

Original Research Article

Outcome of cephalo-medullary nailing in intertrochanteric fracture of femur

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ABSTRACT

Background: Intertrochanteric fracture is commonly seen in elderly and osteoporotic bone due to trivial trauma and requires hospitalization. Nonoperative treatment leads to complications like bedsores, pneumonia and deep vein thrombosis. The introduction of cephalomedullary nailing has broadened its use in complex intertrochanteric fracture with least complications.

Methods: A prospective observational study was conducted in Birgunj, Nepal from 4th October 2020 to 3rd October 2021 among 50 patients of age more than 30 years with closed intertrochanteric fractures. Ethical approval was obtained from the institutional review committee and proper informed consent was taken. Modified Harris hip scoring system was used. Type of implant used was PFN long and short.

Results: The mean age of 50 patients was 66.42 years, female to male ratio was 1.5:1 (30:20) and right side (72%) with fall injury (78%) was commonly observed. According to Kyles classification, 40% patients had Kyles's type II fracture followed by type III (38%). Most of the cases start mobilization on 2nd post operative day. Mean Harris hip score at 14 days, 6 weeks, 3 months and 6 months were 52.02, 64.50, 72.91 and 84.40 respectively. Early mobilization within 2 days of post-surgery had significant improvement in functional outcome throughout follow up as compared to more than 2 days ($p=0.001, 0.001, 0.001$ and 0.001 at 14 days, 6 weeks, 3 months and 6 months respectively). Radiological union was achieved in all cases within 6 months.

Conclusions: The study results concluded cephalomedullary nailing is effective treatment for intertrochanteric fracture.

Keywords: Cephalomedullary nail, Intertrochanteric fracture, Femur, Modified Harris hip score

INTRODUCTION

Intertrochanteric fracture is one of the most common fractures of the hip especially in the elderly with osteoporotic bones, usually due to low-energy trauma like simple falls.¹ More than 90% of hip fractures in elderly are intertrochanteric fractures with complication rate of 20-30% and mortality rate of about 17%.²⁻⁴ Traditionally in early 19th century, Intertrochanteric fracture treated with prolonged continuous traction in skeletal traction. Long term immobilization on traction resulted in bed ridden for many days and suffer from psychosocial problems.⁵ Due to such complication, management of intertrochanteric fracture

with skeletal traction, surgical treatment represents the optimal strategy. It allows early rehabilitation and functional recovery, and reduces the risk of post-operative complications.⁴

Surgical treatment includes, external fixation and internal fixations.⁶ Internal fixation is a most common surgical treatment for intertrochanteric fractures and intra-medullary (nails) and extra-medullary (screws or plates) fixations are two commonly used approaches.^{7,8} Extramedullary fixation i.e. Dynamic compression plate and screw required large dissection while applying and blood loss is maximum.⁸⁻¹⁰ DHS does not show good

outcome in Unstable Intertrochanteric fracture.⁹⁻¹¹ To overcome this problems in surgical management of Intertrochanteric fracture of femur in old age, intramedullary fixation is come into practice.⁸⁻¹¹ In Intertrochanteric fracture of femur the aim of treatment is to stabilize the fracture, control the rotational alignment, early mobilization, decrease morbidity and mortality, minimal incision, reduced wound infection, and decreased femoral neck shortening.¹⁰⁻¹²

AO/ASIF in 1996 designed a new medullary device, the “Cephalomedullary nail”.^{13,14} CMN has additional anti rotational screw (Hip pin), secondly nail tip is specially shaped to reduce the stress and therefore to prevent low energy fracture at the tip of the implant.¹⁴ Compared with DHS, CMN greatly reduces the lever arm distance from the reactionary forces generated in hip joint as a result of movements at the hip joint and increases compressive forces implanted to the tension side application of DHS.¹³ Rapid in implant and instrumentation in quest of an ideal fixation has made cephalomedullary nail superior.¹⁴ Less exposure time less soft tissue discretion less radiation exposure, less blood loss and most important is taking advantage of the natural biomechanics at the hip joint.^{13,14}

General objectives

The objective of the study was to assess functional outcome of cephalomedullary nailing in intertrochanteric fracture of femur.

Specific objectives

The objective of the study was to assess the outcome by modified Harris hip score and to evaluate the mean time of radiological union.

METHODS

A prospective observational study was conducted in department of orthopedic surgery, National medical college and teaching hospital, Birgunj, Nepal from 4th October 2020 to 3rd October 2021, among 50 patients. Sample size was calculated using the formula $n = Z^2 \times p(1-p) / m^2$ and estimated prevalence of intertrochanteric fracture of femur in previous year in this institute was $p = 0.032$ (3.2%). Purposive sampling technique was used. Patients with age above 30 years, both sexes, closed intertrochanteric fracture of femur, patient fit for surgical procedure and who gave consent for study was included. Patients with cognitive disorder, age less than 30 years, associated with head injury, contralateral limb fracture, preexisting hip pathology like arthritis, patients not willing and medically not fit for surgical procedure was excluded from study. Ethical approval was obtained from the institutional review committee (IRC). Proper informed consent was taken from those patients who were fit for surgery and gave written consent. The fracture was classified according to Kyle's classification. The patients were treated with cephalomedullary nailing on standard

fracture table under fluoroscopy and followed up at 2 weeks, 6 weeks, 3 months and 6 months till the radiological union was achieved. Modified Harris hip scoring system was used to assess the final outcome of the study. All data were processed, analyzed, and disseminated by MS office and statistical package for social sciences (SPSS) version 26.

RESULTS

In this study, out of 50 patients, majority of the patients 30 (60%) were female whereas 20 (40%) were male and most of the patients 17 (34%) were of age group 61-70 years.

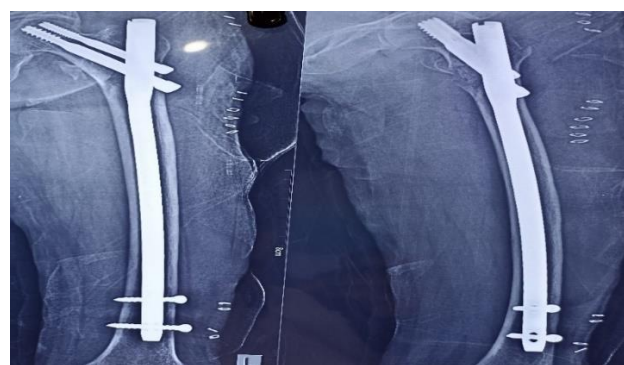


Figure 1: X-ray.

Table 1: Age distribution of the study participants, (n=50).

Age (years)	Frequency	Percentage (%)
30-40	3	6
41-50	4	8
51-60	11	22
61-70	17	34
71-80	8	16
81-90	7	14

The study result revealed 39 (78%) patients sustained injury due to fall injury while 11 (22%) patients due to road traffic accident (RTA) and 36 (72%) patients had fracture on the right side while 14 (28%) patients on left side. Regarding status of fracture stability, unstable fracture were 26 (52%) and stable fracture 24 (48%).

Intertrochanteric fracture was classified according to most commonly used Kyle's classification system for intertrochanteric fracture

Table 2: Kyle's classification of intertrochanteric fracture.

Type of fracture	Frequency	Percentage (%)
Type 1	4	8
Type 2	20	40
Type 3	19	38
Type 4	7	14
Total	50	100

Out of 50 patients we found 11 (22%) patients were suffering from cardiovascular disease while 10 (20%) patients were suffering from chronic lung disease, 8 (16%) patients had diabetes mellitus, 3 (6%) had hypothyroidism and other 4 (8%) were having renal disease, hepatobiliary disease, cerebral disease (stroke) and 13 (26%) had no comorbidities. Among 50 patients, 6 (12%) were operated in less than 24 hours from the time of injury, 15 (30%) cases were operated between 24-48 hours, 12 (24%) were operated in 48-72 hours and 17 (34%) cases were operated in >72 hours. Time taken for surgery varied from 30 minutes to 180 minutes with mean time of 87.28 minutes and standard deviation of 30.494. The 28 (56%) case were operated within 61-90 minutes followed by 9 (18%) within 30-69 minutes, 8 (16%) within 91-120 minutes, 4 (8%) in 121-150 minutes and 1 case were in 151-180 minutes. In most of the patient, 18 (36%) cases had blood loss about average of 100-200 ml, 16 (32%) cases had 50-100 ml, 10 (20%) cases had 200-300 ml and in 6 (12%) had >300 ml. Blood loss was measured by no. of soaked gauze pad and suction in drain and number of normal saline used to wash.

Mobilization was started on partial weight bearing and crutch walking as soon as possible after surgery. In 32 (64%) cases mobilization was started from 2nd post-operative day, followed by 16 (32%) on 3rd-7th post-

operative day. In 1 case mobilization was only possible after 6 weeks as he developed intraoperative complication and wound infection. In 1 case mobilization was not possible as he developed left ventricular failure and died on 3rd post-operative day. In majority of the patients 47 (94%) patients were allowed to full weight bear on 6 weeks of follow up. One (2%) case was allowed weight bear after 3 months (12 weeks) as he developed wound infection and intraoperative fracture. In 2 cases mobilization was not possible as 1 developed left ventricular failure and died on 3rd post-operative day and another died due to renal failure on 24th post-op day. The study results showed that the mean duration of hospital stay was 11.18 days and standard deviation of 8.017.

The mean modified Harris hip score at 14 days, 6 weeks, 3 months and 6 months postoperatively were 52.02±6.01, 64.50±6.15, 72.91±7.86 and 84.40±8.75 respectively.

There was a significant relationship between early mobilization and improvement in Harris hip score at the time of discharge, at 14 days, 6 weeks, 3 months and 6 months post-surgery with p=0.001, 0.001, 0.001 and 0.001 respectively.

Table 3: Distribution of patients with modified Harris hip score.

Variables	Modified Harris hip score							
	14 Days		6 Weeks		3 Months		6 Months	
	N	%	N	%	N	%	N	%
<70 (poor)	49	98	37	74	16	32	3	6
71-79 (fair)	-	-	11	22	17	34	10	20
81-89 (good)	-	-	-	-	13	26	17	34
90-100 (excellent)	-	-	-	-	-	-	13	26
Missing case (dead)	1	2	2	4	4	8	7	14
Total	50	100	50	100	50	100	50	100

Table 4: Day of mobilization started and modified Harris hip score.

Variables	Days in mobilization (days)	N	Mean	SD	T	P
Modified Harris hip score-14 days	<2	32	54.31	5.515	4.275	<0.001
	≥3	17	47.71	4.356		
Modified Harris hip score-6 weeks	<2	32	67.19	4.540	5.423	<0.001
	≥3	16	59.13	5.451		
Modified Harris hip score-3 months	<2	31	76.77	5.789	6.761	<0.001
	≥3	15	64.93	5.063		
Modified Harris hip score-6 months	<2	30	89.13	4.083	9.611	<0.001
	≥3	13	73.46	6.489		

In all cases, fracture union was achieved by 6 months. Z-effect was seen in 1 (2%) case at 3 months follow up. Reverse Z-effect were seen in 2 (4%) cases, 1 at 3 months and 1 at 6 months follow up

DISCUSSION

In our study, 50 patients were included with mean age of 66.42 years (30 years to 90 years) and most were age group

(61-70 years). In a study done by Korkmaz et al mean age of the patients was 77.66 years (range: 37-98 years) and in study of Li et al showed the mean age of patients was 74.7 years and similarly Gadegone et al showed in their study the mean age was 67 (56-83) years, which was similar to our study.¹⁵⁻¹⁷ In our study, out of 50 patients 30 (60%) were female and 20(40%) were male. The demographics were similar to study results of Korkmaz et al in which the sex distribution was 32 males and 68 females.¹⁵

The study result revealed 39 (78%) cases sustained injury due to fall and 11 (22%) cases due to road traffic accident (RTA). Fall injury included like fall while walking, fall from bed, and fall from height. Our study was similar to Li et al which showed sustained injury by domestic fall in 117 cases and RTA in 46 cases.¹⁶ Korkmaz et al revealed in their study that mechanisms of injury were simple fall at home 87, simple fall outside home 4, traffic accident 4, sports injury 3 and Gunshot 1.¹⁵ In our study, 24 (48%) were stable fracture and 26 (52%) were unstable. Study conducted by Gadegone et al showed 36 (36%) cases had stable fracture and 64 (64%) had unstable fracture.¹⁷

The mean time interval from injury to surgery were 3.00 days (range 1 to 7 days). Among 50 patients, 17 (34%) cases were operated in >72 hours 15 (30%) cases were operated between 24-48 hours from the time of injury, 12 (24%) were operated in 48-72 hours and 6 (12%) were operated in less than 24 hours. According to Novack et al patients who had surgery within 2 days had lower mortality (in hospital, 1 month, and 1 year) compared to those who waited for surgery more than 4 days but the author has not mentioned about the functional recovery in subsequent follow up.¹⁸ In our study, operative delay was prolonged due to comorbidities and hence longer period of pre operative optimization for surgery.

Time taken for surgery varied from 30 minutes to 180 minutes with mean time of 87.28 minutes and standard deviation of 30.49. The 28 (56%) case were operated within 61-90 minutes followed by 9 (18%) within 30-60 minutes, 8 (16%) within 91-120 minutes, 4 (8%) in 121-150 minutes and 1 case in 151-180 minutes. The average duration of surgery was slightly less i.e., 45.7 min (range, 35-110 min) in the study conducted by Li et al.¹⁶ In the study of Korkmaz et al the mean duration of the operation was 87.9 minutes (range: 30-300 minutes).¹⁵

Out of 50 patients, 18 (36%) cases had blood loss in an about average of 100-200 ml, 16 (32%) cases had 50-100 ml, 10 (20%) cases had 200-300 ml and in 6 (12%) had >300 ml. Blood loss was measured by number of soaked gauze pad and suction in drain and number of normal salines used to washed. Our study was supported by Li et al study, in which average intra-operative blood loss of 115.2 ml (range, 65-430 ml).¹⁶ Kale et al study showed the mean blood loss 87.17 ± 27.84 ml in long PFN group and 98.67 ± 47.32 ml in short PFN group.¹⁹ Li et al, Kale et al and our study showed less blood loss due to minimum incision and short operation duration.^{16,19}

Mobilization was started on partial weight bearing and crutch walking as soon as possible after surgery. In 32 (64%) cases mobilization was started from 2nd post-operative day, followed by 16 (32%) on 3rd-7th post-operative day. In 1 case mobilization was only possible after 6 weeks as he developed intraoperative complication and wound infection. FWBCW was started after 6 weeks in 47 (94%) cases and 1 (2%) cases were started after 12 weeks as he developed wound infection. Study conducted

by Boldin et al²⁰ showed immediate full weight bearing was permitted in 49 cases and partial weight bearing in 6 cases. Study conducted by Kawatani et al showed all cases were allowed weight bear from the 1st post operative day.²¹ In our study, significant association was found between mobilization started within 2 days of post-surgery and improvement in Harris hip score at the time of discharge, 14 days, 6 weeks, 3 months and 6 months post-surgery with $p=0.001$, 0.001 , 0.001 , 0.001 , respectively as compared to mobilization started after 2 days. Study results of Sui et al showed in patients with hip fractures delay in getting the patients out of bed was associated with poor outcome at 2 months and worsened 6 months early survival.²² Many authors revealed in their study that early mobilization results into better functional outcome.^{17,22,23}

Functional outcome classified as per modified Harris hip score was excellent in 13 patients (26%), good in 17 patients (34%), fair in 10 patients (20%) and poor 3 patients (6%) on 6 months follow up. Asad et al showed in their study that excellent outcome observed in 28.6% patients, good in 45.1%, fair outcome in 16.5% and only 9.9% expressed poor outcome among 91 patients.²⁴ Similar results were shown by Uzun et al in their study, were excellent in 11 (31.4%) patients, good in 15 (42.9%) and fair in 7 (20%) patients.²⁵ Most author revealed that intertrochanteric fracture of femur treated with CMN has excellent outcome as per modified Harris hip score.^{16,17,23-25}

In our study, out of 50 patients, 4 (8%) patients had thigh pain, 2 (4%) had reverse Z-effect and 1 (2%) had Z-effect. They had pain on weight bearing and limitation in mobilization in subsequent follow up. There was wound infection 1 (2%) case. Similar result was found by Kawatani et al.²¹ Six cases (1.7%) included where wound infection in two cases, and one case each with secondary fracture at subtrochanteric region, nonunion, back-out of the guiding sleeve and medial perforation of the lag screw. Gadegone et al found two patients had Z-effect and one reverse Z-effect.¹⁷

In all cases, fracture union was achieved by 6 months. Our study was supported by Yadkikar et al study in which they found average fracture union time was 16 weeks and Rethnam et al study in which fracture union time was 14.8 ± 3.76 weeks (Range: 8-24 weeks).^{26,27}

Limitation

The limitations were-small sample size. Long term follows up required for functional outcome for more authenticity and validity.

CONCLUSION

Cephalo-medullary nailing is effective treatment for stable and unstable intertrochanteric fracture of femur. It provides stable fixation and early mobilization.

Recommendations

It is to recommend for conducting more studies regarding the same issue with larger sized sample.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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