

MEDICINE UPDATES JOURNAL
Faculty of Medicine Port Said University
Volum: 29 No: 8 PP: 129 - 135

" A Combined Nail-Plate Construct Fixation in Treatment of Distal Femoral Fractures."

Authors

**Hazem Khaled Sabry, Ashraf Abdelaziz Mahmoud,
Mohamed Eltabey El Girtly**

Department of Orthopedic Surgery, Faculty of Medicine, Port
Said University

ABSTRACT:

Submitted: 2025-09-28

Accepted: 2025-10-18

DOI: 10.21608/muj.2025.427862.1267

ISSN : 2682-2741

This is an open access article licensed under
the terms of the Creative Commons

Attribution International License (CC BY 4.0).

<https://muj.journals.ekb.egdean@med.psu.edu.eg>

vice_dean_postgraduate@med.psu.edu.eg

<https://creativecommons.org/licenses/by/4.0/>.



Abstract:

Background:

Distal femur fractures remain challenging to manage, particularly in osteoporotic and comminuted patterns. The nail-plate construct (NPC) has emerged as a hybrid fixation technique combining the biomechanical advantages of retrograde intramedullary nailing and lateral plating.

Methods:

We conducted a prospective study of 15 patients (mean age 52.4 years, range 18–80; 53.3% female) with AO/OTA 33A and 33C1 distal femur fractures treated using NPC between May 2024 and May 2025. Primary outcomes included radiographic union and functional recovery assessed by the Knee Injury and Osteoarthritis Outcome Score (KOOS) at 3 and 6 months. Secondary outcomes included assessment of any post operative complications.

Results:

All patients achieved radiographic union (100%), with a mean union time of 15.5 weeks. Distribution of union was 60% by 12 weeks, 20% by 16 weeks, 13.3% by 20 weeks, and 6.7% at 36 weeks (delayed union). KOOS scores improved significantly from baseline (38.7) to 62.4 at 3 months ($p < 0.01$) and 78.3 at 6 months ($p < 0.001$). Mean operative time was 107 minutes and mean intraoperative blood loss was 720 mL. Complications were limited to one superficial infection (6.7%) and one delayed union (6.7%), with no implant failures, malalignment, or reoperations.

Conclusion: Nail–plate construct fixation demonstrated reliable union, excellent early functional outcomes, and low complication rates in distal femur fractures. The technique may offer a biomechanically advantageous alternative to single-implant constructs, warranting further validation in larger multicenter trials.

Keywords

distal femur fractures, nail–plate construct, hybrid fixation, KOOS, outcomes

Introduction

Distal femur fractures represent 0.4% of all fractures and remain a complex surgical challenge, particularly in elderly or osteoporotic patients. Fixation with a single implant either retrograde intramedullary nailing (RIMN) or lateral locked plating (LLP) is associated with mechanical limitations, including varus collapse, nonunion, and implant failure.^[1,2]

The nail–plate construct (NPC) has recently been introduced as a hybrid method, combining the axial load-sharing properties of a nail with the angular stability of a plate. Biomechanical studies suggest that NPC provides superior torsional and axial stability, potentially permitting earlier mobilization and weight-bearing. However, clinical evidence remains limited.^[3-5]

This study aimed to evaluate the clinical and radiological outcomes of NPC fixation in distal femur fractures, focusing on union rate, functional recovery, and complications.

Patients and Methods

This prospective case series was conducted at Port Said Health Insurance Hospitals, Egypt, between May 2024 and May 2025. A total of 15 patients (7 males and 8 females; mean age 52.4 years, range 18–80) with AO/OTA 33A1–A3 and 33C1 distal femur fractures were included (Table 1).

Only closed injuries and type I open fractures were eligible, while type II–III open, peri-prosthetic, pathological fractures, and medically unfit patients were excluded.

All patients underwent fixation using a combined nail–plate construct (NPC), consisting of retrograde intramedullary nailing augmented with a lateral locking plate, performed in a single-stage procedure under standardized perioperative antibiotic prophylaxis and thromboprophylaxis.

Preoperative evaluation included history, clinical examination, radiographic assessment with X-ray and CT as indicated, and baseline laboratory investigations. Functional outcome was assessed using the Knee Injury and Osteoarthritis Outcome Score (KOOS) at 3 and 6 months, while radiographic union was defined as bridging callus across at least three cortices. Operative details (time, blood loss) and complications were recorded. Statistical analysis was performed using SPSS software, with significance set at $p < 0.05$.

Surgical Techniques

Patient position will be in a supine and anesthesia will be spinal with a bump under ipsilateral buttock and a rolled sheet or bump under the knee joint to help in reduction and for inserting the nail. C-arm will be positioned on the opposite side for imaging.

A 3-4 cm midline skin incision will be made extending distally from the lower border of the patella, followed by a small incision through the patellar tendon over the intercondylar notch.

Once incisions had been made, the guide wire will be placed and position confirmed with images. Then a protector for the soft tissue will be placed and an opening reaming will be used. The fracture reduction will be maintained before further reaming. After inserting the Nail and removing of the guide wire, the aiming device will be placed for insertion of distal locking screws. Proximal locking screws will be taken freehand through stab incisions.^[6-8]

For lateral plate application, a direct lateral incision will be made. A split through the muscular layer will be done along its direction. The femur will be cleared from its soft tissue with a periosteal elevator. Using image, the plate will be positioned and fixed transiently by K-wires, compression screw will be placed to approach the plate to the bone. Distal locking cancellous screws will be taken. Through minimally invasive approach proximal locking screws will be done. Drain will be placed, wound will be closed in layers and sterile dressing will be done.^[7,8]

Results

In this cohort study, 15 cases were included presenting with distal femur fractures and all cases were fixed by a Nail-Plate Construct (Figures 1 and 2). The mean age group was 52.4 years; 53.3% female; 66.7% left-sided fractures. Mechanism of injury was 73.3% low-energy falls and 26.7% motor vehicle accidents. (Table 1).

The mean operative time was 107 min (range 90–130) and the mean blood loss was 720 mL (500–1000).

The mean time to fracture union was 15.5 weeks and all cases achieved healing. 60% by 12 weeks, 20% by 16 weeks, 13.3% by 20 weeks, and 6.7% at 36 weeks. (Table 2.)

Table 1. Socio-demographic data (n=15)

Socio-demographic data		NPC fixation (n=15)
Age (years)	Mean $\pm$ SD	52.4 $\pm$ 18.29
	Range	18-80
Sex	Male	7(46.7%)
	Female	8(53.3%)

Mechanism of injury	Motor vehicle accident	4(26.7%)
	Fall down	11(73.3%)

Table 2. Union rate and healing time.

Fracture type	No. of Patients	Union by 12 weeks	Union by 16 weeks	Union by 20+ weeks	Mean Union Time (weeks)
33A2	6	4(66.7%)	2(33.3%)	0	15.5
33A3	8	3(75%)	0(0%)	1(25%)	
		2(50%)	1(25%)	1(25%)	
33C1	1	0(0%)	0(0%)	1(100%)	
	15	9(60%)	3(20%)	3(20%)	

KOOS subscale scores improved significantly between 3 and 6 months of follow-up. Pain, symptoms, ADL, sport, and QOL all showed substantial gains, with improvements ranging from 59.4% to 68.4%. The greatest improvement was observed in symptoms (68.4%), followed by ADL (66.7%) and pain (64%), while sport showed the least improvement (59.4%). All differences were highly significant ($p < 0.001$), reflecting notable functional recovery and enhancement in quality of life (Table 3.)

Table 3. KOOS subscales scores at 3 and 6 months

KOOS Score			Improvement %	p-value
Subscales	3 months	6 months		
Pain	46.9 ± 13	80.9 ± 12.1	64%	<0.001 ^{*a}
Symptoms	40.5 ± 15.2	81.2 ± 15.6	68.4%	<0.001 ^{*a}
ADL	40.6 ± 13.7	80.2 ± 11.9	66.7%	<0.001 ^{*a}
Sport	36 ± 15.3	74 ± 15.3	59.4%	<0.001 ^{*a}
QOL	33.8 ± 20.8	74.6 ± 16.8	61.6%	<0.001 ^{*a}

a: Paired t test, *: Statistically significant at $p < 0.05$

Complications: 1 superficial infection (resolved with antibiotics) and 1 delayed union. No deep infections, implant failures, or malalignment.

Discussion

This study demonstrates that NPC fixation provides reliable union, significant functional recovery, and a low complication profile in distal femur fractures. Compared with lateral plating alone, which has been associated with nonunion rates up to 18% and implant failure up to 14%, NPC achieved 100% union without failure.^[9]

Biomechanical studies support these findings, showing superior torsional and axial stability with NPC compared to either implant alone. Clinically, our results are consistent with reports of improved union rates and functional outcomes using NPC, while avoiding the morbidity of dual plating.^[8,9,12]

Limitations include the small sample size, single-center design, and short follow-up. Nevertheless, the consistency of outcomes highlights the potential role of NPC as a primary fixation strategy for complex distal femur fractures.^[10,11]



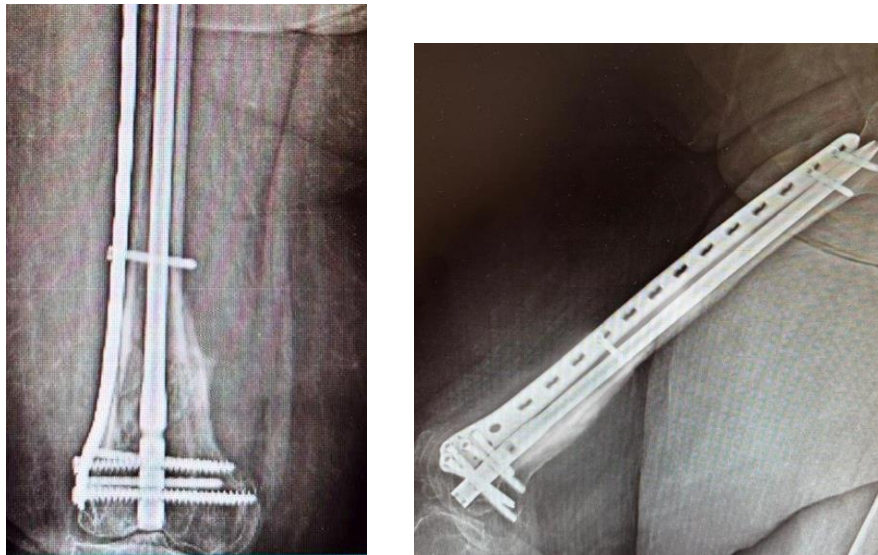


Figure 1. Pre-operative and post-operative radiographs (fracture union) of distal femur fracture treated with linked nail/plate construct.



Figure 2. Shows failure of initial fixation of distal femur fracture by single lateral locking plate and complete fracture union after revision by Nail-Plate Construct

Conclusion

Nail–plate construct fixation for distal femur fractures achieved excellent union rates, functional recovery, and low complication rates in this prospective series. NPC may represent a reliable alternative to traditional single-implant methods, particularly in osteoporotic or comminuted fractures. Larger randomized studies with longer follow-up are warranted.

References

1. Elsoe R, Ceccotti A, Larsen P. Population-based epidemiology and incidence of distal femur fractures. *Int Orthop*. 2018;42:191-6.
2. Neer CS II, Grantham SA, Shelton ML. Supracondylar fracture of the adult femur: a study of one hundred and ten cases. *J Bone Joint Surg Am*. 1967;49(4):591-613.

3. Butt MS, Krikler SJ, Ali MS. Displaced fractures of the distal femur in elderly patients: operative versus non-operative treatment. *J Bone Joint Surg Br.* 1996;78(1):110-4.
4. Weight M, Collinge C. Early results of the less invasive stabilization system for mechanically unstable fractures of the distal femur. *J Orthop Trauma.* 2004;18(8):503-8.
5. Adams JD Jr, Tanner SL, Jeray KJ. Far cortical locking screws in distal femur fractures. *Orthopedics.* 2015;38:153-6.
6. Sanders R, Swiontkowski M, Rosen H, Helfet D. Double-plating of comminuted, unstable fractures of the distal part of the femur. *J Bone Joint Surg Am.* 1991;73(3):341-6.
7. Sain A, Sharma V, Farooque K, Muthukumaran V, Pattabiraman K. Dual plating of the distal femur: indications and surgical techniques. *Cureus.* 2019;11(12):e6483.
8. Liporace FA, Yoon RS. Nail plate combination technique for native and periprosthetic distal femur fractures. *J Orthop Trauma.* 2019;33(2):e64-8.
9. Hake ME, Davis ME, Perdue AM, Goulet JA. Modern implant options for the treatment of distal femur fractures. *J Am Acad Orthop Surg.* 2019;27(19):e867-75.
10. Fontenot PB, Diaz M, Stoops K, Barrick B, Santoni BG, Mir H. Supplementation of lateral locked plating for distal femur fractures: a biomechanical study. *J Orthop Trauma.* 2019;33(12):642-8.
11. Salas C, Mercer D, DeCoster TA, Taha MR. Experimental and probabilistic analysis of distal femoral periprosthetic fracture: a comparison of locking plate and intramedullary nail fixation. *Comput Methods Biomech Biomed Engin.* 2011;14(2):157-64.
12. Başçi O, Karakaşlı A, Kumtepe E, Güran O, Havitçioğlu H. Combination of anatomical locking plate and retrograde intramedullary nail in distal femoral fractures: comparison of mechanical stability. *Eklem Hastalik Cerrahisi.* 2015;26(1):21-6.