Long-term outcomes for Kienböck's disease

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Published online: 5 December 2012
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Abstract

Background The precise etiology of Kienböck's disease is unclear. Controversy exists regarding the appropriate treatment modality. The present study sought to investigate and compare surgical and nonsurgical treatment outcomes of patients suffering from Kienböck's disease in the province of Newfoundland and Labrador (NL), Canada.

Methods The present study was a retrospective analysis of 66 patients. The primary outcome was the Disabilities of the Arm, Shoulder, and Hand (DASH) score. Student's *t* test was used to assess differences in outcomes between treatment groups. One-way ANOVA was used to assess differences in primary outcome in time since first assessed in an effort to examine progression over time. Pearson correlation was used to assess for correlation between primary outcome and age at diagnosis.

Results The average age was 38.6 ± 11.4 (18–70) years; Four patients were excluded due to inaccessible imaging. Of the remaining patients, 44 were treated conservatively, while 18 were treated surgically. The DASH scores for the surgical group were 23.7 ± 24.5 (0.9–82.8) and nonsurgical group were 20.0 ± 20.1 (1.7–81). As expected, the surgical group was mainly comprised of late-stage Kienböck's. When both groups were compared, there was no significant difference in the DASH scores. There were no difference in DASH scores within groups according to time since first diagnosed (<5 years; between 5 and 10 years; and >10 years). A positive correlation was found between age at diagnosis and DASH score ($r=0.42$, $p=0.007$), despite treatment modality. This finding remained significant after accounting for confounding factors ($p=0.029$).

Conclusion The DASH score for the surgical group was 23.7 ± 24.5 (0.9–82.8) and nonsurgical group was $20.0 \pm$

20.1 (1.7–81). No significant difference in DASH scores was found between surgically and nonsurgically treated patients. A positive association was found between the age at diagnosis of Kienböck's and DASH score, which suggests that patients diagnosed and treated later in life tend not to do as well.

Keywords Kienböck's disease · Surgical treatment · Nonsurgical treatment · DASH · Long-term outcomes

Background

The precise etiology and natural history of Kienböck's disease remain unclear. Many theories have been postulated to explain the actual cause resulting in avascular necrosis. It is likely a combination of local vascular and anatomical variations that predisposes the lunate to developing avascular necrosis [2]. It is generally accepted that as the disease progresses, initial sclerosis of the lunate eventually leads to collapse and osteoarthritis [1, 4]. The Lichtman classification system is commonly used for staging [11]. Treatment of Kienböck's disease can vary from conservative to complex surgical interventions, including joint leveling procedures [20] by radial shortening [22] or ulnar lengthening [19], intercarpal arthrodesis [7, 14, 16, 21], proximal row carpectomy [12], and vascularized bone grafts [9]. The present study sought to investigate and compare the outcomes of operative and non-operative treatment of Kienböck's disease in the Newfoundland and Labrador population.

Methods

The present study was a retrospective analysis of 66 patients (42 males and 24 females) diagnosed with Kienböck's disease between 1990 and 2007 in the province of Newfoundland and Labrador, Canada. A database search was completed of a single orthopedic surgeon with subspecialty

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in hand and wrist and all patients diagnosed with Kienböck's disease were reviewed. Subsequently, an attempt was made to contact all patients at their residence and asked if they would provide responses to the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, which served as our primary outcome to the treatment they received. All analyses were performed using SPSS for Windows (version 15.0), and significance was set at $p < 0.05$. Student's t test was used to assess differences in the primary outcome between surgical and nonsurgical treatments. Nonsurgical treatment modalities included nonsteroidal anti-inflammatory drugs, removable splints, and casting. Analyses were also completed within each group of Kienböck's, as well as combined groups. One-way ANOVA was used to assess differences in DASH scores among three groups based on time since first assessed in clinic (<5 years, between 5 and 10 years, and >10 years), in an effort to examine progression over time. Pearson correlation was used to assess for correlations between primary outcome and age of diagnosis and radiographic stage of disease.

Results

The average age at presentation was 38.6 ± 11.4 (18–70) years; right wrist was affected in 61.5 % of cases and left in 38.5 % (Table 1). With respect to radiographic stage of Kienböck's at time of diagnosis, 6 cases were in stage I, 26 cases in stage II, 9 cases in stage IIIa, 16 cases in stage IIIb, and 5 cases in stage IV. Radiographs were inaccessible for four cases and consequently were excluded from the study. Of the remaining patients, 44 were treated conservatively, while 18 surgically (11 partial wrist fusions, 5 complete fusions, 1 lunate excision, and 1 radial shortening). All patients were initially treated conservatively with a combination of NSAIDs and splinting. Surgery was offered to those who failed conservative management and had associated disability (unable to work, play sports, etc.). Patients with stage IIIA or less were offered scaphotrapeziotrapezoid fusion if ulna neutral and radial shortening if ulna minus. Patients with stage IIIB were offered partial or full fusion, with expectations that full fusion would lead to more reliable pain relief. One patient had a lunate excision that was

completed elsewhere, but followed in the present institution. As expected, the surgical group was mainly comprised of late-stage Kienböck's disease.

When combining all patients, there was no statistically significant difference in DASH scores within groups according to time since first diagnosed (<5 years = 23.1 ± 21.9 ; between 5 and 10 years = 26.9 ± 24.2 ; and >10 years = 18.1 ± 20.1) (Table 2). Similarly, when surgical and nonsurgical groups were examined separately, no significant difference in DASH scores was found. Overall, there was no statistically significant difference in DASH scores between surgically treated and conservatively treated patients. (23.7 ± 24.5 and 20.0 ± 20.1 , respectively) (Table 3). There was no difference in DASH scores among surgical and conservatively treated patients when individual stages of Kienböck's were considered. Furthermore, because of low numbers within each Kienböck's stage, stage IIIb and stage IV were combined. However, once again no significant difference was found between the surgical and conservative treatment modalities (14.1 ± 14.6 and 15.5 ± 20.0 , respectively). A positive correlation was found between age of diagnosis of Kienböck's disease and DASH score ($r = 0.42$, $p = 0.007$). This finding remained significant even after accounting for the radiographic stage of disease, gender, and time since diagnosed using multiple linear regression ($p = 0.029$). When the groups were analyzed separately, the correlation approached significance for the surgical group ($p = 0.059$) and was significant for the nonsurgical group ($p = 0.035$).

Discussion

The precise etiology and natural history of Kienböck's disease are unclear. The condition is more frequent in young adults, often without any recollection of injury [8]. Patients tend to present with pain and stiffness in the wrist with associated swelling and tenderness dorsally over the radio-lunate joint. Diminished range of motion with weakness in grip strength is typically present.

Previous research has shown that the severity of the disease and symptomatology are related [17]; however, there have been documented cases of severe radiographic arthrosis, yet patients remain asymptomatic [13]. Kristensen

Table 1 Patient demographics

Characteristic	Nonsurgical $n = 44$	Surgical $n = 18$	Combined $n = 62$
Gender (male/female)	29:15	11:7	40:22
Age at diagnosis (years)	39.2 ± 11.5	35.4 ± 7.9	38.6 ± 11.4
Affected wrist (%)			
Left	38	44	39
Right	62	56	61
Dominant hand (%)	59	25	47

Table 2 Analysis of DASH scores based on time since diagnosed for surgical and nonsurgical treatment groups

	Time since dx (years)	Total		Nonsurgical		Surgical	
		<i>n</i>	DASH	<i>n</i>	DASH	<i>n</i>	DASH
No significant difference between any groups based on one-way ANOVA	<5	6	23.1±21.9	6	23.1±21.9	–	–
	5–10	9	26.9±24.2	6	28.7±27.1	3	23.3±21.9
	>10	24	18.1±21.1	15	14.7±15.1	9	23.8±26.6

and colleagues claim that Kienböck's disease has a benign course. Data on 46 conservatively treated patients showed little difference in amount of deformation of the lunate during long-term follow-up. Moreover, nearly 86 % of wrists were pain-free or only having pain with heavy labor [10]. Evans and coworkers indicate that 63 % of conservatively treated patients during 20-year follow-up had a fair to good outcome [6]. Conversely, other long-term follow-up studies have shown much higher failure rates with conservative treatment. Mikkelsen and Gelineck reported that only 24 % of their conservatively treated patients were pain-free. Majority of their patients experienced daily problems [15].

Contradictory results also exist in comparing surgical and nonsurgical treatments. Delaere and associates found comparable outcomes with surgically treated patients, operated using various techniques, and conservatively treated with a mean of 5-year follow-up [5]. Salmon and colleagues, however, found that surgically treated patients (radial shortening) with stage II and III disease experienced less pain and demonstrated superior grip strength than their conservatively treated counterparts at a mean follow-up of 3.6 years [18].

As with most studies, it is truly difficult to compare treatment modalities based and stage of Kienböck's disease, given low numbers when analyzed in this fashion. Furthermore, as in the present study, the surgical group is mainly comprised of late-stage Kienböck's disease. Overall, the average long-term DASH score for the surgical group in the present study was 23.7. This finding is consistent with a previous study stating an average DASH

score of 28 for patients with late-stage disease treated with a salvage procedure at 4-year follow-up [14].

The average long-term DASH score for the conservative group was 20. The current literature indicates that 12.7 points is the minimal change in DASH score that is considered to be statistically significant [3]. We were unable to demonstrate this with our data, even when analyzing outcomes within the different stages of Kienböck's disease (stage IIIb/IV combined, 15.5 vs 14.2 for nonsurgical and surgical, respectively). In an effort to examine progression over time, we examined DASH scores over time intervals. Within the conservative group, there was no significant difference in DASH scores between these intervals. This indicates that not all individuals with Kienböck's will continue to progress clinically. Surgical intervention should only be entertained if patients' symptoms dictate, rather than basing decisions on radiographic parameters at this point.

A positive correlation was found between age at diagnosis of Kienböck's disease and DASH score ($r=0.42$, $p=0.007$). This finding remained significant even after accounting for the radiographic stage of disease, gender, and time since diagnosed. To our knowledge, this is the first time a positive correlation between age at diagnosis of Kienböck's and DASH score has been presented.

The reasons for its existence may lie in the fact that patients who are diagnosed at a younger age would benefit from having an understanding for the cause of their pain and disability. Younger patients may learn to “favor” the affected wrist and reduce their symptoms. On the contrary, without a diagnosis, older individuals may regard their wrist symptoms as “normal” aches and pains associated with aging. Perhaps, this leads to greater damage to the joint and eventually poorer function when they finally do present with wrist pain. This finding suggests the importance of early diagnosis of Kienböck's disease.

The limitations of the present study include moderate response to the DASH questionnaire and incomplete clinical data, which is secondary to the nature of the retrospective study. In addition, it is possible that the primary outcome measure used in this study may not have captured the extent of disability of patients with Kienböck's, as it was not designed specifically for this condition.

Overall, the long-term DASH score outcomes for surgical and nonsurgical treatment were 23.7 and 20, respectively.

Table 3 Analysis of DASH scores based on stage of Kienböck's disease

KB stage	Nonsurgical		Surgical		<i>p</i> value
	<i>n</i>	DASH	<i>n</i>	DASH	
I	3	31.7±24.1	0		–
II	15	18.0±20.8	1	25.8	ns
IIIa	8	12.7±7.5	0		–
IIIb	2	22.9±21.8	6	17.6±17.1	ns
IV	1	0.8	3	7.3±4.9	ns
IIIb/IV	3	15.5±20	9	14.2±14.6	ns
Combined	29	20.0±20.1	10	23.7±24.5	ns

ns not significant

Not all patients continued to deteriorate clinically with conservative management; thus, surgery can be delayed until patients' symptoms dictate. Furthermore, a positive association was found between age of diagnosis of Kienböck's disease and DASH score, even after accounting for confounding factors, which suggests that patients diagnosed and treated later in life tend not to do as well.

Conflict of interest The authors declare that there are no conflicts of interest, commercial associations, or intent of financial gain regarding the present research.

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