Original Research Article

A Randomised Study on Outcome of Dynamic Hip Screw Fixation versus Helical Hip Screw System in Intertrochanteric Fracture

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Abstract

Introduction: Trochanteric fractures occur in the young population due to high velocity trauma, whereas in the elderly population, it is most often due to trivial trauma. In the United States 49% of the hip fractures are intertrochanteric. The most commonly used devices for fixation is the Dynamic Hip Screw with Side Plate assemblies. We aimed to compare the outcome of dynamic hip screw fixation versus helical hip screw system in intertrochanteric fracture. **Methods:** A prospective study was conducted at our institution. A total of 25patients with comparable characteristics in each the DHS group and the spiral blade plate group were selected for the study, randomizing them into the 2 groups for comparison. Radiological outcome on the basis of union, complications with respect to implant cut-out and malalignment and functional outcome on the basis of Harris Hip Score were recorded.**Results:** The mean time taken for surgery in the DHS group (in mins) mean was 57.44(SD±9.305), and in the DHHS group mean was 48.44(SD± 6.740). There was significant statistical difference (p=0.00014). Time taken for union was insignificant (p=0.399). At 6 months mean Harris Hip Score statistically had no difference (p=0.288). There was no failure or complication in both groups. **Conclusion:** Although the mean operative time was almost 10 mins more in the DHS group, there is no statistically significant difference in the functional outcome between the DHS group and DHHS group. Key to success is maintaining the Tip-apex distance to within 25 mm, consistent with the Bauemgarter series with the DHS.

Keywords: Intertrochanteric Fracture, Dynamic Hip Screw (DHS), Dynamic Helical Hip Screw System (DHHS).

Introduction

Trochanteric breaks are regular in the elderly individuals. The recurrence of these fractures has expanded principally because of the expanding life expectancy and more dynamic way of life expedited by urbanization. These fractures happen more in youthful populace because of high speed injury, though in the elderly populace it is frequently because of trifling injury[1]. The incidence of trochanteric fractures is more in the female population compared to the male due to osteoporosis[2]. In 1990, the number of hip fractures in persons aged 50 years or older was 1.7 million worldwide[1] and data from the United States suggest that 49% of hip fractures are intertrochanteric[3].

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There are different types of fixation devices utilized for trochanteric fractures, of them the most ordinarily utilized one is the Dynamic Hip Screw with side plate gatherings. This is a collapsible implant, which allows the proximal fragment to subside on the implant, looking for its own position of strength. Regardless of the advances in anaesthesia, nursing care and the surgical systems, hip fractures remain a critical reason for dreariness and mortality in the elderly population. Clawson introduced the dynamic hip screw (DHS) in 1964 and has been widely adopted as the implant of choice for these fractures. The failure rates associated with the DHS vary between 5-23%.

It is very much reported that precise situating of the cephalic screw of a sliding hip screw (SHS) or intramedullary (IM) nail in the femoral head decides the result following open reduction internal fixation of trochanteric fractures[4-6]. The most well-known mode of failure is cut-out of the lag screw from the femoral head[7], and it has been demonstrated[4-6,8,9] that the tip-apex distance (TAD) is the most significant factor in deciding the probability of lag screw cut-out, with a distance >25 mm an indicator of inadmissible screw position and a measurably higher rate of cut-out. In addition to TAD the position of the cephalic screw in one of nine zones in the head has been described[10]. The ideal position is centre, but a short screw which is

centre may still allow for a TAD >25 mm. Thus, it is both the correct length of the screw within the head, as well as the central position of the screw, that will help to prevent cut-out of the cephalic implant. Since the position of the implant in the head is dependent upon the initial guide wire, and since the position of the guide wire is solely under the control of the surgeon, proper placement of any of these implants is the best way to ensure a satisfactory outcome[11,12]. However, even with a very low rate of fixation failure and lag screw cut-out there has been a shift in the type of cephalic implant that is used with either a SHS or IM nail. A helical blade has been introduced for use with either of the two implants, with the idea that there will be an improved hold in the femoral head and a reduced rate of cut-out. Although there are biomechanical studies [12,13] which give support to this idea, it has not been confirmed by clinical studies. Additionally, there is no information in the literature concerning any difference between a helical blade and screw with respect to placement of the implant within the femoral head. In view of these considerations, the present study of Surgical Management of Peritrochanteric Fractures is taken up.

Materials and methods

The study was a prospective one, where the fractures were classified on the basis of AO system as 31-A1/ 31-A2. The surgeries were performed at P. D. Hinduja National Hospital and M R C, Mumbai with surgeons who had experience in the field of orthopaedic traumatology. Informed consent was obtained from all patients before the operation. The patients operated from Aug 2011- June 2013 with DHS and DHHS (spiral blade plate) were included. 25 patients in each the DHS group and the spiral blade plate group were selected for the study randomizing them into the 2 groups for comparison. The many characteristics of both the groups of the patients were comparable. The patients included were older than 18 years of age and had fractures operated with a plate using either a sliding hip screw or a helical blade, were less than 10 days old.

Reverse intertrochanteric fracture and patients who had a concomitant ipsilateral /contralateral other lower limb injuries were excluded.

Management of patients: As soon as the patient with suspected intertrochanteric fracture was seen, necessary clinical and radiological evaluation was performed and necessary resuscitation and splintage using skin traction was done. All routine pre-operative investigations were done along with X-rays of Pelvis with both hips-AP view, involved side hip with femur full length-AP and Lateral view in all patients. Associated injuries were evaluated and treated simultaneously. All the patients were operated on elective basis. The implant choice was independent of age, sex and fracture configuration. All implants used belonged to the Depuy Synthes. A standard operative technique (lateral approach) used for all cases. The duration of the surgery from skin incision to skin closure was recorded. The following outcomes were measured:

1. Radiological outcome on the basis of union, complications with respect to implant cut-out and malalignment and
2. Functional outcome on the basis of Harris Hip Score.

Radiological assessment was done intra-operatively in terms of guidewire placement and the screw size and location. This assessment was purely based on the surgeon's experience and the instrumentation used in the system. The second assessment was done immediately post-operatively in terms of reduction, zone of screw placement and TAD. It was accurate and was done on the basis of PACS (picture archiving and communications systems) which was available in the institute.The post-operative protocol was similar for both sliding screw and the spiral blade. The patient was asked to bear full weight on both the limbs with the help of a walker. If the first 3-4 post-operative days were uneventful, they were discharged and asked to follow-up at 10th day post operation. The patient was asked to avoid squatting/sitting cross-legged. They were advised to stop using walker and start completing free weight bearing when tolerated. Serial post-operative X-rays were done, and the same parameters were followed in 1month, 3 months, 6 months and at 1 year. At 6 months follow-up, the functional outcome was assessed on the basis of Harris Hip Score. A questionnaire was prepared on the basis of Harris Hip Score and given to the patient. Also, the surgeon evaluated the objective points of assessment in Harris Hip Score and noted them down. The overall outcomes of both the modalities of fixation were then assessed and the results were derived.

Results

In our study 50 patients with intertrochanteric fracture were randomised for treatment, 25 patients in each group. The DHS and DHHS (Helical Blade Plate) group were similar statistically in demographical (age, sex). In this study age group in both groups is similar, mean age in DHS group was 76.04 (SD ±10.03) and in DHHS group was 78.36(SD ±10.39). In this study we compared time taken for surgery, tip apex distance, time taken for union (Radio-logically) and functional outcome using Harris Hip Score(HHS) (Table 1-3). The DHS group had mean Tip Apex Distance (TAD) of 17.05 mm (SD ±4.633) and in DHHS group mean TAD was 19.40 mm (SD ±5.430). There was a statistical difference between the TADs of the two groups (p=0.046). The mean time taken for surgery in the DHS group (in mins) mean was 57.44(SD ±9.305), and in the DHHS group mean was 48.44(SD+ 6.740). Statistically difference in these group was significant (p=0.00014). The mean time taken for union (in weeks) in the DHS group was 16.21(SD ±3.15) and in the DHHS group was 16.45 (SD ±3.05). There was no significant statistical difference (p=0.399). At 6 months mean Harris Hip Score was in the DHS group was 84.5(SD ±8.153) and in the DHHS group 82.744 (SD ±11.78), which statistically had no difference(p=0.288). There was no failure in both groups (DHS and DHHS). Postoperatively there was no complications like superficial or deep infection, implant cut out, revision or segmental osteonecrosis.

Table 1: Summary Statistics of the considered variable under DHS and DHHS

	Method	N	Mean	Std. Deviation	Std. Error Mean
Time taken for surgery (mins)	**DHS**	25	57.440	9.3054	1.8611
	Helical	25	48.480	6.7399	1.3480
TAD (mm)	**DHS**	25	17.028	4.6334	.9267
	Helical	25	19.472	5.4300	1.0860
AP	**DHS**	22	5.291	5.6429	1.2031
	Helical	24	8.813	4.7407	.9677
LAT	**DHS**	22	2.941	2.6550	.5661
	Helical	24	4.388	3.0585	.6243
Harris Hip Score	**DHS**	20	84.500	8.1529	1.8230
	Helical	24	82.746	11.7818	2.4049
time taken for union (weeks)	**DHS**	23	16.22	3.133	.653
	Helical	22	16.86	3.167	.675

Table 2: Mean difference table among the considered variable under DHS and DHHS along with t-statistics

					95% Confidence Interval of the Difference	
Variables	**t**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**Lower**	**Upper**
Time taken for surgery (mins)	3.899	.000	8.9600	2.2980	4.3396	13.5804
TAD (mm)	-1.712	.093	-2.4440	1.4276	-5.3144	.4264
AP	-2.298	.026	-3.5216	1.5322	-6.6095	-.4337
LAT	-1.706	.095	-1.4466	.8480	-3.1556	.2624
Harris Hip Score	.563	.577	1.7542	3.1184	-4.5390	8.0474
Harris Hip Score	-.688	.495	-.646	.939	-2.540	1.248

Table 3: HHS Score At 6 Months

GRADE	DHS	DHHS
Excellent (90-100)	5(36%)	9 (64%)
Good (80-89)	11 (61%)	7 (39%)
Fair (70-79)	6 (55%)	5 (45%)
Poor (<70)	2 (40%)	3 (60%)

Discussion

Intertrochanteric hip fractures are common and resulted in heavy burden to affected patients [14]. Sliding hip screws have been widely used but it is associated with problems[15]. There have been various biomechanical studies comparing the strength of helical blade plate and DHS screw[12,13]. Ekmke et al[16] measured forces and energy required to insert DHS screw and DHHS blade and found that total energy required for DHS screw insertion is much higher than DHHS blade. Kyle et al[17] evaluated sliding characteristics of different versions of DHS screws. They noted four factors in the initiation of sliding, including coefficient of friction between shaft and barrel, length of screw out of barrel, length of contact between barrel and shaft of screw, and force acting perpendicular the screw. Our study didn't have any exclusion criteria as far as age was concerned. Also, the quality of bone was not considered a deciding factor for the choice of implant. A large prospective randomized series done by Stern et al[12] wasn't able to demonstrate any difference in complications of a blade vs a screw in terms of re-operation rates and cut outs in 1 year. The series included blade vs screw involving both the plate and nail. It did not address issues like the quality of reduction, time taken for the surgery, incidence of varus malunion and time taken to heal[18]. Also, considering it was a prospective study, it didn't take into account intra-operative factors like the time taken for the surgery and immediate post-operative morbidity for the two modalities of fixation. Also, there was no difference in time taken for union between 2 groups. On an average time taken for union in our study was 16 weeks. In our study we included time taken for surgery, which has significant difference (p=0.046), DHHS group took less time than DHS group though time taken for union was insignificant (p=0.399). In our study TAD in DHS group was 17.05 mm and in DHHS group was 19.40 mm which was statistically insignificant and also clinically irrelevant. Baumgaertner et al[5,9] demonstrated in their series that if the TAD was within 25 mm there wouldn't be any cut outs of the screw and this variable would be by far the most important predictor of outcomes of screw. In our study TAD was within 25 mm except in 5 patients where TAD was more than 25 mm (3 in DHHS group and 2 in DHS group). At 6 months mean Harris Hip Score was in the DHS group was 84.5 and in the DHHS group 82.744, which statistically had no difference(p=0.288). However, there was no complication in any of these cases.

Conclusion

In conclusion our study shows that, there is no difference in the clinical outcomes between the DHS group and DHHS group. However, the mean operative time was almost 10 mins more in the DHS group. There was no complication in both the groups. The supposed biomechanical stability of the spiral blade plate has not been converted to a definite clinical superiority in our study. Key to success is maintaining the Tip-apex distance to within 25 mm consistent with the Baumgaertner series with the DHS. However, it has to be kept in mind that cost of Helical blade plate is significantly higher than DHS screw.

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