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Research Paper

Clinical Outcomes of Surgically Treated Rotational Dislocations of the Proximal Interphalangeal Joint: A Case Series

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ABSTRACT

Background: Rotational dislocation of the proximal interphalangeal (PIP) joint is an uncommon but functionally important injury that can be overlooked or treated later, leading to stiffness and disability.

Objectives: This study aimed to evaluate the long-term clinical and functional outcomes of patients who underwent surgical intervention for rotational dislocation of the PIP joint.

Methods: This retrospective case series reviewed the medical records of patients treated for PIP rotational dislocation at a tertiary hand surgery center between 2013 and 2024. Eligible patients were contacted for clinical follow-up. Functional assessment included range of motion, grip and pinch strength, pain evaluation using the visual analog scale (VAS), and patient-reported outcomes using the quick disabilities of the arm, shoulder and hand (QuickDASH) and patient-rated wrist and hand evaluation (PRWE) questionnaires. Descriptive statistics were used for analysis.

Results: Nine patients were included. The mean age was 30.0±9.9 years, and the mean interval from injury to surgery was 11.1±13.6 days. The mean follow-up duration was 9.0±1.5 years. At final follow-up, all patients reported complete pain relief (VAS, 0.0±0.0). The mean QuickDASH score was 1.8±3.7, and the mean PRWE score was 2.7±3.2. Grip strength of the operated hand was comparable to the contralateral side, with no significant difference between sides. Overall patient satisfaction and functional recovery were favorable.

Conclusion: Surgical treatment of PIP rotational dislocation was associated with excellent long-term pain relief and favorable functional outcomes. Early surgical intervention and restoration of joint congruity may help prevent the stiffness and persistent disability associated with this rare injury.

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Introduction

The proximal interphalangeal (PIP) joint is the most commonly injured joint in the hand and plays a crucial role in finger motion and grip strength. Because of its exposed anatomy and dependence on a fine balance between bony congruity and soft-tissue stabilizers, the PIP joint is vulnerable to angular, axial, and rotational forces, and even relatively minor trauma may result in significant functional impairment [1, 2].

PIP joint injuries are frequently underestimated at the initial presentation and may be mistaken for a simple sprain or "jammed finger," leading to delayed diagnosis and inappropriate treatment. This is clinically important because the PIP joint is highly prone to stiffness, and prolonged immobilization or persistent incongruity can cause permanent loss of motion, deformity, pain, and long-term disability [1, 3].

Fracture dislocations and dislocations of the PIP joint are generally classified according to the direction of displacement and stability of the reduction. When closed reduction is not achievable or concentric reduction cannot be maintained, operative treatment may be required to restore joint alignment and permit early motion protection [2, 3]. Despite these general principles, rotational dislocation of the PIP joint remains a rare and poorly defined injury, and evidence of its clinical course and surgical outcome is limited.

Therefore, this study aimed to evaluate the clinical outcomes and complications of surgically treated rotational dislocations of the PIP joint following trauma.

Methods

Study design and participants

This study was a retrospective case series of patients with rotational dislocation of the PIP joint who underwent surgical treatment at Shafayahyaeian Hospital, affiliated with Iran University of Medical Sciences, between 2013 and 2024. Medical records were reviewed retrospectively to identify eligible patients. All patients with complete medical records who met the inclusion criteria were enrolled using a census-based sampling approach. The inclusion criteria included diagnosis of rotational dislocation of the PIP joint, surgical intervention at the study center, availability of complete medical records, and willingness to participate in follow-up evaluation. The exclusion criteria were incomplete medical records, refusal to participate in the follow-up assessment, inability to contact the patient, and failure to attend the follow-up visit. Eligible patients were subsequently invited for clinical and radiographic follow-up assessments. Informed consent was obtained from all participants before their inclusion in the study.

Data collection

Data were collected in two stages. In the first stage, the medical records of all eligible patients were reviewed retrospectively, and relevant demographic, clinical, and treatment-related variables were extracted using a predefined checklist. These variables included age, sex, occupation, cause and mechanism of injury, fracture type (open or closed), time interval from injury to surgery, surgical technique, duration of postoperative immobilization, and early postoperative complications such as infection or sensory deficit. In the second stage, patients were contacted and invited for follow-up clinical and radiographic evaluations.

Clinical evaluation and questionnaires

The patients were contacted and invited to a clinical follow-up visit. During the examination, range of motion (ROM) of the PIP joint, including flexion and extension, was assessed using a standard finger goniometer. Hand strength was evaluated using a calibrated hand dynamometer, and grip and pinch strengths were measured separately and recorded for the operated hand. In addition, neurological and musculoskeletal examinations were performed to identify residual deficits. All clinical assessments were conducted by a hand surgeon who was not involved in the index surgery or preparation of the study report to minimize observer bias. Patients were also asked to complete the Persian-validated versions of the quick disabilities of the arm, shoulder and hand (QuickDASH) [4] and patient-rated wrist and hand evaluation (PRWE) [5] questionnaires to assess functional outcomes and disability.

Statistical analysis

The collected data were entered into SPSS software, version 17. Descriptive statistics (frequency, percentage, Mean±SD) were used to summarize the data. The Kolmogorov-Smirnov test was used to assess the normality of the data distribution. Independent and paired t-tests were employed for comparing means. Statistical significance was set at a $P<0.05$.

Results

During the study period, 13 patients with rotational dislocation of the PIP joint were identified. Two patients were excluded due to incomplete medical records, one declined participation in the follow-up evaluation, and one could not be contacted because of a change in address and loss to follow-up. Ultimately, nine patients who underwent surgical treatment and completed follow-up assessments were included in the final analysis.

Nine patients who underwent surgical treatment for rotational dislocation of the PIP joint were included in this study. The mean age of the participants was 30.0±9.9 years, ranging from 17 to 42 years. The study population consisted of 5 males (55.6%) and 4 females (44.4%). Most patients were right-handed (7 patients, 77.8%). In terms of injury laterality, the left hand was involved in six cases (66.7%) and the right hand in three cases (33.3%).

Regarding the injured finger, the index and middle fingers were the most commonly affected, each involved in three patients (33.3%). The ring finger was injured in two patients (22.2%) and the little finger in one patient (11.1%).

Trans-articular pin fixation was used in five patients (55.6%), whereas four patients (44.4%) were treated without trans-articular pinning. Clinical and functional outcomes: The mean duration of follow-up was 9.0±1.5 years (range: 6–11 years).

Pain over the PIP joint was present in five patients (55.6%) at presentation. At the final follow-up, all patients reported complete pain relief, with a visual analog scale (VAS) score of 0.0±0.0.

Functional scores and strength: The functional outcomes were assessed using the QuickDASH and PRWE questionnaires. The mean QuickDASH score was 1.8±3.7, and the mean PRWE score was 2.7±3.2. Regarding strength measurements, the mean pinch strength of the operated hand was 32.2±10.0 lb, while the mean grip strength of the operated hand was 66.1±22.9 lb. The detailed descriptive statistics of the study population are presented in Table 1.

Strength measurements were recorded in the operated hand at the final follow-up visit.

Grip and pinch strengths were compared between the operated and contralateral hands at the final follow-up. The mean grip strength of the operated hand was 65.56±23.11 lb compared with 66.67±23.32 lb in the contralateral hand, with no statistically significant difference (P=0.447). The mean pinch strength was 32.22±10.03 lb in both the operated and contralateral hands. Because identical pinch strength values were recorded for all patients, statistical comparisons were not applicable (Table 2).

Discussion

Rotational dislocation of the PIP joint is a rare and complex injury that poses significant diagnostic and therapeutic challenges. This study evaluated the clinical and radiological outcomes of patients with PIP rotational dislocation treated surgically. Our findings indicate that surgical management yields excellent functional recovery, with a mean QuickDASH score of 1.77, PRWE score of 2.75, and VAS score of 0. These results suggest that patients achieved nearly complete functional restoration and were entirely pain-free at a mean follow-up of 9 years. When comparing our functional outcomes with existing literature, our results appear superior. In the present study, the mean QuickDASH score (1.77) was significantly lower—indicating better function—than the median QuickDASH score of 4.5 reported by Demir et al. in their study of 34 patients treated with various surgical methods for PIP injuries [6]. Similarly, Kastenberger et al. reported a mean DASH score of 11.6 in patients treated with a dynamic external fixator for pilonoidal fracture dislocations, which is higher than the scores observed in our cohort [7]. Even compared to the specific case of volar rotatory subluxation described by Assiotis et al., where the patient underwent anatomical repair, the reported QuickDASH score was 9.1 [8]. A crucial comparison was made using the PRWE score. Nordback et al., in their long-term follow-up study (mean 16 years) of extension block pinning for dorsal fracture-dislocations, reported a mean PRWE score of 6 and a mean pain score of 1 [9]. Notably, our study, despite a much shorter follow-up period of 9 years, demonstrated even lower scores (PRWE 2.75 and VAS 0). This suggests that the functional outcomes and pain relief achieved with surgical treatment of rotational dislocations in our series are comparable, if not superior, to the established long-term results of extension block pinning for fracture dislocations.

Table 1. Demographic characteristics and postoperative outcomes of patients with PIP rotational dislocation

Variables		Mean±SD/No. (%)
Age (y)		30.00±9.92
Gender	Male	5(55.6)
	Female	4(44.4)
Hand dominance	Right	7(77.8)
	Left	2(22.2)
Injured side	Right	3(33.3)
	Left	6(66.7)
Injured finger	Index	3(33.3)
	Middle	3(33.3)
	Ring	2(22.2)
	Little	1(11.1)
Trans-articular pin	Yes	5(55.6)
	No	4(44.4)
Collateral ligament injury	Yes	3(33.3)
	No	6(66.7)
Time trauma to surgery (days))		11.11±13.57
Follow-up duration (y)		9.00±1.50
Vas		0.00±0.00
QuickDASH score		1.77±3.73
PRWE score		2.75±3.17
Pinch strength (operated hand)		32.22±10.03
Grip strength (operated hand)		66.11±22.88

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PRWE: Patient-rated wrist and hand evaluation; QuickDASH:Quick disabilities of the arm, shoulder and hand.

Table 2. Comparison of strength measurements between the operated and contralateral hands

Variables	Mean±SD		P
	Operated Hand	Contralateral Hand	
Grip strength (lb)	65.56±23.11	66.67±23.32	0.447
Pinch strength (lb)	32.22±10.03	32.22±10.03	N/A

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In addition to patient-reported outcome measures, objective strength assessment demonstrated satisfactory recovery of hand function. Comparison of the operated and contralateral hands showed no statistically significant difference in grip strength (65.56±23.11 lb vs 66.67±23.32 lb, P=0.447). These findings suggest that surgical treatment of rotational PIP joint dislocations can restore hand strength to a level comparable to the unaffected side. Although pinch strength values were identical between the two hands in our dataset, precluding meaningful statistical comparisons, the overall strength measurements support the favorable functional outcomes observed in our cohort.

Pain control is another critical measure of success in hand surgery. In our cohort, all patients reported a VAS score of 0, indicating complete absence of pain. This is an improvement compared to the findings of Demir et al., who reported a median VAS of 1 [6], Kastenberger et al., who reported a mean VAS of 0.7 [7], and Nordback et al., whose long-term patients reported a mean numeric rating scale for pain of 1 [9]. The complete pain resolution in our study highlights the efficacy of surgical intervention in stabilizing the joint and addressing the interposed soft tissues that typically cause pain in chronic or unreduced dislocations. The timing of surgery plays a crucial role in the prognosis of PIP injuries. Assiotis et al. emphasized that volar rotatory subluxations are easily missed in the acute setting and that delayed diagnosis leads to joint stiffness and significant adhesions, complicating surgical correction [8]. In our study, the mean time from trauma to surgery was 11.1 days. This interval is shorter than the mean 27.5 days reported by Demir et al., who hypothesized that relatively late surgery might have contributed to a reduced range of motion (ROM) in their study population [6]. It is plausible that the relatively early intervention in our patients (mean, 11 days) prevented the development of extensive soft tissue adhesions and joint contractures, thereby contributing to the excellent functional scores and complete pain relief observed at follow-up [1]. In rotational dislocations of the PIP joint, soft tissue interposition—including the volar plate, collateral ligaments, or lateral band—may block closed reduction and prevent restoration of normal joint congruity [1]. Therefore, our findings support the role of surgical exploration and reduction in cases in which closed reduction is unsuccessful, with the aim of restoring anatomical alignment, addressing soft tissue instability, and facilitating early mobilization [1]. Despite the severity of the initial injury, this approach was associated with a high degree of patient satisfaction and favorable functional outcomes in our series. The main limitation of this study is the small sample size, which is inherent to the rarity of PIP rotational dislocations. In addition, the retrospective design and the absence of a control group limit the strength of our conclusions. Long-term follow-up is required to determine whether these favorable outcomes are maintained over time.

Conclusion

Surgical treatment of rotational dislocation of the PIP joint results in excellent functional outcomes and complete pain relief. The QuickDASH and PRWE scores in our series were superior to those reported in previous studies, including long-term benchmarks. We believe that timely surgical intervention to correct the rotatory deformity and address soft tissue interposition is key to preventing long-term stiffness and disability.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

All authors contributed equally to the conception and design of the study, data collection and analysis, interpretation of the results, and drafting of the manuscript. Each author approved the final version of the manuscript for submission.

Conflict of interest

The authors declared no conflict of interest.

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