



E-ISSN: 2395-1958  
P-ISSN: 2706-6630  
IJOS 2020; 6(4): 802-805  
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[www.orthopaper.com](http://www.orthopaper.com)  
Received: 23-08-2020  
Accepted: 07-10-2020

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## Single Vs double implants in ipsilateral fracture shaft with neck of femur fracture: A comparative study

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DOI: <https://doi.org/10.22271/ortho.2020.v6.i4l.2421>

### Abstract

Combined ipsilateral femoral neck and shaft fractures are uncommon and challenging injuries to manage. Treatment of these type of fractures are different and associated with high rate of complication. Choosing a right implant is necessary to get optimal results with minimal complication. To evaluate the functional, radiological and anatomical outcomes of these cases treated by single implant or individual implant for each fracture by osteosynthesis. A total of 20 patients with ipsilateral femoral neck and shaft fractures were included in our study. Patients were divided into single implant group (Group I; 10 patients) and multiple implants group (Group II; 10 patients). All the patients were followed up prospectively for two years. Fracture union was confirmed radiologically, and functional evaluation was done as per Harris Hip Score. 70% of both groups achieved successful fracture union with the remaining 30% with either nonunion, malunion or necrosis of the femoral head but with no statistical significant difference between both the groups. Upon comparing single versus multiple implants methods nearly similar results; were clinically and radiologically obtained. However, it is difficult to draw a definite conclusion as the number of cases were relatively smaller. A study with a larger population scale probably can give a definite conclusion.

**Keywords:** Femur, neck, shaft, ipsilateral

### 1. Introduction

Although combined ipsilateral femoral neck and shaft fractures are relatively uncommon injury pattern, it is critical to recognize the presence of an associated ipsilateral femoral neck fracture occurring in conjunction with the more obvious femoral shaft fracture. Associated ipsilateral femoral neck fractures have been reported to occur in 1% to 9% of femoral shaft fractures<sup>[1]</sup>. These are challenging injuries to manage and often require modification of the routine shaft fracture treatment approach. Failure to recognize an associated ipsilateral femoral neck fracture may result in fracture displacement, delayed treatment, and a poorer outcome<sup>[2]</sup>. The injury mechanism is commonly an axially directed force against the distal femur with the hip and knee flexed, such as a motor vehicle accident in which the knee strikes the dashboard. It has been postulated that the femoral shaft absorbs the majority of injury energy<sup>[3]</sup>, as demonstrated by the shaft comminution, decreasing the amount of force transmitted across the neck. Most surgeons agree that treatment of the femoral neck should take priority because this is critical to the patient's long-term outcome. Although numerous options exist for the subsequent management of a femoral neck nonunion, the complications of osteonecrosis of the femoral head and nonunion of the femoral neck are more difficult to manage. Controversy exists about whether this combined injury pattern should be treated with a single implant or with separate implants. Low-level evidence from case series suggests that separate femoral neck and shaft implants may result in fewer reoperations<sup>[4]</sup>. Treatment options for ipsilateral femoral neck and shaft fractures include: reconstruction nail, antegrade nail, separate screws adjacent to the nail and Femoral neck screws combined retrograde femoral nail, Sliding hip screw with retrograde femoral nail, Femoral neck screws and plate fixation of the shaft, Sliding hip screw with Cephalomedullary Reconstruction Nail. Each method has its own advantages and disadvantages. Three major issues related to management of these fractures are optimal timing of surgery, which fracture to address first, and the optimal implant to use<sup>[5]</sup>.

The rate of avascular necrosis of the femoral head in ipsilateral femoral neck and shaft fractures is lower than that seen with isolated femoral neck fractures. In ipsilateral femoral neck and shaft fractures, the reported incidence in various series has ranged from 1.2% to 5%, with the highest rate reported in patients treated with reconstruction nailing. Nonunion of both the femoral neck and femoral shaft can occur. A short delay of 5–6 days in stabilizing femoral neck and shaft fractures does not seem to affect the ultimate functional outcome [6].

**Aim and objective**

1. To evaluate radiological and anatomical outcomes of these cases treated by single implant or individual implants for each fracture by osteosynthesis.
2. To evaluate the functional outcomes of all cases by Harris hip scoring system.
3. To evaluate complication regarding the fracture management like nonunion, mal union, implant failure, infection and avascular necrosis in all cases.

**Materials and Methods**

This prospective study was conducted at our institution over a period of two years from 2018-2020 with an average follow up period was one year(10-24 months).An informed consent from patients and departmental permission were obtained according to this hospital guidelines. The study population was 20.The patients were selected randomly in to 2 group i.e. group 1(single implant) &group 2(double implant).

**Inclusion criteria**

1. Patients aged above 15 years patients with combined ipsilateral fractures of the femoral neck and shaft
2. Patients who have given consent for surgery.

**Exclusion criteria**

1. Compound fracture.
2. Patients < 15 years & >60 yr
3. Patients unfit for surgery
4. Pathological fracture

An approval of the study was obtained from Institutional Ethics Committe S.C.B Medical College Cuttack Odisha. Every patient signed an informed written consent for acceptance of the operation.

Pre operatively all patients were evaluated carefully includes detailed history, clinical & radiological examination. Radiological assessment was done by taking X ray of pelvis with both hip AP view. & thigh with hip and knee AP & Lateral view. All surgical procedures were performed under spinal anesthesia. For the first group reconstruction nail was introduced for fixation of both neck and shaft femur after placing the patient in fracture table and preparing the appropriate size nail under C-arm image intensifier [7]. For the second group with non-displaced femoral neck fracture (6 patient), fixation of fracture neck femur was done at first followed by fixation of shaft fracture, while in displaced femoral neck fracture (4 patients); fixation of femoral shaft fracture was done at first followed by fixation of femoral neck fracture. Femoral neck fixation was performed according to the degree of displacement and anatomical location of femoral neck fracture (15-16-17). Postoperatively, all patients were followed up clinically and radiologically at regular intervals

monthly for 3 month then every 3 monthly. Functional outcome of patient were assessed using Harris Hip Score [8].

**Result**

In our study 20 patients with fracture shaft and ipsilateral neck femur were evaluated. The mean age for group I was 32.2±7.92 years & group II was 35.5 ±8.58 years. The majority of cases belonged to male gender (17:3) and mostly suffered from road traffic accidents (RTA).We performed proximal femur nail in 10 patients, DHS and retrograde nailing in 4 patients, CC Screw and Retrograde nailing in 6 patients.

In group 1, average operation time is 80 min, mean follow up period is 18 month. All femoral neck and shaft except 1 neck, unite with an average union time 4.3±.95. There were good to excellent result in 7(70%) cases, poor in 1(10%) cases. Avascular necrosis of head developed in one case which needs revision surgery. Only in one case superficial infection develop which is treated by dressing and appropriate antibiotics. Two case get coxa vara malunion but the pt is asymptomatic.

In group 2 average operation time is 110 min, mean follow up period is 18 month. All femoral neck and shaft except 2, unite with an average union time 4.9±.99. There were good to excellent result in 8(80%) cases, poor in 1(10%) cases. 3 case develop infection. out of which 2 was superficial treated by dressing and antibiotics and one needs debridement.

**Table 1:** [Comparison between two studied group regarding radiological outcome]

Radiological outcome	The studied group		TEST	P value
	Group 1	Group 2		
Union	7	7	0.03	1.0
Nonunion	0	2	0.02	1.0
Malunion	2	1	0.75	0.46
AVN of femoral head	1	0	0.05	1.0
Duration of union			U	
X±/-SD	4.3±/-0.95	4.9±/-0.99	1.38	0.17
Range	3-6	3-6		

**Table 2:** [Functional outcome assessed by Harris Hip Score, chi-square testis .444, P value 0.9309(P>.05)]

Outcome	Group 1	Group 2
Excellent	4	5
Good	3	3
Fair	2	1
Poor	1	1

**Table 3:** [Comparison of other functional outcome among study group]

Clinical outcome	The study cases		FE	P value
	Group 1	Group 2		
Hip pain	2	4	0.95	0.63
Deformity	1	2	0.39	1.0
Affected range of movement	2	5	1.37	0.35
Rehabilitation duration			U	
X±/-SD	1.20±/-0.42	2.0±/-0.67	2.68	0.007
RANGE	1-2	1-3		S

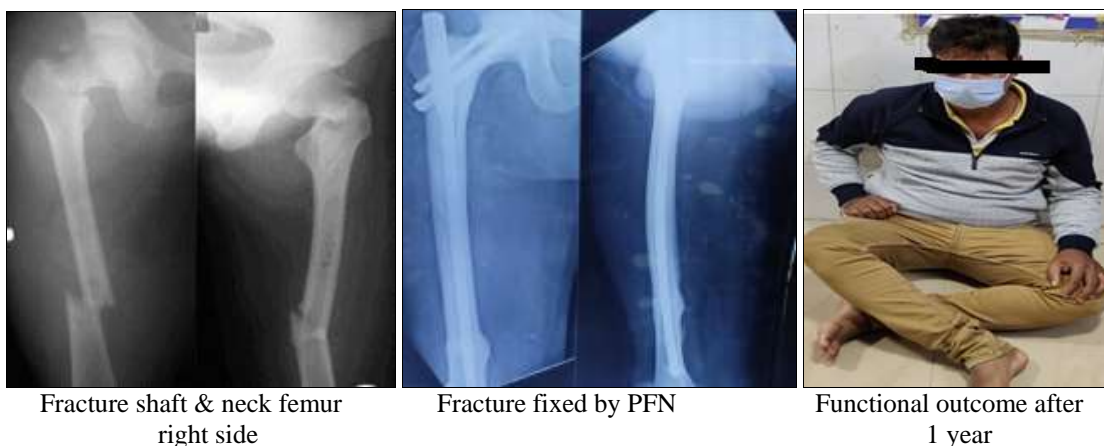
Clinical outcome of the studied cases are illustrated in table 3; all the assessed parameters showed no significant statistical difference between two studied groups (P>0.05) except for the duration of rehabilitation (P<0.05)

**Table 4:** Comparison with other studies

Study	Study design	Patients no.	Group 1 Single implant	Group 2 Double implant
Mohapatra 2017	Prospective	18	N=10	N=8
Kharel 2017	Retrospective	24	N=11	N=13
Kivi 2014	Prospective	40	N=15	N=19
Wang 2010	Retrospective	21	N=10	N=11
Tsai 2009	Retrospective	43	N=5	N=38
Singh 2008	Retrospective	27	N=12	N=15
Present sudy	prospective	20	N=10	N=10

**Table 5:** Functional outcome

Study	%Union		%Nonunion		%Malunion	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
Mahapatra	N/a	100%	10%	N/A	N/A	N/A
Kharel	Neck-n/A Shaft-100%	Neck-n/A Shaft-92%	0%	7.7%	N/A	N/A
Kivi	N/A	N/A	N/A	15%	N/A	N/A
Wang	Neck-1005 Shaft-90%	Neck-100% Shaft-99%	0%	9.1%	N/A	N/A
Tsaiu	Neck-80% Shaft-100%	Neck-635 Shaft-83%	0%	5.3%	0.5%	7.9%
Singh	Neck-91 Shaft-75	Neck-100% Shaft-87	9%	0%	N/A	N/A
Present study	80%	70%	0%	20%	20%	10%



**Fig 1.**



**Fig 2.**

**Discussion**

Ipsilateral femoral neck and shaft fractures are challenging. Many methods have been recommended for managing ipsilateral neck and femoral shaft fractures [3-6]. Although biomechanical study and some clinical investigations have shown no significant differences between the various methods of fixation [7], debate about the best methods of internal fixation for these fractures continues. Femoral neck fractures

are often missed in initial diagnosis up to 30% of cases. Hence a thorough radiological evaluation of pelvis with both hips should be done in all fracture shaft of femur cases. The majority of the patients in the present series were young males with high-energy trauma, as also reported in the literature. Emergency fixation of the fractured neck of femur in this combined injury pattern, unlike isolated femoral neck fractures, may be unnecessary [2]. Though there is confusion

regarding which fracture should be managed first, there appears to be a general consensus regarding the seriousness of the complications involving femoral neck fractures. Hung *et al.* [8]. Reported that the order of fixation of the fractures may not be very important. We stabilized femoral neck fractures first in patients operated with double implant. This protocol is satisfactory in patients with un displaced neck fractures, as further displacement of the neck fracture is prevented. There is still no consensus on the optimal treatment method for these complex fractures. In a meta-analysis of the reports published in the literature, the locked intramedullary nails or reconstruction nails yielded results that were superior to double implant [9]. A cephalomedullary nail is advantageous in terms of possible closed antegrade nailing with minimal incision, reduced blood loss, decrease chance of infection. The dual implant was associated with more frequent infections and nonunion, while the nail fixations were complicated by rotatory malalignments and shortenings [10]. However, the difference between the two treatment methods with respect to union, complications and functional outcome was not significant in the present series.

The average time for femoral neck and shaft union in the present series was consistent with that reported in other series [9]. The use of this IM nail for this fracture pattern was ‘demanding’ and that technical errors with this implant will lead to fracture complications. Watson and Moed. Reported that 25% of the femoral neck nonunion that occurred in 13 patients developed after the use of reconstruction-type intramedullary nails. Jain *et al.* reported a 20% incidence of femoral shaft nonunion using reconstruction nailing.<sup>11</sup> Vidyadhara and Rao reported delayed union of the shaft fracture in 12 out of 43 patients. However, we recorded 20% nonunion in the same group. Average time for femoral neck and shaft union in the present series was consistent with that reported in other series. Mohapatra *et al.* reported that, all femoral neck fractures united at an average union time of 15 weeks & shaft of femurs was 20 weeks. Such observations matched with our results as we found 3 cases delayed union 2 of them united after 6 months and one case had done revision after one year. Khallaf *et al.* in 2005 reported 2-6% deep infection after fixation of the shaft by plate and screws but in our series we recorded 3 infected cases in the second group two of them was superficial infection treated with dressing and antibiotic and one was deep infection that needed debridement. In our series we get only one case of AVN in group 1 which is consistent with study by mohapatra *et al.* A reconstruction nail is advantageous in terms of possible closed antegrade nailing with minimal incision, and reduced blood loss and biological fixation of both fractures with a single implant this in agreement with Jain *et al.* [11]. Fixation with plates for the shaft and screws or DHS for the hip is easy from a technical perspective.

Cephalomedullary nailing is technically more demanding and challenging in completely displaced neck fracture. However, in most of cases, neck fracture is minimally displaced and where it is easier to antegrade nail. Fixation of both fractures with two implant is relatively easy in technique point of view. In our view both modalities of treatment give satisfactory results. In displaced neck fracture it is better to use double implant for both fractures.

## Conclusion

Although combined ipsilateral femoral neck and shaft fractures are uncommon, it is essential to carefully evaluate the femoral neck in all patients sustaining high energy

femoral shaft fracture. The goal of any treatment plan should be anatomic reduction of neck fracture and stable fixation of both fractures, so the patient can be mobilized early. Both of the treatment methods used in the present study achieved satisfactory functional outcome in these complex fractures. While each has its own merits and demerits. Although in the present study both method give satisfactory results, it is difficult to draw a definite conclusion as the sample size is very small and short term follow up. A large multicentric study is required to know the better functional outcome of the patients.

**Funding:** No funding sources

**Conflict of interest:** None declared

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

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