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Am J Sports Med published online June 18, 2014
DOI: 10.1177/0363546514536843

AJSM PreView, published on June 18, 2014 as doi:10.1177/0363546514536843

Prevalence and Clinical Characteristics of Osteochondritis Dissecans of the Humeral Capitellum Among Adolescent Baseball Players

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Background: The prevalence and clinical characteristics of osteochondritis dissecans (OCD) of the humeral capitellum among adolescent baseball players are unknown.

Purpose: To determine the OCD prevalence in adolescent competitive baseball players and to investigate the clinical characteristics of these patients.

Study Design: Cross-sectional and case-control study; Level of evidence, 3.

Methods: A total of 2433 baseball players (mean age, 14.5 ± 1.5 years) belonging to junior high school and high school baseball clubs were enrolled. Players completed a questionnaire, and the elbow of each player's throwing arm was assessed by ultrasonography. Participants with abnormal results on ultrasonography were further examined through radiographic study. The OCD lesions were classified into stages based on radiographic results, and demographic data were compared between players with and without OCD lesions.

Results: Osteochondritis dissecans of the humeral capitellum was found in 82 (3.4%) elbows by ultrasonography. Players with an OCD lesion began playing baseball at an earlier age ($P = .016$), had a longer duration of competitive play ($P = .0013$), and had experienced more present ($P = .0025$) and past ($P < .0001$) elbow pain compared with players without a lesion. There were no differences between the 2 groups in the position played ($P = .26$). Sixty-eight patients underwent further radiographic examination for OCD (radiography, computed tomography, magnetic resonance imaging). Of these players, 10 (14.7%) were classified as having stage I OCD (radiolucent stage); 26 (38.2%), stage II (fragmentation stage); 9 (13.2%), stage III (loose body stage); 9 (13.2%), stage IV (residual stage); and 14 (23.5%), stage V (postoperative stage).

Conclusion: The prevalence of OCD of the humeral capitellum, including latent cases, was 3.4% among adolescent baseball players. Players with OCD lesions began playing baseball at earlier ages, had played for longer periods, and had experienced more elbow pain. The player's current baseball position may not be related to the existence of OCD lesions in adolescents.

Keywords: baseball; elbow; osteochondritis dissecans; ultrasonography; adolescent; prevalence

Osteochondritis dissecans (OCD) of the humeral capitellum is a common cause of elbow pain and disability in young athletes, typically affecting the throwing arm of baseball players. The cause of OCD of the humeral capitellum is believed to involve ischemia,[10] genetic factors,[19,25] and microtrauma.[1,24] The major clinical symptoms of this condition are elbow pain and restricted range of motion, and these symptoms become increasingly pronounced as the disease progresses. Although substantial numbers of patients with OCD are baseball players, few studies have investigated the prevalence of OCD of the humeral capitellum among baseball players. According to previous reports, the incidence of OCD of the humeral capitellum among Little League baseball players is 1.3% to 1.6%.[9,11] However, no studies have investigated a large study population (>1000 baseball players) and used imaging to confirm the diagnosis of OCD for all players, irrespective of the occurrence of any symptoms. Moreover, no reports have addressed the occurrence of OCD in adolescent baseball players.

As OCD of the humeral capitellum is a form of refractory osteochondral damage, treatment entails a prolonged absence from sports activity,[15,17] and surgical treatment may be indicated for advanced and severe lesions.[3,5,22,23,26]

The American Journal of Sports Medicine, Vol. XX, No. X
DOI: 10.1177/0363546514536843

Surgery for OCD lesions is most often required for adolescents[22,23]; however, many patients of this age continue playing sports without visiting a doctor despite their symptoms, and they often present for medical examination only after their injuries become serious. Asymptomatic or minimally symptomatic patients rarely visit medical institutions. Therefore, a better understanding of the prevalence of OCD of the humeral capitellum, including latent cases and potential risk factors for its development, may help players, their parents, and clinicians identify cases of OCD before they become serious.

Beginning to play baseball earlier in life and playing for longer periods places repetitive valgus stress on the humeral capitellum. Hence, being introduced to baseball at a younger age may be a risk factor for OCD of the humeral capitellum. Similarly, the number of opportunities that baseball players have to make a throw differs depending on the positions they play. Playing the position of pitcher or catcher—positions that experience the most throws—is reported as a risk factor for elbow injury.[6] However, to our knowledge, no studies have assessed these clinical characteristics in young baseball players with OCD of the humeral capitellum. Accordingly, the objective of this study was to investigate the prevalence of OCD of the humeral capitellum among competitive junior high school and high school baseball players and to investigate the patient characteristics that may be risk factors for the development of OCD (age introduced to baseball, duration of competitive play, present and past elbow pain when throwing, and position played).

MATERIALS AND METHODS

Baseball skill camps are held annually for all junior high school baseball clubs in Kyoto City and high school baseball clubs in Kyoto Prefecture during the off-season. Study participants were recruited for this study at these camps. We enrolled 2433 baseball players (2431 male, 2 female), who were between 12 and 18 years old (mean, 14.5 ± 1.5 years). All belonged to junior high school and high school baseball teams that took part in these skills courses between 2008 and 2011. This included 1559 junior high school students and 874 high school students. Institutional review board approval was received for this study.

All players completed a questionnaire asking about present and past elbow pain when throwing, their current position, the age at which they started playing baseball, and their duration of competitive play (see the Appendix, available online at http://ajsm.sagepub.com/supplemental). Players who had practiced and played as a pitcher were considered pitchers even if they also played other positions.

All players underwent an ultrasonography examination of the humeral capitellum as an initial screening. The devices used for the ultrasonography examination were the MyLab125 (Esaote SpA), Titan (Sonosite), Micromaxx (Sonosite), and LOGIQe (GE Healthcare), with a 10- to 14-MHz high-frequency linear array transducer used in all cases. The ultrasonographic examinations were performed by orthopaedic surgeons and ultrasonography technicians; the number of examiners differed from 2 to 10, according to the number of players participating in the baseball skill camps. In addition, 2 authors (Y. Kida and Y. Kotoura) supervised the examinations; both are orthopaedic surgeons and well experienced in elbow ultrasonography. When an abnormal ultrasonogram of the humeral capitellum was noted, ultrasonography of the lesion was reexamined and reconfirmed by the senior author (Y. Kida). The procedure for ultrasonographic examination was based on that previously described.[9,26,27,29] The probe was first placed on the anterolateral aspect of the elbow in the maximally extended position and then moved to the posterolateral aspect of the elbow in the maximally flexed position. Details of the ultrasonographic examination technique are presented in the Video Supplements available online. The articular surface of the humeral capitellum was scanned by carefully moving the probe along the long and short axes (Figure 1, Video 1). An irregularity, a break in continuity of the echo line, or a double floor line of the subchondral bone of the capitellum, in other words, "loss of smooth articular surface" was regarded as an abnormality (Figures 2-6, Video 2). Patients with these findings were diagnosed as having OCD of the humeral capitellum, and it was recommended that they undergo a secondary survey in the hospital. Answers to the questionnaire by players with and without OCD of the humeral capitellum were then compared.

As secondary screening, players underwent plain radiography scanning of the elbow in the hospital. Plain radiographs were taken in the anteroposterior plane of the elbow at 0°, 45° flexed, and lateral positions. Additional computed tomography and/or magnetic resonance imaging scans were performed when the existence of bony or cartilaginous loose bodies was suspected. Radiographs that revealed OCD of the humeral capitellum were further subclassified into 5 groups: stage I (radiolucent), stage II (fragmentation), stage III (loose body), stage IV (residual), and stage V (postoperative). Stages I, II, and III followed the guidelines of Matsuura et al.[15] If the surface of the humeral capitellum was residually irregular but the epiphyseal line was closed and there was no evidence of dissociation or loose bodies, then the lesions were separately classified as stage IV. Patients who had previously undergone surgery for OCD of the humeral capitellum were

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The authors declared that they have no conflicts of interest in the authorship and publication of this contribution.

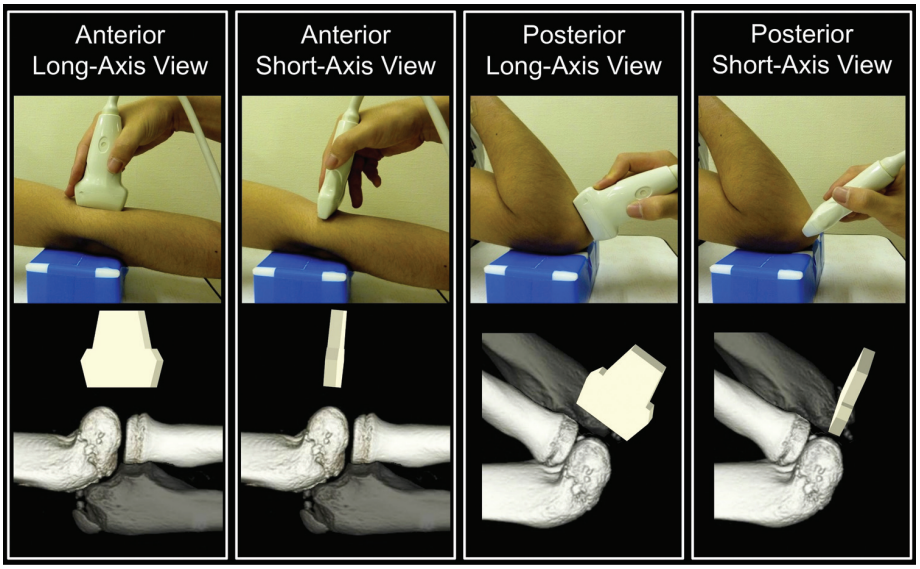

Figure 1. Procedure for ultrasonographic examination of the humeral capitellum. When the elbow was in the maximally extended position, the ultrasonography probe was placed on the anterolateral aspect of the elbow and then moved to the posterolateral aspect of the elbow when it was in the maximally flexed position. In each position, the humeral capitellum was scanned in both the long and short axes.

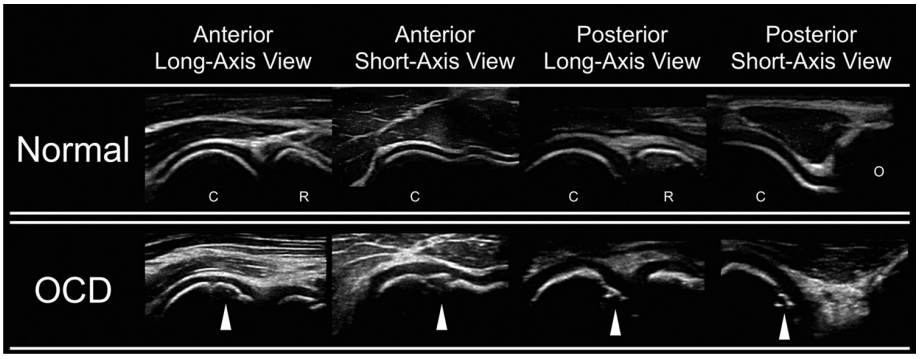

Figure 2. Ultrasonographic images of the humeral capitellum (normal and OCD). (Top row) In the normal capitellum, the echo lines of the subchondral bone are smooth. (Bottom row) Images of a capitellum affected by OCD show an irregularity, a break in continuity of the echo line, and a double floor line of the subchondral bone of the capitellum (white arrowheads). C, capitellum; O, olecranon; OCD, osteochondritis dissecans; R, radial head.

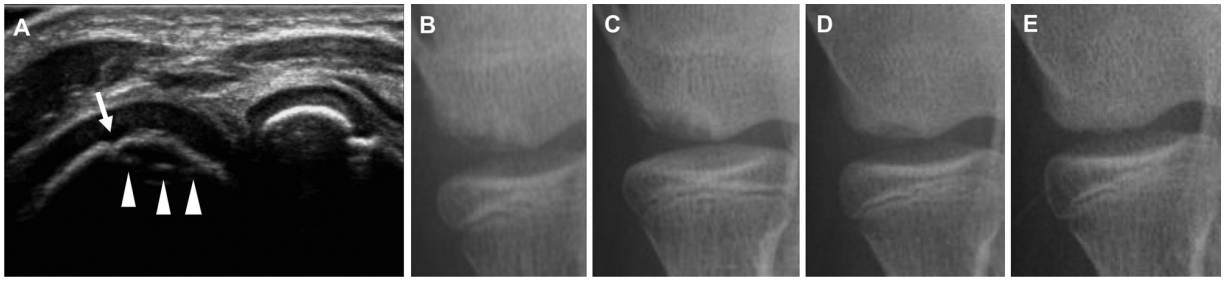

Figure 3. Stage I (radiolucent stage) osteochondritis dissecans of the humeral capitellum (radiolucent area). (A) Ultrasonographic image obtained during the initial screening (posterior long-axis view). Irregularity (arrow) and double floor line (arrowheads) were found on the capitellum. (B) Radiograph (45° flexed tangential anteroposterior view) obtained at the initial examination. (C-E) Radiographs obtained at 2, 6, and 10 months after the initial examination, respectively.

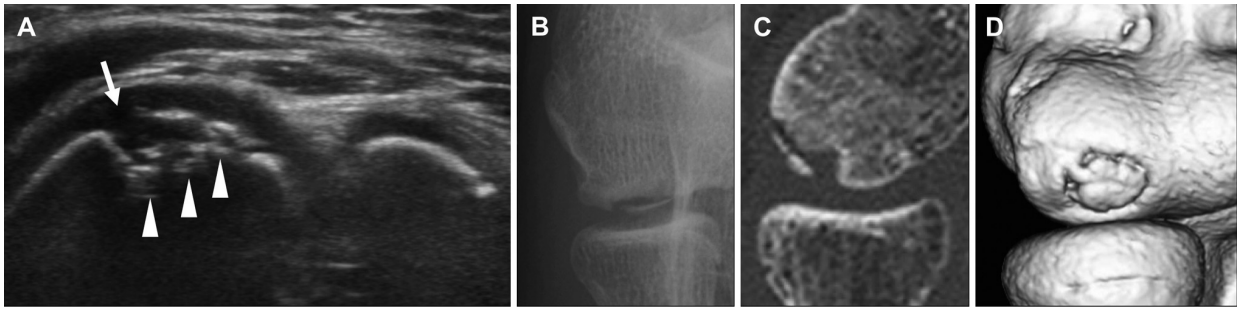

Figure 4. Stage II (fragmentation stage) osteochondritis dissecans of the humeral capitellum (nondisplaced fragments). (A) Ultrasonographic image taken during the initial screening (posterior long-axis view). A break in continuity of the echo line (arrow) and a double floor line (arrowheads) was observed on the capitellum. (B) Radiograph (45° flexed tangential anteroposterior view) obtained at the initial examination. (C) Sagittal slice of the humeral capitellum by computed tomography. (D) Anterior view of the 3-dimensional computed tomography.

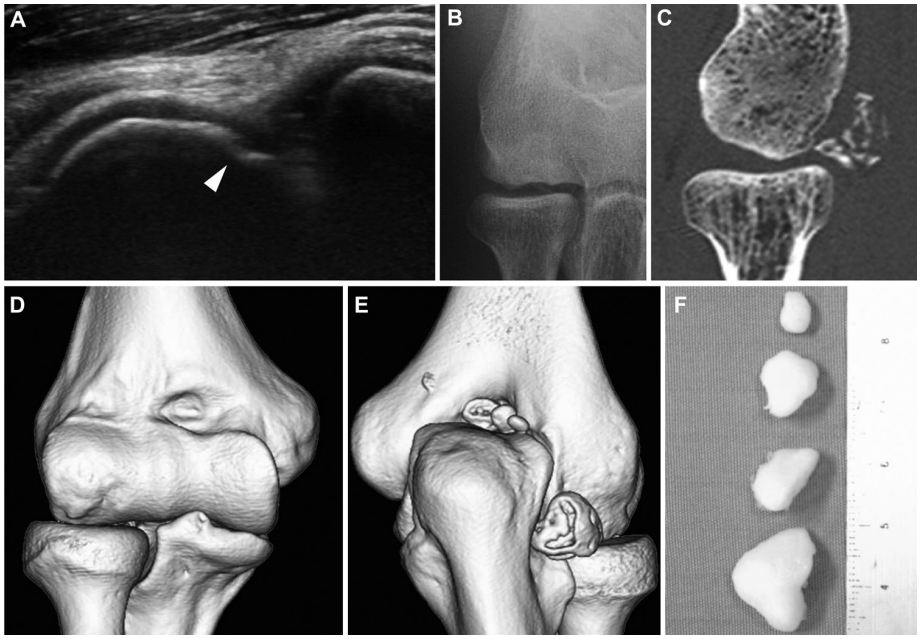

Figure 5. Stage III (loose body stage) osteochondritis dissecans of the humeral capitellum (loose bodies and sclerotic change). (A) Ultrasonographic image obtained during the initial screening (anterior long-axis view). Irregularity of the subchondral bone was observed on the capitellum. (B) Radiograph (45° flexed tangential anteroposterior view) obtained at the initial examination. (C) Sagittal slice of the capitellum by computed tomography. (D) Anterior view of the 3-dimensional computed tomography. (E) Posterior view of the 3-dimensional computed tomography. (F) Loose bodies that were removed by arthroscopic surgery.

classified as stage V. Each parameter of the OCD and non-OCD groups were statistically compared by Student *t* test (ie, age, age introduced to baseball, duration of competitive play, experience of present and past elbow pain, and position played). To evaluate the relationship of OCD incidence and each parameter, odds ratios (ORs) and 95% CIs were calculated and statistically tested with univariate logistic regression analysis. A 1-way analysis of variance with Tukey post hoc test was used to determine differences among the OCD stages for age, age introduced to baseball, and duration of competitive play. These analyses were performed with SAS software v. 9.2 (SAS Institute). We considered $P < .05$ to be statistically significant.

RESULTS

The mean age of the players enrolled in the study was 14.5 ± 1.5 years; the mean age that players were introduced to baseball was 9.2 ± 2.0 years; the mean duration of competitive play was 5.3 ± 2.7 years; and the proportions of players with present and past pain when throwing

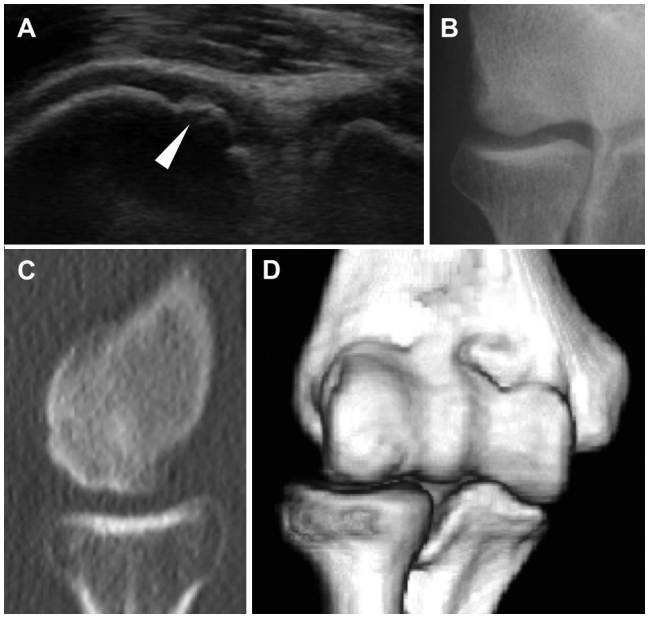

Figure 6. Stage IV (residual stage) osteochondritis dissecans of the humeral capitellum (irregular capitellum with no dissociation or loose bodies after closed epiphyseal line). (A) Ultrasonographic image obtained during the initial screening (anterior long-axis view). Irregularity of the subchondral bone was observed on the capitellum (arrowhead). (B) Radiograph (45° flexed tangential anteroposterior view) obtained at the initial examination. (C) Sagittal slice of humeral capitellum by computed tomography. (D) Anterior view of the 3-dimensional computed tomography.

were 17.1% and 57.0%, respectively. There were 634 (26.1%) pitchers, 322 (13.2%) catchers, and 1477 (60.7%) field players (Table 1).

The initial ultrasonographic screening revealed OCD of the humeral capitellum in 82 players (3.4%). Players with OCD had a mean age of 14.9 ± 1.6 years and without OCD, a mean age of 14.5 ± 1.5 years ($P = .034$). The mean age at which the adolescents began playing baseball was 8.7 ± 1.8 years for those with OCD and 9.2 ± 2.0 years for those without OCD ($P = .016$). The duration of competitive play was 6.2 ± 2.4 years for those with OCD and 5.3 ± 2.6 years for those without OCD ($P = .0013$) (Table 1). The incidence of OCD lesions among adolescent baseball players was significantly related to age (OR = 1.16; 95% CI = 1.01, 1.34; $P = .037$), age introduced to baseball (OR = 0.88; 95% CI = 0.79, 0.99; $P = .028$), and duration of competitive play (OR = 1.14; 95% CI = 1.04, 1.23; $P = .0039$) (Table 2).

Present elbow pain when throwing was experienced by 27 of 82 (32.9%) players with OCD, which was a significantly higher proportion than the 388 of 2351 (16.5%) players without OCD ($P = .0025$). Players with OCD reported previous elbow pain when throwing in 67 of 82 (81.7%) cases, which was also a significantly higher proportion than the 1320 of 2351 (56.1%) players without OCD ($P < .001$) (Table 1). The incidence of OCD lesions was significantly correlated with experiences of present elbow pain (OR = 2.54; 95% CI = 1.59, 4.04; $P < .001$) and past elbow pain (OR = 4.71; 95% CI = 2.54, 8.73; $P < .001$) (Table 3).

The percentages of pitchers, catchers, and fielders were 29.3%, 7.3%, and 63.4%, among the OCD group and 25.9%, 13.4%, and 60.6% among the non-OCD group, respectively, with no statistically significant differences ($P = .50$, .11, and .61, respectively) (Table 1). The incidences of OCD lesions for pitchers, catchers, and fielders were 3.8%, 1.9%, and 3.5%, respectively. There were no correlations between lesions and current positions (overall $P = .26$) (Table 4).

Secondary screening and examination in the hospital were recommended for players with OCD detected by ultrasonography on initial screening. Sixty-eight players underwent further examination. For all 68 players, OCD lesions of the humeral capitellum were evident on plain radiographs or computed tomography and magnetic resonance images obtained during secondary screening. In terms of the OCD stage, 10 patients (14.7%) were classified as stage I (Figure 3), 26 (38.2%) as stage II (Figure 4), 9 (13.2%) as stage III (Figure 5), 9 (13.2%) as stage IV (Figure 6), and 14 (23.5%) as stage V (Table 5). The mean age at which the players at stage V underwent surgery was 14.1 ± 1.2 years, and the surgical procedures were for microfracture in 8 cases, bone-peg grafting in 3 cases, and osteochondral autograft transplantation in 3 cases. Five players had received nonoperative treatment: 3 were stage IV, and 2 did not show up for the secondary survey at hospitals associated with the authors. Players with lesions at stages I and II were significantly younger compared with the players at stages III, IV, and V ($P < .001$) (Table 5). Yet, there was no significant difference between the groups in the age at which the participants started playing baseball (Table 5). A difference in the duration of playing baseball competitively was only seen between players at OCD stages II and V ($P = .019$) (Table 5).

DISCUSSION

Osteochondritis dissecans of the humeral capitellum is a serious sports injury for baseball players. Because it becomes more difficult to treat as the disease progresses, early diagnosis and treatment are essential.[15,17] However, in early stages of OCD of the humeral capitellum, patients may not feel pain, or the pain may be mild enough that they remain capable of throwing and therefore do not seek medical attention. Little is known about the prevalence of OCD of the humeral capitellum. In 1933, Neilsen[19] reported that OCD of the humeral capitellum affected the elbow of 1 of 139 office workers and 40 of 861 manual workers. A study by Gugenheim et al,[7] which investigated physical findings and plain radiographs of 595 Little League baseball players, demonstrated that elbow pain and restricted range of motion were apparent in 17% of players without any evidence of OCD of the humeral capitellum. In another Little League survey by Larson et al,[13] which enrolled 166 players, elbow pain and restricted range of motion were apparent in 20% of players, and morphologic

TABLE 1
Characteristics of Players by Diagnosis: OCD or Non-OCD[a]

	All Players	OCD	Non-OCD	*P* Value
n	2433	82 (3.4)	2351 (96.6)	
Age, y	14.5 ± 1.5	14.9 ± 1.6	14.5 ± 1.5	.034[b]
Age introduced to baseball, y	9.2 ± 2.0	8.7 ± 1.8	9.2 ± 2.0	.016[b]
Duration of competitive play, y	5.3 ± 2.7	6.2 ± 2.4	5.3 ± 2.6	.0013[b]
Elbow pain, %				
Present	17.1	32.9	16.5	.0025[b]
Past	57.0	81.7	56.1	<.001[b]
Position				
Pitcher	634 (26.1)	24 (29.3)	610 (25.9)	.50
Catcher	322 (13.2)	6 (7.3)	316 (13.4)	.11
Fielder	1477 (60.7)	52 (63.4)	1425 (60.6)	.61

[a]Values are expressed as mean ± SD or n (%) unless otherwise indicated. OCD, osteochondritis dissecans.
[b]$P < .05$, between OCD and non-OCD players.

TABLE 2
Relationship of OCD Lesion to Age and Duration[a]

	OR (95% CI)	*P* Value
Age, y	1.16 (1.01, 1.34)	.037[b]
Age introduced to baseball, y	0.88 (0.79, 0.99)	.028[b]
Duration of competitive play, y	1.14 (1.04, 1.23)	.0039[b]

[a]Per each subsequent year. Players, N = 2433; players with OCD, n = 82; rate of OCD, 3.4%. OCD, osteochondritis dissecans; OR, odds ratio.
[b]$P < .05$.

abnormalities of the humeral capitellum were seen in 5%. In the largest study of Little League baseball players to date by Iwase, which included 6677 players aged 8 to 12 years, the prevalence of OCD of the humeral capitellum was 1.6%, calculated on the basis of the number of players in which an OCD lesion was revealed by secondary screening with plain radiography in a hospital, which was recommended to players with elbow pain or restricted range of motion in an initial screening.[11] In a 2004 study by Hang et al[8] of 343 adolescent baseball players in Taiwan, although morphologic abnormalities of the medial epicondyle were common among pitchers and catchers, there was only 1 case of OCD of the humeral capitellum. The prevalence of OCD of the humeral capitellum in our study was 3.4%. Radiographic scanning on secondary screening revealed that a relatively low percentage of players had stage I OCD (14.7% of players). At this stage, the recovery rate is high with nonoperative treatment.[15,17] There were 38.2% players at stage II and 13.2% players at stage III; players at these stages had a high probability of requiring surgery. The present study is the largest diagnostic imaging study of the humeral capitellum in junior high school and high school players engaged in competitive baseball. Because we assessed participants playing at the school club level across a large residential area, it can be considered representative of the population of baseball players at regular junior high schools and high schools across Japan.

Plain radiographs have been used for the diagnosis of OCD of the humeral capitellum, but because most OCD lesions are located at the front of the humeral capitellum, the addition of anteroposterior images at 45° flexion or tangential images has reportedly enabled the detection of small disease foci.[4] However, using radiography scanning as a screening test would be associated with radiation exposure. Recent improvements in the spatial resolution of ultrasonography images have enabled more detailed cross-sectional images to be obtained in various musculoskeletal fields.[16,21] Compact, portable, diagnostic ultrasonography devices have also been developed that are now commercially available. In 2000, Takahara et al[27] compared ultrasonography images, plain radiographs, and surgical findings for OCD of the humeral capitellum, and they reported that ultrasonography is valuable for the diagnosis of OCD of the humeral capitellum. In 2006, Harada et al performed ultrasonography scanning of the elbows of 153 adolescent baseball players, and they found signs of medial epicondylar fragmentation in 33 players and OCD of the humeral capitellum in 2 players (1.3%). Their findings were similar to those from plain radiographs of all 23 players who underwent secondary screening in a hospital, demonstrating the reliability of ultrasonography for diagnosing baseball elbow.[9]

In this study, portable diagnostic ultrasonography devices were used because of the convenience for carrying onto the sports field. The method of Harada et al[9] was followed as previously described. OCD lesions were evident on plain radiographs of all players who showed morphologic abnormalities of the humeral capitellum on ultrasonography. Ultrasonography scanning thus had a positive predictive value of 100% for OCD of the humeral capitellum in adolescents. A distinctive loss of the smooth articular surface was useful for detecting OCD of the humeral capitellum with ultrasonography.

Because players with OCD of the humeral capitellum can continue playing baseball even if they experience pain, there are players who do not undergo medical examination until symptoms become severe. We found that 77.8% of stage III players experienced pain in the past but endured it to continue playing baseball. Players with

TABLE 3
Relationship of OCD Lesion to Present and Past Elbow Pain[a]

Elbow Pain	Players, n	Players With OCD, n	Rate of OCD, %	OR (95% CI)	*P* Value
Present					
Yes	415	27	6.5	2.54 (1.59-4.04)	<.001[b]
No	2018	55	2.7	1	
Past					
Yes	1388	67	4.8	4.71 (2.54-8.73)	<.001[b]
No	1045	15	1.4	1	

[a]OCD, osteochondritis dissecans; OR, odds ratio.
[b]$P < .05$.

TABLE 4
Relationship of OCD Lesion to Player Position[a]

Position	Players, n	Players With OCD, n	Rate of OCD, %	OR (95% CI)	Overall *P* Value
Pitcher	634	24	3.8	1.04 (0.64-1.69)	.26
Catcher	322	6	1.9	0.50 (0.21-1.17)	
Fielder	1477	52	3.5	1	

[a]OCD, osteochondritis dissecans; OR, odds ratio.

TABLE 5
Characteristics of Players With OCD (n = 68) by Disease Classification[a]

	OCD Stage				
	I: Radiolucent	II: Fragmentation	III: Loose body	IV: Residual	V: Postoperative
No. of players, %	10 (14.7)	26 (38.2)	9 (13.2)	9 (13.2)	14 (23.5)
Age, y	13.2 ± 0.4[b]	13.9 ± 1.2[b]	16.2 ± 0.7[c]	16.4 ± 0.5[c]	15.9 ± 1.3[c]
Age at surgery, y					14.1 ± 1.2[b]
Age introduced to baseball, y	7.8 ± 2.3	8.8 ± 1.6	8.8 ± 2.3	9.3 ± 2.4	8.4 ± 1.5
Duration of competitive play, y	5.4 ± 2.0	5.2 ± 2.1[d]	7.4 ± 2.7	7.1 ± 2.5	7.5 ± 2.2[e]
Elbow pain, %					
Present	50.0	23.1	44.4	33.3	35.7
Past	100	73.1	77.8	66.7	100

[a]Values are expressed as mean ± SD unless otherwise indicated. ANOVA, analysis of variance; OCD, osteochondritis dissecans.
[b]Significantly different from stage III, stage IV, and stage V; $P < .001$, ANOVA and Tukey post hoc test.
[c]Significantly different from stage I, stage II, and age at the time of operation; $P < .001$, ANOVA and Tukey post hoc test.
[d]Significantly different from stage V; $P = .019$, ANOVA and Tukey post hoc test.
[e]Significantly different from stage II; $P = .019$, ANOVA and Tukey post hoc test.

OCD experience elbow pain in significantly higher proportions than players without OCD, and this could be considered as a risk factor for the existence of lesion. However, our data also show that the awareness of elbow pain while throwing is not enough to detect OCD of the humeral capitellum, and diagnostic imaging is necessary to detect the latent lesion. Young baseball players with a history of elbow pain should be medically examined and undergo imaging examination to check for the presence of lesions, even if they are still able to throw.

Stage IV could not be categorized by previously reported classifications. Those in this stage were significantly older than those in stages I and II and had no or slight symptoms and irregularity on the surface of humeral capitellum with a closed capitellar physis and no loose bodies. This stage is difficult to recognize in the absence of imaging diagnosis for all players, because the players with this stage would not visit the hospital. Taking into account that OCD of the humeral capitellum with open capitellar physis has active spontaneous healing ability by nonoperative treatment, stage IV may represent a healed stage without becoming symptomatic. Only the degradation process of this lesion has been emphasized and classified in stages in previous reports.[12,15,18,26,28] However, our study revealed this new classification, which focuses on the natural healing process of this disease.

The age of participants at the time of the survey had a small but significant correlation with the existence of an OCD lesion, indicating that the existence of an OCD lesion is cumulative by age among adolescent baseball

players. This is understandable because OCD lesions are difficult to treat when patients keep on playing baseball without changing throwing levels.[15]

Studies by Lyman et al[14] and Fleisig et al[6] about the risk factors for elbow injury in baseball pitchers found a strong correlation with the number of pitches and elbow injury. However, no previous study has addressed risk factors specifically for OCD of the humeral capitellum. The present study found that players with OCD of the humeral capitellum started playing baseball at younger ages and had been playing competitively for longer periods than those without OCD of the humeral capitellum. Starting to play baseball at a young age and continuing to specialize in the sport may be risk factors for OCD of the humeral capitellum in junior high school and high school students. The repetitive action of throwing is known to be an etiologic factor in OCD of the humeral capitellum.[1,2] Throwing-induced elbow damage is believed to be more common in players with positions that entail more frequent throwing, such as pitchers and catchers.[1,6,8] A study of major league players also found that elbow damage was around 6 times more frequent in pitchers than in field players.[20] In the present study, however, there was no difference among the positions. One possible reason is that players tend to frequently change positions from elementary through high school; therefore, the comparison of the current positions may not have accurately assessed the burden on the elbow. Since we did not investigate players' past positions, it is difficult to conclude that the position is not related to OCD. Nevertheless, in screenings of junior high school and high school students, the possibility of OCD of the humeral capitellum should always be kept in mind, irrespective of position.

The strength of this study is the information on the prevalence of OCD by diagnostic imaging in a large population of adolescent baseball players.

There are several limitations to this study. First, radiographs were obtained only in players with positive ultrasonography findings, raising the possibility of false-negative findings. Second, there is a possibility of false-positive findings, as 17.1% of players whose ultrasonographic findings were positive did not undergo radiographic examinations. Third, there is a possibility that recall or memory bias may exist for the question about "past elbow pain." Fourth, the inter- and intraobserver reliabilities of the ultrasonography examination were not investigated. Fifth, detailed information on pain and physical characteristics were not investigated.

Young baseball players themselves, parents, coaches, and health care providers should be aware of the prevalence of OCD of the elbow and its clinical characteristics to promote safe play practices and to ensure that young players are able to reap the benefits of continuing sports competitively today and for a lifetime.

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ACKNOWLEDGMENT

The authors thank the players, coaches, members of baseball associations, and the staff for their assistance. They are deeply grateful to Mr Hiroyoshi Otsuki, Mr Masashi Matsuzaki, Mr Mutsuhiro Yamaguchi, Mr Yoshiaki Murase, and Mrs Noriko Kashiwagi for their great support of this study. Special thanks also to Dr Gregor Szöllösy for translating the reference written in German. Finally, they express gratitude to their families for the moral support and warm encouragement.

A Video Supplement for this article is available in the online version or at http://ajsm.sagepub.com/supplemental.

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