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Research Article

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Efficacy of Locking Compression Plate in Comparison with Intramedullary Nailing for Humerus Shaft Fracture

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Abstract

Background: *Humeral shaft fractures constitute approximately 5% of all fractures. Surgical fixation is commonly achieved using either intramedullary nails (IMNs) or locking compression plates (LCPs), each with distinct advantages. IMNs are valued for their minimally invasive approach, while LCPs offer superior stability and control over fracture reduction.*

Objective: *This study aimed to compare the efficacy of IMNs and LCPs in managing humeral shaft fractures, focusing on operative parameters, postoperative recovery, and functional outcomes.*

Methodology: *This retrospective case study was conducted at Sheikh Zayed Medical College/Hospital Rahim Yar Khan, including patients treated between March 1, 2018, and February 28, 2019. A total of 68 patients with humeral shaft fractures were reviewed. The patients were divided into two groups based on the surgical fixation* ***method used.***

- ***IMN Group:*** *34 patients underwent intramedullary nailing.*
- ***LCP Group:*** *34 patients received locking compression plate fixation.*

Patients were followed retrospectively after their surgery for a period of one year. Data were collected on operative time, length of hospital stay, intraoperative blood loss, and functional recovery through a review of medical records and follow-up assessments

Results: *Demographics: The mean age was 38.05 ± 11.5 years for the IMN group and 39.7 ± 12.3 years for the LCP group. Operative Metrics: The IMN group demonstrated significantly shorter operative times, reduced hospital stays, and lower intraoperative blood loss ($P < 0.05$). Functional Outcomes: Patients in the IMN group showed superior functional recovery, exhibiting better range of motion, enhanced strength, and improved ability to perform daily activities without pain or restriction.*

Conclusion: *Intramedullary nailing is a more effective treatment for humeral shaft fractures compared to locking compression plating. The benefits observed include reduced blood loss, shorter operative time, decreased hospital stay, faster bone union, and fewer complications. Therefore, intramedullary nailing is recommended as the preferred surgical approach for managing humeral shaft fractures.*

Keywords: Humerus Shaft Fracture (HSF), Intramedullary Nails (ILN), Locking Compression Plates (LCP)

1. Introduction

Humeral shaft fractures are relatively common, accounting for approximately 1-5% of all fractures, with an incidence rate of 10-20 per 100,000 individuals. This rate increases to 100 per 100,000 in the elderly population due to factors such as decreased bone density and a higher risk of falls [1]. Common causes include sports-related injuries, motor vehicle accidents, and falls from height [2]. Non-operative management, including casting or bracing, is typically suitable for most humeral shaft fractures, given the bone's intrinsic healing capacity and the likelihood of satisfactory functional recovery. However, surgical intervention is often required in specific circumstances, such as open fractures, polytrauma, or failure of non-operative treatment to achieve appropriate outcomes [3,4]. Additionally, complex fractures with significant displacement, comminution, or those requiring early mobilization, usually necessitate surgical fixation to restore alignment, promote healing, and regain functional capacity [5,6].

Advancements in surgical techniques and internal fixation implants have enhanced the management of humeral shaft fractures. Intra Medullary Nails (IMNs) and Locking Compression Plates (LCPs) are now the most frequently employed methods for surgical fixation [5]. IMNs are less invasive, preserving the biological environment necessary for bone healing by avoiding periosteal stripping and maintaining the fracture hematoma [7]. They also provide a biomechanical advantage through load-sharing at the fracture site, promoting efficient bone union [7,8]. While numerous studies have compared IMNs and LCPs, the optimal surgical method remains controversial. Some research indicates no significant differences in radiological and functional outcomes between the two techniques, leading to debate over the best treatment approach [8,9]. The present study seeks to contribute to this ongoing discussion by investigating the efficacy and functional outcomes of IMNs versus LCPs in the treatment of humeral shaft fractures.

2. Methods

This retrospective case study was conducted at Sheikh Zayed Medical College/Hospital Rahim Yar Khan. Patients who underwent surgical treatment for humeral shaft fractures between March 1, 2018, and February 28, 2019, were included. A total of 68 patients met the inclusion criteria, which consisted of patients of both genders aged 18 years or older with humeral shaft fractures. Patients with pathological fractures, neurovascular injury, a history of previous humeral shaft fracture, and fractures older than two weeks were excluded from the study.

The study divided patients into two groups based on the surgical fixation method employed:

- **IMN Group**: 34 patients underwent intramedullary nailing.
- **LCP Group:** 34 patients received locking compression plate fixation.

Patients were followed retrospectively for a year post-surgery. Data were collected on operative time, length of hospital stay, intraoperative blood loss, and functional recovery, primarily through a review of medical records. Radiographic scans were also reviewed monthly until complete bone healing was confirmed.

2.1. Operative Technique

2.1.1. Intramedullary Nailing (IMN)

This is done be antegrade and retrograde nails. Antibiotics are given intravenously to patients before to surgery to prevent infection. Following general anesthesia, the patient had an antegrade nail placed, his elbow was bent to 90 degrees, and his shoulder was exposed as widely as feasible. Manipulation was carried out prior to nailing. A bone awl was inserted into marrow cavity along the bone foramen 1 cm to the medial of the Humerus greater tuberosity and lateral to cartilage. The deltoid fascia was then dissected by a longitudinal incision above the acromion. The guiding pin was then put into the intra-medullary cavity 2 cm proximal to olecranon, with the reaming 1 mm larger than nail, to secure proximal and distal screws. After fixing, incision might be stitched. An incision in longitudinal direction was created from olecranon to triceps at back of elbow for patient who underwent retrograde nail. The upper olecranon fossa was punctured at 2.5 mm with a bone awl. Interlocking intramedullary nails were implanted in every patient and locked using static mode. Patient needed a triangular arm sling to secure his shoulder after surgery. On second and third postoperative days, he was able to rotate his wrist and finger joints and perform some non-gravity shoulder and elbow exercises.

2.1.2. Locking Compression Plates (LCP)

A 90-degree abduction of the patient's shoulder was performed following general anesthesia. In order to prevent damaging radial nerves, superficial fascia was sliced open by an incision that was separated between triangle muscle and the pectorals major. In order to achieve anatomic reduction of fracture segments, broken end of humerus shaft were first exposed by bluntly dissecting the brachialis muscle along space between biceps and triceps. Aim is to protect the periosteum. If the bone was cut into slices, it might be feasible with lag screws or reduction wire. So that the anatomic reduction site could be reached as far as possible, 3/4 locking screws were used to secure the plate. After fixing, the incision might be seamed. Patient needed a tri-angular arm sling to secure his shoulder after surgery, and on second and third postoperative days, he was able to rotate his wrist and finger joints and perform some non-gravity shoulder and elbow exercises. Antibiotics are given to patients before and after surgery to prevent infection.

2.2. Outcome Measures

Surgical outcomes were assessed based on operative time, intraoperative blood loss, hospital stay, and time to bone union. Functional outcomes were evaluated using the American Society of Shoulder and Elbow Surgeons (ASES) score. Complications such as shoulder pain, stiffness, delayed union, and non-union were documented.

3. Results

Mean age of patients was 38.05 ± 11.5 years in group intra-medullary nails and 39.7 ± 12.3 years in locking compression plates. There were 21(61.8%) males and 13(38.24%) females in intra-medullary nails and 23 (67.47%) males and 11(32.53%) females in locking compression plates. Fractures were classifiedby AO system, 16(47.06%) in intra-medullary nails and 19(55.88%) in locking compression plates belonged to 3B. Most injurieswere due to road traffic accident (70.58%for intra-medullary nails, and 73.53%) for locking compression plates, rest of patient's presentation was because of blunted trauma. This Data is Presented in table 1 below.

Variable	Intra Medullary Nails	Locking Compression Plates
Age	38.05 ± 11.5	39.7 ± 12.3
Gender		
Male	21(61.8%)	23 (67.47%)
Female	13(38.24%)	11(32.53%)
Type of Fracture		
A	12(35.29%)	11(32.35%)
B	16(47.06%)	19(55.88%)
C	6(17.65%)	4(11.77%)
Cause of Injury		
Road traffic accident	24(70.58%)	25(73.53%)
Crushed by heavy object	5(14.71%)	7(20.59%)
Fall from height	5(14.71%)	2(5.88%)

Table 1: Demographics Data of Patient

Operative time, hospital stay and intra-operative blood loss was much lower in group intra-medullary nails as compared to locking compression plates group (P<0.05).

	Intra Medullary Nails	Locking Compression Plates	P Value
Intra Operative Blood Loss(ml)	58.00 ± 8.32	148.14 ± 10.44	<0.004
Operative Time (min)	61.02 ± 8.13	91.82 ± 4.20	<0.002
Hospital Stay (days)	7.41 ± 1.05	9.02 ± 1.16	<0.000

Table 2: Comparison of Surgical Outcome

At final follow-up in intra-medullary nails, 70.59% patients show excellent, 17.65% patients show good and 11.65% had fair with no poor results while in locking compression plates 35.29% patients shows excellent, 47.07% patients show good 8.2% shows fair and 8.2%patients had poor functional outcomes with statistically significant difference (<0.036).

Outcome	Intra Medullary Nails	Locking Compression Plates	P Value
Excellent	24(70.59%)	12 (35.29%)	0.036
Good	6 (17.65%)	16 (47.07%)	
Fair	4(11.76%)	3 (8.82%)	
Poor	0	3 (8.82%)	

Table 3: Functional Outcome of Patients

Mean union time in intra-medullary nails was significantly shorter (2.35±0.78 vs. 3.14±1.26 months) than locking compression plates group. Delayed union was noted in 0(0.00%) in intra-medullary nails and 3(8.82%) in locking compression plates group. Shoulder pain was 20 (58.82%) in locking compression plates and 7(20.59) in Intra-medullary Nails. In locking compression plates shoulder stiffness was 9 (26.71%) in locking compression plates to 1 (2.94%) intra-medullary nail group. Non-union was 3(8.82%) LOCKING compression plates patients only. Complications rate was significantly high in locking compression plates (p-value <0.05).

	Intra Medullary Nails	Locking Compression Plates	P Value
Bone Union (months)	2.35±0.78	3.14±1.26	0.04
Complications			
Shoulder Pain	7(20.59)	20 (58.82%)	0.03
Non-Union	0	3(8.82%)	0.00
Delayed Union	0 (0.00%)	3(8.82%)	
Stiffness	1 (2.94%)	9 (26.71%)	

Table 4: Complication in Two Groups

4. Discussion

Patients with humeral shaft fractures often present with neurovascular injury, forearm fractures, and compound injuries [9,10]. The ideal treatment plan for a humeral shaft fracture is still debated in medical settings. Currently, intramedullary nailing, open reduction, and internal fixation are the most common surgical techniques. Inconsistent results have been reported in several systematic reviews and meta-analyses that compared the use of locking compression plates and intramedullary nails for treating humeral shaft fractures [11,12]. Ozan et al. found that for treating type A humeral shafts, intramedullary nailing was more appropriate, effective, and safe compared to steel plating [13]. Numerous studies have discussed the use of intramedullary nailing and dynamic compression plating for the treatment of humeral shaft fractures, but local data is deficient [14-16]. In this study, we investigated, compared, and contrasted different aspects of both surgical techniques, including outcomes and related complications.

In the current study, men comprised the majority of patients (65%), while women accounted for 35%. These findings align with other studies where the proportion of male patients was higher (60-75%) compared to female patients (25-40%) [6]. When compared to locking compression plates, intramedullary nailing showed significantly reduced operative times, hospital stays, and intraoperative blood loss ($P < 0.05$). These results are consistent with prior research [17]. At the final follow-up, 24 patients (70.59%) in the intramedullary nailing group exhibited excellent outcomes, while 6 patients (17.65%) showed good results. In contrast, in the locking compression plate group, 12 patients (35.29%) had excellent outcomes, and 16 patients (47.07%) had good functional results ($P < 0.05$). These findings correspond with other studies [18,19]. There was no statistically significant difference in the incidence of complications, union rate, or ASES scores. The results for the intramedullary nailing approach support its superiority, as demonstrated by prior investigations [17].

4.1. Limitations

This study has several limitations. The relatively small sample size may limit the generalizability of the results, indicating the need for larger, multicentre studies to confirm these findings. The one-year follow-up period may not fully capture long-term complications or outcomes, suggesting that future research should include longer follow-up periods to thoroughly assess the effectiveness of these therapeutic approaches. Additionally, conducting this study at a single centre could introduce selection bias, highlighting the value of a multicentre approach for a more comprehensive understanding of treatment outcomes.

5. Conclusion

Intramedullary nailing is a superior technique for the treatment of humeral shaft fractures compared to locking compression plating. The observed benefits include less intraoperative blood loss, shorter operative times, reduced hospital stays, faster bone union, and fewer complications. These findings suggest that IMNs should be considered the preferred surgical option for managing humeral shaft fractures. Further research is recommended to explore the long-term outcomes and impact on patient quality of life.

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