



Are We Adherent To The Best Practice Regarding The Tip Apex Distance Measurement Of Dynamic Hip Screw (DHS) for Neck Of Femur Fracture? (Complete Cycle Audit)

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Abstract

Background: Fracture neck of femur is one of the commonest injuries that mainly affect the elderly population. Dynamic hip screw (DHS) is the treatment of choice for the per-trochanteric fracture type. Tip-Apex Distance (TAD) is used to determine the correct positioning of the sliding hip screw. It is the most reliable factor in predicting the quality of fixation as explained by Baumgartner.

Aim: Review our current practice in local UK hospital and implement changes with a complete closed loop audit.

Material & Methods: Prospective and retrospective data collection of DHS with TAD measurement for all patient from November 2018 to April 2020 using postoperative AP & Lateral X-rays to calculate TAD. The gap between the two audits were 12 months.

Results: a total of 210 patients who sustained per-trochanteric fracture neck of femur and were fixed by DHS. First audit was: 156 and second was: 44. Patients' demographics showed similar age and sex distribution to the national rates. 78 % of the 1st set of patients had TAD of less than 25 mm. After presenting the audit, 100 % of the fixed hips in the second cycle showed TAD under 25 mm which predicts a low risk of mechanical metalwork failure (cut-out) and excellent outcome and improvement.

Conclusions: The first audit cycle and presentation of the results were effective and improved the quality of surgical management of hip fracture. Acceptable screw placement was proved by TAD measurement below 25 mm. The results of the second cycle showed marked improvement in compliance. This will eventually reduce the risk of the metalwork mechanical failure in the form of screw cut out.

Introduction:

Fracture Neck of femur (NOF) is the most common serious injury in older people in the UK population. 65,000 were presented to 177 of the UK hospitals in 2016 with hip fracture (1). It happens with low energy trauma for the elderly people and high energy trauma in the younger population.

The use of extramedullary implants such as a sliding/dynamic hip screw (DHS) is preferred to an intramedullary nail in patients with trochanteric fractures above and including the lesser trochanter as shown in the AO classification (types A1 and A2) (2) (figure1).

Fixed angle sliding hip screw is a favourable treatment option as it allows controlled impaction at the fracture site and hence it promotes a stable construct (3). The hip screw cut out with femoral neck-saft angle varus collapse is the presentation of mechanical failure of the sliding hip screw. There were several studies trying to identify factors of this failure as it accounts for 16-23% of fixed cases (4, 5, 6). The location of the screw in the femoral neck and head is the most important factor.

Tip-Apex distance (TAD) measurement is the most reliable method in predicting the quality of fixation and estimating the rate of mechanical failure. This concept was initially introduced in 1995(3) and its significance was proved in 1997 by Baumgaertner (7).

TAD is calculated using a special formula (figure2); Surgeons should reconsider reduction and redirection of the screw if the TAD is greater than 25 millimetres (mm) (3). This formula allows easier calculation intraoperatively on image intensifier without need for calibration.

$$\text{Corrected TAD} = (X_{ap} \times D_{true} / D_{ap}) + (X_{lat} \times D_{true} / D_{lat})$$

X is TAD and D is diameter of lag screw in millimetres.
D true is the actual diameter of the lag screw used.

Figure 2: Formula to calculate the tip-apex distance (TAD)

Aim:

A complete audit cycle to assess the quality of screw placement using the TAD as a predictor of mechanical failure in our general district hospital (one of the National Health Service (NHS) hospitals).

Methods:

Retrospective and prospective data collection as we reviewed our local database of the fracture neck of femur patients. We included only the patients who sustained extracapsular per-trochanteric fracture and were managed surgically using the sliding hip screw. The TAD was measured on the post-operative plain X-rays (antero-posterior and lateral views). We retrospectively measured the TAD for one hundred fifty-six patients during twelve-month period in the first cycle and prospectively measured fifty-four cases during four-month period. Data analysis was done for percentage per group of patients. Kettering general hospital audit department approved the audit with first audit had number (122-18-19) and closing the loop had number (235-18-19).

Patients’ demographics included: age and sex (table 1) and the side of the fracture were collected. TAD was measured on post-operative images through the image viewer system. We analysed the Male to female ratio, age groups, the affected side, TAD score and TAD value distribution.

		First cycle	Second cycle
Total No. of patients		156	54
Sex	Male	48 (31%)	15 (27%)
	Female	108 (69%)	39 (73%)
Mean Age		80.96	80.22
Side	Right	72 (46%)	21 (38%)
	Left	84 (54%)	33 (62%)

Table 1: Patients’ demographics

Results:

In the first audit cycle, 78 % of cases were found to have TAD measurement of less than 25 mm. This reflected that 22 % of cases were at high risk of mechanical failure (figure 3). 24 mm was the highest TAD noted in the second cycle in contrast to 54 mm in the first cycle. Observations of the first cycle were presented in the local audit meetings which happens monthly in the presence of the trauma and orthopaedic team. 54 cases were reviewed in the second cycle. And all of them had TAD of less than 25 mm. We reviewed the second set of patients 12 months after the first cycle (figure 4). This number showed good compliance to Baumgartner’s conclusion about the TAD.

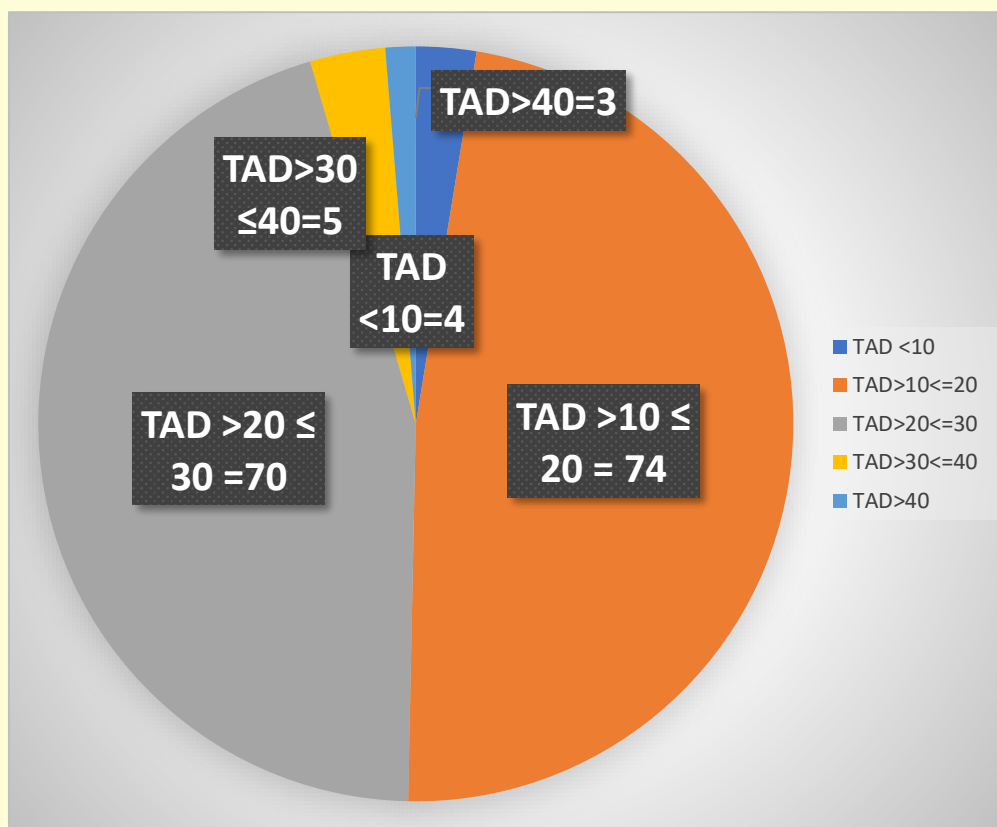


Figure 3: TAD measurements in the first cycle.

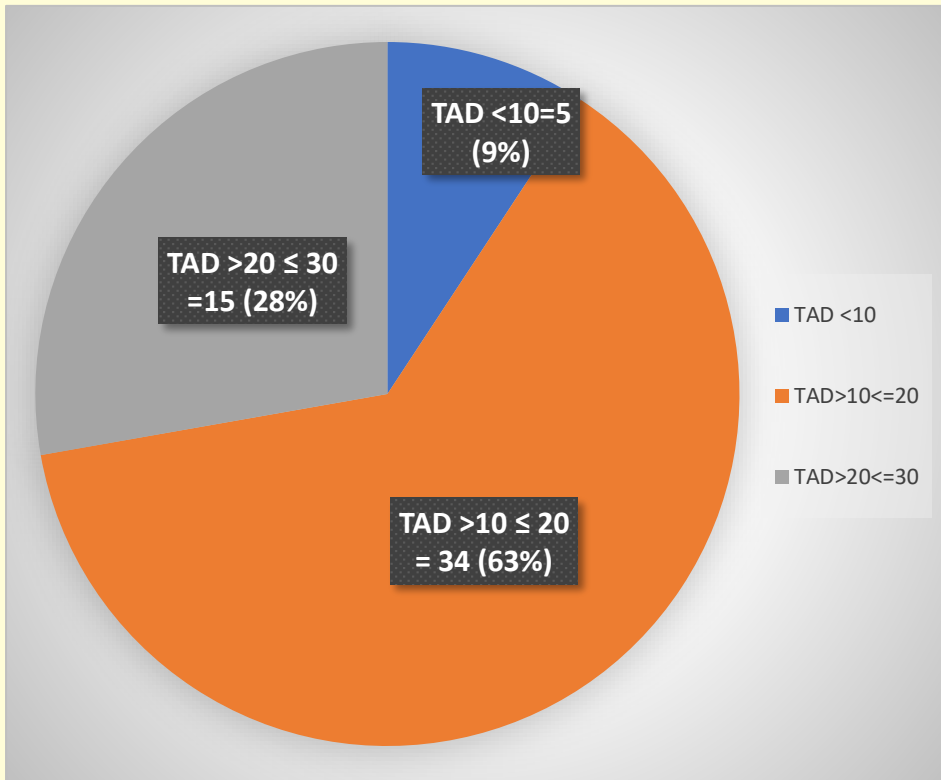


Figure 4: TAD measurements in the second cycle.

TAD distribution (as shown in figure 3 and 4) showed that more than 60 per cent of cases in the second cycle were between 10 and 20 mm in comparison to approximately 50 % in the first cycle. Also, 45 % of the TAD measurements were between twenty and thirty mm in the first set of patients and 28 per cent were found less than 30 mm and more than 20 mm in the second set of patients.

In both cycles female represents around 70% of cases which reflects the national rate, and the mean of age was around 80 years old (77 is the national average age) (table 1). Also, left hips were broken in more patients than the right hips with 8% and 24% more in the first and second cycles, respectively.

It was also noted that we used a de-rotational screw in 14 and 7 cases in the reviewed patients of the first and second cycles, respectively.

Conclusions:

The first audit cycle and presentation of the results were effective and improved the quality of surgical management of hip fracture. Acceptable screw placement was proved by TAD measurement below 25 mm. The results of the second cycle showed marked improvement in compliance. This will eventually reduce the risk of the metalwork mechanical failure in the form of screw cut out.

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