Minimally Invasive Dynamic Hip Screw for Fixation of Stable Intertrochanteric Fractures of The Femur

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ABSTRACT

Objective: To determine outcome of minimal invasive dynamic hip screw procedure for fixation of stable intertrochanteric fractures of the femur.

Methodology: A total of 40 patients with closed stable intertrochanteric femur fractures (AO type A1.1 to A2.1) were operated with MIDHS technique. Reduction of postoperative haemoglobin and haematocrit, pain score, theatre time, length of hospital stay, evidence of wound infection, hip screw position and tip apex distance were studied.

Results: Of 40 patients, 22 (55%) were female and 18 (45%) were male. 14 (35%) had left hip while 26 (65%) had right hip involvement. Mean age at the time of surgery was 54.5 years. Based on AO classification: 12 had A1.1, 17 had A1.2 and 11 had A2.1. Mean reduction of post-operative hemoglobin was 1.2g/dl and haematocrit was 0.07. The mean post-operative pain score was 2.8 (using Visual Analogue Scale). The mean duration of surgery was 38.6 minutes and mean time to discharge from hospital after surgery was 4.3 days. We had no instances of postoperative haematoma or infection, malalignmnent of lag screws position of the operated limb in any of the patients.

Conclusion: The MIDHS fixation of intertrochanteric fractures in our view is a surgical esthetic procedure; it involves minimal bleeding, less post-operative pain, shorter duration of surgery and length of hospital stay without sacrificing reduction, alignment, screw position and fixation stability.

Additionally, the technique is performed using a standard dynamic hip screw set and requires no additional equipment.

Key Words: Intertrochanteric fracture, Minimal invasive surgery, dynamic hip screw.

INTRODUCTION

The intertrochanteric femur fractures are among the most common injuries necessitating hospital admission to an orthopaedic trauma ward and for this indication, dynamic hip screw (DHS) with a side plate has been the gold standard and the most commonly used device in most centers[1-8]. However, the disadvantages of DHS techniques are a large skin incision and an extensive soft tissue dissection, dividing the vastus lateralis muscle for at least 10 cm, so it may be associated with significant blood loss and tissue damage that may worsen patients' status[5,6]. These complications do not necessarily prevent fracture repair, but the pain caused by weight-bearing may delay the patient's short-term mobilization and recovery. Because of these drawback, the concept of Minimally invasive DHS (MIDHS) has gained in popularity in modern traumatology, as it is associated with lower blood loss, better cosmetic results, less post-operative pain and potentially, a lower risk of post-surgical morbidity with faster functional recovery. These factors are particularly important for elderly patients to allow early weight-bearing and reduce related complications[1].

Recently several authors have reported in international literature on their application of MIS in DHS fixation for intertrochanteric femoral fracture, However in our setup, where we are also treating intertrochanteric femur fractures in substantial number, nevertheless no such specific study has been done. Hence to introduce the technique of minimal invasive DHS for fixation of stable intertrochanteric fractures of the femur and to determine its outcome, the current study is being undertaken.

METHODOLOGY

Subject:

This is a prospective case series study conducted at Civil Hospital Karachi during the period from January 2014 to December 2014. In this study, a total of 40 patients with closed stable intertrochanteric femur

fractures (Arbeitsgemeinschaft für Osteosynthesefragen (AO) type A1.1 to A2.1)[9,10] operated upon by one surgeon with MIDHS technique were selected for assessment of outcome. Patients with polytrauma, pathological fracture, compound fracture, fractures sustained more than 3 weeks before presentation, failed closed reduction on fracture table, or requiring open reduction were excluded from the study.

Surgical Procedure & Post-operative Management:

After a careful history and examination of injured limb, antero-posterior and lateral radiographs were taken, and skin traction was applied to relieve pain. The operative procedure and its advantages were explained in detail to each patient and informed consent was obtained. All patients underwent Minimal invasive DHS with 4-hole side plate once they were deemed medically stable. The operation was done under general or spinal anesthesia in the supine position on a radiolucent traction table. All fractures were reduced by closed manipulation under c arm guidance prior to the start of operation. Skin preparation and draping were performed as normal. The 135^0 DHS 4-hole plate was put along the anterior aspect of the thigh and on the lateral femoral cortex on AP view and barrel passing through it was centered over the femoral neck and head as shown in figure 1. The first hole and the third hole of plate were marked over the lateral side of the thigh showing site of incision. An incision of 3 cm long was made from first hole mark to third hole mark distally along the lateral thigh. The fascia lata and vastus lateralis were incised by diathermy to minimize blood loss. A periosteal elevator was inserted moving distally to ensure a gap between the vastus lateralis and femoral shaft. The guide wire was introduced along the wound into the trochanteric region through the fracture site. Check radiograph in both AP and Lat views was taken to ascertain the wire position. The length of the guide wire was then measured. As the triple reamer carried the risk of soft tissue damage, a triple reamer sleeve was made by modifying proctoscope was used to act as a soft tissue protector.
It was placed over the guide wire and headed downward onto the femur. The reamer was then introduced through it and contained within the modified sleeves (figure 2).

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The lag screw was then inserted after tapping and the guide wire was removed. Four hole barrel plate was inserted submuscularly in such a way that barrel faces laterally (figure 3). After inserting the plate it was turned 180 degree and introduced over lag screw. The guide wire was then reinserted through the side plate barrel and aligned to enter through the lag screw under c arm guidance (figure 4). The barrel was then engaged in the lag screw and advanced in the usual fashion. A compression screw was inserted, but not tightened, to keep the barrel plate in position. The four transverse cortical screws were then inserted in the normal manner through side plate holes with the aid of a soft tissue retractor. The proximal three were usually directly opposite the incision. The bottom hole may need drilling obliquely. The traction was released and the compression screw was tightened. The wound was closed in layers in the usual fashion.

Rehabilitation Protocol and Outcome Assessment

All the patients had received prophylactic intravenous antibiotics for 2 days, followed by oral antibiotic for further 5 days to prevent infection. Low molecular weight heparin was also given to prevent deep venous thrombosis in the affected limb in elderly patients. Depending on the general status of the patient, supervised therapy for sitting, standing and toe touch ambulation with a walker was begun from the first post-operative day, followed by partial weight bearing after 3 to 4 weeks and full weight bearing ambulation after 3 months duration of achieving union. Sutures were removed in two weeks.

Preoperative and postoperative clinical details were recorded for all the cases. In particular, we also analysed the difference between pre- and postoperative haemoglobin concentration and haematocrit, which is indicator of blood loss, pain evaluation (using a 10-point Visual Analogue Scale, VAS), theatre time, length of hospital stay and evidence of wound infection. This study does not asses the post-operative mobility of the patients due to the variety of co-morbidity in a relatively small patient group, which would confound the results.

AP and Lat radiograghs were obtained immediately postoperatively in all cases, for assessing the position of the lag screw of the DHS device in the femoral head[11,12] and tip apex distance to ascertain the accuracy for implant fixation[13].

RESULTS

Of 40 patients, 22 (55%) were female and 18 (45%) were male. 14 (35%) had left hip while 26 (65%) had right hip involvement. Mean age at the time of surgery was 54.5 years (range 25 - 85 years). Out of 40, 28 (70%) had a history of simple fall, generally at home. Based on AO classification: 12 had A1.1, 17 had A1.2 and 11 had A2.1. Mean time from injury to surgery was 8.8 days (0-21 days). In 80% of cases, spinal anaesthesia was given. The mean post-operative drop in hemoglobin concentration was 1.2g/dl (range 0.6 – 2.4g/dl) and the mean haematocrit drop was 0.07 (range 0 – 0.12). The mean post-operative pain score was calculated to be 2.8 (using a 10-point Visual Analogue Scale, VAS. The mean duration of surgery was 38.6 minutes from skin to skin (range 25 – 65 minutes) and mean time to discharge from hospital after surgery was 4.3 days (range 3 – 11 days). Ambulation was delayed in 9 patients due to generalized weakness. The remaining 31 patients were discharged on toe touch ambulation with walker support. We had no instances of postoperative haematoma or infection, mal-alignment of lag screws position of the operated limb in any of the patients. The mean tip – apex distance was 20 mm (range 18 – 25).

Fig. 1: Marking made on skin under C-arm

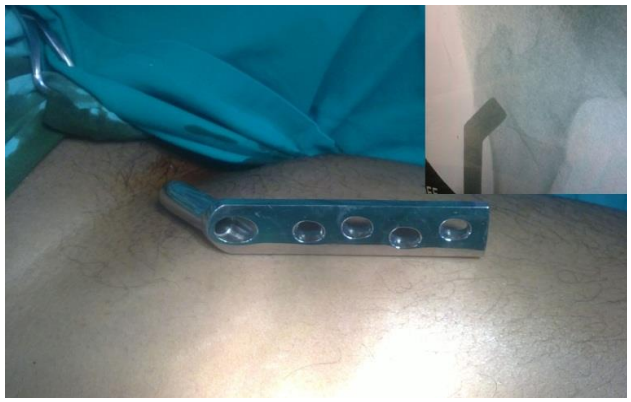

Fig. 2: Triple reamer sleeve made up by modifying protoscope

Fig. 3: Side plate placed with barrel at 180^0 of rotation, then turned to 90^0 of rotation.

Fig. 4: Guide-wire reinserted through the barrel to help in coupling the plate to the screw

Fig. 5: Skin incision closed with 2 matress sutures.

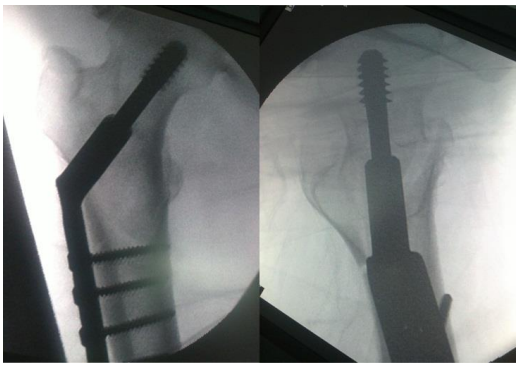

Fig. 6: Postoperative final image under c-arm

DISCUSSION

Minimally invasive dynamic hip screw for fixation of stable intertrochanteric fractures of the femur is becoming more and more common in modern traumatology. This procedure is performed through tiny incision instead of one large opening. Because the incision is small, patients tend to have quicker recovery times and less discomfort than with traditional invasive procedure while maintaining equal fracture stability.

Recently, several authors have reported its outcome and indicated significant advantages in comparison with traditional invasive procedure[1,5.14.15.16].

Pandey BK et al[17] reported a series of 25 cases of stable intertrochanteric fractures of femur treated with minimal incision and a 4 -hole plate and observed, lower consumption of opiates, less blood loss and shorter hospital stay. This is further supported by Waters TS et al[18]; in a small study of 13 cases, they observed less blood loss and decreased length of hospital stay in cases of minimal invasive technique of DHS. Wong TC et al[19] evaluated the results of MIDHS versus Conventional DHS in 66 patients and reported significantly reduced blood loss, pain and rehabilitation period without sacrificing reduction alignment, screw position, fixation stability or bone healing.

Michael HO et[20] al also reported the similar findings, who compared MIDHS for fixation of hip fractures with conventional DHS technique in 88 cases and observed shorter duration of surgery and length of hospital stay as well as intraoperative blood loss without compromising the stability of fracture fixation. Mahmood A et al[21] compared the results of the MIDHS to the CDHS in 60 consecutive patients and noted decreased blood loss, less postoperative pain along with a quicker rehabilitation time and shorter hospital stay.

In our study, we also found similar findings; we observed decrease haemoglobin concentration and haematocrit drop, which is indicator of blood loss, decrease postoperative pain (using a 10-point Visual Analogue Scale, VAS), shorter duration of surgery and length of hospital stay. We had no instances of postoperative haematoma or infection, malalignmnent of lag screws position of the operated limb in any of the patients.

Clinical studies for the two-hole side-plate were published in 1999 by Bolhofner et al[22]. and in 2004 by DiPaola et al[23] They reported good clinical outcomes, shorter operating time, less blood loss and fewer blood transfusions without failure of the fixation. In our study, all fractures were fixed with 4 - hole side plate without affecting the wound size.

Advanced age and osteoporosis[24,25] are the major risk factor for implant failure thus we inferred that a four-hole side plate would provide a greater pull-out strength, in particular before the fracture united, and would be beneficial for these osteoporotic fractures in elderly patients.

CONCLUSION

The MIDHS fixation of intertrochanteric fractures in our view is a surgical esthetic procedure; it involves minimal bleeding, less post-operative pain, shorter duration of surgery and length of hospital stay without sacrificing reduction alignment, screw position and fixation stability.

Moreover, it offers significant benefits during the immediate postoperative period, since it involves less pain and mobility is resumed sooner.

Additionlly, the technique is performed using a standard dynamic hip screw set and requires no additional equipment.

Despite the limitations of this study, including its non-comparative design and short follow-up period, we believe that it would contribute to the evaluation of benefits expected from the MIDHS for surgeons treating intertrochanteric fractures of femur.

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