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Closed k wire treatment of perilunate dislocations and fracture dislocations: clinical and radiological results

Asif Ali Dar, Ishfaq Sadiq, Ansar Ul Haq Lone
(PG Scholar, Department of Orthopaedics, Govt. Medical College Srinagar)
(PG Scholar, Department of Orthopaedics, Govt. Medical College Srinagar)
(Lecturer, Department of Orthopaedics, Govt. Medical College Srinagar)

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ABSTRACT
Introduction: Perilunate dislocations and fracture-dislocations are a subcategory of the carpal instability complex. Perilunate injuries are rare and often caused by high-energy trauma. Despite surgical treatment, there can still be a high incidence of functional dissatisfaction and post-traumatic arthritis.This study aimed to present the clinical and radiological outcomes of patients with perilunate injuries.
Materials and Methods: We conducted this prospective study in Govt. Bone and Joint Hospital Barzulla an associated Hospital of Govt. Medical College Srinagar. A total of 9 patients diagnosed with perilunate dislocations and fracture-dislocations between January2020and December 2021. Among 9 patients 7 (77.78%) were males and 2 (22.22%) were females. The mean age of the study population was 37.3 (range 21-53) years
Results: In all patients treated in this study, adequate scaphoid and intercarpal bone alignment was obtained and maintained. No permanent pain was reported by any of the patients. One patient reported occasional pain and two patient experienced occasional pain during daily activities. At the final follow-up, these three patients reported no pain.
Conclusion: Perilunate injuries are very complex lesions which characteristically have a guarded prognosis. Loss of function is expected, but efforts to perform a prompt and adequate treatment are helpful to avoid worst results.
KEYWORDS: Wrist, Perilunate dislocations, Fracture-dislocations, Reduction, Fixation, Herzberg classification

I. INTRODUCTION

Perilunate dislocations and perilunate fracture dislocations are devastating injuries to the wrist and are a subcategory of the carpal instability complex. The ligamentous and bony structures around the lunate are severely damaged. Perilunate injuries account for approximately 2% of all hand injuries. These injuries generally occur in young patients after high-energy trauma [1].

Perilunate dislocations are high-energy injuries caused by a fall from a height, motor vehicle accidents or sporting injuries. Depending on the severity and direction of the injury, it has been shown that there are a number of different injury types, ranging from perilunate fracture-dislocation to a full lunate dislocation [2-6]. The direction of the perilunate dislocation is dorsal in 97% of the patients, with 10% being open injuries and 65% being accompanied by carpal and distal radial fractures [3].

Perilunate injuries were first described by Joseph Francois Malgaigne[7] and pose as a type of carpal instability complex[8]. In 1980, Mayfield staged a series of experiments into a new classification system: a continuum of four stages[5], in which progressive ligament and bone dissociation occur[8]. Starting radially from the scaphoid, force propagates to the midcarpal and then ulnar aspects of the wrist[9], as the capitate and remainder of the carpus dislocate around the lunate.Scapholunate, radioscaphocapitate, lunotriquetal, dorsal intercarpal and radial collateral ligaments are torn and lunocapitate articulation is disrupted. Lunate dislocates fromthe lunate fossa of the distal radius after rotating out and around the short radiolunate ligament as an hinge.

Reverse pattern ofMayfieldclassical injury has also been described. Herzberg further divided stages into two: stage I, when lunate remains in its place under the radius, and stage II, when lunate is palmarly dislocated from the radial fossa. At the end, according to Johnson, both pure ligamentous injuries around the lunate (lesser arc injuries) and fracture-dislocations involving bones around the lunate (greater arc injuries) can occur[10].

The literature lacks any consensus regarding the modality of treatment. Although closed treatment was historically advocated for these injuries, the trend has shifted toward anatomic reduction and repair of the ligamentous and osseous structures with early open reduction

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and internal fixation Although open reduction and internal fixation methods allow for direct anatomic reduction and appropriate fixation of most injured components, it has several complications such as inevitable soft tissue,cartilage, tendon,ligament and vascular injuries, carpal instability and traumatic arthritis, closed reduction and internal fixation can offer a valuable method of dealing these injuries without grave complications.

The purpose of this study was to evaluate the clinical and radiological outcomes in the patients including pain, range of motion, disability, and pinch strength, along with functionality and disability during the activities of daily living, of patients treated within our clinic for perilunate dislocation and fracture-dislocation. In addition, the clinical and functional outcomes were compared with the radiological findings.

II. MATERIALS AND METHODS

We conducted this prospective study in Govt. Bone and Joint Hospital Barzulla an associated Hospital of Govt. Medical College Srinagar. A total of 9 patients diagnosed with perilunate dislocations and fracture-dislocations between January2020and December 2021. Among 9 patients 7 (77.78%) were males and 2 (22.22%) were females. The mean age of the study population was 37.3 (range 21-53) years Table 1.

Inclusion criteria:

- Age > 18 years
- Patients with perilunate dislocations (PLD) and perilunate fracture dislocations (PLFD)
- Both sexes

Exclusion criteria:

- Collagen disease
- Rheumatoid arthritis
- Osteomalacia.
- Patient who received proximal row carpectomy

The mode of trauma was road accidents in 6 (66.67%) and fall 3 (33.33%) of patients. All patients were with unilateral fracture. The right wrist was injured in 4 (44.44%) of patients and the left wrist in 5 (55.56%) of patients. A perilunate injury was diagnosed after standard postero;anterior and lateral plain radiographs of the wrist joint at their initial presentation. Injuries were classified according to the Herzberg classification (Table 1). Patients were immobilized with a short arm splint until surgery. The average time between injury and surgery was 3 (range, 0 to 7) days.

Table 1: Demography of patients

S. No.	Sex	Age	Etiology	Side	Type	Herzberg stage
01	M	37	RTC	Right	PLFD	2B
02	M	51	RTC	Left	PLD	1
03	F	32	Fall	Left	PLD	2B
04	M	21	RTC	Left	PLFD	2A
05	M	49	Fall	Right	PLFD	2B
06	M	25	RTC	Right	PLFD	2B
07	M	31	RTC	Left	PLFD	2A
08	F	42	RTC	Left	PLFD	1
09	M	53	Fall	Right	PLD	1
M= Male, F= Female, RTC= Road accidents						

Surgical technique:

All surgeries were performed under General anaesthesia / regional block. In all the nine cases, closed reduction was performed using the **Tavernier maneuvre**. Gentle traction,with finger traps and elbow at 90 degrees , for 10-15 minutes.flexion. For a dorsal perilunate dislocation longitudinal traction followed by volar flexion of the wrist with volar pressure on the lunate was done. Once reduction was complete PA and lateral views of the wrist were obtained to assess carpel alignment. To hold the reduction,two,1.8mm k wires were passed, one from scaphoid to lunate and other from lunate to radius. Associated fractures were fixed with k wires/screws.

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Figure 1:- A: Pre-operative, B: Post-operative

Post-operative protocol:

In the postoperative period, all the patients sustained 6 weeks of wrist immobilization. Physical rehabilitation was started afterwards. Total time of therapy was stated on an individual basis. After 6 weeks, a removable splint is used for another 3–4 weeks with compliant patients before the removal of k-wires is performed. Removal of the k-wires after 10 weeks was done under fluoroscopy followed by mobilization of the wrist. Depending on the radiographic appearances, progressive mobilization and strength training was started after 10 weeks and removal of k-wires. The mean follow-up time of cohort was 17 (range 13 to 24) months.

Assessment:

Clinical and radiologically patients were assessed at the final follow-up. Radiographs of the wrist including anteroposterior view, lateral view, ulnar-deviation view, radial deviation view and clenched fist view were performed at regular intervals after the surgery and at the final follow-up visit. A review of the median nerve function, wrist extension/ flexion, wrist radial/ulnar deviation, pronosupination, grip strength, , Visual Analogue Scale (VAS) for pain (0 -10) was applied and data from preoperative period were reviewed. Global hand function was evaluated using Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire (0 - 100). Wrist range of motion (ROM) parameters (extension, flexion, radial deviation, ulnar deviation, pronation and supination) were evaluated with classic goniometer. The postoperative complications were identified through clinical and radiological assessment.

III. RESULTS

In all patients treated in this study, adequate scaphoid and intercarpal bone alignment was obtained and maintained. No permanent pain was reported by any of the patients. One patient reported occasional pain and two patient experienced occasional pain during daily activities. At the final follow-up, these three patients reported no pain.

Compared with the uninjured side, mean grip strength was 80.2 %, . The mean active flexion-extension arc was 104° (range 80^0 to 125°).

At the last X-ray examination, 1 (11.11%) of patients had scaphoid non-union but refused further surgery. At the final follow-up evaluation, the average SL gap was 1.6 (range, 1 to 2.3) mm. The mean SL and CL angles were 49.3° (range 40 to 75°) and 4.2° (range 2 to 12°) respectively. Posttraumatic arthritic changes were observed in 7 (77.78% %) of patient involving the lunocapitate joint.

At the latest follow-up, mean post-operative VAS score forpain was 2.73. Average post-operative DASH score was10.42. Time to return to work was 5.00months by mean.

IV. DISCUSSION

Perilunate dislocations and fracture-dislocations are extremely complex injuries that carry a guarded prognosis, even when the most adequate surgical treatment is performed. As a spectrum of a rare injury, multiple lesion patterns are expected and several options are available for their management. Anatomic reduction, fracture fixation and ligamentous repair are often required, but controversy still occurs among sparse literature.

In this study, it was found that perilunate injuries were mainly in the form of fracture-

dislocations in young, actively working men, and the most common concomitant injuries were radial styloid and scaphoid fractures of the same extremity. Furthermore, in the follow-up, the wrist active joint range of motion and grip strength was lower compared with the uninjured extremity. Young patients had less resting pain and the time duration until their return to work was longer in those with scaphoid fractures. It is possible to achieve optimal functional treatment results in peri-lunate injuries affecting hand function and activities of daily living with accurate diagnosis and timely treatment. Although open reduction and internal fixation methods allow for direct anatomic reduction and appropriate fixation of most injured components, it has several complications such as inevitable soft tissue,cartilage, tendon,ligament and vascular injuries, carpal instability and traumatic arthritis, closed reduction and internal fixation can offer a valuable method of dealing these injuries without grave complications . In this study, we evaluated the clinical and radiological outcomes of the patients with perilunate dislocations treated by Closed reduction and internal fixation in our hospital Outcome measurements were compared according to age, occupation, accident, treatment time, and scaphoid fracture.

In this study the age group of enrolled population was between 21-53 years, and other literature has also reported that injuries were usually seen in a similar age range[2, 11, 12]. In this study the number of male patients was7 (77.78%) and in previously done studies all or most of the cases were males [2, 11, 12]. In this study, the most common injuries associated with the perilunate injury were radial styloid and scaphoid fractures. In previous case series, scaphoid fractures had been reported as the most common concomitant injury [11, 13, 14].We believe that the radial styloid fracture was the most common concomitant injury in our study because high-energy injuries were more common in our patients.

Surgical treatment was performed within 1 week in all patients. Many previous authors have reported that perilunate injuries can be missed, and early treatment is important for good functional outcomes[2, 15, 16].

In this study, the range of motion of the wrist joint was reduced in 4 directions and the grip, and pinch grip strengths were reduced relative to the unaffected side, similar to the results of the previous studies. The flexion-extension range of motion was80^0 to 125° and grip strength was 80.2 % of the unaffected side. In previous studies, results showed that the flexion-extension range of motion was 57%-80% of the unaffected side, and grip strength ranged between 71%-87% of the unaffected side[17]. Wrist flexion range was significantly lower in patients with work-related injuries. It has been reported that the range of motion, grip strength, and functionality outcomes were affected more in work-related perilunate injuries [11-13, 16].

Our first aim was to describe clinical and functional results at final follow-up of surgical treatment. Mean postoperative VAS score for pain was 2.73 and mean postoperative DASH score was 10.42. This is quite a low value when comparing to literature [18]. In this study the average time taken to return to work was 5.0 months. Data analysis showed that patients with accompanying scaphoid fractures returned to work over longer periods. Similarly, Kremer et al. showed that patients with scaphoid fractures had poorer functional outcomes, although they were not statistically significant.

V. CONCLUSION

In conclusion, perilunate injuries are very complex lesions which characteristically have a guarded prognosis. Loss of function is expected, but efforts to perform a prompt and adequate treatment are helpful to avoid worst results. As clinical and radiological outcomes are not imperatively related, it is important to percept how patients are dealing with their sequelae behind the radiographs to decide when to escalate treatment options.

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