



INTERTROCHANTERIC FRACTURES; FREQUENCY OF LAG SCREW CUT OUT FIXED WITH DYNAMIC HIP SCREW

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Article received on:

06/02/2017

Accepted for publication:

15/09/2017

Received after proof reading:

03/11/2017

ABSTRACT... Objectives: To determine the frequency of lag screw cut out in intertrochanteric fractures fixed with dynamic hip screw and to identify the possible contributing factors for screw cut out. **Study Design:** Descriptive case series. **Place and Duration of the Study:** Orthopaedic & Traumatology Unit "A" Lady. Reading Hospital Peshawar from January 2014 to January 2017. **Material and Methods:** Patients of either gender or age with intertrochanteric fractures fulfilling the inclusion and exclusion criteria were fixed with dynamic hip screw (DHS). Post operatively fracture reduction, position of screw in head of femur and tip apex distance were calculated on antero posterior and lateral radiographs. All the patients were reviewed fortnightly for two month and then monthly for six months for lag screw cut out on radiographs. **Results:** Total 110 patients mean age 72 (range 22 to 98 years) years were fixed with dynamic hip screw. Lag screw cut out was noted in 12(10.9%) patients with 4(33.3%) male and 8(66.6%) female patients. The mean age was 62 years. Right side was involved in two (16.6%) patients while left in ten (83.3%) patients. Radiographically fracture reduction was poor in most (50%, n=6) patients. The mean tip apex distance (TAD) was 32mm (range 24 to 40 mm). Majority (75%, n=9) of cut out screw were in superior portion of the head of femur. Four (33.3%) patients had screw cut out at 8th week postoperatively while eight (66.6%) patients had screw cut out at 12th week. **Conclusion:** Lag screw cut out was the most common mechanical complication after fixation of intertrochanteric fractures and all of the cut out patients were elderly with inadequately reduced fracture, superiorly placed lag screw and longer tip apex distance.

Key words: Intertrochanteric fracture, dynamic hip screw, tip apex distance.

Article Citation: Shah FA, Alam W, Ali MA. Intertrochanteric fractures; Frequency of lag screw cut out fixed with dynamic hip screw. Professional Med J 2017;24(11):1740-1744. DOI:10.17957/TPMJ/17.3867

INTRODUCTION

Hip fractures commonly occur in old age with osteoporosis and intertrochanteric fracture is the common one.¹ Approximately 296,000 hip fractures are reported annually in United States and intertrochanteric fractures constitute half of these fractures.² Various implants like dynamic hip screw (DHS), angular blade plate and intramedullary nails are used to treat intertrochanteric fractures.³ Dynamic hip screw (DHS) is an extramedullary implant which is relatively simple, safe and favored device to fix these fractures.^{4,5} Although dynamic hip screw is a time tested device, lag screw cut out is the most common mechanical failure of this implant reported in 8% of cases in the literature.⁶ In 1995 Baumgaertner⁷ in his classical landmark study showed that although multiple risk factors like old age and osteoporosis, unstable fracture

type, poor fracture reduction or fixation and use of 150 degree angle implants were responsible for screw cut out but the most important and the gold standard predictor of lag screw cut out he identified was the tip apex distance (TAD) which is the sum of distances from the tip of the lag screw to the apex of femoral head measured on antero-posterior view (X_{ap}) and lateral view (X_{lat}) after magnification is corrected by using the true diameter (D_{true}) of the shaft of lag screw as a reference. (Figure-1) Baumgaertner⁷ further noted that there were no screw cut-out in patients with a tip apex distance (TAD) of less than 25mm but 27% of his patients had cut out of lag screw because they had a TAD of more than 30mm. Furthermore his results supported the central placement of lag screw to obtain tip apex distance of less than 25 mm. Subsequent studies.^{8,9,10} supported

his recommendations. Screw cut out in patients with a hip fracture require another surgery which might not be tolerated by these elderly patients because of the existing comorbidities associated with advancing age. The purpose of this study was to determine the frequency of lag screw cut out in patients with intertrochanteric fractures fixed with dynamic hip screw. This study will also identify the possible factors that may contribute to screw cut out. This will be the first study on this topic in our institution.

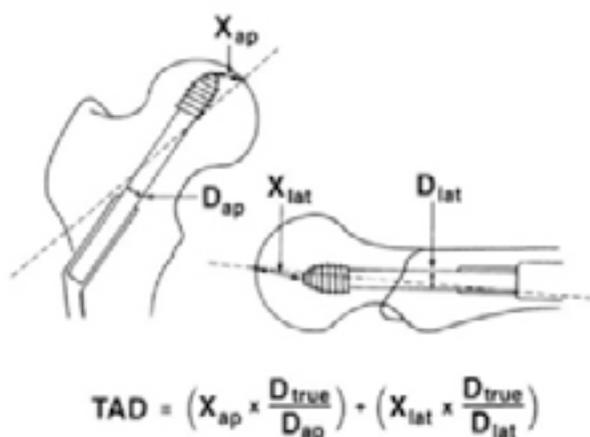


Figure-1. Technique for the calculation of tip apex distance (TAD)

MATERIAL AND METHODS

This descriptive case study was conducted in Orthopaedic & Traumatology Unit "A" Lady Reading Hospital Peshawar from January 2014 to January 2017. Patients of either gender and age with intertrochanteric fractures which were fixed with dynamic hip screw (DHS) were included in the study. Patients with revision hip surgery, pathological fractures, polytrauma patients with multiple fractures, patients with in hospital mortality or those died within six months post operatively, those unable to complete follow up for at least first six months post operatively and those with inadequate or missing radiographs were excluded from the study. The research protocols were approved by the hospital Ethical Review Board. Informed written consent from the participants were taken. In the included subjects pre operative complete history and physical examination was done. X-ray AP & Lateral view of the affected hip was taken and fracture was classified according to Orthopedic

Trauma Association (AO/OTA) fracture classification.¹¹ All the fractures were fixed with DHS (135degrees) under image intensifier with optimum surgical skills taking into consideration the correct position of lag screw as advocated by Baumgaertner.⁷ Immediate post operative check X-ray of the hip AP & Lateral view were done in all cases. The fracture reduction was labelled as Good when the fracture alignment was normal or slight valgus on AP X-ray, not more than 20 degree angulation on lateral x-ray and less than 4 mm displacement of any fracture fragment. The reduction was Acceptable when either alignment or displacement was of good quality but not the both and Poor when both were not present.⁷

Tip apex distance (TAD) was calculated on AP & Lateral X-ray according to Baumgaertner's formula.⁷ (Figure-1) The position of the lag screw in femoral head was located in one of the nine zones superior, central and inferior on AP x-ray and anterior central and posterior on lateral x-ray.^{12,13} All post operative patients received the uniform standard postoperative protocol of protected weight bearing with a walking stick for two months. All the patients were regularly followed fortnightly for first two months and then monthly for six months. In each visit lag screw position was radiologically assessed for cut out (protrusion of lag screw from femoral head by more than 1 mm). 14 Data collected was entered into SPSS (version 16) for statistical analyses.

RESULTS

A total of 110 patients mean age 72 years (range 22 to 98) were included in the study. Male patients were 64(58.1 %) while female patients were 46(41.8%). Right intertrochanteric fracture was present in 78(70.9%) while left in 32(29%) patients. The aetiology of fracture was fall in 80(72.7%) and road traffic accidents in 30(27.2%) patients. The fracture type was AO type 31A1 in 45(40.9%) and AO 31A2 in 65(59%) patients. There was no screw cut out in 90(81.8%) patients with mean TAD 22mm (range 18 to 38 mm). Lag screw cut out was found in 12(10.9%) patients with 4(33.3%) male and 8(66.6%) female patients. The mean age was 62 years. AO type 31A1 was present in 4(33.3) patients while AO type 31A2 was present

in 8(66.6%) patients. Radiographically fracture reduction was good in 2(16.6%), acceptable in 4(33.3%) and poor in 6(50%) patients. The mean tip apex distance (TAD) was 32mm (range 24 to 40 mm) in screw cut out group. The location of lag screw in femoral head according to the zones are shown in Figure-2. Majority (75%, n=9) of cut out screw were in superior portion of the head of femur. Four (33.3%) of our patients had screw cut out at 8th week postoperatively while eight (66.6%) patients had screw cut out at 12th week. Right side was involved in two (16.6%) patients while left in ten (83.3%) patients. No breakage of implant was noted. Revision surgery was performed in 8(66.6%) patients, implant removal followed by skeletal traction in 2(16.6%) while 2(16.6%) patients refused revision surgery.

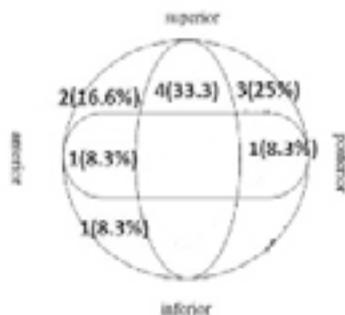


Figure-2. Distribution of lag screw cut out in femoral head according to Cleveland's zones.

DISCUSSION

The lag screw cut out rate in literature varies from 1.6% to 36.4%(table 1) while in our study it was 10.9% comparable to previous studies. With regard to the screw position in femoral head, majority of screw cut out in our study were in superior and posterior superior position(33.3% and 25% respectively) according to the Cleveland's¹² nine zones of femoral head while no screw cut out was noted in central or middle/middle, central inferior and posterior inferior position. Similar to our study Hsueh¹⁶ reported highest lag screw cut out rates (36.8% and 33.3%) in superior and posterior location while lowest cut out in middle/middle or central position (2.1%) and they proposed the central or middle/middle position as the best position for lag screw placement in hip fracture fixation. Other studies^{7,14,19} support the same findings.

The mean tip apex distance (TAD) was 32mm (range 24 to 40 mm) in screw cut out group in our study. Andruszkowet al¹⁸ evaluated 188 patients of DHS and documented a higher incidence of cut out rates with anterior placement of lag screw and twenty four times increased risk of lag screw cut out when TAD exceeded 25mm. Other studies^{9,10,20} had the same observation that a TAD of greater than 25 mm is a strong risk factor for lag screw cut out. Hsueh¹⁶ reported 11 cases of lag screw cut out with TAD < 25 mm, two cases of cut out with TAD < 20 mm and no cut out in patients with TAD < 15 mm. He suggested that to avoid lag screw cut out TAD should be less than 15mm. he also noted that screw position had a relation with TAD i.e the more peripheral (posterior or superior) the position of the screw the more longer the TAD. Bruijn¹⁹ noted the threshold of TAD 19.9mm in his study. In our study we also observed that majority (66.6%) of our patients in the cut out group had unstable fractures (AO type 31A2) and reduction was poor (50%) in most of them. This has been confirmed by other studies.^{15,16}

An interesting findings of our study was that majority (83.3%, n=10) of cut out patients had involvement of left sided hip. This can be explained by a theory proposed by Mohan²³ that left intertrochanteric fractures have a tendency for displacement of their proximal fragment because of the torque created when the lag screw is rotated clockwise for insertion into the head of femur and as a result fracture is fixed in a poorly reduced position and with ambulation further torque is applied causing gradual cut out of lag screw from femur head. On the other hand this torque effect of lag screw rotation causes compression of the right sided intertrochanteric fractures and further stabilizes the fracture and reducing risk of screw cut out. This theory is not only supported by Goh²¹ but he also proposed provisional kirschner wire fixation of the main fracture fragments in order to reduce the excessive torque while inserting the lag screw in left intertrochanteric fractures.

Our study had some limitations or weaknesses. TAD was measured by the principal author alone on radiographs and errors in uniform measurements was a possibility. This error could be minimize by

using digital system such as Picture Archiving and Communication System (PACS)²² which is more accurate and reproducible but unfortunately which was not available to us. Furthermore bone mineral density (BMD) of our patients could not be evaluated and no pre surgery protocols with regard to TAD and screw position was set. We recommend that larger number of patients should be evaluated to confirm our observations.

S. No	Study Name	Year	Dhs Lag Screw Cut Out
1	Guyen et al. ¹⁵	2010	5.8-7.1%
2	Hsueh ¹⁶	2010	6.8%
3	Agni ¹⁷	2012	1.6%
4	Andruszkow et al. ¹⁸	2012	3.2%
5	Sedighi ⁶	2012	8%
6	Brujin ¹⁹	2012	19%
7	Imadudin ²⁰	2014	2-36.4%
8	Goh ²¹	2016	6%
9	Our study	2017	10.9%

Table-I. Frequency of dynamic hip lag screw (DHS) cut out in different studies.

CONCLUSION

Lag screw cut out was the most common mechanical complication after fixation of intertrochanteric fractures and all of the cut out patients were elderly with inadequately reduced fracture, superiorly placed lag screw and longer tip apex distance.

To decrease the chances of lag screw cut out we recommend that fracture should be reduce accurately, superior screw placement of lag screw should be avoided and tip apex distance(TAD) should not exceed 25 mm.

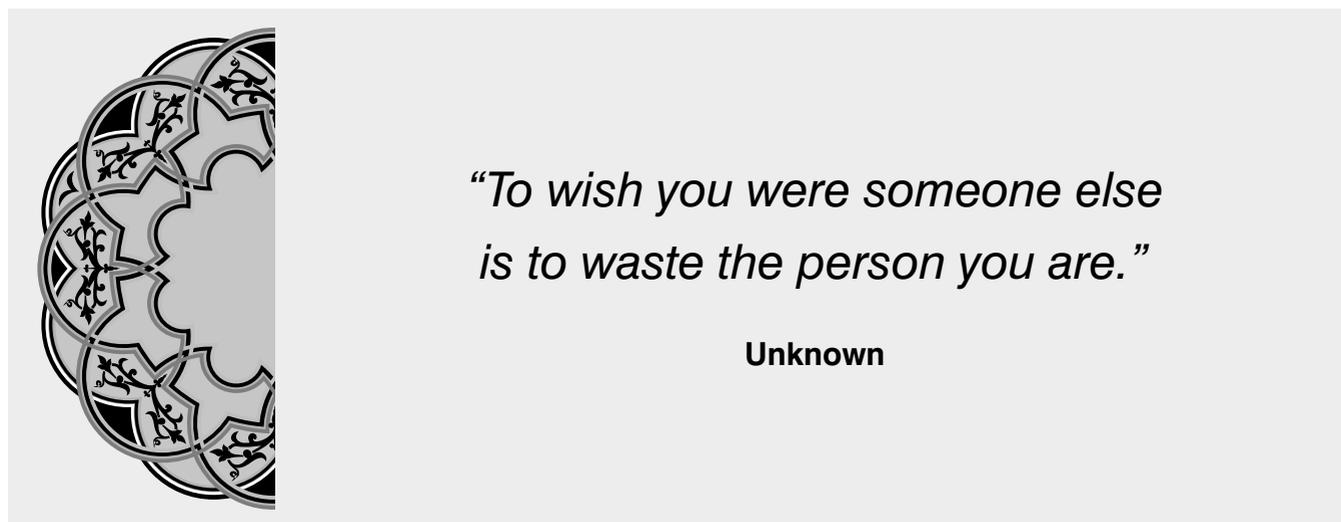
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AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
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2	Waqar Alam	Data interpretation, Drafting	
3	Main Amjad Ali	Final approval of study	