

Kaplan's Lesion – Functional and Radiological Outcome of Open Reduction by Dorsal Approach: A Case Series.

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ABSTRACT

Background:

Kaplan's lesion is an uncommon complex dorsal dislocation of the metacarpophalangeal (MCP) joint caused by forceful hyperextension, with interposition of the volar plate and surrounding soft tissues. Closed reduction frequently fails, requiring open reduction. This case series describes the clinical, functional, and radiological outcomes following dorsal open reduction.

Case Presentation:

Five adult male patients with complex dorsal dislocation of the index MCP joint were treated at PRM Medical College and Hospital, Baripada, Odisha, between January 2022 and August 2023, with a minimum follow-up of one year. All injuries resulted from road traffic accidents, and closed reduction failed in all cases. Three patients underwent mobilization of the volar plate using a thin osteotome, while two delayed cases required longitudinal splitting of the volar plate. Stable reduction was achieved in all patients, with K-wire fixation as required. One patient with an associated osteochondral fragment underwent fixation with two K-wires.

Conclusion:

At one-year follow-up, all patients maintained anatomical reduction and joint congruity. Mean VAS pain score decreased from 8.6 to 0.4, while mean MCP flexion improved from 0° to 82°. All patients returned to their pre-injury occupations within three months, with no redislocation, infection, neurovascular injury, or revision surgery.

Take-away Lessons:

When closed reduction fails, early recognition and open reduction of Kaplan's lesion are important. The dorsal approach allows direct management of the entrapped volar plate and can provide stable reduction and satisfactory functional recovery.

Keywords: Kaplan's lesion, Metacarpophalangeal joint dislocation, Dorsal approach, Open reduction, Volar plate, K-wire fixation.

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INTRODUCTION

Complex dorsal dislocation of the metacarpophalangeal (MCP) joint, commonly referred to as **Kaplan's lesion**, is an uncommon but clinically significant injury of the hand. First described by Kaplan in 1957, this injury is characterised by irreducible dorsal dislocation of the MCP joint resulting from entrapment of the volar plate and surrounding soft-tissue structures around the metacarpal head, rendering closed reduction unsuccessful in most cases.¹ Although simple MCP joint dislocations can often be

managed by closed reduction, complex dislocations almost invariably require open surgical reduction because of the buttonholing phenomenon produced by the displaced volar plate and associated ligamentous structures.²

The index finger is the digit most frequently involved owing to its unique anatomical configuration and biomechanical characteristics. These injuries typically result from forceful hyperextension of the MCP joint following high-energy trauma such as road traffic accidents, falls on an outstretched hand, or sports-related injuries.^{2,3} During hyperextension,

the volar plate avulses from its proximal attachment at the metacarpal neck and becomes interposed between the metacarpal head and the base of the proximal phalanx. Simultaneously, displacement of the flexor tendons, lumbricals, natatory ligament, and deep transverse metacarpal ligament further prevents successful closed reduction.⁴

Patients usually present with pain, swelling, deformity and marked restriction of finger movements. Palmar skin puckering, often considered a characteristic clinical sign of Kaplan's lesion, indicates incarceration of the metacarpal head within the surrounding soft tissues. Careful clinical examination should be complemented by radiographic evaluation, including anteroposterior, lateral, and oblique radiographs. While widening of the MCP joint space may be appreciated on anteroposterior views, lateral radiographs more reliably demonstrate dorsal displacement of the proximal phalanx. Computed tomography may be valuable in identifying associated osteochondral fragments or complex fracture-dislocations that may influence surgical planning.⁵

Open reduction remains the treatment of choice for irreducible MCP joint dislocations. Both dorsal and volar surgical approaches have been described. The volar approach provides excellent visualisation of the volar plate and facilitates direct repair; however, it carries a greater risk of digital neurovascular injury because of the close proximity of the neurovascular bundles.⁶ In contrast, the dorsal approach offers safer exposure, avoids extensive dissection around the neurovascular structures, allows direct access to the incarcerated volar plate, and provides excellent visualisation for fixation of associated osteochondral fragments when present. Consequently, many authors consider the dorsal approach technically simpler and associated with satisfactory clinical outcomes.^{4,7}

Despite advances in hand surgery, Kaplan's lesion remains a relatively rare injury, and most published literature consists of isolated case reports or small case series. Consequently, evidence regarding long-term functional recovery, radiological outcomes, and complication rates following dorsal open reduction remains limited.^{1,8,9} Furthermore, delayed presentation may necessitate modification of the surgical technique, including longitudinal splitting of the volar plate to facilitate reduction, although concerns regarding postoperative instability have been raised.¹⁰

The present **case series** evaluates the clinical, functional, and radiological outcomes following **open reduction through the dorsal approach** in five patients with Kaplan's

lesion treated at **PRM Medical College and Hospital, Baripada, Odisha**, with a minimum follow-up of one year. The study aims to describe operative findings, postoperative recovery, radiological healing, and functional outcomes while highlighting the effectiveness and safety of the dorsal approach in the management of this uncommon injury.

MATERIALS AND METHODS

Case Presentation

Five adult male patients with complex dorsal dislocation of the index metacarpophalangeal (MCP) joint (Kaplan's lesion) were treated by open reduction through a dorsal approach at PRM Medical College and Hospital, Baripada, Odisha, between January 2022 and August 2023. The patients were aged 24, 28, 32, 38, and 46 years. All injuries resulted from road traffic accidents, and closed reduction was unsuccessful in all five patients. Three patients presented within two weeks of injury, whereas two patients presented more than two weeks after injury. The right hand was involved in three patients and the left hand in two patients. All patients were male and had involvement of the index MCP joint.

Patient 1

A 24-year-old male presented with a complex dorsal dislocation of the index MCP joint following a road traffic accident. Clinical examination demonstrated pain, swelling, deformity, and marked restriction of MCP joint movement. There was no distal neurovascular deficit. Standard anteroposterior, lateral, and oblique radiographs confirmed the dorsal MCP joint dislocation. An attempted closed reduction was unsuccessful, consistent with a complex dislocation with soft-tissue interposition.

The patient underwent open reduction through a dorsal approach. The entrapped volar plate was identified and mobilized using a thin osteotome to facilitate reduction. The joint was reduced anatomically and assessed for stability under fluoroscopic guidance. A K-wire was used for temporary stabilization.

Postoperatively, the MCP joint was immobilized in approximately 45° of flexion for three weeks. The K-wire was removed after confirmation of satisfactory alignment, followed by supervised range-of-motion exercises. Progressive functional recovery was observed during follow-up, with restoration of stable and painless MCP joint function.

Patient 2

A 28-year-old male presented following a road traffic accident with a complex dorsal dislocation of the index

MCP joint. He had pain, swelling, deformity, and restricted MCP joint movement. Neurovascular examination was normal. Radiographic assessment with anteroposterior, lateral, and oblique views confirmed the dislocation, and closed reduction was unsuccessful.

Open reduction was performed through the dorsal approach. The entrapped volar plate was identified and repositioned using a thin osteotome, allowing anatomical reduction of the MCP joint. Temporary K-wire fixation was performed, and stability was confirmed clinically and fluoroscopically.

The MCP joint was immobilized at approximately 45° of flexion for three weeks. Following K-wire removal, active and passive mobilization was initiated under physiotherapy supervision. The patient subsequently achieved stable, painless MCP joint function and returned to pre-injury occupational activities.

Patient 3

A 32-year-old male sustained a complex dorsal dislocation of the index MCP joint following a road traffic accident. On presentation, he had pain, swelling, deformity, and inability to flex the MCP joint. There was no distal neurovascular deficit. Radiographs confirmed the dorsal dislocation, and closed reduction was unsuccessful.

The patient underwent dorsal open reduction. The entrapped volar plate was carefully mobilized with a thin osteotome and returned to its anatomical position. Reduction was confirmed using fluoroscopy, and the MCP joint was stabilized with a K-wire.

Postoperative immobilization was maintained for three weeks, followed by K-wire removal and supervised range-of-motion exercises. The patient demonstrated progressive improvement in MCP joint movement and pain and subsequently regained stable, painless hand function.

Patient 4

A 38-year-old male presented with a complex dorsal dislocation of the index MCP joint after a road traffic accident. Clinical assessment showed pain, swelling, deformity, and restricted finger movement. Neurovascular examination was normal. Plain radiographs demonstrated the MCP joint dislocation, and closed reduction was unsuccessful.

Open reduction was performed through the dorsal approach. The entrapped volar plate was addressed to facilitate reduction, and the joint was restored to anatomical alignment. Temporary K-wire fixation was performed, followed by confirmation of stability with fluoroscopy and passive flexion-extension.

The MCP joint was immobilized in approximately 45° of flexion for three weeks. After removal of the K-wire,

supervised mobilization and subsequent strengthening exercises were initiated. The patient achieved satisfactory functional recovery and returned to pre-injury occupational activity.

Patient 5

A 46-year-old male sustained a complex dorsal dislocation of the index MCP joint following a road traffic accident. Radiographic evaluation demonstrated the dislocation with an associated osteochondral fragment. Because of the suspected osteochondral injury, computed tomography was performed for further assessment. Clinical examination showed pain, swelling, deformity, and restricted MCP joint movement without distal neurovascular deficit.

Open reduction was performed through the dorsal approach. The entrapped volar plate was identified and addressed to facilitate reduction. The associated osteochondral fragment was stabilized using two K-wires, and anatomical joint reduction and stability were confirmed under fluoroscopic guidance.

The MCP joint was immobilized for three weeks. Following removal of the K-wires, supervised range-of-motion exercises were initiated, followed by progressive strengthening. Follow-up radiographs demonstrated union of the osteochondral fragment and maintenance of joint congruity. The patient achieved good functional recovery without redislocation or other postoperative complications.

Follow-up and Clinical Outcomes

All five patients were followed for a minimum of one year. Functional assessment included pain using the Visual Analogue Scale (VAS), MCP joint range of motion, return to pre-injury occupational activities, and assessment of postoperative complications. The mean VAS pain score decreased from 8.6 ± 0.5 preoperatively to 1.8 ± 0.8 at three months and 0.4 ± 0.5 at one year. Mean MCP joint flexion improved from 0° preoperatively to $70 \pm 8^\circ$ at three months and $82 \pm 6^\circ$ at one year. The mean extension deficit improved from $18 \pm 5^\circ$ to $2 \pm 2^\circ$ at final follow-up.

All patients achieved stable MCP joint function and returned to their pre-injury occupations within three months. Radiographs demonstrated maintained anatomical reduction and joint congruity at one year. The osteochondral fragment in the affected patient united following fixation with two K-wires. No patient developed redislocation, infection, neurovascular injury, K-wire migration, wound complication, or required revision surgery.

RESULTS

A total of five adult patients with **Kaplan's lesion (complex dorsal metacarpophalangeal joint dislocation of the index finger)** underwent open reduction through a dorsal approach during the study period. The mean age of the patients was **34.8 ± 8.3 years** (range: 24–46 years). All injuries resulted from road traffic accidents (100%), and all involved the index finger MCP joint. Two patients presented

more than two weeks after injury, while three presented acutely.

Clinical examination demonstrated pain, swelling, restricted finger movements, and inability to flex the MCP joint in all patients. Palmar skin puckering and dorsal hollowing, classical signs of Kaplan's lesion, were observed in two patients (40%). No patient had distal neurovascular deficit. Baseline demographic and injury characteristics are summarized in **Table 1**. The age distribution of the patients is illustrated in **Figure 1**.

Table 1. Baseline demographic and injury characteristics (n = 5)

Variable	Result
Number of patients	5
Mean age (years)	34.8 ± 8.3
Age range	24–46
Sex (Male/Female)	5/0
Injured side (Right/Left)	3/2
Mechanism of injury	Road traffic accident (100%)
Finger involved	Index finger (100%)
Acute injuries (<2 weeks)	3 (60%)
Delayed injuries (>2 weeks)	2 (40%)
Palmar skin puckering	2 (40%)
Neurovascular deficit	None

Figure 1. Age distribution of patients included in the study.

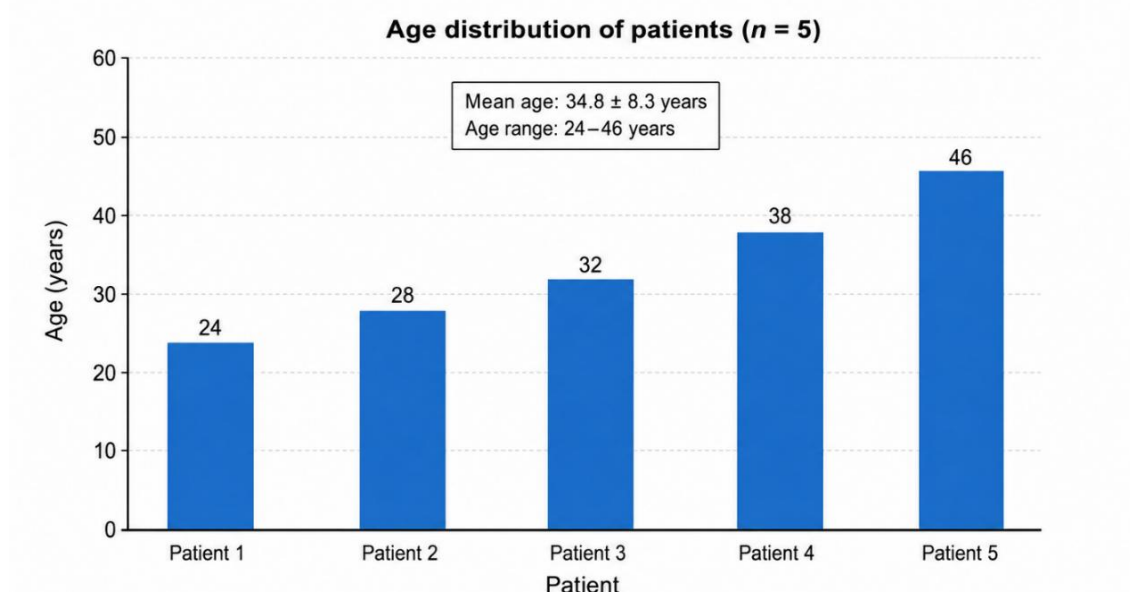


Figure 1. Age distribution of patients included in the study.

Open reduction through the dorsal approach was successfully performed in all five patients. In three acute cases (60%), the volar plate was carefully levered back to its anatomical position using a thin osteotome without division of the volar plate. In two delayed cases (40%), longitudinal splitting of the volar plate was required to facilitate reduction. Following reduction, joint congruity was confirmed under image intensifier, and stability was

assessed clinically. Four patients underwent fixation with a single Kirschner wire, whereas one patient with an associated osteochondral fragment required fixation using two K-wires. The operative findings are summarized in **Table 2**. The distribution of intraoperative reduction techniques and K-wire fixation methods are presented in **Figures 2 and 3**, respectively.

Table 2. Operative findings and surgical management

Operative variable	Number (%)
Successful reduction	5 (100)
Dorsal approach used	5 (100)
Volar plate reduced using osteotome	3 (60)
Longitudinal splitting of volar plate	2 (40)
One K-wire fixation	4 (80)
Two K-wire fixation	1 (20)
Image intensifier confirmation	5 (100)
Stable reduction achieved	5 (100)

Figure 2. Intraoperative procedures performed (volar plate reduction using osteotome versus longitudinal splitting).

Intraoperative procedures performed (n = 5)

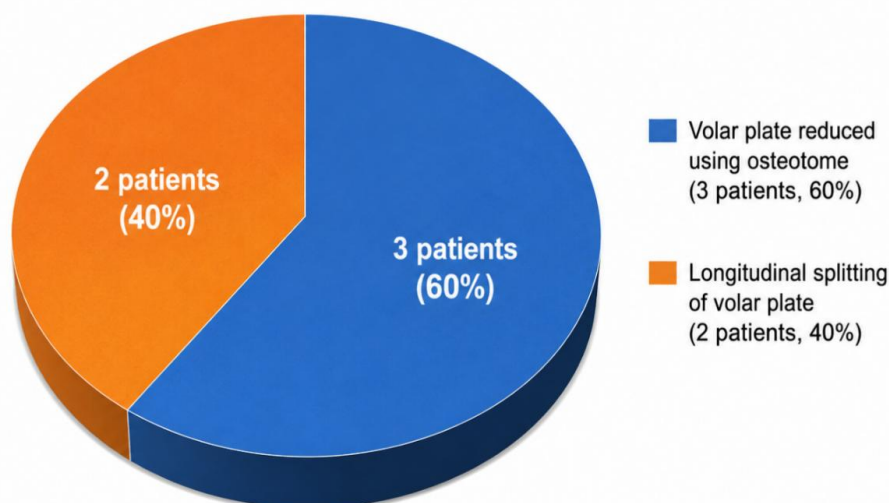


Figure 2. Intraoperative procedures performed (volar plate reduction using osteotome versus longitudinal splitting).

Figure 3. Type of K-wire fixation used following reduction.

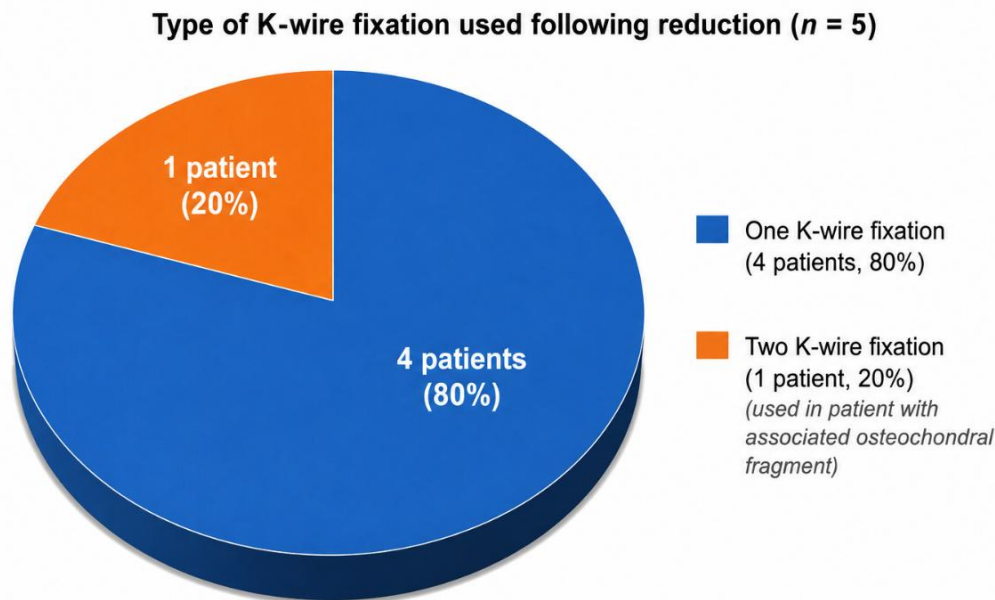


Figure 3. Type of K-wire fixation used following reduction.

Postoperatively, all MCP joints were immobilised at 45° of flexion using a below-elbow slab for three weeks. K-wires and sutures were removed at three weeks, followed by supervised active mobilisation exercises. Functional recovery improved progressively during follow-up. The mean VAS pain score decreased from 8.6 ± 0.5 preoperatively to 1.8 ± 0.8 at three months and 0.4 ± 0.5 at one year. Mean MCP flexion improved from 0°

preoperatively to $70 \pm 8^\circ$ at three months and $82 \pm 6^\circ$ at final follow-up, while the mean extension deficit improved from $18 \pm 5^\circ$ to $2 \pm 2^\circ$. All patients regained stable, painless MCP joint function and returned to their pre-injury occupational activities within three months. Functional outcomes are summarised in Table 3, and overall recovery at one year is illustrated in Figure 4.

Table 3. Functional outcomes after surgery

Outcome parameter	Preoperative	3 months	12 months
Mean VAS pain score	8.6 ± 0.5	1.8 ± 0.8	0.4 ± 0.5
Mean MCP flexion (°)	0	70 ± 8	82 ± 6
Mean extension deficit (°)	18 ± 5	5 ± 3	2 ± 2
Stable MCP joint, n (%)	—	5 (100)	5 (100)
Return to pre-injury occupation, n (%)	—	5 (100)	5 (100)
Redislocation, n (%)	—	0	0
Infection, n (%)	—	0	0
Joint stiffness requiring intervention, n (%)	—	0	0

Figure 4. Functional outcome at one-year follow-up showing return to pre-injury activity.

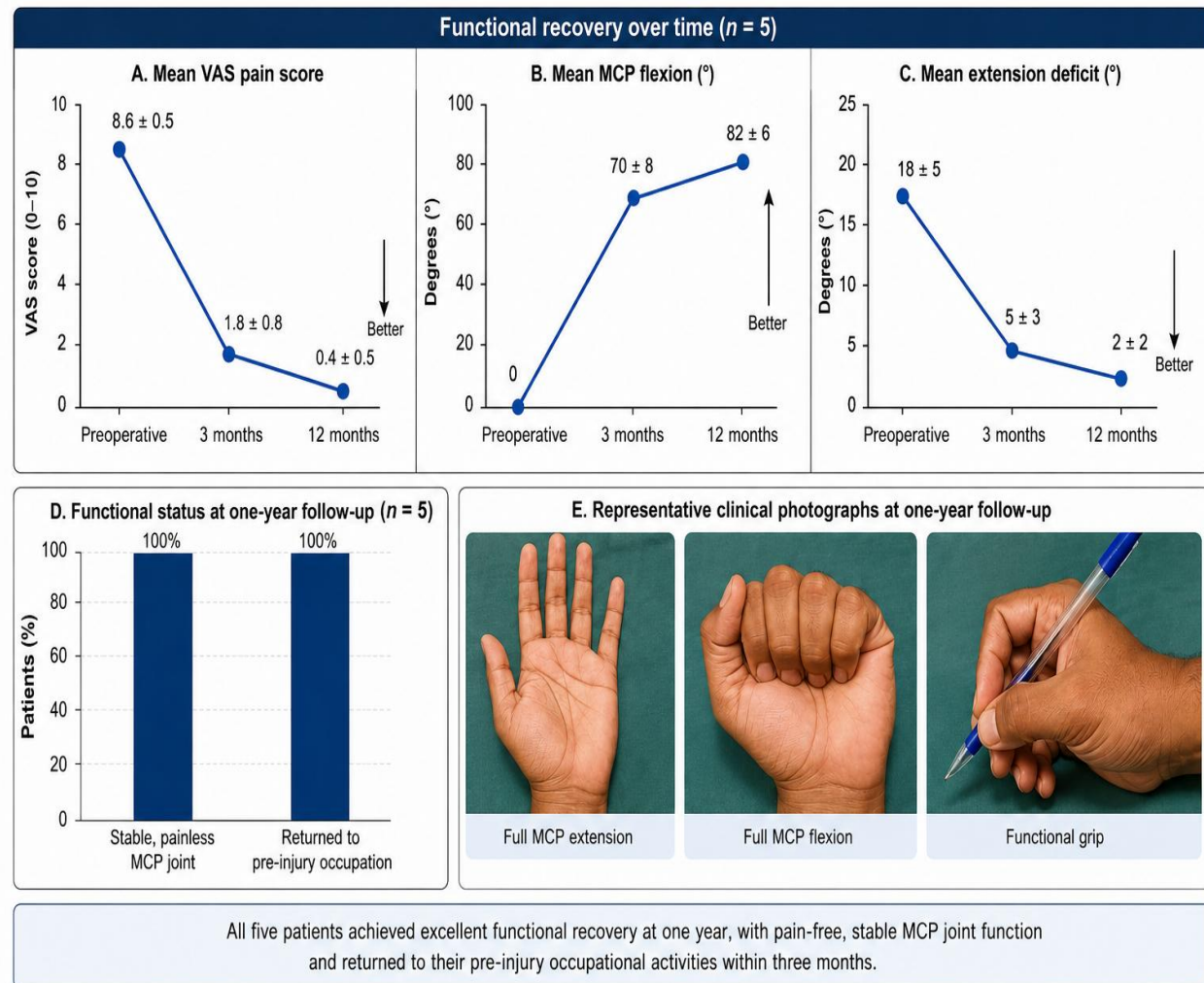


Figure 4. Functional outcome at one-year follow-up showing return to pre-injury activity.

Radiographic evaluation performed immediately after surgery demonstrated concentric anatomical reduction of the MCP joint in all patients. Follow-up radiographs obtained at one year confirmed maintenance of reduction without redislocation, implant failure, joint subluxation, or

degenerative arthritic changes. The osteochondral fragment in one patient united satisfactorily following fixation with two K-wires. Radiological outcomes are summarized in **Table 4**, and the maintained reduction at final follow-up is illustrated in **Figure 5**.

Table 4. Radiological outcomes

Radiological parameter	n (%)
Anatomical reduction achieved	5 (100)
Maintained reduction at 1 year	5 (100)
Osteochondral fragment united	1/1 (100)
Implant failure	0
Redislocation	0
Degenerative changes	0

Figure 5. Case images-Clinical image-Case 1-





(d)



(e)

a- pre-op clinical and X-ray b- Intra-op volar plate c- C-arm images after reduction and K-wire fixation d- congruent joint at 1-year follow-up e – Good functional recovery Case 5



(a)



(b)



(c)



(d)

*a- X-ray of Kaplan's lesion with osteochondral fragment b- Intra-op image of volar plate
c- Post op Xray with 2 K-wire fixation d- Good functional recovery*

No intraoperative or postoperative complications were encountered throughout the study period. There were no cases of surgical site infection, neurovascular injury, wound-related complications, K-wire migration, recurrent instability, redislocation, or revision surgery. Postoperative complications are summarized in **Table 5**.

Table 5. Postoperative complications

Complication	Number (%)
Infection	0
Neurovascular injury	0
Wound complications	0
K-wire migration	0
Redislocation	0
Revision surgery	0

Overall, the dorsal approach provided successful reduction and stable fixation in all five patients, with excellent clinical, functional, and radiological outcomes and no procedure-related complications during the one-year follow-up.

DISCUSSION

Complex dorsal metacarpophalangeal (MCP) joint dislocations, commonly known as Kaplan's lesions, are uncommon injuries that frequently require surgical intervention because interposition of the volar plate and surrounding soft tissues prevents successful closed reduction. In the present case series, all five adult patients underwent open reduction through a dorsal approach with temporary K-wire fixation. Anatomical reduction and stable joint fixation were achieved in all patients, with satisfactory functional recovery and maintenance of joint congruity at

one-year follow-up. No intraoperative or postoperative complications were observed.

The dorsal approach provides direct visualization of the entrapped volar plate while avoiding extensive dissection around the digital neurovascular structures. Becton et al. described a simplified dorsal approach that provides exposure of the incarcerated volar plate and facilitates anatomical reduction.¹¹ Similar principles were applied in the present series, in which all five patients underwent dorsal open reduction with satisfactory postoperative outcomes.

Early anatomical reduction is an important component of management. Thakur et al. reported successful treatment of a delayed pediatric Kaplan's lesion using a dorsal approach, with restoration of finger motion and no instability at one-

year follow-up.¹² In the present series, two patients had delayed presentation and required longitudinal splitting of the fibrosed volar plate to facilitate reduction. Both patients subsequently achieved stable MCP joint function without recurrent instability during follow-up.

Previous reports have also described satisfactory outcomes following open reduction of complex MCP joint dislocations. Sattari et al. reported successful recovery following dorsal open reduction of an index-finger Kaplan's lesion, with satisfactory functional results and no major complications.¹³ These findings are comparable with the outcomes observed in the present case series.

Radiological assessment demonstrated concentric reduction immediately after surgery and maintenance of joint congruity throughout follow-up. Chitnis and Chitnis emphasized the role of computed tomography when an osteochondral injury is suspected, particularly when associated fragments may not be adequately characterized on plain radiographs.¹⁴ In the present series, CT was performed in one patient and identified an associated osteochondral fragment, which was subsequently stabilized using two K-wires. Follow-up radiographs demonstrated satisfactory union of the fragment and maintenance of joint congruity.

Functional recovery was satisfactory in all five patients. The mean VAS pain score decreased from 8.6 ± 0.5 preoperatively to 0.4 ± 0.5 at one year. Mean MCP joint flexion improved from 0° preoperatively to $82 \pm 6^\circ$ at one year, while the mean extension deficit improved from $18 \pm 5^\circ$ to $2 \pm 2^\circ$. All patients returned to their pre-injury occupational activities within three months. Durand et al. reported restoration of near-full MCP joint motion following open reduction of a complex Kaplan's lesion and emphasized the importance of anatomical reduction and appropriate postoperative rehabilitation.¹⁵ The functional recovery observed in the present series is consistent with these observations.

Although both dorsal and volar approaches have been described for complex MCP joint dislocations, the present case series specifically evaluated outcomes following the dorsal approach. The findings demonstrate that this approach allowed successful management of the entrapped volar plate and associated osteochondral injury in the patients included in this series. However, because of the small number of patients and absence of a comparative group, the present findings should not be interpreted as demonstrating superiority of the dorsal approach over alternative approaches.

Generalizability

The generalizability of these findings is limited by the characteristics of the study population. All five patients were adult males, all injuries resulted from road traffic accidents, and all involved the index MCP joint. In addition, the patients were treated at a single institution using a similar surgical approach and were followed for one year. Therefore, these findings may not be directly applicable to children, female patients, injuries involving other digits, different mechanisms of injury, or patients treated in other healthcare settings. Nevertheless, the case series provides clinical information regarding the presentation, surgical management, and one-year outcomes of this uncommon injury.

Conclusion

Kaplan's lesion is an uncommon complex MCP joint dislocation in which interposition of the volar plate and surrounding soft tissues frequently prevents successful closed reduction. In this case series of five adult patients, open reduction through the dorsal approach with temporary K-wire fixation resulted in anatomical reduction, stable MCP joint function, and maintenance of joint congruity at one-year follow-up.

All patients demonstrated improvement in pain and MCP joint motion and returned to their pre-injury occupational activities within three months. The two patients with delayed presentation required longitudinal splitting of the volar plate to facilitate reduction and subsequently achieved satisfactory functional recovery. An associated osteochondral fragment in one patient united following K-wire fixation. No redislocation, infection, neurovascular injury, K-wire migration, or revision surgery was

Limitations

This case series has several limitations. First, the sample size was small, reflecting the rarity of Kaplan's lesion and limiting the extent to which the findings can be generalized. Second, the retrospective, single-centre design may limit external validity. Third, there was no comparison group treated using an alternative surgical approach; therefore, the relative advantages of the dorsal approach cannot be determined from this series. Fourth, validated patient-reported outcome measures, such as the DASH or QuickDASH, were not included. Finally, the follow-up period was limited to one year, which may be insufficient to assess longer-term complications such as post-traumatic degenerative changes.

Take-away lessons

Kaplan's lesion should be suspected when a dorsal MCP joint dislocation is irreducible by closed reduction.

Interposition of the volar plate and surrounding soft tissues is an important cause of failed closed reduction.

Careful radiological assessment is important to identify associated osteochondral fragments that may require additional fixation.

The dorsal approach provides direct access to the entrapped volar plate and facilitates anatomical reduction.

Delayed presentation may result in fibrosis of the volar plate and may require longitudinal splitting to achieve reduction.

Stable fixation followed by structured rehabilitation can facilitate recovery of MCP joint movement and function.

Clinical and radiological follow-up is important to confirm maintenance of joint reduction and identify postoperative complications.

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List of abbreviations

CT – Computed tomography

K-wire – Kirschner wire

MCP – Metacarpophalangeal

SD – Standard deviation

VAS – Visual Analogue Scale

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Conflict of interest

The authors declare that they have no conflicts of interest.

Author contributions

Rashmi Ranjan Dash: Conceptualization, patient management, surgical management, data collection, and critical revision of the manuscript.

Indrajit Munda: Patient management, data collection, interpretation of clinical and radiological findings, and critical revision of the manuscript.

Barada Prasanna Samal: Patient management, data collection, interpretation of clinical findings, and critical revision of the manuscript.

Subhamaya Chinmaya Swain: Conceptualization, patient management, surgical management, data analysis, manuscript preparation, and correspondence.

All authors contributed to the manuscript, reviewed the final version, and approved it for publication.

Data availability

The data supporting the findings of this case series are available from the corresponding author upon reasonable request, subject to applicable ethical, privacy, and confidentiality restrictions.

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