

# To Study the Effectiveness and Safety of Dynamic Hip Screw (DHS) Fixation for Intertrochanteric Fractures

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## ABSTRACT

**Background:** One of the leading causes of death and disability among the elderly are hip fractures. Approximately half of these injuries are intertrochanteric fractures and the incidence is continuously increasing. Different types of implants were tried at different times for internal fixation of these fractures, of which dynamic hip screw has remained the most popular one. But with the advent of some newer implants, the efficacy of dynamic hip screw is being questioned.

**Aim:** To determine the failure after DHS fixation of intertrochanteric fracture and identify causes (instability, increased tip apex distance and high angle side plate) leading to failure after DHS fixation.

**Methods:** This was a descriptive interventional case study. Forty five cases fulfilling the inclusion criteria were included after taking informed consent. There were 32 males and 13 females with male to female ratio of 2.5:1. They were operated under standard surgical protocol for DHS by senior residents. Pre, per and post-operative findings during hospital stay and follow-up were recorded.

**Results:** The mean±SD between the ages was 71.91±10.40 years. The lag screw size was 85 mm & 90 mm in 12 and 33 patients respectively.

**Conclusion:** DHS showed satisfactory results with fewer complications.

**Keywords:** Dynamic hip screw, Intertrochanteric fractures, failure

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## INTRODUCTION

The incidence of extracapsular fractures of the proximal femur or intertrochanteric fractures is increasing<sup>1</sup>. The most common injuries in the elderly near the hip are intertrochanteric fractures<sup>2</sup>. These fractures are 4-5 times more common than the femoral neck fractures<sup>3</sup>. The sufferers are mainly 66-76 years of age<sup>4</sup>.

The intertrochanteric fractures occur in 10-12 years older population than intracapsular femoral neck fractures<sup>4,5</sup>. Classically intertrochanteric fractures extend along the line between lesser and greater trochanter of the femur, only a fraction are simple fracture and majority about sixty percent of these fractures are comminuted with different geometric patterns<sup>6</sup>.

These fractures are more frequent in women with male to female ratio range from 2:8. In younger patients these are less and mostly result from a high velocity trauma<sup>2</sup>. The cancellous bone of trochanteric area usually heals well regardless of treatment<sup>8</sup>. Optimal treatment of such fractures is an exercise on balancing the biological and mechanical considerations to maximize the likelihood of healing with early & full restoration of function, with minimal risk of complications<sup>9</sup>.

Cost effectiveness is also a major concern for the patient and society<sup>9</sup>. Little options exist for treatment of intertrochanteric fractures besides operations; a skeletal traction for 8-10 weeks is recommended only in highly unfit

patients<sup>1</sup>. The goal of surgical treatment is to achieve union in acceptable position with early return to pre injury level with low mortality and morbidity<sup>10</sup>.

In developing countries, many patients are not operated on because of many factors e.g. low socioeconomic status, beliefs of families, availability of orthopedic setup, other risk factors such as severe anemia, poor pulmonary status etc. In these situations alternatives have been opted in the past<sup>11</sup>.

The dynamic hip screw (DHS) is mostly applied for treatment of fractures of the proximal part of the femur despite different surgical options used<sup>12</sup>. Providing a controlled collapse is the basic principle of DHS<sup>1</sup>. The pattern of each fracture must be carefully and cautiously evaluated through X-rays before operation can be performed.

To effectively resist varus and posterior displacement of major proximal and distal fragments, stable reduction is required which provides sufficient posteromedial cortical contact<sup>14</sup>. Sometimes posteromedial bone fragments are difficult to reduce; under such circumstances the desired anatomical reduction cannot be achieved. For such unstable fractures non-anatomical reductions can be achieved by Dimon and Houghton medial displacement osteotomy & Sarmiento valgus osteotomy<sup>15</sup>.

The type of fracture, stability, adequacy of reduction, osteoporosis and placement of screw within the femoral head are some of the factors that relate to implant failure in intertrochanteric fractures<sup>16</sup>. Cutting out of the screw from

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femoral head is the most common cause of failure with an incidence reported of 2.25-12.6%<sup>12</sup>.

Clockwise rotational torque is imparted during screw fixation<sup>13</sup>. It was reported by Kovel et al<sup>17</sup> that 41% patients return to pre-fracture ambulatory ability, 40% patients remained showed ability to move about in the household and the community and that surgically reduced unstable fractures healed uneventfully 97% of the time. Reduction in the rate of failure is shown by proper fracture reduction and implant placement<sup>12</sup>.

The final outcome of these unstable intertrochanteric fractures also depends upon quality of the bone, as decreased bone density results in poor functional results. Fractures geometry and age of patient are other etiological factors, which affect the surgical results<sup>18</sup>. Relations between position of screw and fracture pattern is of prime importance<sup>19</sup>. To achieve good results, ideally the lag screw of DHS should be placed inferiorly towards the medial margin in the frontal plane and centrally in the sagittal plane; tip of the screw should be 1.0 cm below the subchondral bone<sup>20</sup>.

Specific positions of the screw in the femoral neck and head produced high percentage of good results<sup>17</sup>. Causes of DHS failure include instability (40%), increased tip apex distance (up to 45 mm) 60%, high angle side plate which is 150(50%)<sup>21,22,23</sup>. Less the tip apex distance the better results have been seen<sup>24</sup>.

**MATERIAL AND METHODS**

This was a descriptive interventional case series study. This study was conducted in the Orthopedics department of Ghurki Trust Teaching Hospital / Lahore Medical and Dental College Lahore, over a period of thirty months from November 2011 to May 2014. This study was approved by the institutional Ethical Committee. Forty five patients of intertrochanteric fractures of age 40 years or more were included and operated after taking informed consent. Patients who had implant failure due to trauma, osteoporosis or hip arthritis were excluded. In the hospital pre-discharge period, patients were assessed for instability by getting the post-operative radiographs.

The sum of distances from the tip of lag screw to the apex of femoral head was taken as the tip apex distance. It was measured on anterior-posterior and lateral view radiographs. High angle of side plate i.e. 150° or more was measured from postoperative radiographs. The findings were recorded on specially designed proforma. The data was analyzed by using latest SPSS version.

**Statistical Analysis:** The data was entered and analyzed using latest version of SPSS. The variables to be analyzed include demographic information's like age, gender, DHS fixation (failure and success) and causes leading to failure (instability, increased tip apex distance, high angle plate). These variables were analyzed by applying simple descriptive statistics; mean and standard deviation for quantitative data like age, qualitative data like gender, failure after DHS fixation and causes leading to failure. Data was stratified for mode of injury (fall, minor trauma, high energy trauma).

**RESULTS**

Out of 45 patients, 32 were males and 13 were females. Male to female ratio was about 2.5: 1. Mean age of the patients was 71.91±10.40 years. Fractures were comminuted plus displaced in 16 patients (35.6%), unstable plus displaced in 15 patients (33.3 %) and stable plus undisplaced in 14 patients (31.1%). The size of the lag screw was 85 mm & 90 mm in 12(26.7%) and 33 (73.3%) patients respectively. Cortical screws of 45, 50 and 55 mm sizes were used in 17(37.8%), 20(44.4%) and 8(17.8%) patients (Table 1).

28 and 17 patients showed grade III and grade IV respectively, on the Sirkoski and Barrington pain scale. 22, 15 and 8 patients showed Grade III, IV and V callus formation respectively (Table 2).

Post operatively the causes of failure were found in 31(68.9 %) patients with instability, 11 patients (24.4%) with increased tip apex distance and 3(6.7%) with high angle side plate (Table 3).

Table 1 Size of lag screws and interlocking screws

Size of lag screw	Frequency	%age
85 mm	12	26.7
90 mm	33	73.3
45 mm	17	37.8
50 mm	20	44.4
55 mm	8	17.8

Table 2 Grades of Callus formation and Pain after DHS Fixation

Grade	Frequency	%age
<b>Hammer et al radiological assessment of callus formation</b>		
Grade III	22	48.8
Grade IV	15	33.4
Grade V	8	17.8
<b>Sirkoski and Barrington Pain Scale</b>		
Grade III	28	62.3
Grade IV	17	37.7

Table 3 Causes of failure of DHS Fixation

Causes of failure	Yes		No	
	Frequency	%age	Frequency	%age
Instability	31	68.9	14	31.1
Increased tip apex distance	11	24.4	34	75.6
High angle side plate	3	6.7	42	93.3

**DISCUSSION**

Intertrochanteric fractures are still considered 'unsolved fractures' due to complications related to the different methods and techniques recommended for treating these difficult fractures<sup>1</sup>. The elderly patients frequently have inadequate strength and coordination to effectively protect the fractured hip from excessive stresses while using walker or crutches. Immediate post-op integrity of both implant & reduction is thus of prime concern<sup>25</sup>. Patients' general health and activity levels before the fracture are some factors that predict the practical outcomes of such fractures.

Returning patients to their pre-fracture activity as soon as possible is the primary goal in elderly patients. Stable reduction, adequate internal fixation, safe anesthesia, minimal blood loss and early mobilization are

required to fulfill this aim<sup>2</sup>. To achieve this goal implant must be strong enough and fracture must be reduced in stable position<sup>25</sup>. The five determinants for surgical management of these fractures include fracture geometry, type of reduction, bone quality, choice and placement of implant.

Only two factors i.e., bone quality and fracture geometry are out of the surgeon's control while remaining three are in surgeons hand<sup>1</sup>. Intertrochanteric fractures are mainly seen in the elderly. The mean age was 77.1 years in one study of 182 patients<sup>26</sup>. In another study consisting of 2903 cases, mean age of 80 years for hip fractures was reported<sup>27</sup>.

Low bone mass and postmenopausal osteoporosis are the major causes of these fractures being more common in women than men. This is shown in most of the studies conducted, where one reported 76% females<sup>27</sup>, while another reported 78% females<sup>29</sup>, both showing a much higher female to male ratio.

In our study male to female ratio was 2.5:1 (Table 1). Education and awareness has increased the demands of the patients<sup>30</sup>. It is the early diagnosis and surgical management, which decreases the morbidity and improves the mobility after surgery. Fracture geometry is the major determinant, which helps in anticipating the functional outcome of surgical management<sup>31</sup>. In the present study, the maximum fractures were of comminuted displaced type. Posteromedial contact is a very important factor for a stable fixation of these fractures<sup>32</sup>.

If anatomical reduction is not possible then different methods for non-anatomical but stable configuration have been advocated<sup>15</sup>. Anatomical reduction was achieved in most of the patients. Recent studies have shown that as compared to medial displacement osteotomy, anatomical reduction allows greater load sharing by the bone<sup>15</sup>. One of the major causes of implant cut out with varus deformity is poor positioning of the lag screw in the femoral head.

Studies have shown that the sliding hip screw acts as a lateral tension band in stable fracture patterns, transmitting forces through the medial cortex<sup>26</sup> and that loss of this tension results in high failure rates<sup>33</sup>.

Non-union is an uncommon problem in intertrochanteric fractures as they are through vascular cancellous bone. Therefore, these fractures heal well even if deformed<sup>8</sup>. One report showed average healing time of 13 weeks<sup>34</sup> and another reported union time of 16 weeks<sup>35</sup>. The chances of post-operative complications are directly related to the health status, comorbidities & perioperative management<sup>36</sup>. Common technical complications are varus deformity, implant cutting out, implant breakage, loosening in femoral head and plate pulling off from the shaft<sup>1</sup>.

There is a very strong tendency of this fracture to settle in varus due to the strong adductor pull of the adductor muscles on the proximal shaft. Factors causing fracture to settle in varus and implant cutting out superiorly include type of fracture, reduction, medial comminution, bone quality and improper placement of screw within the femoral head<sup>37</sup>.

Mortality is high in hip fractures, factors are old age, comorbid medical problems like, chest infection, pressure sores, deep vein thrombosis and cardiovascular

complications & immobilization<sup>36</sup>. Pain is a significant post-operative problem; main sources of pain are varus and implant loosening<sup>25</sup>. Pain decreases with fracture healing & getting patient ambulated. Larsson et al<sup>38</sup> also showed that increased risk of pain & socioeconomic problems is due to severe loss in ambulatory function caused by these fractures.

## CONCLUSION

For intertrochanteric fractures of femur DHS is still the effective mode of treatment. The cause of failure is poor technique, not the implant and commonest reason for failure is instability.

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