

1 Reliability of Lichtman's classification for Kienböck's disease in 99 subjects

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15 This study is a retrospective study and the approval was given by the institutional review
16 board (IRB).

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19 Key words: Kienböck's disease, wrist, classification

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3 Abstract

4 Purpose: The objective of this research was to investigate the reliability of Lichtman's
5 classification for Kienböck's disease.

6 Methods: Interobserver reliability and intraobserver reproducibility were investigated by
7 interpreting both anteroposterior and lateral X-rays of the wrist joint twice in 99 patients
8 with Kienböck's disease using the modified Lichtman's classification system. Observers
9 comprised 3 orthopedic surgeons, and no information was exchanged between
10 observers either before or during the study.

11 Results: Intraobserver reliability was moderate (0.313-0.628), and interobserver
12 reliability was fair (Siegel's kappa=0.228).

13 Conclusion: Low values were obtained regarding interobserver reliability for the
14 modified Lichtman's classification of Kienböck's disease. This classification is thus
15 inadequate for use in clinical settings. A new classification should be established.

16

1 Introduction

2 Lichtman's classification is frequently used in the assessment and management of
3 Kienböck's disease (1)(2). Radiological assessment, however, is not an easy task and
4 all classification systems used in Kienböck's disease show some degree of inter- and
5 intraobserver variability. In the past, isolated studies have examined the reliability of
6 Lichtman's classification of Kienböck's disease, but sample sizes in those reports have
7 been relatively small (39, 64, and 48 cases) (3)(4)(5). The purpose of the present study
8 was to assess the reliability of this commonly used classification system, and to
9 determine possible reasons for low reliability associated with Lichtman's classification.

10

11 Materials and methods

12 We reviewed radiographs of all patients with Kienböck's disease who were treated in
13 our hospital from 1988 to 2007. The inclusion criterion was the availability of complete
14 preoperative radiographs of anteroposterior and lateral views bilaterally. Bilateral cases
15 and cases diagnosed based on magnetic resonance imaging alone were excluded. All
16 radiographs of the wrist were obtained with the shoulder in 90° of abduction, the elbow
17 in 90° of flexion, the forearm in neutral rotation, and the wrist in neutral alignment,
18 utilizing a wrist support. We included 99 cases in the present study. The observers
19 comprised 3 orthopedic surgeons with 16, 14, and 10 years of experience. These
20 observers assessed Lichtman's classification of radiographs in a blinded manner on two
21 separate occasions.

22 We used the modified Lichtman's classification system, consisting of 4 stages, including

1 a subdivision of stage 3 into stage 3a (no carpal collapse) and stage 3b (carpal collapse
2 and fixed scaphoid flexion) (Fig. 1). No information was exchanged between observers
3 either before or during the study. Before carrying out assessments, each observer was
4 asked to read the original article on the classification system. We then determined the
5 inter- and intraobserver reliabilities of the classification system.

6 All study protocols were approved by the institutional review board of our institute.

7

8 Statistics

9 Kappa statistics were used for the assessment of inter- and intraobserver reliabilities of
10 the modified Lichtman's classification. We also examined inter- and intraobserver
11 correlations between each of the individual radiological parameters using kappa values.
12 According to Landis and Koch (6), a kappa value of 0.21-0.40 is considered "fair",
13 0.41-0.60 "moderate", 0.61-0.80 "substantial" and 0.81-1.0 "excellent".

14

15 Results

16 Results for intraobserver reproducibility are summarized in Tables 1 and 2. For the
17 modified Lichtman's classification, kappa values ranged from 0.313 to 0.628, indicating
18 moderate agreement. Interobserver reliability for the modified Lichtman's classification
19 showed a kappa value of 0.228 (Siegel's kappa; 95% confidence interval (CI):
20 0.198-0.273) (Table 3). The classifications thus showed fair agreement. Intra- and
21 interobserver agreement for stages 3a and 3b were 75.5% and 65.3%, respectively.
22 Interviews after the examination revealed that the three examiners determined the

1 classifications of stage 3a and 3b by referring to the contralateral side.

2

3 Discussion

4 Radiography is the most commonly performed investigation when assessing the
5 severity of Kienböck's disease. In 1977, Lichtman proposed a classification system to
6 assess the severity of this disease (1). The original classification was based on
7 anteroposterior radiographs. Lichtman's classification is well-accepted, with most
8 reports depending on this classification (7)(8), while clinical results have shown no
9 correlation with radiographic stage (9)(10). For the original Lichtman's classification,
10 Jensen et al. reported poor reliability from a study of 48 cases (5) and Jafarnia et al.
11 reported good reliability from a study of 64 cases (4). For modified Lichtman's
12 classification, Goldfarb et al. reported reliability/reproducibility in 39 cases using an
13 additional criterion (subdividing stage 3 radioscaphoid angle based on a cutoff of 60°)
14 (3). Sample sizes in those reports were relatively small. The most important aspect of
15 the present study was the thorough and systematic analysis of the reliability of
16 Lichtman's classification systems in a relatively large sample of 99 patients with
17 Kienböck's disease.

18 An ideal radiological classification system should aid in assessing the severity of the
19 disease and help in deciding on treatment and prognosis. Furthermore, the
20 classification system should offer reasonable inter- and intraobserver reliabilities and
21 should not use obscure measurements. While various classifications have been
22 proposed in the past to achieve these goals, no ideal classification system for

1 Kienböck's disease has yet been established (1)(11)(12). The present study included
2 complete radiographs from 99 patients with Kienböck's disease, and the reliabilities of
3 the classification systems for this disease were assessed. The results showed that the
4 modified Lichtman's classification offers only "fair" interobserver reliability even with
5 experienced orthopedic surgeons.

6 According to the current results, one cause of disagreement arises from the
7 identification of stages 3a and 3b. Abe et al. recently reported that a cortical ring sign
8 indicates only scaphoid flexion (13). All three observers in the present study referred to
9 the contralateral side to determine the classification of stages 3a and 3b, but these
10 stages do not indicate a pathological condition and the cutoff between 3a and 3b thus
11 has little clinical relevance. The controversy resides in stage 3a and 3b for both
12 radiological and pathological status, which might be a reason for the lack of a correlation
13 with clinical results. Moreover, our findings revealed low interobserver reliability in all
14 stages. For differentiating between stages 3 and 4, computed tomography (CT) may be
15 useful to evaluate degenerative joint changes. However, we did not use CT in the
16 present study, which may partly explain the poor reliability. We do not recommend using
17 the modified Lichtman's classification system to aid in treatment decision-making. Most
18 surgeons base treatment plans on the results of CT and MRI and any new classification
19 system should include findings from plain radiography, CT, and MRI.

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21 Conclusion

22 The modified Lichtman's classifications showed only "fair" agreement even for

- 1 orthopedic experts. A new classification system should be established, based not only
- 2 on plain radiography, but also on CT and MRI.
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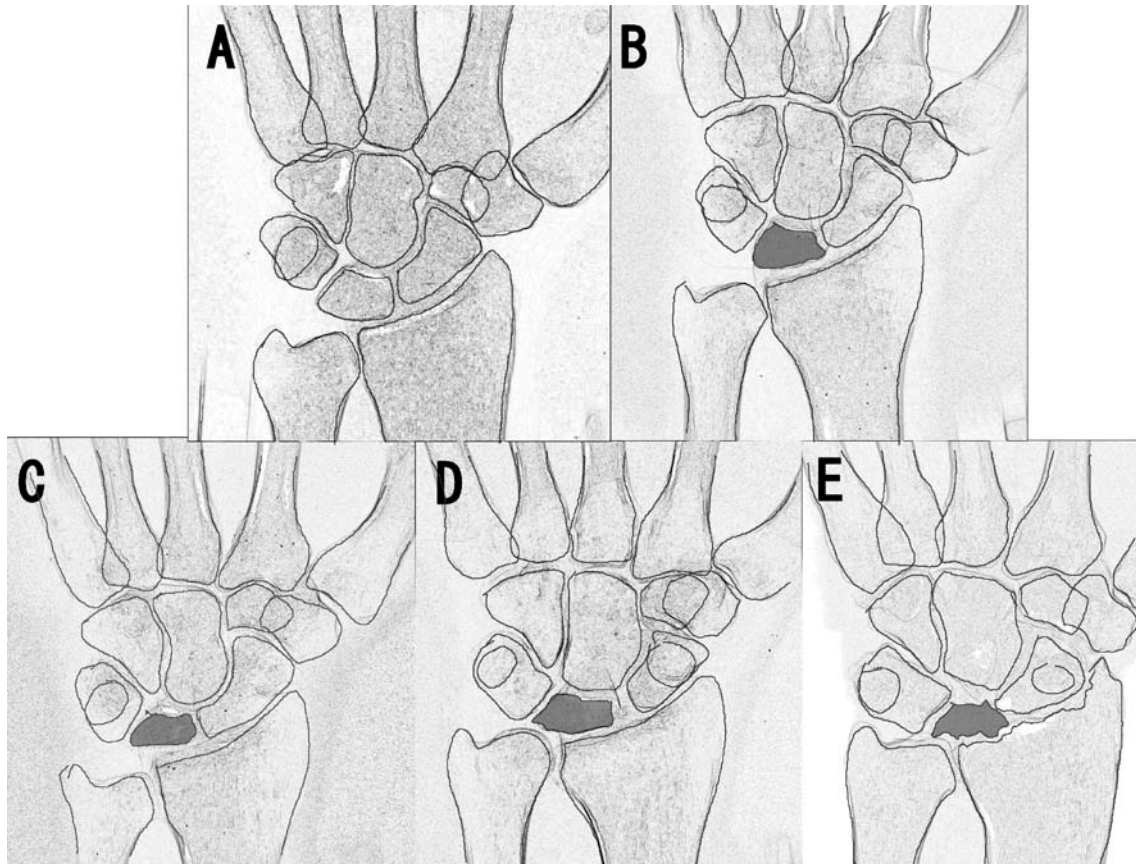
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1 Figure legend

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3 Figure 1. Lichtman's classification. A: stage 1, B: stage 2, C: stage 3a, D: stage 3b, E:

4 stage 4.



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1 Table 1. Modified Lichtman's classification; kappa values for intraobserver reliability

Observer No.	observed % agreement	Kappa value (95%CI)
1	62.6	0.313 (0.138-0.488)
2	76.8	0.628 (0.495-0.761)
3	66.7	0.505 (0.367-0.643)

2 Years of experiences observer No. 1: 16 year, No.2: 14 years, No.3: 10 years.

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1 Table 2. Intraobserver classification

2 Observer 1

		2 nd examination				total
1 st examination	Stage	2	3a	3b	4	
	2	0	3	0	0	3
	3a	1	29	12	0	42
	3b	1	16	33	2	52
	4	0	0	2	0	2
total		2	48	47	2	99

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4 Observer 2

		2 nd examination				total
1 st examination	Stage	2	3a	3b	4	
	2	6	2	0	0	8
	3a	2	29	6	0	37
	3b	1	10	36	1	48
	4	0	1	0	5	6
total		9	42	42	6	99

5

6 Observer 3

		2 nd examination				total
1 st examination	Stage	2	3a	3b	4	
	2	17	8	5	0	30
	3a	2	29	8	0	39
	3b	1	6	19	0	26
	4	0	1	2	1	4
total		20	44	34	1	99

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1 Table 3. interobserver classification

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3 Observer 1 and 2

		Observer 2				total
Observer 1	Stage	2	3a	3b	4	
	2	2	0	1	0	3
	3a	5	23	14	0	42
	3b	1	13	33	5	52
	4	0	0	0	1	2
total		8	37	48	6	99

4

5 Observer 2 and 3

		Observer 2				total
Observer 3	Stage	2	3a	3b	4	
	2	7	15	8	0	30
	3a	0	19	20	0	39
	3b	1	3	18	4	26
	4	0	0	2	2	4
total		8	37	48	6	99

6

7 Observer 1 and 3

		Observer 3				total
Observer 1	Stage	2	3a	3b	4	
	2	3	0	0	0	3
	3a	14	22	5	1	42
	3b	13	16	20	3	52
	4	0	1	1	0	2
total		30	39	26	4	99

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