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Status of Ulnar Nerve in Patients After Open Reduction Surgery Internal Fixation of Distal Humerus Fracture at Adam Malik Hospital Medan

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ABSTRACT

Background: Distal humerus fractures are complex injuries that often require internal fixation open reduction surgery (ORIF). One of the complications that often accompanies is an ulnar nerve injury, which is reportedly related to the surgical approach technique. This study aims to analyze the relationship between the type of surgical approach and the incidence of post-ORIF ulnar nerve injury in distal humerus fractures. Methods: An analytical observational study with a cross-sectional design was conducted on 45 patients undergoing distal humerus fracture ORIF at Adam Malik Hospital Medan for the 2020-2024 period. Data were collected from medical records and postoperative neuroimaging results using McGowan's classification. The surgical approaches studied are: paratricipital, triceps splitting, Chevron osteotomy. Results: The mean age of patients was 42.02±12.46 years, with the majority being male (60%). The most frequent injury mechanism was falling (46.67%). The paratricipital approach is most commonly used (44.44%), followed by chevron osteotomy (35.56%) and triceps splitting (20%). Postoperative ulnar nerve injury was found in 3 patients (6.67%), with the highest proportionally incidence on the triceps splitting approach (11.1%). Analysis with Kolmogorov-Smirnov showed an insignificant association between surgical approach and ulnar nerve injury ($p = 0.786$). Conclusions: No significant association was found between the surgical approach of ORIF and the incidence of ulnar nerve injury. These findings may be a consideration in the selection of a safe surgical approach to the ulnar nerve in distal humerus fractures.

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INTRODUCTION

Distal humerus fractures represent 2% of all fractures and show an increased incidence. These injuries are often challenging in management due to complex anatomy, poor bone quality in the elderly, and the need for early recovery of range of motion. Treatment options include non-operative management, open reduction internal fixation (ORIF), or total elbow arthroplasty.1 Non-operative management is generally limited to stable fractures or patients with a high surgical risk. Meanwhile, total elbow arthroplasty is an option for severe comminutive fractures in the elderly, but its use in young patients is still limited. Therefore, ORIF is often the primary treatment option for most of these injuries. The success of ORIF in a distal humerus fracture depends on several factors, including the selection of the right surgical approach. Some commonly used approaches are triceps splitting, paratricipital, and chevron osteotomy to provide adequate exposure.

The paratricipital approach offers an advantage in maintaining the extensor mechanism. On the other hand, chevron osteotomy provides excellent exposure despite the challenges in bone technique and healing.1-5

Ulnar nerve injury is a significant complication of distal humerus fractures, with a reported prevalence ranging from 0% to 51%. These injuries can occur during initial trauma, during surgical procedures, or as a result of postoperative complications such as swelling and scarring formation. Some studies have shown a variable incidence of postoperative ulnar nerve dysfunction, e.g. 10% immediately after surgery and increasing to 16% after one year. However, the optimal treatment of the ulnar nerve, whether by in situ decompression or anterior transposition, is still a matter of debate. Some studies have even found that anterior transposition does not necessarily reduce the risk of neuropathy. The lack of data that clearly distinguish between traumatic nerve injury, surgery, or delays, as well as the majority of studies that are retrospective, warrant the need for further research. Therefore, this study aims to analyze the relationship between the ORIF surgical approach and ulnar nerve status in patients with distal humerus fracture at Adam Malik Hospital Medan. 6-12

METHOD

This study is an analytical observational design with a cross-sectional approach to evaluate the relationship between the type of open reduction surgery and the incidence of ulnar nerve injury in patients with distal humerus fracture in patients aged 18 to 59 years who underwent open reduction surgery with internal fixation carried out at Haji Adam Malik Hospital Medan. In this study, 45 patients who met the research criteria were used

RESULTS

A total of 45 research subjects were included in this study. The average age of the subjects was 42.02±12.46 years. The majority of subjects were men, which was 27 people (60%). The most frequent mechanism of injury was falling (21 cases, 46.67%), followed by traffic accidents (20 cases, 44.44%). The most common type of fracture is supracondylar (32 cases, 71.11%). The most commonly used operative approach is

paratricipital in 20 cases (44.44%), followed by chevron osteotomy in 16 cases (35.56%), and triceps splitting in 9 cases (20%). Overall, 3 of 45 patients (6.67%) had postoperative ulnar nerve injury, with 2 patients (4.44%) classified as McGowan grade 1 and 1 patient (2.22%) as McGowan grade 2. The complete characteristics of the subject are presented in Table 1

Table 1. Characteristics of Research Subjects

Variable	Frequency (n)/ average ± SD	Percentage (%)
Age (years)	42.02 ± 12.46	
Male Gender FemaleTotal	 27 18 45	 60.0 40.0
Mechanism of Fall Injury Traffic Accidents Sport	 21 20 4	 46.67 44.44 8.89
Supracondylar Fracture Type: Transcondylar Isolated Condyle	 32 20 4	 71.11 20.0 8.89
ORIF Approach Paracipital Triceps splitting Chevron osteotomy	 20 9 16	 44.44 20.0 35.56
McGowan Ulnaris Nerve Injury 1 McGowan 2	 2 1	 4.44 2.22

Of the 45 patients, 42 (93.3%) did not have postoperative ulnar nerve injury. The incidence of ulnar nerve injury was found in all three groups of surgical approaches. The proportionally highest proportion of injury incidence was found in the triceps splitting approach, where 1 in 9 patients (11.1%) experienced it. On the chevron osteotomy approach, the incidence was 1 in 16 patients (6.3%), while on the paratricipital approach it was 1 in 20 patients (5%). Despite the difference in proportions, the results of the Kolmogorov-

Smirnov statistical test showed no significant association between the type of surgical approach and the incidence of ulnar nerve injury (p = 0.786). Details of this relationship are presented in Table 2.

Table 2. The Relationship of Ulnar Nerve Injury to the ORIF Approach

ORIF Approach	Ulnar Nerve Injury		Total (n.%)	P-value
	No (n, %)	Yes (n,%)		
Paratricipital	19 (95.0%)	1 (5%)	20 (44.44%)	0.786
Triceps Splitting	8 (88.9%)	1 (11.1%)	9 (20.0%)	
Chevron Osteotomy	15 (93.8%)	1 (6.3%)	16 (35.56%)	

DISCUSSION

This study did not find a statistically significant association between surgical approaches (paratricipital, triceps splitting, or chevron osteotomy) and the incidence of ulnar nerve injury post-ORIF distal humerus fracture (p = 0.786). These findings suggest that the risk of ulnar nerve injury may be more influenced by other factors beyond the choice of approach alone, such as soft tissue handling, nerve dissection techniques, and the complexity of the fracture itself. Descriptively, the paratricipital approach showed the lowest incidence of nerve injury (5%). This is in line with the literature that highlights the advantages of this approach in maintaining the integrity of the extensor mechanism and minimizing dissection around the ulnar nerve.13-15

Some studies reported good functional outcomes and no cases of postoperative ulnar neuropathy when using a modified paratricipital approach , especially if nerve mobilization was avoided. In contrast, the triceps splitting approach showed the highest proportion of injuries in the study (11.1%). Although this approach provides better articular visualization than paratricipital, separation of the triceps muscle risks leading to wider tissue trauma near the ulnar nerve pathway. However, other literature does not show a significant increased risk of neuropathy if nerves are carefully identified and retracted. The high proportion in this group may be due to the small sample size (n=9). Chevron osteotomy was used in 35.56% of cases in the study, making it the second most commonly used approach. This most likely reflects the complexity of the cases referred to Adam Malik Hospital, where heavier and comminutive fractures require the maximum intraarticular exposure offered by osteotomy. While providing the best visualization, this approach carries the risk of complications related to osteotomy itself, such as non-union and implant irritation.16-18

The rate of ulnar nerve injury in this group (6.3%) was between the other two approaches, which is consistent with the literature showing that osteotomy does not inherently increase the risk of neuropathy if nerve management is done safely. Overall, our findings support the idea that careful ulnar nerve management—including identification, in situ decompression, and minimal retraction—is key to preventing neuropathy, regardless of the approach. The controversy regarding routine nerve transposition is also relevant; Some studies show an increased risk of neuropathy with unnecessary transposition. This research has several limitations. The relatively small sample size, especially the number of cases of nerve injury (n=3), limits the statistical power to detect significant differences. In addition, there were other confounding factors such as implant type, complexity of the initial fracture (AO type), and intraoperative decision to perform nerve transposition that were not analyzed in depth in this study.13:14-17

CONCLUSIONS

Based on an analysis of 45 patients, this study concluded that there was no statistically significant association between surgical approaches (paratricipital, triceps splitting, and Chevron osteotomy) with the incidence of ulnar nerve injury in patients postoperative ORIF distal humerus fracture (p = 0.786). Descriptively, the lowest incidence of ulnar nerve injury was found in the paratricipital approach (5%), while the highest proportion was found in the triceps splitting approach (11.1%). These results imply that the selection of surgical approaches should be based on the need for fracture visualization, while the prevention of ulnar nerve injury relies more on careful surgical techniques in dealing with the nerve itself.

REFERENCES

Nauth A, Nousiainen MT, Jenkinson R, Hall J. The treatment of periprosthetic fractures. Instr Course Lect. 2015;64:161-173.

Holte AJ, Dean RE, Chang G. Distal humerus fractures: review of literature, tips, and tricks. JSES Rev Rep Tech. 2024; 4(3):639-646. doi:10.1016/j.xrrt.2023.11.004

Xue Z, Huang X, Guo W, Tian Y, Xu B, Cao L. Comparison of clinical outcomes between the olecranon osteotomy approach and the Bryan-Morrey approach for total elbow arthroplasty. J Shoulder Elbow Surg. 2023; 32(7):1505-1513. doi:10.1016/j.jse.2023.02.128

Falgiano PA, Heifner JJ, Guerra C, Araiza ET, Hoekzema NA, Sandilands SM. A standardized chevron osteotomy for exposure of the distal humerus: a technique description and literature review. JSES Rev Rep Tech. Published online June 14, 2025. doi:10.1016/j.xrrt.2025.05.021

Singh R, Kanodia N, Singh H. Outcome following olecranon osteotomy versus paratricipital approach for complex intra-articular (AO 13-C) fracture of distal humerus: a prospective comparative study. J Shoulder Elbow Surg. 2019; 28(4):742-750. doi:10.1016/j.jse.2019.01.002

Chen RC, Harris DJ, Leduc S, Borrelli JJ, Tornetta P, Ricci WM. Is ulnar nerve transposition beneficial during open reduction internal fixation of distal humerus fractures? J Orthop Trauma. 2010; 24(7):391-394. doi:10.1097/BOT.0b013e3181c99246

Ruan HJ, Liu JJ, Fan CY, Jiang J, Zeng BF. Incidence, management, and prognosis of early ulnar nerve dysfunction in type C fractures of distal humerus. J Trauma. 2009; 67(6):1397-1401. doi:10.1097/TA.0b013e3181968176

Worden A, Ilyas AM. Ulnar neuropathy following distal humerus fracture fixation. Orthop Clin North Am. 2012; 43(4):509-514. doi:10.1016/j.ocl.2012.07.019

Savvidou OD, Zampeli F, Koutsouradis P, et al. Complications of open reduction and internal fixation of distal humerus fractures. EFORT Open Rev. 2018; 3(10):558-567. doi:10.1302/2058-5241.3.180009

Vazquez O, Rutgers M, Ring DC, Walsh M, Egol KA. Fate of the ulnar nerve after operative fixation of distal humerus fractures. J Orthop Trauma. 2010; 24(7):395-399. doi:10.1097/BOT.0b013e3181e3e273

Shin R, Ring D. The ulnar nerve in elbow trauma. J Bone Joint Surg Am. 2007; 89(5):1108-1116. doi:10.2106/JBJS. F.00594

Svernlöv B, Nestorson J, Adolfsson L. Subjective ulnar nerve dysfunction commonly following open reduction, internal fixation (ORIF) of distal humeral fractures and in situ decompression of the ulnar nerve. Strateg Trauma Limb Reconstr. 2017; 12(1):19-25.

Jeong HS, Yang JY, Jeon SJ, Shon HC, Oh JK, Lim EJ. Comparison of olecranon osteotomy and paratricipital approach in distal humerus intra-articular fracture: A systematic review and meta-analysis. Medicine (Baltimore). 2022; 101(34):e30216. doi:10.1097/MD.0000000000030289

Oshika Y, Takegami Y, Tokutake K, Yokoyama H, Oguchi T, Imagama S. Ulnar Nerve Neuropathy After Surgery for Intraarticular Distal Humerus Fractures: An Analysis of 116 Patients. J Hand Surg. 2023; 48(11):1171.e1-1171.e5. doi:10.1016/j.jhsa.2023.02.001

Chen G, Liao Q, Luo W, Li K, Zhao Y, Zhong D. Triceps-sparing versus olecranon osteotomy for ORIF: analysis of 67 cases of intercondylar fractures of the distal humerus. Injury. 2011; 42(4):366-370. doi:10.1016/j.injury.2010.09.004 doi:10.1007/s11751-016-0271-5

Iselin LD, Mett T, Babst R, Jakob M, Rikli D. The triceps reflecting approach (Bryan-Morrey) for distal humerus fracture osteosynthesis. BMC Musculoskeletal Disord. 2014; 15(1):406. doi:10.1186/1471-2474-15-406

Rankin IA, Dixon J, Goffin J, Johnstone AJ. A Modified Surgical Approach to the Distal Humerus: The Triceps Bundle Technique. Strateg Trauma Limb Reconstr. 2024; 19(2):99-103. doi:10.5005/jp-journals-10080-1618

Winek NC, Rubinstein AJ, Hwang M, Amadio JM, Hammarstedt JE, Regal S. Percent articular exposure of the distal humerus with triceps fascial tongue approach compared with olecranon osteotomy. J Shoulder Elbow Surg. 2023; 32(2):401-406. doi:10.1016/j.jse.2022.08.025