26
	Good	26	0.52
	Fair	10	0.2
	Poor	1	0.02

Table 3. Salvati Wilson score

		Salvati Wilson Grade					p-value
		Excellent	Good	Fair	Poor	Total	
		n (r%)	n (r%)	n (r%)	n (r%)	n (c%)	
Overall		13 (26)	26 (52)	10 (20)	1 (2)	50	
Sex	Male	2 (12.5)	9 (56.2)	4 (25)	1 (6.2)	16 (32)	0.246
	Female	11 (32.4)	17 (50)	6 (17.6)	0 (0)	34 (68)	
Age Group	<=60	4 (57.1)	3 (42.9)	0 (0)	0 (0)	7 (14)	0.113
	61-70	5 (33.3)	9 (60)	1 (6.7)	0 (0)	15 (30)	
	>=71	4 (14.3)	14 (50)	9 (32.1)	1 (3.6)	28 (56)	
Side	L	7 (30.4)	12 (52.2)	4 (17.4)	0 (0)	23 (46)	0.725
	R	6 (22.2)	14 (51.9)	6 (22.2)	1 (3.7)	27 (54)	
Screw Length	<85	7 (36.8)	9 (47.4)	2 (10.5)	1 (5.3)	19 (38)	0.211
	>=85	6 (19.4)	17 (54.8)	8 (25.8)	0 (0)	31 (62)	
Holes	4	7 (41.2)	7 (41.2)	2 (11.8)	1 (5.9)	17 (34)	0.307
	5	5 (16.1)	18 (58.1)	8 (25.8)	0 (0)	31 (62)	
	6	1 (50)	1 (50)	0 (0)	0 (0)	2 (4)	
TAD (mm) Tip Apex Distance	<=25 Mins	11 (26.8)	24 (58.5)	6 (14.6)	0 (0)	41 (82)	< 0.01
	>25 Mins	2 (22.2)	2 (22.2)	4 (44.4)	1 (11.1)	9 (18)	
Complications Intra OP	No	13 (31.7)	22 (53.7)	6 (14.6)	0 (0)	41 (82)	< 0.05
	Yes	0 (0)	4 (44.4)	4 (44.4)	1 (11.1)	9 (18)	
Complications Post OP	No	13 (35.1)	21 (56.8)	3 (8.1)	0 (0)	37 (74)	< 0.01
	Yes	0 (0)	5 (38.5)	7 (53.8)	1 (7.7)	13 (26)	
Partial Weight Bearing Walk	<=4 Weeks	11 (42.3)	12 (46.2)	3 (11.5)	0 (0)	26 (52)	< 0.05
	>4 Weeks	2 (8.3)	14 (58.3)	7 (29.2)	1 (4.2)	24 (48)	
Full Weight Bearing Walk	<=8 Weeks	12 (32.4)	21 (56.8)	4 (10.8)	0 (0)	37 (74)	< 0.01
	>8 Weeks	1 (7.7)	5 (38.5)	6 (46.2)	1 (7.7)	13 (26)	
Radiological Union Days	<=16Weeks	10 (35.7)	17 (60.7)	1 (3.6)	0 (0)	28 (56)	< 0.01
	>16Weeks	3 (13.6)	9 (40.9)	9 (40.9)	1 (4.5)	22 (44)	
AO Class	1	8 (47.1)	8 (47.1)	1 (5.9)	0 (0)	17 (34)	< 0.05
	2	4 (15.4)	15 (57.7)	7 (26.9)	0 (0)	26 (52)	
	3	1 (14.3)	3 (42.9)	2 (28.6)	1 (14.3)	7 (14)	

due to postmenopausal metabolic changes in the bone and high rate of osteoporosis. In current study, shows the same scenario with high female ratio compared to male (68% females) and almost more than half of the patients are greater than of age 71 years. This was seen in same line in other studies. In stable patients with trochanteric fracture more effective osteosynthesis was achieved by dynamic screw-place technique than others [7]. Tip to apex distance and Dynamic Hip Screw (DHS) were correlated among patient with IT fracture treated by DHS [8]. As the fracture is common in old age group, the incidence of associated comorbidities is also high and they require high medical and surgical attention [9]. In present study, five out of six patients reported any form of comorbidity. The history of having slipped and fell down was the commonest mode of injury (82%). Mnif H et al. and Pradeep AR et al. have shown the similar pattern of mode of injury [7,10].

Majority of the surgeries (60%) were performed in less than 60 minutes with average surgery duration of 60.72 minutes. Most of the patients were comfortable postoperatively (74%) due to greater freedom in mobility and decreased pain. Literature suggested that Tip Apex Distance (TAD) is the most important predictive factor for DHS failure and it is recommended that TAD should be less than 25 mm to avoid screw cut-out [8,11]. In present study, Range of TAD index was 19 mm to 28 mm with a mean of 22.78 mm [10].

Two out of three patients were discharged after a week from the hospital. Patients were discharged within 1 week after surgery if there was no complication postoperatively. The average hospital stay was recorded as 9.48 days. The average time for radiological union was recorded as 16.5

weeks in the current study. Healing of fracture was rarely a problem due to good vascularity. Studies presented by Ecker M.L. et.al and Pradeep AR et.al reported on an average 15 and 24 weeks of radiological union respectively [10,12].

Partial weight bearing walking is begun gradually depending on the fracture configuration and the achieved stability of reduction and fixation. Almost half of the patients from present study have shown the partial weight bearing with walker or axillary crutches within 4 weeks of surgery. Study published by Jonnes C et al. has shown that patient started partial weight bearing walk after 7.87 weeks only [11]. In present study, average duration to commenced full weight bearing walk was 8.2 weeks, Full weight bearing walk to start in the patients was depending on radiological profile, clinical evaluation and patient compliance. Kulkarni GS state that early ambulation did not compromise end result and allowed ambulation after 10-11 days postoperatively when stiches are removed. Sahlstrand T allowed full weight bearing on the operated leg for stable as well as comminute fractures on the 7-10 day after the operation [13,14].

On an average 48.36 intraoperative C-arm shorts were taken in the present study. Whereas, study performed by Shah N et.al has reported that on an average 178 C-arm exposures were required [15]. In present study, five out of six patients were started walking without any support at the final follow-up at 6 months period. In the present study, fractures were classified according to AO classification. Of which, 34% cases belonged to AO type 1, 54% belonged to AO type 2 and only 14% cases in AO type 3.

Patients were followed up at regular interval in OPD at 2 weeks, 6 weeks, 3 months and 6 months for clinical, radiological evaluation. However, Salvati-Wilson score used to evaluate functional outcome at 6 months postoperatively. Using Salvati-Wilson score at six months based on pain, walking, muscle power and motion and function there were 26% excellent, 52% good, 20% fair and 2% poor cases were identified in our follow up of the fractures treated with sliding hip screw and barrel plate assembly osteosynthesis. On an average, 27.8 Salvati- Wilson score was calculated in the present study. Study published by RK Gupta et al. reported more than 30 points Salvati-Wilson score among 55 patients and more than 20 points in 19 patients. Shah N et al. reported Salvati Wilson score was Fair in 39% of patients at 16 weeks and At 24 weeks

it was Fair to Good in 84% patients [15,16]. Poor score in one patient (2%) was seen because of the intra operative complication of difficult reduction, post-operative complication of malunion and having a TAD greater than 25 mm with AO classification of 3.

CONCLUSION

The intertrochanteric fracture of femur surgically treated by sliding hip screw is an effective method and patient could be able to attain the benefits in terms of partial and full bearing ambulation. Complex hip-fracture of elderly are possible to treat with this technique and post-operative patient assessment using Salvati-Wilson criteria are documented by this article in the Indian settings.

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