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Research Article

Comparative study of fracture shaft humerus treated by dynamic compression plate and interlocking nailing

Dr. Anand Kumar Goyal[1], Dr. Girish Dang[2], Dr. Vikrant Sharma[3]

1. Dr. Anand Kumar Goyal, Associate Professor, Department of Orthopaedics, Gautam Buddha Chikitsa Mahavidyalaya, Dehradun, Uttarakhand, drakgoyal@gmail.com
2. Dr. Girish Dang, Associate Professor, Department of Orthopaedics, Saraswati Institute of Medical Sciences, Hapur, Uttar Pradesh, dr.girish.dang@gmail.com
3. Dr. Vikrant Sharma, Senior Resident, Department of Orthopaedics, Gautam Buddha Chikitsa Mahavidyalaya, Dehradun, Uttarakhand, vikrantdsharma220221@gmail.com

Corresponding author:

Dr. Vikrant Sharma, Senior Resident, Department of Orthopaedics, Gautam Buddha Chikitsa Mahavidyalaya Dehradun, Uttarakhand, vikrantdsharma220221@gmail.com

Abstract

Background: Commonly deployed surgical procedures for humerus shaft fractures include dynamic compression plating and interlocking nailing. This study compared dynamic compression plating (Group A) and interlocking nailing (Group B) in a cohort of 100 patients. **Methods:** A total of 100 humeral shaft fracture patients were randomly divided into two equal groups (n = 50 each), Group A was treated by dynamic compression plating, whereas Group B treated by interlocking nailing. Following surgery, the patients were monitored for 24 weeks, and evaluated for radiological union, pain (VAS), functional scores (CMS, DASH) and time to mobilization, hospital stay, and complications. **Results:** With similar mean in both groups (p = 0.47), the Group B showed a significantly faster radiological healing time (14.2 ± 1.51 weeks) than Group A (16.46 ± 1.28 weeks, p = 0.00). At 24 weeks, CMS scores in Group B was 100 compared to 94 in Group A, indicating a better functional recovery and a quicker decline in VAS scores. In both groups' DASH scores gradually increased, but disability was lower in Group B (5 compared to 10 in Group A) at the final follow-up. Compared to Group B, the Group A had higher rates of infections, nerve damage, and implant-related problems. **Conclusion:** Interlocking nailing offers a better alternative to dynamic compression plating in the management of humeral shaft fractures, owing to quicker healing, reduced complications, and better functional outcomes.

Keywords: Fracture shaft humerus, Dynamic compression plate, Interlocking nailing

Introduction: Humeral shaft fractures are quite common consequent to trauma from falls, auto accidents, or sports-related events [1]. A considerable number of these fractures have a significant negative influence on patients' quality of life and cause impairment and loss of function [2]. Over the years the treatment of humeral shaft fractures has evolved into multiple surgical fixation strategies. Interlocking nailing (ILN) and dynamic compression plate (DCP) fixation have become common techniques for fixing humeral shaft fractures [3].

Dynamic Compression Plate (DCP) which is an extramedullary fixation technique has long been regarded as a standard to achieve stable fixation in complex fractures.. It promotes healing while lowering the chance of nonunion or malunion by offering compression at the fracture site [4]. Conversely, interlocking nailing (ILN) provides internal fixation with little damage to the soft tissues around the humerus as opening of the fracture site is not resorted to. Because it can give a flexible and robust fixation while minimizing the need for substantial surgical exposure, this approach is frequently chosen [5]. Reportedly, interlocking nailing provides improved biomechanical stability, quicker healing times, and less wound infection-related problems [6]; and DCP produces better results in specific fracture configurations, such as comminuted fractures or fractures close to the elbow or shoulder giving better control over fracture alignment [7].

The relative efficacy of the two fixation techniques of humeral shaft fractures i.e. DCP and IMN will be assessed through evaluation of a number of factors, including rate of union, healing duration, complication rates, functional outcomes and overall patient satisfaction.

Materials and Methods

Study Design: The objective of this cross-sectional study was to assess and compare the clinical results of interlocking nailing (ILN) and dynamic compression plate (DCP) fixation in the treatment of humeral shaft fractures in Department of Orthopaedics, Gautam Buddha Chikitsa Mahavidyalaya, Dehradun. Every patient who satisfied the inclusion criteria was chosen for the study. For this investigation, institutional ethics approval was obtained.

Study Population: According to the AO/OTA (Arbeitsgemeinschaft für Osteosynthesefragen / Orthopaedic Trauma Association) classification, 100 adult patients (18–70 years old) with closed or open humeral shaft fractures were included in the study. According to the surgical method employed, the patients were split into two groups:

1. **Group A**: Patients undergoing **DCP fixation**.
2. **Group B**: Patients undergoing **ILN**.

Inclusion criteria for the study followed:

1. Grade I open (Gustilo Anderson classification) or closed humeral shaft fractures; fractures operated within three weeks of the injury..
2. Patients in 18–70 age range.
3. Patients who have given their informed consent to take part in the study.

Exclusion criteria for the study followed:

1. Pathological Fractures.

2. Patients with significant co-morbidities (e.g., cardiovascular illnesses, uncontrolled diabetes).
3. Fractures with additional injuries having a major impact on the course of treatment (e.g., neurovascular compromise, brachial plexus injury).

Surgical Methods:

1. **Dynamic Compression Plate Fixation** - The patient was induced with either regional or general anesthesia and prepped and draped for lateral exposure of the shaft of humerus. The fracture ends were exposed and reduced under vision and fixed with DCP and screws achieving due compression across the fracture line . The wound was closed in layers after due haemostasis and sterile dressing applied.
2. **Interlocking Nailing -** The patient was induced with general anesthesia and placed in beach chair position with forearm resting on patient's flexed thigh. C-arm of the IITV was positioned on the head end of the OT table such that proximal humerus and the shaft of the humerus can be visualized on the monitor. The trial close reduction of the fracture was done under IITV. Through a small incision just distal to the acromion process an entry point is selected on the highest point of the head of the humerus in line with the medullary canal of the diaphysis head of the humerus, as a straight AO type humerus nail was used. Utilizing guide wire and sequential reaming of medullary canal, humerus nail of required dimensions was introduced across the fracture while maintaining the fracture in reduction in normal alignment and rotation. The nail was secured with the proper locking screws placed proximally and distally. Sterile dressings were applied and the wound was closed in layers.

Outcome Criteria:

Radiological Evaluation: X-rays were done to evaluate fracture union at 4, 8, 12, and 24 weeks of surgery. Evidence of callus formation and visibility of the fracture site on X-rays were assessed to categorize fracture healing as either union, delayed union, or nonunion. Alignment of fracture fragments was checked for any malalignment viz. rotation or angulation.

Functional Outcome: Assessment of Pain was done through Visual Analog Scale (VAS), both at rest and with activity. Functional status was assessed using Constant-Murley Score (CMS) for shoulder function, which evaluates pain, activities of daily living, range of motion, and strength. The Quick DASH (Disabilities of the Arm, Shoulder, and Hand) score was also used to assess upper extremity function and quality of life.

Complications: Patients were evaluated for any post surgery complications viz. surgical site infection, nerve damage, vascular damage, plate failure, nail displacement, and issues related to implants. The duration of mobilization and length of hospital stay were noted for both groups to assess the speed of recovery and the necessity for postoperative rehabilitation.

Statistical Evaluation: Continuous variables are reported as means with standard deviations, while categorical variables are shown as percentages. Group comparisons were performed using the Student's t-test for continuous variables and the Chi-square test for categorical variables. A p-value of <0.05 was considered statistically significant.

Follow-up: Patients were followed at 2 weeks, 6 weeks, 12 weeks, and 24 weeks after surgery to monitor their recovery and results. During each follow-up, X-rays and clinical evaluations were conducted.

Data Collection and Analysis: All clinical, radiological, and follow-up information was recorded using a standardized data collection form. The data were analyzed employing suitable statistical methods to assess the efficacy, complications, and outcomes of DCP compared to ILN.

Observation and Results

In this study, the mean ages of the two groups were similar (p = 0.47). The radiological union of Group B was significantly faster than that of Group A (16.46 ± 1.28 weeks, p = 0.00) at 14.2 ± 1.51 weeks. In Group A, 2 percent of patients experienced complications like delayed union, malalignment, and angulation deformity; in Group B, no such issues were noted. As indicated in Table-1, Group B had quicker healing and fewer alignment-related issues. The clinical results of humeral shaft fractures treated with interlocking nailing (Group B) and dynamic compression plating (Group A) are summarized in Table-2. Results for Group B were marginally better on all metrics. Faster decline in VAS scores was noted in Group B indicative of faster pain relief.. Both groups saw a steady improvement in CMS, with Group B showing maximum score of 100 in contrast to 94 in Group A, by 24 weeks. Further, DASH scores in Group B gradually declined to a score of 5 compared to 10 by 24 weeks, indicating less disability over the course of the follow-up period. Complications, hospital stay, and time to mobilization for humeral shaft fractures treated with dynamic compression plating (Group A) and interlocking nailing (Group B) are summarized in Table-3. Group A experienced more complications, including two infection cases, five nerve injury cases, one plate failure case, and one implant-related problem. With one infection, one nerve injury, one case of nail migration, and two implant-related issues, Group B on the other hand, experienced fewer complications.

Table No. 1: Showing the time to radiological union (weeks) for fracture shaft humerus by dynamic compression plate and interlocking nailing

Parameters	Group A Mean ± SD	Group B Mean ± SD	P-value
Age (years)	40.74 ± 7.29	39.70 ± 7.23	0.47
Time to radiological union (Weeks)	16.46 ± 1.28	14.2 ± 1.51	0.00
Fracture healing (delayed union)	1 (2%)	0 (0%)	
Fracture alignment (Malalignment)	1 (2%)	0 (0%)	
Fracture alignment (Rotation)	0 (0%)	0 (0%)	
Fracture alignment (Angulation)	1 (2%)	0 (0%)	

Table No. 2: Showing the Clinical Outcomes for fracture shaft humerus by dynamic compression plate and interlocking nailing

Surgical technique	VAS Score (4 weeks)	VAS Score (8 weeks)	VAS Score (12 weeks)	VAS Score (24 weeks)
Group A	4	3	2	0
Group B	3	2	1	0

Surgical technique	**CMS (4 weeks)**	**CMS (8 weeks)**	**CMS (12 weeks)**	**CMS (24 weeks)**
Group A	42	56	72	94
Group B	47	62	78	100
Surgical technique	**DASH Score (4 weeks)**	**DASH Score (8 weeks)**	**DASH Score (12 weeks)**	**DASH Score (24 weeks)**
Group A	55	42	30	10
Group B	50	37	22	5

Table No. 3: Showing the complications, Time to mobilization and hospital stay for fracture shaft humerus by dynamic compression plate and interlocking nailing

Complications	**Group A (Number)**	**Group B (Number)**
Infection	2	1
Nerve injury	5	1
Vascular injury	0	0
Plate failure	1	0
Nail migration	0	1
Implant-related issues	1	2
Time to mobilization (days)	9 days	4 days
Hospital stay	6 days	4 days

Discussion

In this study the results of interlocking nailing (ILN) and dynamic compression plating (DCP) on the treatment of fractures of the humeral shaft were compared. In view of no statistically significant difference in the mean age between the two groups ($p = 0.47$), baseline similarity was ensured. Radiological union, with a highly significant p-value of 0.00, occurred significantly earlier in the ILN group (14.2 ± 1.51 weeks) than in the DCP group (16.46 ± 1.28 weeks). This confirms earlier findings that less periosteal stripping and blood supply preservation via minimally invasive procedures like ILN promote quicker fracture healing [8]. Across all variables that were observed, the ILN group exhibited superior clinical outcomes, such as pain relief, shoulder function, and disability. In terms of pain, function, and activity limitation [9], Group B demonstrated a better overall recovery with faster VAS score improvement, higher Constant-Murley Scores (CMS), and a faster DASH score reduction [10, 11]. Multiple cases of nerve injury and infection were among the complications that were significantly more common in the DCP group. On the other hand, the ILN group showed shorter hospital stays, earlier mobilization, and fewer complications, which were probably owing to the procedure's less invasive nature and shorter postoperative rehabilitation. Although DCP is still a good technique, ILN shows up, particularly in specific fracture patterns or when DCP is not practical [12,13].

Conclusion

This study concludes that, in comparison to dynamic compression plating, interlocking nailing is a better technique for treating humeral shaft fractures. ILN was linked to earlier mobilization, better functional outcomes, fewer complications, a shorter hospital stay, quicker radiological union, and quicker pain relief. When used properly, ILN offers a better recovery profile and ought to be the recommended choice, even though both approaches are efficient.

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