



Original Article

Management of Lunate and Perilunate Fracture Dislocation through Isolated Volar Approach: A Case Series of Ten Cases

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Abstract

Objective: Lunate and perilunate fracture dislocations are complex injuries. Mayfield, Johnson, and Kilcoyne described four stages of progressive disruption of ligament attachments and anatomical relationships to the lunate resulting from forced wrist hyperextension. Urgent close reduction and pop slab is first line of management. Unsatisfactory reduction and poor fixation at the same time can lead to poor treatment outcome. There are numerous surgical methods to treat such injuries.

Methods: We describe here a series of ten cases of lunate and perilunate fracture dislocation treated by using single volar approach.

Results: All patients gained full ROM in 6 months. We have longest follow up of 5 years (Fig 5,6) with MAYO15 wrist score 94.

Conclusions: We strongly recommend isolated volar surgical approach for treating these injuries.

Keywords: Volar; dislocation; ROM (Range of Motion); MAYO Wrist Score.

Background

The most common cause of wrist injury is fall on outstretched hand. Severity of injury varies from simple ligament sprain to fracture dislocation. Wrist joint is made of distal radioulnar, radiocarpal, ulnocarpal joints and the eight carpal bones and their proximal and distal articulations and attached ligaments.¹ The bones of the proximal carpal row appear to be less tightly bound to one another than the bones of the distal carpal row.² This construct makes the bones of proximal carpal row to more prone for dislocation.

Lunate and perilunate fracture dislocations are complex injuries due to high energy trauma in young individual and low energy trauma in old. Mayfield, Johnson, and Kilcoyne described four stages of progressive disruption of ligament attachments and anatomical relationships of lunette resulting from forced wrist hyperextension (Figure 1). Stage I represents scapholunate failure; stage II, capitulunate failure; stage III, triquetrolunate failure; and stage IV, dorsal radiocarpal ligament failure, allowing lunette dislocation.^{3,4}

In type IV perilunate dislocations with lunate extrusion, no standardized treatment exists. While the literature documents several closed lunate enucleations, the treatment for these injuries varied and included arthrodesis, PRC or ORIF with Kirschner wires (K-wires)¹⁸⁻²¹. Urgent close reduction and pop slab is first line of management⁵. Unsatisfactory reduction and poor fixation can lead to poor treatment outcome. . Open reduction with internal fixation (ORIF) with ligament repair utilizing dorsal, volar, or combined approaches are the most commonly employed techniques.⁶ORIF involves reducing and fixing the dislocated lunate using Kirschner wire (K-wire).SL (Scapholunate) and LT (Lunotriquetral) ligament can be repaired with or without suture anchor. Dorsal or combined volar approach is excellent for exposure but soft tissue damage is quite high. The benefits of isolated volar approach are minimal trauma, simultaneous release of transvers carpal ligaments to release median nerve⁷ and less probability of AVN lunate. We describe here a series of ten cases of lunate and perilunate fracture dislocation treated by using single volar approach. Ligament repair was done in all cases. Associated scaphoid fracture was fixed using percutaneous Herbert screw (Synthes).

Methods

We reviewed ten cases (10 male, 0 female) of mean age 24.8(19-29)years. Right wrist was involved in all the cases. Fall from bike was seen in 7 cases. There was scaphoid fracture in 1 case (Figure 2). All cases were operated through isolated volar approach. Median nerve compression was seen in six cases, in which transverse carpal ligaments was released (Figure 3). After reduction k wire was inserted to fix capitates to lunate (Fig. 4) and scaphoid to lunate. scapho –lunate k wire fixation was not possible in patient with scaphoid fracture. Scaphoid fracture was fixed with Herbert screw (Synthese) percutaneously. Scapholunate and capito lunate Ligaments were repaired and Pop slab was given

for 6 weeks. After that both slab and k wire removed. Patients were given wrist immobilizer (Tynor) for further 6 weeks with guarded flexion and extension.

Results

All patients gained full ROM in 6 months. We have longest follow up of 5 years (fig 5) with MAYO¹⁵ wrist score 94. Signs of AVN lunate was seen in two case but without any symptom. Radiological arthritis was not seen in any case at 5 year follow up. There was strong correlation with delay in treatment (p score=.035), reduced scapho-lunate angle (p score=.017) with AVN lunate.



Figure 01



Figure 02



Figure 03

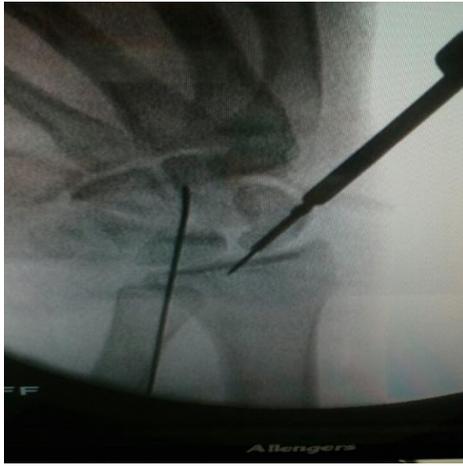


Figure 04



Figure 5

Discussion

Volar lunate dislocation is an uncommon injury, but due to increase in road traffic accident we are getting a lot no of cases in emergency department as well as outpatient department. These injuries are the result of high-energy injuries to the carpus Careful examination and radiological evaluation is mandatory for satisfactory results. But sometime these injuries are easily missed due to lack of proper x ray and negligence.

In 1980, Mayfield et al published their classification system of progressive perilunate instability. This system described the propagation of forces leading to the progression of carpal dislocation. It has 4 progressive stages ranging

from I to IV.³ It is the fourth stage of Mayfield progression. The mechanisms of perilunate dislocation as per Mayfield progression are extension, ulnar deviation, and intercarpal supination. This injury can be divided into a lesser-arc injury and a greater-arc injury. A lesser-arc injury is a purely ligamentous disruption around the lunate (Disruption of the radiocapitate, radioscapoid and volar radiotriquetral ligaments). However, the ligaments including the ulnolunate ligaments between the lunate, ulna, and radius remain intact. In a greater-arc injury, the osseous structures around the lunate including the scaphoid waist are fractured. The typical radiographic appearances of a perilunate dislocation include disruption of the proximal and distal outlines of the proximal carpal rows called as Gilula lines. On the lateral view, the lunate no longer articulates with the head of the capitate, but appears palmarly rotated, the so-called 'spilled teapot sign'.⁸

Urgent close reduction is always attempted. But failure warrants need of exploration. There is no consensus concerning whether a dorsal or a combined dorsal-volar approach is most suitable for open treatment of these injuries. The dorsal approach provides the best exposure for anatomical alignment and interosseous ligament repair, and a volar incision allows decompression of the carpal tunnel and direct repair of the palmar capsule and ligament tear. Extended carpal tunnel incision is preferred during volar surgical approach. The median nerve is retracted radially and the lunate and volar capsular rent will be visible in the space of Poirier. Most of the surgeons favour the combined approach because of the restoration of the intercarpal relationships to achieve wrist stability^{9,10}. Combined approach provide excellent exposure but leads to sever soft tissue damage.

So in the present cases, we chose the volar approach because of concerns about additional soft tissue injury and subsequent development of a vascular necrosis that might result from the dorsal approach particularly severe soft tissue disruption

and complete detachment of all ligamentous structures around the lunate.¹¹ The incomplete ligament reconstruction and K-wire fixation leads to loss of reduction and difficulty in preserving the alignment of the dislocated lunate due to the presence of extensive inter carpal ligament disruption. Therefore, complete primary ligament repair through a combined volar and dorsal approach may be required when performing open reduction and internal fixation in such complicated cases. However complete ligament primary repair is difficult because there is severe loss of ligaments and torn ligaments are too friable for repair. Therefore we used only volar approach to decrease the soft tissue damage as compare to combine approach.

Other authors had reported a higher incidence of avascular necrosis of lunate or scaphoid (44%) in case of transscaphoid lunate or perilunate dislocation.¹² The lunate bone receives its blood supply from dorsal and palmar branches only in a small periosteum-covered area, as classified to Y, I, X, and simple palmar types¹⁶. Untreated lunate fractures are prone to ischemic necrosis¹⁷. In our study, AVN lunate was seen in 20 % of cases. Incidence of AVN strongly correlate with delay in diagnosis and treatment. So early diagnosis and treatment is key for good result.

In literature it is mentioned that despite restored carpal integrity, the patients may suffer from osteoarthritic alterations and permanent instability in the wrist. Range of motion of the wrist might be limited even after anatomic reconstruction with rapidly developing painful radiocarpal osteoarthritis. There is controversy in literature regarding the optimal management of such complication. Complete lunate enucleation is associated with high rate of osteonecrosis of lunate thus wrist arthrodesis or proximal row carpectomy has been advocated as primary treatment for such cases in literature²². The reason may be initial sever soft tissue damage that could not be assessed on plain radiograph. Long term studies and initial MRI may be useful for explained prognosis. The advantages of proximal

row carpectomy should be kept in mind in such cases.^[6,7]

So a longer period of follow up and more studies will be needed for making appropriate guideline for treating such complex injury. But functional activity does not always correlate with radiological appearance as many patients with radiological signs of arthritis were completely pain free and excellent functional result.

Conclusions

In brief all treatment methods used in perilunate and lunate injuries focus on early management and good carpal integrity. Moreover, the consequences of missed diagnosis are serious. Patients suffering persistent wrist swelling after a trauma should be carefully examined and followed up. If necessary, CT and MRI should be performed to prevent severe secondary diseases and wrist joint dysfunction. This is important for a satisfactory outcome including the grip strength and joint range of motion. We could achieve these results with an isolated volar surgical approach with minimal soft tissue damage. So we strongly recommend isolated volar surgical rather than combined dorsal and volar approach for treating these injuries.

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