



RESEARCH ARTICLE

Functional Outcome of Quadratus Femoris Muscle Pedicle Bone Graft with Internal Fixation in Neglected Fracture Neck of Femur

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ABSTRACT

Aim: To evaluate the functional and radiological outcomes of quadratus femoris muscle pedicle bone grafting with internal fixation in patients with neglected fracture neck of femur.

Materials and Methods: A retrospective observational study was conducted in the Department of Orthopaedics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India, over a period of two years. Fourteen patients diagnosed with neglected fracture neck of femur who underwent quadratus femoris muscle pedicle bone grafting with internal fixation were included. Demographic characteristics, fracture pattern, duration between injury and surgery, operative details, radiological union, complications, and functional outcomes assessed using the Harris Hip Score (HHS) were retrieved from hospital records. Descriptive statistics were used to summarize the data. Fisher's exact test and Mann-Whitney U test were applied where appropriate, with statistical significance set at $p < 0.05$.

Results: The mean age of the patients was 37.9 ± 10.8 years, with males comprising 64.3% of the study population. The average interval between injury and surgery was 9.1 ± 3.8 weeks, and the mean follow-up duration was 16.8 ± 5.4 months. Radiological union was achieved in 12 (85.7%) patients, with a mean union time of 5.8 ± 1.2 months. The mean Harris Hip Score at final follow-up was 85.1 ± 11.3 . Excellent and good functional outcomes were observed in 64.3% of patients. One patient (7.1%) developed avascular necrosis, two (14.3%) had non-union, and one (7.1%) experienced superficial wound infection. Earlier surgical intervention was associated with better functional outcomes ($p = 0.03$).

Conclusion: Quadratus femoris muscle pedicle bone grafting with internal fixation demonstrated satisfactory radiological union and favorable functional outcomes while maintaining a relatively low complication rate in patients with neglected fracture neck of femur. This technique appears to be an effective femoral head-preserving procedure for carefully selected young and active patients. Larger prospective studies with longer follow-up are required to confirm these findings.

Background: Neglected fracture neck of femur remains a challenging orthopedic condition, particularly in young and active individuals, because of the high risks of non-union and avascular necrosis (AVN). Quadratus femoris muscle pedicle bone grafting combined with internal fixation has been proposed as a biological augmentation technique to improve fracture healing by enhancing vascularity and providing mechanical stability.

Keywords: Neglected fracture neck of femur; Quadratus femoris muscle pedicle bone graft; Internal fixation; Harris Hip Score; Avascular necrosis; Femoral head preservation.

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INTRODUCTION

Fracture neck of femur is one of the most challenging injuries encountered in orthopedic practice because of its unique intracapsular location and limited blood supply to the femoral head. While arthroplasty is often used to treat older people, the main goal of treatment for younger patients is to preserve the original hip joint. Due to gradual fracture displacement, resorption at the fracture site, disruption of femoral head vascularity, and higher risks of non-union and avascular necrosis (AVN), delayed diagnosis or presentation considerably worsens prognosis. Due to delayed referral, socioeconomic limitations, limited access to healthcare, and initial treatment by traditional bone setters, neglected fracture neck of the femur—generally defined as fractures

presenting more than three weeks after injury without definitive treatment—remains relatively common in developing nations [1].

These patients often exhibit discomfort, functional impairment, shortening of the affected limb, and difficulty to bear weight. Neglected fractures are even more challenging to treat than acute fractures due to their altered biology and mechanics. A number of surgical techniques, such as valgus intertrochanteric osteotomy, vascularized fibular grafting, free cancellous bone grafting, muscle pedicle bone grafting, and internal fixation with biological augmentation, have been suggested to preserve the femoral head in young adults [2]. Among these methods, quadratus femoris muscle pedicle bone grafting—which was first reported

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by Judet and then made popular by Meyers—offers the femoral head both structural support and an extra vascular contribution by harvesting a vascularized corticocancellous graft along with its muscular attachment. This method seeks to preserve stable fixation while enhancing biological healing. Following quadratus femoris muscle pedicle bone grafting, a number of clinical investigations have shown promising functional outcomes and good fracture union, with comparatively low rates of AVN and non-union in carefully chosen patients [3].

Muscle pedicle bone grafting is still a desired alternative for young, active people who want to preserve the femoral head, despite the availability of more recent reconstructive techniques. However, there is still a dearth of published research on this process, especially from eastern India. Understanding the efficacy of this physiologically augmented fixation approach in standard orthopaedic therapy requires evaluating institutional outcomes[4].

Aim

To evaluate the functional outcome of quadratus femoris muscle pedicle bone graft with internal fixation in patients with neglected fracture neck of femur treated at Darbhanga Medical College and Hospital.

Objectives

- To evaluate radiological union following surgery.
- To assess postoperative functional outcome using the Harris Hip Score.
- To determine complications including non-union,

avascular necrosis, infection, implant failure, and limb shortening.

- To assess the effectiveness of quadratus femoris muscle pedicle bone grafting in preserving the native femoral head.

MATERIALS AND METHODS

Study Design

Retrospective observational study.

Study Setting

Department of Orthopaedics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India.

Study Duration

Two years.

Study Population

Patients diagnosed with neglected fracture neck of femur who underwent quadratus femoris muscle pedicle bone grafting with internal fixation during the study period.

Sample Size

- Fourteen patients.
- Inclusion Criteria
- Patients aged 18–60 years.
- Neglected intracapsular fracture neck of femur presenting more than three weeks after injury.
- Patients managed with quadratus femoris muscle pedicle bone grafting and internal fixation.
- Minimum postoperative follow-up of six months with available clinical and radiological records.
- Exclusion Criteria
- Pathological fractures.
- Polytrauma requiring staged orthopedic procedures.
- Previous surgery for fracture neck of femur.
- Advanced avascular necrosis with femoral head collapse requiring arthroplasty.
- Incomplete medical records or loss to follow-up.

Surgical Procedure

All patients underwent open reduction of the fracture through a posterior approach. Following anatomical reduction, stable internal fixation was achieved using cannulated cancellous screws according to fracture configuration. A corticocancellous bone graft based on the quadratus femoris muscle pedicle was harvested from its insertion on the femur while preserving the vascular pedicle. The graft was positioned across the fracture site and secured using screw fixation when required, according to the principles of Meyers' procedure. Wound closure was

performed in layers after confirmation of fixation stability.

Postoperative Rehabilitation

Patients received standardized postoperative rehabilitation including intravenous antibiotics, thromboprophylaxis when indicated, and analgesia. Quadriceps strengthening exercises and hip range-of-motion exercises were initiated early. Toe-touch or partial weight-bearing was permitted according to radiographic evidence of healing, while full weight-bearing was allowed after satisfactory fracture union.

Data Collection

- Data were retrieved from hospital case records and operative registers. Variables collected included:
- Age
- Sex
- Side involved
- Mechanism of injury
- Duration between injury and surgery
- Fracture classification
- Operative details
- Time to radiological union
- Duration of follow-up
- Harris Hip Score



“Fig. 1: Case 1: Preoperative x-ray



Fig. 2: Case 1: Postoperative at 6 weeks”



Fig. 3: Case 1: Postoperative x-ray at 10 week AP view



Fig. 4: Case 1: Postoperative x-ray at 10 week lateral view

- Complications (non-union, AVN, infection, implant failure, coxa vara, limb shortening)

Statistical Analysis

Data will be entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0. Continuous variables will be expressed as mean $\pm$ standard deviation or median (interquartile range), depending on data distribution. Categorical variables will be presented as frequencies and percentages. Descriptive statistics will summarize demographic and clinical characteristics. Functional outcomes and complication rates will be analyzed using appropriate descriptive measures. A p-value <0.05 will be considered statistically significant where inferential analyses are applicable.

RESULTS

Study Population

A total of **14 patients** with neglected fracture neck of femur who underwent quadratus femoris muscle pedicle bone grafting with internal fixation were included in the analysis. The mean age was 37.9 ± 10.8 years (range: 21–58 years).



Fig. 5: Case 1: Postoperative at 16 weeks



Fig. 6: Case 1: Postoperative at 20 weeks



Fig. 7: Case 1 : Clinical photograph postoperative at 20 weeks



Fig. 8: Case 1: Clinical photograph at 20 weeks postoperative

Table 1: Baseline demographic and clinical characteristics

Variable	Value
Sample size	14
Mean age (years)	37.9 ± 10.8
Male	9 (64.3%)
Female	5 (35.7%)
Right side	8 (57.1%)
Left side	6 (42.9%)
Mean delay before surgery	9.1 ± 3.8 weeks
Mean follow-up	16.8 ± 5.4 months

Table 2: Fracture characteristics

Variable	n (%)
Garden III	5 (35.7)
Garden IV	9 (64.3)
Pauwels II	4 (28.6)
Pauwels III	10 (71.4)

* Fisher's Exact test or Mann-Whitney U test.

Table 3: Operative findings

Variable	Value
Mean operative time	114 ± 18 min
Mean blood loss	235 ± 55 mL
Cannulated cancellous screws	10 (71.4%)
DHS + screw	4 (28.6%)

Table 4: Radiological outcome

Outcome	Value
Union achieved	12 (85.7%)
Non-union	2 (14.3%)
Mean union time	5.8 ± 1.2 months
AVN	1 (7.1%)

Table 5: Functional outcome (Harris Hip Score)

Outcome	n (%)
Excellent (>90)	5 (35.7)
Good (80–89)	4 (28.6)
Fair (70–79)	3 (21.4)
Poor (<70)	2 (14.3)

Table 6: Postoperative complications

Complication	n (%)
None	9 (64.3)
AVN	1 (7.1)
Non-union	2 (14.3)
Superficial infection	1 (7.1)
Limb shortening (>1 cm)	1 (7.1)

Table 7: Factors associated with satisfactory functional outcome (Excellent + Good)

Variable	Satisfactory (n=9)	Unsatisfactory (n=5)	p value*
Mean age (years)	34.6 ± 8.7	43.8 ± 11.6	0.09
Surgery within 8 weeks	7	1	0.03
Union achieved	9	3	0.04
AVN	0	1	0.18

Table 8: Overall outcome

Parameter	Value
Mean Harris Hip Score	85.1 ± 11.3
Radiological union	85.7%
AVN	7.1%
Non-union	14.3%
Satisfactory functional outcome	64.3%

Nine (64.3%) patients were male and five (35.7%) were female. The mean duration between injury and surgery was **9.1 ± 3.8 weeks**.

Interpretation

Most patients were young adults with delayed presentation averaging approximately nine weeks.

Mean Harris Hip Score: **85.1 ± 11.3**

Overall satisfactory outcome (Excellent + Good): **9/14 (64.3%)**

Among the 14 patients, radiological union was achieved in 12 (85.7%), with a mean union time of 5.8 ± 1.2 months. The mean Harris Hip Score at final follow-up was 85.1 ± 11.3. Excellent or good functional outcomes were observed in 64.3% of patients. One patient (7.1%)

developed avascular necrosis, while two patients (14.3%) had persistent non-union. Superficial wound infection occurred in one patient and resolved with antibiotics. Patients treated within eight weeks of injury demonstrated a higher likelihood of satisfactory functional outcomes than those treated later ($p = 0.03$).

DISCUSSION

One of the most difficult orthopaedic problems is still neglected femur neck fractures, especially in young, active individuals where preservation of the original femoral head is desired over replacement. Fracture displacement, reduced blood flow to the femoral head, resorption at the fracture site, and elevated risks of non-union and avascular necrosis (AVN) are all consequences of delayed presentation. In order to enhance fracture healing and functional recovery, biological augmentation in conjunction with stable internal fixation has been recommended. The quadratus femoris muscle pedicle bone grafting with internal fixation showed promising radiological union and excellent functional results in the current investigation. With a comparatively low incidence of AVN and non-union, the majority of patients achieved fracture union, indicating that this method successfully improves the biological milieu of fracture healing while offering mechanical stability [5].

These results are in line with Ly TV, Swiontkowski MF, 2008 systematic review, which found that, when compared to past results of internal fixation alone, muscle pedicle bone flap transplantation was linked to lower rates of non-union and AVN [6]. Gupta AK *et al.*, 2009, highlighted the value of quadratus femoris muscle pedicle grafting as a head-preserving technique in younger patients by demonstrating good clinical and radiological outcomes in patients treated for ununited femoral neck fractures [7]. Similarly, Bhuyan BK, 2012 noted significant union rates after internal fixation and quadratus femoris muscle pedicle grafting, emphasising the muscle pedicle graft's extra vascular contribution [8].

Individuals who had surgery sooner rather than later after an injury seemed to have better functional results. Early intervention increases the likelihood of successful osteosynthesis by reducing femoral neck resorption and maintaining residual femoral head vascularity. Similar findings have been documented in other reviews that suggest biological restoration techniques mainly for stage I and II ignored fractures, while arthroplasty is frequently necessary for later stage III fractures with femoral head collapse. Complications including AVN, non-union, or superficial wound infection only occurred in a tiny percentage of

patients. These rates of complications are similar to those found in earlier research on muscle pedicle bone grafting conducted in India and other countries. Successful outcomes are still largely determined by careful patient selection, precise surgical technique, vascular pedicle preservation, and secure fixation [9].

There are various limitations to the current investigation. The results' generalizability is limited by the retrospective design, small sample size, lack of a reference group, and comparatively little follow-up. The Harris Hip Score was the main tool used for functional evaluation, and modern imaging techniques like MRI were not frequently available to identify early AVN. To verify the long-term efficacy of quadratus femoris muscle pedicle bone grafting and compare it with alternative head-preserving methods, larger prospective multicenter studies with longer follow-up are needed [10].

CONCLUSION

For young, physically active patients with neglected femur neck fractures, quadratus femoris muscle pedicle bone grafting in conjunction with internal fixation seems to be a successful head-preserving surgical option. In this series, the operation was linked to favourable functional results, good radiological union, and a comparatively low incidence of comorbidities, such as non-union and avascular necrosis. When combined with stable internal fixation, the biological benefit of the vascularized muscle pedicle graft may promote fracture healing and femoral head preservation. Successful outcomes are still largely dependent on early surgical intervention following diagnosis and careful surgical technique. The results are promising, but due to the retrospective study methodology, small sample size, and absence of a control group, they should be interpreted cautiously. To determine the long-term effectiveness and relative advantages of this technique over alternative femoral head-preserving surgeries, future prospective trials with bigger patient cohorts and longer follow-up are necessary.

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