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FUNCTIONAL OUTCOME ASSESSMENT OF OSTEOSYNTHESIS IN IPSILATERAL FRACTURES OF HIP AND SHAFT OF FEMUR USING INTRAMEDULLARY RECONSTRUCTION NAIL

Ashwini Kumar Khicher[1], Mahesh Chand Bansal[2], S. L. Sharma[3], Ravindra Lamoriya[4], Anurag Dhakad[5], Rahul Upadhayay[6]

[1] Resident Doctor, [2] Senior Professor and Unit Head, [3,5] Professor, [4] Assistant Professor, [6] Senior Resident
Department of Orthopedics, S M S Medical College, Jaipur Rajasthan
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Corresponding author: Ashwini Kumar Khicher

Abstract:
Background- Fractures of ipsilateral hip and shaft of femur is an uncommon and complex pattern of injury. This combination of fractures usually occur in young individuals with history of high energy trauma like road traffic accidents and fall from height.
Methods- The study was conducted prospectively on patients admitted with concomitant fractures of ipsilateral hip and shaft of femur in the department of orthopaedics, SMS medical college and hospital, Jaipur during April 2016 to Nov2017. All data were analyzed by Epi-info software.
Results-Out of 13 patients who had delayed union, 9 patients had delayed union of shaft and 4 had delay in union of neck fracture. In 5 patients shaft of femur fracture failed to unite requiring further intervention. One patient developed fat embolism preoperatively, managed in intensive care unit. 9 patients had shortening, 3 had shortening <2cm and 6 patients had shortening between 2-3cm. One patient developed reverse Z-effect. 3 patients developed superficial infection. Malunion was seen in 14 patients, out of which 7 were trochanteric fracture 3 were neck of femur fracture and 4 were shaft fracture.
Conclusion- Reconstruction nail is a very good implant choice to fix both the fractures simultaneously with minimal soft tissue damage and providing biological fixation for both the fracture combination.
Keywords- Reconstruction Nail, Ipsilateral femoral neck-shaft fracture, Malunion

Introduction

Modern life is all about pace and speed, increasing vehicular traffic on our roads leading to increase in incidence of cases of high velocity trauma. We are now encountering more patients with multiple injuries of skull, thorax and abdomen associated with multiple fractures.

Femur is one of the most commonly fractured bone. Being the largest and principle load bearing bone of our body, its anatomical shape and anterolateral bowing makes it more vulnerable to fractures.

Fractures of ipsilateral hip and shaft of femur is an uncommon and complex pattern of injury. This combination of fractures usually occurs in young individuals with history of high energy trauma like road traffic accidents and fall from height. Alho A reported road traffic accidents as a cause in 78% and other high velocity injuries in 13% of cases in his study.

A wide range of treatment methods have been tried for this combination injury and until now no method can be considered absolutely superior to any other.

Reconstruction interlocking nails (recon nails) have many technical requirements but they have gradually become increasingly popular for the treatment of ipsilateral hip and femoral shaft fractures worldwide. The use of recon nails have advantages of being less invasive, ease of application and decreased surgical time and blood loss. Success rates of this procedure have been reported to be 69-100%.

This prospective study was conducted to evaluate the functional outcome of reconstruction nail in patients with ipsilateral fractures of hip and shaft.

Material and Methods

The study was conducted prospectively on patients admitted with concomitant fractures of ipsilateral hip and shaft of femur in the department of orthopaedics, SMS medical college and hospital, Jaipur during April 2016 to Nov2017.

SAMPLE SIZE- The sample size was calculated to be 42 subjects at 95% confidence level and 10% absolute allowable error assuming 88% of the patients had union of shaft of femur fractures (as per seed article). Hence for the purpose of this study 45 subjects were taken.

INCLUSION CRITERIA-

1. Patients with ipsilateral fractures of hip and shaft of femur.
2. Patients of either sex aged between 18 to 75 yrs.
3. Patients consented to be included in the study

EXCLUSION CRITERIA-

1. Medically and anaesthetically unfit patients.
2. Patients with associated vascular injuries.
3. Patients with associated acetabular and extensive pelvic fractures.
4. Patients with fractures in paralytic or poliotic limb
5. Patients with pathological fractures.
6. Patients not consented to be included in study.

SURGICAL TECHNIQUE-

a. Determining the nail to be used prior to surgery

The length of nail was measured from tip of greater trochanter to upper pole of patella. The diameter of nail was determined from the anteroposterior and lateral radiographs and from reaming during surgery.

b. Position of the patient

Patients were laid supine on fracture table, with affected limb in extension and adduction at hip and traction was applied. The opposite limb was kept in flexion at hip and knee of 90° and abduction at hip. Image intensifier was placed on the unaffected side of the patient.

Closed reduction was attempted in all patients with traction and manipulation under image intensifier before draping the field

c. Draping the patient

Draping is a very important step in all surgeries and should always be done by experienced surgeon or assistant. We did drape our patients after proper scrubbing and painting with betadine with sterile sheets and under all aseptic precautions.

d. Incision

An oblique incision was given after feeling and starting from the tip of greater trochanter extending it proximally and posteromedially for 6-8 cm. For obese patients a longer incision was given. Superficial fascia, deep fascia and gluteus medius were split.

e. Entry point

Tip of Greater trochanter was palpated by blunt dissection and entry was made with pointed awl and medullary cavity was perforated under image intensifier.

f. Guide wire insertion

A guide wire was passed through the proximal and distal fragments after proper reduction under C-arm control. One or two K-wires were inserted in femoral head to maintain the hip fracture reduction during reaming and nail insertion whenever needed.

g. Reaming

Reaming was done by manual or flexible reamers of successively increasing sizes (increments of 0.5mm). Ball tip guide wire was then exchanged with pointed guide wire with help of exchange tube.

h. Nail insertion

Appropriate size nail was selected based on the radiograph and size of largest reamer used. The nail was then mounted on jig and introduced into medullary cavity over the guide wire, using hammer if necessary, maintaining the reduction. Position of nail was then checked under C-arm and guide wire was removed. Rotational alignment was checked clinically and intraoperatively.

i. Recon locking

After insertion of appropriate size nail, two guide wires were introduced into femoral neck and head while checking their position and maintaining reduction under C-arm. Reaming was done and appropriate size 6.5mm cannulated lag screws were inserted, keeping in mind to place them posteriorly. Inferior screw was inserted first in most of the cases.

j. Distal locking

After recon locking was done, jig was removed and limb was abducted. Distal locking was then done using free hand technique and using C-arm.

Finally the reduction at hip and shaft, nail size, placement of cervical screws, distal locking was checked under image intensifier. And after confirmation all the incised wounds were washed and closed in layers. Betadine dressing was done.

POSTOPERATIVE CARE-

- After patients were shifted to postoperative ward, they were kept nil by mouth for 3-4 hours.
- Appropriate intravenous fluids, blood transfusion was done.
- Intravenous antibiotics were started the same day and continued for the patient's hospital stay to the maximum of 7 days.
- Appropriate analgesics were given to the patient
- Postoperative radiographs of operated limb in anteroposterior and lateral view were taken depending upon stability and comfort of the patient.
- Head was kept low for 24hours.
- Quadriceps strengthening and active assisted movements of limb were started on 1st postoperative day.
- Mobilisation with crutches or walker was started as soon as pain and patient's general condition permitted. Patient was kept non weight bearing.
- Patients were then discharged with oral postoperative antibiotics and analgesics. They were adviced to do static quadriceps and hamstrings exercises.
- All the patients were adviced to review after 2 weeks for suture removal or earlier if necessary.

FOLLOW UP-

- All the patients were adviced to review for follow up monthly initially and at interval of 3 months later on.
- On each follow up patients were examined clinically and radiologically.
- Clinical examinations included evaluation of complaints by the patients, assessment of range of motion, incision site healing, soft tissue assessment, rotational alignment, limb length discrepancies and deformities, if any.
- Radiological examination included performing x-rays in anteroposterior and lateral views of the patients. And assessing them for rotational alignment, varus or valgus and flexion-extension deformities and callus formation.
- Finally the functional assessment was done at 9 months using Harris Hip Score.

Observations and Results

This study included 45 patients with concomitant ipsilateral femoral shaft and hip fractures treated with reconstruction nails between april 2016 to November 2017.

Age distribution:-

Youngest patient in our study was 18 years old and oldest patient was 62 years old. Mean age was 35 years. Distribution according to age is as follows-

Table 1: Age distribution

	Number of Cases	Percentage (%)
18-30	19	42.22
31-40	13	28.88
41-50	8	17.77
>50	5	11.11
Total	45	100.0
Mean±SD	35.02±11.33	

Sex distribution:-

Out of 45 patients, 40 (88.88%) were male and 5(11.11%) were female.

Table 2: Sex distribution

Gender	Number of Cases	Percentage (%)
Male	40	88.88
Female	5	11.11
Total	45	100.0

Intraoperative complication:-

Following table shows distribution of different intraoperative complications occurred during treating this combination fractures.

Table 3: Intraoperative complication

Intraoperative complication	Number of Cases (N=45)	Percentage (N=45)
Iatrogenic comminution		
At fracture shaft of femur	4	8.88
At intertrochanteric fracture	1	2.22
Difficulty in reduction		
At intertrochanteric fracture	5	11.11
At neck of femur fracture	7	15.55
At fracture shaft of femur	8	17.77
Difficulty in passing guide wire	6	13.33
Improper cervical screws		
Inadequate size screws	5	11.11
Superior placement of screws	7	15.55
Difficulty in locating entry site	9	20.00

Iatrogenic comminution at fracture site occurred in 5 patients, 4 of them at shaft of femur fracture. Difficulty in reduction of fracture was experienced in 20 patients. For eight patients at shaft of femur fracture, 7 at neck and in 5 patients with trochanteric fracture. In 6 patients, difficulty in passing guide wire through fracture site into distal fragment was experienced. 12 patients had improper cervical screws, 7 had superior placement of cervical screws and 5 with inadequate sizes screws. In 9 patients, difficulty in locating entry site was experienced.

Post operative radiological evaluation:-

16 patients had distraction at fracture site, out of which eight had distraction at shaft fracture site, 4 patients had at trochanteric fracture site and 4 patients had distraction at neck fracture.

Seven trochanteric fractures were malreduced in varus and 4 neck fractures were reduced in varus.

Four patients had valgus reduction at shaft fracture and one patient had varus reduction.

Table 4: Post operative radiological evaluation

Postoperative radiological finding	Number of Cases	Percentage (N=45)
Distraction at fracture site		
At trochanteric fracture	4	8.88
At neck of femur fracture	4	8.88
At shaft of femur fracture	8	17.77
Varus malreduction at hip		
At trochanteric fracture	7	15.55
At neck of femur fracture	4	8.88
Malreduction at fracture shaft of femur		
Valgus reduction	4	8.88
Varus reduction	1	2.22

Time of union (weeks):-

Mean time for union at fracture neck of femur was 15.53 weeks with standard deviation of 4.44. Mean time for union at trochanteric fracture site was 14.04 weeks ± 2.51SD. Mean time of union for shaft of femur was 27.49 weeks ± 8.18 SD.

Table 5: Time of union (weeks)

Fracture site	Mean	SD
Fracture neck of femur	15.53	4.44
Fracture I/T femur	14.04	2.51
Fracture shaft of femur	27.49	8.18

Final Outcome:-

Twenty three patients out of 45 had excellent results on the basis of harris hip score. 14 patients had good 4 patients had fair and 4 patients had poor functional outcome.

Table 6: Final Outcome

Functional outcome	Number of Cases	Percentage (%)
Excellent	23	51.11
Good	14	31.11
Fair	4	8.88
Poor	4	8.88
Total	45	100.0

Complications:-

Out of 13 patients who had delayed union, 9 patients had delayed union of shaft and 4 had delay in union of neck fracture. In 5 patients shaft of femur fracture failed to unite requiring further intervention. One patient developed fat embolism preoperatively, managed in intensive care unit. 9 patients had shortening, 3 had shortening <2cm and 6 patients had shortening between 2-3cm. One patient developed reverse Z-effect. 3 patients developed superficial infection. Malunion was seen in 14 patients, out of which 7 were trochanteric fracture 3 were neck of femur fracture and 4 were shaft fracture.

Table 7: Complications

Complication	Number of Cases	Percentage (%) (N=45)
Delayed Union		
Fracture neck of femur	4	8.88
Shaft of femur fracture	9	20.00
Nonunion		
Shaft of femur fracture	5	11.11
Fat embolism		
Present	1	2.22
Shortening		
<2 cm	3	6.66
2-3 cm	6	13.33
z effect or reverse z effect	1	2.22
Superficial infection	3	6.66
Malunion		
Trochanteric fracture	7	15.55
Fracture neck of femur	3	6.66
Shaft of femur fracture	4	8.88

DISCUSSION

Ipsilateral hip and shaft fractures are well known to all orthopaedicians since it was first described by Delaney and Street in 1953. This injury pattern occurs in patients with high energy trauma with multiple injuries. Early recognition of all fractures is of paramount importance in planning the surgical treatment and is the first step towards good results. Till date no single treatment method is considered best among all.

This study has been conducted in the department of orthopaedics SMS medical college and group of

hospitals Jaipur during the period of April 2016 to November 2017. We chose 45 patients with ipsilateral concomitant fractures of hip and shaft of femur and treated them with reconstruction nail to fix both the fractures simultaneously.

In our study majority of patients were young belonging to the age group of 18 to 62 years, with mean age of 35 years. This finding correlates with the study done by Jain et al (2004), Shetty et al (2007) and Roop Singh et al (2008).

In our study there were 40 males and 5 female patients out of total 45 patients. Similar findings were observed in all other studies.

Five of the patients in our study were complicated with iatrogenic comminution four of them at fracture shaft of femur and in one of the patient at proximal femur. In 9 patients with comminuted fractures of hip difficulty in locating entry site was seen. Difficulty in passing guide wire in distal fragment was observed in 4 of our patients with type 3 shaft fractures and 2 patients with type 4 fractures. Difficulty in reduction was experienced in 8 patients with fracture shaft of femur, in 7 patients with fracture neck of femur and in 5 patients with intertrochanteric fracture. Most of these fractures were highly comminuted and displaced. 12 of our patients had improper cervical screws with inadequate screw size in 5 and superiorly placed screws in remaining of 7 patients. In one of our patients diagnosis of fracture neck of femur was missed initially which was diagnosed just before start of the surgery.

In our study various degree of distraction was present. In eight patients, at shaft fracture site; in 4 patients at neck fracture site and in 4 patients at trochanteric fracture site. Varus malreduction was observed in 7 patients with trochanteric fracture and in 4 patients with neck fracture. Five patients in our study had malreduction at shaft of femur fracture.

Mean union time for fracture neck of femur was 15.53±4.44 weeks in our study. For trochanteric fractures, this period was 14.04±2.51 weeks and for shaft of femur mean time to union was 27.49 ± 8.18 weeks. Our results were comparable to the studies of Wang(2010), Vidyadhara(2009),Roop singh (2008), Krishna et al(2017) and Jain et al(2004). While different authors have reported different union time for these fractures in their study.

Delayed union in our study was observed in 9 patients with shaft of femur and in four patients with neck of femur. Five patients experienced non-union of shaft of femur. Three patients were Winquist type 4, one of type 3 and another one belong to type 2 fracture shaft of femur. One of these was infected non-union at shaft of femur, which was debrided and healed with intravenous antibiotics. Another patient who had hypertrophic non-union, exchange nailing with bone graft was done for the patient. While simple bonegraft was done for the remaining 3 patients, two of them are still to unite. All fractures at neck and trochanteric region united.

Shortening of 2-3 cm was seen in six of our patients and less than 2 cm of shortening in three of our patients. One of our case was complicated with Reverse Z-effect of proximal locking, in whom the loose screw was removed and bone graft was done. Three of our cases were complicated by superficial infection of the incision site, who were treated with debridement and intravenous antibiotics. One of our patient developed fat embolism in preoperative period and was managed in ICU for 10 days.

Malunion at fracture neck of femur was seen in 3 patients. In patients with trochanteric fracture, malunion was observed in 7 patients and in shaft of femur in four patients.

We did not have any cases of avascular necrosis of head of femur in our study.

Mean Harris Hip Score, in our study was 85.93, ranging from minimum of 47 to maximum of 97. Similar results were observed by Tsarouhas A. et al (2011) in their study.

Thirty seven patients (82%) out of 45 patients included in our study had excellent to good results. While 4 patients had fair results. Four patients experienced poor functional outcome.

CONCLUSION

Reconstruction nail is a very good implant choice to fix both the fractures simultaneously with minimal soft tissue damage and providing biological fixation for both the fracture combination.

Ethical approval: The study was approved by the Institutional Ethics Committee

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