

A Comparative Analysis of International Knee Documentation Committee Scores for Common Pediatric and Adolescent Knee Injuries

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Background: Several different etiologies cause knee pain in the pediatric and adolescent population, including anterior knee/patellofemoral pain, patellar instability, anterior cruciate ligament (ACL) tears, meniscal tears, osteochondritis dissecans (OCD) lesions, and discoid meniscus. The purpose of the current study was to determine the relative morbidity of different causes of knee pain in children and adolescents using the International Knee Documentation Committee (IKDC) score.

Methods: We performed a retrospective review of prospectively collected data of a cohort of pediatric and adolescent patients with knee pain who presented to a single surgeon. Each patient completed an IKDC questionnaire at the time of diagnosis and patients were grouped by diagnosis for analysis. Statistical analysis was performed to compare the IKDC scores of the 7 diagnostic groups, and a *P*-value < 0.05 was considered significant.

Results: The IKDC mean score for all 242 patients was 50.3 ± 18.3 . The mean IKDC score for patients with isolated meniscal tears was 41.2 ± 16.0 , combined ACL and meniscal injuries was 50.2 ± 13.9 , and isolated ACL tears was 48.1 ± 14.1 . The mean IKDC score for patients with symptomatic discoid meniscus was 46.3 ± 13.2 , anterior knee pain/patellofemoral pain was 49.0 ± 17.4 , patellar instability was 49.2 ± 22.1 , and OCD lesions was 62.2 ± 19.5 .

Conclusions: The IKDC scores of most of the diagnostic groups were similar to the overall average score, with the notable exception of patients with OCD lesions exhibiting statistically significant less morbidity reflected by a higher IKDC score. Although symptoms in each individual clinical presentation may vary, knowledge of the relative morbidity of these diagnostic groups is valuable in counseling patients and their families regarding these common pediatric and adolescent sources of knee pain.

Level of Evidence: Level IV.

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Key Words: anterior knee/patellofemoral pain, patellar instability, anterior cruciate ligament (ACL) tears, meniscal tears, osteochondritis dissecans (OCD) lesions, discoid meniscus

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Knee pain in pediatric and adolescent patients is common and can result from a variety of underlying causes including acute injury, overuse, or muscular weakness. The spectrum of causes of knee pain is somewhat different in the skeletally immature patient compared with the skeletally mature patient.^{1–6} Different etiologies of pain in this population include anterior knee/patellofemoral pain, patellar instability, anterior cruciate ligament (ACL) tears, meniscal tears, osteochondritis dissecans (OCD) lesions, and discoid meniscus. Males and females are both affected by knee injuries, although more patterns of lower extremity injury have a female predominance.^{7–13} Children may present with acute knee injuries as the result of a single traumatic episode, or they may have a chronic course of more insidious symptoms due to overuse or underlying muscular imbalance. For each injury pattern, the acuity or chronicity of the symptoms may have a direct impact on the morbidity that pathology causes the pediatric patient. The relative morbidity of different causes of knee pain in children and adolescents has not been well established.

The International Knee Documentation Committee (IKDC) knee score is a responsive, reliable, and valid subjective self-evaluation of functional level and symptom-related disability.^{14–19} This questionnaire assesses the self-described functional level and symptoms of the patient in terms of activities of daily living and sports activities.¹⁶ The purpose of the current study was to determine the relative morbidity of different causes of knee pain in children and adolescents using the IKDC score.

METHODS

We performed a retrospective review of prospectively collected data of a cohort of pediatric and adolescent patients with knee pain who presented to a single surgeon. At the time of initial clinical evaluation,

each patient completed the hand-written IKDC knee questionnaire with or without the assistance of a parent. These questionnaires were collected by a research coordinator in the outpatient clinic. Although the pediatric IKDC (Pedi-IKDC) has recently been validated and is now widely used in the outpatient clinic setting at our institution for all pediatric patients with knee injuries, its validation in 2011 was after the enrollment of many of the patients in this study.¹⁸ Clinical diagnosis was established based on the combination of history, physical examination, relevant imaging, and intraoperative findings (for any patients undergoing surgery) by the senior author. Patients were included if they completed the IKDC questionnaire and had a clinical diagnosis of one of the following: (1) anterior knee/patellofemoral pain, (2) patellar instability, (3) isolated ACL tear, (4) isolated meniscal tear, (5) combined ACL tear and meniscal tear, (6) OCD lesion, or (7) discoid meniscus. A total of 242 patients with an age range from 7 to 21 years were included in the cohort over a 7-year study period. Patients with diagnoses in >1 category or previous ipsilateral knee surgery were excluded ($n = 77$). For ACL tears, IKDC questionnaires were administered during clinical visits >2 weeks after the initial injury to allow for initial recovery from the acute injury.

Several of the diagnostic groups were further classified into subgroups. Patellar instability was subclassified based on the presence or absence of loose bodies. Meniscal tears were subclassified by method of treatment based on tear configuration and tissue quality. Finally, the OCD lesions were classified as stable or unstable based on imaging and/or intraoperative findings. Lesions with an intact articular surface were considered stable and lesions that violated the articular surface were defined as unstable.²⁰ Statistical analysis was performed to compare the IKDC scores of the 7 diagnostic groups, including independent samples tests utilizing Levene Test for Equality of Variances and 2-sample t testing. A P -value <0.05 was considered significant.

RESULTS

Demographic data for the 242 pediatric and adolescent patients included in this comparative analysis of IKDC scores is provided in Table 1. The average age at the time of the IKDC questionnaire for all patients was 14.9 years with a range of 7 to 21 years. Overall, 146 patients (60%) were female, whereas 96 (40%) were male.

The distribution of injuries by diagnostic group included 67 patients (28%) with anterior knee/patellofemoral pain, 59 (24%) with patellar instability, 36 (15%) with combined ACL and meniscal tears, 31 (13%) with isolated ACL tears, 30 (12%) with OCD lesions, 10 (4%) with symptomatic discoid meniscus, and 9 (4%) with isolated meniscal tears. The average age at presentation varied among the 7 diagnostic groups, ranging from 11.9 years (for discoid meniscus) to 16.2 years (for isolated meniscal injuries). Sex predominance differed between the diagnostic groups. Several groups showed female pre-

dominance (anterior knee/patellofemoral pain, patellar instability, isolated ACL tears, combined ACL/meniscal tears, discoid meniscus), whereas other groups showed male predominance (isolated meniscal tear, OCD lesions).

The IKDC mean score for all 242 patients was 50.3 ± 18.3 . The mean IKDC score for patients with isolated meniscal tears was 41.2 ± 16.0 , combined ACL and meniscal injuries was 50.2 ± 13.9 , and isolated ACL tears was 48.1 ± 14.1 . The mean IKDC score for patients with symptomatic discoid meniscus was 46.3 ± 13.2 , anterior knee pain/patellofemoral pain was 49.0 ± 17.4 , patellar instability was 49.2 ± 22.1 , and OCD lesions was 62.2 ± 19.5 (Table 2).

Patients with OCD lesions had a significantly higher preoperative IKDC score than the other 6 diagnostic groups ($P = 0.01$). The mean IKDC score in the OCD group was 62.2 ± 19.5 , compared with a mean IKDC score of 48.6 ± 17.6 in non-OCD patients. No statistically significant differences were noted between the other 6 diagnostic groups.

Patients with patellar instability presented with a mean IKDC score of 49.2 ± 22.1 , which included patients both with and without concomitant loose bodies. There was no significant difference in the IKDC scores between these 2 subgroups of patients ($P = 0.12$). Patients with ACL tears presented with both isolated tears and with combined ACL/meniscal tears. No significant difference in the mean IKDC scores between these 2 groups was noted ($P = 0.56$). Patients with OCD lesions presented with both stable and unstable lesions. Again, there was no significant difference in the mean IKDC scores between these 2 subgroups of patients with OCD lesions ($P = 0.23$).

DISCUSSION

Knee injuries are increasing in the pediatric and adolescent patient population, largely due to increased participation in youth athletic activities.²¹ The current study presents a comparative analysis of the relative morbidity of different causes of knee pain as measured by the IKDC score. Patients presenting with a symptomatic OCD lesion appear to have milder symptoms at presentation than most other causes of knee pain. In addition, pediatric and adolescent patients presenting with anterior knee/patellofemoral pain have similar levels of morbidity as patients with more significant intra-articular pathology, including ACL tears, meniscal tears, and patellar instability.

There were 30 patients (12%) with OCD lesions with an average age of 14.4 years and male (83%) predominance. The overall average IKDC score of 62.2 ± 19.5 was significantly higher than the other diagnostic groups (Table 2). This highlights the importance of radiographic evaluation in this patient population with relatively mild knee symptoms. Radiographic identification of OCD lesions on AP, notch, and lateral radiographic images are important in the diagnosis of these patients as reported symptoms and physical examination findings are often

TABLE 1. Demographic Data

Diagnostic Group	Group Size [n (%)]	Age at Presentation (y)	Females [n (%)]
Anterior knee/patellofemoral pain	67 (28)	14.9 ± 2.16	58 (87)
Patellar instability	59 (24)	14.9 ± 3.06	40 (68)
Isolated ACL tear	31 (13)	14.6 ± 3.51	16 (52)
Combined ACL/meniscal tear	36 (15)	15.9 ± 1.91	20 (56)
Isolated meniscal tear	9 (4)	16.2 ± 1.64	1 (11)
OCD lesion	30 (12)	14.4 ± 2.31	5 (17)
Discoid meniscus	10 (4)	12.0 ± 2.87	6 (60)

ACL indicates anterior cruciate ligament; OCD, osteochondritis dissecans.

nonspecific in early OCD lesions. No statistically significant differences in IKDC scores were noted between unstable and stable OCD lesions, but a trend toward more severe symptoms in unstable lesions was present but limited by the number of patients in the current cohort.

Anterior knee pain was the most common diagnosis within our cohort (28%) and had a female predominance (87%). In the majority of these patients, the development of the knee pain had been a chronic process, with many patients reporting symptoms for several years before presentation. The average IKDC score for patients with anterior knee/patellofemoral pain symptoms was 49.0 ± 17.4, slightly lower than the total IKDC average score of 50.3 ± 18.3 for all patients in the cohort. Thus the perceived morbidity of this diagnosis to the patient is similar to other conditions with more severe intra-articular pathology. Nonoperative treatment including strengthening/physical therapy remains the initial approach in this patient population.

Patients with isolated chronic ACL tears, isolated meniscal tears, and combined ACL/meniscal tears were found to have no significant differences in IKDC scores at presentation. Similarly, patients with symptomatic discoid meniscus presented with a similar level of IKDC scores. Patellar instability, similar to the anterior knee/patellofemoral pain, showed a strong female predominance (68% females vs. 32% males). The average IKDC score

for patients with patellar instability was 49.2 ± 22.1, slightly higher but similar to the anterior knee/patellofemoral pain diagnostic group. Of the patients who had loose bodies identified, the average IKDC score was 37.0 ± 23.6, whereas patients who did not have loose bodies had a much higher average IKDC score of 51.3 ± 21.3. This difference was not statistically significant with the current sample size ($P = 0.12$), but additional morbidity may exist in patients with associated loose bodies. Patients presenting with loose bodies after initial patellar dislocation event generally require surgical treatment, whereas those without loose bodies are treated conservatively.

There are several limitations to this study. In the study period, patients were only enrolled if the clinical diagnosis matched one of the diagnostic groups. In addition, the classification into a particular diagnostic group often relied on retrospective review of the senior author's clinical assessment. Finally, the small number of patients in several of the diagnostic groups decreases the power of statistical comparisons.

With these limitations, an opportunity exists to improve on our findings with future studies. The Pedi-IKDC questionnaire has been recently validated and is now being used for all pediatric patients with knee injuries at our institution. This questionnaire may provide data that is more generalizable to the pediatric population. The similar scores in many of the different diagnostic groups suggest the need for further evaluation of factors that affect a particular patient's level of morbidity.

This study presents a comparative analysis of IKDC scores for several of the most common causes of pediatric and adolescent knee pain. The IKDC scores of most of the diagnostic groups were similar to the overall average score, with the notable exception of patients with OCD lesions exhibiting less morbidity. In addition, patients with anterior knee/patellofemoral pain present with similar levels of morbidity to patients with more severe intra-articular sources of pain. Although symptoms in each individual clinical presentation may vary, an understanding of the relative morbidity of these diagnostic groups is valuable to the physician treating these patients. Knowledge of the comparative functional limitations of each source of knee pain is beneficial in counseling patients and their families regarding these injuries.

TABLE 2. IKDC Data

Diagnostic Group	IKDC Mean	SD
Anterior knee/patellofemoral pain	49.0	17.4
Patellar instability	49.2	22.1
Patellar instability (with loose bodies)	37.0	23.6
Patellar instability (without loose bodies)	51.3	21.3
Isolated ACL tear	48.1	14.1
Combined ACL/meniscal tear	50.2	13.9
Isolated meniscal tear	41.2	16.0
OCD lesion	62.2	19.5
OCD lesion (stable)	65.4	18.1
OCD lesion (unstable)	55.0	21.9
Discoid meniscus	46.3	13.2
Total	50.3	18.3

ACL indicates anterior cruciate ligament; IKDC, International Knee Documentation Committee; OCD, osteochondritis dissecans.

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