Comparative Study Of Dynamic Hip Screw And Trochanteric Nail For Management Of Stable Intertrochanteric Fracture

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Abstract: Background& objectives : Intertrochanteric fractures of hip are relatively one of the common fractures and it is imposing a huge burden on patients in terms of medical expenses and morbidity .A sliding hip screw (DHS) and trochanteric nail (TN) both are described for fixation of these fractures. The discussion about the selection of ideal implant is controversial in terms of outcomes in various studies. Methods: Ninety patients with intertrochanteric fracture were treated in our hospital from Jan 2009 to Dec 2011. All AO 31-A1 patients who were between 40-80 years old were included to compare Dynamic hip screw and Trochanteric nail in the management of intertrochanteric fractures by analyzing operative time, duration of hospital stay, complications, time taken to union and post operative mobility. 63 patients were enrolled in DHS group and 27 were enrolled in intertrochanteric nail group. Results: Patients treated with DHS had shorter operative time ,less radiological exposure ,easy reduction and fewer intraoperative and postoperative complications .Implant failure and non union was noted in one out of twenty seven patients treated with trochanteric nail group. Interpretation & Conclusions : The analysis of our study supports the use of DHS rather than trochanteric nail for the treatment of stable intertrochanteric fractures in elderly patients [Jesan M NJIRM 2016; 7(4):61-67]

Key Words: DHS, TN, Intertrochanteric fracture

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Introduction: Intertrochanteric fractures of femur are relatively one of the common fractures and it imposes a huge burden on patients in terms of morbidity and medical expenses. The frequency of these fractures has increased primarily due to increased life expectancy. Extra capsular hip fractures most frequently occur in elderly patents.[1] Trochanteric fractures occur in the younger population due to high velocity trauma, whereas in the elderly it is most often due to low energy impact.[1]

According to the concept of quality-adjusted life years; operative treatment is said to be the most cost-effective approach for displaced intracapsular and all extra capsular fracture.[2]

A sliding screw is said to be the gold standard for the fixation of intertrochanteric fractures as it provides secure fixation. Cutting out of the implant from femoral head is the most common cause of failure.[3] Mechanical failures continue to occur in as many as 9% of cases treated by a compression hip screw and side plate.[4]

Recently intertrochanteric nails were developed to circumvent the drawbacks of the compression hip screw by combining the advantages of intramedullary fixation with those of a sliding screw. Theoretically, a decreased operative time and decreased blood loss are expected.[5] Mechanically, the shorter lever arm of the Gamma nail decreases the tensile strain of the implant and thus reduces the risk of failure of the implant.[6] Also, intramedullary fixation provides more efficient load transfer through the calcar because of its more medial location compared with the lateral cortical fixation of the sliding hip screw. Insertion of the intertrochanteric nail is a closed procedure and needs less soft tissue dissection.[3]

However, problems with intertrochanteric nail are also reported. These include fatigue fractures of the nail,[7]pain in the mid-portion of the thigh,[8] intraoperative,[9] and late diaphyseal fracture of the femur.[8-10]

The discussion about the ideal implant for treatment of proximal femoral fractures continues. The results have been contradictory in terms of outcomes in various studies. [11-14] Therefore we performed, a prospective randomized study comparing trochanteric nail (TN) with dynamic hip screw (DHS) in stable intertrochanteric fracture.

Material and Methods: Ninety patients with intertrochanteric fracture were included in our prospective study from Jan 2009 to Dec 2011. All AO 31-A1 patients who were between 40-80 years old were selected for inclusion in our study. We excluded

patients with, a pre-existing femoral deformity or intramedullary nailing, previous surgery on the ipsilateral hip or femur and pathological fractures.

Approval for this prospective study was taken from local institutional ethical committee. Informed consent was taken and all ninety patients were randomized into two treatment groups with a ratio of 2:1 using the open source software "Random allocation software" because of cost effectiveness of DHS over TN.[15] DHS being cheaper than TN. 63 patients (Group I) were managed with DHS and rest 27 patients (Group II) received TN.

Treatment protocol: All patients were provided with one dose (1 g) of prophylactic intravenous antibiotic. All procedures were performed by senior consultants.

In group 1 technique of DHS was the same as described by Tristan et al.[16] A 135° 4 hole barrel plate with 12.5mm lag screw and 4.5mm cortical screws were used in all the cases after putting the patient on traction table (Fig 1a, b, c). In group 2 TN (size 180mm, trochanteric part -15mm,medullary part-9;12 mm, cervical screw 8mm, stabilising screw 6.4mm distal locking screw 4.9mm) was used for fixing trochanteric fracture(Fig2a,b,c). Operative technique for fixation with the intramedullary nail is the same as that previously described by Simmermacher et al.[17] Reaming was done in both distal and proximal fragment. Additional reaming with 15mm reamer was done in proximal fragment. Distal locking was done in all patients (02 screws) and proximal lag screws (02) were put in all patients except two. Optimum positioning of the tip of the screw in the subchondral bone of the femoral head was achieved with a tip apex distance measuring <25 mm in both anteroposterior and lateral radiographs.

The patients were mobilized without bearing weight on operated side after third day and knee physiotherapy was started.

Data Collection: We prospectively recorded patient's age, gender, American Society of Anaesthesiologists (ASA) grade, [18] mobility score [19] and the type of fracture. Operative data included specific information on the type of fixation device used. For the patients in Group I, the length of the lag screw and the number of holes in the side-plate were recorded. For the patients in Group II diameter of the nail and the lengths of the hip screws were recorded. We also recorded the type of anaesthesia, the duration of the operation, and the total duration of fluoroscopy, units of blood transfused, duration between date of injury and date of operation and time of union. We also noted all intraoperative and postoperative complications in both groups.

Fig 1: X ray pelvis with both hip anteroposterior radiograph (a) of 65 year old patient showing intertrochanteric fracture left femur. Postoperative radiograph (b and c) of same patient after 09 months of follow up showing union.

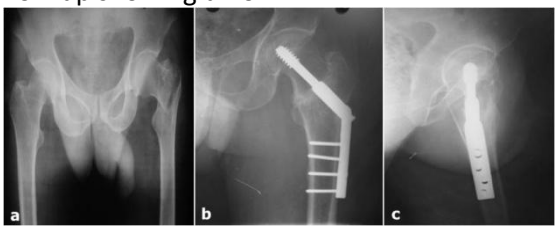


Fig 2: Preoperative anteroposterior radiograph (a) of right hip of a 60 year old man showing intertrochanteric fracture. Post operative anteroposterior and lateral views (b and c) of same patient after 09 months of follow up showing union.

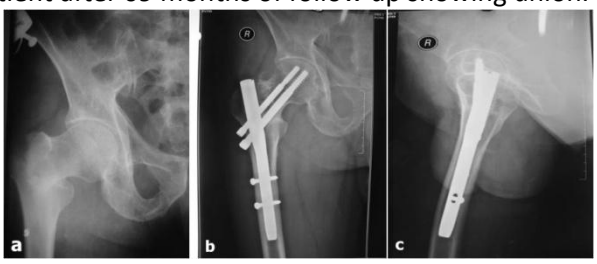


Fig 3:Radiograph of pelvis anteroposterior view (a) showing intertrochanteric fracture, immediate post operative radiograph (b) showing iatrogenic fracture shaft of femur and follow up radiograph (c) showing union of shaft femur after 10 month of follow up.

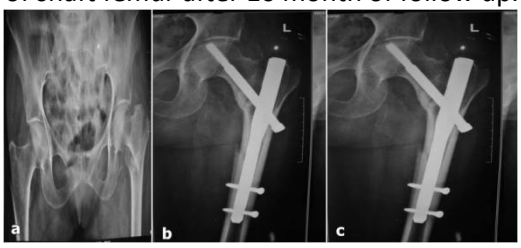
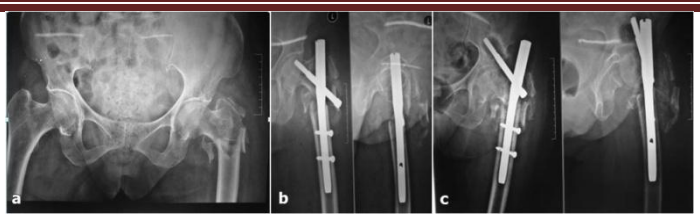


Fig 4:Radiograph of pelvis anteroposterior view (a) showing comminuted intertrochanteric fracture left femur, immediate postoperative radiograph (b) and follow up radiograph anteroposterior, lateral view (4c) showing screw cut out and non union.



Follow up: Follow ups were done on OPD basis regularly after 3month, 6month and 1 year postoperatively. The follow up was done by clinical and radiological evaluation, and the patients were assessed for: pain, swelling in the trochanteric region, deformity, movement of the Hip, sitting cross-legged and squatting, walking, fracture union and patient satisfaction. Union was defined clinically as absence of pain on weight bearing on injured side and radiologically by bridging bony trabeculae. Final evaluation of patients was done after six months of surgery according to Harris Hip Score.[20]

Statistical Analysis: The sample size calculation was done on the basis of a pilot study of 10 patients which showed a mean operative time of 65.8±23.25 minutes in DHS group and 80.02±22.55 minutes in TN group. Based on this data to achieve 80% power with a 2:1 randomization a total sample size of 90 was calculated. Statistical analysis was performed with use of two tests. We have used Student t test to compare the two groups with regard to mean age, operative time, fluoroscopy time, the number of units of blood transfused, time between date of injury and date of operation, duration of follow up, time to union, Harris hip score and the duration of hospital stay. Chi-square analysis was performed to compare the groups with regard to gender and complications that occurred during intraoperative and postoperative periods. Differences were considered significant when the p value was <0.05.

Results: The sixty three patients who were treated with DHS and twenty seven patients who were treated with TN were comparable with regard to age, sex, ASA, mobility score, duration between time of injury and time of operation.

All the patients received spinal anaesthesia. The mean age was 63.30 ± 9.0 years in TN group and the mean age was 60.21 ±15.5 (p=0.25) years in patients treated by DHS .There were 16 males and 11 females in TN group and there were 32 males and 31 females in DHS group (p=0.46). Mobility score was 7.9 in DHS group and 8.1 in TN group (p=0.60). ASA (American Society of Anaesthesiologists) grade was 1.81 in DHS group and 1.96 in TN group (p=0.26) Follow up was nearly 15.81±1.2 months in TN group and was nearly 15.46±1.5 months in DHS group (p=0.28). Blood transfusion required (0.70±0.46 units) in TN group was significantly lower than DHS group (1.08±0.27 units) (p<0.001).Operative time was significantly lower (59.79±5.0 minutes) in DHS group as compared to (91.89±5.7 minutes) TN group (p<.001). Duration of radiological exposure was also significantly lower (1.22±0.45 minutes) in DHS group as compared to (3.67±0.62 minutes) TN group (p<0.001).

All the patients treated with DHS and TN had undergone close reduction. Reduction was quiet easy and satisfactory in all cases of dynamic hip screw whereas in two patients of TN group reduction and instrumentation was difficult. In these two cases only one screw was placed in head of femur.

The mean time for the fracture to unite in TN was (15.62±1.60) weeks while it was (16.35±2.24) weeks in DHS group (p=0.13).This difference was insignificant statistically.

There was no significant difference in intra operative and postoperative complications between two groups .There were two cases of breakage of drill bit in DHS group and one case of intra operative fracture shaft femur which occurred in TN group (p=0.20)(Fig3a,b,c). Fortunately this fracture occurred proximal to distal screws and patient was not mobilised until callus was evident on radiographs .There was also 01 case of implant failure with screw cut out that resulted in non union in TN group (Fig4a, b, c). In this patient implant was removed and patient was put on skeletal traction. 02 patients developed superficial wound infection in TN group and 06 patients developed superficial wound infections (p=0.50) in DHS group as postoperative complications.

The mean duration of follow up was 15.46±1.5 months in DHS group and 15.81±1.2 months in TN group (p=0.28).Average Harris hip score after final follow up was 87.27±9.4 for TN and for DHS was 85.44±13.5 (p=0.52).

The duration of the stay in the hospital was significantly different between the two groups. The mean hospital stay for the patients of the DHS was

4.86 ±0.64 days and for the TN was 3.33± 0.55days (p<0.001).

Table 1: Summarizing Demographics Of Patients Included In The Study.

	DHS (Group 1)	TN (Group 2)	P value
Number of patients	63	27	
Sex Female Male	 31 32	 11 16	0.46
Age(mean ,years)	60.21	63.30	0.25
Mean mobility score	7.9	8.1	0.60
Mean ASA* score	1.81	1.96	0.26
Duration between time of injury and date of operation (days)	9.30	8.41	0.50
Duration of operation (minutes)	59.79	91.89	<0.001
Blood transfusion (units)	1.08	0.70	<0.001
Radiological exposure (minutes)	1.22	3.67	<0.001
Intraoperative complication 1. fracture shaft femur 2. breakage of drill bit	 00 02	 01 0	0.20
Post operative complications 1. non union 2. fracture shaft femur 3. infection	 00 00 06	 01 00 02	0.29
Time of union (weeks)	16.35	15.62	0.13
Harris Hip Score	85.54	87.26	0.52
Duration of follow up (months)	15.46	15.81	0.28
Hospital stay(days)	4.86	3.33	<.001

ASA*, American Society of Anaesthesiologists

Discussion: The discussion about the ideal implant for treatment of proximal femoral fractures is still a debate. Intertrochanteric fractures of the hip are very common and they are imposing severe medical and economic burden on health services and patients.

At present it is generally considered that all intertrochanteric fractures must be internally fixed so as to reduce the morbidity by early ambulation but differences still exist regarding the type of implant to be used.[14] In this study our aim was to determine whether there is a difference between DHS and TN in treatment of stable AO 31 –A1 intertrochanteric fractures. The data collected in this study was studied and compared.

Intertrochanteric fractures most commonly occur in elderly patients and it can be seen in our study that average age is 61.13 years. Chacko and Mohanty[21] have reported an average age group of 61.7 years and they found that 74% of the patients were above the age of 51 and Kundlacik[14] found 68% of patients were above 70 years. Leung have also found that proximal femoral fractures are common in the elderly and more are seen with increase in ageing population.[8]

Trochanteric nail required more radiological exposure than the dynamic hip screw in our study. Studies done by Baumgaertner et al.[22] and Yassin[1] have reported similar results. O Brien et al.[23] have also reported increased fluoroscopic time in patients treated by gamma nail as compared to patients treated by DHS.

The duration of operation was significantly lower in DHS group (59.79±5.05minutes) as compared to trochanteric nail (91.89±5.72 minutes) (p<0.001) in our study. During the beginning of the study, the operation time of trochanteric nailing was quite longer, however the operation time reduced drastically as we negotiated the learning curve. Many authors have also experienced the similar learning curve.[1,24]

In the study by Hardy et al.[5] the operative time for intramedullary hip-screws was more than compression hip screw. Hans et al.[25] have found DHS insertion to be quicker than gamma nail. Although Baumgaertner et al.[22] and Yassin[1] reported that in patients with unstable intertrochanteric fractures, the intramedullary nail was associated with lesser surgical time as compared to DHS. Leung et al.[8]have reported no difference in the operative time for Gamma nail. Yassin[1] and Bridle et al.[26] have reported no significant difference between the two groups.

Cutting-out from the femoral head is regarded as a known complication of DHS fixation but such cutting-out also occurred in trochanteric nail as against DHS in our series.[8,26]Bridle et al.[26] have reported 03 cases in DHS and 02 cases screw cut out in intra medullary group. Leung et al.[8] have also reported 03 cases in DHS and 02 cases of screw cut out in intramedullary nail group. Goldhagen et al.[24] have reported 02 patients of screw cut out in Gama nail. Vipin et al.[27] reported 01(1.78 %) case of screw cut out in his study. In the study by Henry Jones et al.[28] there was no statistically significant differences between the two groups and the overall cut-out rate was 2.6% for the IMN versus 2.3% for the DHS. Kjell matre et al.[29]have also reported more cut out in sliding hip screw 09 (2.6%) cases as compared to intramedullary nail 06(1.8%) cases. Contrary to this we have only one (0.01%) case of screw cut out leading to non union in trochanteric nail group.

The incidence of non-union in patients with intertrochanteric fractures is reported to be 1%.[30]There is only one case of non union in trochanteric nail group in our study and there is no case of non union in DHS group. Henry Jones et al.[28] have reported higher re-operation rates of 4.2% in the Intramedullary nail group as compared to the DHS group(2.5%) due to fixation failure .Contrary to this Kjell Matre et al.[29] have reported 03 patients (0.9%) in intramedullary nail group and 10(2.9%) patients of non union in sliding hip screw.

There was 01 case of intraoperative femoral shaft fracture treated with intramedullary device that developed proximal to distal locking site. Hardy et al.[5] have reported one intraoperative femoral shaft fracture in a series of fifty patients. Bridle et al.[26]have reported 04 such cases in their study. Out of these 04 fractures 02 were intraoperative and 02 were post operative fractures. Leung el al.[8] and Radford et. al[9] have also reported higher incidence of fracture shaft femur in the intramedullary nail group. However Vipin Sharma et al.[27] have reported no case of intraoperative femur fracture in his study. Henry Jones et al.[28] have reported operative fracture of the femur in 35 cases of intramedullary device and 04 cases of DHS. Brian aros et al.[31]found higher revision surgery rate for intertrochanteric femur fractures stabilized with an Intramedullary nail compared with a sliding hip screw because of fracture shaft of femur distal to the nail. They have reported 35% greater risk of revision surgery during the first postoperative year in intramedullary nail group compared with the sliding hip screw group. Kjell matre et al.[29] have also found more number of fractures 05(1.5%) around intramedullary nail as compared to sliding hip screw 01(0.3%) patient. But in our case none of the patient developed fracture shaft of femur distal to the nail.

In this study, final assessment has been done with Harris hip scoring system which is 85.54 in DHS group and 87.26 in TN group. Chang et al.[32] and Wang JP et al.[33] had also reported similar results with DHS and got score of 84.7 and 87.7 respectively in their study. Yao C et al. [34]had reported score of 83 and Liu et al.[35] had reported sore of 84 with the use of intramedullary device in their studies. In our study there was no difference clinically between the two groups after final follow up.Varela JR et al.[13] and Barton et al.[16] had also reported similar result with no significant difference between the two groups in clinical outcome.

In our study blood loss was less in intramedullary device as compared to DHS. Hardy et al.[5] and Christophe Sadowski[36] and Baumgaertner et al.[22] have also shown similar results in their studies. Christophe Sadowski has shown 44% less blood loss in intramedullary device.[36] Contrary to this Hans et al.[25] have found less blood loss in DHS group as compared to Gamma nail group.

Henry Jones et al.[28] in their meta analysis summarised that intramedullary device cannot be recommended for stable intertrochanteric fracture. Parker MJ et al.[37] concluded that sliding hip screws are better in treating intertrochanteric fractures as compared to intramedullary devices .

Conclusion: It can be concluded from our study that the advantage of DHS over TN include shorter operation time ,less radiological exposure, easy reduction and fewer intraoperative and post operative complications. DHS is surgeon friendly device and can be performed easily by any average orthopaedic surgeon as compared to trochanteric nail.

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