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<td>辻本 慎</td>
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<td>著者</td>
<td>長崎大学 博士 医学 研究員</td>
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Epidemiology of Kienböck’s Disease in Middle-aged and Elderly Japanese Women

Ritsu Tsujimoto, MD; Junichiro Maeda, MD; Yasuyo Abe, MD, PhD; Kazuhiko Arima, MD, PhD; Masato Tomita, MD, PhD; Hironobu Koseki, MD, PhD; Eiji Kaida, MD, PhD; Kiyoshi Aoyagi, MD, PhD; Makoto Osaki, MD, PhD

The authors are from the Department of Orthopaedic Surgery (RT, JM, MT, HK, MO) and the Department of Public Health (YA, K Arima, K Aoyagi), Nagasaki University Graduate School of Biomedical Sciences, Sakamoto, Nagasaki; and the Department of Orthopaedic Surgery (EK), Aino Memorial Hospital, Ainochoukou, Unzen, Japan.

The authors have no relevant financial relationships to disclose.

Correspondence should be addressed to: Ritsu Tsujimoto, MD, 1-7-1 Sakamoto, Nagasaki 852-8501, Japan (r-tsujimoto@msb.biglobe.ne.jp).

E-mail address: tsuta@nagasaki-u.ac.jp
Abstract

Little research has been done on the prevalence of Kienböck’s disease, and there is no consensus on the relationship between Kienböck’s disease and negative ulnar variance. The goal of this cross-sectional study was to determine the prevalence of Kienböck’s disease in middle-aged and elderly Japanese women and to clarify the relationship between Kienböck’s disease and negative ulnar variance. The authors analyzed plain radiographs of both hands in women 40 years and older residing in the community to investigate the prevalence of Kienböck’s disease and the relationship between Kienböck’s disease and negative ulnar variance. Kienböck’s disease was seen in 7 of the 572 participants. In the group with Kienböck’s disease, ulnar variance did not differ significantly between affected (0.3 mm; SD, 1.5) and unaffected (0.3 mm; SD, 1.0; P=.285) sides. No significant difference was seen in ulnar variance values between the affected side in the group with Kienböck’s disease and the normal group (P=.118). The number or proportion of participants with negative ulnar variance did not differ significantly between the affected side in the group with Kienböck’s disease (3 of 7) and the unaffected side in the group with Kienböck’s disease (1 of 7; P=.237) and between the affected side in the group with Kienböck’s disease and the normal group (111 of 504;
P=.189) by chi-square test. The prevalence of Kienböck’s disease was 1.2% in middle-aged and elderly Japanese women. Negative ulnar variance is not a contributing factor to Kienböck’s disease.
Kienböck’s disease is more common in men, young people, and manual laborers, but epidemiologic research on the subject is scarce. To the best of the authors’ knowledge, there is little research on the prevalence of Kienböck’s disease, and the only relevant literature is a survey in Japan by Kiyoshige and Watanabe based on community health examinations and a survey in South Africa by Mennen and Sithebe based on examinations done in the hospital.

Various factors are believed to contribute to Kienböck’s disease, including fracture, repeated microtrauma, negative ulnar variance, and the pattern of blood supply to the lunate bone. However, the role of negative ulnar variance is rejected in some studies and there is no consensus on the relationship between Kienböck’s disease and negative ulnar variance.

The goals of this study were to determine the prevalence of Kienböck’s disease in middle-aged and elderly Japanese women and to clarify the relationship between Kienböck’s disease and negative ulnar variance.
Materials and methods

From 2001 to 2002, osteoporosis screening was provided for women 40 years and older who lived in the town of Oshima, Nagasaki Prefecture, Japan. Screening included measurement of height and weight, plain radiograph of both hands, and an interview questionnaire. Body mass index was calculated from height and weight. Age, presence of wrist joint pain, and handedness were obtained from the questionnaire.

The prevalence of Kienböck’s disease was investigated by identifying Kienböck’s disease and disease stage according to the Lichtman stage\textsuperscript{15} based on radiographic images of the front of both hands (posteroanterior view, with both hands imaged simultaneously on 1 film). Radiographic images were evaluated separately by 2 orthopedic surgery specialists (R.T. and J.M.). In case of disagreement in their evaluations, the specialists arrived at a final decision through mutual consultation.

Radiographic images were used to measure ulnar variance as the distance between the distal margin of the ulnar head and the line (d) perpendicular to the radial axis and passing through the central point (c) on the line connecting the anterior border (a) and the posterior
border (b) of the distal articular surface of the radius on the distal radioulnar articulation (Figure 1). Distances were measured in units of 1 mm and were classified as positive ulnar variance if the ulna was longer than the radius, negative ulnar variance if the ulna was shorter than the radius, and neutral if the radius and ulna were of equal length, based on Hultén’s classification.6

The group with Kienböck’s disease was compared with the normal group. The normal group excluded participants without Kienböck’s disease whose radiograph showed injury, osteoarthritis, or rheumatoid arthritis of the wrist joints and those whose ulnar variance could not be measured because of poor imaging. In this group, ulnar variance was defined as the mean value of the left and right hands. In the group with Kienböck’s disease, ulnar variance was determined separately on the affected and unaffected sides.

Ulnar variance values of the affected and unaffected sides in patients with Kienböck’s disease and age, height, weight, body mass index, and ulnar variance in the group with Kienböck’s disease and the normal group were compared with the Mann-Whitney U test. The proportion of negative, neutral, and positive ulnar variance in the normal group and the affected and unaffected sides in the group with Kienböck’s disease were compared
with a chi-square test.

The correlation between age and ulnar variance in the normal group was also analyzed. P<.05 was set as the level of significance for each test.

The study was conducted with the approval of the ethics committee at the authors’ institution. Participants gave informed consent for the effects of radiograph exposure of the hands and were informed that the radiograph and the questionnaire were obtained for a research project only.

**Results**

Screening included 572 women, with mean age of 64.8 years (SD, 10.5 years; range, 40–91 years). Kienböck’s disease was seen in 7 of the 572 participants (1.2%), with mean age of 70.6 years (SD, 8.7 years; range, 61–85 years). The normal group (as defined in Materials and Methods) had 504 participants (mean age, 64.5 years; SD, 10.8 years; range, 40–91 years).
In the group with Kienböck’s disease, there were 4 participants at Lichtman stage II, 1 at stage IIIa, and 2 at stage IIIb. The affected side was the dominant hand in 4 cases and the nondominant hand in 3. None of the participants with Kienböck’s disease had pain in the wrist joints. On the side affected by Kienböck’s disease, ulnar variance was negative in 3 cases, neutral in 2, and positive in 2 (Table 1).

In the group with Kienböck’s disease, ulnar variance did not significantly differ between affected (0.3 mm; SD, 1.5 mm) and unaffected (0.3 mm; SD, 1.0 mm; P=.285) sides (Table 2). Age, height, weight, and body mass index did not differ significantly between the group with Kienböck’s disease and the normal group. No significant difference was seen in ulnar variance values between the affected side in the group with Kienböck’s disease and the normal group (P=.118) (Table 3).

The number or proportion of participants with negative ulnar variance did not differ significantly between the affected side in the group with Kienböck’s disease (3 of 7) and the unaffected side in the group with Kienböck’s disease (1 of 7; P=.237), and between the affected side in the group with Kienböck’s disease and the normal group (111 of 504; P=.189) by chi-square test (Table 4).

In the normal group, a weak correlation was seen between age and ulnar variance,
with a correlation coefficient of 0.089 (P=.047; Y=.012X-0.152) (Figure 2).

Discussion

To the authors’ knowledge, the current study is the first epidemiologic study of the relationship between Kienböck’s disease and ulnar variance in a community population.

There is little research on the prevalence of Kienböck’s disease. To the best of the authors’ knowledge, the only published studies are a survey by Kiyoshige and Watanabe targeting the residents of a particular area and a survey by Mennen and Sithebe including hospital-based examinations. Kiyoshige and Watanabe surveyed 520 local residents 65 years and older (201 men and 319 women) and found Kienböck’s disease in 13 residents (9 men and 4 women), a prevalence of 2.5% (4.5% of men and 1.3% of women). Mennen and Sithebe reported that of 1287 patients (734 men and 553 women; age range, 28–77 years) whose hands were radiographed during hospital visits within a 12-month period for problems unrelated to the upper limbs, 23 patients (14 men and 9 women) had Kienböck’s disease, a prevalence of 1.8% (1.9% of men and 1.6% of women). In the current study, the prevalence of Kienböck’s disease in middle-aged and elderly Japanese women was 1.2%, which is approximately the same as the rates for women reported by
Kiyoshige and Watanabe\textsuperscript{2} (1.3\%) and Mennen and Sithebe\textsuperscript{3} (1.6\%).

There is no consensus on the relationship between Kienböck’s disease and negative ulnar variance. Negative ulnar variance was identified as a contributing factor to Kienböck’s disease by some researchers,\textsuperscript{4,6–9} but was rejected by others.\textsuperscript{8,14}

The current study of middle-aged and elderly women in a community population found no significant difference in ulnar variance between the group with Kienböck’s disease and the normal group. Similarly, the proportion of participants with negative ulnar variance did not differ significantly between the group with Kienböck’s disease and the normal group. These results suggested that negative ulnar variance is not a contributing factor to Kienböck’s disease in middle-aged and elderly Japanese women.

Evidence of a correlation between age and ulnar variance was shown previously,\textsuperscript{8,14} and the current study found a weak correlation between age and ulnar variance in the normal group.
The current study had several limitations. At Lichtman stage I, no changes are visible on plain radiograph, and diagnosis requires magnetic resonance scan or bone scintigraphy.

Because this study used only radiographs, it is possible that the normal group included patients at Lichtman stage I and that the study underestimated the prevalence of Kienböck’s disease.

In addition, the number of participants could have been greater. A large-scale study would be needed to provide a fuller understanding of Kienböck’s disease.

Because measured values of ulnar variance are known to be influenced by arm position on radiographs, accurate measurement requires correct radiographic imaging of the wrist joints in the front view.\textsuperscript{16,17} This survey was based on community screening for osteoporosis, in which a single image was taken of the front of both hands simultaneously to measure bone density (radioabsorptiometry), rather than correct imaging of the hand joints in the front view. Therefore, the authors could not measure ulnar variance accurately, so the measured ulnar variance values are reference values. However, these values were useful for comparing the affected and normal groups.
Conclusions

In this study, the prevalence of Kienböck’s disease was 1.2% in middle-aged and elderly Japanese women. Because the prevalence of ulnar variance did not significantly differ between patients with Kienböck’s disease and those in the normal group, the authors concluded that negative ulnar variance is not a contributing factor to Kienböck’s disease.

References


4. Beckenbaugh RD, Shives TC, Dobyns JH, Linscheid RL. Kienböck’s disease: the


Figure legends

Figure 1  Method of measuring ulnar variance in this study. Posteroanterior view, with both hands imaged simultaneously on 1 film, for osteoporosis screening. Anterior border of the distal articular surface of the radius on the distal radioulnar articulation (a). Posterior border of the distal articular surface of the radius on the distal radioulnar articulation (b). Central point on the line connecting points a and b (c). The line perpendicular to the radial axis and passing through point c (d). Ulnar variance in this study (arrow). The distance between the distal margin of the ulnar head and the line d.

Figure 2  Correlation between ulnar variance (UV) and age in patients without Kienböck’s disease (R=0.089; P=.047; Y=.012X-0.152).
Figure 1

Figure 2
Table 1. Age, Affected Side, Stage, Ulnar Variance of Affected Side, and Ulnar Variance of Unaffected Side of Patients With Kienböck's disease

<table>
<thead>
<tr>
<th>Case No./Age, y*</th>
<th>Dominant Hand</th>
<th>Affected Side</th>
<th>Lichtman Stage</th>
<th>Wrist Pain</th>
<th>Ulnar Variance of Affected Side, mm</th>
<th>Ulnar Variance of Unaffected Side, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/64</td>
<td>Right</td>
<td>Left</td>
<td>IIIb</td>
<td>None</td>
<td>-2</td>
<td>1</td>
</tr>
<tr>
<td>2/63</td>
<td>Right</td>
<td>Right</td>
<td>II</td>
<td>None</td>
<td>-2</td>
<td>0</td>
</tr>
<tr>
<td>3/75</td>
<td>Right</td>
<td>Left</td>
<td>IIIa</td>
<td>None</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4/76</td>
<td>Right</td>
<td>Right</td>
<td>II</td>
<td>None</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5/70</td>
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<td>Right</td>
<td>II</td>
<td>None</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>6/61</td>
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<td>II</td>
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<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7/85</td>
<td>Right</td>
<td>Left</td>
<td>IIIb</td>
<td>None</td>
<td>-1</td>
<td>-1</td>
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*Average, 70.6 years.
Table 2. Comparison of Ulnar Variance Between Affected and Unaffected Sides in Kienböck's disease

<table>
<thead>
<tr>
<th>Side</th>
<th>Ulnar Variance, Mean (SD), mm</th>
<th>P&lt;sup&gt;a&lt;/sup&gt;</th>
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<tbody>
<tr>
<td>Affected side (n=7)</td>
<td>-0.3 (1.5)</td>
<td>.285</td>
</tr>
<tr>
<td>Unaffected side (n=7)</td>
<td>0.3 (0.1)</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Mann-Whitney U test.
Table 3. Characteristics of Participants With and Without Kienböck’s disease

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Participants With Kienböck’s disease (n=7)</th>
<th>Participants Without Kienböck’s disease (n=504)</th>
<th>Pᵃ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD), y</td>
<td>70.6 (8.7)</td>
<td>64.5 (10.8)</td>
<td>.174</td>
</tr>
<tr>
<td>Height, mean (SD), cm</td>
<td>146.4 (8.2)</td>
<td>149.6 (6.4)</td>
<td>.136</td>
</tr>
<tr>
<td>Weight, mean (SD), kg</td>
<td>53.3 (8.6)</td>
<td>52.2 (8.2)</td>
<td>.751</td>
</tr>
<tr>
<td>Body mass index, mean (SD), kg/m²</td>
<td>24.8 (2.7)</td>
<td>23.3 (3.3)</td>
<td>.097</td>
</tr>
<tr>
<td>Ulnar variance, mean (SD), mm</td>
<td>-0.3 (1.5)ᵇ</td>
<td>0.6 (1.5)ᶜ</td>
<td>.118</td>
</tr>
</tbody>
</table>

ᵃMann-Whitney U test.
ᵇAffected side.
ᶜAverage of both sides.
Table 4. Comparison of Ulnar Variance in Participants With and Without Kienböck’s disease

<table>
<thead>
<tr>
<th>Measurement Side</th>
<th>Negative Ulnar Variance</th>
<th>Neutral Ulnar Variance</th>
<th>Positive Ulnar Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants with Kienböck’s disease, affected side, No./Total(%)</td>
<td>3/7 (43)</td>
<td>2/7 (29)</td>
<td>2/7 (29)</td>
</tr>
<tr>
<td>Participants with Kienböck’s disease, unaffected side, No./Total(%)</td>
<td>1/7 (14)</td>
<td>4/7 (57)</td>
<td>2/7 (29)</td>
</tr>
<tr>
<td>Participants without Kienböck’s disease, average of both sides, No./Total(%)</td>
<td>111/504 (22.0)</td>
<td>95/504 (18.8)</td>
<td>298/504 (59.1)</td>
</tr>
</tbody>
</table>

\(^a\)P=.237(chi-square test), compared with unaffected side in patients with Kienböck’s disease.

\(^b\)P=.189(chi-square test), compared with patients without Kienböck’s disease, average of both sides.