Original Research Article

A comprehensive study of complications and management of dynamic hip screw surgery

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Received: 04-02-2021 / Revised: 11-03-2021 / Accepted: 08-04-2021

Abstract

Background: Trochanteric fracture is one of the leading causes of hospital admissions in elderly people. The number of such admission is on the rise because of increasing life span and activity. Generalized osteoporosis, the loss of reflexes, failing eyesight and anemia are also the predisposing factor to cause trochanteric fractures.Conservative methods of treatment result in malunion with gross shortening and limitation of hip movements as well as complications of prolonged immobilization like bed sore, deep vein thrombosis and respiratory infections.**Aim & Objective:** Mortality & morbidity can be reduced by doing early surgery in the elderly people in case of trochanteric fractures. This study is done to analyze the complications of dynamic hip screw surgery for intertrochanteric fractures.**Materials and methods:**It is a prospective study which was carried out;110 cases of intertrochanteric fracture are studied with surgical intervention by dynamic hip screw. **Results:**In our series, majority of the patients were females in the 7th decade with self fall being the commonest mode of injury. Most of the cases were Type II according to Boyd & Griffin classification. All patients were surgically treated by dynamic hip screw after thorough evaluation. Union was noted clinically and radiologically and functional evaluation was done by Harris Hip Score. Excellent results were noted in 52(51%) of the patients, good results in 27(26%), fair in 14(13%) and poor results in 9(8%) of patients. Union was achieved in 98(96%) of the cases. The complications noted were screw cut out in 6 patients, varus collapse with shortening in 14, infection in 1, implant failure in 4 and nonunion in 4 patients in a total of 21 patients.**Conclusion:** From the present study, it is concluded that dynamic hip screw surgery for intertrochanteric fractures of femur is safe, reliable, achieves good union and gives excellent functional outcomes for the patient. Some complications like screw cut out can be avoided by meticulous placement of the lag screw. On the whole, this is a cost effective and excellent surgical procedure.

Keywords: Intertrochanteric fractures, Dynamic Hip Screw, Complications

Introduction

Intertrochanteric fractures are seen with increasing frequency and severity as the life expectancy of our population increases. The primary goal in the treatment of an elderly patient with Intertrochanteric fracture is to return the patient to his / her pre-fracture activity as early as possible. Rapid mobilization of these elderly patients reduces the morbidity and mortality rate in geriatric patients.Before the introduction of suitable fixation devices, treatment of intertrochanteric fractures was nonoperative, consisting of prolonged bed rest in traction until fracture healing occurred (usually 10–12 weeks), followed by a lengthy programme of ambulation training. In elderly patients, this approach was associated with high complication rates; typical problems included Decubitus ulcers, Urinary tract infection, Joint contractures, Pneumonia and Thromboembolic complications, resulting in a high mortality rate. In addition, fracture healing was generally accompanied by varus deformity and shortening because of the inability of traction to effectively counteract the deforming muscular forces.For these reasons, the treatment of intertrochanteric fracture by reduction and internal fixation has become the standard method of treatment.It is important to understand the principles behind the evolution of the multitude of implants that have been used to stabilize intertrochanteric fractures. The first implant to be used with success was Fixed-angle Nailplate (e.g., Jewett nail58, Holt nail) consisting of Triflanged nail fixed to a plate at an angle between 1300 and 1500. Although these devices provided stabilization of the femoral head and neck fragment to the femoral shaft, they did not allow fracture impaction. If significant.Intramedullary Sliding Hip Screw devices have recently been developed for stabilization of pertrochanteric fractures **(Gamma Nail)**[1-4] These devices couple a sliding hip screw with a locked intramedullary nail. However, patients treated with these devices are at increased risk for femoral shaft fracture at the nail tip and the insertion sites of the distal locking screws.Unstable intertrochanteric fractures (A2 & A3) are best treated with intramedullary implant such as Gamma Nail and Intramedullary Hip Screw. The theoretical advantages of intramedullary nails are improved biomechanics, decreased blood loss and smaller incisions.The largest meta analysis comparing intramedullary nails with side plate devices from the Cochrane database concluded that side plates are superior to intramedullary nails in the treatment of intertrochanteric fractures.Hence, for these various complications associated with other fixation devices in the treatment of unstable intertrochanteric fractures, Dynamic Hip Screw Fixation has become the Gold standard treatment.

Objectives of the Present study

1.To analyse the results of the intertrochanteric femoral fractures treated by Dynamic Hip Screw fixation.
2.To study the outcome of the procedure, with respect to early mobilization and return to ambulatory status.

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Methodology

The data for this study was collected from the patients admitted during the period 1st October 2013 to 30th September 2015 treated surgically using DHS for patients diagnosed with intertrochanteric femoral fractures. Patients above 18 years of age were included under our study.The follow up period ranges from 6 months to 2 1/2 years.

Inclusion criteria

All patient with intertrochanteric fracture
All patient presenting with age more than 18 years
Sex: both males and females

Exclusion criteria

Age group less than 18 years.
Patient with malunited trochanteric fracture treated elsewhere
Medical unstable patient, who are at extremely poor anesthesia risk
Compound fracture.
Associated with any other fracture of femur.
Diaphyseal extension of trochanteric fracture.
Pathological fractures

Evaluation

Proper history to rule out pathological fracture
Blood investigations
Xray pelvis –AP and cross table lateral
Co-morbidities like Diabetes, HTN and Asthma

Initial management:

Initial to start with all the patients were put on skin traction on admission.
Average time interval between admission and surgery was 8.5 (range 3– 15) days during which period patients were evaluated for medical problems.
Spinal anesthesia was given for all the patients.
C-arm and fracture table were used for all the patients.

Surgical technique

Patient poitioning: Patient is positioned supine on a fracture table with a radiolucent, padded countertraction post between the patient's legs and the uninjured leg, flexed and abducted at the hip in a well leg holder. Pad the peroneal nerve on the uninjured leg in this position. The injured leg is held by a foot plate or boot attached to the other leg extension of the fracture table. The adequacy of both anteroposterior and true lateral views should be verified before surgical preparation

Draping:

Prepare the skin over the hip and square off the lateral aspect of the hip from the iliac crest to the distal thigh with towels and drapes, taking care to place the towel clips so that they are not superimposed on the fracture on subsequent imaging. Drape the C-arm separately.

Reduction technique: Perform a closed reduction of the fracture. Generally, the fracture can be reduced in neutral or slight internal rotation. Avoid too much traction, which may cause valgus overreduction. Check for the reduction by anteroposterior and lateral roentgenograms or by image intensifier, paying special attention to cortical contact medially and posteriorly.

Exposure: Skin incision is made from 5 cm above the tip of the greater trochanter passing through center of tip of the greater trochanter and extend down the line of shaft of the femur for approximately 8 cm. Incise the fat and underlying deep fascia, retract the cut edges of the fascia to pull the tensor fascia lata anteriorly. Split the fibres of vastus lateralis along its line of fibres and elevate it from the lateral inter muscular septum taking care to coagulate perforating branches of the profunda femoris artery.

Insertion of plate and lag screw: Assemble the appropriate plate and Lag screw onto the insertion wrench. Screw the Lag screw retaining rod into the distal end of the Lag screw until a firm connection is obtained. Place the entire assembly over the guide pin and introduce it into the reamed hole. Advance the Lag screw into the proximal femur to the predetermined level and verify its position with image intensification.A 180degree turn represents a 1.5 mm advancement of the Lag screw. Verify the position and depth of the screw with image intensification in both planes. Remove the centering sleeve and advance the side plate onto the Lag screw shaft. Use the plate tamper to fully seat the plate. Unscrew the Lag screw retaining rod and remove the insertion wrench from the back of the Lag screw. Then remove the threaded guide pin.

Attachment of plate: Use plate clamp to secure the plate to the shaft. Release traction to allow impaction of the fracture fragments especially in unstable intertrochanteric fractures. Attach the plate to the shaft of femur using 4.5 mm cortical screws.When all screws have been inserted and all traction has been released, the fracture can be compressed with the compression screw, (usually the 36 mm screw). If a short barrel is used, placement of compression is mandatory to prevent potential disengagement of the screw plate assembly

Post operative protocol

All patients were allowed to flex the knee from 2nd Post operative day and physical ambulation was started on 8th Post operative day on an average.All the patients were covered with appropriate antibiotics.All the patients were checked both clinically and radiologically for the first 6 weeks and partial weight bearing was allowed with the help of a walker.All patients were reviewed at 3 months both clinically and radiologically for proper placement of implant , compression at the fracture site, examined for range of movements, tenderness and shortening . All patients were advised to weight bear with the help of walker.At 6 months both clinical and radiological assessment were done, check x-ray is taken to see whether fracture has healed. Clinical examination was done for range of movements and tenderness, shortening and any fixed deformities. All Patients were advised to walk with full weight bearing.All patients were assessed between 9 months or 1 year by Harris Hip Score for the analysis of results of Intretrochanteric fractures treated by Dynamic Hip Screw.Assessment of the patient was done on the basis of clinical ad radiological union, range of motion at hip joint, shortening and subjective complaints like pain.

The results were analysed based on the Harris Hip Scoring System and the patients were categorized according to the scores they attained as follows:

Excellent : 100 - 90
Good : 89 - 80
Fair : 79 - 70 Poor : < 70
Harris hip score:40
Pain:
None or ignores it - 44
Slight, occasional, no compromise in activities - 40
Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin - 30
Moderate pain, tolerable but makes concessions to pain; some limitation of ordinary activity or work; may require occasional pain medicine stronger than aspirin-20
Marked pain, serious limitation of activities - 10 Totally disabled, crippled, pain in bed, bedridden – 0

Our study had a total of 110 cases of intertrochanteric fracture of femur treated by Dynamic Hip Screw surgery. The study is conducted over a period of 2 years between October 2013 and September 2015. 102 patients were followed for a minimum of 6 months. The observations made are tabulated below.

Table 1 : Age Distribution

Age in years	No. of patients	Percentage
41 – 50	11	10
51 – 60	21	19
61 – 70	39	35
71 – 80	30	27
>81	9	8

Age range of our patients was from 45 yrs to 88 yrs with a mean of 66.2 yrs.

Table 2: Sex Distribution

Sex	No. of patients	Percentage
Male	49	45
Female	61	55

The majority of patients 61(55%) were females and 49(45%) were males.

Table 3 : Side Affected

Side	No. of Patients	Percentage
Right	64	58
Left	46	42

Right side was involved in 64(58%) patients and left side in 46(42%) patients.

Table 4 : Mode of Injury

Mode of Injury	No. of Patients	Percentage
RTA	21	19
Self fall	89	81

Self fall was the commonest mode of injury, accounting for 89(81%) of patients and Road traffic accidents accounted for 21(19%) of fractures.

Table 5 : Fracture Type by Boyd and Griffin classification

Type	No. of Patients	Percentage
I	38	35
II	43	39
III	22	20
IV	7	6

Type II fracture was the commonest, accounting for 43(39%) of fracture, followed by Type I 38(35%), Type III 22(20%) and Type IV 7(6%) which was the least common

Associated Injuries

7 patients had Colle's fracture which was treated conservatively by closed reduction with below elbow cast in 6 patients and closed reduction with K-wire in 1 patient. 2 patients had fracture neck of femur on the opposite side previously, operated with hemiarthroplasty.

Associated Medical Problems Diabetes Mellitus –42 patients Hypertension – 39 patients IHD – 8 patients

Table 6 : Trauma to surgery interval

Trauma to surgery time	No. of Patients	Percentage
1 – 7 days	72	65
8 – 15 days	38	35

Majority of the patients 72(65%) were operated within a week of trauma. The other patients were operated after control of co-morbid conditions.

Fixation of fracture

All patients were treated by closed reduction and fixation by Dynamic Hip Screw and side plate.

Table 7 : Fracture Union

Period of Union	No. of Patients	Percentage
10 – 12 weeks	29	28
12 – 16 weeks	69	67
Non union	4	4

Nonunion was defined as persistent pain or mechanical failure occurring at least 4 months following initial internal fixation. Union occurred in 98(96%) of our patients by 16 weeks, with an average of 13.33 weeks. Among the 4 patients who had non union, 2 had screw cut out , 1 had implant failure and 1 had infected non union[17]

Period of immobilization after surgery:All patients were allowed to flex the knee from 2nd Post operative day and physical ambulation was started on 8th Post operative day on an average. All patients were advised strict non-weight bearing for 4 weeks. After assessment on follow-up, they were allowed partial weight bearing with the help of walker. At the end of 12 weeks, after clinical and radiological assessment, they were allowed full weight bearing after confirmation of union.

Follow up period: Out of a total of 110 patients, 4 died of natural causes during the course of follow up and 4 patients were lost during follow up. Finally, 102 patients were available for follow up at the end of 1 year.

Complications

Infection: In our study we encountered infections in 4 patients, among which 3 were superficial and subsided with appropriate antibiotics and regular dressings. 1 patient had infected implant that eventually lead to non union.

Screw cut out : 6 cases had screw cut out which had a correlation with Tip Apex Distance(TAD).

TAD < 25 mm – 78 cases with 2 cut out. (2.5%),TAD > 25 mm – 24 patients with 4 cut out. (17%)

Varus Collapse: Varus collapse with significant shortening of more than 2cm was found in 14 patients among whom 8(57%) patients were Type III and 3(21%) were Type IV fractures.

Implant Failure: We encountered 4 cases of implant failure in our study. This included broken side plate in 2 cases and pull out of side plate with screws in 2 cases.

A total of **21 complications** were documented.

The results were analysed based on the Harris Hip Scoring System and the patients were categorized according to the scores they attained as follows:

Excellent : 100 - 90

Good : 89 - 80

Fair : 79 - 70

Poor:<70

Table 8 : Functional Assessment

Score	No. of Patients	Percentage
100 – 90 (Excellent)	52	51
89 – 80 (Good)	27	26
79 – 70 (Fair)	14	13
< 70 (Poor)	9	8

In our study, 52(51%) patients had excellent results and 27(26%) patients had good result. The functional outcome was fair in 14(13%) and poor in 9(8%) of patients.

Discussion

The aim of treatment in these fractures is to achieve union without shortening by providing a favorable environment for bone and soft tissue healing.Most intertrochanteric fractures are treated by Sliding Hip Screw system these days. There has been a shift towards intramedullary devices but still, Dynamic Hip Screw holds the sway.It has yielded enormous success rate when used with expertise after following all protocols.In this study, we have treated 102 intertrochanteric fractures with dynamic hip screw surgery. We evaluated our results and compared them with those obtained by various studies opting different modalities of treatment. Our analysis is as follows.

Our results were comparable with the studies of **Bolhofner et al[5]** (journal of orthopedic trauma, 13(1):5-8, January 1998 and studies of **Babst et al[6]** (journal of orthopedic trauma 12(6): 392-399, August 1998.In the present study there were 6 cases of implant cut through. **N.D Chatterjee et al**[7] reported coxa vara in 3 cases due to cutting of implants through head & neck of femur and also proximal migration of DHS with avascular changes of femoral head in one case. **Mattan et al[8]** in 2002 reported 10 patients with osteoporosis developed painful avascular necrosis after DHS fixation.

Heyse-Moore et al[9], retrospectively compared the results of 107 intertrochanteric fractures stabilized with a sliding hip screw to 103 fractures treated with a Jewett nail and concluded that those patients treated with the sliding hip screw had shorter hospitalization stays and a lower incidence of fixation failure. In our study average hospital stay was 13days.

Bannister et al[10], in a prospective randomized study of 155 intertrochanteric fractures stabilized using sliding hip screw and Jewett nail, found that fractures that fractures stabilized with sliding hip screw had a significantly lower risk of mechanical failure and a lower incidence of revision surgery. In our study 6 cases got screw cut through the head and neck of femur and required revision surgery.

Jacobs et al[11], reported on a series of 173 intertrochanteric fractures treated with internal fixation, 72 with a Jewett nail and 101 with a Sliding Hip Screw. Treatment failure – defined as either loss of fixation, symptomatic joint penetration, osteonecrosis, malunion or nonunion – occurred in 25% of fractures stabilized with a Jewett nail and in 6% of fractures stabilized using a Sliding Hip Screw. In our study failure rate was 5.8% by using sliding hip screw.

Sernbo et al[12], compared use of Ender nails to use of a Sliding Hip Screw for the treatment of unstable intertrochanteric fractures in a prospective randomized trial.

Butt et al[13], reported on a prospective, randomized controlled trial that compared results in 95 consecutive patients who sustained a pertrochanteric fracture of the femur and were treated using a Sliding Hip Screw (no. = 48) or a Gamma nail (no. = 47). Whereas clinical and radiological outcomes were similar, the Gamma nail was

associated with a higher incidence of complications - in particular, femur fracture distal to the implant. In our study implant cut through was seen in 6 cases and implant failure in 4 cases

Aune et al[14], reported on a series of 378 intertrochanteric and subtrochanteric fractures prospectively randomized to treatment with either a Gamma nail (177 fractures) or a Sliding Hip screw (201 fractures). At an average follow-up of 17 months, 15 patients needed revision surgery - 13 in the Gamma nail group and 2 in the Sliding Hip Screw group. In our study 6 patients required revision surgery due to implant cut through.

Baumgaertner et al[15], reported on a series of 131 patients (135 fractures) who sustained an intertrochanteric fracture and were randomly assigned to treatment with either a Sliding hip Screw or an Intramedullary Hip Screw (IMHS). In patients with unstable intertrochanteric fractures, the intramedullary device was associated with significantly less surgical time and blood loss; however, use of the Intramedullary Hip Screw in patients who had a stable fracture pattern required significantly greater fluoroscopy time. Intraoperative complications occurred exclusively in the Intramedullary Hip Screw group. At latest follow-up, there was no difference in the percentage of functional recovery between the two fixation groups.In our study, 52(51%) patients had excellent results and 27(26%) patients had good result. The functional outcome was fair in 14(13%) and poor in 9(8%) of patients.

Complications Infection:In 2008 **Edwards et al[16]**, reported a 1.2% rate of deep wound infection and 1.1% superficial wound infection in a series of more than 3000 cases. Fifty-seven of eighty infections (71.3%) were caused by Staphylococcus aureus and 39 (48.8%) by MRSA (multiple organisms). No statistically significant preoperative risk factors were detected. Length of stay, cost of treatment, and predischarge mortality all significantly increased with deep wound infection. In our study, we had 4 cases of infection among which 3 were superficial and settled down with appropriate antibiotics. One patient developed infected non union. We had infection rate of 0.9%. With sterile operating environment and strict aseptic precautions during all steps of surgery and post operative dressings has made infection almost negligible.

Implant Malfunction: Implant malfunction or failure is estimated to occur approximately 5% of cases usually from a combination of implant fatigue failure, shaft fixation failure with broken screws, femoral head medial penetration, screw cutout, and disassembly of the device components.**Parker et al[17]**analyzed by the radiographic characteristics of 27 patients with a trochanteric fracture treated with a sliding hip screw in which fixation failure occurred, and compared them with 74 patients having uneventful fracture union. Femoral medialization was more common in specific fracture types, particularly if there was comminution of the lateral femoral cortex at the site of insertion of the lag screw. Femoral medialization was strongly associated with fixation failure, with a sevenfold increase in the risk of failure if medialization at more than one third occurred.In our study, we had 6 cases of screw cut out. 2(2.5%) cases out of 78 who had screw cut out had Tip Apex Distance of less than 25 mm. 4(17%) cases out of 24 who had screw cut out had Tip Apex Distance of more than 25 mm.14(13.7%) cases had varus collapse and significant shortening of more than 2 cm. This was due to unstable fixation for Type III and Type IV fractures.4(3.9%) cases had implant failure such as broken implant and pull out of screws and plate from bone. One patient who had broken implant was obese, weighing 125kg. The patient who had pull out of screws and plate was non compliant and was squatting, sitting cross-legged on the floor. This probably led to implant failure. He was not willing for revision surgery either.Most of our findings, including union rates, functional outcome, and complications are comparable with the studies where dynamic hip screw was used to treat intertrochanteric fractures.

Conflict of Interest: Nil Source of support:Nil

Conclusion

Based on our study and results, we conclude that dynamic hip screw surgery is a versatile and safe surgery for intertrochanteric fractures provided the fracture pattern is stable and due care is taken to position the lag screw. In short, dynamic hip screw surgery is an excellent and viable surgical option to treat intertrochanteric fractures with excellent union rates and functional outcome. It decreases hospital stay and provides better post operatice ambulation if the basic principles are followed while fixing osteoporotic bones.

Acknowledgment

The author is thankful to Department of Orthopaedics for providing all the facilities to carry ut this work.

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