

# Does Tip Apex Distance Predict Implant Failure in Stable Intertrochanteric Fractures of Femur?

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## ABSTRACT

**Aim :** To assess the rate of implant failure in stable intertrochanteric fractures of femur in elderly patients treated with the dynamic hip screw with a tip apex distance.

**Study design:** Descriptive

**Place and duration of study:** Department of Orthopaedic, Sahara Medical College, Narowal from 12<sup>th</sup> August 2019 to 11<sup>th</sup> February 2020.

**Methodology:** Sixty patients with implant failure. Patients of both genders, age more than 50 years, closed undisplaced intertrochanteric fractures (AO/OTA 31A1) identified on preoperative radiograph and history of fall were included. Those patients who have fracture shaft of femur, bone mineral density less than 2 standard deviation on DEXA scan, open intertrochanteric fractures, polytrauma and advanced osteoporosis as diagnosed by X-ray were excluded from the study. All patients were underwent dynamic hip screw fixation.

**Results:** Thirty six (60%) were males and 24 (40%) patients were females with mean age 59.9±12.7 years. Mean body mass index of the patients was 26.7±3.8 kg/m<sup>2</sup>. Thirty seven cases (61.7%) had right side fracture and rest 23 patients (38.3%) had left sided fractures. The tip apex distance <20mm was found among 35 patients (58.3%) in which frequency of implant failure was among 3 cases (8.6%). Among 15 patients (25%) had tip apex distance 20-30mm in which implant failure measured among 5 cases (33.3%) and 10 patients (16.7%) had tip apex distance >40mm in which implant failure observed among 1 patient (10%). Falling was the most common reason of injury in which 51 cases (85%) found, 6 injuries (10%) due to road traffic accident and 3 cases (5%) had other reason of injury.

**Conclusion:** The tip apex distance 20-40mm increased the rate of the implant failure of the dynamically fixed dynamic hip screw, with stable femoral intertrochanteric fracture.

**Keywords:** Tip apex distance, Implant failure, Intertrochanteric fracture, Dynamic hip screw

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## INTRODUCTION

Intertrochanteric fractures of femur in old age account for a large proportion of hospitalization among patients with history of fall requiring surgical intervention.<sup>1</sup>An overwhelming majority of these patients are aged above 60 years. These fractures are thrice more frequent in women than in men.<sup>2</sup> Surgical management is the treatment of choice for these fractures as to mobilize the patients out of the bed and thus preventing complications of prolonged immobilization.<sup>3</sup> Rigid fixation with early mobilization of patients should be considered as the standard treatment. Although many devices can achieve rigid fixation, dynamic hip screw (DHS) is the most commonly used device for intertrochanteric fractures. Proximal femoral fracture treatment is associated with mechanical complications and, in particular, the screwing and fall of the surgeon causes dreadful problems and is one of the primary causes of treatment failure. For closing femoral intertrochanteric fracture, dynamic hip screw has now become a treatment of choice.<sup>2</sup>Closed reduction and interior fixation by means of the traction table and picture strengthener is achieved by dynamic hip screw fixation<sup>4</sup>.

Dynamic hip screw requires appropriate preoperative planning, good antibiotics and excellent operative techniques and skill and is not without complications. Dynamic hip screw is the most acceptable fixation method to treat intertrochanteric fractures of femur.<sup>5</sup>The best advantage of fixation is dynamic lag screw which can promote compression at fracture site. Most common complication of dynamic hip screw is screw cut out.<sup>6</sup>The highest screw cutting factor is the tip apex distance (TAD)<sup>4</sup>. A tip apex distance over 25 mm is associated with a higher risk of screw-out<sup>5</sup>. Distance to the tip apex with Baumgaertner formula is measured on X-ray. It is the sum of distance in millimeter from tip of implant to apex of femoral head on normal anteroposterior and lateral x rays of the hip.<sup>7</sup> Dynamic hip screw fixation is usually performed surgical procedure in old age. The risk factors for a screw cutout were measured in 937 patients by Hsueh and colleagues<sup>4</sup> and a 6.8% reduction rate was found (64 patients). In an additional analysis, 3.4% hip screw cutouts and the most significant factor to cut in healthy and stable fractures were demonstrated by a TAD of more than 25 mm.

## PATIENTS AND METHODS

This descriptive case series study was carried out at the Department of Orthopedics DHQ Hospital, Narowal over a

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period of 6 months from 12<sup>th</sup> August 2019 to 11<sup>th</sup> February 2020. This study included 60 patients with implant failure. Patients of both genders, age more than 50 years, closed undisplaced intertrochanteric fractures (AO/OTA 31A1) identified on preoperative radiograph and history of fall were included. Those patients who have fracture shaft of femur, bone mineral density less than 2 standard deviation on DEXA scan, open intertrochanteric fractures, polytrauma and advanced osteoporosis as diagnosed by X-ray were excluded from the study. All patients were undergoing dynamic hip screw fixation. Patients were followed up regularly at intervals of 3 weeks, 6 weeks, 10 weeks and 14 weeks. Patients were mobilized with walker with touchdown weight bearing on 5<sup>th</sup> post-operative day, partial weight bearing with walking frame between 3-4 weeks and full weight bearing without support after 6 weeks. Radiographs should take on each follow up visit and checked for evidence of implant failure i.e. cutout/breakage of lag screw, screw pullout or plate breakage. Data was also collected for history of current smoking and BMI >29.9kg/m<sup>2</sup> and both variables were treated as effect modifier. Data collected was entered and analyzed in the SPSS version 17.

## RESULTS

Thirty six patients (60%) were male and 24 patients (40%) were female with mean age of 59.9±12.7 years. Mean BMI of the patients was 26.7±3.8 kg/m<sup>2</sup>. We found 37 cases (61.7%) had right side fracture and rest 23 patients (38.3%) had left sided fractures. Falling was the most common reason of injury in which 51 cases (85%) found, 6 injuries (10%) due to road traffic accident and 3 cases (5%) had other reason of injury (Table 1). Tip apex distance (TAD) <20mm was found among 35 (58.3%) patients, 15(25%) patients had TAD 20-30mm and 10 (16.7%) patients had TAD >40mm (Table 2). Frequency of implant failure in TAD <20mm was among 3(8.6%) out of 35 cases (58.3%), implant failure measured among 5 cases (33.3%) in TAD 20-40mm out of 15 cases (25%) and 1% implant failure measured in TAD >40mm among 10 patients (16.7%) [Table 3].

Table 1: Demographic information of the patients

Variable	No.	%
Gender		
Male	36	60.0
Female	24	40.0
Mean age (years)	59.9±12.7	
Mean BMI	26.7±3.8	
Mode of fracture		
Right	37	61.7
Left	23	38.3
Reason of Injury		
Falling	51	85.0
RTA	6	10.0
Others	3	5.0

Table 2: Association of TAD among patients (n=60)

Tip Apex Distance	No.	%
<20mm	35	58.3
20-40mm	15	25.0
>40mm	10	16.7

Table 3: Distribution of implant failure with respect to TAD

Implant failure	No.	%
<20mm (n=35)	3 (8.6%)	32 (91.4%)
20-40mm (n=15)	5 (33.3%)	10 (66.7%)
>40mm (n=10)	1 (10%)	9 (90%)

## DISCUSSION

The growing number of seniors in this country is responsible for the intertrochanteric fracture of the femur. This fracture is normally managed by immediate optimization of medical comorbidity of the patient and operational stabilization. The mean age 59.9±12.7 years with mean BMI 26.7± 3.8 kg/m<sup>2</sup>. Thirty six (60%) were male patients and the rest 24 (40%) were females, these results were comparable to some previous studies<sup>7,8</sup>. The occurrence of intertrochanteric fractures in women, however, was 1.5 to 12 times higher in most studies than in males<sup>9,10</sup>.

Conventional and modern types of intramedullary sliding devices are included in the mounting option (i.e. gamma nail or proximal femoral nailing devices). Dynamic hip screw fixation in several studies has proved to be the standard treatment for the fracture. While superior DHS fixation results reported in several studies, a substantial implant failure rate of between 5% and 24% was also demonstrated.<sup>11</sup> In our study we found out of 60 patients, tip apex distance (TAD) <20mm was found among 35 (58.3%) patients in which frequency of implant failure was among 3 (8.6%) cases. Among 15 (25%) patients had TAD 20-30mm in which implant failure measured among 5 (33.3%) cases and 10 (16.7%) patients had TAD >40mm in which implant failure observed among 1 (10%) patients<sup>12,13</sup>.

We found 37(61.7%) cases had right side fracture and rest 23(38.3%) patients had left sided fractures. In the other series, the figures were 53% of Brayn<sup>14</sup>, 26 56% of Clark and Ribbans<sup>15</sup>, 27 and 54% of Lewng et al<sup>16</sup> 28, on the left. The hip fractures of Pun et al 29 were found on the right-hand side, at 53%. The most common cause of injury was falling in which 51 (85%) cases were reported, 6 (10%) were injured due to a road accident and 3(5%) were injured due to other causes. In the elderly population, intertrochanteric fractures are normal and 90% of intertrochanteric fractures in the elderly occur as a result of a simple drop<sup>17</sup> and the healthcare system's relationship with increased mortality and morbidity plays a significant part.<sup>18</sup> In the calculation of TAD in synthetic femur taken in neutral and varying degrees and positions (adduction and abduction), Kumar and colleagues<sup>19</sup> investigated the significance of hip rotation. They, found statistically significant discrepancies among the TADs for AP and side x-rays and suggested that to avoid placing the rotating hip through the joints, hip should be positioned within rotation. The meta-analysis indicated that for the therapy of pertrochanteric fractures the dynamical hip screw should be preferred.<sup>20,21</sup>

The use of a trochanter stabilizing platform was shown previously to prevent or even treat early cut-down of the lag screw, which proved quick, easy and secure, particularly in unstable intertrochanteric fractures<sup>22</sup>.

The impact of the screw is also associated with the lag screw position in the femoral head. Many TAD and

postoperative outcomes results were inconsistent. In order to minimize and eliminate the chance of fixation failure by DHS, Jensen et al<sup>23</sup> recommended the use of a 10mm spindle tip from the joint surface while Kyle et al<sup>24</sup> advised it to place the spindle spikes in a ten mm position within 10 mm. Several new alternatives have been developed and evaluated in the treatment of the intertrochanteric fractures of femur. These include cerebrospinal nail, Gamma Nail, proximal femoral nail antirotation (PFNA), percutaneous compression plate (PCCP), twin hook, DHS blade and dynamic screw plates. These are dynamic screw plates.<sup>25</sup>

## CONCLUSION

The tip apex distance 20-40mm increased the rate of the implant failure of the dynamically fixed dynamic hip screw, with stable femoral intertrochanteric fracture.

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