SPECIAL COMMUNICATION

IMPLANTS FOR EXTRACAPSULAR NECK OF FEMUR FRACTURE DYNAMIC HIP SCREW VERSUS INTRAMEDULLARY NAILING

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Neck of femur fractures are the most prevalent type of injury in elderly trauma patients. Both intra and extra capsular type of fractures are equally distributed in the given population. Traditionally, Extra capsular fractures are fixed with Dynamic Hip screw or Intra medullary nailing based on the type of fracture. NICE (National Institute of Clinical Excellence) recommends fixing 31-A1 and 31-A2 fractures with DHS (Dynamic Hip Screw) whereas AO recommends fixing 31-A1 with DHS and 31-A2.1 subtype with DHS and 31-A2.2 and 31-A2.3with IMN (Intra medullary nail). In regional trauma centre 178 patients, 125 females and 53 males with extra capsular neck of femur fractures fixed were selected in a retrospective study. The data was spanning over a period of 1 year. Fractures were classified as per AO classification by two registrars. The implant selection was analysed in terms of the short term out come to find out the cost effectiveness of one over the other. The quality of reduction was assessed as per standard criteria and consideration of lateral femoral wall thickness was taken into account to assess the stability of fracture. The study found more risk of peri prosthetic fractures associated with Intra medullary nailing as compared to Dynamic Hip screw and more risk of Varus collapse was found to be associated with DHS as compared to IM Nail. Moreover, despite of Nail being costly as compared to DHS, the study did not reveal its superiority in terms of inpatient hospital stay. In appropriately selected patient DHS provides results in terms of hospital stay, revision rate and wound complications comparable to IM Nail in the short term justifying its use in the above-mentioned fracture patterns as per the standard National Institute of clinical Excellence guidelines.

Keywords: Femur fractures; Screw; Intramedullary nailing; trauma centre; Acetabulum

J Ayub Med Coll Abbottabad 2017;29(4):697–701

INTRODUCTION

Neck of femur fractures are the most prevalent fractures in elderly patients associated with high mortality and morbidity.

Because of ageing population, the incidence of neck of femur fractures is on the rise and is roughly about 65000 per annum in the UK. There is about 10% mortality associated with this particular injury within a month and mortality at about 1 year is about 30%. Both intra and extra capsular NOF fractures occur with same frequency. Females suffer from these three times more than males. About 1 billion pounds is spent annually on NOF fractures management excluding the expenditure on social issues in the UK.[1]

Neck of femur fractures are divided broadly into intra capsular and extra capsular based on location of fracture. Capsule of hip joint extends from the margin of acetabulum to attach anteriorly to intertrochanteric line where as posteriorly it stops just proximal to intertrochanteric crest. This division is important to determine management. Intra capsular fractures are treated with replacement of head as the blood supply of the head is at risk in case of displacement. This leads to increased risk of AVN of the femoral head. Extra capsular fractures on the other hand are fixed with either extra medullary implant such as DHS or an intra medullary implant such as IM nail based on the fracture configuration. The successful outcome of fixation of neck of femur fractures depends on patient s age, quality of reduction and the choice of implant.[2] Another very important factor in achieving successful outcome in NOF fractures is the quality of reduction along with the position of the screw achieved with gamma nail fixation.[3]

We evaluated the short-term outcome of intra and extra medullary fixation fpr extra capsular neck of femur fractures. With special focus to see if 31-A2.2 and 31-A2.3 are better fixed with DHS or IM Nail in terms of short term complications.

AO Classification of ECNOF

AO classification of extra capsular NOF correlates well with the stability of fractures

31-A1 are simple two-part fractures with intact medial buttress.

31-A2 are multifragmentary with involvement of lesser trochanter.

31-A3 are the fractures when fracture line passes above the lesser trochanter medially and below the crest for vastus lateralis laterally.

Recommendations for implant selection:

Currently AO recommendations favour extra medullary implants such as Dynamic Hip screw for stable fracture patterns 31-A1 all subtypes and 31-A2.1. AO recommends use of intra medullary device IM Nail for unstable 31-A2.2 and 31-A2.3 subtypes as extra medullary devices fail to provide necessary stability.

NICE (National Institute of clinical excellence) guidelines differ slightly in a way that it recommends all subtypes of 31-A1 and 31-A2 to be fixed with extra medullary devices in preference to intra medullary devices.

The fracture configuration determines the stability of the fracture along with the integrity of lateral femoral wall and postero-medial comminution. Some studies recommended using DHS for all 31-A1 and 31-A2.1 subtypes and use of IMN in preference to DHS or DHS/TSP for 31-A2.2 and 31-A2.3 based on findings in their work. In their study, IM nail provided better out come in terms of prevention of shaft medialisation and varus collapse. as DHS or DHS TsP which does prevent shaft medialization but in unstable fractures, use of nail gave better results.[4]

The fractures associated with deficient lateral femoral walls are considered unstable because of the lack of medial buttress for proximal fragment, the use of DHS in these fractures can result in uncontrolled collapse and limb shortening. DHS use in such fracture pattern can also result in proximal fragment lateralisation and shaft medialisation as patient starts to bear weight. There is more than 50% failure rate if DHS is used for unstable fracture with osteoporosis.[5] The successful outcome of fixation of neck of femur fractures depends on patient's age, quality of reduction and the choice of implant. Lateral femoral wall thickness plays vital role in selection of implant for fixation. Lateral wall thickness less than 20.5mm merits use of IM nail for fixation instead of DHS.[5]

Mechanics of Intra and extra medullary implants

Intra medullary Nail has shorter lever arm on fixation and is located closer to centre of gravity and shows resistance to the forces across calcar preventing shaft medialization.

Extra medullary implants on the contrary have a longer lever arm and are located away from the centre of gravity and from mechanical axis of femur therefore, provide less resistance to the forces across the calcar.[6]

MATERIAL AND METHODS

This is a retrospective study under taken at a major regional trauma centre Queen Elizabeth Hospital Birmingham. All patients having DHS or IM nail for ECNOF from June 2015 to May 2016 were included. Intra capsular Neck of femur fractures were excluded along with patients who could not have surgery due to medical reasons. This study looked at the short-term complications of DHS and IM nail to prove superiority of one over the other. Two registrars reviewed plain radiographs and intraoperative reduction images to classify 178 fractures according to AO classification. The implant selection was assessed for each individual fracture pattern and integrity of lateral femoral wall, quality of reduction and complications were noted for each. In our experience Intra operative reduction images are very important as classifying fractures on initial radiographs in ED was not always possible. We used Baumgaertner' s criteria to assess reduction quality which are as follows:

1) Reduction: normal or slight angulation on AP view and <20 deg anuglation on lateral view

2) Displacement <4 mm of any fragment

If both criteria were met the reduction was considered good. If one of the criteria was met reduction was considered adequate and the reduction was considered poor if both criteria were not met.

RESULTS

Total 178 patients were analysed with 53 male and 125 female patients with ECNOF fractures. Out of 44 31-A1 fractures 43 were fixed with a DHS and only one fracture was fixed with PFNS. Out of 79 A2 fractures 48 were fixed with DHS but 26 received PFNS. 2 fractures had a DHS and trochanteric stabilisation plate (TSP) as a measure to improve stability. In addition to that 3 fractures were fixed with a long PFNA.A total of 55 A3 fractures were fixed a combination of Intra and extra medullary devices.5 were given DHS and 2 DHS and TSP .30 PFNS and 18 had PFNL.A total 178 cases 96 were fixed with DHS 4 had DHS and TSP whereas 58 had PFNS and 20 had PFNL. 97.7% of A1 fractures were given DHS whereas 60.75% of A2 fractures were fixed with DHS.

Reduction: 86.5% of patients had good reduction according to Baumgaertner s criteria and 11.8% had moderate reduction whereas 1.68% had poor reduction.

Total 57 fractures 31-A2 were treated with DHS or PFN. 22 of 31-A2.2 were fixed with extra medullary devices and 4 had Intramedullary nail. There were 35 fractures of 31-A2.3 subtypes with 18 DHS and 17 IM nailings. One case of shaft medialization was noted with 31-A2.2 cases after DHS fixation .and this had 1 case of wound infection treated with antibiotics. 31-A2.2 subtype fixed with SPFNA had 1 case of wound infection.

In 31-A2.3 subtypes fixed with DHS 1 case of shaft medialisation and one screw cut out revised

to Total Hip replacement, no wound infection was however found 31-A2.3 fixed with IMN were found to have 2 cases of wound infection and 1 peri prosthetic fracture requiring revision surgery. More wound complications were noted in nailing considering the fewer number of nailing as compared to DHS. One DHS TSP failed and was revised to nail in 31-A2.2 category

The average age of patients having DHS fixation with either of subtypes was 74.8 and the inpatient hospital stay was 28.2 days. The average age for SPFNA patient category was 80.6 and the length of hospital stay was 30.6 days. Average age of SPNA category was 80.6 and hospital stay 23 days.

The hospital stay in DHS fixation was shorter by about 2 days. However, there were many variables affecting this finding no it cannot be taken as true reflection of impact of implant on hospital stay.

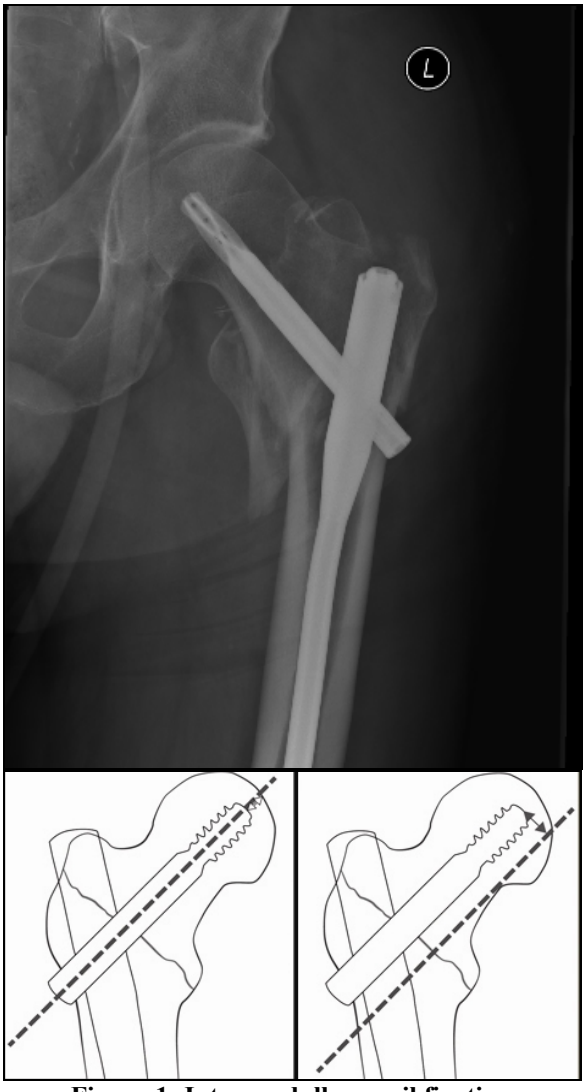

Figure-1: Intra medullary nail fixation

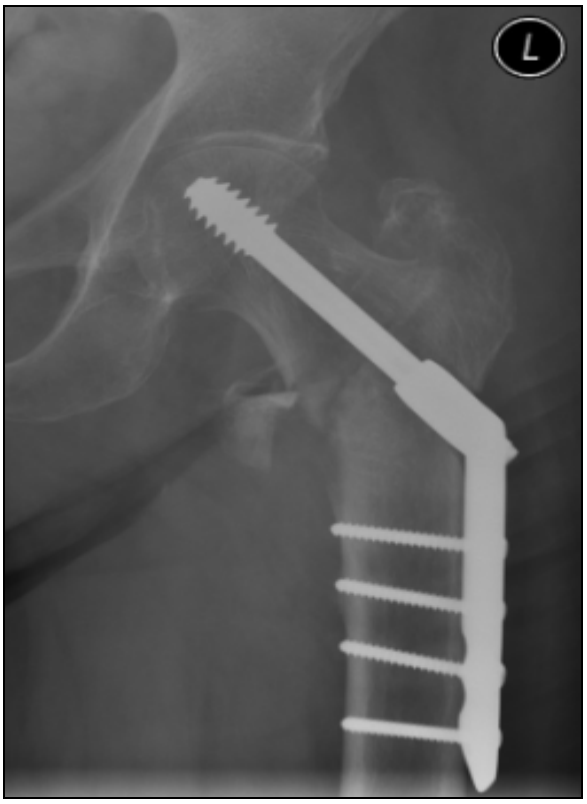

Figure-2: Dynamic Hip screw fixation

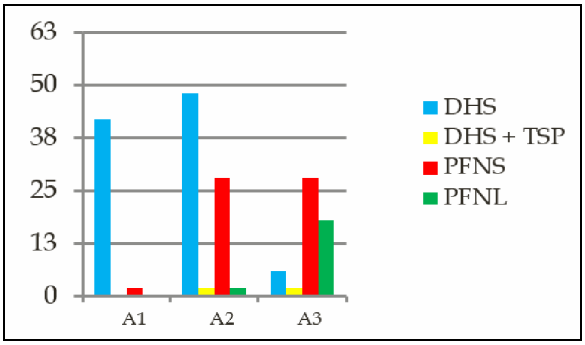

Figure-3: Representation of type of fractures fixed with respective implants

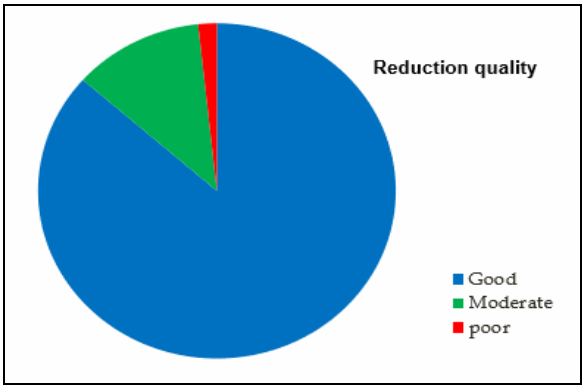

Figure-4: Diagrammatic representation of Quality of reduction achieved intra operatively

Table-1: Tabulated representation of types of fractures and devices used

	DHS	DHS + TSP	PFNS	PFNL	Total
A1	43	0	1	0	44
A2	48	2	26	3	79
A3	5	2	30	18	55
Total	96	4	57	21	**178**

Table-2: Tabulated representation of types of fractures and fixation device used

AO TYPE	Total/ Complicated	DHS/ DHSTSP	SPFNA/ LPFNA
31–A2.2	22 (13.6%)	18 (5.5%) (5.5%)	4 (25%) wound infection
31–A2.3	37 (13.5%)	18(11.11%) (5.5%)	17 (5.88%) (5.88%)

DISCUSSION

Choice of implant selection remains a topic of great interest and controversy for orthopaedic surgeons. Many studies have been done and recommendations have been made. However, conflicting evidences keep emerging and hence, the need for more studies is justified. The outcome of surgery in ECNOF fractures depend on the age of the patient, the fracture configuration, bone quality, quality of reduction and fixation, general health of the patient and optimal rehabilitation.

There are different studies to suggest superiority of one implant over the other.

No statistically significant difference was noted in Meta-analysis with regards to blood loss, duration of surgery, wound complication, hospital stay and mortality rate.[7]

Another study in Rasoul Akram Hospital Tehran, Iran comparing the two devices in terms of anterior thigh pain, operation duration, cut out, shaft medialization, varus angulation, non-union and walking recovery to pre-operative level was performed on patients undergoing surgery from 2011 till 2013.This proved superiority of PFNA over DHS in all the categories listed above.[8]

Parker and Handoll also reviewed the comparison of gamma and other cephalomedullary nails with extramedullary implants for fixation of extracapsular hip fractures in adults. In this systematic review four studies were considered which included PFN and Targon PF nail comparison was made with DHS. The study found that there was no significant difference between the two groups compared in outcomes of blood loss and transfusion, fixation complications, and post-operation complications and hospital stay.[9]

Quality of reduction and acceptable values of Tip Apex Distance and more recently discussed CalTAD has been related to the successful outcome of surgery in ECNOF fracture. Calcar reference Tip Apex Distance (CalTAD)is measured in a similar way as Tip Apex distance (TAD) on lateral view of hip radiograph. However, on AP film TAD apex of femoral head is determined by passing a guideline through the midline of the femoral head. This guideline is moved to medial cortex of femoral neck in order to measure CalTAD. Addition of TAD on lateral view is added to both the above measurements to get TAD and Cal TAD.

Tip Apex Distance AP View Calcar Reference Tip Apex Distance AP view. Cal TAD concept suggests inferior position of the lag screw when using IMN provides more chance to avoid cut out and cut through.[10] It is not yet clear as to whether it is better than TAD as a predictor of stability. There is better purchase in the postero inferior head of femur owing to the presence of stronger bone. Therefore, there remains need for more studies to find out its superiority to Tip Apex Distance which is an established measure of reducing risk of cut out.

Meta-analysis of 6 Randomized and quasi randomized studies by Bin Yu *et al* found less blood loss, operative time and a smaller incision for the IM Nail group. However, it failed to show any significant difference in certain valuable parameters such as infection rate, lag screw cut out and re operation rates.[11]

The limitations of this study include retrospective design, limited follow up and small pool of patients. There too many variables to affect inpatient hospital stay the important finding was that Extra medullary devices when used in 31-A2.2 and 31-A2.3 did not prevent varus collapse and limb shortening as well as intra medullary fixation. However, the revision rates for both groups remained almost the same. The impact of limb shortening and collapse on mobility was not assessed due to lack of long term follow up. However, in short term the revision rate due to mechanical complications remains almost the same in both categories. DHS being more cost effective due to lower implant cost. DHS patients had a shorter hospital stay but the difference was not found to be statistically significant and had many confounding factors to influence the outcome therefore was not considered reliable.

Based on the study we could recommend that 31-A1 fractures should be fixed with DHS and 31-A2.1 should preferably be fixed with DHS. With regards to 31-A2.2 and 31-A2.3 the choice of implant depends upon surgeon's experience as the revision rate remains the same in both groups.

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Received: 11 September, 2017	*Revised: 9 October, 2017*	*Accepted: 15 October, 2017*

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