



## Kienbock's Disease treated with Interposition Arthroplasty using Ipsilateral Palmaris Longus Tendon and Muscle Belly

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### ABSTRACT

**Introduction:** Kienbock's disease is an osteonecrosis of lunate bone (lunatomalacia) seen more commonly in males in the second to fourth decade of life. The exact etiology is unknown and symptoms include wrist pain and stiffness of wrist. Advanced stages of disease may require lunate excision and filling of the void by various substitutes like silicone implants, tendon grafts etc. We report a case of Kienbock's disease with lunate excision and filling of defect by coiled palmaris longus muscle and tendon unit.

**Case Report:** An 18 year old male student presented with progressive wrist pain and difficulty in wrist movements. Investigations revealed a diagnosis of grade 4 Kienbock's disease. Lunate excision by a palmar approach followed by interposition arthroplasty with ipsilateral coiled Palmaris longus muscle belly along with the tendon was done under regional anaesthesia. Nine months post-operatively patient is pain free and wrist movements are full and free.

**Conclusion:** In advanced stages of Kienbock's disease lunate excision surgery is recommended. Post excision void can be filled with coiled Palmaris longus tendon-muscle unit together to increase the volume of the graft. This achieves snug fit, avoids the need of internal fixation, and also prevent carpal collapse. Our case shows good clinical outcome in short term with no carpal collapse by use of this procedure.

**Keywords:** Kienbock's disease, lunate excision, palmaris longus, interposition arthroplasty.

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### INTRODUCTION

Aseptic necrosis of the Lunate bone (Lunatomalacia) is also termed as Kienbock's disease. It's a rare disease of unknown etiology and occurs mainly in the age group between 20 – 40 years with males affected twice as commonly as females [1]. Kienbock in his original article noted that the disease is more common in laborers [2]. Nakamura described similar pattern with sports related Kienbock's disease [3]. Chronic repetitive trauma, especially in manual laborers, leading to damage to arterial supply of lunate is a common predisposing factor related to Kienbock's disease.

Treatment is based on the stage of the disease with surgery being preferred in advanced stages. Various treatment options have been proposed, none of them being proven completely effective. The treatment options include immobilization in cast [4], joint leveling by ulnar lengthening or radial shortening [5], revascularization of lunate [6], scaphotrapezio-trapezoid arthrodesis [7], scaphocapitate arthrodesis [8], vascularised bone grafting [9], lunate resection and vascularised bone capitate/pisiform [10], prosthetic replacement [11], proximal row carpectomy [12] and wrist arthrodesis [13].

Although the use of coiled tendon to fill the void created by excision of lunate has been previously described [14,15], we believe that this case is a unique report detailing use of coiled tendon along with the muscle belly to fill the void created by lunate excision.

### CASE REPORT

An 18 year old male presented with pain in his left (non-dominant) wrist for the past one year. The pain was progressively increasing in nature with difficulty in carrying out activities of daily living like holding a glass and toilet activities. Patient had no history of trauma or strenuous activity and no known risk factors for avascular osteonecrosis like deep sea diving, sickle



cell disease, Gaucher's disease, coagulation disorders, systemic lupus erythromatosus (SLE), high dose corticosteroid administration, and alcohol abuse. Clinical examination revealed tenderness over proximal carpal row. Wrist movements were painful and decreased range of motion with 30° of palmar flexion and 60° of dorsiflexion, in comparison to the uninvolved wrist. Patient had a Visual Analogue Scale (VAS) score of 6 for wrist pain.

Antero-posterior and lateral radiographs of the wrist showed a collapsed and sclerotic lunate bone with negative ulnar variance of the wrist (Fig.1). MRI revealed a diagnosis of grade 4 Kienbock's disease (progressive carpal collapse and osteoarthritis) according to the Lichtman et al grading system for Kienbock's disease [16] (Fig. 2).



**Figure 1:** Radiographs of the wrist showing collapsed, sclerotic lunate bone with negative ulnar variance of the wrist.



**Figure 2:** MRI showing grade 4 Kienbock's disease (progressive carpal collapse and Osteoarthritis).

Based on the grade of the disease, we treated the patient surgically by excision of lunate bone using a palmar approach under regional anaesthesia. Interposition arthroplasty with ipsilateral coiled Palmaris longus muscle belly and tendon was done. The palmar incision used to excise the lunate bone was extended proximally and the palmaris longus

muscle was identified and detached from its origin, keeping the insertion of the palmaris longus tendon intact. The muscle belly along with the tendon was coiled and placed into the void created by the excision of lunate (Fig. 3A & B). Since tendon and muscle belly



**Figure 3A:** Clinical photograph showing lunate bone exposed



**Figure 3B:** Clinical photograph showing excision of lunate bone

rolled combined formed a good size roll, it fitted snugly in the void and we felt no need for temporary K wire fixation. Postoperatively, wrist was immobilized in a cast for four weeks. Patient subsequently underwent physical therapy to improve strength and range of motion of wrist. Nine months postoperatively, the patient was relatively pain free with a VAS score of 2 as compared to VAS score of 6 pre-operatively and was able to carry out most of his routine activities. The radiograph at final follow-up [9 months post surgery] showed no carpal collapse (Fig. 4A). Palmar flexion and dorsiflexion at final follow up were 25° each (Fig. 4C & D).



**Figure 4A:** Post operative radiograph of the wrist showing no obvious carpal collapse. Post operative Clinical photograph showing the scar [4B], wrist palmar flexion [4C] and wrist dorsiflexion [4D].

**DISCUSSION**

Kienbock's disease was first described by Robert Kienbock in 1910 as a traumatic softening of lunate bone [2]. It is a form of ischemic necrosis probably due to chronic stress or injury. Negative ulnar variance at



the wrist has been proposed as the most important mechanical risk factor for Kienbock's disease. It predisposes to axial stress overload of lunate due to inadequate transmission of force from the ulna to the wrist [17].

As a part of reparative process there is a zonal osteopenia of lunate which is the basis for pathological fracture. The fibrovascular tissue at the fracture site fails to ossify leading to separation and osteonecrosis resulting in bone collapse. Collapse of lunate is associated with carpal instability and decrease in height of proximal carpal row. This finally results in osteoarthritis of radiocarpal joint leading to pain, stiffness and restricted wrist movements [18]. Lichman Classification [16] which is a modification of Stahl classification [19] has proven reproducibility and is reliable [20,21]. According to this classification, Kienbock's disease is classified into 4 stages [16] based on radiological findings - 1. Radiographic findings are normal, diagnosis may be by MRI, 2. Increased radiographic density, no distortion of shape, 3. Lunate collapse without or with carpal instability, and 4. Disruption on radio-carpal congruence and osteoarthritis.

The treatment of Kienbock's disease is determined by the stage of the disease [17]. Surgical treatment is advocated in advanced stages of the disease and the aim of surgery is to reduce the axial stress load on the lunate, avoid further fragmentation and collapse and thereby, promote revascularization of lunate [22]. Joint leveling procedures are recommended for stage 2 and stage 3a Kienbock's disease [5]. However the role of this procedure in stage 3b (with associated carpal instability) is debatable [23]. In late stages of Kienbock's disease with carpal osteoarthritis this procedure is not very effective and a salvage procedure is recommended [24]. Recently advocated is the use of vascularised bone grafts from the distal end of the radius with excellent results being achieved [9].

Excision of lunate is a time tested procedure recommended for late stage Kienbock's disease which results in pain relief and functional improvement. However, filling the void with a coiled tendon after excision of the lunate is recommended to prevent carpal collapse [14, 15]. Silicone replacement arthroplasty vascularised pisiform transposition and coiled tendon grafts are current methods of filling the void. Silicone replacement arthroplasty increases the cost involved in the procedure and the results are not encouraging due to silicone synovitis and subsequent carpal collapse [10]. Interposition arthroplasty with a biological material like transposed vascularised pisiform (Saffars procedure) have also been described [11]. However, this procedure is technically

difficult when compared to interposition arthroplasty using a coiled tendon. Coiled tendon grafts are currently the procedure of choice and Palmaris longus tendon is preferred as the graft can be harvested through the same incision. One major issue with palmaris longus tendon is that the volume is often insufficient [25] and in our case too, after excision of lunate bone the void created was too large to be filled with coiled palmaris longus muscle tendon alone. Hence coiled palmaris longus muscle belly along with the tendon was used, to fit snugly into the void created in the hope to reduce the chances of post operative carpal collapse. Literature mentions the use of coiled tendon to fill the gap created by excision of Lunate [14, 15] and Yajima et al [25] have used a bone core tendon roll to increase the volume of Palmaris roll. However extensive search did not reveal the use of coiled tendon along with the muscle belly. Hence we believe that this is a unique case to report the use of coiled tendon along with the muscle belly in order to fill the void after lunate excision. We also believe the snug fitting of the tendon-muscle roll will prevent early collapse and hence no K wire fixation was used in our case. At 9 months follow up no obvious carpal collapse supports our theory.

## CONCLUSION

Late stage Kienbock's disease can be successfully treated with lunate excision and interposition arthroplasty using the ipsilateral coiled palmaris longus tendon and muscle belly to give excellent functional results in the short-term.

## CLINICAL MESSAGE

*Coiled Palmaris tendon-muscle unit forms a good volume to snugly fit the void created by lunate excision for Grade 4 Kienbock's disease. This large volume and snug fit is enough to avoid carpal collapse and may not require temporary K wire fixation. Short term follow up of use of this technique in single patient has shown good result. However, long-term follow-up is necessary to determine the extent of carpal collapse and functional loss which may occur over time.*

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