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Original Article

Comparative study of fresh femoral neck fractures managed by multiple cancellous screws with and without fibular graft in young adults

Snajay Kumar MS Orthopaedics^a, Ajay Bharti MS Orthopaedics, PGDCIR^{b,*},
Ashok Rawat MS Orthopaedics^c, Vineet Kumar MS Orthopaedics^a,
Sachin Avasthi MS Orthopaedics, PhD^a

^a Assistant Professor Orthopaedics, G.S.V.M. Medical College, Kanpur, Uttar Pradesh 208002, India

^b Associate Professor Orthopaedics, G.S.V.M. Medical College, Kanpur, Uttar Pradesh 208002, India

^c Senior Resident, G.S.V.M. Medical College, Kanpur, Uttar Pradesh 208002, India

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ABSTRACT

Objectives: Aim of our study was to assess the role of addition of fibular strut graft to multiple cancellous screws in functional outcome, union and complications associated with those managed by only multiple cancellous screws in fresh femoral neck fractures.

Methods: A randomized control trial study was conducted on the patients of femoral neck fractures managed with multiple cancellous screws (group A) and multiple cancellous screws with fibular graft (group B). Patients aged between 20 and 50 years, having Gardens type III or IV fracture with duration of injury less than two weeks were included in the study.

Results: Eighty seven cases were analysed $n = 45$ were in group A and $n = 42$ in group B. Functional outcome (Harris hip score) was excellent in 30 patients in group A as compared to 12 in Group B which was statistically significant favouring group A. The time of full weight bearing, union and non union rates showed no statistical significance ($p > 0.05$). On statistical grounds none of the procedures proved to be better than other.

Conclusions: Fresh femoral neck fracture in young adults managed with multiple cancellous screws fixation with fibular graft has no added advantage over multiple cancellous screws fixation alone.

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1. Introduction

Femoral neck fractures are uncommon in young adult population and usually occur after significant trauma. Femoral

neck fractures in patients of less than 50 years constitute about 2–3% of all femoral neck fractures.¹ Osseous and vascular anatomy, mechanism of injury, associated injuries, fracture pattern and the goals of treatment, all characteristics are considered in treatment of femoral neck fracture.¹

* Corresponding author. L-16, G.S.V.M. Medical College, Swaroop Nagar, Kanpur, Uttar Pradesh 208002, India. Tel.: +91 9451373955.

E-mail address: dr_ajay2001@rediffmail.com (A. Bharti).

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Fig. 1 – Surgical procedure in Group A.

Incidence of osteonecrosis is 20–90%, in young patients after femoral neck fracture as reported in the literature.^{2,3} Various osteosynthetic procedures fixation with multiple cancellous cannulated screw, valgus osteotomy and fixation with double angle barrel/blade plate, dynamic hip screw, displacement osteotomies, muscle pedicle grafts, free fibular graft (vascularized or non-vascularized) with internal fixation are available.⁴ Osteosynthesis with partially threaded multiple cancellous cannulated screw is preferred method in fresh cases of fracture neck of femur in young patients⁵ with screws placed in upright or inverted triangle pattern,⁶ usually in old cases fibular strut graft is used along with multiple cancellous cannulated screws to enhance union and early restoration of function.⁷ In young adults fixation with multiple cancellous cannulated screws is associated with non-union (0–62%) and avascular necrosis (12–86%).^{2,3} As insertion of fibular strut graft offers advantage of stability, osteoinductive and osteoconductive properties thus enhancing union,⁸ it also prevents avascular necrosis⁹ and collapse of head of femur.^{10,11} Moreover it is technically easy to harvest the graft. Lateral radiograph of hip is not very sensitive to show the posterior comminution of neck and displaced fractures, Garden type III and IV are definitely associated with posterior comminution.¹² So we have inducted use of fibular strut graft in fresh fractures with an aim to assess the role of addition of fibular strut graft

to multiple cancellous screws in functional outcome, union and related complications.

2. Material & methods

A randomized control trial was conducted at our institution from Aug.2009 to Aug.2013, on the patients with femoral neck fracture, two groups were formed, Group A was managed with multiple cancellous screws (Fig. 1) and Group B was managed with multiple cancellous screws with fibular graft (Fig. 2). Each patient was subjected to detailed clinical and radiological examination along with routine haematological investigations.

All patients between 20 and 50 years of age with Garden type III and IV fresh femoral neck fractures and duration of post traumatic fracture less than two weeks attending the Orthopaedic OPD/Emergency between August 2009 & December 2011 were included in the study.

Patients with diabetes mellitus, infection around surgical site, evidence of sequelae of septic arthritis or avascular necrosis or previous history of any surgery around affected joint, Polytrauma and fractures those requiring open reduction were excluded from the study.

A total of 100 patients were taken into the study. The patients were randomized as per random allocation table to receive either of the above operative management into group A & B respectively. Three patients required open reduction so they were excluded from the study. Four patients were lost to follow up in group A and six patients were lost to follow up in group B.

In total, 45 in group A (multiple cancellous screws) and 42 in group B (multiple cancellous screws with fibular graft) were left for analysis.

Preoperatively all patients were applied with above knee skin traction till the operation to alleviate pain and overcome muscle spasm. Preoperatively informed written consent of the patient was taken duly in all the cases. All operations were done on fracture table. The fractures were reduced by standard technique of closed methods. Reduction was confirmed with the help of C-arm image intensifier with anteroposterior and lateral views, based on the Garden's alignment index. An angle of 160°–180° in both views was considered satisfactory reduction. In group A cases after closed reduction, internal fixation were done either percutaneously or through small incision laterally with 3 partially threaded 16/32 mm × 6.5 mm cannulated or non cannulated cancellous screws out of them at least one was placed along the calcar and other along the posterior cortex. In cases of group B two teams were deployed. One surgical team prepared the tunnel in proximal femur for the fibular strut grafts using a 10 mm cannulated reamer. The other team harvested the fibular graft from the ipsilateral leg using the standard posterolateral approach. The standard lateral approach was used and after securing reduction with multiple 2 mm K wires, channel for fibula graft was prepared in central or superior part of head and neck. The fracture was fixed with two 6.5 mm partially threaded cannulated or non cannulated cancellous screws in the previously mentioned fashion and then fibular graft was duly impacted. Post operatively single POP hip spica cast was applied in all the patients

for six weeks after wards they were allowed quadriceps and knee range of motion exercises upto eighth weeks and later on hip abductor strengthening exercises in supine position. Partial or full weight bearing was allowed only on the basis of radiological presence of bridging trabeculae. Initial follow up were done at six weeks interval till the bony union and 3 monthly thereafter. Hip pain, range of hip motion, walking capacity, evidence of bone union, presence of avascular necrosis, graft incorporation, and position of the screws/graft were evaluated. Functional outcomes were evaluated using the Harris hip score.

Data was compiled using MS office Excel 2007 and statistically analysed using SPSS version 16. Since it was non parametric distribution, Mann–Whitney U Test was used to compare Harris hip score and time of clinico-radiological union. Complications were assessed using Chi-square test. Time of partial/full weight bearing was compared using Independent samples t test.

3. Results

Results were calculated at an average follow up period of two years and 87 patients were included in analysis. There were 55.17% (48) males and 44.82% (39) females in our study. According to Garden's classification, 66 (75.86%) cases were of

type III, out of which 33 patients were in group A while 33 were in group B. 21 (24.13%) patients were of type IV, 12 in group A and nine in group B (Table 1).

In our study, according to Harris hip score, the functional outcome was statistically significant in favour of group A with excellent results in 30 (66.6%) patients as compared to only 12 (28.5%) patients of group B (Table 2).

The mean time of partial weight bearing was 10.13 ± 4.81 weeks in group A, and 12 ± 4.04 weeks in group B ($p = 0.004$). The mean time of union was 16.53 ± 8.2 weeks in group A and 16.28 ± 8.8 weeks in group B ($p = 0.99$) & the mean time of full weight bearing was 16.53 ± 8.2 weeks in group A and 16.28 ± 8.3 weeks in group B ($p = 0.46$). In both the groups these findings were statistically not significant (Table 3).

On assessment of complications in group A there were six (13.33%) patients of non union out of which three patients showed distal migration of screws. Three patients had avascular necrosis of femoral head.

In group B there were five (11.90%) patients of non union, in which two patients also had avascular necrosis of femoral head. One patient had broken fibular graft which finally showed sign of union (Fig. 3). In both the groups occurrences of complications were not statistically significant ($p = 0.48$) (Table 4). Three patients developed incisional pain at Fibula donor site and two patients developed initial Extensor hallucis weakness which resolved within three months of surgery. None of the patients developed ankle instability and peroneal nerve injury (Table 4).

4. Discussion

Displaced femoral neck fractures often accompany comminution of the posteromedial cortex of the femoral neck, which is an important risk factor of non-union due to the loss of the buttressing effect against lateral rotation and insecure fixation.^{12–16} In Garden grade III and IV, comminution of the posteromedial cortex has been observed in 70% of cases.¹⁷ This has been important cause of unstable or insecure fixation, that results in subsequent loss of reduction and non-union.^{18–20} A cancellous screw with a single fibular graft has been reported with excellent results in patients below the age of 50 years.^{21,22} Free fibular grafting has been widely studied as a method to introduce both structural support and a graft framework due to osteoconductive⁸ and osteoinductive⁸ properties, in a femoral neck fracture.^{23–27} The time required and blood loss for the procedure MHS with fibular graft was relatively more, which is a drawback to this procedure. Our study is comparable with Zahid et al, who reported a series of 37 patients treated with fixation using cannulated screws and fibular strut grafts for fresh femoral neck fractures with posterior comminution.²⁸ Harris hip score was good to excellent in 20 patients, fair in 7, and poor in 6 while in our study the Harris Hip Score of 30 patients in group A and 12 patients in group B had excellent results and 06 patients in group A and 24 patients in group B had good results. Our study is comparable with Goyal et al. Who showed union in 15 patients with 24 months follow up with fibular grafting and MHS.²⁹ Nagi et al reported a series of 26 cases (10 fresh and 16 old) treated by open reduction and one cancellous screw with

Fig. 2 – Surgical procedure in Group B.

Table 1 – Distribution of cases according to fracture type – Garden's classification in Group A & Group B.

Fracture type	Group A (n = 45)		Group B (n = 42)		Total (n = 87)	
	No. of patients	%	No. of patients	%	No. of patients	%
III	33	73.33	33	78.57	66	75.86
IV	12	26.66	9	21.4	21	24.13

Table 2 – Comparison of functional outcome based on Harris hip score in Group A and Group B.

Functional outcome	Group A (45)				Group B (42)				p value
	Type III	Type IV	Total		Type III	Type IV	Total		
	No. of cases	No. of cases	No. of cases	%	No. of cases	No. of cases	No. of cases	%	
Excellent	24	06	30	66.6	12	0	12	28.5	0.001
Good	6	00	06	13.3	18	6	24	57.1	
Fair	0	0	0	0	0	0	0	0	
Poor	0	0	0	0	0	0	0	0	
Failure	3	6	09	20	03	03	06	14.2	

free fibular graft followed by single hip spica to all his patients.^{23,26} Kumar et al reported 40 cases of femoral neck fracture treated with multiple cannulated screws in younger patients with union in 31 patients.³⁰ The osseous union, in our study was achieved at 16.53 ± 8.2 weeks in group A and 16.28 ± 8.8 weeks in group B. The risk for non-union is greater with displaced fractures (Garden III and IV) and has been reported to be as high as 30% in some series.^{31–33} Our results are superior to Jain et al³⁴ who compared fixation of sub capital hip fracture in 38 patients, with average age of 46.4 years, avascular osteonecrosis developed in 16% of the patients. In our series all fractures were displaced, Garden type III, 73.33% in group A, 78.57% in group B and Garden IV, 26.66% in group A & 21.4% in group B. The nonunion rates were 13.3% (06) in group A and 14.28% (06) in group B. In group A 6 cases of nonunion were associated with implant failure (distal migration of screws three cases). In group B, 5 cases of nonunion (three were associated with avascular necrosis & one with broken fibular graft). The average age of patients in group A was 38.2 years and 39.02 years in group B. These failures were mainly due to non compliance, premature weight bearing, physiological factors and habits related to patients and in two patients with improper placement of screws. With respect to morbidity associated with Fibular graft donor site in our study three patients (7%) developed incisional pain and two patient developed initial Extensor hallucis weakness (4.7%) which resolved within three months of surgery our results are superior to Nassr et al³⁵ who reported study of 163 patient with 53% had Incisional pain, lasted longer than 3 months, 1.2%

developed superficial peroneal neuroma, 3% developed tibial stress fractures and 1.2% developed ankle instability. So Functional outcome in two different procedures evaluated by Harris hip score and compared taking different variables into considerations eg. Sex, Anatomical basis classification, obliquity of fracture classification (Pauwel's), displacement of fracture classification (Garden's) showed no statistically significant difference. There was no statistically significant difference on comparing the results of group A and group B in osseous union, weight bearing, and non union and avascular necrosis of head of femur in both groups. But on contrary to belief the functional outcome was statistically significant in favour of group A ($p = 0.001$).

5. Conclusion

There is no added advantage of non-vascularized fibular grafting with multiple hip screw fixation in fresh femoral neck fractures in young adults over multiple hip screw fixation alone. It is unnecessary to increase donor site morbidity,

Table 3 – Comparison of time of union & weight bearing in Group A and Group B.

	Group A (45)	Group B (42)	p value
Partial weight bearing	10.13 ± 4.81 weeks	12 ± 4.04 weeks	0.004
Union	16.53 ± 8.2 weeks	16.28 ± 8.8	0.99
Full weight bearing	16.53 ± 8.2 weeks	16.28 ± 8.3 weeks	0.46

Fig. 3 – Complications.

Table 4 – Comparison of complications in group A and group B.

Complications	Group A (45)		Group B (42)		p value
	Type III	Type IV	Type III	Type IV	
Gardens type					
Non union	03	03 (with implant failure)	03 (2 cases had AVN)	02	
AVN of head of femur	—	03	—	—	
Non union with fibula fracture	—	—		01	
Total	09		06		0.48

operative time and intra-operative blood loss. Because of no difference between the results of both, it all depends on the decision making of the surgeon who can choose the procedure according to patient.

Conflicts of interest

All authors have none to declare.

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