A COMPARATIVE STUDY OF FIXATION OF FRACTURE INTERTROCHANTERIC FEMUR WITH D.H.S. BY M.I.S. VERSUS CONVENTIONAL MUSCLE REFLECTION SURGICAL APPROACH

Dhakad R.K.S.* **Kapoor A.**** **Gupta S.*****

ABSTRACT

Background: Hip fractures are a common cause of morbidity and mortality and are associated with considerable health expenditure. The dynamic hip screw (DHS) has been the standard type of fixation for intertrochanteric fractures. We have used a prospective study design to ascertain the short/long-term safety and effectiveness of a standardised DHS device inserted using a minimally invasive technique compared with the same implant inserted in a traditional fashion to manage fracture intertrochanteric femur.

Materials and Methods: In the period June 2011 to June 2012, all patients admitted in orthopaedic ward of Jayarogya Group of Hospitals with fracture intertrochanteric femur needing surgical fixation, were evaluated with inclusion/exclusion criterion.They were assigned randomly in minimally invasive DHS approach or a conventional open/muscle reflection approach group and evaluated for following outcome measures: duration of surgery, intraoperative blood loss, drain use/output, requirement of blood transfusion intra/postoperatively, analgesic intake, length of hospital stay, rate of infection, time to mobilisation and weight bearing postoperatively & overall functional outcome.

Conclusion: Minimally invasive surgical techniques, as a whole, reduce operative complications and postoperative morbidity. Our study shows that, when compared with the conventional approach in the implantation of the DHS device, the minimally invasive surgical technique described here resulted in shorter duration of surgery and length of hospital stay, as well as less intraoperative blood loss. This is accomplished without compromising the stability of fracture fixation

Keywords: fracture intertrochanteric femur, dynamic hip screw and barrel plate, conventional muscle reflection approach, minimal invasive approach.

INTRODUCTION

Hip fractures are a common cause of morbidity and mortality in the elderly population and are associated with considerable health expenditure in most developing countries.[4] The dynamic hip screw (DHS) has been the standard type of fixation for intertrochanteric fractures.[3,20] In the attempt to find less invasive techniques to simplify surgery and minimise complications by reducing surgical time and blood loss,[1] some authors used custom made implants[11] or new devices which require the purchase of additional armamentarium by the hospital.[5] We have used a prospective study design to ascertain the short/long-term safety and effectiveness of a standardised DHS device inserted using a minimally invasive technique compared with the same implant inserted in a traditional fashion to

* Asso. Professor
** A.D.M.O., N.R.C.H, N.R
*** Proffesor and Head

Address for correspondence:
Dr. R.K.S. Dhakad
Asso.Professor
Department of Orthopaedics,
G.R. Medical College, Gwalior

manage fracture intertrochanteric femur A.O. type 31-A1.1 and 31-A1.2 & 31-A2.1 and 31-A2.2.

We have compared/evaluated a minimally invasive surgical technique to the conventional (open/muscle reflection approach) surgical technique used in fixation of hip fractures with the dynamic hip screw (DHS) device. Using a case-control design with prospective inclusion of patients, we test the null hypothesis that there is no difference between the two techniques in the following outcome measures: duration of surgery, intraoperative blood loss, requirement of blood transfusion intra/ postoperatively, analgesic intake, length of hospital stay, duration of antibiotic intake, rate of infection, time to mobilisation and weight bearing postoperatively & overall functional outcome.

The minimally invasive DHS technique has significantly shorter duration of surgery and length of hospital stay in previous done studies. There is 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.

MATERIAL AND METHODS

The present study is being carried out in the Department of Orthopaedics, G.R. Medical College & Jay Arogya Group of Hospitals, Gwalior, M.P.

The study includes patients with fractures intertrochanteric femur presenting at the Casualty Department of Jay Arogya Group of Hospitals, Gwalior from June 2011 to June 2012.

PATIENTS

In the period June 2011 to June 2012, all patients admitted in orthopaedic ward of Jay Arogya Group Of Hospitals with fracture intertrochanteric femur needing surgical fixation, has been evaluated with inclusion/exclusion criterion. All minimal invasive operations were performed by a single, fully trained orthopaedic surgeon (RKS) with a special interest in the procedure. The patients represented the whole cohort of patients with extracapsular hip fractures operated on by that surgeon in the period of study. Patients who received a conventional DHS were operated on by fully trained orthopaedic surgeons in the same period. The patients werenotpreselected for the procedure and were part of a cohort of patients with extracapsular hip fractures operated on by those surgeons in the period between June 2011 to June 2012. Each patient within the 'minimally invasive DHS' group were matched, according to their sex, age, ASA grade, and fracture type according to the AO classification, to a patient who had their hip fracture fixed with a DHS placed through the conventional muscle reflection approach.

We test the null hypothesis that there is no difference between a minimally invasive DHS approach or a conventional (open/muscle reflection approach) procedure DHS approach in the following outcome measures:duration of surgery, intraoperative blood loss, drain use/output, requirement of blood transfusion intra/ postoperatively, mean difference of pre- and postoperative haemoglobin levels, analgesic intake, length of hospital stay, duration of antibiotic intake, rate of infection, time to mobilisation and weight bearing postoperatively & overall functional outcome.

1. Inclusion Criterion:

1. More than 16 year old, i.e. skeletally mature
2. A.O. type 31-A1.1, 31-A1.2, 31-A2.1, 31-A2.2
3. Closed Fractures
4. Multi-system & Multi-skeletal trauma
5. ASA Grade 1 & 2.

2. Exclusion Criterion:

1. A.O. types 31-A1.3, 31-A2.3, 31-A3.1, 31A-3.2, & 31A-3.
2. Pathological fractures
3. Patient not giving consent for surgery
4. Patient not medically fit for surgery
5. ASA Grade 3, 4, & 5.

MINIMALLY INVASIVE SURGICAL TECHNIQUE

All patients in this study had adequate closed reduction (anatomical to 10° of valgus on antero-posterior radiograph nd 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 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.[1] After the insertion of a guide wire, reaming is carried out through this incision. The standard AO screw and side plates are introduced through the small incision under fluoroscopic guidance. The side plate is then placed over the guide wire as in the conventional technique and then rotated until it lies under the skin and fascia. The side plate screws are placed in the usual manner by retracting the skin and subcutaneous tissue with a right angle retractor. No drain is used, and deep layers and the skin incision closure are performed in the usual fashion. Final fluoroscopy views are taken as in any other conventional side plate fixation technique.

CONVENTIONAL MUSCLE REFLECTION TECHNIQUE

All the operations in a given centre were performed by fully trained orthopaedic surgeons. Through a skin incision 15 cm long, the fascia lata is incised longitudinally. The vastus lateralis muscle is split under direct vision.[12] A dissector is then used to gently sweep the musculature off the intermuscular septum to allow identification and electro-coagulation of the perforators from posterior to anterior. Following fixation of the fracture in the standard fashion, a drain is placed and the incision is closed in layers.

OUTCOME MEASURES AND STATISTICAL ANALYSIS

Demographic data for both case and control groups of patients were collected. Descriptive statistics for ASA grade and type of anaesthesia were determined. Nonparametric outcome measure were compared like length of time from admission to operation, duration of surgery, time to mobilisation and weight bearing postoperatively, and length of hospital stay. In both groups, bleeding was measured by the summation of the blood collected from a plastic bag taped to the surgical drapes, below the operative field, and from the weighed swabs. Herris hip score was used as outcome measure evaluation.

The location of the tip of the DHS screw in the femoral head was recorded as defined previously.[12] The tip-apex distance[2] was also measured. Antero-posterior and lateral postoperative radiographs were viewed to obtain these two measurements. The mean difference of pre- and postoperative Hb levels and the tip-apex distance was compared using the independent two-tailed t test (95% confidence interval for difference between The fluoroscopic images for both groups of patients were assessed as an means) for parametric data.

RESULTS

PATIENTS

Forty-four patients constituted the minimally invasive DHS group. They were matched with 44 patients in the conventional DHS groups according to the matching criteria described above (Table 1).

Table 1
Demographic data for the minimally invasive DHS and conventional DHS groups

	MIS Group	Conventional Group
Mean Age	69.5+/-9.7	70.5+/-0.1
Range	59-97	60-94
Gender		
Male	10 (23%)	10 (23%)
Female	34 (77%)	34 (77%)
Source of Admission		
Trauma Centre	36 (82%)	23 (62%)
OPD	8 (18%)	21 (41%)

Patients received routine antibiotic prophylaxis with 1.5g of cefuroxime given intravenously on induction of anaesthesia.

In the 24 patients in the conventional DHS group who had drains inserted after surgery, these were removed 24-48 hours after surgery. Drains were not used in the minimally invasive DHS group. All the patients in both cohorts had the same postoperative rehabilitative regime, starting mobilisation and weight bearing within 24 hours of surgery unless specified otherwise by the surgeon. The difference of the median duration of surgery and median length of hospital stay were statistically significant between the two groups of patients. These outcome measures were more favourable in the minimally invasive group than the conventional DHS group. The mean difference of preoperative and postoperative Hb levels was lower in the minimally DHS group when compared to the conventional DHS group, but this was found to be not significant statistically. The mean tip-apex distance in both groups of patients was similar. One patient in the minimally invasive DHS group and two patients in the conventional DHS group had tip-apex distances of more than 27 mm. Table 2 shows the summary of statistical data from the outcome measures outlined above and the amount of postoperative analgesia used.

Table 2
Statistical data from outcome measures

	MIS Group		Conventional Group	
	Median	**Mean**	**Median**	**Mean**
Interval between admission to surgery (Days)	1	1.4+/-1.5	1	3.2=/-2.2
Duration of surgery (Min)	42	30+/ -10.6	60	53.5+/ -17.7
Time from surgery to mobilisation (Days)	1	1.3+/ -0.4	1	2.4+/ -2
Time from surgery to weight bearing	2	2.2+/ -1.4	2	2.4+/ -2

The distribution of the location of the tip of the screw in the femoral head was similar in both groups (Table 3).

Table 3
Position of DHS screw in the femoral head

	Anterior	**Central**	**Posterior**	**Total**
MIS Group				
Superior	5	27	2	34
Middle	5	5	0	10
Inferior	0	0	0	0
Total	**10**	**32**	**2**	**44**
Conventional Group				
Superior	10	27	2	30
Middle	0	2	3	5
Inferior	0	0	0	0
Total	**10**	**29**	**5**	**44**

COMPLICATIONS

Five patients from the conventional DHS group required transfusion of two units of blood each due to perioperative blood loss. A transfusion threshold of 9 g/dL of haemoglobin was used as an indication for transfusion. Two patients from the minimally invasive DHS group had dehiscence of the wound site. This was managed by dressing of the wound, which healed uneventfully. In the conventional DHS group, four patients developed infection of the surgical wound which required treatment with systemic antibiotics and wound dressing.

In one patient in the minimally invasive DHS group, a two-hole side plate pulled out of the femoral shaft five weeks after the index operation. It was replaced with a four-hole side plate extending the original wound to a length of 6 cm, with no adverse effect.

DISCUSSION

In this study, 94% (83/88 patients) of the

fractures in both the minimally invasive and conventional DHS surgery groups healed without any complication. In this respect, both techniques of fixation of hip fractures worked well. There was no difference in the following outcome measures when the two groups of patients were compared: time from surgery to mobilisation and weight bearing postoperatively, position of the lag screw of the DHS device in the femoral head and the tip-apex distance. On the other hand, there were significant differences in the duration of surgery and length of hospital stay between the two cohorts of patients. Although the mean differences of pre- and postoperative haemoglobin levels between the two groups were not significant statistically, clinically this may have great significance, as five patients in the conventional DHS group required blood transfusion postoperatively while none of the patients in the minimally invasive DHS group required any blood transfusion. The minimally invasive DHS requires less operating time, reduces the amount of intraoperative blood loss, and allows patients to be discharged earlier. This may carry benefit to the patients, and has significant financial implications to the patient as well as to hospital.[7,9,10,14,18,19,21]

The percutaneous compression plate (PCCP) is a new implant for the minimally invasive treatment of pertrochanteric hip fractures.[5] The PCCP seems to be similar to the DHS in relation to bone and stability, but has significant advantages for blood loss, soft tissue healing, and operation time.[5] While the results were promising, the economic and logistical disadvantage caused by the need to increase hospital inventory and the learning curve involved in familiarising oneself with the new equipment offsets its perceived advantage. On the other hand, the minimally invasive DHS technique uses the existing instruments with which the operating team is familiar and confident, with no need to purchase new instruments. This and other studies[1-8] have shown that the same advantages can be gained by modifying the surgical approach while using existing fixation devices, thus requiring neither a new plating system nor training of operating theatre staff to familiarise with them.

The type of DHS device used in both the minimally invasive surgical and conventional approaches were mainly four-hole side plates, but the choice of the length of the side plate was left to the individual surgeons. Biomechanical studies demonstrated equivalent peak load to failure results when comparing the two- and four-hole DHS plates.[15] In recent studies,[13,22] stable pertrochanteric fractures (AO classification 31-A1 and 31-A2) had successful fixation with two-hole DHS. It is possible that the widespread use of four-hole side plate DHS in stable pertrochanteric fractures is merely based on tradition, and needs reconsideration in this era of evidence-based medicine. Therefore, using the two-hole DHS may be at least as safe as the four-hole DHS, as the surgical exposure required will be smaller. It may be economical financially and in the use of operating time. In osteporotic bone, though, it may be safer to use longer side plates.

Recent studies using robust research methodology have ascertained the safety of limited access hip fracture surgery, and have demonstrated that it is associated with decreased bleeding and postoperative pain, reduced postoperative morbidity, and faster recovery of function.[17] Our results confirm these findings.

CONCLUSIONS

Minimally invasive surgical techniques, as a whole, reduce operative complications and postoperative morbidity.[5] Our study shows that, when compared with the conventional approach in the implantation of the DHS device, the minimally invasive surgical technique described here resulted in shorter duration of surgery and length of hospital stay, as well as less intraoperative blood loss. This is accomplished without compromising the stability of fracture fixation.

STRENGTHS AND LIMITATIONS

There are limitations to this study. For example, this is a case control study; therefore,

several variables could not be accounted for and may produce differences in outcome. This is true, for example, for the choice of anaesthesia. In the minimally invasive DHS group, few patients received general anaesthesia. However, as spinal and epidural anaesthesia produce less blood loss than general anaesthesia,[16] the differences found in this investigation are even more remarkable.

This is a short term investigation. But the same study is still very much on to see the long term outcome of the same and we are confident that we are unlikely to have produced adverse effects on our patients undergoing minimally invasive DHS fixation

IMPLICATIONS FOR FUTURE RESEARCH

If this investigation is being performed even at larger scale and more importantly, involving long term follow up and outcome, it can radically change the standard approach as well as traditional way to treat fracture intertrochanteric femur , once results of the same come affirmative.

PREVIOUS LITERATURE

The results of this study are comparable with the results of a randomised controlled trial[1] where a prospective, surgeon-randomised, blinded-outcome clinical study comparing the use of the standard DHS device in a minimally invasive and conventional surgical approach was carried out. The minimally invasive technique group of patients had significantly less blood loss and shorter operating time

There have been some other studies at different parts of world on the same topic as being cited in references[23,24] and almost all suggest similar outcome/conclusion as of this study.

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