

Original Article

FIXATION OF DISPLACED DISTAL ULNA FRACTURES IN ADULTS BY  
FLEXIBLE INTRAMEDULLARY NAIL

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**Abstract**

**Background:** A distal ulnar fracture that occurs alone is a rare injury. It frequently results from a direct trauma to the ulnar border, which already has inadequate soft tissue. The purpose of this study was to assess the clinical & radiological outcomes of using a flexible intramedullary nail to treat displaced distal ulna fractures in adults. **Methods:** Prospective research included 20 adults with displaced distal ulna fractures admitted in orthopedic department of Sohag University Hospital. Evaluation was done using Grace & Eversmann rating system, VAS score & DASH score (Disabilities of the Arm, Shoulder, & Hand). **Results:** Regarding the surgical outcomes; the operation time ranged from 52 to 127 min with a mean time of  $86.9 \pm 16.8$  mins. The time of consolidation ranged from 9 to 27 weeks with a mean of  $16 \pm 4.05$  weeks. Regarding the complication, 5 (25%) patients had superficial infection, and 2 (10%) patients had a nail back-out. Most patients experienced significant improvement in the Grace & Eversmann rating system, with excellent outcomes observed at 6 months postoperatively. **Conclusion:** The use of flexible intramedullary nails for fixation of displaced distal ulna fractures in adults yielded favorable clinical & radiological outcomes. **Keywords:** Fixation, Distal Ulna, Ulna Fractures, Flexible Intramedullary Nail

**Keywords:** Ulnar fracture, Adults, Flexible nails, Intramedullary fixation

**1. Introduction**

A vital weight-bearing component of the wrist joint & a crucial part of the articulation of the forearm is the distal ulna. After an injury, the distal ulna's displacement, malalignment, or lack of ligamentous support negatively impacts grip strength & forearm rotation [1]. Distal radius fractures are typically linked to distal ulna fractures [2]. A distal ulnar fracture that is isolated is a rare injury. Usually, it is connected to a direct injury to the ulnar border beneath the skin [3]. Distal ulna fractures can derange the distal radioulnar joint, which can lead to fibrosis-induced limited forearm rotation, weakening because of joint instability, & persistent discomfort from incon-

gruity or ulnocarpal impact [4]. Isolated fractures of the distal 3<sup>rd</sup> of shaft ulna may be successfully treated conservatively in absence of significant displacement and rotational malalignment. To preserve forearm rotation, internal fixation & functional rehabilitation are the best forms of treatment for fractures that are significantly displaced or that have rotational malalignment, such as displaced spiral fracture patterns [5,6]. While there is disagreement over the optimal course of care for displaced distal ulnar fractures, most surgeons strive to preserve distal radioulnar joint motion by achieving anatomical reduction & stable fixation [3]. In this study we used flexible intramedullary nail for fixation of distal ulna fractures

because the short distal segment sometimes prevents the use of plate for fixation. Also, the presence of extensor carpi ulnaris tendon tightly close to distal ulna makes plating fixation not applicable. K-wires fixation is another option but it is not so stable and needs long times of immobilization postoperative. The study's objective was to evaluate the clinical & radiological outcomes of using a flexible intramedullary nail to treat displaced distal ulna fractures in adults.

## 2. Patients and Methods

It is a prospective case series research conducted at Orthopedic Department of Sohag Univ. Hospital. Among patients attending the outpatient clinic, patients with displaced distal ulna fractures and >18 years old were included. Patients with disturbed radioulnar joints, intra-articular fractures and malunited fractures or deformed ulna were excluded. The Ethics Committee of Sohag University's Faculty of Medicine gave its approval to the project. We acquired informed consent from everyone. Appropriate emergency treatment was given for associated head, chest, and/or abdominal injuries after hemodynamic stabilization, washing and cleaning of the wound (if present) by saline. Antibiotics injection and tetanus toxoid for open fractures. The limb was rested on a posterior splint. Grace & Eversmann performed each patient's clinical evaluation [7]. rating system: the Visual Analogue Scale, the DASH (Disabilities of the Arm, Shoulder, & Hand) score, & the functional assessment was all evaluated using it [8]. Evaluation was done 2 weeks, one month, 2 months and 6 months postoperatively. Radiological evaluation was done at time of accident, immediate postoperative, 3, 6 and 12 weeks postoperatively, fig. (1).



Figure (1) X-ray of Rt wrist (AP and lateral views) showing fracture of distal ulna; **a.** pre-operative, **b.** Immediate postoperative, **c.** 3 months postoperative, **d.** After nail removal.

### 2.1. Operative technique

We used Nancy nail made by Orthomed E®. About two thirds of the medulla ought to be visible through the nail. A small incision was created immediately distal to the olecranon tip, and the medulla was punctured with a flexible nail. 3 mm laterally & 6.5 mm distal to the most noticeable portion of the olecranon tip. From the proximal ulna distally to the fracture site, the nail had been advanced. Under fluoroscopy, closed decrease had been accomplished by hammering the nail into the distal end of the ulna after it had crossed the fracture site. It takes this impaction step to give stability & stop rotation. Long-arm splints were used for two weeks following surgery. Exercises for the elbow & wrist range of motion were started right away after the slab was removed.

### 2.2. Statistical analysis

A coding sheet was created when the data was gathered. Data were organized, tabulated, presented, & analyzed using IBM's (USA) SPSS (Statistical Package for the Social Sciences) V25. The standard deviation & mean value of the data were displayed. The Chi-square test had been used to compare qualitative data & the unpaired student t-test was used to examine quantitative data.

## 3. Results

This study included 20 adults with displaced distal ulna fractures. Demographic data of the studied cases are presented in tab. (1). Regarding the cause of fracture, AO/ASIF classification and soft tissue

coverage are presented in tab. (2). Regarding Grace and Eversmann rating system, there was significant improvement during the follow-up. Patients with excellent outcomes were significantly higher at 6 months

post operative compared to previous assessments. VAS and DASH scores were significantly decreased 2 weeks, 1, 2 and 6 months, tab. (3 & 4).

Table (1) Baseline characteristics of the study participants.

Study participants (n =20)		
<b>Years old</b>	<i>Mean ± SD</i>	46.15 ± 9.31 (31 – 59)
<b>Sex</b>	<i>Male</i>	16 (80%)
	<i>Female</i>	4 (20%)
<b>Height (cm)</b>	<i>Mean ± SD (Range)</i>	176.4 ± 9.8 (159 – 189)
<b>Weight (kg)</b>	<i>Mean ± SD (Range)</i>	87.9 ± 15.79 (60 – 110)
<b>BMI (kg/m<sup>2</sup>)</b>	<i>Mean ± SD (Range)</i>	28.6 ± 6.8 (19 – 42)

*BMI: Body mass index.*

Table (2) Fracture characteristics of the study participants (Study participants n= 20).

<b>Cause of fracture</b>	<i>Fall</i>	7 (35%)
	<i>Motor vehicle accident</i>	10 (50%)
	<i>Sports injury</i>	3 (15%)
<b>Forearm</b>	<i>Right</i>	13 (65%)
	<i>Left</i>	7 (35%)
<b>AO/ASIF Classification</b>	<i>A3</i>	8 (40%)
	<i>B3</i>	12 (60%)
<b>Soft tissue coverage</b>	<i>Closed</i>	13 (65%)
	<i>Open</i>	7 (35%)
<b>Grade of the open fracture (n =7)</b>	<i>I</i>	4 (57%)
	<i>II</i>	2 (29%)
	<i>III</i>	1 (14%)

Table (3) Outcome scores of study participants (n =20).

		Immediately post. op.	2 weeks post. op.	1 month post. op.	2 months post. op.	6 months post. op.	P value
<b>Grace and Eversmann rating system</b>	<i>Excellent</i>	0 (0%)	0 (0%)	0 (0%)	6 (30%)	15 (75%)	<0.001*
	<i>Good</i>	0 (0%)	0 (0%)	13 (65%)	12 (60%)	4 (20%)	
	<i>Acceptable</i>	6 (30%)	13 (65%)	7 (35%)	2 (10%)	1 (5%)	
	<i>Un-accept.</i>	14 (70%)	7 (35%)	0 (0%)	0 (0%)	0 (0%)	
<b>VAS score</b>	<i>Median (IQR)</i>	7 (5 - 8)	4 (3 - 4)	4 (2.75 - 4)	2 (1.75 - 3)	0 (0 - 1.25)	P1: 0.024* P2: 0.001* P3: <0.001* P4: <0.001*
	<i>Range</i>	5 – 8	3 – 5	2 – 4	1 – 3	0 – 2	
<b>DASH Score</b>	<i>Mean ± SD</i>	68.5 ± 6.32	57.4 ± 5.54	49.3 ± 6.31	26.4 ± 5.54	13.15 ± 5	P1: <0.001* P2: <0.001* P3: <0.001* P4: <0.001*
	<i>Range</i>	60 – 80	50 – 66	40 – 60	20 – 36	6 – 20	

Table (4) Outcomes of study participants (n =20).

Study participants (n =20)		
<b>Operation time (min)</b>	<i>Mean ± SD</i>	86.9 ± 16.8 (52 – 127)
<b>Time to union (weeks)</b>	<i>Mean ± SD</i>	16 ± 4.05 (9 – 27)
<b>Complications</b>	<i>Screw back-out</i>	2 (10%)
	<i>Superficial Infection</i>	5 (25%)

## 4. Discussion

Because of the lack of attention in distal ulna fractures' incidence, management, or functional outcomes, their importance can be understated. According to a 2008 evaluation of the literature, there isn't much scientific evidence to back managerial pra-

ctices [9]. When the fracture is too distal close to the neck of ulna the fixations options are few. Plating is the most stable option but we cannot have sufficient number of screws in the distal segment. The adherence of extensor carpi ulnaris tendon to

distal ulna prevent adequate exposure for plating. We used flexile intramedullary nail because it provides good stability whatever short the distal segment by impacting the nail to the head of ulna. K-wires fixation is familiar but lack of stability so it needs long time of immobilization besides pin track infection and loosening with time. In this study, the age of the study participants ranged from 31 to 59 years old with a mean value of  $46.15 \pm 9.31$  years old. Of the study participants, 16 (80%) participants were males, and the rest were females. Bakouri et al. [10] revealed that the studied cases with distal ulnar fractures ranged in age from twenty-two to fifty-eight years old, with a mean age of  $35.9 \pm 9.7$  years. The age range of half the group (50.0%) was between thirty and forty years old. There were eight female studied cases & ten male studied cases. However, this is consistent with the results of Lee et al. [11] retrospective study, which found that the mean age of studied cases with distal radius fractures related to ulnar styloid fractures was  $49.1 \pm 11.6$  years. In this study, regarding the cause of fracture, it was due to fall in 7 (35%) participants, motor vehicle accident in 10 (50%) participants, and sports injury in 3 (15%) participants. Bakouri et al. [10] reported that, several injury mechanisms were documented in their series, with falls from heights accounting for most injuries (fifty percent), while direct trauma & road traffic accidents (RTAs) accounted for 27.8 percent & 22.2 percent of injuries, respectively. In the current study, regarding Grace and Eversmann rating system, there was significant improvement during the follow-up. Patients with excellent outcomes were significantly higher at 6 months postoperative compared to previous assessments. Also, VAS and DASH scores were significantly decreased 2 weeks, 1, 2 and 6 months postoperatively. Regarding the surgical time in this study; ranged from 52 to 127 min with a mean value of  $86.9 \pm 16.8$  mins. Also, the time of union ranged from 9 to 27 weeks with a mean value of  $16 \pm 4.05$  weeks. Gadegone et al. [12] who

sought to evaluate the efficacy of elastic intramedullary nails in treating adult patients with diaphyseal fractures of both forearm bones. Forty-five minutes was the average surgical time, according to their assessment (thirty-five to sixty-five minutes). Fourteen weeks passed between the union (ten to twenty-one weeks). Using Grace & Eversman's criteria, the findings had been rated as exceptional in fifty studied cases, good in eighteen studied cases, & acceptable in eight studied cases. Köse et al. [13] intended to assess the aesthetic & functional results of adult studied cases who had isolated radius diaphyseal fractures treated with intramedullary nailing using newly developed intramedullary radius nails. They stated that when intramedullary nailing was used, the rate of bone union was one hundred percent. The average time to union was 10.2 (eight to twenty) weeks. For both approaches, the time-to-bone union was comparable. Six percent of the instances were classified as good, & sixteen cases (ninety-four percent) as excellent. The current research's mean DASH score was 12.58 (3.3–32.5). Grace-Eversman functional evaluation criteria used by Gao et al. [14] with locked intramedullary nails, are documented as having outstanding outcomes in one hundred percent of cases, or 88.6 percent of cases by Visna et al. [15] ninety two percent by Lee et al. [16] whereas De Pedro et al. [17] reported a one hundred percent union rate in forearm. Amit et al. [18] described the outcome of treating twenty adolescents with unstable diaphyseal fractures of the forearm with closed intramedullary nailing. Every fracture healed in six weeks. Using flexible intramedullary rods, early pilot tests of the fracture-fixation procedure in children had been developed in France [19, 20]. There was no postoperative immobilization utilized. studied cases quickly united, & 2 months after their injuries, they resumed their sports. Every studied case was able to move freely, & there were no issues. The union rates & functional outcome of plating & interlocking nailing were determined to be similar by the



authors in a comparative study [21]. On the other hand, closed interlocking nailing is a difficult process with expensive equipment [22,23]. During locked intramedullary nailing, iatrogenic posterior interosseous nerve damage may be noticed [24]. Dhariwal et al. [25] concluded that, for short oblique fractures of the radius & ulna or midshaft transverse fractures, the stacked nailing technique is a good choice. It permits early mobilization without the need for a splint or brace. This easy & minimally invasive method can produce good outcomes with the right patient selection. Due to the high likelihood of non-union & lower functional outcomes associated with this approach, the use of intramedullary treatment for forearm fractures in the adult population has come under fire [26]. In this study, regarding the complication, 5 (25%) patients had superficial infection, and only 2 (10%) patients had nail back-out. The rest of patients didn't suffer from any complications. Gadegone et al. [12] had 2 cases of painful bursa, 2 cases of delayed union, 2 cases of malunion with dislocation of the distal radioulnar joint, 1 case of delayed infection, 3 cases of superficial infection, 2 cases of injury to the thumb's extensor tendon, & 1 case of incomplete radioulnar synostosis. Henley et al. [27] observed hypertrophy ossification at nail entrance sites when humerus fractures were treated with stacked nailing. We believe that creating a large enough entry point will assist prevent this difficulty, as we did not encounter it in our circumstances. Intramedullary nailing, like any medical treatment, comes with inherent risks and complications. The choice of nail diameter is crucial, as using nails that are too large can lead to iatrogenic fractures, while nails that are too small may result in rotational instability [28].

## 5. Conclusion

*The use of flexible intramedullary nails for fixation of displaced distal ulna fractures in adults revealed good clinical and radiological outcomes with low complication rate.*

## References

- [1] Faierman, E. & Jupiter, J. (1998). The management of acute fractures involving the distal radio-ulnar joint and distal ulna. *Hand Clin.*; 14 (2): 213-229.
- [2] Biyani, A., Simison, A. & Klenerman, L. (1995). Fractures of the distal radius and ulna. *J Hand Surg Br.*; 20 (3): 357-364.
- [3] Richards, T. & Deal, D. (2014). Distal ulna fractures. *J Hand Surg.*; 39 (2): 85-391.
- [4] Geissler, W., Fernandez, D. & Lamey, D. (1996). Distal radioulnar joint injuries associated with fractures of the distal radius. *Clin Orthop Relat Res.*; (327): 135-146.
- [5] Patrick, J. (1946). A study of supination and pronation, with especial reference to the treatment of forearm fractures. *J Bone Joint Surg Am.*; 28 (4): 737-748.
- [6] Matthews, L., Kaufer, H., Garver, D., et al. (1982). The effect on supination-pronation of angular malalignment of fractures of both bones of the forearm. *J Bone Joint Surg Am.*; 64 (1): 14-17.
- [7] Saini, R., Sharma, A., Baisoya, K., et al. (2023). A comparative study between plate osteosynthesis and intramedullary nailing for diaphyseal fracture of radius and ulna in adults. *Cureus.* 15 (4): e37277.
- [8] Beaton, D., Katz, J., Fossel, A., et al. (2001). Measuring the whole or the parts? validity, reliability, and responsiveness of the disabilities of the arm, shoulder and hand outcome measure in different regions of the upper extremity. *J Hand Ther.*; 14: 128-146.
- [9] Logan, A. & Lindau, T. (2008). The management of distal ulnar fractures in adults: a review of the literature and recommendations for treatment. *Strategies in Trauma and Limb Reconstruction*; 3 (2): 49-56.
- [10] Bakouri, M., El-Soufy, M., El-Hewala, T., et al. (2021). Fixation of distal ulna fractures by distal ulnar locked hook plate. *Egypt J Hosp Med.*; 82 (3): 506-513.

- [11] Lee, J-K., Park, I., Baek, E., et al. (2019). Clinical outcomes of conservative treatment for distal radius fractures with or without ulnar styloid fractures. *'Arch Hand Microsurg*; 24 (1): 32-39.
- [12] Gadegone, W., Salphale Y. & Lokhande V. (2012). Screw elastic intramedullary nail for the management of adult forearm fractures. *Indian J Orthop*; 46 (1): 65-70.
- [13] Köse, A., Aydın, A., Ezirmik, N., et al. (2016). Intramedullary nailing of adult isolated diaphyseal radius fractures. *Ulus Travma Acil Cerrahi Derg*; 22 (2): 84-191.
- [14] Gao, H., Luo, C., Zhang, C., et al. (2005). Internal fixation of diaphyseal fractures of the forearm by interlocking intramedullary nail: Short-term results in eighteen patients. *J Orthop Trauma*; 19 (6): 384-391.
- [15] Visná, P., Beitzl, E., Pilný, J., et al. (2008). Interlocking nailing of forearm fractures. *Acta Chir Belg*; 108 (3): 333-338.
- [16] Lee, J. & Healy, J. (2005). Normal sonographic anatomy of the wrist and hand. *Radiographics*; 25 (6): 1577-1590.
- [17] De Pedro, J., Garcia-Navarrete, F., Garcia De Lucas, F., et al. (1992). Internal fixation of ulnar fractures by locking nail. *Clin Orthop Relat Res*; (283): 81-85.
- [18] Amit, Y., Salai, M., Chechik, A., et al. (1985). Closing intramedullary nailing for the treatment of diaphyseal forearm fractures in adolescence: A preliminary report. *J Pediatr Orthop*; 5 (2): 143-146.
- [19] Lascombes, P., Prevot, J., Ligier, J., et al. (1990). Elastic stable intramedullary nailing in forearm shaft fractures in children: 85 cases. *J Pediatr Orthop*; 10 (2): 167-171.
- [20] Cullen, M., Roy, D., Giza, E., et al. (1998). Complications of intramedullary fixation of pediatric forearm fractures. *J Pediatr Orthop*; 18 (1): 14-21.
- [21] Verstreken, L., Delronge, G. & Lamoureux, J. (1988). Shaft forearm fractures in children: intramedullary nailing with immediate motion: A preliminary report. *J Pediatr Orthop*; 8 (4): 450-453.
- [22] Ozkaya, U., Kiliç, A., Ozdoğan, U., et al. (2009). Comparison between locked intramedullary nailing and plate osteosynthesis in the management of adult forearm fractures. *Acta Orthop Traumatol Turc*; 43 (1): 14-20.
- [23] Weckbach, A., Blattert, T. & Weisser, C. (2006). Interlocking nailing of forearm fractures. *Arch Orthop Trauma Surg*; 126 (5): 309-315.
- [24] Tabor Jr, O., Bosse, M., Sims, S., et al. (1995). Iatrogenic posterior interosseous nerve injury: Is transosseous static locked nailing of the radius feasible? *J Orthop Trauma*; 9 (5): 427-429.
- [25] Dhariwal, Q., Inamdar, P., Arora, P., et al. (2017). Stacked flexible nailing for radius ulna fractures: Revival of a lost technique. *J Orthop Case Rep*; 7 (1): 106-108.
- [26] Surgeon, C. (2009). Flexible intramedullary fixation of pediatric forearm fractures- report on twenty-one patients. *Bahrain Medical Bull*; 31 (1): 45-78.
- [27] Henley, M., Chapman J. & Claudi, B. (1992). Closed retrograde Hackethal nail stabilization of humeral shaft fractures. *J Orthop Trauma*; 6 (1): 18-24.
- [28] Fanuele, J. & Blazar P. (2009). Extensor pollicis longus tendon rupture in an adult after intramedullary nailing of a radius fracture: Case report. *J Hand Surg Am*; 34 (4): 627-629.