Research Article
Orthopaedics

COMPARATIVE EVALUATION OF CLINICAL AND RADIOLOGICAL OUTCOME OF TROCHANTERIC FRACTURE TREATED WITH DIFFERENT INTRA AND EXTRAMEDULLARY FIXATION TECHNIQUES AND INTRA AND EXTRA MEDULLARY FIXAION DEVICES

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Abstract:

Objective: To compare the clinical and radiological outcome of different Intra and Extramedullary techniques and Extra and Intramedullary fixation devices.

Methods: Of the 75 participants in this study where we compared, three groups of MIDHS (Minimally invasive DHS) , CDHS (Conventional DHS) Extramedullary fixation and Proximal femoral nailing (Intramedullary fixation). Main outcome measurements were wound size, assessment of blood loss, blood transfusion rate, pain score, operative time and ease of surgery, analgesic consumption, union rate, time to healing, postoperative mobilization of patients, bio mechanical advantages, hospital stay after surgery and complication rate.

Results: Postoperatively the MIDHS group and PFN group had significantly smaller wound size, less blood loss, lower blood transfusion rates, pain scores and rates of analgesic consumption, and higher early mobilization rates as compare to Conventional DHS group. There were no significant differences in fracture union rate, time to healing, harris hip score and complications rate between all three groups.

Conclusion: MIDHS and PFN fixation of intertrochanteric fractures is effective and safe and significantly reduces blood loss, pain and rehabilitation period, without sacrificing reduction alignment, screw position, fixation stability or bone healing as compare to conventional DHS; however intramedullary implant (PROXIMAL FEMORAL NAIL) is a better implant than extramedullary implant (DYNAMIC HIP SCREW) for unstable trochantric fractures and have good biomechanical stability.

***Key words:** Minimally invasive dynaminc hip screw with side plate(MIDHS), Dynamic hip screw fixation, Intertrochanteric fracture, Femur, PFN (PROXIMAL FEMORAL NAIL)*

Introduction

Hip fractures are a growing concern for the orthopaedic surgeons all over the world, trochanteric fractures are one of the commonest injuries sustained predominantly in elderly patients due to trivial fall and in younger individuals due to significant trauma.

Operative treatment for hip fractures was introduced in the 1950s with the expectation of improved Several implant designs have been developed in an attempt to aid fracture fixation, facilitate early ambulation and reduce the risk of complications with improved functional outcomes when treating these trochanteric fractures.[1] Functional outcome and a reduction of the complications associated with immobilization and prolonged bed rest[2].

Since then a variety of different implants had been used either extramedullary or intramedullary in nature. Treatment options for hip fracture patients depend on the location and pattern of the fracture[2].

Sliding devices like the Dynamic Hip Screw (DHS) and Intramedullary devices like the proximal femoral nail (PFN) have their own advantages & disadvantages and various meta-analysis conducted so far have come out with conflicting results regarding superiority of PFN over DHS[1].

For many years, the sliding hip screw and plate had been the gold standard in treating pertrochanteric fractures. Nowadays, there is an increasing interest in intramedullary nailing. Intramedullary devices, although technically difficult seems to have a biomechanical advantage over laterally fixed side plates. Biological advantage includes close reduction, less soft tissue dissection and comparatively less blood loss[2].

Different kind of fixation devices available for treating the intertrochanteric femur fracture but Dynamic hip screw (DHS) with barrel plate is the most commonly using device among orthopaedic surgeons, as DHS is freely available fixation device, cost effective, not technically demanding, very minimal complication and this is very much familiar surgery for most of the Orthopaedic surgeon. Wide surgical exposure is traditionally used for DHS fixation, the potential drawbacks of which are large skin incisions, considerable soft-tissue dissection, blood loss, pain and length of hospital stay[3-6].

Minimally invasive DHS (MIDHS) offers the theoretical advantages of decreased blood loss, less pain, faster rehabilitation, and of course better cosmetic results. The exposure is less invasive than the standard technique with intent to minimize blood loss, preserve the soft-tissue envelope, diminish the postoperative pain, and encourage early ambulation[7].

Our study aimed to compare different kinds of a extramedulary techniques, (minimally invasive dynamic hip screw with side plate and the conventional (open approach)) with intramedulary fixation surgical fixation technique used in fixation of trochanteric fractures (A.O. type 31-A1.1 and 31-A1.2 & 31-A2.1 and 31-A2.2)

Material and methodology

This study conducted in the department of Orthopaedics and traumatology, Gajra raja medical college and jay arogya hospital group of hospital, Gwalior, Madhyapradesh from June 2015 to April 2017.

Sample size : 75 patients with 25 patients in each group, the group A (n =25, Minimally invasive DHS group) and group B (n=25, Conventional DHS group) and group C (n=25,PFN group)

Inclusion criteria

1. Fracture with intertrochanteric femur with age group between 40 to 80 years.
2. All closed fracture with A.O. type 31-A1.1 and 31-A1.2 & 31-A2.1 and 31-A2.2
3. ASA grade 1 and 2.

Exclusion criteria

1. A.O. types 31-A1.3, 31-A2.3, 31-A3.1, 31A-3.2 and 31A-3.
2. Pathological fractures.
3. Patients not willing for surgery or Patient not medically fit for surgery.
4. ASA Grade 3, 4 and 5.

Surgical method

For **Minimally invasive DHS technique,** all patients posted for surgery, after getting medical, surgical clearance took is operation theater. After Anaesthesia (Mostly Regional or rarely general), the patient was positioned supine over the fracture table with the uninvolved limb supported, flexed, and abducted then after reduction of fracture (under IITV control in both AP and lateral views) then painting and draping done by taking all universal precautions. The image was fixed in the anteroposterior (AP) plane with an AP image of the head, neck, and proximal femur in the fluoroscopic screen. The goniometer was set at a 135-degree angle. One limb of the goniometer was kept in line with the lateral cortex of the femur on the screen and the other limb was adjusted at the center of the head and neck. This 135-degree-angled goniometer adjusted at an appropriate position would give us the position of the DHS assembly, which was marked with a temporary marker on the fluoroscopy screen . The intersection of the 2 limbs of the goniometer or the apex of the angle would be the point of entry for the guide pin in AP plane. A percutaneous guide pin was inserted verifying the point of entry under imaging, with angulation corresponding to the temporary marker line on the fluoroscopy screen. The image was then focused on the lateral plane. If the guide pin was in the correct position it was advanced up to the sub chondral area. If the guide pin was anterior or posterior in the lateral view, another guide pin was inserted with reference to the first guide pin. The final position was checked under imaging. After obtaining an acceptable position for the guide pin, a 2 to 3 cm skin incision (but never more than 3 cm) was made caudal to the guide pin. The fascia and muscles were incised up to the bone. The provisional length of the lag screw was measured. A soft-tissue protector was mounted over the guide pin and reaming was performed. The lag screw was placed up to the appropriate length and the guide pin was removed. A 4-hole barrel plate was inserted sub muscularly and a guide pin was placed from the barrel plate and aligned to enter through the lag screw under imaging. A 4.5 mm cannulated screwdriver was mounted over the guide pin to guide the barrel plate to engage the lag screw. When the barrel plate engaged the lag screw, a compression screw was inserted, but not tightened, to keep the barrel plate in position. The position of the barrel plate was checked and the first, second, and third cortical screws were inserted from the incision with minimal tissue retraction. For the distal-most cortical screw, a stab incision was made. A drill sleeve was inserted and drilled with a drill bit and the cortical screw was tightened. The traction was released and the compression screw was tightened. No drain is use,deep layers (muscle), Iliotibial band and the skin incision closure was performed in the usual fashion. sterile dressing done. No intraoperative complication occur in any of patients in our study.

In the **Conventional (standard)** technique the all the procedure is same as minimally invasive for anaesthesia and positioning of patient except skin incision and soft tissue and muscle exposure, where we used 13 to 15 cm long skin incision, soft tissue exposure done, fascia lata (Iliotibial band incised longitudinally then vastus muscle elevated by using elevator and deep tissue retractors, all small and big arterial purforators and bleeders catch with hemostat and coagulated with electrical cautery, then guide wire placed by using 135^0 angled goniometer angled guide and the DHS with side plate is fixed as described previously in Minimally invasive technique, thereafter negative suction drain is place inside soft tissue plane. blood loss calculated and closure done in layers.

For **Proximal femoral nailing,** after anaesthesia, positioning of patient done, reduction done under IITV control and checked in both AP and lateral views, Palpate the greater trochanter. Make a 3 cm incision approximately 5 to 8 cm proximal from the tip of the greater trochanter. Make a parallel incision in the fasciae of the gluteus medius and split the gluteus medius in line with the fibres Under fluoroscopic guidance, a 3.2mm pin is inserted into the tip of greater trochanter, taking care to centre it on both antero posterior and lateral views. The pin is then driven 5 cm into proximal femur. An alternative to this method is to use an awl, under fluoroscopic guidance to provide the opening. The awl should be inserted up to the point of largest outer diameter under fluoroscopic guidance and then removed.

The 9 mm end cutting reamer is used above fracture site after the position of guide wire is verified by fluoroscopy. Reaming must be carried out carefully in proximal fragment to avoid further comminution. The reaming process is continued at 0.5 mm increments until 1mm more than the selected nail size is reached and the proximal fragment entry point is widened with entry point widener. The selected nail is then assembled to jig and passed over the guide wire[14]. Now sleeves are placed in proximal hole and guide pin is inserted and the final position of guide pins is checked under image intensifier before drilling. Now the distal screw hole is drilled with 6.4 mm drill up to 5mm of subchondral bone. The length of screw to be inserted is read from calibrations on drill bit and it is tapped up to 5mm of subchondral bone and tapped with 8.0 mm tap and appropriate 8.0 mm screw is selected and inserted into the inferior hole of the nail. Now proximal screw site is drilled with 5.0 mm drill bit and tapped with cortical tap of 6.4 mm and the screw is inserted. Then the distal interlocking screw is inserted. After the fixation is over, lavage is given using normal saline. Incision closed in layers. Sterile dressing is applied over the wounds and compression bandage given.

Assessment of blood loss

- Maximum capacity of Swab-Small (10x10cm): 60ml
- Medium (30x30 cm): 140ml
- Large (45x45 cm): 350ml
- Floor spill -50 cm diameter:

500ml

Calculating blood loss in theater

1. Weigh a dry swab. 2. Weigh blood soaked swabs as soon as they are discarded and subtract their dry weight (1ml of blood weighs approximately 1gm). 3. Subtract the weight of empty suction bottles from the filled ones. 4. Estimate blood loss into surgical drapes, together with the pooled blood beneath the patient and onto the floor. 5. Note the volume of irrigation fluids, subtract this volume from the measured blood loss to estimate the final blood loss

The Actual Blood Loss is a modification of the Gross formula: ABL = BV [Hct (i) - Hct (f)]/ Hct (m) Blood Volume=Body Wt in Kgs x 70 mlkg-1 Hct (i), Hct (f) and Hct (m): the initial, final and mean (of the initial and final) Hematocrits respectively. weight Adults: 70ml/ kg body weight.

A course intravenous Antibiotics (Injection ceftriaxone 1 gram BD) given for 5 days for Minimally invasive DHS and PFN groups and 7 days for Conventional DHS group and. Then oral Antibiotics (Tablet Augmentin 625 mg BD) started afterwards till suture removal. Lastly sutures were removed on 14th day postoperatively.

Patients were followed up fortnightly in the first month, then monthly until 6 months or till clinical or radiological union is achieved. X-ray of the involved hip with femur was done to assess fracture union.

Results

Our study was a comparative randomized prospective study where 50 patients randomly divided into two groups:

Group A: n=25 (Minimally invasive DHS group)

Group B: n=25 (Conventional DHS group)

Group C: n=25(PFN group)

- The means age in group A was 63 years, in group B it was 67 years and group C, it was 59 years.
- In terms of gender in group A There were 15 male and 10 female, in group B there were 17 male and 8 female and group C there were 16 males and 9 female.
- Main mode of injury in both group was fall from height on ground ,86%, 90% and 89% in group A, group B and group C respectively. Whereas road side accidental cases 14%, 10% and 11% in group A,B and C respectively.
- Mean duration of surgery, in group A it was 34±6 minutes, in group B its was 60±8 minutes and group C it was 75±8 minutes.
- The minimal weight bearing mobilization was started just after of 1st check dressing (after 48 hours) in group A and group C whereas as in group B mobilization started after 7 days as the pain permit, the mean was 8±2 days.
- The mean duration of Partial weight bearing in group A and C,was 7±1 days whereas in group B partial weight bearing started after 14±1 days.
- The mean duration of full weight bearing in group A and 40 ±5 days wheras it was in group B, 45±8 days.
- The average amount of blood loss in group A was 50±7 ml, in group B it was 125±4 and group C,it was 80±9ml (the average(approximate amount of blood loss measure as per guideline of blood soaked gauge pieces, blood soaked mobs and spillage of blood in floor.)
- No Blood transfusion required in group A and C whereas 8 patients require blood transfusion intraoperative and 9 patients required postoperatively.
- The average visual analogue score (VAS score) in group A was 3±1, in group C, 4±1; whereas in group B it was 7±1.
- Duration of analgesics intake in group A was 8±2 days, in group C it was 10±3 days,whereas in group C it was 21+2 days.
- The average time of union in group A was 14.4 weeks,16.7 weeks in group B whereas in group C,14.7 weeks respectively.
- Infection rate, none in group A and C whereas in group B, there were 3 cases got infected
- Implant failure; not occur in group A, where in group B,3 cases need revision surgery with bone grafting because of implant failure and group C need 1 cases revision surgery because of implant failure.
- Hospital stay after surgery:

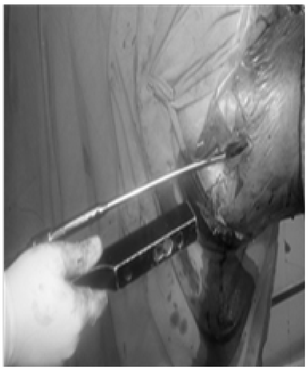
	Minimally DHS group	Conventional DHS group	PFN group
Days	3	7±1	3±2

- In term of harris hip score there is excellent to good results in all groups.

Harris Hip Score

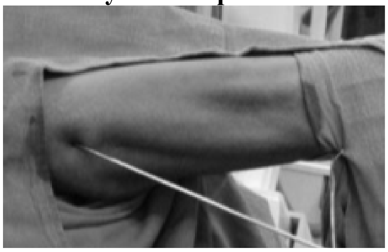
Score of Patients	Minimally DHS group	Conventional DHS group	PFN group
Good (80-89)	23	12 (40%)	22 (73.33%)
Fair (70-79)	2	12(40%)	02 (20%)
Poor (<70)	0	06 (20%)	02 (6.66%)

Operative technique for proximal femoral nailing



Pre and post operative xrays of results of Proximal femoral nailing

Operative technique for minimally invasive dynamic hip screw fixation



Percutaneous guidewire insertion. Skin incision is made once the guidewire is inserted.

Plate fixation

The skin incision closed with 4 staples

Pre and post operative xrays of results of DHS fixation

Discussion

Operative treatment in the form of internal fixation permits early rehabilitation and offers the best chance of functional recovery, and hence has become the treatment of choice for virtually all fractures in the trochanteric region.

In this study an attempt was made to evaluate by using different techniques for the fixation of trochantric fracture and compare the result in three groups.

The DHS remains the most common method for treating intertrochanteric hip fractures. DHS provides rigid fixation and allows early mobilization because it enables optimal collapse and compression of the fracture site.[8] However, successful treatment depends upon many additional factors, including the age of the patient, the time from fracture to surgery, soft-tissue handling, and the presence of concurrent medical disease.

The conventional method of DHS fixation has potential drawbacks such as large skin incision, considerable soft-tissue dissection, blood loss, and pain leading to increased hospital stay. MIDHS and PFN minimizes these drawbacks and is hence gaining popularity. Several studies of MIDHS fixation for the treatment of intertrochanteric femoral fractures have been published and their results are promising.[9–11]

If we compare extramedulary fixation with intramedulary fixation like PFN in terms of bio mechanical advantage, because the shaft fixation is nearer to the center of rotation of the hip, giving a shorter lever arm and a lower bending movement on the device . PFN, being a load sharing implant, provided a good bio mechanically stable construct It gives a bio mechanically sound fixation.

Malrotation and deformity after trochanteric fracture fixation is usually a result of improper fixation of fracture fragments in rotation at time of surgery. In fractures managed by closed intramedullary nailing, incidence of malrotation & deformity is found to be lower. The rotational stability was higher when Proximal femoral nail.

The incidence of wound infection was found to be very much lower with minimally invasive DHS and intramedullary implants like PFN with that of conventional DHS.

Intramedullary devices also acts as a buttress to prevent medialisation of the shaft and provides more efficient load transfer than does a sliding hip screw.

However, the rate of union was approximately similar in all groups. (minimally DHS,PFN & conventional DHS). But PFN is a good treatment modality in management of unstable trochantric fractures.

Minimally invasive DHS and PFN have other the advantages of closed techniques i.e. preservation of fracture hematoma in situ, minimum soft tissue dissection and periosteum stripping which helps in the fracture healing and less post-operative infections as compared to DHS which requires larger incision and extensive soft tissue dissection.

Functional and radiological status of PFN was much better than DHS in unstable type of intertrochanteric fractures.

Postoperative complications were also very less with minimally invasive DHS PFN as compared with conventional DHS.

Operative management which allows early rehabilitation and offers to the patient the best chances for functional recovery is the treatment of choice for virtually all trochanteric fractures.

Conclusion

We conclude that MIDHS technique is technically smooth, reproducible, logical, and accurate. this technique as a simple and reliable method to perform MIDHS fixation for any surgeon who wishes to insert a lag screw in proper position using a conventional side plate accurately however intramedullary implant (proximal femoral nail) is a better implant than extramedullary implant (dynamic hip screw) for unstable trochantric fractures and have good biomechanical stability.

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