Incidence and Epidemiology of Symptomatic Capitellar Osteochondritis Dissecans of the Elbow

A United States Population–Based Study Over a 25-Year Period

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Background: There are limited data on the incidence of capitellar osteochondritis dissecans (OCD) in the United States (US) population.

Purpose: To determine the incidence of symptomatic capitellar OCD in a representative US subpopulation and identify changes in its incidence over time and to investigate the relationship between the incidence of capitellar OCD and patient sex and age.

Study Design: Descriptive epidemiology study.

Methods: A retrospective review was performed of patients aged ≤24 years from Olmsted County, Minnesota, with symptomatic capitellar OCD over a 25-year period (1995-2019). Patients with acute osteochondral injuries, Panner disease, and hereditary arthropathy were excluded. Poisson regression was utilized to identify the predictors of a capitellar OCD diagnosis. Incidence rates (per 100,000) were assessed for changes over time. Age groups of younger (10-15 years) versus older (16-24 years) patients were compared.

Results: A total of 45 patients (78% male) were identified. The mean age was 14.5 years (range, 10-24 years); 31 patients were in the younger group, and 14 patients were in the older group. Sport participation was seen in 89%of patients; 90% were overhead athletes, and 58% were throwing athletes. The incidence of capitellar OCD was 6.0 per 100,000 overall, 9.5 per 100,000 for male patients, and 2.6 per 100,000 for female patients. The incidence was highest for male patients in the younger group (15.3/100,000) and lowest for female patients in the older group (0.8/100,000). The estimated incidence rate ratio for younger versus older patients was 3.3 ($P < .001$), and the incidence rate ratio for male versus female patients was 3.5 ($P < .001$). There were no changes in the incidence of capitellar OCD over time as a continuous or 5-year categorical variable ($P = .290$ and $P = .460$, respectively). Overall, 82% of patients were treated surgically. There were no significant changes in surgical rates over time.

Conclusion: In this US subpopulation, the overall incidence of symptomatic capitellar OCD between the ages of 10 and 24 years was 6.0 per 100,000 over the 25-year period studied, which is higher than previously reported US estimates. Incidence rates and treatment strategies did not change significantly over time.

Keywords: capitellar OCD; osteochondritis dissecans; elbow OCD; elbow

Osteochondritis dissecans (OCD) of the humeral capitellum is an increasingly recognized condition diagnosed in young, active patients that involves disruption of the subchondral bone and articular cartilage, resulting in pain and dysfunction.[3,6,16] The cause of capitellar OCD remains unknown. However, studies by Aichroth[1,2] have presented clinical and experimental evidence to suggest that the pathogenesis is related to a stress fracture in the subchondral bone; this may be in part related to findings from a separate study[15] that showed repetitive shear stress due to axial compression or valgus loading across the radiocapitellar joint during elbow motion.[3,6,15] There are few studies that have looked at the epidemiology of capitellar OCD in the general United States (US) population. The estimated

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prevalence in a cross-sectional study[11] of just over 2400 Japanese youth baseball players was 3.4%, while in a separate study,[13] the 1-year cumulative incidence in a group of 6- to 11-year-old baseball players was reported to be 1.8%. In the US, a study of the general population demonstrated a much lower incidence rate of only 2.2 per 100,000 people per year for OCD of the elbow.[10]

The cause for the discrepancy in the reported rates of capitellar OCD in the Japanese versus US population is not fully elucidated. While there may be a genetic predisposition, the differing incidences are likely because the Japanese epidemiological data are focused on those at risk for capitellar OCD (ie, youth baseball players). In the US, early youth sport specialization is becoming more common, and some literature suggests an increased rate of overuse injuries in these athletes.[7,8,12] This may portend an increasing incidence and prevalence of capitellar OCD among young athletes. To our knowledge, there are no studies investigating any changing incidence rates of capitellar OCD over time in a US subpopulation.

With limited knowledge to date on the epidemiology of capitellar OCD in the US and the potential for rising rates over time as it relates to early sport specialization, an updated assessment is warranted. Accordingly, the primary purpose of the present study was to better understand the epidemiology of capitellar OCD in a representative US subpopulation. We sought to (1) describe the incidence of capitellar OCD over time, (2) assess for changes over time, and (3) identify factors that correlate with a diagnosis of capitellar OCD. We hypothesized that, although uncommon, the incidence of capitellar OCD would increase over time and that younger age and male sex would confer an increased likelihood of a capitellar OCD diagnosis.

METHODS

After receiving institutional review board approval, we performed a retrospective cohort study utilizing a geographic cohort from the Rochester Epidemiology Project (REP) to identify patients aged 0 to 24 years with a diagnosis of capitellar OCD between 1995 and 2019. The REP is a medical records linkage system and contains almost 500,000 unique patients living within southeast Minnesota and the surrounding areas.[18] This study only included patients who were diagnosed with capitellar OCD while a resident of Olmsted County, Minnesota, and those with appropriate research authorization.

Patients were identified via International Classification of Diseases (ICD) and Current Procedural Terminology (CPT) codes as shown in Appendix Table A1. Briefly, these codes cast a broad net to capture all potential patients within the selected geographic region and time frame. Patients were only included if they had a clinical diagnosis of symptomatic capitellar OCD and imaging (radiography, ultrasound, computed tomography [CT], and/or magnetic resonance imaging [MRI]) of the elbow that was consistent with capitellar OCD. Patients were excluded if they had an acute osteochondral injury related to trauma, inflammatory arthritis, congenital or hereditary arthropathy, or Panner disease.

Patient medical records (clinical notes, imaging studies, and operative reports) were manually reviewed to confirm the diagnosis and obtain the necessary study information. Data extracted included patient demographics (age, sex, ethnicity, sport participation), physical examination findings, OCD lesion characteristics on imaging, and treatment strategies. Patients who underwent surgery after a trial of nonoperative management were designated only as such if they had undergone nonoperative management for a period of 6 months after their index diagnosis. Throwing athletes were designated as such if they played baseball, softball, or football (quarterback). Overhead athletes included throwing athletes as well as those participating in gymnastics, volleyball, swimming, tennis, and weight lifting. Nonoverhead and nonthrowing athletes included those playing lacrosse, hockey, golf, and karate.

Statistical Analysis

Incidence rates were calculated for the study population (ages 10-24 years) and are expressed per 100,000 people. Incidence rates of capitellar OCD were sex and age specific and calculated by utilizing incident cases as the numerator with population estimates based on decennial REP census counts within the defined geographic area as the denominator. Multiplicative Poisson regression modeling was fitted as log-linear regression with an offset being the log population for a given age and year. These models were utilized to assess the relationship between the incidence of capitellar OCD and age, age groups, sex, year (as a continuous variable), and 5-year time intervals (1995-1999, 2000-2004, 2005-2009, 2010-2014, 2015-2019). Estimated incidence rate ratios (IRRs) were obtained by the coefficient output in these models. The IRR is a ratio that describes the

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Ethical approval for this study was obtained from the Mayo Clinic (No. 21-003864).

TABLE 1
Patient Characteristics (n = 45)[a]

Variable	Value	Variable	Value
Age, mean ± SD (range), y	14.5 ± 3.0 (10-24)	Participation in sport	40 (89)
Male, mean ± SD	15.1 ± 3.0	Single sport	22 (55)
Female, mean ± SD	12.5 ± 2.0	Multiple sports	18 (45)
Sex distribution overall		2 sports, n	10
Male	35 (78)	3 sports, n	8
Female	10 (22)	Throwing athlete	23 (58)
Sex distribution by age group		Overhead athlete	36 (90)
Younger (10-15 y; n = 31)		Sport type, n	
Male	23 (74)	Baseball	18
Female	8 (26)	Football	12
Older (16-24 y; n = 14)		Basketball	10
Male	12 (86)	Weight lifting	4
Female	2 (14)	Volleyball	4
Ethnicity		Gymnastics	4
White	41 (91)	Wrestling	4
Black	3 (7)	Golf	3
Asian	1 (2)	Ice hockey	1
Body mass index, mean ± SD (range), kg/m^2	24 ± 5 (18-37)	Karate	1
Laterality		Lacrosse	1
Right	28 (62)	Softball	1
Left	17 (38)	Swimming	1
Dominant side affected (n = 41)	27 (66)	Tennis	1

[a]Data are reported as n (%) unless otherwise indicated.

relative magnitude of a difference between 2 incidence rates associated with 2 different variables (eg, incidence among male compared to female patients).

For clinical and statistical utility and to approximate the age of physeal maturation in male patients, the cohort was split into 2 age groups: younger (10-15 years) and older (16-24 years). Unadjusted incidence rates were utilized, as the age and sex distribution among patients aged 10 to 24 years in Olmsted County, Minnesota, is similar to that of the general US population.[17]

To study any difference between the age groups of patients with capitellar OCD, the Fisher exact test and chi-square test were used as appropriate for determining the difference in categorical data, a 2-sample t test assuming unequal variance determined differences in means between continuous variables, and a 2-sample test of the equality of proportions without a continuity correction was utilized when the odds ratio (OR) in a 2 × 2 table contained a 0 value (overhead athletes and operative management).

Standard descriptive statistics were used to characterize patient demographics. Statistical analysis was conducted with BlueSky Version 7.40 (BlueSky Statistics). $P < .05$ was considered significant.

RESULTS

After applying exclusion criteria, 45 patients between the ages of 10 and 24 years were identified. There were 31 patients in the younger group (10-15 years) and 14 patients in the older group (16-24 years). The mean age of the overall cohort was 14.5 years (range, 10-24 years), and 35 (78%) were male. The mean age of male patients was 15.1 years (range, 11-24 years), while the mean age of female patients was 12.5 years (range, 10-16 years), resulting in a mean difference of 2.6 years between male and female patients (95% CI, 0.5-4.7; $P = .020$). The dominant side was affected in two-thirds of patients. Sport participation was seen in 89% of patients, and of these patients 58% were throwing athletes (Table 1). Sport participation was seen in 90% of the younger group and 86% of the older group (OR, 1.6 [95% CI, 0.2-10.5]; $P = .650$). Throwing athletes represented 54% of the younger group compared to 67% of the older group (OR, 0.6 [95% CI, 0.1-2.8]; $P = .680$). The mean follow-up was 8.7 years (range, 0.1-24 years).

The incidence rate of symptomatic capitellar OCD in the 25-year period studied was 6.0 per 100,000 overall, 9.5 per 100,000 for male patients, and 2.6 per 100,000 for female patients (Table 2). The male-to-female IRR was 3.5 ($P < .001$), and the IRR of the younger group compared to the older group was 3.3 ($P < .001$) (Table 3). There were no changes in the incidence of capitellar OCD over the study period when it was analyzed as a continuous variable ($P = .290$) or when analyzed in 5-year intervals ($P = .460$) (Figure 1).

In the younger group, the incidence rate was 10.6 per 100,000 in total and 15.3 and 5.6 per 100,000 for male and female patients, respectively (Table 4). Within this age group, male patients had an IRR of 2.8 compared to female patients ($P = .012$) (Table 3). The incidence rate within this age group did not change over time ($P = .710$) (Figure 1). In the older group, the incidence rate was 3.1 per 100,000 in total and 5.5 and 0.8 per 100,000 for male and female

TABLE 2
Incidence Rates for Capitellar Osteochondritis Dissecans by 5-Year Intervals

	Overall	1995-1999	2000-2004	2005-2009	2010-2014	2015-2019
Incidence						
Female	10	1	2	1	1	5
Male	35	6	7	10	4	8
Total	45	7	9	11	5	13
Incidence population (person-years)						
Female	384,058	69,014	78,010	79,698	76,868	80,468
Male	366,988	66,864	75,461	75,400	72,796	76,467
Total	751,046	135,878	153,471	155,098	149,664	156,935
Incidence rate (per 100,000)						
Female	2.6	1.4	2.6	1.3	1.3	6.2
Male	9.5	9.0	9.3	13.3	5.5	10.5
Total	6.0	5.2	5.9	7.1	3.3	8.3

TABLE 3
Predictors of Capitellar Osteochondritis Dissecans[a]

	Estimated Incidence Rate Ratio (95% CI)	*P* Value
Overall		
Age group	3.3 (1.8-6.4)	<.001
Male sex	3.5 (1.8-7.4)	<.001
Year	0.02 (0.2-1.1)	.290
Age 10-15 y		
Male sex	2.8 (1.3-6.7)	.012
Year	1.0 (1.0-1.1)	.710
Age 16-24 y		
Male sex	6.3 (1.7-40.4)	.016
Year	1.1 (1.0-1.1)	.570
Male sex		
Age group	2.8 (1.4-5.9)	.004
Year	1.0 (1.0-1.1)	.160
Female sex		
Age group	6.3 (1.6-41.7)	.020
Year	1.1 (1.0-1.2)	.080

[a]Multivariable analysis utilizing Poisson regression was performed with year as a continuous variable, sex as a categorical variable, and age group as a categorical variable.

patients, respectively (Table 4). Within this age group, male patients had an IRR of 6.3 compared to female patients ($P = .016$) (Table 3). The incidence rate within this age group did not change over time ($P = .570$) (Figure 1). When patients were analyzed by sex, male patients in the younger group had an incidence rate of 15.3 per 100,000, while the incidence rate for male patients in the older group was 5.5 per 100,000 ($P = .004$). Female patients in the younger group had an incidence rate of 5.6 per 100,000, while the incidence rate for female patients in the older group was 0.8 per 100,000 ($P = .020$) (Table 3).

MRI was utilized as an imaging modality more frequently over time ($P < .001$), but this was not the case for radiography or CT (Table 6). An operative intervention was performed in 37 of 45 patients (82%). Operative management was performed significantly more often in the older group compared to the younger group (100% vs 74%, respectively; $P = .040$) (Table 5). There were no statistically significant differences in operative intervention rates over time ($P = .130$). Of the patients who underwent operative management, the majority had a combination of procedures (eg, debridement with microfracture). Only 5 of 37 (14%) underwent debridement in isolation, and 3 of 37 (8%) underwent microfracture in isolation. The use of osteochondral allograft transplantation or osteochondral autograft transfer began after 2010 in the current cohort and was performed in 5 of 18 (28%) cases after that time. Additionally, 21 of 37 (57%) patients were managed operatively initially, while 16 of 37 (43%) underwent surgery in a delayed fashion after a minimum of 6 months of dedicated nonoperative treatment. Further, 8 of 45 (18%) patients were treated with definitive nonoperative management and never underwent surgery.

DISCUSSION

In this US population–based study on the incidence of symptomatic capitellar OCD between the ages of 10 and 24 years, the overall incidence rate was 6.0 per 100,000 in total and 9.5 and 2.6 per 100,000 for male and female patients, respectively. Both male sex and young age were significant predictors of capitellar OCD, with the incidence in younger male patients being 15.3 per 100,000 compared to 0.8 per 100,000 in older female patients. Although the overall incidence rate was higher than has previously been reported for the US population, this rate did not increase substantially over time. Overall, 82% of patients underwent surgical management, with older patients more likely to have surgery (100%) compared to younger patients (74%). The trends in treatment strategies (nonoperative vs surgical) or surgical approaches (arthroscopic vs open) did not change significantly over time.

The most relevant study in the published literature investigating incidence rates of capitellar OCD in the US population is that of Kessler et al.[10] Although that study calculated the incidence rate of elbow OCD (ie, including other areas of noncapitellar OCD), the proportion of cases affecting the capitellum was 97.5% of those identified.[10] That study utilized data from a Californian health system and reported an incidence rate of 2.2 per 100,000 patients

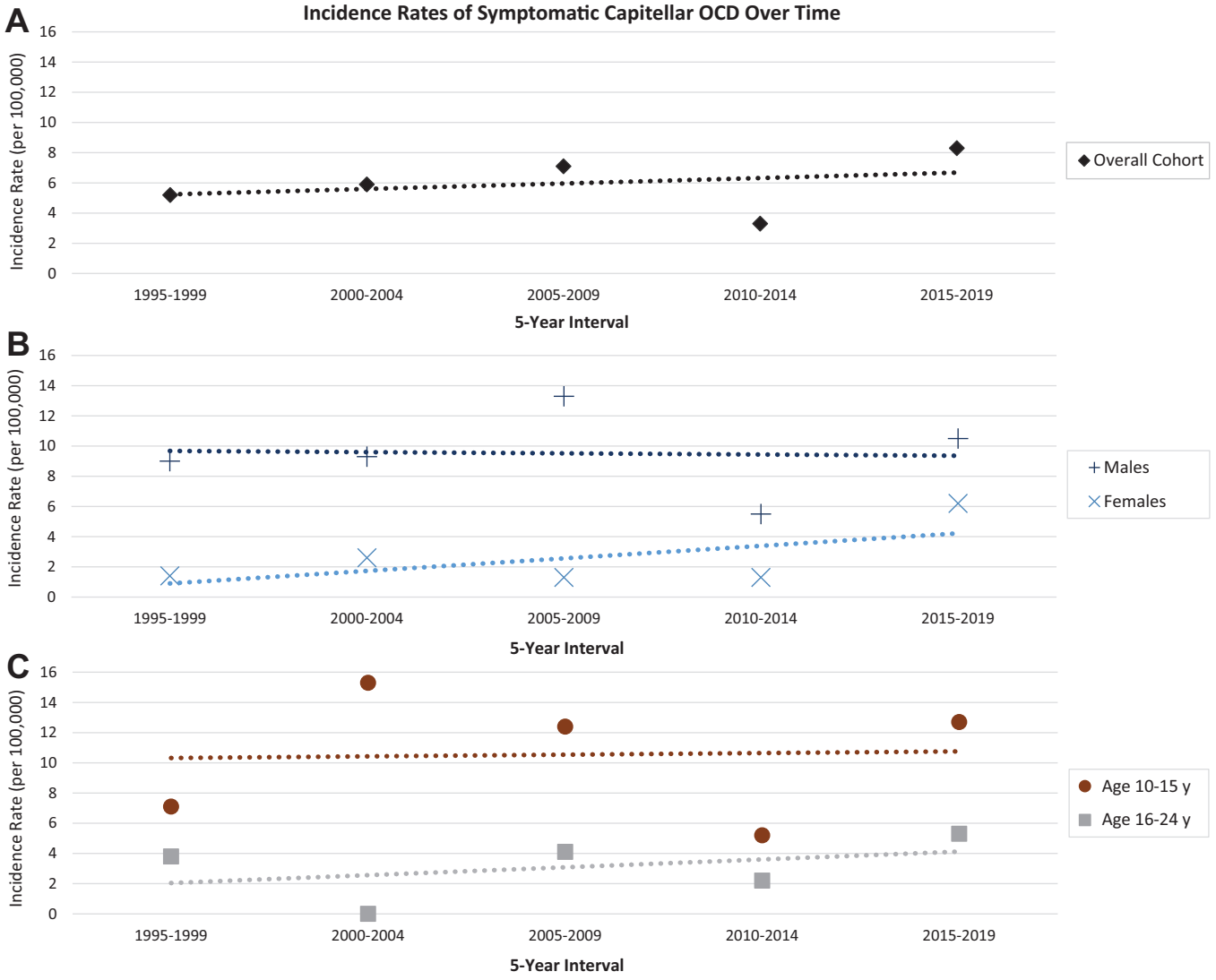

Figure 1. Incidence rates of symptomatic capitellar osteochondritis dissecans over time: (A) overall, (B) by sex, and (C) by age group. Simple linear lines of best fit were plotted. The overall cohort had an incidence rate of 6.0 per 100,000 over the 25-year period studied. The incidence rate was greatest among male patients aged 10 to 15 years (15.3/100,000) and lowest among female patients aged 16 to 24 years (0.8/100,000).

aged 6 to 19 years. The present study identified an incidence rate that was nearly 3 times higher in patients aged 10 to 24 years. These discrepancies may be attributable to differences in the populations of these regions, as the proportion of non-Hispanic White patients was 22% in their sub-population compared to nearly 90% in the current investigation. In the Kessler et al[10] study, the incidence rate of capitellar OCD among non-Hispanic White patients was 7.4 per 100,000, which more closely parallels the findings of our investigation. A separate study published in 2019 was a prospective cohort study of just over 1400 Japanese baseball players aged 6 to 11 years, which demonstrated a cumulative incidence of 1.8%, with only one-third of those patients being symptomatic.[13] Their rate of symptomatic capitellar OCD is 100 times greater than the incidence of capitellar OCD in the present study, and although their participants were found via a screening protocol in asymptomatic patients, this seems to point to a clear etiological mechanism responsible for OCD in a specific at-risk population of young, male Japanese baseball players. Rotman et al[15] showed that the radial head lags behind the coronoid during simulated overhead throwing and that this would be expected to cause shear stress in the subchondral bone of the capitellum.

Despite querying health records of all patients aged 0 to 24 years, capitellar OCD was only diagnosed among those aged 10 to 24 years. Within this age range, patients were split into 2 groups: 10-15 and 16-24 years. This was done to separate patients based on the approximate age at which capitellar physeal maturation and closure occur. The incidence rate of capitellar OCD within the younger age range was a little over 3 times that of the older age range.

Similarly, when comparing patients aged 12-19 years to those aged 6-11 years, Kessler et al[10] reported an incidence rate of capitellar OCD nearly 5 to 8 times higher in the 12- to 19-year age group. Taken together, these data suggest a strong predilection for capitellar OCD to occur between the ages of 10 to 19 years.

In the present study, there was no statistical change in the incidence rate of capitellar OCD over time. There are no studies in the literature to compare this finding to, and this finding is contrary to our hypothesis. An increase in the incidence was anticipated because of growing participation in youth sports and early sport specialization, but the data did not support this hypothesis. A recent study on this topic indicated that a reduction in the pitch count and inning count in adolescent baseball players did not decrease the incidence of capitellar OCD in an at-risk population, and this suggests that additional factors may be at play beyond the repetitive stress experienced by the throwing athlete.[14]

When evaluating sex as a variable in the incidence of capitellar OCD, male sex was identified as a significant factor. However, when the IRR comparing female patients in the younger versus older group (6.3) is compared to the same IRR in male patients (2.8), there is a greater magnitude of difference for younger female patients relative to their older counterparts than the analogous comparison in male patients. A few potential explanations for this disparity may be related to the differing sport/activity profiles of male and female patients as well as generally earlier physeal maturation in female patients. To explain the disparity between the male and female incidence rates, it may

TABLE 4
Incidence Rates for Capitellar Osteochondritis Dissecans by Age Group[a]

	Younger (10-15 y)	Older (16-24 y)
Incidence		
Female	8	2
Male	23	12
Total	31	14
Incidence population (person-years)		
Female	142,873	241,185
Male	150,154	216,834
Total	293,027	458,019
Incidence rate (per 100,000)		
Female	5.6	0.8
Male	15.3	5.5
Total	10.6	3.1

[a]The estimated incidence rate ratio of the younger group compared to the older group was 3.3 ($P < .001$).

TABLE 5
Sport Participation and Eventual Operative Management[a]

	Younger (10-15 y; n = 31)	Older (16-24 y; n = 14)	OR (95% CI)	*P* Value
Any sport participation	28 (90)	12 (86)	1.6 (0.2-10.5)	.650
Throwing athlete	15 (54)[b]	8 (67)[c]	0.6 (0.1-2.8)	.680
Overhead athlete	24 (86)[b]	12 (100)[c]	N/A[d]	.170[d]
Operative management	23 (74)	14 (100)	N/A[d]	.040[d]

[a]Data are reported as n (%) unless otherwise indicated. N/A, not applicable; OR, odds ratio.
[b]In the younger group, percentages were calculated with the denominator of patients who participated in sports (n = 28).
[c]In the older group, percentages were calculated with the denominator of patients who participated in sports (n = 12).
[d]The odds ratio was deemed of limited utility in this setting as the zero input (no non-overhead athletes between the ages of 16-24) into the 2x2 table provided a non-statistically significant, infinite odds ratio. As such, a 2-sample test of equality of proportions without a continuity correction was performed which demonstrated no statistical difference between overhead athletes in the 10-15 age group and 16-24 age group. This same rationale (0 nonoperative patients in the 16-24 age group) and subsequent test demonstrated a statistically different proportion of patients undergoing operative intervention in the 10-15 age group compared to the 16-24 age group.

TABLE 6
Diagnostic and Treatment Modalities by 5-Year Intervals[a]

	1995-1999	2000-2004	2005-2009	2010-2014	2015-2019	*P* Value
Imaging						
MRI	0/7 (0)	4/9 (44)	7/11 (64)	4/5 (80)	12/13 (92)	<.001
CT	3/7 (43)	5/9 (56)	8/11 (73)	4/5 (80)	8/13 (62)	.680
Radiography	7/7 (100)	9/9 (100)	11/11 (100)	5/5 (100)	13/13 (100)	N/A
Surgical treatment	5/7 (71)	5/9 (56)	10/11 (91)	5/5 (100)	12/13 (92)	.130
Approach						.390
Open	0/5 (0)	0/5 (0)	0/10 (0)	0/5 (0)	3/12 (25)	
Arthroscopic	4/5 (80)	5/5 (100)	9/10 (90)	3/5 (60)	7/12 (58)	
Combined	1/5 (20)	0/5 (0)	1/10 (10)	2/5 (40)	2/12 (17)	

[a]Data are reported as n (%). CT, computed tomography; MRI, magnetic resonance imaging; N/A, not applicable.

be that female patients are more protected from OCD given their earlier maturation before participation in higher intensity sports. Additionally, earlier physeal maturation may also help explain the predilection for female patients to develop capitellar OCD at a younger age (mean, 12.5 years) than male patients (mean, 15.1 years).

The use of MRI as a diagnostic imaging modality increased over time. CT was utilized at a similar rate over time and in the present study was used mainly to help identify loose bodies. The proportion of patients undergoing a surgical intervention did not statistically vary over time. Despite the small numbers, the older group did have a higher proportion of patients undergoing surgical management (100% vs 74% in the younger group). This supports the current clinical practice of using age and skeletal maturity as key factors in surgical decision making.[5,9,19]

Limitations

The limitations to this study include its retrospective nature, a limited geographic cohort, and an inability to capture asymptomatic patients who did not present for medical care. The uncommon nature of capitellar OCD led to an overall small sample size, which made it difficult to perform subgroup analyses. This small sample size additionally limits our overall conclusions and may predispose them to a type II error. Power analysis was not performed. In addition, this study demonstrated substantial ethnic differences compared to the epidemiological work of Kessler et al.[10] It is worth noting that the REP is readily generalizable to populations within Minnesota and the upper Midwest; however, it is less ethnically diverse compared to the remainder of the US.[4,17] As a result of the racial makeup of Olmsted County, the incidence rates identified herein likely parallel those of a majority non-Hispanic White population.

CONCLUSION

The overall incidence of symptomatic capitellar OCD between the ages of 10 and 24 years was 6.0 per 100,000 over the 25-year period studied, which is substantially higher than previously reported US estimates. The incidence was highest for 10- to 15-year-old male patients at 15.3 per 100,000 and lowest for 16- to 24-year-old female patients at 0.8 per 100,000. Older patients were more likely to undergo a surgical intervention compared to younger patients. Incidence rates and treatment strategies did not change significantly over the 25-year period studied.

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APPENDIX

TABLE A1
Diagnostic and Procedural Codes Utilized in Database Query

Code	Description
ICD-10	
M93.20	Osteochondritis dissecans of unspecified site
M93.22	Osteochondritis dissecans of elbow
M93.221	Osteochondritis dissecans, right elbow
M93.222	Osteochondritis dissecans, left elbow
M93.82	Other specified osteochondropathies of upper arm
M93.821	Other specified osteochondropathies, right upper arm
M93.822	Other specified osteochondropathies, left upper arm
M93.829	Other specified osteochondropathies, unspecified upper arm
M93.83	Other specified osteochondropathies of forearm
M93.831	Other specified osteochondropathies, right forearm
M93.832	Other specified osteochondropathies, left forearm
M93.839	Other specified osteochondropathies, unspecified forearm
M93.92	Osteochondropathy, unspecified of upper arm
M93.921	Osteochondropathy, unspecified, right upper arm
M93.922	Osteochondropathy, unspecified, left upper arm
M93.929	Osteochondropathy, unspecified, unspecified upper arm
M93.93	Osteochondropathy, unspecified of forearm
M93.931	Osteochondropathy, unspecified, right forearm
M93.932	Osteochondropathy, unspecified, left forearm
M93.939	Osteochondropathy, unspecified, unspecified forearm
ICD-9	
732.3	Juvenile osteochondrosis of upper extremity
732.7	Osteochondritis dissecans
CPT	
29830	Arthroscopy, elbow, diagnostic, with or without synovial biopsy (separate procedure)
29834	Arthroscopy, elbow, surgical; with removal of loose body or foreign body
29835	Arthroscopy, elbow, surgical; synovectomy, partial
29836	Arthroscopy, elbow, surgical; synovectomy, complete
29837	Arthroscopy, elbow, surgical; debridement, limited
29838	Arthroscopy, elbow, surgical; debridement, extensive
29999	Unlisted procedure, arthroscopy
24999	Unlisted procedure, humerus or elbow