

Original Article

Acute and delayed trans-radial perilunate dislocations: open reduction and internal fixation

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Abstract: Objective: To assess hand function after open reduction of acute and delayed perilunate dislocations. Methods: Seven patients (5 men) with perilunate dislocations were treated with open reduction and internal fixation. The injuries included 2 dorsal trans-radial perilunate dislocations, 4 trans-radial styloid perilunate dislocations, and one combined dorsal and styloid trans-radial dislocations. Open reduction, internal fixation with K wires or cannulated screws, ligament repair, and external fixation using plaster were employed. The average follow-up period was 18 months (range, 10-26). The patients were evaluated according to a Mayo wrist score. Results: We obtained 2 excellent results, 3 good, and 2 fair, according to the Mayo wrist score. The mean active range of flexion-extension was 109.4°. The mean grip strength of the injured wrist was 84.2%, compared with the contralateral side. Misdiagnosis existed in 3 of 7 patients (42.9%). The early treatment group included 2 excellent results and 2 good, while 1 good result and 2 fair were obtained in delay treatment group. Four patients in early treatment group were free of pain, while two patients reported moderate pain and one developed aseptic necrosis of the lunate in delay treatment group. None of the patients experienced nonunion or post-traumatic arthritis. Conclusions: Open reduction and internal fixation can be used to achieve good results and prognosis in cases with both acute and delayed perilunate dislocations.

Keywords: Perilunate dislocations, early treatment, delayed treatment, open reduction, internal fixation

Introduction

Perilunate dislocations (PLDs) are relatively uncommon in all carpal injuries, constituting about 10% of all carpal injuries [1, 2]. PLDs usually caused by high-energy trauma, such as by falls, sports, or motor vehicle accidents [3]. The management proposed for PLDs has varied from closed reduction to open reduction with or without internal fixation [4]. Early treatment with open reduction with internal fixation is recommended to be a reliable treatment in order to obtain satisfactory clinical outcomes [2, 3, 5-7].

Late diagnosis in about 25% of the cases of PLDs can be classified into three phases [3]. The acute phase means appropriate diagnosis is made within the first week after injury, the delayed phase is defined as the period between the 7th and 45th day, and the interval between initial injury and the treatment is more than 45 days in the chronic phase [3]. The time limit of

open reduction and internal fixation in the late treatment of perilunate dislocations are controversial [7-9]. Komurcu et al. compared acute treatment of 6 patients of PLDs with delayed treatment (average of 26 days, range, 10-40 days) of 6 patients. Although better hand function was found in the early treatment group than that in the delayed treatment group, the results in the delayed group were still excellent in 1, good in 1, and fair in 4. Inoue et al. recommended two months to be the time limit for open reduction [9].

The aim of this study was to assess hand function after open reduction and internal fixation of acute and delayed perilunate dislocations.

Patients and methods

Between 2004 and 2008, 7 patients (5 men) with perilunate dislocations were treated with open reduction and internal fixation in our hospital. All procedures were approved by the hos-

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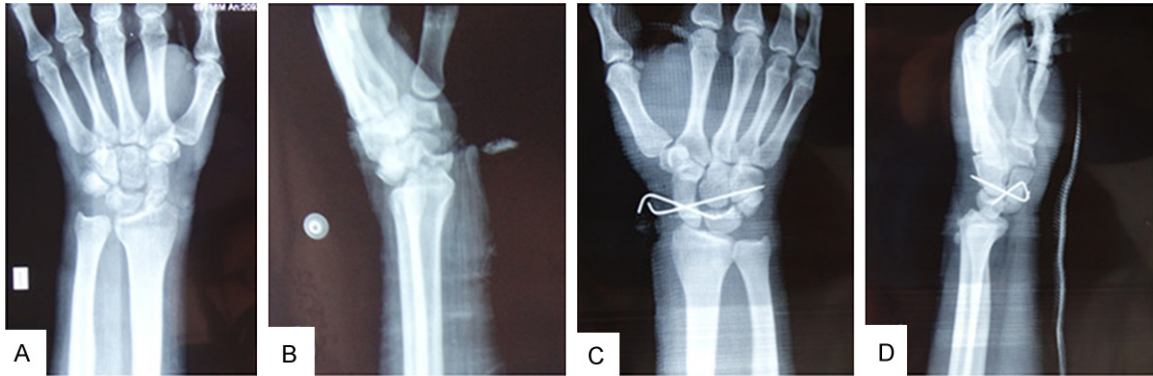


Figure 1. Representative of dorsal trans-radial perilunate dislocations. Preoperative posteroanterior (PA) (A) and lateral (B) views; postoperative PA (C) and lateral (D) views. The dorsal radial fracture was removed due to its small size.

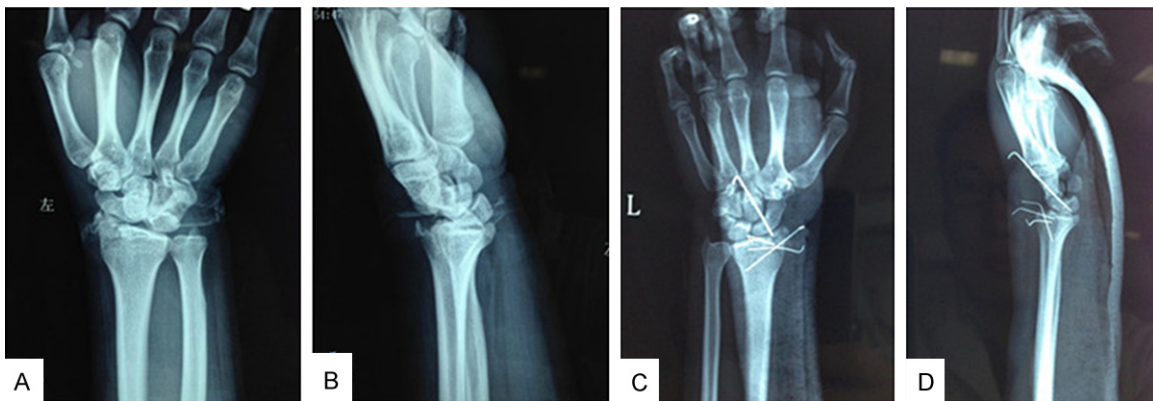


Figure 2. Representative of trans-radial styloid perilunate dislocations. Preoperative posteroanterior (PA) (A) and lateral (B) views; postoperative PA (C) and lateral (D) views. Open reduction and internal fixation with K wires were used.

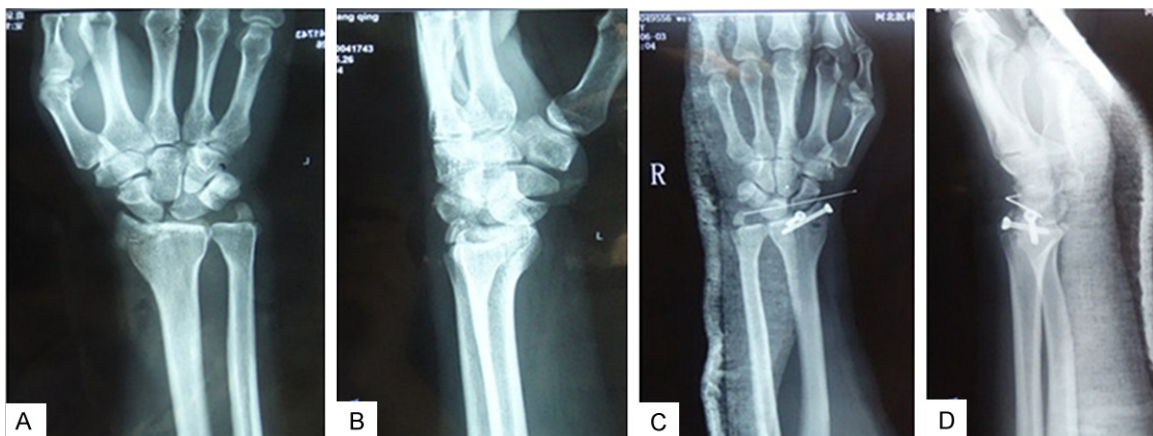


Figure 3. Representative of combined dorsal and styloid trans-radial dislocations. Preoperative posteroanterior (PA) (A) and lateral (B) views; postoperative PA (C) and lateral (D) views. The patient was treated with open reduction and internal fixation with K wires and cannulated screws.

pital ethics committee, and informed consents were obtained from all patients. The average

age was 33 (20-45) years. Standard posteroanterior and lateral views of the wrist were used

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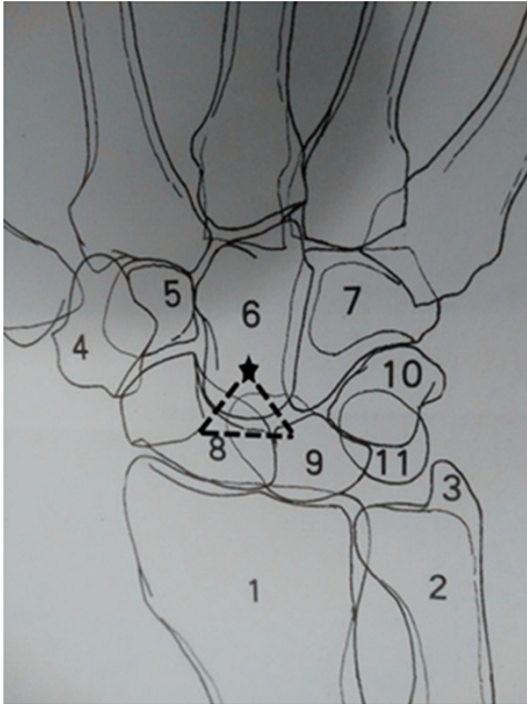


Figure 4. A diagram of ligamentous repair using transosseous suture techniques after screw fixation of the scaphoid.

for preoperative and postoperative radiological evaluation. The injuries included two dorsal trans-radial perilunate dislocations (dorsal perilunate dislocation with distal radius fracture) (**Figure 1**), four trans-radial styloid perilunate dislocations (**Figure 2**), and one combined dorsal and styloid trans-radial dislocations (**Figure 3**). All patients presented symptoms such as swelling, pain and malformation of the wrist joint; the wrist motion was significantly limited with moderate or severe wrist pain. Open reduction was performed through the dorsal approach in all cases. After incision and exposure of lunate bone and carpal bone around the dislocation, longitudinal manual distraction to the hand was used based on leverage reduction. During leverage reduction, the lunate bone should be carefully protected. Smaller radius fractures should be removed directly; larger radius fractures or fractures affecting the stability of wrist joint should be stabilized using K wires or cannulated screws. Lunotriquetral interosseous ligament was repaired as shown in **Figure 4**. Dorsal radiocarpal ligament and dorsal articular capsule were also need to be repaired in trans-radial dorsal perilunate dislocations; while radioscapulu-

nate ligament should be paid more attention to in trans-radial styloid perilunate dislocations.

After completing the reduction, internal fixation and ligamentous repair, the wrist was fixed with a plaster. The plaster was removed one month after the surgery, and a range of postoperative wrist exercises were started from then on. The internal fixation was removed 4-6 weeks after the surgery when fracture recovery was indicated by plain radiographs. A series of radiographs were taken, and grip strength and range of motion were tested every 2 months during the follow-up examination.

Results

The misdiagnosis at the time of the initial evaluation was existed in 3 patients of the 7 patients (misdiagnose rate of 42.9%). The average follow-up period was 18 months (range, 10-26). During follow-up, the patients were evaluated according to a Mayo wrist score after evaluation for pain, functional status, range of motion, and grip strength [7] (**Table 1**). The numerical score is classified into five categories: 100-90, excellent; 90-80, good; 80-65, fair; and <65, poor.

We obtained 2 excellent results, 3 good, and 2 fair; according to the Mayo wrist score (**Table 2**). The mean active range of flexion-extension was 109.4°. The mean grip strength of the injured wrist was 84.2%, compared with the contralateral side. Though the number of patients in early treatment group (4 cases) and that in delay treatment (3 cases) was too small to reach a statistical significance, the early treatment group included 2 excellent results and 2 good, while 1 good result and 2 fair were obtained in delay treatment group (**Table 2**). Four patients in early treatment group were free of pain, while two patients reported moderate pain and one developed aseptic necrosis of the lunate in delay treatment group. We did not experience any nonunion in our surgically treated population and none of the patients developed post-traumatic arthritis.

Discussion

Carpal fracture-dislocations are rare injuries and their classification, diagnosis and treatment are rather difficult. PLDs are relatively uncommon in all carpal injuries. Delay of treat-

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Table 1. The mayo wrist score

Parameter	Score
Pain (25 points)	25 No pain
	20 Mild occasional
	15 Moderate, tolerable
	0 Severe to intolerable
Functional status (25 points)	25 Returned to regular employment
	20 Restricted employment
	15 Able to work,unemployed
	0 Unable to work because of pain
Range of motion (25 points)	Percentage of normal
	25 100%
	15 75-100%
	10 50-75%
	5 25-50%
	0 0-25%
Grip strength (25 points)	Percentage of normal
	25 100%
	15 75-100%
	10 50-75%
	5 25-50%
	0 0-25%

The numeric score obtained is categorized as follows: 100-90, excellent; 89-80, good; 79-65, fair; <65 poor.

ment causing by misdiagnosis has adverse effects on the prognosis of perilunate dislocations [10]. Treatment options for delayed and chronic cases included closed reduction, open reduction, or salvage procedures like proximal row corpectomy and wrist arthrodesis. Considering the relative higher nonunion rate in the cases treated by closed reduction, it is widely accepted that closed reduction not recommended for the treatment of PLDs. It has been reported by Russell [11] that only 5 out of 11 cases who treated by closed reduction obtained good prognosis. Good results were reported by Woodward et al. in only 12 of 27 cases treated with closed reduction. In our surgically treated patients, all patients did not suffered from nonunion during follow-up.

Herzberg et al. reported that 25% of PLDs were misdiagnosed firstly which might lead to significantly worse clinical outcomes. Through comparing 6 patients with perilunate fracture dislocations (PLFD) treated acutely to 6 patients with delay treatment (average interval between injury and surgery, 26 days), Mahmut et al. [12] found that early treatment group obtains be-

tter wrist motion and grip strength, and clinical scores. During the follow-up, although the prognosis in delayed group was not as good as that in early treatment group, the results in delayed group were still excellent in 1 case, good in 1, and fair in 4. Thus, the author suggested that open reduction and internal fixation is still reasonable for PLD or PLFD injuries presenting in a moderately delayed timeframe. In our study, open reduction, internal fixation with K wires or cannulated screws, ligament repair, and external fixation using plaster were employed to treat acute and delayed trans-radial perilunate dislocations. Both early treated group and delay treated group achieved good results. Two excellent results and 2 good were obtained in the early treated group, and 1 good and 2 fair were in the delay treated group. There was no incapacitating pain in our cases. The mean active range of flexion-extension was 109.4°. The mean grip strength of the injured wrist was 84.2% of the contralateral side, which is similar to findings reported by others [9, 12, 13].

The restoration of intercarpal stability is crucial in the treatment of PLDs, where interosseous ligament repair or reconstruction plays an important role. The severity of ligamentous injury and the type of ligament were evaluated and detected in the surgery. The severity of ligamentous injury was classified according to the Geissler classification system [14]. Knoll et al. [15] reported success in 23 of 25 patients with transscaphoid PLFD treated with screw fixation of the scaphoid and lunotriquetral interosseous ligament (LTIL) repair with a small bone anchor using a dorsal approach alone. In our study, lunotriquetral interosseous ligament was repaired with satisfactory results, using transosseous suture techniques after screw fixation of the scaphoid.

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Table 2. Treatment and outcomes for all patients

Parameter	Case						
	Early treated group			Delay treated group			
	1	2	3	4	5	6	7
Age (years)	20	42	45	28	33	26	37
Diagnosis	TSPD	TSPD	DTPD	TSPD	TSPD	CDST	DTPD
Interval (days)	7	2	6	5	16	19	25
Surgical approach	Dorsal	Dorsal	Dorsal	Dorsal	Dorsal	Dorsal	Dorsal
Treatment	OP IF LR	FR IF LR	OP IF LR	OP IF LR	OP IF LR	OP IF LR repair	FR IF LR
Follow-up (months)	15	26	23	16	10	16	20
Pain	25	25	25	25	20	20	20
Functional Status	25	25	25	20	20	20	20
Range of Motion	25	25	15	15	15	15	10
Grip Strength	15	15	15	25	25	15	15
Total	90	90	80	85	80	70	65

Trans-radial styloid perilunate dislocations, TSPD; Dorsal trans-radial perilunate dislocations, DTPD; Combined dorsal and styloid trans-radial perilunate dislocations, CDST; Open reduction, OP; internal fixation, IF; ligamentous repair, LR; Fracture removal, FR.

In conclusion, open reduction and internal fixation can be used to achieve good results and prognosis in cases with both acute and delayed perilunate dislocations. The restoration of intercarpal stability through ligamentous repair is crucial to restore hand function, such as grip strength.

Disclosure of conflict of interest

None.

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