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RESEARCH ARTICLE

RETROSPECTIVE STUDY OF MINIMALLY INVASIVE METHOD FOR FIXING STABLE INTERTROCHANTERIC FRACTURES WITH DYNAMIC HIP SCREW

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ABSTRACT

We compared a minimally invasive surgical technique to the conventional (open approach) surgical technique used in fixation of hip fractures with the dynamic hip screw (dhs) device. We tested following outcome measures: duration of surgery, mean difference of pre- and postoperative haemoglobin levels, post operative vas score and bony union . The minimally invasive dhs technique had significantly shorter duration of surgery and length of hospital stay. There was also less blood loss in the minimally invasive dhs technique. The minimally invasive dhs technique produces better outcome measures in the operating time, length of hospital stay, and blood loss compared to the conventional approach while maintaining equal fixation stability

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INTRODUCTION

Hip fractures are a common cause of morbidity and mortality in the elderly population and are associated with considerable health expenditure in most industrialised countries (Boufous, 2004). The dynamic hip screw (dhs) has been the standard type of fixation for intertrochanteric fractures (Bolhofner *et al*., 1999; Shah *et al*., 2003). Intertrochanteric fractures in the elderly are associated with high rates of mortality, ranging from 15 to 20%, as they are at a high risk for deep vein thrombosis (dvt), urinary tract infections, and pulmonary embolism if they fail to mobilize or ambulate early (Watson-jones *et al*., 2009). Surgical stabilization fulfills the aim of early mobilization and facilitates union in an anatomical position. Due to this, operative stabilization of these fractures is now the gold standard treatment. Although other options are available, the standard approach is to use a dynamic hip screw (dhs) with a 4-holed side plate in stable fractures in most centers (Bolhofner *et al*., 1999; Lee *et al*., 2007; Lyons *et al*., 1997).

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Traditionally a wide surgical exposure is necessary for this procedure which comes with its drawbacks like a large skin incision, considerable soft tissue trauma, significant blood loss, and pain. To avoid these problems minimally invasive surgery has been advocated recently (Alobaid *et al*., 2004; Wong *et al*., 2009). It has theoretical advantages of decreased blood loss, better cosmesis, less pain, and rapid rehabilitation. We conducted a retroprospective comparative study of minimally invasive dhs at our center to test the utility of this new approach.

Aims and objectives

This study is designed to study the outcome (functional and radiological) in management of stable intertrochanteric femur fracture by minimally invasive dynamic hip screw.

Methodology

In this study, all consecutive patients with intertrochanteric femoral fractures having stable pattern, of either sex are selected to undergofixation with the dhs. The relevant information collected from all patients including history, general and systemic examination findings. Initial radiograph

of the hip joint are conducted besides routine pre anesthetic investigations. The patients are evaluated as per the history and mode of injury. Necessary radiological investigations and hematology profile is done on admission. The intraoperative parameters required for the study will be noted from operative records. The immediate post-operative x-rays and fall in hematocrit are evaluated from the records. All the cases were again evaluated through clinical and radiological methods at suture removal 6 weeks & 12 weeks for any morbidity and mortality and datas will be collected from follow up records.

Inclusion criteria

In this study, all consecutive patients with intertrochanteric femoral fractures having stable pattern, of either sex were selected to undergo fixation with dhs.

Eligibility criteria for the patients included in the study are as follows:

- Patients with stable pattern (31A1.1 to 31A1.3) intertrochanteric fracture,
- Patients who attained stable reduction under anaesthesia

Exclusion criteria

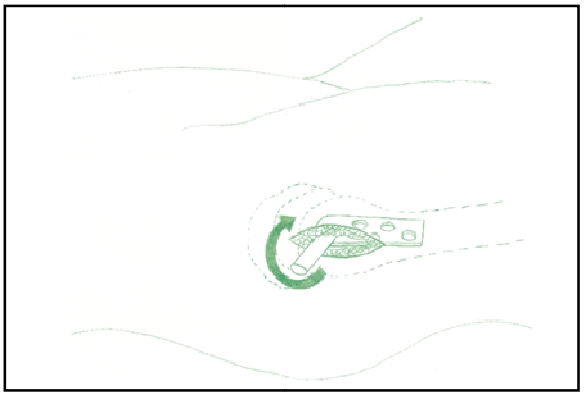
- Patients with compound or pathological fractures.
- Patients admitted for re-operation.
- Patients whose reduction is not achieved after anaesthesia.
- Patients with old fracture.
- Patients with severe obesity(bmi more than 30).
- Patients with other fractures in same extremity.

Description of procedures

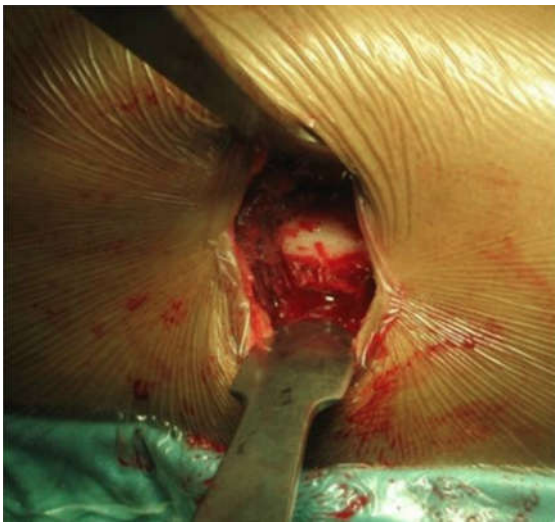
All patients are positioned supine on a fracture table. The unaffected lower limb is flexed and abducted to allow easy access for the image intensifier.

Reduction

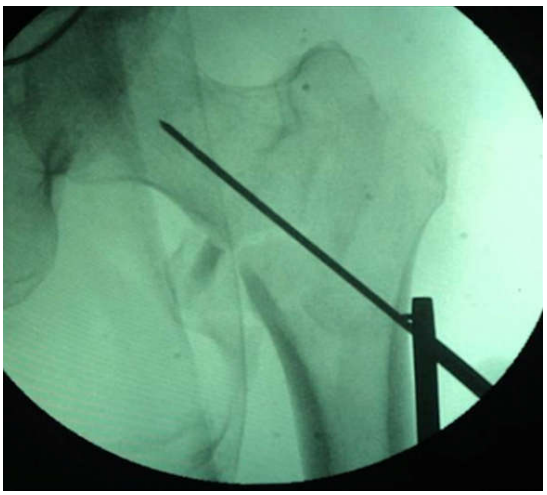
The fracture is reduced by traction in neutral, slight internal rotation and checked by anteroposterior and lateral views on the image intensifier. All fractures are reduced by the closed method. The objective of reduction is to confer weight bearing stability and correct varus and rotational deformities. In stable fractures this is achieved by reduction of the calcar femorale. All patients in this study had adequate closed reduction (anatomical to 10° of valgus on antero-posterior radiograph and anatomical on lateral) prior to the start of surgery. The incision is placed under fluoroscopic guidance by identification of the site on the hip that corresponds to the position of the fractured neck of femur. The size of the incision is no longer than 5 cm. The iliotibial band and muscle are split in one incision with the scalpel blade. After the insertion of a guide wire, reaming is carried out through this incision. After this barrel plate was also introduced through the same incision, turning the barrel from 180° to 90° as shown in figure. The guide wire was then reintroduced through the side plate barrel and then rotated until the side plate lied suitably under the soft tissues. The guide wire was then passed through the lag screw under c arm guidance. The barrel was then engaged in the lag screw and advanced in the conventional fashion. The side plate screws were then placed in the usual manner through side plate holes by retracting the skin and subcutaneous tissue with a right angled soft tissue retractor. A drain was used according to surgeon's preference. The deep layers and the skin incision were closed in the usual fashion.



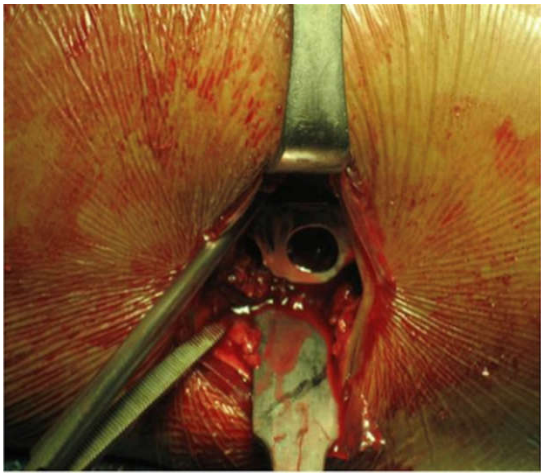
Technique of plate insertion



Mini incision for guide wire entry



Insertion of guide wire with help of fluoroscopy



Reaming with help of sleeve

Patient assessment and follow up

Intraoperative parameters like total blood loss, surgical time and immediate post operative fall in hematocrit are noted from records. Radiographs were obtained on the first day, or immediately after surgery. Follow-up evaluations consisting of clinical examination, radiographs, are performed at suture removal, 6 weeks and 12 weeks and the datas are collected from follow up records.

Observation and results

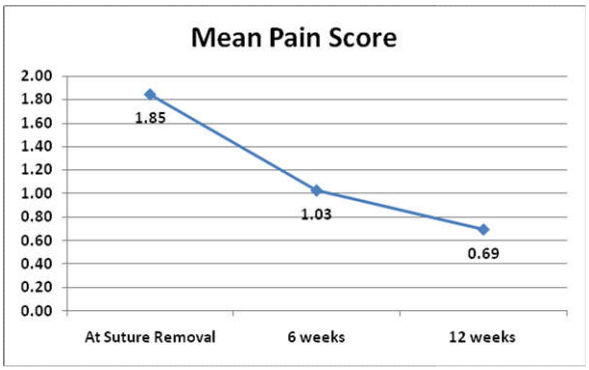
Age group (yrs)	N	%
</= 40	1	2.5%
41-60	21	52.5%
61-80	18	45.0%
Total	40	100.0%
Mean age - 60.7 +/- 9.6 years		

Agewise distribution of study subject

Variable	Mean	Min.	Max.
Duration of surgery (hrs)	1.1	0.42	2.1
Fall in hct (gm%)	1.19	0.48	2.00
Blood loss (ml)	137.82	64.97	350.00

Pain score

Pain score	N	Mean	Sd	P-value
At suture removal	40	1.85	0.49	< 0.001
6 weeks	40	1.03	0.49	
12 weeks	40	0.69	0.47	



Mean stay at hospital- 6.3 days

Radiological signs of union		
Radiological signs of union	N	%
At suture removal	0	0.0%
6 weeks	22	55.0%
12 weeks	40	100.0%

DISCUSSION

Intertrochanteric fractures are very common fractures encountered in orthopaedic practice. Insertion of a conventional dynamic hip screw and barrel plate requires an incision of about 10 to 15 cm. This is associated with considerable tissue dissection and damage, along with excessive bleeding. Reduction in operative time and blood loss is desirable especially in the elderly demographic group in which these fractures are seen. These geriatric patients have a poor cardiopulmonary reserve and can easily undergo decompensation even with minimal blood loss. Lesser operative time also is associated with decreased exposure to the anaesthetic agents that might profound side effects in the geriatric age group. Minimally invasive surgery is associated with lesser surgical time, less hemorrhage and quicker surgery and therefore may be associated with better results. In the minimally invasive dynamic hip screw technique, a 3–5 cm incision is made, and the incision point is approximately 4 cm below the vastus lateralis ridge. Therefore, blood loss decreases due to less soft tissue dissection and less fracture exposure and because an incision is made in the safe vascular zone. Because decreased blood loss is thought to be an explanation of reduced cardiovascular complications, which decrease the need for blood transfusion, this may have great clinical significance.

In a prospective study by zhang *et al.* surgical incision length averaged (8.0+/-1.2) cm, peri-operative bleeding averaged (150.0+/-6.4) ml, time from extending the incision in the operation to close incision averaged (22.0+/-1.3) min, 1 case had postoperative rupture of the external wall, and 3 cases had tension screw cut out in the femoral head,4 cases had excessive shrink back. The mean blood loss in our group using the minimally invasive technique was about 138 ml with a standard deviation of 65 ml. The mean fall in hematoctit was 1.19 gm% with a standard deviation of 0.63GM%. The mean duration of the surgery was 1.1 hours. In a prospective study by Yih-Shiunn Lee (Yih-Shiunn Lee *et al*., 2007) patients were divided into 2 groups i.e. minimally invasive (MIDHS)and conventional (CDHS) method for fixation. All fractures healed within six months. Differences in healing time between the two groups were not significant (p=0.38). All the fractures in the MIDHS group and the CDHS group had adequate reduction. The adequate reduction rates showed no difference (p=1.0) between the two groups. Differences in the rate of adequate screw position, surgery time between the two groups were not significant (p=0.69). The average incision length showed significantly smaller (p< 0.001) in the MIDHS group (3.0±0.21 cm) when compared to the CDHS group (9.5±2.61 cm). The average haemoglobin level drop showed significantly less (P< 0.001) in the MIDHS group (13.8±1.9 g/L) when compared to the CDHS group (24.2±3.6 g/L). The blood transfusion rate was significantly higher in conventional group, with longer

hospital stay. Post operative VAS score did not significantly differ between the two groups on the first two postoperative days (p=0.25, p=0.21, respectively). However, patients in the MIDHS group had lower pain scores on days three and four when compared to the CDHS group.

In a study by A. Mahmood drain output and decrease in haemoglobin level were not significantly different in the 2 groups. Patients undergoing minimally invasive DHS also had a shorter duration of hospital stay and all fractures united within 4 months. In prospective study by Michael Ho & Giorgio Garau (2009) e. the minimally invasive DHS technique had significantly shorter duration of surgery and length of hospital stay. There was also less blood loss in the minimally invasive DHS technique. The minimally invasive DHS technique produces better outcome measures in the operating time, length of hospital stay, and blood loss compared to the conventional approach while maintaining equal fixation stability. Difference in pre- and post-op Hb levels (g/dl) was 1.18 ± 1.0 (mean ± S.D.), Length of hospital stay (days) 13.5 ± 11.0, Duration of surgery (min) 39 ± 10.6.

In a study by Wang (2009) the MIDHS group had significantly smaller wound size, shorter surgery time, less blood loss, lower blood transfusion rate, earlier active mobilization of fractured hip joint, shorter hospital stay, lower serious complication rate and higher Harris hip score than the CDHS group (all $P < 0.05$). The satisfactory reduction, adequate screw position, healing time and union rate was not significantly difference between two groups (all $P > 0.05$). This study being a retrospective study, we have not been able to prospectively evaluate the difference between the minimally invasive and standard technique. Also comparison with cephalomedullary nailing system could not be done and this is possible weakness of this study.

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