RESEARCH ARTICLE

Carpal Tunnel Syndrome in Surgically Treated Wrists with Kienböck Disease

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Abstract

Objectives: We hypothesized that the prevalence of carpal tunnel syndrome (CTS) in wrists with surgically treated Kienböck disease does not differ from its prevalence in the general population.

Methods: This cross sectional study investigated 53 patients (25 males and 28 females) with surgically treated Kienböck disease for clinical and electrophysiological CTS. The mean age of the patients was 37±11 years (SD), and the mean interval between treatment and this study was 64±9 months (SE). Among these cases, 29 involved the right wrist and 24 involved the left wrist. Based on the Lichtman staging system, there were 17 stage II cases, 18 stage IIIA cases, 15 stage IIIB cases, and 3 stage IV cases. Surgical interventions included radial shortening osteotomy with plate and screw fixation in 38 patients, capitate shortening osteotomy in 12 patients, vascularized bone graft in 2 patients, and wrist arthrodesis in one patient.

Results: Five patients (9.4 %) had clinically and electrophysiologically confirmed CTS; all of whom were housewives, aged between 24 and 60 years. Two of these patients were explicitly treated for CTS in the Kienböck disease affected wrist.

Conclusion: The prevalence of CTS in the wrists Kienböck disease was higher than 3-4% prevalence reported in the general population. These findings suggest a potential relationship between the two conditions rather than a coincidental occurrence within a similar population.

Level of evidence: IV

Keywords: Carpal tunnel syndrome, Kienböck disease, Lichtman stage, Prevalence, Wrist disorder

Introduction

Carpal Tunnel Syndrome (CTS) is a common hand disorder, particularly among middle-aged women, and carpal tunnel release is the most performed hand surgery. The incidence of CTS in the general population is estimated at 3-4%.[1,2] However; the prevalence may be higher in certain occupational groups[3,4] and in patients with specific wrist disorders[5-12] CTS has a well-established correlation with distal radius fractures. The incidence of delayed CTS, occurring within six months of distal radius fractures, has been reported to range from 0.5 to 22%[5-9] Factors such as altered carpal tunnel anatomy due to wrist deformity, displaced bone fragments, carpal misalignments, chronic tenosynovitis, volar callus formation, scarring, and prominent surgical hardware increase the risk of CTS following distal radius fracture.[5-9]

Partial or total wrist osteoarthritis also heightens the risk of CTS. A strong correlation has been observed between CTS and basal joint osteoarthritis.[10-12] Florack et al. reported that 106 out of 246 patients (43%) with basal joint arthritis exhibited symptomatic CTS.[10]

Kienböck disease, though rare, typically affects individuals aged 20 to 40 years.[13] Several authors have noted the coexistence of CTS and Kienböck disease[14-19] This study aimed to determine the prevalence of CTS in wrists affected by surgically treated Kienböck disease. The hypothesis posited that the prevalence of CTS in such cases does not differ from the prevalence of CTS in the general population.

Materials and Methods

The study received approval from the Medical Research

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and Ethics Committee of the hospital (IR.UMSU.HIMAM.REC.1402.135). Between 2006 and 2023, a total of 142 patients with Kienböck disease underwent surgical intervention in our hand surgery department. As part of a cross-sectional study, we invited these patients to participate in interviews, clinical examinations, wrist radiographs, and electrophysiological evaluations. However, several patients declined participation due to various reasons: some declined the invitation entirely, others refused the electrophysiological examination or updated wrist radiographs, and some were unreachable due to changes in their contact information. Ultimately, 53 patients (25 male, 28 female) with a mean age of 37±11 years consented to participate and provided informed consent before their inclusion in the study. All cases involved unilateral wrist conditions, with 29 affecting the right wrist and 24 affecting the left. The mean interval between Kienböck disease treatment and the follow-up for this study was 64±9 months (SE).

Diagnosis and staging of Kienböck disease were determined through plain wrist radiographs using the Lichtman staging system.[20] The frequency of Kienböck disease among study participants based on Lichtman classification is shown in [Table 1].

Table 1. Frequency of Kienböck disease among study participants based on Lichtman classification in the plain wrist radiograph

Lichtman Kienböck Disease Stage	Frequency
I: Normal	-
II: Lunate sclerosis	17(32%)
III-A: Lunate collapse without fixed carpal instability	18(34%)
III-B: Lunate collapse with fixed carpal instability	15(28%)
III-C: Coronal fracture of lunate	-
IV: Pan-carpal degenerative changes	3(6%)

Patients were assessed for symptoms and signs of CTS. CTS was suspected in individuals presenting a combination of clinical features, including a history of night pain, paresthesia, sensory deficits within the median nerve's distribution, flick sign, thenar muscle atrophy, and positive outcomes in provocative tests such as Tinel's sign, Phalen's test, and Durkan's test. Patients with suspected CTS were referred for electrophysiological studies (EPS) to confirm the diagnosis.

Based on the EPS findings and in accordance with Stevens' recommendations, the severity of CTS was classified as mild, moderate, or severe.[21] None of the patients had been diagnosed with CTS prior to undergoing surgical intervention for Kienböck disease.

Among the patients with Kienböck disease, 34 underwent radial shortening osteotomies with plate and screw fixation via a dorsal approach, while 4 underwent the same procedure via a volar approach. Additionally, 12 patients had capitate shortening osteotomies, 2 received vascularized bone grafts based on the distal radius 4+5 extensor compartment artery, and 1 patient underwent wrist arthrodesis. None of the patients had systemic illnesses, such as diabetes mellitus, rheumatologic disorders, and thyroid conditions that could influence the prevalence of CTS.

Results

Five out of the 53 patients (9.4%) had clinically and electrophysiologically confirmed CTS [Table 2]. All five patients were housewives age of 24-60 years. None of these patients had stage IV Kienböck disease. Two of the patients were explicitly treated for CTS in the wrist affected by Kienböck disease. One patient presented with severe CTS on the affected side, for which carpal tunnel release surgery was recommended and performed. Another patient had previously been treated with a corticosteroid injection, although she had not been aware of her CTS diagnosis at the time.

Among the five patients with both CTS and Kienböck disease, four underwent radial shortening osteotomies, while one had a capitates shortening osteotomy. All surgical procedures were performed using dorsal approaches. Consequently, there was no hardware placement or soft tissue dissection that could compromise the volar side of the wrist or adversely impact the carpal tunnel anatomy.

Due to the small sample size, statistical analysis was insufficient to determine whether Kienböck disease adversely impacted the severity of CTS.

Table 2. Characteristics of the five patients with both Kienböck disease and CTS

	Gender/Age	Involved side	Operation Technique	Lichtman stage of Kienböck disease	Electrophysiological severity of CTS	Occupation
1	F/24	Left	CS	II	Severe**	Housewife
2	F/39	Left	RS	II	Mild*	Housewife
3	F/42	Right	RS	IIIA	Mild	Housewife
4	F/56	Right	RS	IIIB	Mild	Housewife
5	F/60	Left	RS	IIIB	Mild	Housewife

CTS: carpal tunnel syndrome; F; female; RS: radial shortening through dorsal approach; CS: capitate shortening Severity of CTS is classified as mild, moderate and severe based on electrodiagnostic examination.

(**) carpal tunnel release performed

(*) She was treated with corticosteroid injection

Discussion

Several reports have sparked curiosity about a potential association between CTS and Kienböck disease.[14-19] Codega et al. hypothesized that the spread of inflammation from tenosynovitis in CTS contributes to the development of Kienböck disease. Although this opinion is now considered obsolete and outdated, it is worth noting that Codega et al. treated 17 patients with Kienböck disease using carpal tunnel release and median nerve neurolysis. They reported improved function and sustained pain relief in ten patients, with follow-up periods ranging from 1 to 8 years.[23-25]

Taniguchi et al. reported four female CTS patients, aged between 62 and 72 years, who had stage IV Kienböck disease identified on plain wrist radiographs.[19] Hayashig et al. documented 17 CTS patients (5 males and 12 females) with a mean age of 69±11 years, all of whom had underlying stage IV Kienböck disease. They suggested that stage IV Kienböck disease could be a predisposing factor for CTS.[14] Shinohara et al. observed 12 CTS patients (3 males and 9 females), with a mean age of 72 ± 8 years, who were in the late stages of IIIB and IV Kienböck disease.[17] Similarly, Sasaki et al. reported three cases of CTS (1 male and 2 females) with ages of 34, 55, and 71 years, all of whom had stage IV Kienböck disease.[16] The diagnosis of Kienböck disease in the aforementioned studies was an incidental finding, as plain wrist radiographs were routinely performed as part of the wrist examination to identify potential osseous abnormalities prior to CTS surgery.[14,16,17,19]

Kienböck disease is a progressive disorder.[26-28] Schuind et al. noted that CTS may complicate the progression of Kienböck disease.[28] Nieradko-Iwanicka described a case involving a 61-year-old man with hand-arm vibration syndrome who had undergone CTS surgery. However, his symptoms persisted, and Kienböck disease was subsequently diagnosed two years later using MRI.[15] Beckenbaugh et al., in a 15-year retrospective review of the natural history of Kienböck disease, found that five out of 46 patients developed symptoms of CTS.[18] Similarly, Hayashig et al. suggested that advance age, female gender, and late-stage Kienböck disease increase the risk of developing CTS.[14]

During surgery, Shinohara et al. observed that in 11 out of 12 patients with both CTS and Kienböck disease, the maximum compression on the median nerve occurred at the carpal tunnel inlet. This was attributed to the palmar protrusion of the lunate or its fragments. In contrast, in ordinary CTS cases, median nerve compression typically occurs beneath the transverse carpal ligament at the carpal tunnel outlet.[17]

The prevalence of clinical CTS and clinically and electrophysiologically confirmed CTS in the general population has been estimated at 3.8% and 2.7%, respectively.[1] Similarly, Papanicolaou et al. estimated the prevalence of CTS in the general population to be 3.72%.[2] In the current study, the prevalence of clinically and electrophysiologically confirmed CTS was found to be 9.4% among 53 patients. This figure is notably higher than those reported in general population studies and aligns with prevalence rates observed in specific populations: 17.5–25% in industrial workers,[3,4] 0.5-22% following radial fractures[5,7-9]; and 40-43% in patients with basal thumb joint arthritis,[10,11] These findings suggest a potential relationship between the two conditions rather than a coincidental occurrence in a similar population. Factors such as reduced carpal height, carpal collapse, volar-protruded fragments, chronic arthritis, and wrist synovitis may contribute to reduced carpal tunnel volume and an increased risk of CTS development.

The current study had some limitations. First, the study was designed as a cross sectional investigation. Second, Kienböck disease is a rare disorder, which limited the size and scope of the sample population. Third: there are discrepancies between the prevalence rates of clinical CTS, and clinically and electrophysiologically confirmed CTS.[1-4] Fourth, both wrist arthritis due to Kienböck disease and CTS can cause wrist pain and overlapping symptoms for different reasons; hence, we focused specifically on the clinically and electrophysiologically confirmed CTS. Fifth, the study lacked a matched control group for comparison. Sixth, the low number of participants made it challenging to determine with accuracy whether Kienböck disease adversely impacts the severity of CTS.

Despite these limitations, the study aimed to ignite curiosity among researchers, encouraging larger multicenter investigations with matched groups to further explore the potential association between CTS and Kienböck disease.

The current study stand apart from previous studies, which were limited to small case series in which Kienböck disease was an incidental finding in CTS patients.[14-19] However, in the current study, none of the CTS patients presented with stage IV Kienböck disease.

Given the progressive nature of Kienböck disease, longer follow-ups may reveal a higher incidence of CTS among wrists affected by Kienböck disease, particularly in cases that advance to stage IV.

Conclusion

The prevalence of CTS in the wrists Kienböck disease was higher than 3-4% prevalence reported in the general population. These findings suggest a potential relationship between the two conditions rather than a coincidental occurrence within a similar population.

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