

Research Article: The Role of Lunate Morphology in the Severity of Kienböck Disease: A Retrospective Study



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ABSTRACT

Background: Lunate morphology has been associated with several wrist pathologies. In this study, we aimed to find how lunate morphology (absence or presence of hamate facet) affects the severity of Kienböck disease.

Objectives: Evaluation of the relationship between lunate morphology and kienbocks disease.

Methods: A total of 106 patients with stage IIIA or IIIB of Kienböck disease at initial presentation were included in this study. Modified Litchman classification system and standardized lateral radiographs were used for staging the Kienböck disease. Lunate morphology was investigated on plain radiograph and computed tomography scan or magnetic resonance imaging and was classified into type I (absence of hamate facet) and type II (presence of hamate facet).

Results: The Mean±SD age of the patients was 33.5±9.2 years. Kienböck disease stage IIIA and IIIB were identified in 68 (64.2%) and 38 (35.8%), respectively. Hamate facet was present in 65 (61.3%) patients and absent 41 (38.7%) patients. A significant association was found between lunate morphology and stage of disease so that the number of patients with lunate type I was significantly more in stage IIIB and number of patients with lunate type II was significantly more in stage IIIA (P<0.001).

Conclusion: Lunate morphology is associated with the severity of Kienböck disease in patients initially presented with stage IIIA or IIIB. These associations could be implicated to prevent disease progression as well as to optimize the outcome of treatment.

1. Introduction

Kienböck disease, also known as avascular necrosis of lunate, is a condition in which the lunate loses its blood supply result-

ing in the necrosis of the lunate bone. Kienböck disease is associated with pain, swelling, and increased risk of fracture, and in late stages with carpal osteoarthritis [1]. It is an almost rare disease with a prevalence of less than 5 in 10,000 people [2].

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Despite the identification of the disease entity over 100 years ago, the etiopathogenesis of Kienböck disease is still uncertain. Even so, it has been associated with a variety of predisposing factors including single trauma, repetitive microtrauma, damage to the lunate blood supply, corticosteroid use, negative ulnar variance, decreased radial inclination, and lunate morphology [3-5]. Viegas et al. classified the lunate morphology based on the absence (type I) or presence (type II) of hamate facet at least 2 mm. They attributed the type II lunate with a higher risk of degenerative change at the proximal pole of the hamate [6]. Later, the lunate morphology was associated with greater scaphoid translation in type I and greater scaphoid flexion with radial deviation in type II [7, 8].

Recently, a connection was suggested to be present between the lunate morphology and severity of Kienböck disease so that type II lunates appeared to be protective against the disease progression [9]. This association may have therapeutic implications for the treatment of Kienböck disease. However, further evidence is required to more comprehensively understand the extent of such connection. In this study, we aimed to find if the lunate classification (absence or presence of hamate facet) associates with the severity of Kienböck disease and if yes, in what direction this association plays its role.

2. Methods

This retrospective study was approved by the review board of our institute, and informed consent was obtained from the patients to use their medical data for

publication. Between 2014 and 2018, patients who were referred to our center with a diagnosis of stage IIIA or stage IIIB of Kienböck disease were evaluated for eligibility criteria. Only patients with the radiologic confirmation of Kienböck disease were included. The exclusion criteria were a concomitant wrist ligamentous injury, history of inflammatory disease, and history of operation on the involved wrist.

Demographic and clinical characteristics of the patients were extracted from their medical records. A standardized lateral radiograph was used for carpal measurement so that radius-to-long finger metacarpal angle was fewer than 20° from the neutral position, and an appropriate scaphopisocapitate alignment was obtained. Modified Litchman classification system was used for staging the Kienböck disease. Accordingly, patients with a normal carpal alignment and height were considered as stage IIIA, while patients with fixed scaphoid rotation, decreased carpal height, and proximal migration of capitate was classified as stage IIIB [10].

Lunate morphology was investigated on plain radiograph and computed tomography scan or magnetic resonance imaging and was classified into type I (absence of hamate facet) and type II (presence of hamate facet) (Figure 1) [6]. Two fellowship-trained hand surgeons reviewed the radiographs for the typing of Kienböck disease as well as lunate morphology. In case the report



Figure 1. Anteroposterior radiographs of lunate showing the lunate morphology based on the absence or presence of the hamate facet

A. absence; B. presence

Table 1. Comparison of characteristics features of the patients of stage IIIA and IIIB of Kienböck disease

Variable	No. (%)		
	Stage IIIA	Stage IIIB	P
Age (year: Mean±SD)	33.2±9.6	34.1±9	0.62
Gender	Male	22 (57.9)	0.37
	Female	16 (42.1)	
Mean disease duration (year: Mean±SD)	2.2±11.1	2.5±12.4	0.26
Involved wrist	Right	26 (68.4)	0.14
	Left	12 (31.6)	
Lunate morphology	Type I	25 (65.8)	<0.001
	Type II	13 (34.2)	

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of two observers did not match, a third observer was involved in reaching a consensus.

Statistical analysis

SPSS V. 16 was used for the statistical evaluation of data. Descriptive statistics were provided as Mean±SD or number and percentage. Comparison of the mean values between the quantitative variables was done using an independent t-test or its nonparametric equivalent (Mann-Whitney U test). Qualitative variables were compared using a chi-square test or Fisher exact test whenever the low expected cell counts were observed. All statistical tests were two-sided, and a P-value of fewer than 0.05 was considered as statistically significant.

3. Results

A total of 106 patients with a confirmed diagnosis of Kienböck disease were included in the analysis. The Mean±SD age of the patients was 33.5±9.2 years, ranging from 12 to 63 years. Study population included 65 males (61.3%) and 41 females (38.7%). The disease was on the right side in 64 (60.4%) patients and the left side in 42 (39.6%) patients. Hamate facet was present in 65 (61.3%) patients and absent 41 (38.7%) patients. Stage IIIA and IIIB of Kienböck disease were identified in 68 (64.2%) and 38 (35.8%), respectively. Characteristics features of the patients of stage IIIA and IIIB are demonstrated in Table 1.

No significant difference was observed between the characteristic features of the patients of stage IIIA and IIIB (Table 1). A significant association was found between lunate morphology and stage of disease so that the number of patients with lunate type I was significantly more in stage IIIB of Kienböck disease (P<0.001)

(Table 1). Lunate morphology was not associated with the gender of the patient (P=0.56). The stage of disease was not associated with the demographic characteristics of the patients such as age, gender (P=0.39 and P=0.58, respectively).

4. Discussion

The primary goal of treatment in Kienböck's disease is to revascularize the lunate to prevent disease progression. Although many forms of surgical treatments have been described, there is no strong evidence to support any particular treatment over the others [11]. In this dilemma, identification of the disease risk factor could be regarded as a valuable choice to prevent disease progression and reduce the disease health and financial burden.

In this study, we aimed to evaluate how lunate morphology associate with the disease progression in Kienböck's disease. We included a series of 106 patients with Kienböck's disease of stage IIIA (68 patients) and stage IIIB (38 patients). The statistical analysis of data revealed a strong association between the stage of Kienböck's disease and lunate morphology so that the number of patients with lunate type I (absence of hamate facet) was significantly more in the stage IIIB. In another word, the results of the present study reveal that type II of lunate could be regarded as a protective factor against the progression of the Kienböck's disease.

Viegas et al. reviewed the incidence of hamate facet and any associated pathologic conditions in 165 cadaveric wrists. Based on their results, type I and II of lunate were seen in 34.5% and 65.5% of patients, respectively [12]. A range of 27%-73% for the type II lunate has been reported in the subsequent investigations [13-15]. Kato et al. in patients with radiographic findings consistent

with Kienböck disease noticed a prevalence of type II lunate in 26% of the unaffected wrist [16]. Rhee et al. reported a 29% prevalence of a type II lunate in the involved wrist of patients with Kienböck disease [9]. The prevalence of type II lunate was 61.3% in patients the present series.

Rhee et al. aimed to determine the role of lunate morphology on the radiographic characteristics of Kienböck disease in a retrospective study of 106 patients. At the presentation, patients with type I of lunate had significantly more advanced disease so that 41.3% of patients with type I lunate were categorized as stage IIIB or greater, versus 29% of patients with type II lunate. Coronal fracture of the lunate was also more prevalent in type I lunate. They concluded that lunate morphology affects the severity of Kienböck disease, and type II of the lunate seem to be protective against the progression of the disease [9]. Similar to the study of Rhee et al. the results of the present study revealed that patients with type II of the lunate at initial presentation might experience less severe disease so that lunate type II was identified in 76.5% of the patients who were categorized as stage IIIA and 34.2% of patients who were detected with type IIIB of Kienböck disease.

Based on the provided evidence, a type II lunate could also result in a better outcome in early stages of disease (II-III A), as classically, stage II-III A of Kienböck disease are managed with unloading or joint leveling procedure. However, in higher stages (IIIB or IV), which carpal malalignment or degenerative change is present, wrist arthrodesis is the main choice of treatment [17].

The present study was not without limitation. The main limitation of this study was the retrospective nature of the study. For this limitation, we were not able to follow patients and monitor disease progression. Thus, further steps to more comprehensively evaluate the role of lunate morphology in the progression of Kienböck disease would be to perform a prospective study. A longitudinal study also provides an opportunity to evaluate the effect of the lunate morphology on the outcome of treatment.

5. Conclusion

Lunate type I was more frequent in patients initially presented with stage IIIB of Kienböck disease, whereas lunate type II was more prevalent in patients who were initially presented with stage IIIA. These results suggest that lunate morphology is associated with the severity of Kienböck disease and could be used to prevent disease progression and optimize the outcome of treatment.

However, longitudinal studies are required to confirm the results of present investigation.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles were considered in this article and all data used with patients permission.

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Authors' contributions

Sampling and methodology: Hooman Shariatzadeh; Data analysis: Farid Najd Mazhar; Writing the manuscript: Hanon Sadony; Paper writing, editing: Nima Bagheri.

Conflict of interest

The authors declared no conflict of interest.

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