Catcher’s Knee: Posterior Femoral Condyle Juvenile Osteochondritis Dissecans in Children and Adolescents

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Background: Juvenile osteochondritis dissecans is an idiopathic condition involving subchondral bone and articular cartilage in skeletally immature patients in whom the growth plates are open, potentially leading to lesion instability. Because of the differing forces experienced by baseball/softball catchers versus position players, the age at which lesions develop and the characteristics of the lesions themselves may differ between these 2 populations. The purpose of the study was to examine relative age and characteristics of osteochondritis dissecans (OCD) knee lesions in catchers compared with position players.

Methods: Using a text-based search tool that queries clinic notes, lesiones in catchers compared with position players. The authors declare no conflicts of interest. None of the authors received any external financial support.

Results: When compared with noncatchers, catchers presented at a younger age (P = 0.035) but were similar with respect to bilateral involvement (P = 0.115), sex (P = 0.457), and lesion severity (P = 0.484). Lesions in catchers were more posterior on the femoral condyle in the sagittal plane (P = 0.004) but similar in location in the coronal plane (P = 0.210).

Conclusions: Catchers developed OCD at a younger age and in a more posterior location on the medial and lateral femoral condyles than noncatchers. These results may represent the effects of repetitive and persistent loading of the knees in the hyperflexed position required of catchers. Increased awareness of this risk may lead to surveillance and prevention programs.

Level of Evidence: Level III—case-control study.

Key Words: OCD, osteochondritis dissecans, baseball, softball, catcher, microtrauma

Osteochondritis dissecans (OCD) of the knee is a localized pathologic process in which an area of subchondral bone undergoes metabolic changes or diminished blood supply, potentially involving separation of the bone and overlying cartilage from surrounding bony tissue. Despite the condition first being described over 100 years ago by Paget and König, its precise etiology and natural history remain largely speculative and controversial. Ischemia, repetitive trauma, abnormal ossification, genetics, and inflammation have all been postulated as etiological factors. Recent increased participation and specialization in youth sports and the rising rate of OCD in skeletally immature athletes may support the theory of overuse and repetitive microtrauma, with OCD recently being reported as the fourth most common overall injury in young athletes seen at a large pediatric hospital. Incidence in the general population has been reported to be < 30/100,000.

OCD has been classified as juvenile OCD (jOCD) if the growth plates are open and adult OCD if the growth plates are closed. OCD has further been classified based on location and stability, with the lateral aspect of the medial femoral condyle being the most common location. Both nonoperative and operative treatments have been described. Nonoperative treatment is usually recommended for stable jOCD lesions with intact articular cartilage and typically consists of activity restriction. Operative treatment is usually recommended for adult OCD lesions, unstable lesions, and stable lesions that have failed nonoperative treatment. Surgical treatment options include drilling, fixation, and chondral resurfacing.

Attention has been paid to overuse upper extremity injuries in youth baseball and softball players including Little League Shoulder, Little League Elbow, internal impingement of the shoulder, OCD of the capitellum, medial epicondyle apophyseal injuries, and ulnar collateral ligament injuries. Early detection of injuries and the establishment of pitch count regulations can reduce the number of these injuries. However, little attention has been paid to overuse injuries of the lower extremity in these athletes. In particular, the repetitive and persistent knee hyperflexion required to play baseball/softball catcher may influence the development and characteristics of OCD lesions.
The purpose of this study was to describe the age of presentation and characteristics of OCD lesions of the knee in youth baseball and softball players and to determine if these parameters differed between catchers and position players.

FIGURE 1. Cohort selection. MRI indicates magnetic resonance imaging; OCD, osteochondritis dissecans.

METHODS

Patient Population

Inclusion criteria for the study were: children and adolescents 18 years old or younger, OCD of the knee,
played baseball and/or softball at the time he/she presented with OCD, the position the patient played was specified in the medical record, and magnetic resonance imaging (MRI) of the affected knee was available.

A computerized search was performed of the medical records of a large tertiary care Children's Hospital from 1990 to 2014 using a text-based tool that queries clinical notes and operative reports. A detailed review of the records returned by the search was then performed to confirm that each patient met the inclusion criteria. The results of this search and filtering process are shown in Figure 1. The original query was performed with the following broad search string to maximize patient identification: ("baseball" OR "softball") AND ("OCD" OR "pOCD" OR "osteochondritis" OR "ICD-9 732.7 Osteochondritis dissecans" OR "ICD9 732.9 Unspecified osteochondropathy").

The final cohort consisted of 98 knees in 78 patients. There were 33 knees in 29 catchers and 65 knees in 49 noncatchers. Only 6 of the 29 catchers reported playing other positions in addition to catcher.

Measurements/Definitions

Demographics

Demographics of the catcher and noncatcher groups were compared, including age at MRI imaging of the lesion, whether the patient had unilateral versus bilateral lesions, and sex.

Lesion Severity

The severity of each lesion was determined using 2 methods. First, a pediatric orthopaedic sports medicine fellow read T2-weighted MRIs to evaluate fluid within the lesion and T1-weighted MRIs to evaluate breaks in the articular cartilage. Each lesion was then graded using the Hefti staging scale, which defines the 5 stages outlined in Table 1. Second, for patients who required surgical treatment, the stage determined using the MRI was confirmed by narrative accounts of the lesion from the pediatric orthopaedic sports medicine attending surgeon’s operative report. When disagreement existed between the fellow’s MRI read and the attending surgeon’s report, a second attending was consulted to read the MRI.

| Table 1. Hefti Staging Scale for Osteochondritis Dissecans |
|-----------------|-----------------|-----------------|
| Stage | Description |
| I | Small change of signal without clear margins of fragment |
| II | Osteochondral fragment with clear margins but without fluid between fragment and underlying bone |
| III | Fluid is visible partially between fragment and underlying bone |
| IV | Fluid is completely surrounding the fragment, but the fragment is still in situ |
| V | Fragment is completely detached and displaced (loose body) |

| Table 2. Patient Characteristics Grouped by Catcher and Noncatcher Position |
|-----------------|-----------------|-----------------|
| Metric | Catchers | Noncatchers | P |
| No. Patients (involved knees) | 29 (33) | 49 (65) | |
| Age (average ± SD) (y) | 12.7 ± 2.0 | 13.7 ± 2.3 | 0.035 |
| Laterality | 4 bilateral | 16 bilateral | 0.115 |
| Sex | 25 M | 45 M | 0.457 |
| Laterality | 25 unilateral | 33 unilateral | |

F indicates female; M, male.
Lesion Location

The location of each lesion was determined using the Cahill and Berg classification system, which defines 3 regions based on the sagittal perspective and 5 regions based on the coronal perspective. For the purposes of statistical comparisons in the current study, patellar lesions were added to the original Cahill and Berg system as a fourth sagittal category and sixth coronal category. The final system used in the current study is detailed in Figure 2.

Statistical Analyses

Ages between the catcher and noncatcher cohorts were compared using 2-tailed Student t test. All other comparisons were performed using χ² or Fisher exact test where appropriate. The level of significance was set at P = 0.05.

RESULTS

Demographics

When compared with the cohort of noncatchers, the cohort of catchers presented at a younger age (P = 0.035) but had similar distributions of unilateral versus bilateral lesions (P = 0.115) and male versus female patients (P = 0.457) (Table 2).

Lesion Severity

Neither the overall distribution of Hefti staging nor any of the individual stages were significantly different between catchers and noncatchers (P = 0.484) (Fig. 3).

Lesion Location

Sagittal Location

Of 33 knees in catchers, 15 had OCD in location C and 9 had OCD in location B. Of 65 knees in noncatchers, 12 had OCD in location C and 39 had OCD in location B. There was statistical significance in the following comparisons: Overall distribution of sagittal locations was different between catchers and noncatchers (P = 0.012), lesions in catchers were more likely to be in region C than lesions in noncatchers (P = 0.010), and lesions in noncatchers were more likely to be in region B than lesions in catchers (P = 0.004) (Fig. 4).

Coronal Location

Neither the overall distribution of coronal locations nor any of the individual regions were significantly different between catchers and noncatchers (P = 0.210) (Figs. 5–7).

DISCUSSION

With increased specialization in youth sports and year round play, the risk of injury has increased. Overuse upper extremity injuries in youth baseball and softball players, including Little League Shoulder and Little League Elbow, have received increasing attention. Early detection of these injuries may result in successful healing with nonoperative treatment. Prevention of these injuries may occur by using pitch counts and decreasing exposure. However, to date, overuse injuries of the lower extremity in youth baseball and softball players have not garnered equal attention. In this study, we describe “Catcher’s Knee,” which is a posterior femoral condylar OCD lesion seen with the repetitive and persistent hyperflexion seen in catchers.

In this cohort from a tertiary care children’s hospital, catchers presented with OCD at a younger age than position players, possibly reflecting the trend of younger positional specialization. Lesion severity did not differ between the 2 groups, which may indicate the chronic rather than acute nature of the condition or that patients...
simply present at a similar level of discomfort regardless of how or when the injury begins. OCD lesions in catchers were more posterior than position players. This difference may occur because of repetitive and persistent hyperflexion of the knee in catchers compared with the upright loading in position players (Fig. 8). Coronal lesion location did not differ between catchers and noncatchers, possibly reflecting that squatting does not alter the force distribution as much in the coronal plan as in the sagittal plane.

The higher percentage of medial femoral condyles in the current cohort is in agreement with the location found in past reports of the general population. The 55% and 66% medial lesions in catchers and noncatchers (excluding patellar lesions), respectively, roughly coincide with the 64% to 87% of medial locations found in the literature. It is possible that the trend toward a lower portion of medial lesions in catchers reflects the valgus position that many catchers adopt when in a deep squat, placing higher stress on the lateral femoral condyle.

FIGURE 6. Sagittal magnetic resonance imaging (A), sagittal radiograph (B), coronal magnetic resonance imaging (C), and notch view radiograph (D) of osteochondral dissecsans lesion on posterior lateral femoral condyle of 12.8-year old male baseball catcher. Posterior (region C) location was significantly more common in catchers than noncatchers. The white box identifies the lesion location.
This study had several limitations. First, 6 of the 29 catchers also reported playing other positions, including pitcher, first base, second base, shortstop, third base, and outfield. This number of players is likely small enough to not skew the findings. Second, a portion of the original search results were eliminated because the records did not specify a position played. It is unlikely that the parameters being retrospectively examined would have influenced whether a position was recorded, so the final cohort is likely a representative subset of the population. Third, many young athletes play several sports. Although this diversity precludes isolating catcher status as the only predictor variable, participation in other high risk sports or positions is likely spread evenly across both the catcher and noncatcher

FIGURE 7. Sagittal magnetic resonance imaging (A), sagittal radiograph (B), coronal magnetic resonance imaging (C), and coronal radiograph (D) of osteochondral dissecans lesion on medial femoral condyle of 14.8-year old male baseball pitcher and second baseman. Upright weight-bearing (region B) location was significantly more common in noncatchers than catchers. The white box identifies the lesion location.
cohorts in a way that minimizes confounding effects. For instance, it is unlikely that all catchers are also at high risk due to being football centers whereas all noncatchers are at low risk due to being basketball point guards. Lastly, determining the severity and location of OCD lesions by imaging and even intraoperatively can be difficult and is often not completely reliable.

OCD of the knee is a serious condition that can require surgical treatment and increases the risk of osteoarthritis. If detected in early stages, OCD can be treated nonoperatively with relatively high healing rates, excellent function, and minimal risk of long-term sequelae. If detected later, OCD may require aggressive surgical treatment including surgical fixation, bone grafting, and chondral resurfacing. Thus, characterizing the risks of certain activities, such as playing catcher, is helpful in that it aids in developing programs to address unique exposures and minimize late detection.

Prevention of youth sports injuries has been emphasized. For upper extremity injuries in youth baseball and softball, pitch counts, technique, and recommendations regarding age appropriate adoption of pitch types may reduce injury. Similarly, prevention of Catcher’s Knee may be influenced by “catch counts” and equipment such as triangular foam “knee savers” that are placed behind the knee to reduce knee flexion or unload the knee in hyperflexion. However, more research is needed to assess the efficacy of these prevention strategies.

REFERENCES

FIGURE 8. Weight-bearing region in upright position typical of noncatchers (A) versus posterior weight-bearing region typical of catcher’s squat (B).