

Original Research Article

Comparative analysis between dynamic hip screw with trochanteric stabilisation plate and dynamic hip screw alone in the management of unstable intertrochanteric femur fractures

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ABSTRACT

Background: Intertrochanteric fractures of the femur are difficult to manage because of the complex patterns they present with. A dynamic hip screw (DHS) and a DHS supplemented with a trochanteric stabilisation plate (TSP) are among a variety of fixation methods used in the management of such injuries. We compared the efficacy of DHS with TSP to DHS alone in the treatment of unstable intertrochanteric femur fractures.

Methods: 30 patients of intertrochanteric femur fractures (mean age 72 years) were included in the study, 14 were treated using DHS with TSP while 16 were treated using DHS alone, they were followed up till 16 weeks and the progress was recorded according to the parameters in the Salvati and Wilson score.

Results: 14 patients were treated using DHS with TSP, 11 of them had excellent Salvati and Wilson scores, 3 patients recorded good scores, 11 patients were able to walk with no pain while 3 needed aids for walking due to pain, normal function was restored in 12 patients while very little restriction was seen in 2 patients

Of the 16 patients treated using DHS alone, 10 had excellent scores, 6 recorded a good score, 10 patients walked with no pain while 6 needed aids for walking due to pain, normal function was re-stored in 11 patients, very little restriction was seen in 4 patients while 1 patient had restricted normal activity.

Conclusions: DHS with TSP appears to provide better fixation and functional outcome in unstable intertrochanteric fractures over DHS alone.

Keywords: DHS, TSP, Intertrochanteric

INTRODUCTION

Intertrochanteric fractures of the hip continue to be a challenge for orthopaedic surgeons. Surgical management of intertrochanteric fractures aims at restoring the pre fracture functional status of the patients as far as ambulation skills are concerned.¹ A variety of implants of internal fixation have been employed to achieve this goal with variable success. The diversity of fixation devices available for treatment of trochanteric fractures illustrates the difficulties encountered in the actual treatment, and the discussion about ideal implant for such cases still

continues. From a mechanical point of view, the dynamic hip screw (DHS), sliding screw device, has many advantages such as controlled impaction and short operation time.¹ However, use of these devices in unstable trochanteric fractures has also been reportedly associated with significant medial displacement of the shaft resulting from excessive sliding of the screw within the barrel and a higher incidence of screw cutout.^{2,3} The intact lateral wall plays a key role in stabilization of unstable trochanteric fractures by providing a lateral buttress for the proximal fragment, and its deficiency leads to excessive collapse and varus mal position.⁴ Therefore, maintenance of the

integrity of the structure should be an important objective in all stabilization procedures for unstable trochanteric fracture. Supplementation of a sliding screw device with a trochanteric stabilization plate (TSP) has been known to provide stability to the lateral femoral wall.⁵ Moreover, up to 12% of unstable trochanteric fractures show radiologically identifiable rotation of the proximal fragment, when fixed with the DHS alone, as DHS provides only single point fixation over which the proximal fragment can rotate with movement of hip.^{1,6} This can result in a significant number of non-unions and mal unions due to poor bony contact between two fragments.

In our study we have compared the efficacy of DHS with TSP and DHS alone in the treatment of un-stable intertrochanteric femur fractures with respect to time of union, post op complications and the Salvati and Wilson score which includes the parameters of pain, walking, stability, muscle power and function in the post-operative period of 4 months.

METHODS

A total of 30 patients of isolated unstable intertrochanteric femur fractures were operated as a part of an interventional clinical study at Anand Nursing Home, Ghaziabad from November 2019 to December 2020 after obtaining ethical clearance from the medical ethics committee at Santosh University, Ghaziabad. There were 10 men and 20 women with a mean age of 72 years. Exclusion criteria included patients with an open fracture, sub trochanteric fracture, intra capsular fracture, dementia and previous history of surgery on the proximal femur. All patients were subjected to detailed clinical and radiological examination. Their pre fracture ambulatory status was ascertained using Parkar’s mobility score.⁷ All fractures were classified on the basis of Muller classification. Informed consent was obtained from all patients. Closed reduction as done in most of the cases with the exception of 7, which required open reduction to achieve anatomical or near anatomic reduction. All fractures were stabilized with a DHS which was supplemented with a TSP (the implant used as shown in Figure 6 in the presence of severe lateral wall comminution (as seen in the pre and post-operative x-rays in Figures 2 and 3). An additional 6.5 mm screw was passed parallel to the DHS through the TSP to act as an anti-rotation screw while permitting sliding collapse. If the lateral wall was observed to be intact, the DHS was supplemented with a single superiorly placed anti rotation screw. All patients were allowed non weight bearing ambulation under the guidance of a physiotherapist on the third post-operative day and began partial weight bearing as soon as possible depending on the quality of bone, stability of biomechanical construction and tolerance of the patient. Patients were followed up in the fracture clinic at regular intervals for possible complications, progress of union and physiotherapy. All patients were followed up for a minimum of 4 months, when they were subjected to final clinical and radiological evaluation, until either the

fracture united or fixation failed. Patients were also examined for abductor weakness by performing Trendelenburg’s test as suggested by Hardcastle and Nade. Overall, the clinical outcome was rated as per the Salvati and Wilson scoring system (Figure 1) at the time of final follow-up.⁸ Final radiological evaluation included any non-union, mal union, screw cut out, implant breakage, avascular necrosis of femoral head and excessive sliding of screw. The data thus collected was analysed using the IBM statistical analysis software (version 9).

Salvati and Wilson Score	
Pain	
0.	All the time, unbearable, strong medication frequently
2.	All the time, unbearable, strong medication occasionally, salicylates frequently
4.	None or little at rest, with activities, salicylates frequently
6.	When starting, then better, or after a certain activity, salicylates occasionally
8.	Occasional and slight
10.	No pain
Walking	
0.	Bedridden
2.	Wheelchair, transfer activities with walker
4.	No support: house bound or markedly restricted; 1 support: <1 block; bilateral support: unrestricted
6.	No support: <1 block, moderately restricted; 1 support: up to 5 blocks; bilateral support: unrestricted
8.	No support: limp; 1 support: no limp
Muscle power and motion*	
0.	Ankylosis with deformity
2.	Ankylosis with good functional position
4.	Poor to fair, flexion <60°, restricted lateral and rotary movement
6.	Fair to good, flexion up to 90°, fair ^b lateral and rotary movement
8.	Good or normal, flexion >90°, good ^d lateral and rotary movement
10.	Normal, motion normal or almost normal
Function	
0.	Completely dependent and confined
2.	Partially dependent
4.	Independent limited housework, shops limitedly
6.	Most housework, shops freely, desk-type work
8.	Very little restriction, can work on feet
10.	Normal activities

Figure 1: Four parameters of the Salvati and Wilson score, which was used in the post-operative assessment of the patients in our study.



Figure 2: Antero-posterior radiograph showing a displaced intertrochanteric fracture of the left femur.



Figure 3: Antero-posterior radiograph showing a post-op x-ray of an intertrochanteric fracture of the left femur fixed using a DHS supplemented with a TSP.

RESULTS

In this study a total of 30 patients were operated, 10 males and 20 females; 24 of which had incurred the injury due to a fall on level surface, the rest of the 8 patients reported a road traffic accident as the cause of injury.

Based on the characteristics of the fracture, 16 were fixed using a DHS alone while the other 14 fractures were fixed using a DHS supplemented with a TSP.

Patients treated using DHS with TSP (14 patients)

The average time between injury and day of surgery was 3 days (range 2-12 days) which was mostly due to delay in reporting to the hospital. All procedures were performed using a lateral approach. No intra operative complications occurred during any of the procedures. Anatomical reduction was achieved in 28 patients overall which were confirmed via intra op fluoroscopy (Figure 5). The mean duration from surgery to discharge was 5 days. The patients were followed up at 4, 8, 12 and 16 weeks for pain, stability, hip range of motion (ROM), muscle power and function.

On the 16-week follow-up, 11 patients were able to walk comfortably and reported no pain, 2 patients needed a walking aid for long distances while 1 patient needed a walking aid for short distances. Normal range of hip movement and full muscle power was achieved in 10 patients while 3 patient had slight decrease in range of hip movement and power and the remaining 1 patient had limited flexion and abduction with fair muscle power. Hip abductor function was observed to be adequate in most of the cases at final follow-up. Normal function was restored in 12 patients, while very little restriction was seen in 1 patient and 1 patient had restricted normal activities but was able to do most of the household work. 1 patient had moderate persistent pain due to varus malunions. The average sliding of the DHS in this study was observed to

be 3.4 mm. No limb length discrepancy was observed in any of the cases with anatomic reduction. 2 cases had less than anatomic reduction in the immediate post-operative period resulting in 7-9 mm of shortening, but none of these cases required a shoe raise. Identifiable rotation on x-rays of the proximal fragment was not observed in any of our cases. The results have been plotted in a graph as seen in Figure 4.

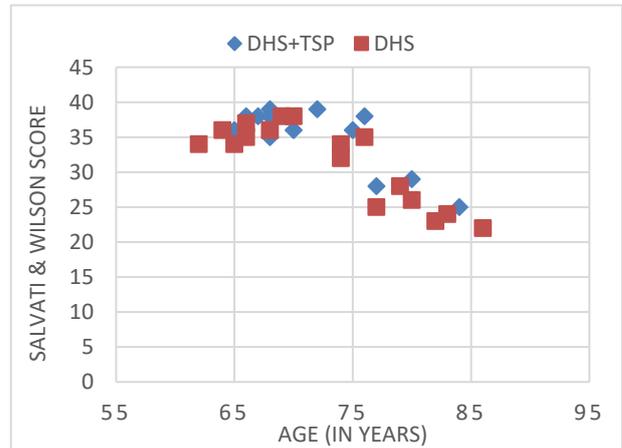


Figure 4: A linear graph showing the age specific Salvati and Wilson scores for patients managed using DHS+TSP and DHS alone. The patients managed using DHS with TSP supplementation show a pattern of higher scores that the patients managed using DHS alone.

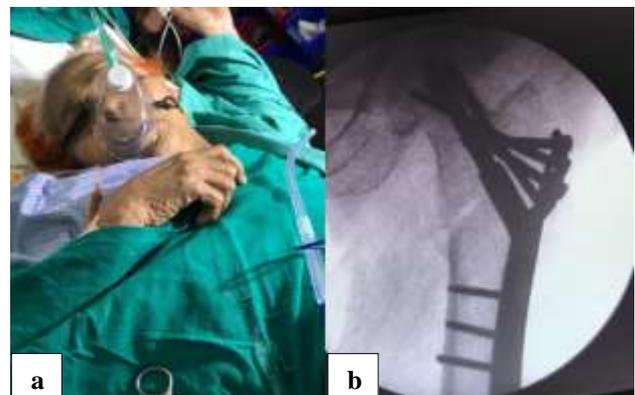


Figure 5: (a) Intra operative clinical picture of a 74 year old female, (b) intra operative fluoroscopy of the left hip being fixed with a DHS supplemented with a TSP.

Full weight bearing was achieved at 12th week in 12 patients, while the other 2 were able to bear full weight in the 14th week post-operative.¹ patient was treated for urinary tract infection (UTI), 1 patient complained of persistent pain in the hip region due to impingement of the proximal part of the TSP and was scheduled for hardware removal. The results have been shown in Figure 4 along with the Salvati and Wilson scores for this group. As per this score, the maximum being 40, 10 patients had

excellent results (score >30) while 6 patients had a fair/good score (score >20).

Patients treated using DHS (16 patients)

The average time between injury and day of surgery was 3 days (range 2-12 days) which was mostly due to delay in reporting to the hospital. All procedures were performed using a lateral approach with a 6.5 mm de-rotation screw added along with the DHS. No intra operative complications occurred during any of the procedures. The mean duration from surgery to discharge was 5 days. The patients were followed up at 4, 8, 12 and 16 weeks for pain, stability, hip ROM, muscle power and function.

On the 16-week follow-up, 10 patients were able to walk comfortably and reported no pain, 3 patients needed a walking aid for long distances while 3 patients needed a walking aid for short distances. Normal range of hip movement and full muscle power was achieved in 9 patients while 3 patient had slight decrease in range of hip movement and power and the remaining 3 patients had limited flexion and abduction with fair muscle power. Hip abductor function was observed to be adequate in most of the cases at final follow-up. Normal function was restored in 11 patients, while very little restriction was seen in 4 patients and the remaining 1 patient had restricted normal activities but was able to do most of the house work and shop freely.

Full weight bearing was achieved at 12th week in 11 patients, while the other 5 were able to bear full weight in the 14th week post-operation. Chest infection was encountered in 2 patients while 1 patient was treated for UTI during the in-patient stay. The results have been shown in Figure 4 along with the Salvati and Wilson scores for this group. As per this score, the maximum being 40, 10 patients had excellent results (score >30) while 6 patients had a fair/good score (score >20).



Figure 6: DHS+TSP implant used in the fixation of the unstable intertrochanteric fractures with severe comminution of the lateral femoral wall (a) antero-posterior view and (b) lateral view.

DISCUSSION

Most authors have reported some incidence of failure in their series of trochanteric fractures following the use of DHS. The primary complications of trochanteric fractures fixed with DHS are post-operative late collapse leading to shortening of the limb and screw cutout resulting in coxa vara.⁹ The mean sliding in our study was an average of 3.4 mm which was significantly lower than previous studies using DHS alone. Jacobs et al have reported an average sliding of 5.3 mm in stable fractures and 15.7 mm in unstable fractures.⁷ Similarly, Larson et al have reported average sliding of 6.3 mm in stable fractures and 12.4 mm in unstable fractures.⁸ Hardy et al and Steinberg et al have reported an average sliding of 10.2 mm and 9.3 mm, respectively.⁸ No limb length discrepancy was observed in our study, which compares favorably to the reports in literature by Frohlich and Benko et al (>1 cm shortening in half of their cases) and Ecker et al (average 2 cm shortening in 12 out of 62 cases).^{8,9} These figures do highlight the importance of anatomic reduction at the time of surgery but this is possible only if stability of these fractures is achieved by buttressing the lateral wall.^{3,8} These finding reinforce the results of Babst et al, who also reported significant reduction in excessive collapse and subsequent reduced limb length discrepancy by using a TSP in combination with the DHS.^{2,8} The stability may also have been further improved by the additional superiorly placed 6.5 mm cancellous lag screw providing two point fixation. The results of assessment for hip abductor functions at final follow up were significantly better, and this is supportive of the view that the DHS in combination with TSP is likely to ensure a better abduction function due to stability provided in the greater trochanter.^{8,10}

A shorter learning curve is consistent with a better outcome of the procedure since it reduces the operative time and the incidence of operative complications.^{5,11} For surgeons familiar with the DHS, the additional surgical time for adding modular TSP over DHS will only be marginal. However, theoretically, the slight increase in the operative time and wider exposure required for a DHS and TSP may also marginally increase the blood loss. The mechanism of action of the TSP has not been properly evaluated in biomechanical studies. However, TSP seems to act as a buttress plate against the medialization of the distal fracture fragment often seen in unstable fractures stabilized with the sliding screw plate system alone. In unstable trochanteric fractures owing to posterior, medial and lateral comminution, the collapse at the fracture site that occurs with sliding hip screw fixation may be more than usual.^{8,12} In such a situation abductor muscle weakness and its consequent fatiguability is likely to be greater.

The functional results in the DHS+TSP group were graded as excellent in 78% of the cases and good in 22% of the cases according to the Salvati and Wilson scoring system, which is depicted in a pie chart in Figure 7. These

observations indicate that lateral wall reconstruction significantly lessens the incidence of lateralization of the greater trochanter with limited telescoping of comminuted fragments following weight bearing. These 2 factors resulted in better hip abductor function and final Salvati-Wilson function score with restoration of pre fracture functional mobility. This study therefore does indicate that addition of a TSP over DHS is likely to improve the stability of fracture fixation, while at the same time permitting a controlled sliding collapse. Improve bony contact between proximal and distal fragments by stabilization the comminuted lateral wall is likely to improve the chances of union and maintenance of adequate lever arm. An additional anti rotation screw effectively prevents the rotation of the proximal fragment.

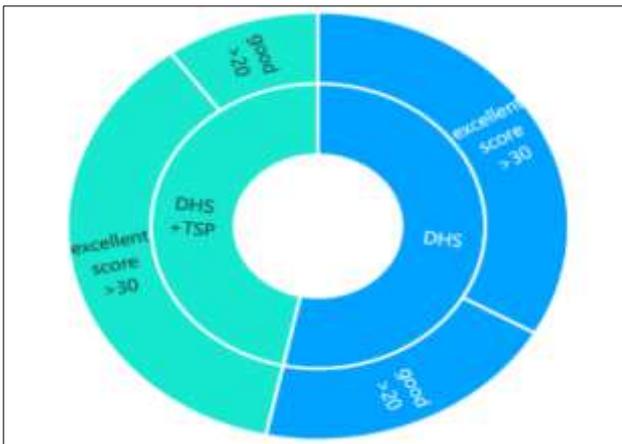


Figure 7: Comparison of patients treated using DHS+TSP and DHS alone along with the distribution of patients achieving excellent and good scores with the respective treatment methods. 78% excellent scores were achieved by the DHS+TSP group compared to 62.5% excellent scores for the DHS group.

CONCLUSION

The combination of TSP and DHS is a useful technique in the treatment of unstable trochanteric femoral fractures. It creates a biomechanically stable construction allowing reconstruction of the lateral wall to maintain adequate lever arm and abductor strength. In addition, it allows the passage of an anti-rotation screw, thereby providing two point fixation with additional rotational stability. Superior over-all functional and radiological outcome in patients with unstable trochanteric fractures does indicate that the combination of DHS and modular TSP is likely to be a better option in the management of these fractures to DHS alone.

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