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Fixation of Unstable Intertrochanteric Fracture: A Prospective Study of Functional Outcomes of Dynamic Hip Screw with Trochanteric Stabilization Plate

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ABSTRACT

Objective: This study aimed to evaluate the functional outcomes of a combination of Dynamic hip screw (DHS) with Trochanter stabilization plate (TSP) in the management of unstable inter-trochanteric fracture.

Method: This study included 30 patients with unstable intertrochanteric femur fractures admitted to the Orthopaedic department at UPUMS, Saifai, Etawah, Uttar Pradesh. The fracture were managed using DHS fixation in combination with TSP, which extends proximally from the side plate to provides lateral buttress support to the trochanteric segment. Functional outcomes were evaluated by using the Salvati-Wilson score.

Results: At 03-month follow-up, the mean Salvati Wilson score was 20.80 ± 3.51, by 6 months, the mean score was 28.27 ± 4.81, increasing to 34.00 ± 2.40 at 12 months and 36.00 ± 2.83 at 18 months. Significant improvement was observed between 3 and 12 month ($p<0.001$). Union was achieved in 93.3% of patients, while 6.7% experienced malunion. Time to union varied : 33.3% of patients healed within 16 weeks, 26.7% within 12 or 14 weeks, and 13.3% within 18 weeks. Post opertative complication were minimal, with 76.7% of patients reporting none. Superficial wound infection occurred in 10%, hardware impingement in 6.7%, and deep woumd infection or screw backout in 3.3% each. Functional outcomes were rated as excellent in 83.3% of patients, good in 10%, and fair in 6.75%.

Conclusion: DHS combined with TSP provides excellent functional and radiological outcome for unstable intertrochanteric fractures. The effective technique minimizes postoperative complications, making it a reliable option for managing such fracture.

Keywords: Dynamic Hip Screw, Trochanter Stabilizing Plate, Intertrochanteric fracture, Salvati wilson score.

INTRODUCTION

Hip fractures are one of the most frequent fractures presented to the emergency department and orthopedic trauma team. Intertrochanteric fracture is a type of hip fracture. Intertrochanteric fractures are defined as extracapsular fracture of the proximal femur that occur between the greater and lesser trochanter. These fractures occur both in the elderly and young but are more common in the elderly population due to osteoporosis, decreased muscle power, decreased reflexes, etc., while in younger patients it requires high-energy trauma. Intertrochanteric fractures are broadly divided into two categories stable and unstable type. Undisplaced fracture and intact posteromedial cortex are categorized into stable fractures. [(1)] Unstable IT fracture accounts for approximately 50-60% of all IT fractures. [(2,3)]. Determination of stability is important as it helps to determine the type of fixation required. The unstable intertrochanteric fracture with loss of posteromedial contact lateral wall contact or both is a major cause of telescoping and metallization with a biomechanically unstable head-neck fragment. [(4)]. Thus, the result is significant limb shortening, fracture of collapse, and implant failure, which increases the rate of re-operation. Indication for DHS includes a stable fracture pattern with an

intact lateral wall whereas intramedullary nailing can be used to treat a broader range of IT fractures. Varus angulations and limb shortening are decreased by locking the head screw that fixes the GT. As a result, the patient is mobilized more quickly and experiences less pain. The trochanteric stabilizing plate is used to stabilize the unstable GT and lateral femoral wall and it is used as a modular extension of DHS. [5] From the mechanical point of view the DHS has many advantages such as controlled impaction and short operation time. [6] However use of this device in unstable intertrochanteric fractures has also been reportedly associated with significant medical displacement of the shaft resulting from excessive sliding of the screw within the barrel and higher incidence of screw cutout. [7,8] Supplementation of a DHS device with a trochanteric stabilization plate has been known to provide stability to the lateral femoral wall. [9] In this study we evaluated the functional outcome of a combination of DHS with TSP in the management of unstable intertrochanteric fracture.

MATERIAL AND METHODS

The research was carried out in the Department of Orthopaedic Surgery, UPUMS Saifai, Uttar Pradesh, India, from Jan 2021 to Aug 2022. In this study, 30 patients were included with unstable intertrochanteric fracture femur, was admitted in the orthopedic department of a tertiary care centre in U.P, India.

Inclusion criteria

- Age>18years
- Both sexes
- Unstable intertrochanteric fractures in elderly patients(Type31A2/31A3)

Exclusion Criteria

- Active infection
- Patients medically unfit for surgery
- Patients with chronic illness
- Patients not giving consent to participate in the study
- Patient with pathological fracture.

The Dynamic hip screw (DHS) or sliding hip screw was used for the fixation of intertrochanteric fractures. The trochanteric stabilizing plate (TSP) was also used, which extends proximally from the side plate and provides a lateral buttress to the Trochanteric segment.

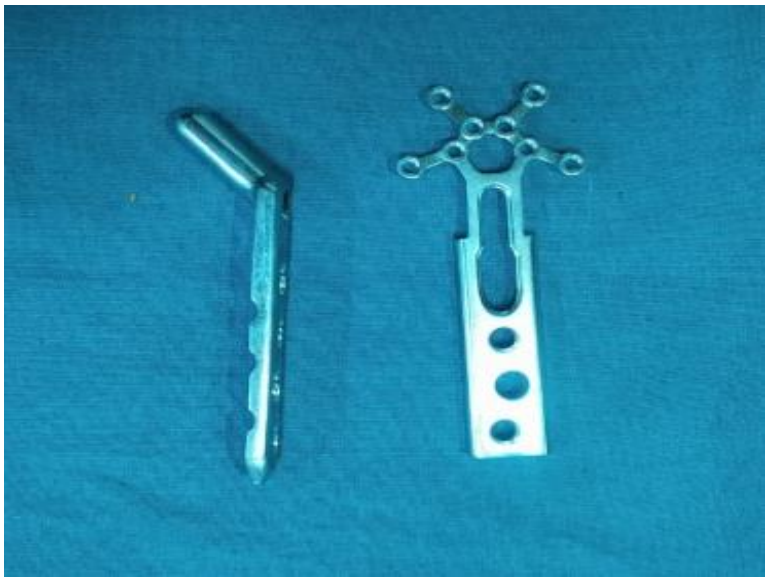

Fig 1- Dynamic Hip Screw and Trochanter Stabilizing Plate.

Fig 2- Instruments

After a thorough history patients were evaluated clinically and each patient underwent a pre-anesthesia checkup. Skeletal traction / Below-knee skin traction was applied. All routine investigations and radiographs were performed. The radiographs were of a good quality anteroposterior and lateral view of both hips with thigh.

The patient should be nil per oral for 6 hours and the patient should be prepared on the morning of day surgery. A single dose of pre-operative antibiotic (3rd gen cephalosporin) was given after the test dose was half an hour before surgery. Under suitable anesthesia, the patient was placed on a fracture table with an unaffected leg in flexion and abduction attitude by using a lithotomy position. The affected leg was placed in a traction boot and the fracture was reduced by traction internal rotation/external rotation along with adduction or abduction.

Under aseptic precaution affected limb was painted and draped in standard fashion for hip surgery in the supine position. The standard direct lateral approach used the same as for the DHS fixation.

Incise the fat and underlying deep fascia in line with the skin incision.

Complete the exposure by sharply incising the origin of the vastus. Approximately 2cm below the vastus ridge guide wire is inserted under C-arm guidance. Then guide wire length was measured and by using a triple reamer, reaming was done and the lag screw was inserted. To lag screw a 5-hole barrel plate fixed to the femoral shaft using a cortical screw. When fixing the DHS plate with cortex screws, do not occupy the first and the third proximal hole so that the Locking Trochanter Stabilizing plate can be secured through these two holes. The guide wire remains in the DHS screw during the entire procedure. Before fixing the Locking Trochanter Stabilizing Plate over the DHS plate, use the appropriate instruments to cut and bend the plate to adapt it to the specific anatomical configurations. Temporarily position the bending template over the greater trochanter to verify both the length and contour of the plate. Insert self-tapping 4.5cm cortex screws through the two remaining open holes of the DHS plate to fix the Locking Trochanter Stabilizing Plate over the DHS.

To fix the trochanter fragments with 3.5mm locking screws, through the threaded LCP Drill Guide into the threaded plate hole until seated. Use the 2.8 mm Drill Bit through the threaded drill guide to drill through the cortex. As the screws are used monocortically, a screw length between 20 and 25mm is sufficient.

Close the vastus lateralis muscle by suturing the two proximal flaps around the “neck” of the Locking Trochanter Stabilizing Plate and along its longitudinal incision. Then perform a simple closure of the tensor fascia latae muscle over a suction drain. Suture the subcutaneous fat and the skin over the suction drain.

Post-operative protocol

The patient was shifted to the ward & Radiograph was taken.
I/V antibiotics were continued for 5 days.
On the 1st and 2nd postoperative day if the pain subsided patient was allowed to sit on the side of the bed or chair in a semi-recumbent position.

RESULT

This Study includes 30 patients with a mean age of 57.9 years (ranging from 22 to 85 years) and most of the patient's ages are more than 60 years (43.3%).

-Out of 30 patients 18 were male and 12 were female (male: female ratio 3: 2).
-Fall from height and road traffic accidents share equal frequency (36.7% each) as a cause of injury, whereas 26.7% were due to trivial falls. -It was observed that 50.0% of the patients had an injury surgery interval of 3-5 days while 33.3% of the patients had an injury surgery interval of 6-10 days and 16.7% of the patients had an injury surgery interval of 11-14 days.
- As for the duration of surgery is concerned, 43.3% of the patients had a duration of surgery of 70 - 80 min while 26.7% of the patients had a duration of surgery of 81 - 90 min and 30.0% of the patients had a duration of surgery >90 min.
-It was observed that 40.0% of the patients had blood loss of 100 - 120 ml while 30.0% of the patients had blood loss of 120 - 140 ml, 16.7% of the patients had blood loss of 140 - 160 ml and 13.3% of the patients had blood loss of >160 ml.
-As per the AO subtype 63.3% of the patients had type A2 fracture while 46.7% of the patients had type A3 fracture.

Fig 3. Pre operative X-rays
(Pelvis with Both Hip AP and Right Hip with Thigh AP and Lateral)

At **03 the month's** follow-up, the mean Salvati Wilson score was 20.80 ± 3.51 with a minimum score of 14 and maximum score of 26 while at **6 months**, the mean score was 28.27 ± 4.81 with a minimum score of 16 and maximum score of 36 and at **12 months**, mean score was 34.00 ± 2.40 with minimum score of 30 and maximum score of 38 and at **18 months**, mean score was 36.00 ± 2.83 with minimum score of 34 and maximum score of 38.

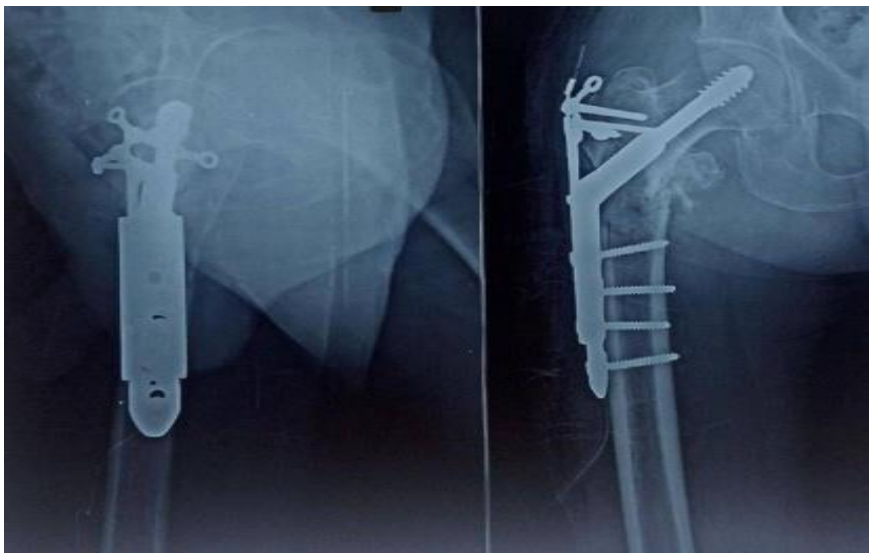

Fig 4. Post operative radiograph
(Hip with Thigh AP and Lateral)

-It was observed that there was a highly significant improvement in patients from 3 months – 12 months (n=19, p-value <0.001).
-It was observed that 93.3% of the patients had union while 6.7% of the patients had malunion. -As per the time of union 33.3% of the patients had 16 weeks' time of union while 26.7% of the patients each had 12 and 14 weeks' time of union and 13.3% of the patients had 18 weeks' time of union.
-It was observed that 76.7% of the patients had none of the post-op complications while 10% of the patients had Superficial wound Infection, 6.7% of the patients had Hardware Impingement, and 3.3% of the patients each had Deep Wound Infection and Screw Backout.
-Functional outcomes in 83.3% of the patients were Excellent while 10.0% of the patients had Good Functional outcomes and 6.7% of the patients had fair Functional outcomes.

DISCUSSION

Intertrochanteric fracture is a type of hip fracture that is defined as extracapsular fractures of the proximal femur that occur between the greater and lesser trochanter. Most intertrochanteric fractures can surgically be treated either with an intramedullary nail or a sliding compression hip screw plate. Restoring safe and effective mobility while lowering the risk of medical complications and equipment failure are two main objectives of care for intertrochanteric fracture in elderly patients. In this study, we attempted to examine the effect of the modified trochanter stabilizing plate in improved outcomes and lowering the complication rates in the therapy of unstable IT fractures of the greater trochanter in the coronal plane. A similar study was conducted by *Shetty A et al (2016)*[10] wherein 32 patients between the age groups of 30-70 years with Evan Jensen unstable and very unstable type of intertrochanteric fractures, were recruited and underwent open reduction and Dynamic hip screw and Trochanteric stabilizing plate fixation. the range of 41 -60 years while the maximum number of patients were in the age group > 60 years. Similar to our study, *Shetty A et al (2016)*[10] also observed that there was a greater number of patients in the older age group (21.8% of patients < 50 years, while the remaining 78.2% were above 50 years of age). On the contrary, the mean age of patients was more in studies by *Alm CE et al (2021)*[11] and *Fu CH et al (12)(2020)*[12] (83.4 ±8.8yrs and 79.6yrs, respectively). Patients were examined based on gender distribution in this study where it was observed that males are more prone to fractures as the data showed higher numbers (60%) compared to females (40%). These results were comparable to *Shetty A et al (2021)*[10], who reported 56.25%of their patients were males and 43.75%were females. On the contrary, in studies by *Alm CE et al (2021)*[11] and *CH et al (2020),*[12] females outnumbered males (72% vs 28% and 65.8% vs 34.2%, respectively).Further, patients were examined on the basis of mode of injury. The three types of mode of injuries were taken into consideration in this study i.e. Fall from height, Road traffic accident, and Trivial fall where it was observed that Fall from height and Road traffic accident shared an equal number of patients i.e. 36.7% (11) each whereas the cases of Trivial fall was lesser in number which was 26.7% (8) only. Patients were compared based on mean injury surgery interval days under the study. It was observed that the mean injury surgery interval days was 6.87 ± 3.25 days including the minimum interval of 3 days and maximum interval of 14 days. The data in this study showed that the maximum number of cases (50%) had 3 - 5 interval days for surgery, 33.3% of the patients had injury surgery interval of 6 -10 days and only 16.7% of the patients had injury surgery interval of 11-14 days. The duration of surgery also plays an important role in the overall evaluation of clinical outcomes. It was observed that the mean duration of surgery was 86.00 ± 9.14 min with a minimum duration of 70 min and maximum duration of 105 min. The majority of patients (43.3%) had a duration of surgery of 70 - 80 min, 26.7% of the patients had a duration of surgery between 81 - 90 min while 30.0% of the patients had a duration of surgery >90 min. Patients were compared based on the mean blood loss of the patients under the study. It was observed that the mean blood loss was 134.00 ± 22.64 ml with minimum to maximum blood loss from 100 ml - 185 ml respectively. The data in this study showed that 40.0% of the patients had blood loss in a range of 100 - 120 ml, 30.0% of the patients had blood loss in a range of 120 - 140 ml, 16.7% of the patients had blood loss in between 140 - 160 ml and only 13.3% of the patients had blood loss >160 ml. Patients were compared according to the type of fracture under the study. It was observed that 63.3% of the patients had type A2 fractures whereas 46.7% of the patients had type A3 fractures. In this study, patients were examined on the basis of associated injury where it was observed that maximum patients (76.7%) had no associated injury while bone forearm injury, Clavicle Fracture, and Head Injury were associated in 6.7% of patients each whereas 3.3% of the patients had Distal End Radius injury. Similarly, the patients were compared based on the mean Salvati Wilson Score at various time intervals under the study. It was observed that the mean scores were analyzed at different month intervals. The mean score at 3 months was 20.80 ± 3.51 with minimum and maximum scores of 14 and 26, at 6 months, the mean score was 28.27 ± 4.81 with minimum and maximum scores of 16 and 36, at 12 months, the mean score was 34.00 ± 2.40 with minimum and maximum scores 30 and 38 whereas, at 18 month, the mean score was 36.00 ± 2.83 with minimum and maximum scores 34 and 38. In this study, patients were examined on the basis of Union where it was observed that the maximum patients (93.3%) had union whereas only 6.7% of the patients had malunion. Similarly, the patients were compared based on mean time of union where It was observed that the mean time of union was 14.67 ± 2.06 with a minimum time of 12 and maximum time of 18. The statistical data in this study showed that 33.3% of patients had a Time of union of 16 weeks, 26.7% of patients had a Time of union of 12 & 14 weeks each, whereas only 13.3% of patients had a Time of union of 18 weeks. In 2022, a similar study was performed by **Sharma S et al (2022) [13],** where he observed the Time of union (14.9 vs. 17 days). In this study, patients were examined on the basis of Post-Op complications. It was observed that 76.7% of the patients had no post-op

complications whereas 10% of the patients had Superficial wound Infection, 6.7% of the patients had Hardware Impingement and only 3.3% of the patients each had Deep Wound Infection and Screw Back out. *Shetty A. et al (2016)*[10]observed the post-op complications at different weeks scales from 3,6,12 to 24 weeks and they concluded that DHS and TSP fixation of unstable intertrochanteric fractures is an effective technique with good radiological and functional outcomes. Patients were compared according to the functional outcome of the study. It was observed that 83.3% of patients had excellent functional outcomes while 10.0% of patients had good functional outcomes whereas only 6.7% of patients had fair functional outcomes. **Shetty A. et al (2016)**[10], conducted a prospective study wherein they observed that DHS and TSP fixation of unstable intertrochanteric fractures is an effective technique with good radiological and functional outcomes.

CONCLUSION

This study concludes the hip fractures and the effect and functional outcomes of the dynamic hip screw with trochanteric stabilization plate after post-operational therapy. Different constraints were considered in this study such as age, gender, mode of injury, injury surgery interval days, duration of surgery, blood loss, type of fracture, associated injury, Salvati Wilson Score at various time intervals, time of union, post-op complications, and Functional Outcome.. the main objective of this study was to analyze the functional outcome of DHS and TSP after post operational therapy. We observed that a maximum number of patients had excellent functional outcomes after treatment with DHS and TSP therapy. Thus, both DHS and TSP fixation of unstable intertrochanteric fractures is an effective technique with good radiological and functional outcomes.

ETHICS APPROVAL-

Consent was obtained or waived by all participants in this study.
Institutional Ethical committee of Uttar Pradesh University of Medical Sciences issued approval with Ethical Clearance number 215/2020-21 .

All authors have confirmed that this study did not involve animal subject.

LIST OF ABBREVATIONS-

DHS – Dynamic Hip Screw.
TSP- Trochanter Stabilization Plate.
IT – Inter-trochanter .

DATA AVAILABILITY-

Data is available in the form of Master Chart, it can be obtained by mailing us on mr.atul2012@gmail.com .

CONFLICT OF INTEREST-

Authors declare that there is no conflict of interest regarding publication of this paper.

FUNDING STATEMENT-

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AUTHORS CONTRIBUTION-

Concept and design- S.P.S Gill, Ajay Kumar Rajput, Pradeep Kumar Gupta, Atul Kumar, Yash Srivastava.

Acquisition , analysis or interpretation od data- S.P.S Gill, Ajay Kumar Rajput, Pradeep Kumar Gupta, Atul Kumar, Yash Srivastava, Gaurav Samant.

Drafting of the manuscript- S.P.S Gill, Ajay Kumar Rajput, Pradeep Kumar Gupta, Atul Kumar, Yash Srivastava.

Critical review of the manuscript for important intellectual content- S.P.S Gill, Ajay Kumar Rajput, Pradeep Kumar Gupta, Atul Kumar, Yash Srivastava, Gaurav Samant.

Supervision- S.P.S Gill, Ajay Kumar Rajput, Pradeep Kumar Gupta.

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