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The Stabilization of Unstable IntertrochantericFractures –A RetrospectiveStudy

Dr. J .Benjamin Vinodh[1], Dr.U.Thyagarajan[2], Dr.L.Senthil[3]
Department Of Orthopaedics/ Sri Ramachandra Medical College And Hospital, Chennai, India

I. Introduction

Due to difficulty in obtaining and maintaining stable anatomical reduction, treatment of unstable intertrochanteric fractures has been challenging. Many fixation devices have been developed to overcome the intraoperative difficulties and postoperative complication of unstable intertrochanteric fractures of the femur. Till recent times most of the intertrochanteric fractures were treated by a sliding hip screw system, previously considered to be gold standard for such fractures,but had high failure rates[3]. Stability of intertrochanteric fractures have been debated among orthopaedic surgeons to improve the treatment results of these fractures. The failure rates of these fixation were directly linked to instability of intertrochanteric fractures and the failure to obtain anatomical reduction of these fractures during surgery. Though there are various opinions in the literature in recent years regarding instability criteria, these factors are always taken into account to assess the treatment outcome of unstable intertrochanteric fractures. The performance of DHS in unstable intertrochanteric fractures led to the popularity of intramedullary fixation devices.

Though the advantage of intramedullary device over side plate construct remain yet to be clinically demonstrated, the added advantage of reduced operative time, reduced time to radiation exposure and less blood loss have made these as the implant of choice in recent years. The main principle of intramedullary device is to combine a closed nailing technique with femoral neck-head screw based on intramedullary rod thereby allowing early weight bearing 1. But serious implant related complication like screw back out 2, fracture at the shaft 3 and complication at the distal locking site 4 require subsequent surgeries with increase in morbidity and mortality. Early results of proximal femoral nails were not promising due to associated complication of screws in the head neck fragment and these were directly related to the inability to achieve stable reduction. Design improvements in the proximal femoral nail construct and the clarity in criteria to be fulfilled in the obtaining reduction of these unstable fracture have shown to improve results of these implants in these inherently unstable fractures. Furthermore design modification like reduced proximal diameter, decreased proximal angle of the nail and distal tip design have shown good clinical outcomes with lower complication rates compared to standard method of treatment.[2]The proximal femoral nail with helical screw (AO, SYNTHES PFNA) in the femoral head and neck segment was developed to incorporate rotational stability to the earlier proximal femoral nails.[7]

Proximal femoral locked plate is a new generation anatomic plate which was developed to reduce the complication of using a DHS in unstable intertrochanteric fractures.[8]These plates were developed to improve the stability of the extra medullary fixation devices used in the treatment of unstable intertrochanteric fracture by increasing the number of screws used in the neck-head fragment creating a fixed angle construct. They are argued to be better than the intramedullary devices because they are applied with less bone injury to the lateral wall, neck and head of femur and provide stability to the construct by the placement of more screws in different angle into the neck-head segment. The proximal femoral locked plate also addressed the issue of providing stability to the lateral femoral wall by direct buttress of this region by the side plate. This construct gives the added advantage of earlier weight bearing with an extra medullary fixation device in an unstable situation.

II. Patients And Methods

We therefore conducted a prospective study from July 2011 till August 2013, a single centre study comparing the outcome, complication and analyse the groups for intraoperative blood loss, duration of the surgery and duration from the day of surgery to mobilization in fractures treated by intramedullary and extra medullary plate devices in unstable intertrochanteric fractures.During this period 60adult patients with unstableintertrochanteric fracture femur were selected according to the inclusion criteria. All patients who fulfilled the inclusion and exclusion criteria underwent DHS and PFN respectively. The minimum follow up was 14 months.

2.1 Inclusion Criteria

a. Age : >45 years
b. Sex : Both sexes
c. Type:AO/ASIF TYPE 31A2.1 to 3 and 31A3.1 to 3.

2.2 Exclusion Criteria

a. Previous surgery of the proximal femur.
b. Pathological fracture other than osteoporosis
c. Polytrauma
d. Type: AO/ASIF TYPE 31A1.1 to 3 fractures.

Of the 60 intertrochanteric fractures 22 were operated with PFN and 28 with DHS/TSP. Both group were comparable (table 1). The fractures are classified according to AO/ASIF classification. All the fracture resulted from low energy trauma.

Variables	Pfn	Dhs/Tsp
Mean Age (Years)	52	54
Ao/Asif		
Type 31a2.2	16 (72.2%)	18 (64.28%)
Type 31a3.3	06 (27.8%)	10 (35.7%)
Female	16	14

2.3 Objectives And Outcomes

The hypothesis was that stable reduction of these unstable fractures before the fixation of the fracture and maintenance of the reduction during implant fixationwould have fewer complications and improved outcome irrespective of device used in these unstable intertrochanteric fractures. The primary end point was defined as complete and uneventful radiological healing of the fracture (at six months and one year). Secondary end points were intraoperative complication and revision surgery, due to failure of primary internal fixation device. Baseline data were documented preoperatively and outcome measures were analysed at 4 weeks, four months and one year.

All the surgery were performed according to standard protocols. Patients received preoperative antibiotics, the choice depended on the hospital policy. General or regional anaesthesia was used in all the patients. All patients underwent the surgery in a fracture table and closed reduction was attempted in all cases with image-intensifier control. The parameters used to obtain a stable reduction were 1) bony contact of the posteromedial cortex of the trochanteric portion 2) angular deformity 3) distraction at the fracture site.The quality of reduction was recorded as acceptable (5-10 degrees of varus / valgus, ante / retroversion) and poor (> 10 degrees of varus / valgus, ante / retroversion).The operating time was recorded. The time required for the closed reduction before the start of the surgery under fluoroscopic guidance was not included. The PFN used in the study was titanium nail with helical blade in the neck and head of the femur. This helical blade inserted in the neck and head fragment provides rotational stability which is lacking in a DHS implant. The PFN was distally locked by a static or a dynamic locking bolt. Reaming of the canal were performed in cases were the quality of the bone was found to be good to get a good fit for the nail, whereas proximal reaming for the broader proximal part of the nail was done routinely in all cases.

The cases were DHS was used were operated by standard protocol and stainless steel wires were used in cases where trochanter was found to be involved. Surgeries done with proximal femoral locked plate were operated in a fracture table and minimal dissection was done for insertion of the side plate. A minimum of three locked screws were used in the proximal fragment with a strut screw to prevent varus collapse the fracture. For the duration of the study, no modification of protocol was done. Routine prophylaxis for DVT was given in the postoperative hospital stay period with low molecular weight heparin and continued with oral thromboprophylaxis in high risk patients for six weeks. Intraoperatively the blood loss was measured from the blood soaked swabs and the suction unit in concurrence with the anaesthetist. The position of fixation and the intraoperative complication were recorded. After operation, analgesics care and were followed by hospital standards and was equal for both the groups. Radiographs were obtained on the first postoperative day whenever possible. Postoperative stability at the fracture site was evaluated by assessing the maintenance of the intraoperative reduction, tip apex distance and implant position.

All patients were encouraged to walk partial weight bearing from the third week after the surgery and assisted by the physiotherapist. The patients were reviewed at four weeks, four months and one year after the operation.At each visit a clinical examination and standard radiographs were performed. Assessment of fracture union were performed by the treating surgeon. The fracture union was evaluated by the recognition of sealing callus on all around the cortices. The identification of callus on three cortices were considered as evidence of union. The fixation is considered as failed if the intraoperative reduction is lost, when there is more than 5 degrees of varus, cut-out of lag screw, back-out of screws or internal fixation device breakage.

III. Results

The method of anaesthesia (general or regional) did not differ between the groups, nor did the level of experience of the operating surgeon who performed the surgery. The perioperative data are given in table 2.

	Intramedullary device	Extra medullary device
Mean operating time (minutes)	60	90
Open reduction	02	06
Reduction quality		
Anatomically acceptable	20 (90.9%)	24 (85.71%)
Anatomically Poor	2 (9.09%)	4 (14.2%)
Mean blood loss (ml)	240	400

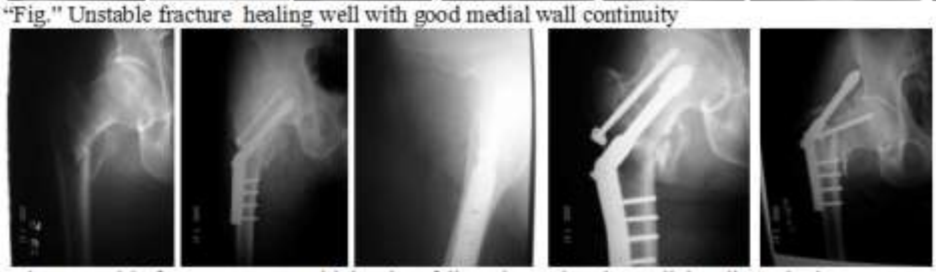
Table 2 -

A total of 60 patients were included in the study. The average follow up period was 18 months (12-36 months). All the fractures united with a mean period of 9 months. The mean intraoperative blood loss was significantly lower in patients who were treated with PFN, 240 ml compared with an average of 400ml in patients treated with DHS/Proximal femoral plates. The mean operating time and fluoroscopy time peroperatively did not differ much.The reduction of fracture was judged to be anatomical and stable in 44 patients (73.3%) based on the criteria which established prior to the assessment of these patients. The quality of reduction was termed as poor in the remaining 6 patients (10%) as the reduction was affected by the medial wall comminution which indirectly resulted in the loss of acceptable stable position of the fragments during the implant fixation. The06 fractures (37.5%)where the reduction was lost belonged to AO fracture type 31A3.3. Of these 04 were treated by extra medullary side plate fixation and 02 patients underwent PFN and all these patients required open reduction of the fracture.

"Fig." PFN Type 31-A3.1

"Fig." DHS Type 31-A2.2

"Fig." Unstable fracture healing well with good medial wall continuity



"Fig."Unstable fracture pattern with implant failure due to loss in medial wall continuity

3.1 IntraoperativeComplications

There were 08 patients who required open reduction in order to restore the medial wall integrity in type 31A3.3. The intraoperative conversion to another method of fixation was based on the integrity of lateral wall of these unstable fractures. Of these 02 patients were treated by PFN and the remaining 04 patients were treated by DHS, and the choice of implant was based on the lateral wall integrity in those patients. We did not encounter any other intraoperative difficulties. Intraoperative assessment of the fixation device showed acceptable head screw length in patients who underwent PFN and tip to apex distance (average – 23mm) in DHS.

3.3 Early Post-Operative Outcome

After the surgery the method followed for mobilization was the same in all patients. The mean duration of stay remained the same at 13 days on an average. At four months follow up 46 patients (76.6%) showed complete radiological union which was our primary end point. We encountered 05 patients who underwent DHS showing signs of impaction at the fracture site and asymptomatic lateral protrusion of the head screw. And nine patients (15%) of the patients had evidence of fixation failure where in the fracture displaced with implant cut-out from the head segment. At six months to one year follow up 51 (85%) patients showed complete radiological consolidation of the fracture.

All the patients who had implant failure were subjected to revision surgery either in form of re-osteosynthesis or arthroplasty based on the available bone quality in the femoral head.

IV. Discussion

The incidence of unstable intertrochanteric fractures have been increasing in pace with the gradually increasing human lifespan and changing lifestyle. They have become one of the most common cause for morbidity among the elderly population. Present day standard treatment of these fractures include either an intramedullary or extra medullary fixation implant construct. All these implant designs aim at retaining anatomical reduction achieved during the surgery, of these unstable fractures that will allow a stable fixation construct that will allow early weight bearing mobilisation of the patients there by reducing the morbidity associated.

In the recent years the use of proximal locking plates and proximal femoral nail for treatment of unstable intertrochanteric have been increasing owing to the insertion of implant using minimally invasive methods. The proximal femoral plates provide greater stability than other extra medullary devices like DHS because they are locking plates and allow placement of multiple screws in different angle. Recent meta-analyses 5 however shows that extra medullary system was associated with lower complication rate and some consider it to be superior to intramedullary devices. It was in concurrence that our analysis which showed uneventful radiological union of these fracture irrespective of the fixation device type and the main outcome predictor was the achievement of stable reduction and maintenance throughout the surgery.

The current study has several limitation. First, this was a retrospective study and could not present the exact rehabilitation program prescribed to or followed by the patient. We did not include the BMD, and one of the main indicators for fixation failure is the regional bone density of the proximal femur. A second limitation is the small number of fixation failures as part of the study. A prospective study with more number of patients and well planned postoperative management protocol is necessary to evaluate these unstable fracture. however

V. Conclusion

The proximal femoral nail with helical head screw provides more stability and allows for earlier weight bearing than the extra medullary devices in unstable intertrochanteric fractures of the femur. Earlyweight bearing in these unstable fractures stabilised with extra medullary devices should be allowed with caution and limited to cases where the criteria for stable reduction is fulfilled. The intramedullarydevices used in these unstable fractures require minimal surgical dissection and it also significantly reduces the operative time in these unstable fracture scenarios.

Theintraoperative blood loss was observed to be significantly less thereby reducing the need for postoperative blood transfusion.Medial wall support was the most reliable indicators of instability. The loss of lateral wall integrity peroperatively during the reaming for head screw insertion and loss medial wall support due to improper reductionhas a major impact on the implant failure rates. Further analysis into the influence of fracture characteristics on failure rates and functional outcomes is needed.

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