Utility of Adult-Based Discoid Lateral Meniscus Diagnostic Criteria in a Pediatric Population

Jennifer J. Beck,*‡§ MD, Charlotte F. Wahle,† BA, Anna Wood,† BS,
Abbie Bennett,‡ MS, and Nicholas Jackson,† PhD
Investigation performed at the UCLA Department of Orthopaedic Surgery, Los Angeles, California, USA

Background: Commonly cited discoid lateral meniscus (DLM) imaging definitions are based on adult magnetic resonance imaging (MRI) measurements. This pathology commonly presents in pediatric populations; however, whether accepted adult measurements reliably apply to children and adolescents is unknown.

Purpose/Hypothesis: This purposes of the study were to determine (1) the utility of applying adult-accepted MRI definitions of DLM to pediatric patients, (2) whether sex differences affect the applicability of the criteria, and (3) whether MRI magnet strength and/or tear presence affect MRI measurements for diagnosing DLM in pediatric patients. It was hypothesized that MRI criteria for DLM would be similar in adults and pediatric patients.

Study Design: Case series; Level of evidence, 4.

Methods: A total of 100 consecutive MRIs from pediatric patients with DLM were evaluated, with 91 scans included. Two study authors independently reviewed the MRIs, evaluating meniscal height and width on sagittal and coronal images, "bow tie signs" on sagittal images, tibial sagittal and coronal width, and tear presence. For analysis, MRI magnet strength was dichotomized into high (>1.5 T) and low (<1.5 T) groups.

Results: The mean age of the patients at MRI evaluation was 12.3 ± 3.4 years; 51% of the patients were male, and 56% of the scans were of left knees. Included patients with DLM showed a mean of 3.68 bow tie signs, a sagittal total anterior to posterior meniscal width/tibial width ratio of 73%, a coronal meniscal width/tibial width ratio of 30%, and a coronal, transverse width of the lateral meniscus at the midportion of the meniscal body of 20.6 ± 7.7 mm. The MRI tesla strength of the images included in this study ranged from 0.3 to 3. It was determined that high- versus low-resolution MRI scans did not affect the inter- or intraobserver reliability of the MRI measurments ($P > .05$). However, several measurements showed improved intraclass correlation coefficients with increased tesla strength.

Conclusion: This study confirms that pediatric patients with DLM, diagnosed by board-certified pediatric sports medicine orthopaedic surgeons, have measurements on MRI consistent with adult DLM diagnostic criteria. This finding held true regardless of sex or MRI tesla strength. Pediatric patients with DLM had >3 bow tie signs, >70% sagittal tibial plateau coverage, >14 mm coronal width, and >20% coronal tibial plateau coverage on MRI.

Keywords: discoid meniscus; lateral meniscus; meniscus pathology; pediatric

Meniscus injuries have been increasing in prevalence in the pediatric population.[3,4] The discoid lateral meniscus (DLM), first described in 1889, is a congenital abnormality whereby the meniscus is increased in height and width.[7] Because of the increased size and histological differences in the collagen orientation and organization, it has been proposed that patients with DLM may possess an increased vulnerability to meniscal tears, especially in pediatric populations.[2,4] Knee pain, stiffness, snapping, popping, or locking are common symptoms of patients with meniscus pathologies and can be diagnosed on advancing imaging such as magnetic resonance imaging (MRI).[9] Understanding patient symptoms is critical, as intact DLM may be asymptomatic and may only be found as an incidental finding on MRI.[2,4]

Current standards for diagnosing DLM using MRI scans are based on an adult population with a mean age of 34 years.[6] These MRI guidelines include (A) ≥3

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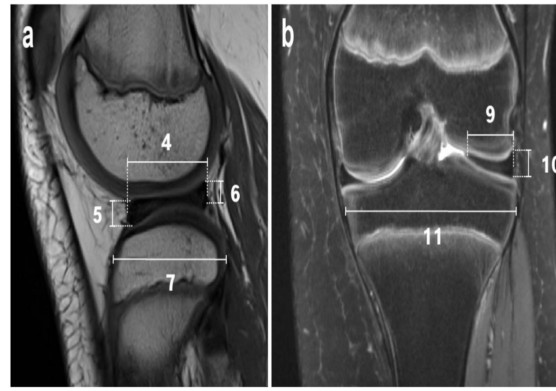
contiguous sagittal images, each 5 mm thick, demonstrating continuity between the anterior and posterior horns (ie, "bow tie signs"), (B) transverse width of a lateral meniscus at the midportion of a meniscal body exceeding 14 mm (independent of the tibial width), (C) increased ratio of the minimal meniscal width to the maximal tibial width of >20% on a coronal image, and (D) the ratio of the sum of the width of both lateral horns to the maximal meniscal diameter on a sagittal image[1,6,7] of >75%.

The original study that established these guidelines primarily focused on older adolescent/adult patients (age range, 13-67 years), thus limiting evidence for applicability to a pediatric population. However, Bedoya et al[3] examined normal meniscal dimensions at different patient ages (range, 0.3-17.8 years) and concluded there were no statistically significant changes in coronal meniscal width measurement with age.[3]

DLM is a common pathology in children and adults.[9] However, no currently established MRI diagnostic criteria are explicitly based on child and adolescent populations. Thus, the true incidence is unknown. It is also unknown whether the adult MRI parameters for diagnosing DLM can be reliably applied in pediatric patients. In the current study, we applied the existing adult MRI criteria of DLM to a group of pediatric patients believed to have DLM based on a constellation of clinical and radiographic criteria. Additional aims included (1) determining whether MRI magnet strength affects MRI measurements in pediatric populations with DLM and (2) determining whether the presence of tears alters the MRI definition of DLM. We hypothesized that the MRI criteria for DLM would be similar in adults and pediatric patients.



Measurements of the lateral meniscus on the **(a)** sagittal plane and **(b)** coronal plane. Sagittal plane image in the mid-condylar slice shows: (4) total anterior to posterior meniscus distance, (5) anterior horn height, (6) posterior horn height, and (7) sagittal tibial width. Coronal plane image shows: (9) meniscus coronal width, (10) meniscus coronal height, and (11) coronal tibial width.

Sequence Plane	MRI Measurement	Description
Sagittal Plane	Anterior Width	Width of anterior horn
Mid-condylar slice	Posterior Width	Width of posterior horn
	Ant + Post Meniscus Width	Total meniscal coverage of tibia
	Total Ant to Post Meniscus Distance (#4)	Meniscal coverage of tibia including tear gap or gap between horns
	Anterior Horn Height (#5)	Height of anterior horn
	Posterior Horn Height (#6)	Height of posterior horn
	Tibial Width (#7)	Width of entire tibia, including periosteal layer
	# of Bowtie Signs	Number of consecutive cuts with bowtie sign
Coronal Plane	Meniscus Width (#9)	Maximum width on any coronal section
Not required to be in the same slice	Meniscus Height (#10)	Maximum height on any coronal section
	Tibial Width (#11)	Width of entire tibia, including periosteal layer

(#) corresponds to Figure 1 numbers

Figure 1. Description of magnetic resonance imaging measurements. Ant, anterior; Post, posterior.

METHODS

Patient Selection

Institutional review board approval was obtained before study initiation. Patients seen from 2013 to 2020 were identified through large academic, institutional records searches using the International Classification of Diseases, Ninth Revision (ICD-9) and ICD-10 codes. The inclusion criteria were age of <19 years and a clinical and radiographic diagnosis of DLM. This diagnosis was made by 1 of the 2 board-certified, pediatric and sports medicine-trained orthopaedic surgeons (including J.J.B.). Clinical diagnosis was made based on a constellation of data points, including history, physical examination, and imaging findings (radiographic and MRI). The exclusion criteria were concomitant musculoskeletal pathology of the patellofemoral joint; large/displaced meniscal tears that would limit the ability to correctly measure the meniscus that obstructed the view of the meniscus; tears of nearby ligaments (including anterior cruciate ligament, posterior cruciate ligament, medial collateral ligament, and lateral collateral ligament); large tibial spine injuries, femoral fractures, previous knee surgery, known syndromes that affect the meniscus or bone formation (ie, skeletal dysplasia); poor MRI quality; or lack of medical records. Of note, as meniscal tear type and displacement may interfere with morphological measurements,[8] all patients with large, displaced tears (n = 9) were excluded at the discretion of the senior author. A chart review was completed for patient data. A 100-patient sample group was determined. This

*Address correspondence to Jennifer J. Beck, Boulder Medical Center, 2750 Broadway Street, Boulder, CO 80304, USA (email: jebeck@bouldermedicalcenter.com) (Twitter: @JenniferJBeckMD).
†UCLA Department of Orthopaedic Surgery, David Geffen School of Medicine, Los Angeles, California, USA.
‡Orthopaedic Institute for Children, Los Angeles, California, USA.
§Boulder Medical Center, Boulder, Colorado, USA.
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Ethical approval for this study was obtained from the University of California–Los Angeles (reference No. 17-000389).

TABLE 1
Comparison of MRI Measurements by Sex[a]

MRI Measurement, mm	Combined	Females	Males	*P*
Ant width, sagittal	(38) 14.2 ± 5.3	(17) 12.3 ± 3.2	(21) 15.8 ± 6.1	.031
Post width, sagittal	(36) 10.7 ± 3.7	(16) 10.7 ± 3.2	(20) 10.7 ± 4.1	.984
Ant + post meniscal width, sagittal	(38) 24.4 ± 5	(17) 22.4 ± 4.1	(21) 26.0 ± 5.3	**.022**
Total ant to post meniscus distance, sagittal	(88) 31.8 ± 6	(43) 29.7 ± 4.7	(45) 33.7 ± 6.4	**.001**
Ant horn height, sagittal	(89) 5.21 ± 1.57	(44) 4.93 ± 1.28	(45) 5.48 ± 1.79	.108
Post horn height, sagittal	(88) 6.45 ± 2.45	(43) 6.18 ± 2.12	(45) 6.70 ± 2.73	.318
Tibial width, sagittal	(89) 43.8 ± 6.9	(44) 41.4 ± 5.9	(45) 46.2 ± 6.9	**<.001**
Meniscal width, coronal	(89) 20.6 ± 7.7	(44) 19.4 ± 8	(45) 21.7 ± 7.4	.177
Meniscal height, coronal	(89) 5.90 ± 1.9	(44) 5.53 ± 1.25	(45) 6.27 ± 2.31	.065
Tibial width, coronal	(89) 70.1 ± 7.9	(44) 65.3 ± 5.5	(45) 74.8 ± 6.9	**<.001**

[a]Data are presented as (No. of patients) mean ± SD. Bold values indicate statistically significant sex-based difference. Ant, anterior; MRI, magnetic resonance imaging; Post, posterior.

group possessed an even distribution of age and sex. All images were reviewed in a blinded and randomized order.

MRI Report and Imaging Review

The senior author (J.J.B.) reviewed MRI scans and reports to determine the appropriateness of including participants in the study. A database was built, randomizing the included patients. MRI measurements were obtained in the coronal and sagittal planes based on measurements taken by Bedoya et al[3] in 2019. The resulting measurements are displayed in Figure 1. In the sagittal plane, measurements included meniscal sagittal width, meniscal anterior horn height, meniscal posterior horn height, and tibial sagittal width measurements. In the coronal plane, measurements included meniscal coronal width, meniscal coronal height, and tibial coronal width. In addition, MRIs were used to count "bow tie signs," which refers to the number of 5-mm-thick contiguous sagittal images demonstrating continuity between the anterior and posterior horns.[7] Last, the ratio of the minimal meniscal width to the maximal tibial width and the sum of the width of both lateral horns to the maximal meniscal diameter on the sagittal image were calculated.[6]

Before a complete data collection, a random sample of 10 patients underwent full data collection by 2 study authors. In several subcategories of measurements >10 patients underwent confirmatory measurements by both study authors.

Statistical Analysis

Descriptive statistics—including the mean, standard deviation, and relative frequency—are presented in the tables. Reliability in MRI measurements across the 2 raters (J.J.B. and A.W.) was established by examining intraclass correlation coefficients (ICCs),[5,10] based on a 1-way random-effects model using absolute agreement and individual measures. Bivariate differences in MRI measurements by sex, tear type, and MRI strength were examined using linear regression models. These regression models for bivariate differences were fit using clustered robust standard errors (ie, Huber-White) because of the presence of 4 patients with bilateral MRIs. Also, 95% CIs were calculated and reported. All analyses were conducted in Stata SE Version 16.1 (StataCorp LP).

RESULTS

Based on a chart review to determine eligibility, 100 consecutive MRIs were screened from 96 patients (4 patients with bilateral scans). Based on the study criteria, 9 patients were excluded because of the large, displaced tears on MRI. Thus, the final cohort comprised 87 patients, providing 91 MRIs for review. The mean age at MRI was 12.3 ± 3.4 years (age range, 5-17 years). Left knee scans comprised 56% (n = 51) of the MRIs, and 51% (n = 44) of the included patients were male.

MRI measurements with sex-based comparisons are reported in Table 1. Males had significantly larger measurements than women in 4 categories, as follows: (1) anterior and (2) posterior meniscal width on sagittal images, (3) total anterior-to-posterior meniscus distance on sagittal images, and (4) tibial width on both sagittal and coronal images. The meniscal width on coronal images were not significantly different between the sexes and was found to be over 14 mm for the combined measurement (20.6 ± 7.7 mm) and when broken down by sex (19.4 ± 8 mm in females vs 21.7 ± 7.4 mm in males).

The number of bow tie signs and the ratios of meniscal width to tibial width on both coronal and sagittal images are reported in Table 2. The mean number of bow tie signs was >3 slices across all included patients. No statistically significant differences were observed between sexes in these measurements. At an individual level, 55 of 88 patients were at or above this criterion. The total anterior-to-posterior meniscal width/tibial width ratio on sagittal images was 0.73 ± 0.1 mm. At an individual level, 44 of 88 patients met or exceeded this average, with 33 of 88 patients meeting the adult criterion of 75%. The coronal

TABLE 2
MRI Ratios and Bowtie Signs by Sex[a]

MRI Measurement, mm	Combined	Females	Males	*P*
Ant + post width/tibial width, sagittal	(38) 0.528 ± 0.12	(17) 0.502 ± 0.08	(21) 0.549 ± 0.14	.197
Total ant to post width/tibial width, sagittal	(88) 0.73 ± 0.1	(43) 0.72 ± 0.1	(45) 0.734 ± 0.1	.569
Meniscal width/tibial width, coronal	(89) 0.3 ± 0.12	(44) 0.3 ± 0.13	(45) 0.293 ± 0.1	.717
No. of bowtie sign, sagittal	(88) 3.68 ± 1.97	(43) 3.52 ± 1.8	(45) 3.83 ± 2.10	.466

[a]Data are presented as (No. of patients) mean ± SD. Ant, anterior; MRI, magnetic resonance imaging; Post, posterior.

TABLE 3
Interobserver Agreement on MRI Measurements by Magnet Strength[a]

MRI Measurement	Combined	MRI <1.5 T	MRI ≥1.5 T
Ant width, sagittal	0.97 [0.93 to 0.98] (33)	0.96 [0.84 to 0.99] (9)	0.98 [0.96 to 0.99] (17)
Post width, sagittal	0.81 [0.65 to 0.90] (33)	0.37 [–0.31 to 0.81] (9)	0.91[b] [0.77 to 0.97] (17)
Ant + post meniscal width, sagittal	0.74 [0.53 to 0.86] (33)	0.33 [–0.35 to 0.79] (9)	0.91[b] [0.77 to 0.97] (17)
Total ant-to-post meniscus distance, sagittal	0.99 [0.98 to 0.99] (83)	0.99 [0.97 to 1] (17)	0.99 [0.98 to 0.99] (52)
Tibial width, sagittal	0.97 [0.95 to 0.98] (83)	0.93 [0.82 to 0.97] (17)	0.98 [0.96 to 0.99] (52)
Ant horn height, sagittal	0.81 [0.72 to 0.87] (83)	0.63 [0.24 to 0.85] (17)	0.80[b] [0.67 to 0.88] (52)
Post horn height, sagittal	0.67 [0.54 to 0.78] (83)	0.74 [0.42 to 0.90] (17)	0.76 [0.62 to 0.85] (52)
Meniscal height, coronal	0.90 [0.85 to 0.93] (83)	0.94 [0.84 to 0.98] (16)	0.86 [0.77 to 0.92] (53)
Meniscal width, coronal	0.88 [0.81 to 0.92] (82)	0.99 [0.98 to 1.00] (16)	0.89 [0.82 to 0.93] (52)
Tibial width, coronal	0.99 [0.98 to 0.99] (82)	0.99 [0.98 to 1] (16)	0.99 [0.98 to 0.99] (52)

[a]Data are presented as ICC [95% CI] (No. of patients). Ant, anterior; ICC, intraclass correlation coefficient; MRI, magnetic resonance imaging; Post, posterior.
[b]Indicates improvement in the ICC based on the magnet strength of 1.5 T.

meniscal width/tibial width ratio was 0.3 ± 0.12 mm. At an individual level, 57 of 89 patients met or exceeded this average, with 67 of 89 patients meeting the adult criterion of 20%.

Recorded MRI strengths included 0.3-T (n = 6 [7.7%]), 0.7 T (n = 7 [9%]), 1.2-T (n = 4 [5.1%]), 1.5-T (n = 47 [60.3%]), and 3.0tT (n = 14 [17.9%]). Good and excellent interobserver agreement (ICC > 0.75) was obtained in all categories except for posterior horn height, which showed moderate agreement (ICC > 0.65). Results are displayed in Table 3.

The number of bow tie signs varied based on MRI strength (0.3-T = 2.58 ± 1.80; 0.7-T = 2.64 ± 1.97, 1.2-T = 2.25 ± 0.50; 1.5-T= 3.88 ± 1.92, 3.0-T = 4.0 ± 2.13; $P < .001$), with a mildly positive correlation ($r = 0.2$) between the magnet strength and the number of bow tie signs. For analysis, images were designated as either high (>1.5 T) or low (<1.5 T) tesla strength groupings. When comparing these 2 groups, it was determined that magnet strength had no statistically significant effect on the inter- and intraobserver measurements ($P > .05$). However, improvement in ICCs was seen in sagittal measurements with increased tesla strength.

Patients with major tears that distorted the ability to record measurement were excluded. Figure 2 displays an example of a minor, nondisplaced tear that remained included versus a major displaced bucket-handle tear.

Minor, nondisplaced tears were reported in 72 MRIs (80%). There were no statistically significant differences in the patients with tears according to sex (33 females [73%] vs 39 males [87%]; P = .16). Four measurements were significantly associated with the presence of tears: (1) anterior meniscal width on the sagittal ($P = .005$), (2) total anterior to posterior meniscus distance on the sagittal ($P < .001$), (3) tibial width on the sagittal ($P = .035$), and (4) number of bow tie signs on the sagittal ($P = .043$) (Table 4). Other MRI measurements and ratios of meniscal width to tibial width were not associated with tear presence.

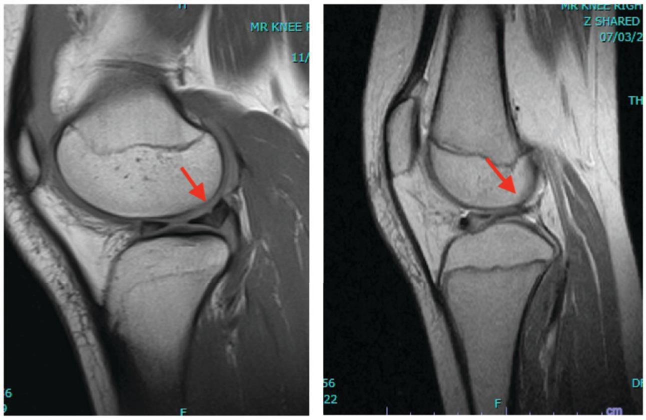

Figure 2. Imaging examples of included versus excluded meniscal tears. On the left is a minor, nondisplaced tear (included). On the right is a major displaced bucket-handle tear (excluded).

DISCUSSION

Based on MRI analysis, the pediatric patients with DLM included in this study had a mean of >3 bow tie signs, >70% tibial plateau coverage on the sagittal, >14-mm coronal width, and >20% tibial plateau coverage on the coronal. These data are consistent with current adult DLM MRI diagnostic criteria and support the utility of applying the existing guidelines in a population of pediatric patients. The applicability was also consistent when compared between the sexes and across MRI tesla strengths.

It is important to keep in mind that the DLM diagnosis is multifactorial and made based on history, clinical examination, and radiologic parameters.[3] In terms of imaging, conventional radiographs offer some insight into the diagnosis of DLM, including cupping of the lateral tibial plateau, squaring of the lateral femoral condyle, lateral joint space widening, a high fibular head, and hypoplasia of the lateral femoral condyle.[4] However, MRI scan has long been considered the most effective method of diagnosis for meniscus pathology, including DLM. The variability in normal and DLM meniscus morphology, a wide spectrum of pathology that can be seen in DLM, and multiple classification schemes have rendered the parameters used for the DLM diagnosis is a common topic of discussion.

Studies examining meniscus morphology over time in pediatric patients have shown that menisci likely grow in all dimensions, except in the coronal meniscal width.[3] Some researchers have extrapolated that the stability in this dimension supports the application of published adult criteria for DLM in pediatric patients.[3] Our work provides evidence that this assumption is reasonable. Our work found sex-based differences in several categories of absolute measurements (see Table 1). However, these differences did not significantly affect diagnostic criteria (see Table 2). This is likely in part because most of the diagnostic criteria consist of ratios and not absolute measures. It has also been suggested that linear growth in the tibia may occur significantly more rapidly, giving mid-portions of the menisci proportionally larger appearances in younger children.[3]

The most commonly cited classification of DLM was described by Watanabe et al,[11] who sorted DLM into complete, incomplete, and Wrisberg types after MRI evaluation. This classification is simple, easy to remember, and can be applied to most DLMs. However, the Watanabe classification has several deficiencies in tear and instability identification, especially including anterior and horizontal instability and tearing that often occur with this condition.[2] Recently, the Pediatric Research in Sports Medicine (PRiSM) Discoid Meniscus Classification has been supported as the standard for diagnosis in pediatric patients.[2] Our work supports the application of the adult discoid meniscus criteria for initial diagnosis of DLM. Subsequent application of the PRiSM Discoid Meniscus Classification on MRI scans and intraoperative arthroscopic findings will improve tear and instability recognition and standardize verbiage used to classify DLM.

Increasing confidence in pediatric-centered diagnostic criteria will improve the quality of research around DLM and help to create treatment algorithms specific to the pediatric population. This, in turn, will improve confidence

TABLE 4
MRI Measurements Based on Tear Presence[a]

MRI Measurement, mm	No Tear	Tear Present	*P*
Ant width, sagittal	(2) 8.75 ± 3.44	(36) 14.54 ± 5.21	**.005**
Post width, sagittal	(2) 10.4 ± 3.2	(34) 10.7 ± 3.8	.848
Ant + post meniscal width, sagittal	(2) 19.1 ± 6.7	(36) 24.7 ± 4.9	.124
Total ant-to-post meniscus distance, sagittal	(18) 28.6 ± 2.9	(70) 32.6 ± 6.3	**<.001**
Ant horn height, sagittal	(18) 5.01 ± 1.20	(71) 5.26 ± 1.66	.467
Post horn height, sagittal	(18) 6.37 ± 1.26	(70) 6.47 ± 2.68	.824
Tibial width, sagittal	(18) 41.4 ± 4.9	(71) 44.5 ± 7.2	**.035**
Meniscal width, coronal	(18) 21.1 ± 5.1	(71) 20.4 ± 8.3	.670
Meniscal height, coronal	(18) 5.51 ± 1.41	(71) 6± 1.99	.240
Tibial width, coronal	(18) 67.9 ± 7.2	(71) 70.6 ± 8	.196
Bow tie sign	(18) 4.28 ± 1.07	(70) 3.53 ± 2.12	**.043**

[a]Data are presented as (No. of patients) mean ± SD. Bold values indicate statistically significant difference between groups. Ant, anterior; ICC, intraclass correlation coefficient; Post, posterior.

in surgeons' ability to offer outcome prediction and risk-versus-benefit counseling. Several studies on pediatric DLM repair estimate that between 20% and 39% of symptomatic DLM tears require surgical repair depending on patient age, among other factors.[4] With high rates of meniscus repair, proper preoperative diagnosis and planning is critical to intraoperative success. In addition, these data suggest that pediatric patients who undergo MRI scan for DLM should have that imaging completed on an MRI scanner with a higher tesla strength wherever possible to improve diagnostic accuracy and preoperative planning.

Although DLM may be asymptomatic, many of the identified patients have symptoms of instability or tears. Therefore, pediatric patients with isolated lateral meniscus pathology on MRI should be evaluated for DLM to guide management. Ellis et al[4] retrospectively examined 261 pediatric knee arthroscopies at a single center and found that 96 out of 99 children <13 years who had lateral meniscus pathology had DLM.[5]

It is important to note that the current study evaluated the applicability of the diagnostic criteria at the population level. As with any medical diagnostic criteria, individual variance, specificity, and sensitivity will vary for each of the 4 established adult parameters.[6] Even in adults, a patient should have all 4 criteria to be diagnosed with discoid meniscus. This study primarily investigated whether MRI metrics in pediatric patients with known discoid meniscus (by clinical and radiographic diagnosis) aligned with adult MRI diagnostic criteria. Because of the rare and variable morphology, discoid meniscus remains an elusive diagnosis at any age. There is certainly room for further investigation to improve the accuracy of diagnosis at all levels. However, this study's practical aim was to reassure surgeons regarding the utility of existing diagnostics and to limit blindly applying adult criteria to a pediatric population.

Limitations

This study has several limitations. First, because of the rare morphology and typical age of presentation, we did not find any patients <5 years. Thus, no sufficient data were available to confirm that these criteria can be applied to patients <5 years. However, sufficient data were available to confirm the applicability for pediatric patients ≥6 years. Second, MRI protocols and scanner resolution varied widely from subject to subject. As highlighted above, while imaging of the meniscus may be more forgiving in adults, pediatric knees are much smaller, and therefore fewer slices contain valuable diagnostic information. Moreover, most patients in this study underwent MRI evaluation because of known knee pathology or symptoms. The decision was made to include patients with minor, nondisplaced tears in this study to provide more widely applicable data. However, previous measurements for DLM diagnosis have been primarily based on intact menisci. The variable nature of DLM MRI measurements in an asymptomatic versus symptomatic patient is unknown. It is possible that less developed, asymptomatic DLM presentations may not fit the same MRI diagnostic criteria. Finally, as large, displaced tears could not be accurately measured and therefore excluded from this study, it is unknown whether the inclusion of these measurements would have impacted findings.

CONCLUSION

The study results indicated that pediatric patients diagnosed clinically and radiographically with DLM had MRI scan findings consistent with the existing adult DLM MRI diagnostic criteria for this pathology. Further, variables such as sex, MRI tesla strength, and minor tears did not significantly interfere with the utility of the criteria. The cohort of pediatric patients who were diagnosed clinically with DLM had a mean of >3 bow tie signs, >70% sagittal tibial plateau coverage, >14-mm coronal width, and >20% coronal tibial plateau coverage—similar to existing adult definitions of DLM.

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