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Management of stable intertrochanteric fractures with minimally invasive dynamic hip screw

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ABSTRACT

Background: Trochanteric fracture is the commonest fracture which accounts to 90 % of the fractures in patients over 50 years. The aim of the treatment is to prevent malunion and early mobilization with ambulation which is accomplished by dynamic hip screw and sliding plate. Minimal invasive technique has advantages of less blood loss, minimal soft tissue dissection, early mobilization and shorter hospital stay. The study was done to evaluate the amount of intraoperative blood loss, reduction of postoperative haemoglobin, requirement of postoperative analgesics and duration of postoperative hospital stay in the patients with stable intertrochanteric fracture treated with minimal invasive dynamic hip screw (MIDHS).
Methods: Twenty five patients with stable intertrochanteric fractures were treated with minimal invasive Dynamic hip screw fixation. Average intra operative blood loss, reduction of postoperative haemoglobin, requirement of post-operative analgesics and total duration of postoperative hospital stay were evaluated. All the patients were followed up periodically at 6 weeks, 3 months, 6 months, 1 year. All the patients were evaluated radiologically in the follow up period. The functional assessment was done with Harris hip score.
Results: Mean intraoperative blood loss was found to be 75 ml. The mean duration of surgery was found to be 44.3 minutes. All the patients were mobilized 24 hours of surgery with non-weight bearing walking with walker support. The average time for union was found to be 4 months. No complications like postoperative infection, malunion, coxa vara, limb length discrepancy were seen. The final functional Harris hip score was found to be excellent in 14, good in 4, fair in 2.
Conclusions: MIDHS is a safe technique having advantages of less blood loss, minimal soft tissue dissection and shorter hospital stay, early rehabilitation in treating stable intertrochanteric fractures compared to conventional DHS.

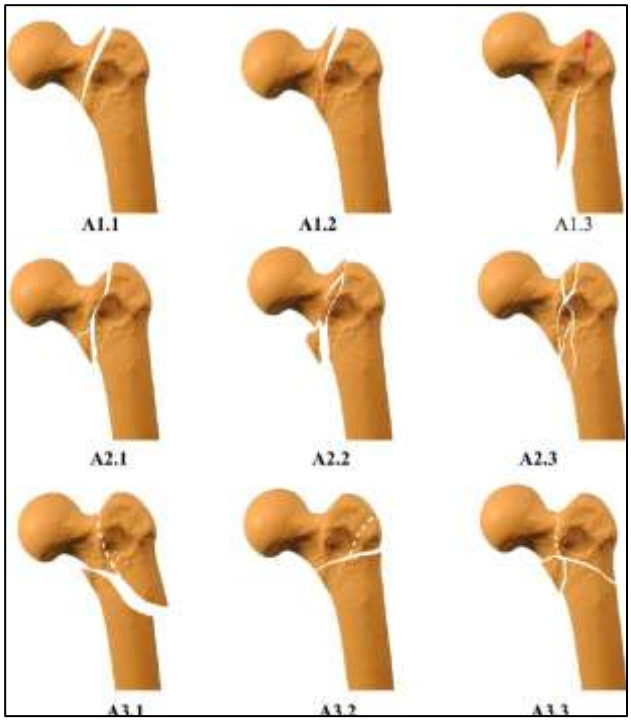
Keywords: MIDHS, Percutaneous, Conventional DHS

INTRODUCTION

Intertrochanteric fracture is the most common fracture which accounts for 90% of the hip fractures mostly resulting from low energy falls in patients over 50 years of age with a higher proportion in females. High energy hip fracture is relatively rare, more common in males under 40 years of age following road traffic accidents. Intertrochanteric fractures are classified into stable and unstable fracture patterns according to AO classification.

Conservative line of management is considered in patients who are non-ambulatory, bed ridden, patients with terminal disease with less than 6 weeks of life expectancy, recent myocardial infarction, cerebrovascular accidents, active systemic sepsis. Union generally occurs in 12 to 16 weeks irrespective of treatment. Commonly used surgical options includes ORIF/CRIF with plates and nails. The principle of dynamic hip screw (DHS) fixation is controlled guided collapse and compression at the fracture site which promotes early fracture union and

early mobilization. Wide surgical exposure is traditionally used for conventional DHS fixation. The potential drawbacks of which are large skin incisions, considerable soft-tissue dissection, blood loss, and pain. Minimally invasive DHS (MIDHS) offers the theoretical advantages of decreased blood loss, less pain, faster rehabilitation and better cosmetic results. In an attempt to minimize incision, 3-hole or 2-hole barrel plates have been used by some authors. In this study, a standard DHS with a either 3 hole or 4-hole side plate was used in a minimally invasive technique.[1-3]



Stable patterns: A1.1, A1.2, A1.3, A2.1, A2.2; Unstable patterns: A2.3, A.3.1, A3.2, A3.3.

Figure 1: AO classification of intertrochanteric fractures.

Table 1: Classification of plates.

Mechanism/ principle	Examples	Failure method
Impaction	Blade plates Nail plates	Medial penetration Breakage
Dynamic compression	Sliding hip Adjustable hip screw Dynamic helical blades	Cutout Plate pull off
Linear compression	Gotfried PCCP Inter TAN, CHS	
Hybrid locking and trochanteric buttress	Proximal femur locking plate Trochanteric stabilization plates	Plate failure

Table 2: Classification of nails.

Mechanism/ principle	Examples	Failure modes
Impaction	Y-nail, TFN	Medial penetration
Dynamic compression	Gamma, IMHS	Cut out peri implant failure with short designs
Two screw dynamic compression	Reconstruction	z- effect
Linear compression integrated	Inter TAN	unknown

PCCP: Percutaneous compression plate, CHS: Compression hip screw, INTERTAN: Intertrochanteric antegrade nail, TFN: Trochanteric femoral nail, IMHS: Intra medullary hip screw.

METHODS

This is a prospective study done over a period of 2 years from June 2014 to June 2016 years at department of orthopedics at Coimbatore medical college hospital. Patients presenting to department of orthopedics with intertrochanteric fractures were evaluated and analyzed to be included in the study.

The inclusion criteria were patients aged between 50–80 years, stable intertrochanteric fracture (AO 31A1, 31A2.1, 31A2.2) and unilateral fractures. Exclusion criteria were patients aged between <50 and >80 years, unstable intertrochanteric fractures (AO 31A2.3, 31A3), bilateral fractures, pathological fractures, any other associated fractures or injury, patients requiring intensive care and bedridden/ non ambulant patients.

Table 3: Showing incidence of intertrochanteric fractures.

Variables	Number of patients
Age (in years)	
50-60	8
60-70	7
70-80	5
Male:female	8:12
AO classification	
3A1.1	3
3A1.2	6
3A1.3	5
3A2.1	5
3A2.2	4
Right:Left	9:11
Mode of injury	
Self fall	17
RTA	2
Fall from height	1

Patients were worked up for surgery as per the standard protocol. All patients were operated under spinal anesthesia. After induction, patients were placed on fracture table and close reduction by standard technique was done and reduction was confirmed under C arm image.

Surgical technique of MIDHS

In MIDHS, entry point on the lateral femoral cortex is at the point of intersection of first guide wire that was placed over the skin along the middle of neck in AP view as verified under C Arm and second K wire that bisects the first wire on the skin surface perpendicular to the ground as shown in Figure 2. The average length of the skin incision was found to be approximately 5 cm. The fascia lata was cut and vastus lateralis muscle was split. Using 135 degree angle guide a guide wire was passed at the predetermined entry point from lateral femoral cortex into the center of neck and head of femur. An obliquely cut 30 ml syringe was passed over the guide wire to act as a sleeve for subsequent triple reaming. Triple reaming was done over the guide wire. A lag screw of appropriate size was passed over the guide wire into the femoral head after prior tapping if necessary. Standard 135° DHS barrel plate was inserted beneath the muscle over the shaft and then finally into lag screw by using the guide wire. The plate was fixed with 4.5 mm cortical screws of appropriate size. The wound was washed, sutured and dressed with or without a drain.

Figure 2: Intraoperative pictures showing the surgical steps.

Intraoperatively, operative time and blood loss during surgery was noted. The blood loss during surgery was calculated by noting the number of mopping pads that was used intra operatively as each pad corresponds approximately to 50 ml of blood loss and the amount of blood collected in suction apparatus.

In postoperative period severity of pain as assessed by visual analogue scale (VAS), reduction of postoperative haemoglobin level and duration of hospital stay was noted. Postoperative management is as per the standard protocol. The patients were followed up for a minimum period for 6 months. During followup pain severity was assessed and time to ambulation was noted along with time to union and any complication.

Figure 3: Preoperative and postoperative picture.

RESULTS

Out of the total twenty five patients in our study, twenty patients came for regular follow up till the end and 3 patients dint turn for follow up and 2 patients died in the follow up period. 9 fractures were in right side and 11 in left. Mean operating time was 44.3 minutes ranging from 30 to 50 minutes. Mean wound size was of 5 cm. Mean per operative blood loss was 75 ml (range: 55 – 95 ml). Mean requirement of analgesics in postoperative period was for five days (three to seven days). Mean hospital stay after surgery was five days (three to eight days). All fractures united within four months. There were no surgery related complications. The final functional outcome based on Harris hip score is as follows - excellent in 14, good in 4, fair in 2. The average final Harris hip score was 86. The number of patients requiring blood transfusions in the postoperative period was found to be nil.

Table 4: Summary of results.

Variables	MIDHS
Age (years)	60
Female:male	12:8
Right:Left	9:11
Operating time (mean) (min)	44.3
DHS barrel plate 3 hole:4 hole	8:12
Mean blood loss in ml	75
Drop in haemoglobin g/dl	1.2
Mean duration of hospital stay (days)	5
Mean Harris hip score	86

There was no incidence of complications like avascular necrosis of femoral head, mal union with coxa vara, superficial, deep seated infection, cut through of the lag screw in femoral head, implant failure or breakage, limb length discrepancy.

DISCUSSION

Intertrochanteric fractures are comparatively more common and occur in greater frequency with increasing life expectancy. In general, these fractures are due to trivial trauma in the elderly and high energy, motor vehicle accidents in the younger individuals. In the elderly, intertrochanteric fractures are associated with significant morbidity and mortality. However, after one year of injury patients fall back to age-related mortality rates. Nonetheless, the primary goal of surgical intervention is rigid, stable fixation of the fracture and early mobilization. Variables that contribute to the success of surgery include the host bone quality, the geometry of the fracture, fracture fragment reduction, implant design, implant placement and surgical technique.[4]

MIDHS offers the theoretical advantages of decreased blood loss, less pain, faster rehabilitation, and of course better cosmetic results. Recent studies have shown that the concentration of some cytokines namely interleukin 6, is increased after pertrochanteric fracture and that further increase is observed after surgery but relatively less increase in MIDHS. Increase of interleukin levels, due to the surgery, can greatly increase exposure to the risk of complications and morbidity as they are pro inflammatory cytokines.[5]

The conventional DHS fixation requires large incision, more tissue dissection resulting in considerable amount of blood loss and thus requiring blood transfusion and prolonged analgesia for pain control. All these intraoperative and postoperative factors increase the duration of hospital stay and thus the overall cost of surgery. Thus MIDHS is desirable, as it overcomes all the above said disadvantages of conventional DHS fixation. Lower amount of blood loss in minimally invasive technique is attributed to a smaller incision in the safe vascular zone where there is risk of injury to underlying perforators.

The time to bony union, desirable screw position and postoperative reduction achieved were same in conventional and MIDHS. Osteoporosis and unstable fracture patterns are major risk factors for implant failure. Thus 4-hole side plates would provide greater pullout strength, particularly before the fracture union and this will be beneficial for osteoporotic patients, whom comprise a large proportion of patients with hip fractures. Therefore, we opted for a standard 4-hole side plate for fracture fixation in majority of patients. As a routine we do not use a drain in postoperative period but when excessive bleeding occurs intraoperatively, we insert the drain from the stab site of the lower-most cortical screw insertion site. It minimizes the additional scar from the drain site. As most of these patients have associated cardiovascular comorbidities, early ambulation and less use of analgesics will definitely lead to less postoperative complications and thus an early discharge.[15]

Wong et al has conducted a detailed preoperative, intraoperative, postoperative, functional outcome study of MIDHS in about 35 patients and so we have compared our study with this study in detail.[8] Gotfried et al has done percutaneous compression plating for inter-trochanteric fractures by minimally invasive technique.[25] This is a newly designed implant and it is not widely available in the market. The details of surgical technique were not mentioned in this study. Dipaola et al has done 13 cases of MIDHS with a two holed barrel plate only and so this study cannot be compared with our study as we have used 3 or 4 hole barrel plate and he has not mentioned about preoperative radiological adequacy of fracture reduction.[18] Alobaid et al study used 2 and 4 holed plate in their study and concluded that the length of the plate has no influence on final functional outcome as even the longer plate can be slided beneath the muscle with in the safe vascular zone without causing any major perforator injury.[17] Lee et al has favored 3 holed plate in his study for majority of cases and has not specified the time interval from injury to surgery in our study the mean duration from time of injury to surgery is 5.5 days.[9] Mcloughlin et al has concluded that there is no difference in biomechanical stability between two holed and 4 holed barrel plate.[4] The associated osteoporosis and unstable fracture patterns are the major risk factor for the implant failure in this study and has concluded 4 holed barrel plate gives a greater pull out strength in the osteoporotic and unstable fracture patterns. In Pandey et al study mean peroperative blood loss is 53 ml (43-85 ml). Mean postoperative analgesic requirement is 5 days (3-7) days.[7] Mean operative time was 50 minutes (40-60). The mean hospital stay was 5 days (4-6) days. All fractures united within 3 months in this study but in our study the fracture union occurred in 2.1 to 4.1 months. In Ho et al post op haemoglobin reduction is 1.18 g/dl and in Wang et al it is 1.3 and in our study is 1.2 g/dl.[8,11] Per operative blood loss in Dipaoula et al study is 41 ml and in our study is about 75 ml. Ho et al, Little et al and Chau et al studies has compared the peroperative blood loss by using conventional DHS and the blood loss in the above studies are 283 ml, 163 ml, 409 ml respectively.[11,19,20] The postoperative analgesic requirement in different studies is as follows, Wong et al is 8.6 mg of pethidine, Alobaid et al has used morphine 15.1 mg, coideine 169 gm, acetaminophen 1.9 gms.[8] We have used 75 mg of diclofenac injection on the night of surgery and next day morning along with one ml of pentazocine in the night following surgery and subsequently with oral tablet diclofenac 50 mg twice daily for 5 days. The postoperative wound size in different studies is as follows, Wong et al is 2.5 cm, Ho et al is 5 cm, Alobaid et al (2004) is 3 cm, Walia et al (2010) is 3 cm and in our

study the size is 5 cm.[8,11,17,24] Lower the wound size reduces the postoperative blood loss which in turn reduces the postoperative blood transfusion requirement and finally is associated cardiovascular complications. The duration of hospital stay in different studies is as follows Lee et al- 5.4, Wang et al- 5.7, Ho et al- 12.1 and in our study it is 5 days. In MIDHS with its small wound size produces less postoperative pain, with early ambulation with less complication rate which in turn reduces the final duration of hospital stay. These factors in turn reduce the overall burden to the care givers and the final treatment cost.

Table 5: Comparative study of Wong et al and our study.

No	Parameters	Wong et al (n=35)	Our study (n=20)
1	Male: Female	10:25	8 : 12
2	Age (Years)	80.6 (56-97)	63.4 (54-79)
3	Associated comorbid conditions		
	Systemic hypertension	21	11
	CVA	03	0
	Diabetes mellitus	11	6
	Cardiac diseases	5	5
	GIT	6	0
	Renal diseases	4	3
	Respiratory diseases	3	5
	Malignancy	3	0
4	Premorbid ambulatory status		
	Unaided walking	15	18
	Walking stick support	16	2
	Quadripod walker support	1	0
	Walking frame	3	0
5	Mode of injury		
	Slip and fall	33	17
	RTA	1	2
	Fall from height	1	1
6	Days from injury to surgery	2.7 (1-7)	5.5 (3 to 9)
7	Right : Left	17:18	9:11
8	Radiological assessment		
	Facture reduction		
	excellent	19	14
	good	13	4
	average	3	2
	Fair	0	0
	poor	0	0
	Weeks to union	10.9 (8-16)	11.2 (9 – 17)
9	Surgical data		
	Duration of surgery (in minutes)	35.7 (25-50)	44.3 (30-50)
	Post op Haemoglobin fall (g/dl)	1.4(0-3.6)	1.2 (0.4 – 2.8)
10	Duration of hospital stay(days)	24.5 (5-50)	5 (3 to 8)
11	Follow up months	12 (8-17)	8 (4 – 12)
12	Harris hip score	87.5 (76-97)	86 (74 -93)

The limitations of our study are small sample size, lack of long term follow up, lack of comparative study with conventional DHS and final radiological outcome was not assessed. One problem we encountered is the determination of entry site for guide wire mainly in obese female patients. MIDHS is suitable only for stable intertrochanteric fractures where adequate close reductions can be achieved. The basicervical fractures where additional derotational proximal screw is required in addition to DHS fixation are not suitable for MIDHS.

CONCLUSION

The management of colorectal cancer has progressed over the past few decades because of many advances, including those in genetics, pathology, imaging, medical

oncology, radiation oncology, and surgery.[16] Undoubtedly, the management of patients afflicted with colorectal cancer will evolve as advances continue to be made in the multiple disciplines that contribute to the diagnosis and treatment of colorectal cancer.

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