Kaplan's Lesion Treated with Open Reduction by Dorsal Approach

SreerangaN[1,*], LakshmeeshaT[2], Shankara K[3], Vishanth K[4]

[1]Professor, [2,3]Assistant Professors, [4]Junior Resident,
Department of Orthopaedics, Hassan Institute of Medical Sciences, Hassan, Karnataka.

***Corresponding Author:**
E-mail: sreerangadoc18@gmail.com

ABSTRACT

Background: *Kaplan's lesion is a rare injury of the metacarpophalangeal joint, which commonly involving the index finger. It is also one of the complex dorsal dislocations of the hand. Proper identification is required to provide appropriate treatment. Though the lesion clinically appears small it is not amenable to closed reduction. Open reduction is the treatment of choice. Two approaches-volar & dorsal have been described. Volar approach is widely used & written about. However the risk to neurovascular bundle is high.*

Method and Material: *At Hassan institute of medical sciences we treated 5 patients with Kaplan's lesion surgically by using dorsal approach. Our Aim was to analyse the effectiveness, accessibility & ease of this approach in treating these lesions & also note the complications.*

Results: *All patients underwent open reduction by dorsal approach and regained their pre-functional status by 8 weeks period without any neurovascular injury.*

Conclusion: *This approach definitely offers better advantage in visualising the volar plate & joint, relatively safe in preventing neurovascular injury & will also be able to fix the associated fractures with ease. The relative disadvantage of longitudinally splitting of the volar plate did not interfere in the healing or stability of the lesion.*

Keywords: *Kaplan's lesion, Open reduction, Dorsal approach.*

Access this article online	
Quick Response Code:	**Website:** www.innovativepublication.com
	DOI: 10.5958/2395-1362.2015.00041.9

INTRODUCTION

Kaplan's lesion is one of the rare dorsal complex dislocations of metacarpophalangeal joint. It usually involves the index finger at the metacarpophalangeal joint[1]. It is important to identify this lesion from subluxation as the latter can be reduced by closed methods whereas dislocations most often need an open reduction[2]. Farabeuf was the first to coin the term complex dislocation[3]& later it was Kaplan who first published his article describing the numerous anatomical interposing structures which prevents reduction by closed methods necessitating open reduction[4]. The patho-anatomy involves dislocation of the head of the metacarpal which gets button-holed within the various anatomical soft tissue structures around it. Normally the strong capsulo-ligamentous attachments around the MCP joint prevent dislocation. The capsule on the volar side attached to the metacarpal proximally & proximal phalanx base distally is reinforced by the volar plate. On the radial side it is the deep transverse metacarpal & collateral ligaments which provide protection, while ulnar wards it is the extrinsic & intrinsic tendons along with the sagittal bands providing additional support thus preventing dislocation[5]. However due to extra force of injury the volar plate & capsule which has a thin attachment to the metacarpal; breaks & dislocation eventually occurs. The volar plate is usually considered the culprit as it prevents relocation by closed methods. The mode of injury is usually a fall with forceful hyperextension of the finger. The volar plate breaks from its proximal attachment of metacarpal neck most often maintaining its attachment to deep transverse ligament. It then interposes between the metacarpal head & proximal phalanx thus forming a primary impediment for closed reduction. Further the flexor tendons on the ulnar side along with the pre-tendinous band of palmar fascia & the lumbricals radial ward form a tight constriction noose or a button hole like phenomenon for the head of the metacarpal preventing its reduction[6-10]. Attempt to do closed reduction in these situations will tighten the noose around the head. Hence open reduction is imperative in this condition.

The index finger is most commonly affected[11,12]. Next commonly affected is the little finger. However the ring & the middle fingers escape isolated injuries due to support from neighbouring digits & strong deep transverse metacarpal ligaments[13].Proper clinical examination & radiological assessment is a must to identify this condition & treat with accordance, as discussed below. Two primary approaches have been described for open reduction - the dorsal & the Volar. It is the volar approach which is widely used & described more in literature[6,8,14,15] & there still is a debate on the right approach to treat such

lesions[10,16,17]**.** Volar approach is precarious to injure the neurovascular structures hence some prefer dorsal approach[7,9,13]**.** We in our institute at Hassan institute of medical sciences treated 5 patients of Kaplan's lesion with dorsal approach between May 2013 to June 2014. Aim of the study was to assess the feasibility, acceptability & ease of reducing the dislocation, fix the associated subchondral fractures if any & also note the complications

MATERIAL AND METHOD

The study was conducted at Hassan institute of medical sciences between May 2013 & June 2014. Five patients who presented to our orthopaedic outpatient department with this condition were included in this study. All of them were adequately examined & radiographs were taken to assess & confirm the diagnosis. One patient had an associated ostochondral chip fracture of the head of the metacarpal while a 14 year old patient had a break in the metacarpal epiphysis. The clinical signs included mild hyper-extension & ulnar deviation attitude of the finger with severe tenderness & restricted movements at MCP joint of the index finger. IP joints had a mild flexed attitude with fairly free movements, however due to pain &swelling, they were restricted. Typical pathognomonic sign of puckering of the palmar skin was noted[14]with head of the metacarpal palpable underneath **(Fig-1)** while dorsally there was a void**.** Sensations of all fingers were intact. Motor powers in all cases were adequate & within normal limits compared to opposite side. No vascular impediment was noted pre-operatively in all cases. Plain radiographs showed ulnar deviation of the base of the phalanx& widened joint space in Antero-posterior view while the lateral view showed dorsal dislocation with head of the metacarpal dug into the palm **(Fig-10)**. Presence of sesamoid interposition within the MCP joint is typical in these lesions best visualized in oblique views. The patients were admitted as in-patients & routine blood investigations were done.

After clearance by the physician & with adequate fitness from the anaesthetist, patient was posted for surgery with proper written consent. Open reduction is the treatment of choice here but a trial of closed reduction was also done though contraindicated. All the cases failed to reduce with closed reduction indicating the need for open reduction. All of them were operated within 2 days of admission.

METHOD

Patient was positioned supine. Regional anaesthesia was used in all cases in the form of brachial block. Tourniquet was used to obtain bloodless field during surgery. The hand was prepared, scrubbed, painted & draped in usual fashion to have an aseptic field.Dorsal approach in the form of curvilinear shape was used **(Fig-2).** The extensor mechanism **(Fig-3)** on the ulnar side was identified & incised **(Fig-4)**. The capsule was visible; it was carefully incised longitudinally usually with a 11 or 14 number blade**.** The collateral ligaments may be caught within the joint which may need release. We were able to gently retract them aside. Then the volar plate was visible which was strong, taut, shiny& glistening white in colour resembling the capsule **(Fig-5)**. This volar plate was completely dorsally dislocated. A longitudinal incision was made over the plate in the centre & with a small retractor or a curved small artery forceps the head of the metacarpal was gently elevated & allowed to relocate between the cut ends of the plate **(Fig-6).** The leaflets of the plate move away ulnar & radial ward allowing the relocation to occur concentrically. Stability & adequacy of the reduction was noted by moving the finger in flexion & extension & by direct visualisation under naked eye **(Fig-7).** Cutting of the notatory ligament & superficial transverse metacarpal ligament as advocated by Kaplan[4] was not done in any of our cases as it was not required. We had 2 cases of associated fracture. One patient had an osteochondral fracture a thin flake of bone on the dorsal aspect which was resutured with vicryl stitch. The other patient had a Slater Harris type 3 fracture of the metacarpal head which was fixed with a small K wire. The wire was left outside which was pulled out after 3 weeks. Following reduction the wound was washed thoroughly & sutured **(Fig-7).**

Puckering of the skin on the volar side & void on the dorsal side disappears as joint relocates **(Fig-8).**The capsule was re-sutured & the ulnar part of the extensor mechanism was reconstructed using vicryl sutures. This is to prevent instability & iatrogenic subluxation or dislocation. The finger was kept in finger cot extension splint with wrist in 15^0-20^0 of extension, 70-90^0 flexion at MCP joint & IP joints in full extension. No neurovascular damage was noted.

FOLLOW-UP

Gentle mobilisation of the finger was started initially only for few minutes in a day after post-operative day-3 once the surgical pain reduced & the surgical wound had settled. Gradually this was progressed to many times & several minutes in a day. Patient was discharged on the 3rd to 5th Post-Operative day. The sutures were removed on 14th post-operative day & the splint was discarded after 3 weeks allowing full mobilisation **(Fig-9)**.

Patient was followed weekly for the first 3 weeks & later once a month for 3 visits. Total visits would be around 6 & the duration of follow-up would be around 3.5 to 4 months. Check X-ray was done once post-operatively **(Fig-11)** for all patients & those with associated fractures it was done at 1 & 3 months to note the union. Physiotherapy in the form of strengthening exercises was started after 6 weeks & once patient had regained >70% of previous movement.

Figure 1: Pre-operative Showing puckering & deformity

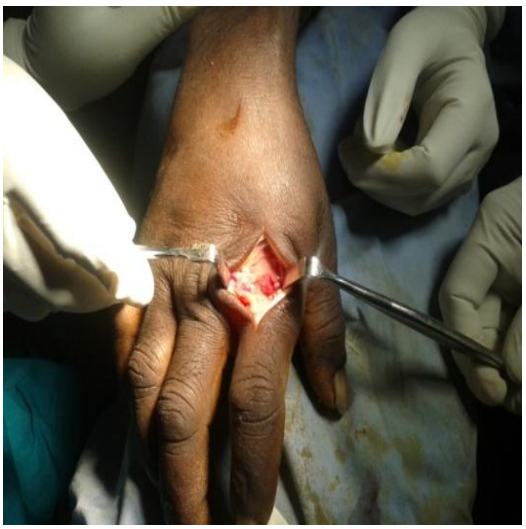

Figure 4: Extensor expansion cut on ulnar side & retracted

Figure 2: Skin incision (Curvilinear dorsal side)

Figure 5: Volar plate visualized

Figure 3: Extensor expansion is visible

Figure 6: Relocation of head of metacarpal (MCP Joint)

Figure 7: Closure of the wound with full motion

Figure 8: Disappearance of puckering post OP.

Figure 9: Patient after Suture removal with good range of movement

Figure 10: Pre-operative X-ray picture

Figure 11: Post-operative X-ray.

Table 1: Age and sex distribution

sex/age	Male	Female	Total
14-25y	1	0	1
26- 35y	0	1	1
36-45y	2	0	2
>45y	1	0	1
TOTAL	4(80%)	1(20%)	5(100%)

Table 2: Mode of injury

Direct injury	3
Road traffic accident	2
Total	5

RESULTS

The 5 patients with Kaplan's lesion included in this study were treated surgically by dorsal approach. 4(80%) of them were males & 1(20%) was female. All of them were between 14 to 48 years of age (Table-1). All injuries were reported within 24 hours. We had 3(60%) cases sustained due to direct injury while the

other 2(40%) sustained the injury following a road traffic accident (Table-2). 3(60%) of them had isolated dorsal dislocations. 2(40%) had associated fractures of them one had an osteochondral fracture while the other had fracture epiphysis of the metacarpal head Slater Harris type 3.All of them underwent open reduction by dorsal approach. Only the epiphyseal injury was fixed with a K-wire. Follow-up was done upto 4 months of injury. Wounds were healed by 2 weeks without any complications of infection, re-dislocation or neurovascular injury. Active movements of the fingers were started by 3rd post-operative day once the post-operative pain & the wound had relatively settled down. Check dressing was done on 5th post-operative day. The range of motion exercises was gradually increased day by day. Initially we noticed resistance in 2 patients due to pain. However with the help of the physiotherapist & proper counselling we were able to overcome it. Full active & passive range of exercises was started after the removal of finger cot extension splint (i.e. after 3 weeks). K wire was removed after 3 weeks in 14 year old boy. Average range of movement noted was $10\text{-}70^0$ of extension to flexion at the MCP joint level at the end of 4 months. At the level of proximal interphalangeal joint the average movement noted was $0\text{-}80^0$ & at distal interphalangeal joint it was about $0\text{-}70^0$. There were no incidences of sensory loss. Grip, hook & pinch strength were adequate in all patients except one with epiphyseal injury who had a mild weakness in pinch strength compared to opposite side. However we did not quantify them. No motor deficits were noted in any patient. Union of the osteochondral fracture & healing of the epiphyseal injury occurred within 6 weeks. All patients returned to their pre-functional status by 8 weeks period. The sample size is small & hence statistical analysis for any of the above variables cannot be concluded, but as the condition is rare & this approach has relevance with relation to the ease of reduction & avoiding neurovascular injury was our inference & aim.

Complications were noted in the form of restriction of motion in one patient who was very apprehensive in moving the finger due to pain. However he ended up with 60^0 of flexion with 15^0 of extension at the end of 4 months of follow up. He was also able to carry out his pre-injury stationary work as before without any problem. The patient with epiphyseal injury had a mild deviation of finger while making a fist towards ulnar side; however he had regained full motion. This may be due to mild malunion but nevertheless could not be termed as a significant complication. All other patients had regained full, painless movement & function of the finger.

DISCUSSION

Kaplan's lesion is a rare injury. This injury commonly involves the index finger at the Metacarpophalangeal joint. Kaplan was the first to describe this injury wherin the tight capsulo-ligamentous structures prevent the closed reduction necessitating open reduction[4]. Forcing closed reduction here further tightens the anatomical structures around the metacarpal head & prevents reduction. Two main approaches have been described for open reduction-volar & dorsal. Plenty of literature has been written on volar approach by Kaplan & other authors[6,8,10,15-21]. In this approach it was required to extensively release the volar structures along with the volar plate. The primary impediment & the risk to radial neurovascular bundle (digital nerve & vessel) was high. This made others to think of dorsal approach[7,9,13]. In dorsal approach the risk of injury to the neurovascular bundle is much less as it lies between the MC head& skin volar wards. It was Becton et al[7]who reported a series of 9 cases complex MP joint dislocations treated by both approaches. He found that few patients treated with volar approach had a sensory loss on the radial aspect of the injured finger while those treated with dorsal approach had full recovery with normal function. He concluded that dorsal approach was the right approach to treat such lesions.

Kaplan also advocated the need to release the superficial transverse metacarpal ligament & distal transverse fibres (Notatory ligament). De Coster[22,23] noted that it was not required to release them unless they obstruct or interfere in reduction. Further, the risk of iatrogenic dislocation following release of ligaments is also reported. In our series, reduction was achieved without release of the above ligaments &hence the ligaments were left intact & no re-dislocation occurred.

The deep transverse metacarpal ligament is also an important impediment for reduction at times. It was Murphy[18] who reported the role of volar subluxation of deep transverse metacarpal ligament which forms a part of the noose around the head of MC & prevents reduction. This also needs release if it prevents reduction. We, in our series, did not encounter such problem & hence did not release it.

Management of osteochondral fractures was much easier in dorsal approach. Becton & Bohart[7,9] noted associated osteochondral fractures in 50% of these lesions. Most often these fracture fragments are on the dorsal side & are ideally addressed by dorsal approach. We, in our series, also had 2 fractures in the metacarpal which were adequately managed with dorsal approach with ease.

The main culprit of this lesion as discussed earlier is the volar plate which dislocates dorsally & lies between the joint which prevents the reduction. In dorsal approach it can be directly visualised by the naked eye as a glistening white structure similar to the capsule. Care should be taken to identify it properly & incise it longitudinally to facilitate reduction.

Volar plate, as mentioned earlier provides stability to the joint volar wards; longitudinal splitting of this volar plate is usually criticised as it causing

delay in recovery, needs more immobilisation &leads to instability of the joint which may result in iatrogenic dislocation or subluxations later[24]. However, this is only theoretical & there are no reports yet suggesting such complications. We also did not come across any such problem & also the final outcome did not change. We have rather ignored this comment & with our regular rehabilitation protocol we were able to get back good range of motion at the earliest.

CONCLUSION

To conclude Kaplan's lesion is a rare injury. Closed reduction is usually futile. Open reduction is the choice of treatment. Two approaches have been described – volar & dorsal. We opine that dorsal approach is better as injury to neurovascular bundle is nil, better visualisation of the volar plate & joint, fixation of the associated fracture is possible with ease & requires no further release of other ligamentous structures. Longitudinal splitting of the volar plate does not cause any instability of the joint or delay in healing. Hence we conclude that this may be the ideal approach for treating Kaplan's lesion, however our series is small to statistically analyse & more studies regarding comparison of both volar & dorsal approaches may be needed to further assess & opine regarding the ideal approach.

ACKNOWLEDGEMENTS

We sincerely thank our colleagues Dr. Poornachandra, Dr SC Kiran (Sr Res), Dr Lokesh P & Dr Somshekar (Jr Res) for helping & supporting us do this work.Our sincere thanks to our principal Dr. Ravikumar for encouraging us & lastly we thank our beloved Director Dr. Rachegowda for allowing & guiding us throughout.

Conflicts of Interest: NIL
Funding: NIL

REFERENCES:

1. Green DP, Butler TE Jr. Fractures & dislocations in the hand. Rockwood C.A. Jr, Green DP, Bucholz RW, Heckman JD. Fractures in adults. 4th editionVol 1. Philidelphia PA; Lippincott-Raven, 1996: 607-700.
2. Eaton RG. Joint injuries of the hand. Springfield III., Charles C. Thomas, 1971.
3. Farabeuf LHF. De la luxation du ponce enarriere, Bull. Xoc. Chir, 1876; 11: 21-62. Kaplan EB. Dorsal Dislocation of the Metaxarpophalangealjoing of the Index finger. J. Bone joint Surg, 1957; 39A: 1081-86.
4. Baldwin LW, Miller DL, Lockhard LD, Evans EB. Metacarpophalangeal Joint Dislocations of the Fingers. J. Bone and Joint Surg; Dec: 1967; 49-A: 1587-90.
5. Al-Qattan MM, Robertson GA. An anatomical study of the deep transverse metacarpal ligament. J Anat. 1993; 182 (pt 3): 443-446.
6. Johnson AE, Bagg MR. Ipsilateral cimplex dorsal dislocations of the index and long finger metacarpophalangeal joint. Am J Orthop. 2005; 34(5): 241-245.
7. Becton JL, Christaian JD Jr, Goodwin HN, Jackson JG III. A simplified technique for treating the complex dislocation of the index metacarpophalangeal joint. J Bone Joint Surg Am. 1975; 57(5): 698-700.
8. Barry K, McGee H, Curtin J. Complex dislocation of the metacarpo-phalangeal joint of index finger: a comparison of the surgical approaches. J Hand Surg Br. 1988; 13(4): 466-468.
9. Bohart PG, Gelberman RH, Vandell RF, Salamon PB. Complex dislocations of the metacarpophalangeal joint. ClinOrthopRelat Res. 1982; (164): 208-210.
10. Adler GA, Light TR. Simultaneous complex dislocation of the metacarpophalangeal joints of the long and index fingers. A case report. J Bone Joint SUrg Am. 1981; 63(6): 1007-1009.
11. Mclaughlin HL. Complex "Locked" dislocation of the metacarpophalangeal joints. J Trauma. 1965; 5(6): 683-688.
12. Deenstra W. Dorsal dislocation of the metacarpophalangeal joint of the index finger. Neth J Surg. 981; 33(5): 243-246.
13. May JW Jr, Rohrich RJ, Sheppard J. Closed complex dorsal dislocation of the middle metacarpophalangeal joint: anatomic considerations and treatment. PlastReconstr Surg. 1988; 82(4): 690-693.
14. Kaplan EB. Dorsal dislocation fo the metacarpophalangeal jint of the index finger. J Bone Joint Surg Am. 1957; 39(5): 1081-1086.
15. Baltas D. Complex dislocation of the metacarpophalangeal joint of the index finger with sesamoid entrapment. Injury. 1995; 26(2): 123-125.
16. Imbriglia JE, Sciulli R. Open complex metacarpophalangeal joint dislocation. Two cases: index finger and long finger. J Hand Surg Am. 1979; 4(1): 72-75.
17. Zemel NP. Metacarpophalangeal joint injuries in; fingers. Hand Clin. 1992; 8(4): 745-754.
18. Murphy AF, Stark HH. Closed dislocation of the metacapophalangeal joint of the index finger. J Bone Joint Surg Am. December 1967; 49(8): 1579-1586.
19. Miller PR, Evans BW, Glazer DA. Locked dislocation of the metacarpophalangeal joint of the index finger. JAMA, 1968; 203(4): 171-173.
20. Mudgal CS, Mudgal S. Volar open reduction of complex metacarpophalangeal dislocation of the index finger: a pictorial essay. Tech Hand UpExtrem Surg. 2006; 10(1): 31-36.
21. Ryan W. Patterson, Steven D. Maschke, Peter J. Evans, Jeffrey N. Lawton. Dorsal Approach for open reduction for Complex Metacarpophalangeal JointDislocations. http://www.healio.com/orthopedics/hand-wrist/journals/ortho/2008 November 2008, volume 31, Issue 11:1-6.
22. De Coster AT, McGrew D, Omer GE. Complex Dorsal Dislocation of the Metacarpophalangeal Joint: The Deep Transverse Metacarpal Ligament as a Barrier to Reduction. Iowa Orthop J, 1988; 8: 9-12.
23. AjitSwamy, Amit Swamy. Dorsal Approach for Dorsal Complex Metacarpophalangeal Dislocation of the Index Finger. http://dar.ju.edu.jo/jmj; J Med J December 2012; Volume 46(4): 347-350.
24. Barry K, McGee H, Curtin J. Complex Dislocation of the Metacarpophalangeal Joint of the Index Finger: A Comparison of the Surgical Approaches. J. Hand Surg, 1988; 13B: 466-468.