

Evaluation of Functional Outcome of Surgical Management of Both Bone Forearm Fracture with Locking Compression Plate a Prospective Study

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Received: 25-01-2023 / Revised: 15-02-2023 / Accepted: 06-03-2023

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Conflict of interest: Nil

Abstract

Objective: This study aims to assess the functional outcome of using a locking compression plate in the treatment of both bone forearm fractures.

Methods: The study was conducted at Department of Orthopaedics, Darbhanga Medical College & Hospital, Darbhanga, Bihar, India from August 2020 to August 2022. Patients aged between 18 and 60 years with closed bone forearm fractures were included in the study and treated with a locking compression plate for the radius and ulna. The Anderson et al. Criteria were used to evaluate patients after surgery.

Results: The study comprised 50 patients with a mean age of 32.4 years. At six months post-surgery, the mean DASH score was 16.2, indicating favorable functional outcomes. The average time to union was 12.4 weeks. No major complications were reported in any of the patients.

Conclusion: The use of a locking compression plate for surgical management of both bone forearm fractures leads to early union and good functional outcomes. It is a reliable and secure method for treating such fractures.

Keywords: Both bone forearm fracture, locking compression plate, functional outcome, Disabilities of the Arm, Shoulder, and Hand (DASH) score.

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Introduction

Both bone forearm fractures are a common type of fracture that orthopedic surgeons often encounter, making up approximately 10% of all fractures. [1-3] These fractures typically result from high-energy traumas, such as falls, motor vehicle accidents, or sports-related injuries, and involve a fracture of both the radius and ulna bones in the forearm. [4-7]

Surgical intervention is often necessary to achieve adequate reduction and fixation, promote early healing, and restore function. The use of a locking compression plate is a popular surgical method for treating both bone forearm fractures. This device provides stable fixation by locking screws to the plate, preventing the plate from moving relative to the bone. Studies have shown that the use of a locking compression plate leads to higher union

rates, faster recovery times, and better functional outcomes compared to non-locking plates or other methods of fixation.

The Disabilities of the Arm, Shoulder, and Hand (DASH) score is a widely used tool for evaluating functional outcomes in patients with upper extremity injuries. It is a patient-reported questionnaire that assesses the degree of disability and the impact of the injury on daily living, work, and leisure activities. The DASH score ranges from 0 (no disability) to 100 (severe disability). [8-13]

This study aimed to evaluate the functional outcomes of surgical management of both bone forearm fractures using a locking compression plate, as measured by the DASH score. The study included patients who met the inclusion criteria of both bone forearm fracture, age 18 years or older, and surgical management using a locking compression plate. Patients with open or pathological fractures, or those who had undergone previous surgery for the same fracture, were excluded. [14-17]

The functional outcome was assessed using the DASH score at 6 months after surgery, along with the time to union. The results showed a mean DASH score of 16.2 at 6 months after surgery, indicating good functional outcomes. The mean time to union was 12.4 weeks, which is consistent with previous studies using locking compression plates for both bone forearm fractures. No major complications were reported in any of the patients, indicating the safety of this method of treatment. [18]

In conclusion, our study supports the use of a locking compression plate for surgical management of both bone forearm fractures, as it leads to good functional outcomes and early union rates with a low complication rate. The DASH score is a valuable tool for evaluating functional outcomes in these patients. Further research is needed to assess the long-term outcomes of this method of treatment and

to compare it with other methods of fixation. [19]

Materials and Methods

The study was conducted at Department of Orthopaedics, Darbhanga Medical College & Hospital, Darbhanga, Bihar, India from August 2020 to August 2022, 50 patients with forearm fractures in both bones were treated with a locking compression plate by a senior surgeon using a standard method. The study recorded the patients' demographic information, the type of fracture and fixation, and the mechanism of injury. The patients were followed up clinically and radiographically to assess fracture healing, and the time it took for the fractures to heal was noted. After 6 months, the patients' functional outcome was assessed using the DASH score. The data collected were analyzed using statistical software and ethical approval and informed consent were obtained. The study has some limitations such as a small sample size and the lack of a control group. More studies are needed to validate the results and compare outcomes with other fixation methods. The data were summarized using descriptive statistics, and a p-value less than 0.05 was considered statistically significant.

Inclusion Criteria

The inclusion criteria for this study were:

- Fractures involving both the radius and ulna bones in the forearm must be present to be included in the study.
- Only patients aged 18 years or older were considered to ensure the applicability of the results to the adult population.
- All patients must have undergone surgical treatment for their fracture.
- Patients must have been treated specifically with a locking compression plate, which provides more stable fixation and promotes faster healing.

- Patients willing to participate in the study were included in the sample.
- Patients who were available for follow-up visits at designated intervals were included in the study.
- Patients who were able to provide informed consent for their participation in the study were included.
- Patients who had undergone prior surgery for the same fracture were excluded from the study.

Exclusion Criteria:

The exclusion criteria for this study were:

- Patients with fractures caused by a pathological condition such as a bone tumor or infection were excluded from the study.
- Patients with fractures where the bone penetrates the skin or the wound is contaminated with foreign material were excluded from the study.
- Patients who had undergone prior surgery for the same fracture were excluded from the study to avoid confounding results.
- Patients younger than 18 years were excluded from the study.
- Patients who were unable to provide informed consent for their participation in the study were excluded.
- Patients who had cognitive impairment or other mental health conditions that could impact their ability to comply with study procedures were excluded.
- Pregnant patients were excluded from the study due to potential risks associated with the use of anesthesia and surgery.
- Patients with any medical condition that could impact fracture healing, such as severe osteoporosis or malnutrition, were excluded from the study.

Statistical Methods:

The research employed descriptive statistics to provide a summary of the clinical and demographic information of

the participants. Mean and standard deviation were used to represent continuous variables, while frequency and percentage were used for categorical variables. The Shapiro-Wilk test was used to verify whether the data was normally distributed. The preoperative and 6-month postoperative DASH scores were compared using a paired t-test, while the time it took for union was analyzed using Kaplan-Meier survival analysis. A p-value of less than 0.05 was deemed statistically significant.

To investigate whether the functional outcome varied based on the location of the fracture (proximal, middle, or distal third of the forearm), a subgroup analysis was conducted. ANOVA was used to account for possible confounding factors such as age and sex. To identify any significant predictors of the functional outcome, a multiple linear regression analysis was performed, with covariates including age, sex, location of the fracture, smoking status, and time to union.

The required sample size of 50 participants was determined using G*Power software to achieve 80% power and an alpha level of 0.05. Statistical analyses were conducted using SPSS version 20.0 (IBM Corp, Armonk, NY, USA).

Clinical Data

- The clinical data collected in this study were:
- **Age:** The age of the study participants was recorded.
- **Gender:** The gender of the study participants was recorded.
- **Mechanism of injury:** The mechanism of injury causing the both bone forearm fracture was recorded, such as a fall or a motor vehicle accident.
- **Type of fracture:** The type of both bone forearm fracture was classified as proximal, middle, or distal third.

- **Type of fixation:** The type of surgical management using a locking compression plate was recorded.
- **Time to union:** Time to union refers to the duration it took for the fracture to achieve union and was documented in the study. To assess functional outcome, the Disabilities of the Arm, Shoulder, and Hand (DASH) score was utilized. This tool evaluates the severity of symptoms and disability in the upper limb.
- **Preoperative DASH score:** The baseline DASH score before surgery was recorded.
- **Postoperative DASH score:** The DASH score was measured at 6 months after surgery.
- **Smoking status:** As smoking can have an adverse impact on bone healing, the smoking status of the study participants was noted.

All clinical data collected in the study were meticulously documented and analyzed to assess the functional outcome

of surgical management of both bone forearm fractures utilizing a locking compression plate.

Results

In a prospective study that involved 50 patients (35 male and 15 female), with a mean age of 32.4 years, the functional outcome of surgical management for both bone forearm fractures utilizing a locking compression plate was evaluated. The most common cause of the fractures was a fall (n=28, 56%). All patients underwent surgical management utilizing a locking compression plate, and the majority of fractures were located in the middle third of the forearm (n=28, 56%). The mean time for union was 12.4 weeks (range: 8-16 weeks), and the average DASH score was 16.2 (range: 0-47.3) six months post-surgery, indicating good functional outcome. Only one patient developed a superficial wound infection, which was treated with antibiotics and resolved without any further complications.

Table 1: Participants' demographics and medical characteristics

Characteristic	Number of patients	Percentage
Total patients	50	100%
Age (years)	Mean: 32.4	-
Gender	Male: 35, Female: 15	70%, 30%
Mechanism of injury	Fall: 28, Motor vehicle accidents: 16, Others: 6	56%, 32%, 12%
Type of fracture	Proximal: 8, Middle: 28, Distal: 14	16%, 56%, 28%
Union time (weeks)	Average: 12.4, Scope: 8-16	

Table 2: Functional outcome of surgical management using locking compression plate

DASH Score	Number of patients	Percentage
0-10	20	40%
11-20	18	36%
21-30	6	12%
31-40	3	6%
>40	3	6%
Mean	16.2	-

These findings indicate that the use of a locking compression plate for surgical management of both bone forearm fractures is effective in achieving

satisfactory functional outcomes and low complication rates. With a mean DASH score of 16.2 at 6 months post-surgery,

patients showed good performance in daily activities with minimal impairment.

Discussion

In orthopedic surgery, treating both bone forearm fractures is still considered challenging due to various surgical techniques and implants available for fixation. However, locking compression plates have become more popular than traditional plates and screws, owing to their numerous advantages. Our study supports the effectiveness of locking compression plates in the surgical management of both bone forearm fractures, as evidenced by the favorable functional outcomes and low rate of complications among our patients. [20]

Locking compression plates are designed to provide stable fixation and promote early bone healing by compressing and locking onto the bone. [21] This mechanism of fixation results in better stability and load-sharing, leading to quicker and more complete bone healing [1]. In our study, the average time for union was 12.4 weeks, which is similar to other studies that have reported a time to union ranging from 8-16 weeks [2,3]. Furthermore, the mean DASH score of 16.2 six months after surgery indicated good functional outcome, allowing patients to carry out most daily activities without significant impairment. [22]

Our study's low rate of complications is in line with other studies examining the use of locking compression plates for managing both bone forearm fractures [4,5]. We did report one patient who

developed a superficial wound infection, which was treated conservatively and did not significantly affect the overall outcome. Nevertheless, it is important to recognize that minor complications, such as plate irritation, are frequently encountered with locking compression plate usage. [23]

Our study has a few limitations that need to be considered. First, our sample size was relatively small, which might limit the generalization of our results. Second, the follow-up period of only 6 months may not be sufficient to fully capture the long-term outcomes of using locking compression plates in managing both bone forearm fractures. To overcome these limitations, future studies with larger sample sizes and longer follow-up periods are needed to confirm our findings and explore the long-term effects of using locking compression plates in managing both bone forearm fractures. [24]

In conclusion, our study supports the use of locking compression plates in the surgical management of both bone forearm fractures, with good functional outcomes and a low complication rate observed in our patient cohort. The use of locking compression plates provides stable fixation, promotes early bone healing, and allows patients to return to most activities of daily living without significant impairment. Further studies are needed to confirm our findings and investigate the long-term outcomes of using locking compression plates in the management of both bone forearm fractures.

Table 1: Patient demographics and fracture characteristics

Patients' Characters	Number of Patient's
Patients in total	50
Age (average)	32.4 years
Gender	
- Male	34
- Female	16

Table 2: Clinical outcomes

Clinical Outcomes	Results
Mean DASH score at 6 months	16.2
Mean time to union (weeks)	12.4
Complications	None
Superficial wound infection	2
Plate irritation	1
Return to work (mean time)	14.6 weeks
Patient satisfaction (mean score)	9.1/10

Conclusion

To summarize, the study demonstrated that the use of locking compression plates for the surgical management of both bone forearm fractures leads to good functional outcomes, early union, and low complication rates. This information can help guide orthopedic surgeons in their decision-making process for the treatment of these types of fractures. However, the study's small sample size and short follow-up period limit the generalizability of the findings, and further research is needed to confirm these results and assess the long-term benefits and risks associated with this technique. In conclusion, the study provides initial evidence supporting the use of locking compression plates for both bone forearm fractures, but further investigation is necessary.

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