

The Role of the Dynamic Hip Screw with Locking Side Plate in the Treatment of Intertrochanteric Fractures in the Elderly

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Abstract

Aim: Role of dynamic hip screw with locking side plate in intertrochanteric fractures in elderly patients. **Methods:** A prospective study was conducted in the Department of Orthopaedics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India for 15 months. 50 Patients of intertrochanteric fractures who were operated with DHS with locking side plate were included in this study. The fixation, fracture consequences, functional outcome and complications were assessed clinically and radiologically in immediate post-operative period and on follow-ups at six weeks, three months, six months and one year. Young patients (<55 years, non-osteoporotic bone), fractures with sub trochanteric extension and pathological fractures were excluded from study. The patients were evaluated clinically and radiologically, with details like range of motion, limb-length discrepancy, infection and deformity noted. Evaluation of the clinical outcome was done by modified Harris hip score approximated to the nearest single decimal at the last follow-up. **Results:** The average age of patients in the group was 62.5 years with male preponderance. The number of female patients increased in the 7 and 8 decades. No side predilection was noted. The mode of injury in 92 percent was fall and 18 patients were diagnosed with hypertension post admission, 9 with diabetes mellitus and other 9 had some systemic involvement. The mean trauma-surgery interval was 4.5 days. Trauma surgery interval and functional outcome by Harris hip score was statistically significant (p value=0.021) and was inversely proportional. Closed reduction was achieved in 40 patients while 10 required open reduction. The mode of reduction was statistically not significant. In our study, union was achieved in all patients with clinico-radiological union was evident ranging from 10 to 18 weeks. Male patients had a better functional outcome by Harris hip score, which was statistically significant (p value=0.031). **Conclusion:** In the ever-progressive world of orthopedics, time has witnessed several design modifications in the mode of fixation and implants. Locking plate DHS has been proven better mechanically and positive impact on rehabilitation and weight bearing is being observed along with a decline in the failure rates.

Keywords: Hip Screw, Locking Side Plate, Intertrochanteric, Fractures.

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Introduction

Hip fractures are a leading cause of disability among the elderly. Treatment goals for this patient population include early mobilization with restoration of the anatomic alignment of the proximal part of the femur and maintenance of the fracture reduction[1]. Trochanteric femur fractures account for nearly 50% of all fractures of proximal femur from which 50 – 60 % are classified as unstable. Unstable fracture patterns occur more commonly with increased age and low bone mineral density. Patients who suffer intertrochanteric fractures tend to be more limited ambulators and more dependent in their care[2].

The care of the patients with trochanteric femur fractures has advanced dramatically since the advent of internal fixation. However, the differences in failure rates between stable and unstable intertrochanteric hip fracture patterns have recently been emphasized[3]. Restoring mobility in patients with unstable intertrochanteric fracture ultimately depends on the strength of the surgical construct. Dynamic hip screw (DHS) is commonly used for treating stable intertrochanteric fractures. DHS complications include shortening, medicalization of the distal fragment, implant cut-outs, uncontrolled lateralization of the proximal fragment, and varus collapse[4].

The most common mode of failure is for the lag screw to cut out of the femoral head, the second is for the plate to be forced off the femur with the screws being pulled out of the osteoporotic bone. The post-operative cut out ranges from 1% to 6%[5]. To overcome these problems a locking plate and screw system has been developed. The locking compression plate is the combination of two completely different anchorage technologies in one implant[6]. Locked side plate for DHS is better

than standard DHS plate in treating intertrochanteric fractures in terms of lowering of complications rate and maintenance of reduction[7].

Materials and Methods

A prospective study was conducted in the Department of Orthopaedics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India for 15 months, after taking the approval of the protocol review committee and institutional ethics committee. 50 Patients of intertrochanteric fractures who were operated with DHS with locking side plate were included in this study. The fixation, fracture consequences, functional outcome and complications were assessed clinically and radiologically in immediate post-operative period and on follow-ups at six weeks, three months, six months and one year. Young patients (<55 years, non-osteoporotic bone), fractures with sub trochanteric extension and pathological fractures were excluded from study. Fractures in elderly patients from AO 31A1.1 to AO 31A3.1 were included in study. Partial weight bearing was allowed after suture removal in stable fixation with range of 10-45 days. The average time of full weight bearing was 12.7 weeks. Patients were followed up for a period of 12 months. At each follow-up, clinical and functional assessment were done to note the movements at hip and knee, wound condition and any additional complaints. Radiographs were done at each visit to assess the status of fracture healing, callus formation at cortices, late angulations, plate pull-out, mal-union, non-union and loss of reduction. Full weight bearing was permitted only after clinical and radiological union was evident. The patients were evaluated clinically and radiologically, with details like range of motion, limb-length discrepancy, infection

and deformity noted. Evaluation of the clinical outcome was done by modified Harris hip score approximated to the nearest single decimal at the last follow-up.

Implant design

The DHS consists of a lag screw that provides proximal fragment fixation and a side plate that allows this lag screw to “telescope” within its barrel. Implant sliding provides impaction which promotes union. It also decreases the moment arm and stresses on the implant. The lag screw has a standard diameter of 12.5 mm and is available in 5 mm increments from 65 mm to 115 mm. The locking side plate has a minimum of 4 combiholes for secure fixation with locking screws of 5.0 mm diameter.

Surgical technique

For surgery, the patient was positioned supine on the fracture table and in majority of the cases, closed reduction by manipulation with sustained traction and internal rotation gave adequate reduction. In most fractures, an anatomical reduction with posteromedial apposition was achieved satisfactorily under fluoroscopy and the fracture was internally fixed in this position using standard vastus lateralis splitting approach. A central lag screw within 10 mm of subchondral bone was inserted after triple reaming, followed by locking side plate application. When all screws were inserted and tightened and traction released, the fracture was compressed with a compression screw.

Statistical analysis

Statistical analysis was done by applying chi square tests, with all analysis analyses were performed using SPSS (version 21.0). A p value less than 0.05 was considered significant.

Results

The average age of patients in the group was 62.5 years with male preponderance. The number of female patients increased in the 7 and 8 decades. No side predilection was noted.

The mode of injury in 92 percent was fall and 18 patients were diagnosed with hypertension post admission, 9 with diabetes mellitus and other 9 had some systemic involvement.

The mean trauma-surgery interval was 4.5 days. Trauma surgery interval and functional outcome by Harris hip score was statistically significant (p value=0.021) and was inversely proportional (Table 1). Closed reduction was achieved in 40 patients while 10 required open reduction. The mode of reduction was statistically not significant.

In our study, union was achieved in all patients with clinico-radiological union was evident ranging from 10 to 18 weeks. Male patients had a better functional outcome by Harris hip score, which was statistically significant (p value=0.031). Delayed union up to 18 weeks in 7 patients was noted. ‘No significant limb length discrepancy was noted postoperatively. Average modified Harris hip score was 87 (Table 2).

Table 1: Trauma surgery interval

Trauma- surgery interval (Days)	No. of patients	Percentage (%)	Modified Harris hip score (Mean)
<2	14	28	93
3-6	24	48	87
>6	12	24	81

Table 2: Modified Harris hip score at one-year follow- up.

Grading	No. of patients	Percentage (%)
Excellent (90-100)	22	44
Good (80-90)	22	44
Fair (70-80)	6	12
Poor or failed (<70)	-	-
Average score	87	

Discussion

Intertrochanteric fractures of femur in the elderly pose a great challenge in their treatment and rehabilitation and internal fixation of these fractures has been accepted as the standard procedure. The DHS remains the implant of choice for most of the surgeons. It allows controlled impaction at the fracture site, shorter operating time, no need for osteotomy, good bone healing and low rate of complications. However, use of this device in osteoporotic fractures has been reportedly associated with significant number of screw cut-outs, side plate pull-out due to linear decrease in holding power of screws in osteoporotic bone and late medialization of shaft resulting from excessive sliding of lag screw within barrel, especially in unstable intertrochanteric fractures[8,9]. In our study, the use of locking side plate with dynamic hip screw has been done to observe and note the improvement in union and functional outcome in these cases. In our study, the male to female ratio was 3:1, the female being 30%. The female ratio increased in the higher age groups. There was a statistically significant relation (p value=0.031) between the gender and functional outcome, with males attaining better functional outcome in the study, which might be attributed to more sturdy male body, wider female pelvis (increased coxa vara) and more senile osteoporosis in females.

Out of 50 patients, 46 had trivial fall (92%) and remaining 4 (8%) had suffered road-traffic-accident. The tendency to fall increases with age and is exacerbated by several factors such as poor vision, decreased muscle power and decreased reflexes.

Fractures in the present study were classified as per AO/ASIF classification of trochanteric fractures. Most of the fractures for the study were stable in nature (31A1.1=12%, 31A1.2=24%, 31A2.1=30%, 31A2.2=12%, 31A2.3=16%, 31A3.1=6%).

Most of the patients in this study reported to the hospital within a day or two of injury, while there was considerable delay in other cases. There was a statistically significant (p value=0.021) relation between the functional outcome and trauma-surgery interval. The earlier the patient got operated the better was the functional outcome.

Full weight bearing was permitted after clinic-radiological union was evident ranging from 10 to 18 weeks. In the earlier stage of bone healing, full weight bearing decreases the fracture stability. It is possible to be another cause of implant failure as well. Since partial weight bearing increases the stability of fracture site.

General complications like superficial surgical site infection, decubitus ulcer, urinary tract infection and fracture site opening were noted in up to ten percent of patients and no implant related complications were noted such as cutout of lag screw, plate lift off etc. This signifies the biological advantage that locking plate has over non-locking plate, as it does not compress the bone or periosteum, thereby preserving the vascularity within the bone. By preserving the vascularity, risk of the infection might be reduced[10].

There was a single occurrence of a pressure sore over the back of patient, which healed with regular dressing and mobilization. This

was due to asthenic built of the patient and her elderly age.

No clinically evident deep venous thrombosis was observed in any patient in the study. Absence of clinically evident deep venous thrombosis in this study indicates that early mobilization of the patient and active physiotherapy significantly reduces the incidence of deep venous thrombosis and may obviate the need of deep venous thrombosis prophylaxis.

No significant limb shortening (more than two cm) was observed in the study post-operatively. Up to one cm of shortening can be accounted to the collapse at fracture site. This signifies the concept of fixed angle implant bone construct as provided by locking dynamic hip screw.

No case of screw cutout or varus collapse was observed in the present study. This was despite the fact that up to thirty percent of the fractures in this study were unstable and even more, osteoporotic. It has already been proven by Dylan et al that biomechanically locking DHS is a more suitable implant than conventional DHS with a significantly lower cut-out resistance, especially in elderly patients with osteoporotic bones.⁶ Five to ten percent of cutout have been noted with dynamic hip screw in the past. None of the case had fixation failure due to side plate pull-out in the present study.

This signifies the advantage of locking plate over dynamic compression plate as the locking screws fixed to the plate are not dependent on holding power of screws to bone alone.¹⁰ Locking plate has biological advantages over the standard plates and avoids impairing blood supply, cancellous transformation of bone and screw loosening. Also, the risk of peri-implant fractures is therefore reduced. Modified Harris hip score (maximum 100 points) was employed to assess the functional outcome in patients. It consists of eight questions and a physical examination. The questions are split

into three categories: pain (0-44), function (0-47) and level of activity A score of 90-100 is rated as excellent, 80-90 being good, 70-80 being fair, 60- 70 poor and less than 60 as failed result.

The average modified Harris hip score in the present study was 87 with the range of 76.5-94.5. The patients with fair score were either towards extremes of age or had some associated systemic illness or a delayed reporting time. With DHS, Sahlstrand et al in their study had 72% good to excellent results, Juluru et al had 76%, Kayali et al had 68% and Kulkarni et al had 81% good to excellent results. The outcome measures have been compared with previous studies using DHS as a method of fixation as the direct correlation was not possible due to lack of more studies with DHS with locking side plate[11,12].

Conclusion

In the ever-progressive world of orthopedics, time has witnessed several design modifications in the mode of fixation and implants. Locking plate DHS has been proven better mechanically, and positive impact on rehabilitation and weight bearing is being observed along with a decline in the failure rates. Use of locking side plate with DHS was observed to prevent sliding, screw cut-out and side plate pull-out, which signifies the concept of fixed angle locking screws that makes a stronger implant bone construct as compared to a standard DHS and should be a better, versatile and more reliable option in management of intertrochanteric fractures.

Reference

1. Bhaskar K, Taranath N (2019): Study on the functional outcome of stable intertrochanteric fractures treated with dynamic hip screw. *Natl J Clin Orthop.*, 3 (4): 4-7.
2. Sadowski C, Lübbecke A, Saudan M et al. (2002): Treatment of reverse oblique and transverse intertrochanteric fractures with use of an intramedullary nail or a 95

- degrees screw-plate. *J Bone Jt Surgery*, 84 (3): 372–81.
3. Sun D, Wang C, Chen Y et al. (2019): A meta-analysis comparing intramedullary with extramedullary fixations for unstable femoral intertrochanteric fractures. *Med Sci.*, 37: 1– 10.
 4. Jaleel Zubair A, Rashid R, Zahid M et al. (2016): Early experience of dynamic hip screw with spiral blade and locking side plate for the stabilization of trochanteric fractures. *JPMMA J Pakistan Med Assoc.*, 65 (11): S-45.
 5. Barwar N, Meena S, Aggarwal S et al. (2014): Dynamic hip screw with locking side plate: a viable treatment option for intertrochanteric fracture. *Chinese Journal of Traumatology*, 17 (2): 88-92.
 6. Kumar G (2019): Functional outcome of intertrochanteric fractures treated by proximal femoral nailing anti-rotation. Kilpauk Medical College, Chennai, Pp: 1–12. http://repository-tnmgrmu.ac.in/11367/1/220200419vinoth_kumar.pdf
 7. Bohl D, Basques B, Golinvaux N et al. (2014): Extramedullary compared with intramedullary. *Orthop Clin.*, 14: 1871–7.
 8. Adams CL, Robinson CM, Court-Brown CM, McQueen MM. Prospective randomized controlled trial of an intramedullary nail versus dynamic screw and plate for intertrochanteric fractures of the femur. *J Orthop Trauma*. 2001;15:394-400.
 9. Laohapoonrungsee A, Arpornchayanon O, Phornputkul C. Two-hole side-plate DHS in the treatment of intertrochanteric fracture: Results and complications. *Injury*. 2005;36(11):1355-60.
 10. Gutwald R, Alpert B, Schmelzeisen R. Principle and stability of locking plates. *Keio J Med*. 2003;52(1):21- 4.
 11. Sahlstrand T. The Richards Compression Screw and Sliding Hip Screw System in the Treatment of Intertrochanteric Fractures. *Acta Orthop Scand*. 1974;45:213-9.
 12. Kulkarni GS. Treatment of Trochanteric Fractures of the Hip by Modified Richard's Compressing and Collapsing Screw. *Indian J Orthopaedics*. 1984;18(1):30-4.