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Open Reduction and Internal Fixation in Old Unreduced Perilunate Injury

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Abstract

Background: Perilunate fracture dislocation (PLFD) and perilunate dislocation (PLD) are wrist injuries, which are commonly missed. Meanwhile, the delay in the treatment of these injuries is leading to a more complicated situation. One of the acceptable treatments for old cases is open reduction and internal fixation.
Objectives: The purpose of this study was to determine the mid-term results of open reduction and internal fixation (ORIF) treatment for old unreduced perilunate injury that had been unreduced and untreated for a minimum of 6 weeks after injury.
Methods: Between 2011 and 2016, 12 patients with old PLFD and PLD, untreated for a minimum of 6 weeks after injury, were treated by ORIF. A retrospective review was performed with a minimum 12 months of follow-up. During the final follow up visit, the patients were evaluated for pain, range of motion, and grip strength. The MAYO wrist score was used for functional assessment. The patients were assessed using a validated Persian questionnaire Quick DASH score. Radiological outcomes were classified using the Herzberg classification.
Results: All of patients were males with a mean age of 25 years (18 to 32 years). Perilunate Fracture Dislocation injury was found in 7 cases and PLD in 5 cases. Mean time from injury to surgery was 14.3 weeks (6 to 26 weeks) and mean follow-up after the surgery was 33.5 months (12 to 60 months). The mean MAYO wrist score was 77.5 (55 to 85). According to the Mayo wrist score, 42% of patients (5 patients) had good, 50% (6 patients) had satisfactory, and 8% (1 patient) had poor results. The active range of flexion-extension averaged 107.5° (range 80 to 155°), and grip strength averaged 84% (range 53% to 100%) of the intact extremity. According to the Herzberg classification, 5 (42%) patients were radiologically located in group A and 7 (58%) in group B. Patients' satisfaction rate based on the Persian Quick DASH score had an average of 12.5.
Conclusions: Open reduction and internal fixation is an appropriate treatment with acceptable functional and clinical results in old unreduced perilunate injuries up to 6 months after trauma.

Keywords: Perilunate Fracture Dislocation, Perilunate Dislocation, Open Reduction, Internal Fixation

1. Background

Perilunate fracture dislocation (PLFD) and perilunate dislocation (PLD) are among rare wrist injuries, which occur after high-energy trauma (1). Even though the diagnosis of these injuries could be easily possible by appropriate radiographs and attention to radiological criteria, about 25% of these patients are diagnosed late (1). It is assumed that this rate is higher in less developed countries and eventually the patients refer for treatment with pain, limitation of motion and reduction in power of the wrist and symptoms of pressure on the median nerve (2). The treatment of the wrist in acute cases of these injuries is open reduction and ligament repair, which could result good clinical and functional outcomes (3-6). There are a few studies about methods and results for the treatment of old cases (2, 7). However, delay in treatment causes affection on the prognosis and the results of the treatment (7). Due to delay in referral, adhesion and contracture of soft tissue leads to a more difficult performance of similar surgery of acute cases and it has been assumed that the possibility of complications, such as avascular necrosis (AVN), will be higher due to extensive soft tissue release for performing the reduction (8).

Among the available treatments, open reduction is one of the acceptable treatments for old cases that could be performed up to 35 weeks after the injury (2, 7), and based on several studies, its clinical and functional results is better than salvage treatments, such as proximal row carpectomy and arthrodesis (mostly done for delayed referral of patients with extensive injury of the cartilage surface) (2, 9).

2. Objectives

The purpose of this study was to determine the mid-term results of Open Reduction and Internal Fixation (ORIF) treatment for old unreduced perilunate injuries that had been untreated for a minimum of 6 weeks after injury and referred for the first time.

3. Methods

Between 2011 and 2016, 14 patients with old unreduced perilunate injury had been left untreated for a minimum of 6 weeks after the initial injury was treated at the center under study (Shafa Orthopedic hospital, Tehran, Iran). After the ethic committee's approval and during a retrospective study, these patients were invited for further evaluation. Twelve patients attended for final assessment. The study only included patients that were left unreduced and untreated for a minimum of 6 weeks after the injury and treated with open reduction and internal fixation surgery.

The research excluded patients, who had received treatment before 6 weeks from injury or treated with other surgical procedures, including closed pining, and patients, who were lost to the final follow-up visit, as well as those, who had incomplete documents.

All surgeries were performed by orthopedic hand surgeons under supervision of the senior author. Patients' final evaluation was performed by a hand surgeon, who had not participated in any of the surgeries.

3.1. Patients' Evaluation

All patients were evaluated in terms of clinical and functional symptoms. The clinical results were evaluated by the MAYO wrist score, which is based on pain, range of motion, and grip strength and functional status (returning to work and activity). Pain was also subjectively graded as lack of pain, mild, moderate, and tolerable, severe, and intolerable pain. A dynamometer (hydraulic hand dynamometer, SH5001, SAEHAN Corporation. Korea) was used to investigate the grip strength and the rate of wrist power was compared with the opposite wrist and expressed as a percentage of the opposite side. Range of motion of the wrist in flexion and extension was determined as a measurement by a standard goniometer and represented as a percentage of the opposite side, and eventually patients' performance in terms of returning to work and activity was evaluated. Patients' satisfaction rate of surgical operation and the result of treatment was measured with the validated Persian Quick DASH (disability of arms, shoulders and hands) score questionnaire (10). At the final visit, anteroposterior and lateral radiography of the wrist was done and patients' radiography was checked for malreduction, nonunion, AVN, and osteoarthritis, and classified using the Herzberg classification (1).

Data were assessed with the SPSS statistical software version 17.0 (SPSS Inc., Chicago, USA).

3.2. Surgical Techniques

This study performed open reduction through the combined dorsal and volar approach in 11 patients and only 1 patient with PLD injury received the dorsal approach. The surgeon first approached the wrist through a straight dorsal incision centered on Lister's tubercle and opened the extensor retinaculum between the third and fourth compartments. Neurectomy of the posterior interosseous nerve was performed in all cases. Wrist arthrotomy was performed by incision in the dorsal wrist capsule and exposed the entire carpus. The researchers usually made no attempt to reduce the dislocation until performing the volar release of the adhesion through the extended carpal tunnel approach. The researchers retracted the flexor tendons and the median nerve radially to expose the volar capsule and the volar displaced lunate. An incision was made in the volar capsule (the surgeon did their best to save the short radiolunate ligament in order to preserve the lunate blood supply). After adhesion release, the surgeon tried to perform the reduction. The lunate was reduced under direct vision by manually pushing it back in between the capitates and radius, while applying longitudinal traction. If the reduction is difficult, it may be facilitated by passing a small retractor or Freer in the joint from dorsal to volar to support the lunate and elevate the capitate, with great care to avoid injury to the articular cartilage . In PLFD cases with scaphoid fracture, the surgeon reduced associated scaphoid fractures and internally fixed them using Herbert screws in 2 patients and K-wires in 5. The carpal joint was then inspected from the dorsum and lunate aligned and pinned first to the distal radius to neutralize the radiolunate alignment. When the researchers achieved restoration of carpal alignment, they pinned the joints with a 1-mm K-wire, which was passed from the scaphoid to both the capitate and lunate and from triquetrum to lunate.

Ligament repair was done if possible and after closing the joint capsule and skin, the wrist was immobilized for 2 weeks in Sugar tong splint and after suture removal for 6 weeks in short arm cast and then the pins were removed and the wrist motion began (Figure 1).

4. Results

All of patients were males with a mean age of 25 years (18 to 32 years). The involvement of the dominant hand was

Figure 1. 18-year-old male with perilunate fracture dislocation that was treated by mistake with cast application (A and B). Preoperative anteroposterior and lateral radiograph 6 weeks post injury (C and D). Postoperative anteroposterior and lateral radiograph showing fixation of the scaphoid fracture with screw and stabilization of the carpus bone with k-wire (E and F).

present in 7 cases and non-dominant hand in 5 cases. Mechanism of the incident was fall from height in 5 patients, car accidents in 4, and sports injuries in 3 cases. The PLFD injury was present in 7 cases and PLD in 5 cases. Three of the cases had symptoms of median nerve compression at the referral time. Mean delay in treatment was 14.3 weeks (6 to 26 weeks) after the injury. Mean follow-up after the surgery was 33.5 months (12 to 60 months).

During the final follow up visit, 7 (58%) out of 12 patients were pain-free. Four of them had mild and occasional pain and one had moderate and tolerable pain. The active range of flexion-extension averaged 107.5 degrees (range 80 to 155°), with wrist extension averaging 46° and flexion averaging 61°. Grip strength averaged 84% (range 53% to 100%) of the opposite side. On the other hand, 2 of the patients changed their jobs and activity and 10 cases returned to the previous activity. The mean MAYO wrist score in the patients was 77.5 (55 - 85); 5 patients (42%) had good, 6 (50%)

had satisfactory, and 1 (8%) had poor results. In the radiographic evaluation of the patients, 5 patients were in the group A of Herzberg classification and 7 in group B. The symptoms of mild dorsal intercalated segmental instability (DISI) was observed in 1 patient, nonunion scaphoid in 1 patient, scapholunate dissociation (SLD) in 1 case, and osteoarthritis (OA) symptoms in radio-scaphoid joints in 4 patients. The patient with scaphoid nonunion refused to have another surgery to treat the nonunion. The Quick DASH score for the Persian version of the questionnaire that was completed by patients, which on average was 12.5 (2.3 to 29.5), indicated patients' satisfaction of surgical operation (Table 1).

5. Discussion

Perilunate injuries treatment in acute cases is ORIF, which could result good and acceptable results (3-6), yet the treatment process in patients who referred with more delay (more than 6 weeks) was more complex. There was no general agreement about the treatment method. There are treatments options for these injuries, such as ORIF, lunate excision, proximal row carpectomy, and wrist arthrodesis, with the last three being salvage treatments (1, 7, 9). In most reported studies, clinical and functional results of ORIF treatment have been better than salvage treatment (2, 9-14). Even though there is no general agreement on the maximum delay interval that ORIF could be done, Green and O'Brien believed that ORIF should be done for all old cases (2). Inoue and Shionoya proposed that ORIF is suitable for patients, who refer up to 2 months after injury (9). Dhillon reported good results of ORIF treatment in old cases that had undergone surgery 5 months after injury (11).

In the current study, ORIF treatment was done for old injuries that had referred up to 26 weeks after injury.

In Herzberg's retrospective study that was done on 166 patients with PLFD, PLD injury who were under different treatments. The authors preferred treatment was ORIF and two effective factors on the treatment results and complications were a delay of more than 6 weeks in order to treatment and open injury. However, poor radiologic results did not necessarily mean bad clinical results in these patients (1). Siegert et al. reported good and acceptable clinical results in 6 patients with old injury, who were treated by ORIF treatment. Meanwhile, the results of proximal carpectomy treatment were good and have been regarded at a lower level than ORIF treatment, and lunate excision is generally not recommended (7). In one study on acute cases of these injuries, Inoue and Kuwahata reported good results in 67% of patients, who were treated during one month after the incident by ORIF treatment (6). In another study by the same author that was done on the 28 cases with old injuries, 6 cases were treated by ORIF. Three patients, who were treated for two months by ORIF, had good clinical and radiological results yet in 3 patients, who were treated by ORIF after 2 months from the accident time, a fair result in 1 of them and poor in 2 were seen. In this study, the results of salvage study were good in other patients (9). Komurcu et al. reported a study, which was done on 12 patients (6 acute cases and 6 chronic cases) with a 45-month follow-up period, in which the average clinical criteria of Green and O'Brien was 89.2 and 72.5 in the acute and old group, respectively (12).

Mussoud studied 19 patients with old injuries with an average 29-week period of delay, who were treated by ORIF surgery, and good to excellent results were reported in 58% of the patients and the average wrist score was 56 (13).

Garg et al. performed a two-step treatment (using external fixator to distract the tissues as a first step) for 16 patients with old injury and in the 4.2-year follow-up, good and excellent results were seen in 14 of them. Mean Mayo score was 78 (8). Kailu also in a 90-month follow-up on 6 patients mentioned good results for 4 patients (14).

In this retrospective study that was done on 12 patients with a 33.5-month follow-up and with an average delay time 14.3 weeks, good and satisfactory results were achieved in 92% of patients (11 case). The average MAYO wrist score was 77.5 that showed good and acceptable results for ORIF treatment and is comparable with previous studies. Abnormal radiological findings were seen in 7 patients, which were not associated with significant dysfunction in these patients in the mid-term follow up.

One major limitation of this study was the lack of a comparison group (such as patients undergoing salvage procedure) to be incorporated in the analysis. Moreover, this study offered medium-term follow-up. A small number of cases was another limitation of this study.

In conclusion, despite late presentation, open reduction and internal fixation in old unreduced perilunate injuries (PLD, PLFD) that are done up to 6 months after injury could result in good and satisfactory result.

Table 1. Demographic Data and Clinical Result of Open Reduction and Internal Fixation in Old Unreduced Perilunate Injury

No.	Age at Surgery, y	Follow-up, m	Delay, w	Pathology	MAYO Score	DASH Score	Radiologic Herzberg Score
1	18	12	6	PLFD	85	4.5	B
2	25	18	7	PLD	75	13.6	A
3	26	12	26	PLD	70	29.5	B
4	24	26	13	PLFD	80	20.5	B
5	28	50	11	PLFD	85	4.5	A
6	21	35	17	PLFD	80	4.5	A
7	26	35	9	PLD	80	2.3	A
8	32	20	21	PLFD	55	22.5	B
9	25	60	26	PLD	75	13.6	B
10	26	59	6	PLD	70	20.5	B
11	32	43	21	PLFD	80	6.8	B
12	21	32	9	PLFD	85	6.8	A

Abbreviations: PLD, Perilunate Dislocation; PLFD, Perilunate Fracture Dislocation.

Footnote

Authors' Contribution: Study design, Davod Jafari and Hooman Shariatzadeh, data analyzing, Ali Asghar Kousari and Alireza Yousof Gomrokchi; drafting and critical revision, Davod Jafari, Hooman Shariatzadeh, Ali Asghar Kousari and Alireza Yousof Gomrokchi; study supervision, Davod Jafari.

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