



ROLE OF ADDITIONAL DEROTATION SCREW IN DHS FIXATION OF STABLE INTERTROCHANTERIC FRACTURES-DOES IT PREVENT VARUS COLLAPSE?

Orthopaedics

Dr. A. N.

Sadanandan

Associate Professor, Malabar Medical College, Modakkallur, Calicut, Kerala, India.

**Dr. Jawahar Adi
Raja***

Associate Professor, Malabar Medical College, Modakkallur, Calicut, Kerala, India
*Corresponding Author

ABSTRACT

Objective: To study the results of 35 patients with stable intertrochanteric fractures of the femur, treated surgically with fixation by dynamic hip screw (DHS) at a secondary care hospital of Kerala, India between June 2015 and August 2018. **Methods:** The patients were divided into two groups-one with DHS fixation alone and other with added derotation screw. All patients were reviewed till bony union. Neck-shaft angle of femur was recorded in all patients immediately after surgery and at the time of bony union. Loss of neck-shaft angle and its percentage was compared between two groups. **Conclusions:** We concluded that adding cancellous derotation screw parallel to and just above dynamisation hip screw reduces the chance of varus collapse at the time of union.

KEYWORDS

Intertrochanteric fracture, dynamic hip screw, derotation screw.

INTRODUCTION

Intertrochanteric (IT) fractures are one of the most common fractures managed by Orthopaedic/Trauma surgeons across the world. Being more common in the elderly, such fractures are difficult to treat due to associated co-morbidities (3,5). Incidence of intertrochanteric fractures in the elderly has been rising due to increase in ageing population (9). Very often surgical management is opted by surgeons worldwide so as to accomplish early mobility except in those with increased risk for anaesthesia.

Aim of the treatment should be to restore mobility with minimum possible complications which in-turn depends on quality of the bone and type of implant used (3). Fixation devices used may be broadly classified into extramedullary and intramedullary (10). Jewett and others in 1941 popularised the internal fixation of intertrochanteric fractures initially by single piece implant which later led to evolution of dynamic hip screw (DHS) following high incidence of impaction at fracture site and nail penetration of the head of femur (17). DHS is the most common extramedullary implant used because of easy availability and its ability to provide secondary fracture impaction which facilitates faster healing. But eventual cut-out of head screw is a concern for these implants which can be minimised by its central position within the neck and by reaching upto subchondral bone. Tip apex distance (TAD) is a reliable prognostic indicator for lag screw cut-out which is measured as the sum of the distance in millimetres from the tip of the lag screw to the apex of the femoral head as measured on anteroposterior and lateral radiographs, after correction for magnification. A TAD of less than 25mm is protective against lag screw cut-out (18). If combined with additional derotation screws, DHS gives the effect of multiple screws and thus provides rotational stability required for controlled impaction at fracture site (1,23). Low cost and easy availability make this combination superior to other methods especially in developing countries (1). Comminuted and unstable fractures are prone for complications especially if lateral wall is absent. Unstable IT fractures are those with posteromedial buttress exceeding a simple lesser trochanter fragment or those with subtrochanteric extension-a major cause of concern especially in the elderly (3).

Both intramedullary (IM) and extramedullary (EM) devices are used with good results (14). IM devices have lesser surgical trauma biologically and greater strength biomechanically (15). But clinical advantages and disadvantages of IM and EM techniques still remains controversial (11). In those elderly patients with possible high mortality and other complication rates, IM devices like proximal femoral nail is a good alternative to DHS because of its shorter operative period (22). Alternatively minimally invasive DHS may be opted for such cases because of its advantage of reduced soft tissue stripping and blood loss (19).

The aim of this study is to determine the role of derotation screw to prevent varus collapse measured indirectly by the difference in neck shaft angle in the follow up radiographs.

MATERIALS AND METHODS

35 patients with stable intertrochanteric fractures were treated using dynamic hip screw (DHS) as fixation device at a secondary care hospital of Kerala, India between June 2015 and August 2018. True AP and lateral radiographs were taken at the time of admission.

Radiographs of patients were assessed till union for loss of neck shaft angle compared to immediate post operative radiographs. 25 patients underwent DHS fixation combined with derotation screw (group A) parallel to and just above the hip screw (fig.1) whereas 10 patients underwent DHS fixation alone (group B) with hip screw passing through centre of the neck in both true AP and lateral views of image intensifier (fig.2). Age of the patient varied from 62 years to 90 years (average=75) in group A. Fig.1: Post-operative AP and lateral images of intertrochanteric fracture fixed with DHS and derotation screw (Table.2) and 39-90 years (average=62.4) in group B (Table.3). All patients in group A had history of fall at home; whereas two patients in group B presented with road traffic accident. True AP and lateral radiographs were taken every 3 weeks till union. Neck-shaft angle (NSA) of femur was measured in immediate post-operative true anteroposterior view and compared to that at the time of bony union. We then compared the percentage difference in NSA between group A and group B (Table.1).



Fig.1: Post-operative AP and lateral images of intertrochanteric fracture fixed with DHS and derotation screw



Fig.2: Post-operative AP and lateral X-rays of a patient treated with DHS alone with hip screw passing through centre of the neck

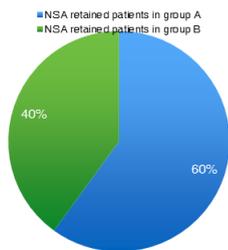


Fig.3 Showing percentage of patients retained with neck-shaft angle (NSA) at the time of bony union in both groups

Table.1 Comparing percentage difference in neck shaft angle (NSA) loss in both groups

Procedure	Number of patients with NSA loss < 2%	Number of patients with NSA loss > 2%	No loss in NSA
Group A-DHS with derotation screw (n=25)	4	6	15
Group B-DHS alone (n=10)	2	4	4

Table 2.Details of patients who underwent DHS with derotation screw

No.	Age/ Sex	Radiological Healing Time (weeks)	NSA at immediate post-operative period (Degrees)	NSA at the time of bone healing (Degrees)	Difference in NSA (Degrees)	Percentage difference in NSA
1	67/F	5	128	128	Nil	Nil
2	82/F	6	138	138	Nil	Nil
3	70/F	7	137	137	Nil	Nil
4	79/F	7	137	137	Nil	Nil
5	75/M	8	135	135	Nil	Nil
6	65/F	8	137	135	2	2
7	80/F	7	141	140	1	0.8
8	75/M	7	138	138	Nil	Nil
9	76/F	8	144	140	4	2.8
10	70/F	6	143	134	9	7
11	75/M	8	143	133	10	7
12	80/M	7	135	135	Nil	Nil
13	90/F	6	137	137	Nil	Nil
14	75/F	10	138	138	Nil	Nil
15	70/F	7	140	136	4	2.9
16	75/F	6	141	139	2	1.4
17	88/F	10	145	145	Nil	Nil
18	72/F	6	136	133	3	2.2
19	90/F	4	139	138	1	0.7
20	72/F	6	142	139	3	2.1
21	75/F	6	137	137	Nil	Nil
22	65/F	6	133	133	Nil	Nil
23	62/F	10	136	136	Nil	Nil
24	80/F	6	139	139	Nil	Nil
25	67/F	6	134	134	Nil	Nil

Table 3.Details of patients who underwent DHS alone

No.	Age/ Sex	Radiological Healing Time (weeks)	NSA at immediate post-operative period (Degrees)	NSA at the time of bone healing (Degrees)	Difference in NSA (Degrees)	Percentage difference in NSA
1	70/F	5	128	128	Nil	Nil
2	85/F	6	138	138	Nil	Nil
3	82/F	7	137	137	Nil	Nil
4	65/F	7	137	137	Nil	Nil
5	65/F	8	135	135	Nil	Nil
6	39/M	8	137	135	2	2
7	67/F	7	141	140	1	0.8
8	90/F	7	138	138	Nil	Nil
9	41/M	8	144	140	4	2.8
10	85/F	6	143	134	9	7

RESULTS AND DISCUSSION

All fractures in both groups united in expected time and did not show any obvious malunion on radiographs. Though 60% of patients in group A showed no loss of NSA at the time of radiological union, only 40% in group B showed same finding. Percentage loss of NSA also was found to be high in DHS alone patients (Fig.3) which points to the advantage of using additional derotation screw in DHS fixation.

Since intertrochanteric fractures occur more often in the elderly, immediate stability, which allows full weight bearing should be the concern while selecting the implant. It is thus important to improve treatment methods and to develop better surgical devices, which can prove its usefulness and superiority over the older methods, especially in terms of functional outcome.

Dynamic hip screw and the cephalomedullary nail are the most commonly used implants for peritrochanteric fractures. Treatment of intertrochanteric femoral fractures using DHS has gained wide acceptance in recent years, mainly because of the simplicity of the techniques used for its application and its lower cost. Though cephalomedullary nails are easy to use with minimal sized incision and less operating time, some of these devices have a significantly increased risk of fracture of the femoral shaft and an increased re-operative rate (9,10). Minimally invasive DHS (MIDHS) can be a good alternative with less blood loss, shorter hospitalisation, decreased postoperative pain, faster fracture healing, and better hip function compared to conventional methods (12,19,21). The technical complications with DHS in unstable peritrochanteric fractures is varus malunion with lag screw cut-out or nonunion, frequently related to femoral shaft medialisation. This can be prevented by reducing TAD index (tip-to-apex distance) to 25 or below (8,20).

In a study by Maroš Hrubina and others using FE numerical simulations, the authors observed that the optimum DHS location with minimum implant failure is in the middle of the neck with subchondral fixation (4). They also documented that the DHS positioning in the upper third of the neck almost always lead to implant failure and re-operation. When we reviewed two other studies, one by Xiao Huang and others and another by Orcun Sahin and others, it was observed that PFN (proximal femoral nailing) and DHS are equally effective in the treatment of trochanteric fractures which substantiates the validity of our study (7,22). Similar result was observed in an in-vitro biomechanical study by Lukas Weiser et al (14). In another study by Wenjiang Duan and others where the authors compared the curative effects of PFNA and DHS in treating IT fractures in elderly patients, the rate of complications like coxa vara, internal fixation sliding, and delayed fracture healing were lower in the PFNA group (6.52%) than in the DHS group (19.35%) without derotation screws (23).

CONCLUSION

From the present study of 35 patients with stable intertrochanteric fractures of various patterns, we recommend use of additional derotation screws, if DHS fixation is opted, in order to limit the possibility and severity of varus collapse.

LIMITATION

The limitation of this study was that, the sample size is not large enough and the follow up period was short. There are only few studies in the literature showing mid or long term results of DHS reinforced with derotation screw in the treatment of intertrochanteric fractures. We recommend a large sample study that evaluates long term results of various treatment modalities in IT fractures to confirm authenticity of our findings.

CONFLICT OF INTEREST

Both authors declare that there is no conflict of interest.

REFERENCES

1. Sameer Ajit Mansukhani, Sanesh Vijay Tuteja, Vaibhav B Kasodekar, Shyamal R Mukhi; A Comparative study of the Dynamic Hip Screw, the Cemented Bipolar Hemiarthroplasty and the Proximal Femoral Nail for the treatment of unstable intertrochanteric fractures; Journal of clinical and diagnostic research 2017 April Vol-11(4)
2. Naiyer Asif, Sohail Ahmad, Owais Ahmad Qureshi, Latif Zafar Jilani, Tajdar Hamesh, Tariq Jameel; Unstable intertrochanteric fracture fixation-Is proximal locked compression plate better than dynamic hip screw; Journal of Clinical and Diagnostic Research. 2016 Jan, Vol-10(1): RC09-RC13
3. Amit Batra, Ankur Dhiman, Mohit Khanna, Anil Gulia, Shubham Joshi, Roop And Aditya Jain; Results Of Intertrochanteric Fractures Fixed With Dynamic Hip Screw Fixation; Indian J.Sci.Res. 7(2): 71-77, 2017
4. Xiaowei Huang, Baoqing Yu, Yong Gu, Zexiang Li; Biomechanical comparison of

- dynamic hip screw and Gamma nail for the treatment of unstable trochanteric fractures: a finite element study; *Int J Clin Exp Med* 2017;10(5):7867-7874
- 5.1. Saarenpää & T. Heikkinen & J. Ristiniemi & P. Hyvönen & J. Leppilähti & P. Jalovaara ;Functional comparison of the dynamic hip screw and the Gamma locking nail in trochanteric hip fractures: a matched-pair study of 268 patients; *International Orthopaedics (SICOT)* (2009) 33:255–260
 6. Gulraj S Matharu, Mohammad Shahid, Paul B Pynsent and Tom Rowlands; Accuracy and awareness of lag screw placement when using the dynamic hip screw for fracture fixation; *Trauma* 2015, Vol. 17(1) 39–46
 7. Elsayed Ibraheem Elsayed Massoud; Fixation of basicervical and related fractures; *International Orthopaedics (SICOT)* (2010) 34:577–582
 8. Wenjiang Duan, Yu Wu, Guoyin Liu, Jianmin Chen; Comparison of the curative effects of PFNA and DHS fixation in treating intertrochanteric fractures in elderly patients; *Biomedical Research* 2017; 28 (6): 2717-2723
 9. Lukas Weiser , Andreas A. Ruppel, Jakob V. Nuchtern, Kay Sellenschloh, Johannes Zeichen, Klaus Puschel, Michael M. Morlock, Wolfgang Lehmann; Extra v/s Intramedullary Treatment of Pertrochanteric Fractures: a biomechanical in vitro study comparing Dynamic Hip screw and Intramedullary nail ;*Arch Orthop Trauma Surg* (2015) 135:1101–1106
 10. Ming Liu & Zhiming Yang & Fuxing Pei & Fuguo Huang & Shiqiang Chen & Zhou Xiang; A meta-analysis of the Gamma Nail and Dynamic Hip Screw in treating peritrochanteric fractures; *International Orthopaedics (SICOT)* (2010) 34:323–328
 11. C Zeng, Y-R Wang, J Wei, S-G Gao, F-J Zhang, Z-Q Sun and G-H Lei; Treatment of Trochanteric Fractures with Proximal Femoral Nail Antitrotation or Dynamic Hip Screw Systems: A Meta-Analysis; *Journal of International Medical Research* 2012;40: 839
 12. Orcun Sahin , Huseyin Demirors , Rahmican Akgun , Ihsan Senturk , Ismail Cengiz Tuncay ; Dynamic hip screw versus proximal femoral nail for treatment of trochanteric hip fractures: an outcome analyses with a minimum 2 years of follow-up; *Eur J Orthop Surg Traumatol* (2012) 22:473–480
 13. Yih-Shiunn Lee & Hui-Ling Huang & Ting-Ying Lo & Chien-Rae Huang; Dynamic hip screw in the treatment of intertrochanteric fractures: a comparison of two fixation methods; *International Orthopaedics (SICOT)* (2007) 31:683–688
 14. Tao Cheng, MD, PhD, Guoyou Zhang, MD, PhD, and Xianlong Zhang, MD, PhD; Minimally Invasive Versus Conventional Dynamic Hip Screw Fixation in Elderly Patients With Intertrochanteric Fractures: A Systematic Review and Meta-Analysis; *Surgical Innovation* 18(2)99–105
 15. Mayank Agrawal , P Yuvarajan , Lalit Maini; Modified minimally invasive approach for dynamic hip screw fixation; *Eur J Orthop Surg Traumatol* (2011) 21:375–379
 16. Ali Sedighi, Jafar Ganjpour Sales, Sahar Alavi; The prognostic value of tip-to-apex distance (TAD index) in intertrochanteric fractures fixed by dynamic hip screw; *Orthopedic Reviews* 2012; 4:e32
 17. Adil Ajjaz Shah, Santosh Kumar, Abdul Rehman, Rizwan Haroon Rashid, Shahryar Noordin; Dynamic hip screw fixation for inter-trochanteric fractures: determinants of outcomes; *J Pak Med Assoc Vol. 64, No.12 (Suppl. 2), December 2014*
 18. Maroš Hrubina, Zdeněk Horák, Radek Bartoška, Leoš Navrátil, Jozef Rosina; Computational modeling in the prediction of Dynamic Hip Screw failure in proximal femoral fractures; *J Appl Biomed*. 11: 143–151, 2013
 19. Xiao Huang, Frankie Leung, Zhou Xiang, Pei-Yong Tan, Jing Yang, Dai-Qing Wei, and Xi Yu; Proximal Femoral Nail versus Dynamic Hip Screw Fixation for Trochanteric Fractures: A Meta-Analysis of Randomized Controlled Trials; *The Scientific World Journal* Volume 2013, Article ID 805805, 8 pages