TREATMENT OF STAGE II KIENBOCK’S DISEASE WITH VASCULARIZED DORSAL RADIUS BONE GRAFT - A CASE REPORT

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Abstract

Introduction: Treatment of Kienbocks disease is based on staging but still lacks proper consensus regarding the modality to be used. Revascularization alleviated the need for second surgery and maintains the normal integrity of the carpal row with good to excellent results. We report a case of stage II Kienbock’s disease treated with 2,3 ICSRA graft.

Material & Methods: 36 year old female presented with complaints of pain in Left wrist joint with a history of previous trauma. She was diagnosed clinoradiologically with Stage II Kienbock’s disease. Vascularized pedicled bone graft with 2,3 ICSRA was performed with a good functional outcome at the end of 2 years.

Conclusion: Superficiality to the extensor compartment makes 2,3 ICSRA an ideal graft with adequate access and good length of the graft thus abating the need for salvage procedures in early cases of lunatomalacia.

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INTRODUCTION
Keinbock’s disease is eponymous for avascular necrosis of the proximal carpal row lunate bone, characterized with pain, sclerosis, fragmentation and collapse finally leading to pANCarpal arthritis[1]. It is also called as lunatomalacia due to the thinning of articular cartilage that occurs as a result of decreased blood supply to the bone. Albeit variety of the causative factors have been mentioned in the literature, the exact aetiology still remains unclear[2,3]. We hereby report a case of Kienbock’s stage II treated with autologous vascularized bone graft from dorsal radius.

CASE REPORT
A 36 year old female presented to the outpatient department in May 2014 with complaints of pain in Left wrist joint since past 1 year. There was a history of antecedent trauma 1 year ago for which she was treated symptomatically. There was no history of constitutional symptoms. On examination, there was localized tenderness over the dorsal aspect of lunate, weakness in grip strength and restricted movements. The antero-posterior drawer test was negative and there were no signs of synovitis or arthritis seen clinically. Her x rays were suggestive of sclerosis in the lunate bone with minimal changes in the shape of the bone and thus a diagnosis of stage II Kienbock’s was made (Figure 1). After her preliminary work-up was done, she was planned for a revascularization procedure.

Fig 1: Pre-operative Stage II x ray
Surgical Technique-

The surgery was performed under general anaesthesia combined with interscalene block. Pneumatic tourniquet was used and the limb was exsanguinated without esmarch bandage. A dorsal approach with 8cm incision centered over the wrist was used. Listers tubercle was the exposed taking care to protect the veins overlying the tubercle. The second and third extensor compartment was then identified and Intercompartmental supraretinacular artery was then exposed and isolated. The pedicle of the graft was then exposed with utmost care and was elevated. After performing capsulotomy at the scapholunate area, the necrosed lunate bone was exposed. Curettage was then performed gently, keeping some part of the articular shell intact. The shell was then filled with the vascularized graft along with its pedicle, maintaining the height of the lunate bone. The capsule was then closed meticulously and a bulky dressing along with a below elbow slab was applied. Check dressing was done on second post-operative day. The slab was converted to a cast after suture removal, 14 days post-operatively which was then kept for 6 weeks. Gentle gradual assisted passive followed by active physiotherapy was then commenced after cast removal. The vascularized bone graft was found to get consolidated on the follow-up x-rays. The final results were calculated using the Disabilities of the Arm, Shoulder and Hand scoring system (DASH score)\textsuperscript{[4]}\textsuperscript{[4]}.The pre-operative DASH score was 87.5, which gradually reduced to 68.3, 55, 35.3 and 17.5 at 3, 6, 12 and 24 months follow-up respectively.Thus, the patient had better functional and radiological outcome with no signs of recurrence at two yearly follow-up.

DISCUSSION

Ever since Robert Kienbock, an eminent Radiologist from Austria published his preliminary work on lunatomalacia, the aetiology continues to be a dilemma even today\textsuperscript{[5]}. The disease is said to be more common in young adults with more dominance among the male gender. Various hypothesis have been proposed which can lead to avascular necrosis of the lunate namely Vascular and the mechanical factors\textsuperscript{[5]}, metabolic factors\textsuperscript{[6]} and biological factors\textsuperscript{[7]}. Extrinsic factors such as negative ulnar variance, flat radial inclination and repetitive trauma and intrinsic factors such as underlying arthritis and vascular disturbances can lead to lunatomalacia.

Precarious blood supply to the lunate bone plays a major role in the pathogenesis apart for the other extrinsic factors like repetitive trauma. As per the findings of Gelberman et
people with I shaped blood supply are more prone to avascular necrosis.

The diagnosis of lunatomalacia is often aided by investigations like x rays and MRI. The severity of the disease can be assessed on x ray by Litchman’s modification of Stahl’s staging, which also helps in determining the treatment plan (Table 1).

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<thead>
<tr>
<th>Staging</th>
<th>X ray finding</th>
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<td>I</td>
<td>Normal</td>
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<tr>
<td>II</td>
<td>Sclerosis of the lunate bone with preservation of the shape and relationship of the bones</td>
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<td>IIIa</td>
<td>Lunate collapse without carpal collapse</td>
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<tr>
<td>IIIb</td>
<td>Static carpal collapse</td>
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<tr>
<td>IV</td>
<td>Extensive Osteoarthritic changes</td>
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Table 1: Litchman’s modification of Stahl’s staging

Treatment for lunatomalacia can be either conservative or operative. Usually the patients with stage I disease, respond well to the conservative line of management with immobilization and cast application. Surgery is preferred for the patients who fail to respond to the conservative management and in patients with advanced disease. Surgeries can be mainly divided as procedures related to the lunate decompression, procedures related to the revascularization and salvage procedures.

Joint decompression procedures usually involve corrective osteotomy of radius or lengthening of ulna thus, reducing the compressive forces on the proximal carpal row. Salvage procedures involve either arthrodesis or arthroplasty and are usually reserved for terminal stages.

Revascularization procedures usually involve removing the necrotic part of the bone and replacing the same with either a bone graft which can be vascularized or free microvascular type. These procedures are indicated in patients with Stage II, IIIA and even in some cases of stage IIIB lunatomalacia as an adjuvant to mechanical procedures like radial shortening and can be used in cases of negative ulnar variance. They have a good success rate in patients with intact shell of lunate bone and those without severe fragmentation. Vascularized grafts are contraindicated in grade IV cases with pancarpal arthritis and relatively contraindicated in patients with previous radial surgery at the dorsal aspect with compromised blood supply. Graft harvested from pisiform, radial metaphysis, second metacarpal head have also been described in
the literature. The pedicled vascularized bone grafts usually have an advantage that they alleviate the need for a second surgery as the vascularity is restored immediately. There are three important criteria’s for a successful acceptance of vascularized graft. First is that graft should have an adequate length without undue tension. Secondly, the pedicle must have a nutrient vessel to supply both cortical as well as cancellous bone. Lastly, the blood flow must be sufficient for the success of the technique. All of these criteria’s are successfully met by distal end radius and thus it acts as a good and effective donor site.

There are four dorsal vessels which arise from the radial artery and posterior division of anterior interosseous artery which can be utilized as pedicled vascularized graft from distal end radius. The vessels from the superficial extensor compartment are 1,2 Intercompartmental supraretinacular artery (ICSRA) and 2,3 ICSRA and the deep vessels which are located at the floor of the extensor compartment are 4th and 5th Extensor compartmental arteries (ECA). The superficial arteries usually have an antegrade flow, whereas the deep arteries have a retrograde flow of blood.

5th ECA is the largest of the four dorsal vessels but it seldom has a nutrient artery supply. However, when used in combination with 4th ECA, it provides an ideal length and large diameter which has been used extensively as a graft.

The 2,3 ICSRA which originates from the anterior interosseous artery or the posterior division of anterior interosseous artery and runs distally to anastomose with the dorsal radiocarpal arch and the intercarpal arch. This artery is superficial to the extensor retinaculum directly over the lister’s tubercle, which makes it easy to identify without extensive dissection. This graft provides an antegrade blood flow which gives a good source of revascularization. The presence of this artery has been proved to be 100% by Sheetz et al. in their study.

DASH score is a reliable method to assess the functional outcome post-operatively. The final DASH of the case in the present study was 24 which was comparable to the study by Tackin et al.

**CONCLUSION**

Treatment of Stage II Lunatomalacia by Pedicled Vascularized bone graft is a reliable and comparatively simple procedure as compared to other mechanical and salvage procedures. Superficiality to the extensor compartment helps to achieve an adequate access and good length of the graft thus
abating the need for salvage procedures in early cases of lunatomalacia.

Conflict of Interest:
There is no conflict of interest.
Informed consent was taken from the patient.

REFERENCES:
13. Sheetz KK, Bishop AT, Berger RA: