

Valgus Reduction with Dynamic Hip Screw: The Answer to Unstable Peritrochanteric Fractures.

Karan Siwach¹, Arunim Swarup¹, Abhay Shanker Dube¹, Avinash Rastogi¹, Sunil Malhotra¹, Gaurav Dev Sharma¹

Abstract

Introduction: Peritrochanteric fractures are amongst the most common fractures sustained in elderly population. Numerous methods of fixation and implant choices are available for management of such fractures. The dynamic hip screw and sliding plate remains the most commonly used implant for surgical management in such fractures. Despite the widespread use of Dynamic hip screw akin to being considered as one of the most forgivable implant, many complications have been reported in the literature. Of these the most commonly described is screw cut out rates of 5-17%. Various attempts have been made to reduce these cut out rates and the most widely accepted method is Baumgartner method of screw placement with Tip apex distance less than 25 mm. The present study was conducted to evaluate the clinical and functional outcome of valgus reduction in peritrochanteric fractures fixed by 135° Dynamic hip screw.

Materials and methods: The 90 cases of peritrochanteric fractures (51 males and 39 females) with mean age of 65.4 years were treated with valgus reduction and internal fixation with Dynamic hip screw. Mean follow up was 28.03 months (range, 12-50 months).

Results: The mean neck shaft angle of hip was 129° (range, 118° to 140°). The mean neck shaft angle of operated hip was 138° (range, 127° to 148°). Union was achieved in all the patients. The average time of union was 9.3 weeks (range 8.1-14 weeks). No patient had cut out or implant failure. 78 patients had limb length equalization and 10 had shortening and five had limb lengthening at final follow up. Average Harris hip score was 94.8 points.

Conclusion: We advocate valgus reduction of peritrochanteric fractures to achieve reliable functional and radiologic outcome. Valgus reduction reduces the chance of shortening of the leg, and prevents implant cut out.

Keywords: Peritrochanteric fractures, valgus reduction, dynamic hip screw, screw cut out.

Introduction

Peritrochanteric fractures are common problems in elderly patients [1]. Operative treatment permits early mobilization and minimizes complications of prolonged recumbency [2]. Peritrochanteric fractures are treated with both extramedullary and intramedullary devices [3]. Each device has its own advantages and disadvantages. The advantage of extramedullary fixation such as dynamic hip screw (DHS) is relatively simple surgical

technique, which is safe and very forgiving [3]. DHS remains the implant of choice because of its favorable results and low rate of non-union or hardware failure [4, 5] still high cut out rates (5-17%) have been reported in the literature which has led to the rise of intramedullary fixation for these fractures [4, 6, 7]. Moreover, osteoporosis, associated with trochanteric fractures in elderly patients, not only enhances the risk of fracture but also represents a problem in osteo synthesis of fractures in

¹Department Of Orthopedics, Subharti Medical College, Meerut , India

Address of Correspondence

Dr. Karan Siwach

Department Of Orthopedics, Subharti

Medical College, Meerut , India

Email: karansiwach@gmail.com



Dr Karan Siwach



Dr Arunim Swarup



Dr Abhay Shanker Dube



Dr Avinash Rastogi



Dr Sunil Malhotra



Dr Gaurav Dev Sharma

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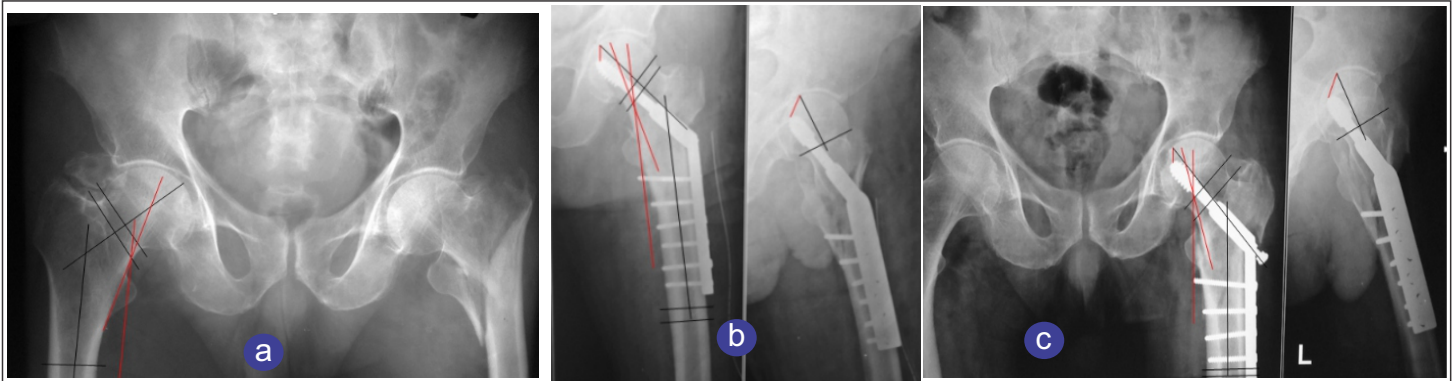


Figure 1: a-Pre-operative skiagram showing neck shaft angle -132° in the contralateral hip. b- Skiagram in post-operative period shows fracture fixed with 135° DHS in valgus position. The neck shaft angle measured was 141°. c-Follow up at 12 months showed satisfactory union without any cut out with neck shaft angle maintained at 141°.

fracture treatment [1, 8].

Screw cut out can occur if the diaphyseal cervical angle or the neck shaft angle decreases, leading to the extrusion of the screw through the femoral head. Using the DHS with deliberate valgus reduction may theoretically result in a gap at the medial side of the fracture however the support is provided laterally by DHS combined with controlled collapse of the fracture by sliding of the screw in a stout barrel of the plate which results in medial continuity being maintained or restored in a valgus position and prevent varus collapse [9]. This study was done to evaluate the outcome of valgus reduction in intertrochanteric fractures fixed by 135° DHS and to correlate its influence on union rate and functional outcome in unstable peritrochanteric fractures.

Materials and methods

All patients presenting with peritrochanteric fractures to the author's institute, a tertiary level center, from May 2007 to January 2015 were included in the present retrospective and prospective study. Patients included in this study were those who were above 40 years with peritrochanteric fracture managed by closed or open reduction and internal fixation by dynamic hip screw and with a minimum follow up of one year. 113 patients were treated with internal fixation and valgus reduction of the fracture. From amongst 113 cases, 23 cases were excluded as 19 patients expired during follow up and 4 developed infection. The 90 cases (51 males and 39 females) included for observation in this study were in the age group from 4th to 9th decade, youngest being 42 years old and oldest being 94 years old. The mean age was 65.4 years irrespective of their gender. The right hip was involved in 54 patients and the left in 36 patients. 78 patients suffered injury due to fall

on the ground and 12 cases sustained road traffic high velocity injury. 59 patients had osteoporosis according to Singh's index [10] assessed from antero-posterior radiograph of contralateral hip.

All fractures were broadly classified into stable and unstable fractures with all the authors coming to a consensus regarding the classification to minimize inter-observational variability (Table 1). The pre-operative anteroposterior skiagram of pelvis with both hips and lateral skiagrams of the fractured hip were studied to classify the fracture to identify the instability. The neck shaft angle of the contralateral hip in the anteroposterior skiagram were used as the reference for comparing the operated fracture. The mean time interval from injury to operation was 5.6 (range, 2-11) days.

Surgical technique: All patients were operated on the fracture table keeping the patient in supine position under the image intensifier. The usual lateral approach was used with a modification during the use of triple reamer. After drilling and reaming with triple reamer, the entry point was over drilled superiorly and the hip screw was placed after tapping. Over the hip screw, the 135° the barrel of the DHS plate was then put to make it appear abducted in relation to the shaft of femur. The foot piece was then loosened to abduct the limb till the shaft of femur could lie against the 135° DHS plate to achieve a valgus at the fracture site at the cost of cancellous collapse of the fracture under the plate over the lateral aspect. The maintenance of valgus was confirmed by image intensifier before the 135° DHS plate was fixed to shaft.

The post-operative evaluation included study of type of reduction, screw placement in the quadrant of the head as seen in the antero-posterior and lateral post-operative

Table 1: Distribution of patients on the basis of classifications in relation to fracture stability

Type of classification	Stable Peritrochanteric fractures	Unstable Peritrochanteric fractures	Total
Evan's classification	42	48	90
Boyd and Griffin's classification	39	51	90
Tronzo's classification	36	54	90
AO/OTA classification	38	52	90

Table 2: Number of patients in their pre-operative, post-operative and final follow up in accordance to the range of neck shaft angle

Neck shaft angle (in degrees)	Number of patients (n=90)		
	Pre-operative period	After fixation in deliberate valgus by 135° DHS	At final follow up
120-125	32	1	1
126-130	43	12	10
131-135	13	35	24
136-140	2	29	26
141-145	-	11	23
146-150	-	2	6
Total	90	90	90

Table 3: Functional outcome in accordance to Harris hip score²⁴

Harris Hip Score ²⁴	No. Of Patients
Poor(<70)	0
Fair(70-79)	13
Good(80-89)	35
Excellent(90-100)	42
Total patients	90

skigram, TAD index [11], post-operative change in diaphyseal cervical angle, occurrence of any union related complications like varus malunion, unacceptable fracture collapse, implant related complications like loosening, cut-out, intra-articular migration or breakage, time of clinico-radiological union and any anisomelia of lower limb. For example, figure 1 shows the pre-operative assessment of one of the patients with diaphyseal cervical angle of 132° consequently, the post-operative skigram and follow up at 1 year is shown in figure 2 and 3 respectively with cervical diaphyseal angle increased to 141° by deliberate valgus reduction. Functional assessment was done using the modified Harris hip score [24]. Isometric hip and knee

strengthening exercises were educated. X-rays were done during follow up to assess union, controlled collapse and implant stability under the parameters described above.

The observations were recorded and individual data were noted and final follow up was taken at a minimum of 1 year on the aspects of functional outcome using Harris hip score. Correlations between the TAD Index and diaphyseal cervical angle, diaphyseal cervical angle and anisomelia and TAD index and anisomelia were calculated statistically using statistical tools like Chi-square test and Spearman's correlation test.

Results:

Mean follow up was 28.03 months (range, 12-50 months). The mean neck shaft angle of hip was 129° (range, 118° to 140°) in contralateral hip. The mean

neck shaft angle of operated hip was 138°(range, 127° to 148°) at final follow up. Table 2 shows number of patients in accordance to the range of neck shaft angle pre-operatively, post-operatively and at final follow up. Average Harris hip score [24] (Table-3) was 94.8 points. 42 patients had an excellent Harris hip score, 35 patients scored good, 13 patients had fair score and none of the patients had a poor hip score. 54 patients had functional return to complete previous routine physical activities within 10 weeks, 40 patients showed signs of union after 10 weeks but within 12 weeks and 6 patients had a delayed fracture union after 12 weeks up to 14 weeks which can be contributed to delayed ambulation, poor nutrition, continued tobacco use and osteoporosis.

Discussion

There is a consensus for the treatment of stable intertrochanteric fractures in the literature. However, the preferred treatment for unstable trochanteric fractures remains controversial [1].The diversity of fixation devices available for treatment of unstable trochanteric fractures illustrates the difficulties encountered in the actual treatment [1]. Even with the evolution of other

modified sliding hip system and cephalo-medullary nail, the DHS continues to enjoy the preference by many surgeons for confident surgical management of peritrochanteric fractures. Osteopenia, age, and gender related variation may not allow the dynamic hip screw for ideal healing. The varus collapse, implant cutout in head region, intraarticular penetration due to sliding proportionate to collapse remain the major causes of unacceptable outcome in failures. Although the neck shaft angle is reported to vary in the population [12], 135° DHS implant has continued to be the universal specification for surgeons. The present study evaluates the outcome of valgus reduction in intertrochanteric fractures fixed by 135° DHS and correlates its influence on the functional outcomes and the rate of union. There was high incidence of unstable fractures in this study with 60% of fractures showing a posterior and medial wall comminution. All the fractures were reduced in valgus position and have shown excellent to good results with a 100 % union rate. Pajarinem J et al [13] also recommended that unstable intertrochanteric fractures should be initially reduced in slight valgus position.

Osteoporosis has been recognized as a major morbid factor in elderly age group. Based on Singh's Index, this study showed that 34 females and 25 males (n=59, 65.5%) were osteopenic. This is consistent with the findings of Hartholt K et al [14] who studied that age adjusted incidence rate increased from 52.0 to 67.6 per 10,000 older persons especially in females. This observation is in contrast to study done by Dube et al [15] where osteoporosis was more common in males than in females. Union was achieved in 100 % patients in the present study which is comparable to rates reported in literature (Table-5). The average Harris hip score [24] in present study was 94.8 points, with 46.6% of total patients in excellent grade, 38.8% in good grade, 14.4 % were in fair grade and none in poor grade. Results of present study were comparable with those in literature [1, 16, 17].

The diaphyseal cervical angle as measured in contralateral hip (118°-140°, mean-129°) was converted to deliberate valgus (127°-148°, mean-138°), the mean increase in valgus being 9°. Majority of patients (n=52) had a mean increase in neck shaft angle of 10° which did not change significantly at the time of union. This finding was also confirmed by drawing the trabecular angle described by M J Parker et al [9] which also did not change significantly

from time of fixation to time of union.

Several authors have reported significant incidence of screw cut out in their studies of trochanteric fractures. Andruszkow H et al [18] reported 3.4 % cut out of hip screw. Bruijn KD et al [19] reported 7% rate of screw cut-out in a study of 215 intertrochanteric hip fractures. Hsueh et al [20] reported 6.8 % cut out of hip screw in a large series of 937 patients. Parker MJ [9] reported that cut-out was significantly associated with a varus position the fracture and a superiorly or posteriorly placed lag screw within the femoral head. He also stressed the importance of trabecular angle being maintained in an optimal range for low rates of fixation failure. It was interesting to note that trabecular angle did not significantly change from the immediate post-operative period till the time of union and was maintained between the optimal range as recommended by Parker M.J et al [9]. This insignificant change in trabecular angle pertains to the fact that the 135° DHS implant does not show migration during the post-operative phase till the time of union which might lead to decreased rates of failure due to implant migration. None of the case had fixation failure due to side plate pull-out in the present study. Incidence of screw cut-out was nil in the present study despite the fact that 55% patients had unstable fractures in the present study. Lateral wall impaction associated with valgus reduction also favours consolidation due to rise in compression forces [21]. A valgus reduction has the mechanical advantage of reducing the deforming forces across the fracture by reducing the distance between the plate and weight bearing axis [9]. This decreases the chances of implant failure.

The valgus reduction leads to lengthening of the lower limb. There was significant limb-length discrepancy observed in present study in the immediate post-operative period in twenty cases (28.8 %), all of which had a true lengthening of less than 1.5 cm each which required shoe raise of the contralateral unaffected limb. However, at final follow up, only 5 patients reported to have a significant limb lengthening. This was in accordance to a study conducted by C.Takeshi et al [21] which reported equalization of limb lengthening in majority of cases (70.5%) managed by valgus reduction. This was probably due to effect of impaction and collapse of fracture assisted by DHS. It was interesting to observe that none of the patients had a limb shortening at the immediate follow up,

ten (11.1%) patients had significant limb shortening due to the controlled collapse achieved by 135° DHS. Several authors have reported varying incidence of true shortening in their series. Ecker et al [22] have reported an average of 2cm of true shortening in 12 out of 62 cases. Leung et al [23] reported the mean femoral shortening of 4.9 mm (range 0-20.2 mm). Incidence of shortening of limb was less in the present study which may be because of valgus reduction achieved in present study. There was no significance ($p=0.977$) found statistically between the change in neck shaft angle and anisomelia at final follow up.

Parker MJ [9] have reported that valgus position would reduce the chance of shortening of the leg, as would occur if the fracture is allowed to unite in varus position. Using the 135° DHS with a valgus reduction may theoretically result in gap at the medial side of the fracture, but support is provided laterally and this combined with compression and progressive controlled collapse of the fracture, results in medial continuity being restored in valgus position. This is in accordance with the observation by Parker MJ [9].

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Conclusion

Although many devices can achieve rigid fixation for intertrochanteric fractures, the dynamic hip screw system is the most commonly used device. The commonest mechanical failure of fixation in using the DHS system is cutout of implant from the femoral head. Fractures considered stable have a much lower rate of complications than the unstable ones. The use of intramedullary devices has also been advocated for the management of unstable peritrochanteric fractures. Most of the cases in the present study were unstable and osteoporotic in which the outcome of deliberate valgus reduction in peritrochanteric fractures was analyzed to have diminished rates of screw cut out and facilitate consolidation. However, lateral wall comminution, reverse oblique type fractures and intertrochanteric fractures with subtrochanteric extension may still be fixed by an intramedullary device. Hence we advocate valgus reduction to achieve reliable functional and radiologic outcomes in all other stable and unstable type of peritrochanteric fractures.

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