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Functional Outcome of Patients with Comminuted Femoral Shaft Fractures Treated By Interlocking Intra Medullary Nailing

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Abstract
Background-*Evaluation of functional outcome of those patients admitted with comminuted femoral shaft fractures treated by interlocking intra medullary nailing*
Materials and Methods: *Patients attending Govt Medical College, Thiruvananthapuram from June, 2004 to September, 2006 are selected. Open fractures are not included. Those cases with ipsilateral fractures in the lower limb in addition to comminuted femoral shaft fracture (like fracture of neck of femur, fracture of tibia, fracture of patella) are also excluded. Type II III and IV comminuted femoral shaft fractures (Winquist and Hansan classification) are taken for study.*
Results: *Excellent results are obtained in all cases of Type II comminuted towards of femoral shaft. Excellent to good results are obtained in Type III comminuted fractures.*
Good to fair results are obtained in Type IV comminuted fractures.
Conclusion: *Interlocking intra medullary nailing is a very good mode of treatment of comminuted fractures of the femoral shaft. Closed nailing and static locking is a technically demanding procedure. Risk of exposure to radiation is there. This method offers the possibility of maintenance of length, alignment and rotational, stability in comminuted fractures of the femoral shaft while preserving the biological environment of fracture healing.*
Keywords: *comminuted fracture of femur, intramedullary interlocking femoral nail.*

INTRODUCTION

Femoral shaft fractures occur most frequently in adults after high energy trauma. Comminuted femoral shaft' fractures occur usually in those group met with very severe trauma.

The comminution of the fracture makes union in a functional position without significant loss of length, alignment or rotation difficult to obtain.

The traditional method of treatment using prolonged skeletal fraction followed by immobilization in a spica cast is almost totally overtaken by surgical methods.

Dynamic compression plating of comminuted femoral shaft fractures were met with high incidence of delayed union, plate breakage, secondary bone grafting, infection and refracture.

From the early 1980s, treatment of comminuted femoral shaft fractures by interlocking inter medulary nailing became available. At present interlocking intramedullary nailing is accepted as the surgical method of choice for treating comminuted femoral shaft fractures.

AIM OF THE STUDY

Evaluation of functional outcome of those patients admitted with comminuted femoral shaft fractures and treated by interlocking intra medullary nailing by taking into account the following:

1. Range of movements in hip and knee
2. Radiological Union
3. Pain and Tenderness.
4. Walking ability
5. Length discrepancy
6. Angular deformity
7. Rotational deformity.

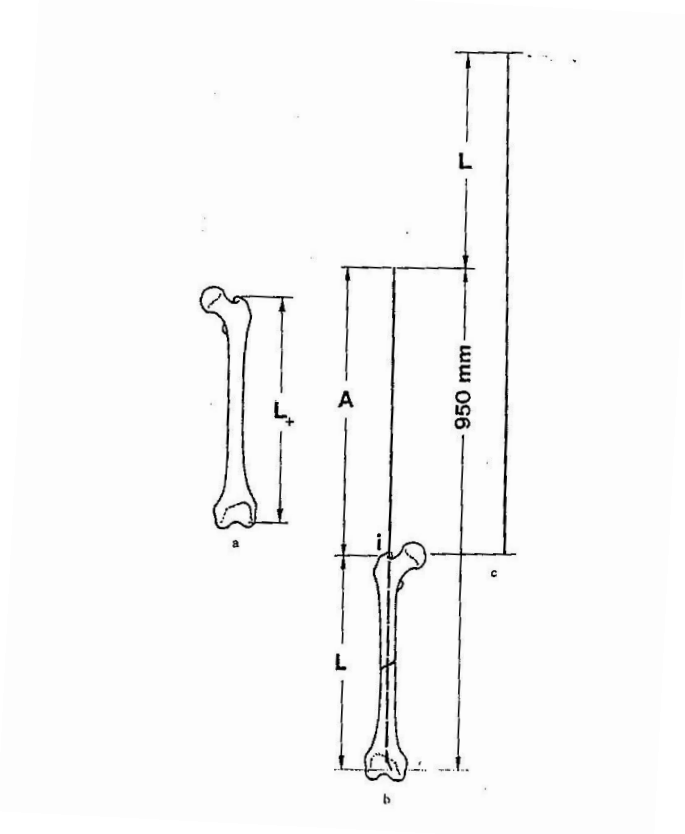
MATERIALS AND METHODS

Implants

AO/ASIF Universal femoral nail is used. It has a cloverleafcross section and 1.2mm wall thickness. The curvature of the nail |corresponds to an average anatomical curvature of the adult femur of |1.5m radius. For proximal locking two holes are available: a 5mm diameter round hole for static locking, and a second slotted hole for dynamic locking. For distal locking, it has two 5mm diameter locking holes, 4.9mm locking bolts are used. 4mm drill bit is used.

The diameter is determined by the last reamer used. A nail of 0.5-1 mm smaller diameter is chosen. Length of the nail is measured by subtracting the exposed length of guide rod from the total length of 950mm.

Patients attending Medical College, Thiruvananthapuram from June, 2004 to September, 2006 are selected. Open fracturesare not included. Those cases with ipsilateral fractures in the lowerlimb in addition to comminuted femoral shaft fracture (like #neck of femur, #Tibia, #patella) are also excluded. Type II III and IV comminuted femoral shaft fractures (Winquist and Hansan classification)are taken for study. Type I comminution cases are excluded. This is to obtain a more conclusive result of cases with severe comminution of femoral shaft.



Length of nail for the femur (L+)-30mm (picture-a) or 950 mm-A

All patients are given I.V fluids in the casualty, lower limb is immobilized in a Thomas splint and send for radiographic evaluation. AP and lateral views of the femur, hip knee, AP view of the pelvis, PA view of chest are taken. All patients were sent to the surgery unit to rule out abdominal, chest and head injuries. Routine hematological investigations were done. Blood transfusions were given when indicated. Patients were admitted in surgical intensive care unit when indicated.

Radiographs were evaluated to determined the fracture pattern, bone quality, presence of bone loss, associated comminution, presence of air in the soft tissues and degree of overriding.

The other suspected area of fracture are also radiographically evaluated. Patients were initially treated by skeletal fraction (upper tibial). Surgery was done later (between 3-7 days).

Operative Procedure

Fracture Table and image intensification are used. In the supine position, traction is applied through an orthopaedic boot. In the lateral position, skeletal fraction (Steinmann pin in the upper tibia) is made use of.

Position of Patient

Supine position is used in cases especially with associated injuries like abdominal or chest injuries. It is easy to reduce the fracture in this position and assess rotational alignment.

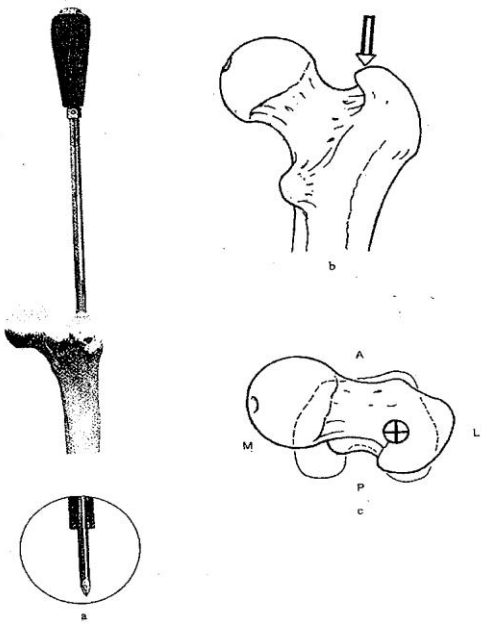
Lateral position is also used especially cases without other systemic injuries. It is easy to identify the pyriform fossa in this position.

Reduction

Traction is applied to the limb preoperatively and the position of fragments checked using c-arm. Positioned of limb is adjusted to obtain alignment.

Incision

Incision of about 7-10 cms starting from the greater trochanter and carried proximally. Subcutaneous tissue, deep fascia and the gluteal muscles are incised. Pyriform fossa indentified.



The point is in the prolongation of the medullary canal- the piriformfossa.

Point of Entry

The pyriform fossa is perforated with a bone awl. The bone awl is held in such a way that its straight part is directed medially. Point of entry is confirmed using c-arm. The awl is directed down wards to pierce the medullary cavity. Its direction is checked with c- arm in both AP and lateral views. A hand reamer of gradually increasing thickness is passed through the point of entry into the medullary canal.

Introduction of guide wire

3mm reaming rod with offset ball tip is introduced through the medullary canal. The angled tip helps threading up the fragments. Adjustment in traction, manipulation are used to catch the distal fragment. Position is checked using c-arm.

Reaming

Before reaming, fracture reduction and position of guide wire are checked fluroscopically. Length, rotation and angulations are corrected. 8mm flexible shaft using interchangeable reamers in increments of 0.5mm is used. Great care is taken while passing the reamer at the site of comminution. Here reaming is restricted to the minimum or reamer is pushed through the comminuted part. After learning, the ball tipped guide wire is replaced with a medullary tube and a guide rod introduced. The medullary tube is taken back.

Insertion of Nail

The appropriate nail is attached to the jig and gently passed over the guide rod. Hammering is avoided as far as possible. Gentle blows with rammingis used to drive the nail into the medullary canal until its tip reaches the distal metaphysis, and the proximal end is, just flush with the superior surface the greater trochanter.

Distal locking

An attempt for distal locking through the jig is made. If it fails, Free hand technique is used. Both distal holes are locked.

Proximal locking

Before proximal locking any distraction at the fracture site is checked. Attention is given to any rotational deformity as well. Proximal locking is easily done through the jig. All fractures are statically locked.

Postoperative Period

Static Quadriceps exercise in the 1st day followed by active assisted and active movement of hip and knee are started from 2nd post op day. However, patients were not allowed to bear weight. Radiograph of femur (AP and lateral views) is taken and the fixation is assessed. Patients are discharged after about 7-10 days. No immobilization is used. Non-weight bearing ambulation using crutches is advised. Patients were reviewed at 8 weeks. The following points are noted:

1.Pain and tenderness at fracture site

2.Evidence of rotation, angulations or shortening

3.Range of movements of hip and knee.

A radiograph is taken and the amount of callus present noted. Patients are allowed partial weight bearing. At 12 weeks, radiograph is taken. Decision for dynamisation and / or bone grafting is made at this point (if needed). If good amount of callus is present, patients are allowed weight bearing to tolerance. At 16-20 weeks, full weight bearing is allowed.

OBSERVATIONS

Total No. of cases Age	:	16
Age	:	20yrs to 48yrs. Average age 32yrs. Peak incidence between 25-40yrs
Sex	:	14 males; 2 females
Nature of trauma	:	All cases were caused high energy trauma 14 cases-road traffic accidents. 2 cases : Mishap at worksite
Associated injuries (Cases with ipsilateral Lower limb # in addition To # shaft of femur are Excluded from study)	:	Haemothorax in 2 cases. Abdominal injury in 1 case (Treated by surgery unit Unit . These cases were operated after about 1 week).
Time interval between	:	Average
injury and surgery	:	3 to 7 days
Classification followed	:	Winquist and Hansen classification
No. of patients with regard:		Type II 8 cases
Regard to comminution	:	Type III 6 cases Type IV 2 cases
Implant used Locking bolts	:	Ao /ASIF Universal femoral nail and Locking bolts
Operating time	:	Average 2hrs
Complications Infection	:	Nil
Broken drillbit	:	Nil

Broken screw	:	Nil
Bending of nail	:	Nil
Nail breakage	:	Nil
Delayed union	:	Nil
Non Union	:	Nil
Iatrogenic fracture	:	Nil
DVT	:	Nil
Fat embotism syndrome	:	Nil

Secondary procedures done

Dynamization	:	In 2 cases with delayed union.
Dynamization and bone	:	In 1 case with delayed union, grafting

RESULTS

The results are graded into excellent, good, fair, poor using a scale in which the maximum score is 40. Scale is constructed in the following manner based on scale of Sanders et al.

Table No.1

			United	Delayed union	Nonunion
1.	Radiological Union	:	10 points	5 points	0
2.	Range of movement	:	No loss of movt. 5 points	Restriction of <30° knee flexion3points	Restriction of >30° knee flexion
3.	Shortening	:	Nil 5 points	<1.5 cm 3points	1 point >1.5cm
4.	Angular deformity	:	Nil 5 points	<15° 3 points	0 point >15°
5.	Rotational deformity	:	Nil 5 points	<15° 3 points	0 point >15°1 point
6.	Walking ability	:	Normal 5 points	Limping 3 points	Walking aid 0 point
7.	Pain and tenderness	:	Nil 5 points		Present 0 point

Maximum Score	:	40
Excellent	:	36-40
Good	:	26-35
Fair	:	16-25
Poor	:	<15

Table No. 2

Type of comminution of femoral shaft fraction	No. of cases
II	8
III	6
IV	2

(Type I comminuted cases excluded from study)

Table No.3

Type Comminution	No. of cases	Radiological union			Movement			Length discrepancy			Angular deformity			Rotational deformity			Walking ability			Pain & tenderness	
		United	Delayed union	Non union	Normal	<30° restriction of knee flexin	>30°	Nil	<1.5 cm	>1.5 cm	Nil	<15°	>15°	NIL	<15°	>15°	Normal	Limping	Walking aid	Nil	Present
II	8	8	0	0	8	0	0	8	0	0	7	1	0	6	2	0	8	0	0	8	0
III	6	4	2	0	5	1	0	3	3	0	4	1	1	5	1	0	5	1	0	5	1
IV	2	0	2	0	0	2	0	1	1	1	1	0	1	1	1	0	0	2	0	1	1

Table No.4 Clinical result related to grade of comminution

Type of comminution	No.of cases	Excellent	Good	Fair	Poor
II	8	8	0	0	0
III	6	4	2	0	0
IV	2	0	1	1	0

Excellent result are obtained in all cases of Type II comminution.

Excellent to good result are obtained in Type 111 comminution

Good to Fair results in Type IV comminuted fracture.

No cases ended In poor result.

DISCUSSION

From the 1980's, treatment of comminuted femoral shaft fracture by interlocking intramedullary nailing became available. The method allows in the placement of an IM nail into the medullary canal with cross bolts through the nail both proximal and distal to the fracture to allow for control of length and rotation.

We have taken at most care to correct the patient to the appropriate femoral length. Care was taken to avoid malrotation at the time of surgery. We did not try achieve perfect anatomical reduction, but concentrated on length and alignment. All procedures were done by closed method. All fractures were statically locked. Help of C-arm is used effectively for all these procedures. Lack of infection in our series could be contributed by the closed method of nailing. Excellent results are obtained in all cases of Type II comminuted towards of femoral shaft. Excellent to good results are obtained in Type III comminuted fractures.

Good to fair results are obtained in Type IV comminuted fractures. No cases developed fat embolism syndrome. This is largely contributed by early correction of oligaemia and early immobilization of fractures. Prophylaxis against deep venous, thrombosis is not given routinely. No cases developed DVT. This can be due to prompt maintenance of fluid electrolyte balance and early mobilization of cases.

CONCLUSION

Interlocking intra medullary nailing is a very good mode of treatment of comminuted fractures of the femoral shaft. Closed nailing and static locking is a technically demanding procedure. Risk of exposure to radiation is there. This method offers the possibility of maintenance of length, alignment and rotational, stability in comminuted fractures of the femoral shaft while preserving the biological environment of fracture healing. We recommend static locking in all comminuted femoral shaft fractures. Routine dynamisation is unnecessary.

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