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The Radiological and Functional Outcome of Unstable Intertrochanteric Fractures Treated With Cephalomedullary Nails

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Abstract
Background and Objectives: *Intertrochanteric fracture is one of the most common fractures of the hip especially in the elderly. These fractures are three to four times more common in women and the mechanism of injury is usually due to low-energy trauma like a simple fall. More than 50% of intertrochanteric fractures are unstable. The surgical stabilization of unstable intertrochanteric fractures remains a persistent challenge. The purpose of this study is to evaluate the effectiveness and drawbacks of the cephalomedullary Nail in the management of unstable intertrochanteric fractures.*
Methodology: *This study is a prospective, time bound, hospital based study conducted at Saint Raphael Hospital, between October 2017 to November 2018. The study included 30 cases of unstable intertrochanteric fractures (AO classification 31A2 & 31A3) that were operated with the cephalomedullary nail. Follow up at 3, , 12, 16 , 18 , 24 weeks for serial clinical and radiological evaluation was done and assessed clinically regarding pain, limp, hip movements, walking ability, deformity and shortening. Functional evaluation at end of 6 months was done by using Harris hip score.*
Results: *The study included 30 cases of unstable intertrochanteric fractures 24(80%) patients had 31A2 fractures and 6(20%) patients had type 31A3 fractures that were operated with the cephalomedullary nail. The average age was 64 years. The most common mode of injury was trivial fall . 3 intraoperative complications and 8 post-operative complications observed. The average time of union was 18 weeks. Maximum number of fractures united between 16-20 weeks.*
Conclusion: *cephalomedullary Nail provides good fixation for unstable intertrochanteric fractures if proper preoperative planning, good reduction and surgical technique are followed, leading to high rate of bone union and minimal soft tissue damage*
Keywords: *Cephalomedullary nail, Intertrochanteric fractures, AO classification, Harris hip score*

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I. Introduction

Intertrochanteric fracture is one of the most common fractures of the hip especially in the elderly. The incidence of intertrochanteric fracture is rising because of the increase in number of elderly population superadded with osteoporosis. These fractures are three to four times more common in women and the mechanism of injury is usually due to low-energy trauma like a simple fall [1] and the outcome may be extremely poor if there is prolonged bed rest. Stable fixation that allows early mobilization is the treatment of choice. The best treatment for trochanteric fracture remains controversial. Intramedullary devices are currently used widely because of their mechanical and biological advantages [2]. More than 50% of intertrochanteric fractures are unstable. Unstable patterns occur more commonly with increased age and with low bone mineral density [3]. The presence of osteoporosis in intertrochanteric fractures is important because fixation of the proximal fragment depends entirely on the quality of cancellous bone present [4]. The surgical stabilization of unstable intertrochanteric fractures remains a persistent challenge. Dissatisfaction with the use of the extramedullary devices like the Dynamic Hip Screw in unstable intertrochanteric fracture patterns led to the evolution of intramedullary devices [5]. The purpose of this dissertation is to study the effectiveness and drawbacks of one such newer intramedullary device, the cephalomedullary Nail in the management of unstable intertrochanteric fractures.

II. Material and Methods

This study is a prospective, time bound, hospital based study conducted at Saint Rafael hospital, between October 2017 to November 2018. The study included 30 cases of unstable intertrochanteric fractures (AO classification 31A2 & 31A3) "Fig 2.1" that were operated with the cephalomedullary nail which fitted into the inclusion criteria. Inclusion criteria included Unstable intertrochanteric fractures according to AO/OTA classification - AO31A2 & AO 31A3, Patients aged more than 18 years age who are medically fit for surgery and Patients who are willing to give consent. Exclusion criteria included Open hip fractures, Pathological fractures, and Paediatric fractures (before physeal closure). Preoperatively Neck shaft angle was measured on the unaffected side on an AP x-ray using a goniometer**,** Nail diameter was determined by measuring diameter of the proximal femur on an AP x-ray and Approximate sizes of the compression screws in the head neck region. After the completion of the hospital treatment, patients were discharged and called for follow up at outpatient level, at regular intervals at 3, 12 ,16, 18 ,24 weeks, for serial clinical and radiological evaluation. Radiological assessment for progression and time of union, fracture alignment and implant related complications were analysed. and assessed clinically regarding pain, limp, hip movements, walking ability, deformity and shortening. Functional evaluation at end of 6 months was done by using Harris hip score "Table 1.1". Data collected at the end of the study was statistically analyzed.

Table 2.1 Harris hip score

Variable	points	Variable	Points
pain		**Distance walked**	
Non or ignores it	**44**	Unlimited	**11**
Slight, occasional	**40**	Six blocks	**8**
Mild pain, rarely moderate	**30**	Two or three blocks	**5**
Moderate pain	**20**	Indoors only	**2**
Marked pain	**10**	Bed and chair	**0**
Totally disabled, pain in bed	**0**	**Stairs**	
Function		Normally without railing	**4**
Limp		Normally with railing	**2**
None	**11**	In any manner	**1**
Slight	**8**	unable to do	**0**
Moderate	**5**	**Shoes and socks**	
Severe	**0**	With ease	**4**
Support		With difficulty	**2**
None	**11**	unable	**0**
Cane, long walk	**7**	**Sitting**	
Cane, most of the time	**5**	Ordinary chair for 1 hour	**5**
One crutch	**3**	High chair for 1 hour	**3**
Two canes	**2**	Unable to sit in any chair	**0**
Two crutches	**0**	**Public transport**	
Not able to walk	**0**	Able to use	**1**
		Unable to use	**0**

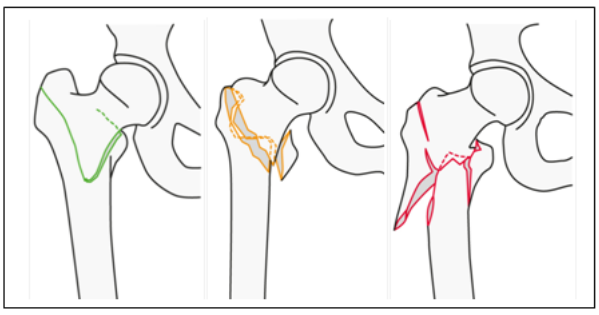

Figure 2.1 AO classification of intertrochanteric fractures

2.1 Surgical approach:

Under Spinal or Epidural Anaesthesia all patients were placed in supine position on a surgical table with the unaffected leg, flexed and abducted as far as possible in order to accommodate the image intensifier. Operative leg was put on traction. A reduction protocol was followed where posterior medial buttress was reduced by closed reduction , flowed by limb was adducted. If fracture remained undisplaced nail was inserted, but if fracture got displaced, fracture was reduced again and transfixed with percutaneous k-wires through anterior cortex and then nail was inserted. After nail

insertion compression screw and was inserted in the neck of femur under image intensifier. And last but not the least the distal screw was locked through jig after releasing the traction. Postoperatively, Patients were encouraged to sit in the bed after 24 hours after surgery. Active isometric and isotonic quadriceps exercises were started from 2nd post-operative day. Non-weight bearing ambulation with the help of walker was started from 2nd post-operative day. Partial weight bearing ambulation was started from 6th week. Full weight bearing ambulation was started after radiological signs of union.

2.2 Operative radiographs

Fig 2.2 preoperative image of 31A2 fracture

Fig 2.3 insertion of lag screw

Fig 2.4 Insertion of static & dynamic distal screws

III. Results

The study included 30 cases of unstable intertrochanteric fractures (AO/OTA classification 31A2 & 31A3) that were operated with the cephalomedullary nail which fitted into the inclusion criteria. The mean age of the patients forming the study group was 55 years. Majority of patients were in the age range of 60-70 years. Majority of patients were females accounting for 26(86.6%) cases. In side distribution, 25(83.3%) cases occurred on the right side and 5(16.6%) on the left side. The leading cause for fracture was trivial fall in 26(86.6%) of cases whereas fall from a height was seen in 2(6.6%), road traffic accident 3(10%) and. The study included 30 cases of unstable intertrochanteric fractures (AO/OTA classification 31A2 & 31A3). 24(80%) patients had 31A2 fractures and 6(20%) patients had type 31A3 fractures. 3 patients had Intra-operative complications where two had fracture displacement by nail insertion and one had difficulty to put distal locking screws . There were 8 cases of postoperative complications in present study which included 4(13.3%), varus malunion , 1(3.3%) lateral thigh discomfort and 3(10%) had shortening of affected limb. Radiological union was achieved, on the evidence of obliteration of fracture lines and appearance of trabecular continuity between the fragments on anteroposterior and lateral x rays in three cortices. The average time of union was 18 weeks, the range being from 12 to 24 weeks in 30 cases. Maximum number of fractures united between 16 to 20 weeks. there were no cases of deep infection & one case of superfiscial infection. Our study had the following functional outcome which was assessed by Harris hip score, 12 cases (40%) with excellent results, 12 cases (40%) with good results, 6 cases (20%) with fair results and no Case with poor results. Good to Excellent results were seen in 80% of the patients.

3.1 Radiographs of result

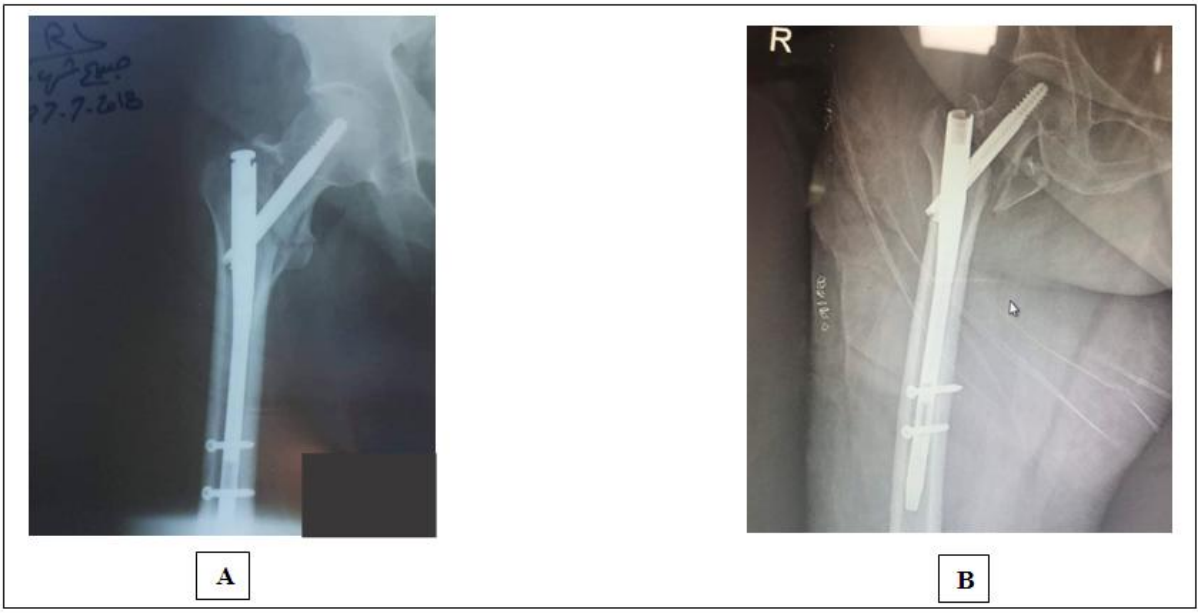

Figure 3.1 : images A&B shows Immediate post operative X rays

IV. Discussion

Intertrochanteric fractures are divided into stable and unstable varieties. In essence, *unstable fractures* are those where poor contact exists between the fracture fragments the fracture pattern is such that forces of weight-bearing continually displace the fragments further [6]. Our study consisted of 30 patients. The mean age was 55 years and 86% of patients were in age group 61 to 70 years, this finding was similar to study done by GS Kulkarni 1984 [1] & Simmermacher RK et al [7] where mean age was 62,63 respectively. There was a female preponderance in the present study with 26(86.6%) of the patients being females. This finding was similar to the prospective study done by Kenneth J.Koval & others (1996) [2] with 71% females, both were different from another study by Schipper IB et al [8] in which there were 28 male patients (54%) and 24 female patients (46%) . The leading cause of the injuries in the present study was trivial fall in 26 patients accounting for 86.6%. This observation was similar to Gupta R.C *et al* [9]. (1974) 79.4%. 3 patients had Intra-operative complications where two had fracture displacement by nail insertion and one had difficulty to put distal locking screws. A study by Vanangamudi.K (2013) showed similar results [10]. There were 8 cases of postoperative complications in present study which included 4 (13.3%) varus malunion, 1 (3.3%) lateral thigh discomfort and 3 (10%) had shortening of affected lower limb as complication. In study by Gadegone WM *et al* [11]. (2010) faced postoperative complications like 6(6%) varus malunion, 7(7%) lateral thigh discomfort and 10(10%) shortening of affected lower limb. The average time of union was 18 weeks being late by 6 weeks from a study conducted by Singla G.A [12] in which the average time of union was 12 weaks , the range being from 12 to 24 weeks in present study. There were no cases of deep infections which is silmiar to a study by Halder SC [13] and one case of superficial wound infection similar to a study by Williams WW [14] . Maximum number of fractures united between 16 to 20 weeks. Where as in a study by Gadegone WM *et al* [8]. (2010) the average time for union was 19.5 weeks, the range being from 15-21 weeks.

V. Conclusion

In our study, we conclude that cephalomedullary Nail provides good fixation for unstable intertrochanteric fractures if proper preoperative planning, good reduction and surgical technique are followed, leading to high rate of bone union and minimal soft tissue damage. Intramedullary fixation has biological and biomechanical advantages over extramedullary fixation. It is a closed method thus preserves the fracture hematoma and yields early healing and early union. The procedure is less invasive, less time consuming, provides stable fixation and allows early weight bearing that in turn enhances the process of union, especially in unstable intertrochanteric fractures. Further, it can be used in all unstable configurations of trochanteric fractures with equally good results. However,

functional outcome in fractures with severe osteoporosis varied. Most of the complications of proximal femoral nailing are related to the operative technique, type of fracture, preoperative reduction, time to weight bearing, instruments and implant quality which can be brought down by proper preoperative planning. Proximal femoral nailing requires a higher surgical skill, good instrumentation and good C-arm control. The implant is comparatively expensive and it has a steep learning curve and should be used after proper training.

4.1 Limitations of our study

1. As this was a descriptive study, due to the absence of a control or comparator group, it is difficult to make a definitive conclusion whether cephalomedullary nail is the best treatment option for the unstable intertrochanteric fractures or not. To make a definitive conclusion, a randomized controlled trial would be needed.
2. Our sample size reflects the routine patient inflow in our hospital. A study with a larger sample size, would have made a better assessment of this surgical intervention.
3. As our study was time bound, the patients were followed up for a minimum of 3 months and a maximum of 6 months. Therefore, the long-term effects of this intervention remain unknown in our cohort. A longer follow up would have made a complete assessment of this surgical intervention.

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