Tip to Apex Distance in DHS Fixation. An audit of practice at a district general hospital.

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Citation

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Abstract

BackgroundDynamic hip screw is still one of the most widely used devices for the fixation of extra-capsular neck of femur fractures. A recognised complication with this device, is the screw cut-out from the femoral head.The tip to apex distance has been shown to be the most reliable predicting factor of screw cut-out. A distance of less than 25 mm is generally predictive of a successful result. Aim The purpose of this audit was to assess the position of the lag screw, in dynamic hip screws performed in a district general hospital and to assess if the principle of tip to apex distance is put into practice. Method We used our theatre logbooks to retrospectively identify all consecutive patients who underwent DHS fixation over the period of Aug08- Nov08. The tip apex distance for every DHS was measured using the intra-operative radiographs.The results were presented in a departmental audit meeting and the importance of tip- apex distance was emphasized.The audit cycle was repeated 3 months later between Mar09 and Jun09.
ResultsIn the first cycle, 36 patients were studied. 9 out of 36 (25%) had a tip-apex distance of more than 25mm and there were 3 cut-outs requiring revision surgery.In the second cycle, 31 patients were studied. 5 out of 31 (16%) had a tip-apex distance of more than 25mm and there was 1 cut-out.
ConclusionBy simply raising awareness and emphasising the importance of the tip-apex distance, we lowered our DHS cut-out rate, improving patients safety and quality of life. We recommend that the tip-apex distance principle is emphasised and regularly re-enforced to all orthopaedic trainees, in order to improve the outcome of dynamic hip screws in patients with neck of femur fractures.

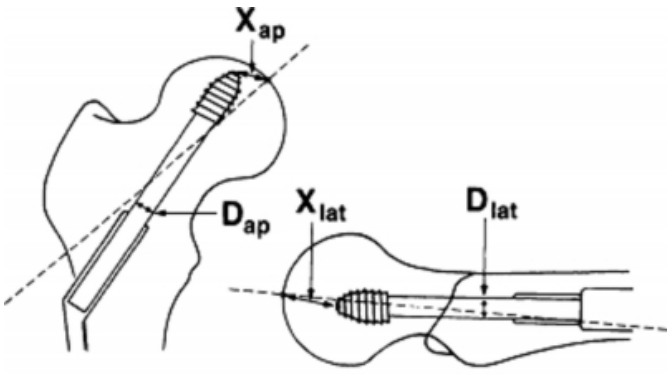
INTRODUCTION

Hip fractures remain one of the major causes of mortality and morbidity in the elderly population[1]. Dynamic hip screw (DHS) has been a successful device used in treating intertrochanteric hip fractures since the 1970s and is still one of the commonest trauma devices used to date. It allows controlled impaction of the fracture to a stable position whilst maintaining the neck to shaft angle. Despite been a highly successful device, it has a rate of mechanical failure which has been reported between 16 and 23%[2]. The commonest mechanism of failure of a DHS is to “cut out” from the femoral head. Many factors have been identified as causes for its mechanical failure, including quality of bone, patient age, fracture pattern, adequate fracture reduction and lag screw position.

The most reliable predictor of mechanical failure in a DHS is the tip to apex distance (TAD)[2]. This measurement is the sum of the distance from the tip of the lag screw to the tip of the femoral head on the anterior-posterior and lateral intra-operative radiographs allowing for magnification (fig1).

Figure 1

Fig 1 Image showing how to calculate the TAD allowing for Xray magnification. (Obtained from Baumgaertner et al)



This sum generates a single number which indicates the position and depth of the screw on both the anteroposterior and lateral radiographs. The ideal position for a lag screw in both planes is deep and central in the femoral head within 10 mm of the subchondral bone[3]. A tip-to-apex distance of less than 25 mm has been shown to be generally predictive of a successful result.

For simplicity, the 'uncorrected TAD can be used intra operatively, which is also shown to be a reliable predictor to mechanical failure[4]. With the uncorrected TAD, the element of X-ray magnification can be ignored

The aim of this audit was to assess if this important principle is followed during DHS fixation in an average district general hospital.

PATIENTS AND METHODS

The initial audit was performed retrospectively. Using the trauma theatre logbook, all the patients that underwent DHS fixation over the period of 4 months between August and November 2008 were identified. In total, 38 patients underwent DHS fixation. Their intra-operative radiographs were studied. For simplicity purposes the uncorrected TAD was measured. In our hospital the AO DHS system is being used. The actual diameter of the lag screw barrel, rounded to the nearest millimetre, is 9mm. As the length measuring tool on the PACS system was measuring units rather than millimetres, we used the known diameter of the lag screw barrel on each radiograph, as a reference length in order to convert the measuring units into millimetres.

The distance were measured on both the anterior-posterior and lateral radiographs and added up to calculate the TAD. All distances were rounded up to the nearest millimetre.

Each patient was followed up for a minimum of 3 months during which period the fractures either united or failed.

Following the initial audit, the results were presented in an intra-departmental audit meeting. Awareness of the TAD principle was raised and the importance of applying this principle in DHS fixation was emphasized.

Three months later the second audit was performed following the same methodology in order to complete the audit cycle. All the patients who underwent DHS fixation during the 4 month period between March and June 09 were identified. In total 33 patients were identified. Their radiographs were studied following the same methodology as in the first cycle.

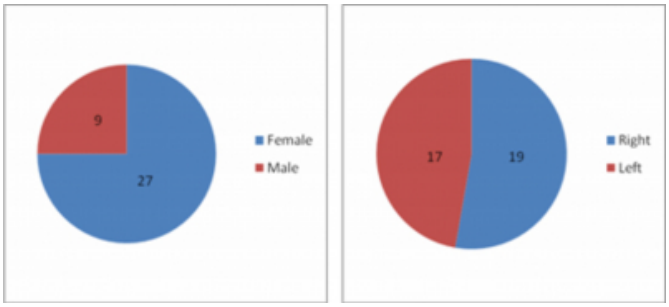
RESULTS

FIRST AUDIT

During the 4 month period between August and November 2008, 38 patients underwent DHS fixation. Of these, 2 were excluded from the audit because their intra-operative radiographs were not available. Of the remaining 36 patients, 27 were female and 9 were male. There were 19 right side DHS and 17 left side DHS performed.

Figure 2

Fig 2 Charts showing male to female and right to left ratios in the first audit



The tip to apex distances were grouped into intervals and are summarized in table 1.

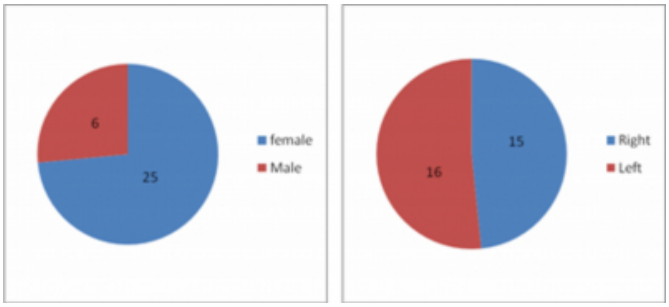
There were 27 DHS performed with a TAD of less than 25mm and 9 with a TAD of more than 25mm. There were 3 cutouts all in the >25mm group.

SECOND AUDIT

During the 4 month period between March and June 2009, 33 patients underwent DHS fixation. Of these, 2 were excluded from the audit because their intra-operative radiographs were not available. Of the remaining 31 patients, 25 were female and 6 were male. There were 15 right side DHS and 16 left side DHS performed.

Figure 3

Fig 3 Charts showing male to female and right to left ratios in the second audit



The tip to apex distances were grouped into intervals and are

summarized in table 1.

There were 26 DHS performed with a TAD of less than 25mm and 5 with a TAD of more than 25mm. There was 1 DHS which cut out in the 15-25mm group.

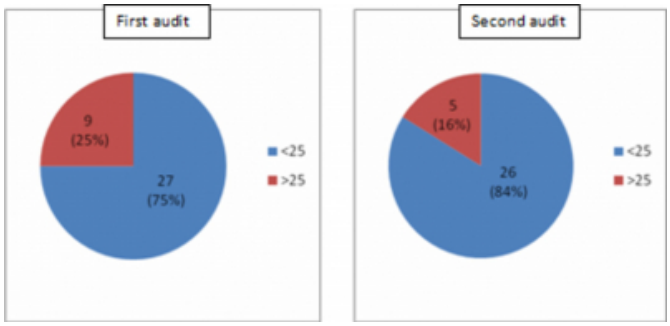
Figure 4

Table 1. Summary of TAD results for both audits

TAD in mm		First audit				Second audit			
		Number of cases		Cut out		Number of cases		Cut out	
< 15	<25	8	27	0	0	10	26	0	1
15-25		19		0		16		1	
26-35	>25	7	9	2	3	4	5	0	0
>35		2		1		1		0	

Figure 5

Fig 4 Charts showing the proportions of DHS with TAD of more than 25mm in the two audit cycles.



DISCUSSION

The results from our first audit cycle show that a large proportion (25%) of the DHS performed had an unacceptably high tip-apex distance. Out of the 9 cases that had a tip-apex distance of more than 25mm, 3 cut out from the femoral head leading to revision surgery. This was equivalent to 33% of the >25mm group and 8% of the total cases performed in this cycle.

These results were presented in a departmental audit meeting. The principle of tip to apex distance was explained and its importance was emphasised among junior surgeons and trainees. On direct questioning, it became apparent that a large proportion of the trainees were not familiar with this principle. Many thought that the screw position should be inferior in the AP radiographs and posterior in the lateral view aiming for better bone stock in the femoral head. However, by positioning the screw inferiorly and posteriorly, the tip of the screws ended in more cancellous bone and not in the preferred subchondral bone, which is shown to lead to failure of the prosthesis. Others preferred to accept a suboptimal screw position, in order to save operative time, claiming that DHS is a ‘forgiving device and not significantly affected by screw position.

The results from the second audit cycle show that DHS cut-out rates can be improved, by simply raising awareness and emphasizing the importance of the tip to apex distance. In our audit, the dynamic hip screws with a TAD of more than 25mm were reduced from 25% to 16%. More importantly, there were no cut-outs in this group. Interestingly, there was 1 DHS, which cut out, although its TAD was less than 25mm. This can be explained, as there are other factors that can affect the failure rate of dynamic hip screws, such as quality of bone, patient age, fracture pattern, and inadequate fracture reduction.

A limitation of this audit is that the numbers of patients studied were small. Despite this, from the results it can be shown that significant improvement in the DHS cut-out rates can be made by simply raising awareness of the TAD principle. We recommend this principle is emphasised and regularly re-enforced to all orthopaedic trainees, in order to improve the outcome of dynamic hip screws in patients with neck of femur fractures.

References.

References

1. Keene GS, Parker MJ, Pryor GA: Mortality and morbidity after hip fractures. BMJ; 1993;307(6914):1248-50.
2. Baumgaertner MR, Curtin SL, Lindskog DM, Keggi JM: The value of the tip-apex distance in predicting failure of fixation of peritrochanteric fractures of the hip. J Bone Joint Surg Am.;1995;77(7):1058-64.
3. Haidukewych GJ: Intertrochanteric Fractures: Ten Tips to Improve Results.J. Bone Joint Surg. Am.; 2009; 91: 712 - 719.
4. Pervez H, Parker MJ, Vowler S: Prediction of fixation failure after sliding hip screw fixation. Injury; 2004;35(10):994-8

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