Locked knee in children owing to torn discoid lateral meniscus: the role of arthroscopic management

Bahaa A. Motawea[a], Mohamed M. Abouheif[a,b]

[a]Department of Orthopedic and Trauma Surgery, Faculty of Medicine, El Hadra University Hospital, Alexandria University, Alexandria, Egypt, [b]Department of Orthopedic Surgery, Graduate School of Biomedical Sciences, Hiroshima University Hospital, Hiroshima, Japan

Correspondence to Mohamed Abouheif, MD, PhD, 20 Omar Lutfy Street, Flat 25, Camp Sizar, Alexandria, 21525, Egypt.
Tel: +20 101 156 4298; fax: 03 5927028;
e-mail: mohamed_heif@yahoo.com

Received 10 March 2017
Accepted 5 June 2017

The Egyptian Orthopaedic Journal
2017, 52:169–174

Background
Discoid meniscusis a relatively rare congenital anatomical abnormality in which the meniscus is discoid rather than semilunar in shape. A torn discoid lateral meniscus (DLM) can be a potential cause of mechanical symptoms in children; moreover, it is considered the commonest reason for arthroscopic interventions performed on children.
Hypothesis
Arthroscopic reshaping of the meniscus (meniscoplasty) by partial excision of the central part achieves good results in these patients.
Patients and methods
Twenty patients (20 knees) presenting with symptomatic torn DLM were included in the study. The age ranged from 3 to 11 years, with a mean of 7.2 years. Five of them were males and 15 were females. Seventeen of them had locked knee owing to displaced bucket handle tear of DLM. Two patients had complex tear of DLM, whereas only one patient had a longitudinal cleavage tear. All the cases experienced knee pain and swelling. Clinical evaluation of the patients was done according to the subjective and objective International Knee Documentation Committee (IKDC) 2000 forms, and Lysholm knee score. Moreover, radiological evaluation was performed using plain radiographs and MRI. All patients were managed by reshaping of the meniscus by arthroscopic central partial meniscectomy regardless of the tear type. The duration of follow-up ranged from 22 to 36 months, with a mean of 26.4 months.
Results
All the patients showed dramatic improvement postoperatively. The average postoperative subjective IKDC score was 76% as compared with 29.25% preoperatively. Postoperative IKDC objective grade was A in six (30%) cases and B in 13 (65%) cases at the end of follow-up, as compared with the preoperative grade assessment, which was D in six (30%) cases and C in 14 (70%) cases, with statistically highly significant results ($P<0.001$).
Conclusion
Torn DLM can be a potential cause of symptomatic knee pain and effusion in children and should not be overlooked. Arthroscopic central partial meniscectomy (meniscoplasty) can give good results in these cases.

Keywords:
arthroscopic, discoid, lateral meniscus, meniscectomy

Egypt Orthop J 52:169–174

1110-1148

Introduction

Discoid meniscus is a relatively rare congenital anatomical abnormality in which the meniscus is discoid rather than semilunar in shape. A torn discoid lateral meniscus (DLM) can be a potential cause of mechanical symptoms in children; moreover, it is considered the commonest reason for arthroscopic interventions performed on children.

Most of the discoid menisci are either asymptomatic or incidental arthroscopic findings [1,2]. However, in symptomatic cases, the symptoms are highly variable depending on the type of diabetes mellitus (DM), its location, the presence or not of a tear, and rim stability [1,3].

Although a degenerative horizontal cleavage is the tear pattern most commonly found in some DM series [4–6], longitudinal or bucket handle tear patterns were present in a higher percentage of cases in others [7–11].

The diagnosis of a DLM should be suspected as the first option in a pediatric population with knee symptoms or pain suggesting a lateral meniscal tear [9].

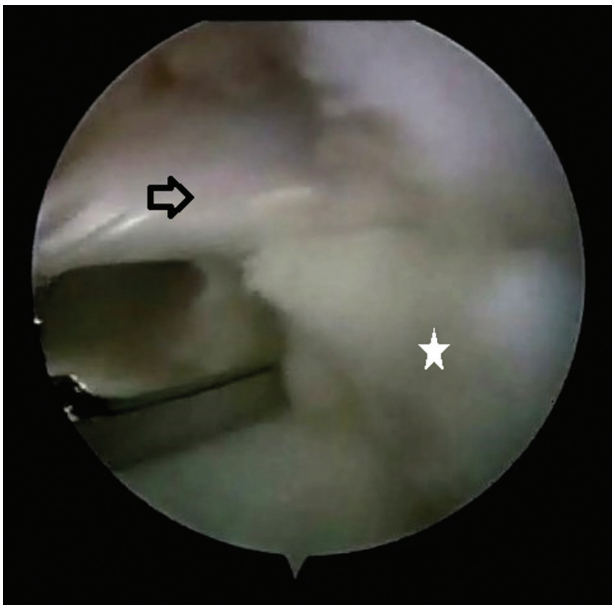
MRI evaluation despite being indispensable to confirm the diagnosis and rule out other knee conditions such as an osteochondral lesion of the lateral femoral condyle, arthroscopy remains the gold standard for diagnosis and management [12]. The final judgment and decision making should be done during the arthroscopic procedure, and the surgeon must be prepared to deal with a meniscus tear and/or instability.

We herein present 20 cases (20 knees) in children who experienced knee pain and showed mechanical symptoms suggestive of lateral meniscal tear. These patients were managed systematically, and MRI was done suggesting a diagnosis of tear of a DLM. The final decision regarding the diagnosis, classification, and grading of the tear as well as the management was left to arthroscopy.

Patients and methods

A total of 20 pediatric patients experiencing knee symptoms presented to us from December 2009 to May 2014. Their ages ranged from 3 to 11 years. Five of them were females whereas 15 were males. All of them experienced knee pain and antalgic gait, whereas only 18 (90%) cases presented to us with locked knee (Fig. 1). Knee swelling was also a significant presentation, and it was mild in two cases whereas moderate in 18 cases. The average duration of symptoms before presentation was 1.2 months. The condition was preceded by a recognizable traumatic incidence in 13 (65%) cases.

Figure 1



Arthroscopic partial meniscectomy of displaced bucket handle tear of a discoid lateral meniscus, the black arrow refers to the anterior cruciate ligament; the star refers to the displaced central part of the discoid lateral meniscus.

Clinical evaluation was done according to the 2000 Subjective and Objective International Knee Documentation Committee (IKDC) evaluation forms, as well as Lysholm score. The average preoperative range of movement was 66.25°. All the cases had extension lag ranging from 15° to 45°. The preoperative subjective IKDC ranged from 20 to 50, with an average of 29.25. The preoperative objective IKDC was grade C in 14 (70%) cases, whereas six (30%) cases were graded D.

The average preoperative Lysholm score was 28, ranging from 20 to 45. MRI was done in all cases to confirm the diagnosis and exclude other etiologies such as osteochondral lesions (Table 1).

The surgical procedure

Under general anesthesia, standard knee arthroscopic examination was performed through the standard anterolateral and anteromedial parapatellar portals. The standard 4-mm arthroscope lens was used. Some difficulty was encountered in only two patients who were younger than 5 years, and an accessory portal had to be made to allow full inspection of the meniscus.

Torn DLM was recognized in all cases. The discoid meniscus was classified as grade 1 complete type covering the whole lateral tibial plateau according to Watanabe *et al*. [13].

The recognized tear was of the bucket handle type in 17 cases, complex tear in two cases, and longitudinal cleavage in only one case (Table 2). No signs of instability of the meniscus were detected (Table 2).

Repair was not feasible in all cases; consequently, arthroscopic central partial meniscectomy was

Table 1 Basic data of the patients

Variables	*n* (%)
Age (years)	
<6	7 (35.0)
>6	13 (65.0)
Range (mean±SD)	3–11 (7.20±2.11)
Sex	
Male	5 (25.0)
Female	15 (75.0)
Pain	20 (100.0)
Mechanical symptoms	18 (90.0)
Swelling	
Mild	2 (10.0)
Moderate	18 (90.0)
Limp	20 (100.0)
Preoperative extension lag	
Range	15°–45°
Mean±SD	33.2±58.47

Table 2 Intra-operative arthroscopic findings

Tear type during arthroscopy	*n* (%)
Bucket handle	17 (80.0)
Complex tear	2 (10.0)
Longitudinal cleavage tear	1 (5.0)

performed by removal of the central part and torn portions of the discoid meniscus and preserving as much stable peripheral tissue as possible (Figs 2 and 3). The aim of the procedure was excision of the torn part, meanwhile restoration of the normal semilunar shape of the meniscus while preserving as much as possible of the meniscal tissue. The procedure was accomplished using combination of manual arthroscopic punch (basket forceps) and 3.5-mm shaver blade.

At the end of the procedure, the stability of the remaining meniscal tissue was tested with a probe to ensure that there is no Wrisberg ligament type of instability (menisci without posterior tibial attachment, but with a femoral attachment by a meniscofemoral ligament). Range of movement was tested under arthroscopic visualization to ensure that there are no obstacles to full extension.

After conclusion of the procedure, the portals were closed and the patients were allowed partial weight bearing as soon as possible. Full active as well as passive assisted range-of-movement exercises were encouraged in the immediate postoperative period as tolerated. Quadriceps strengthening exercises were also encouraged.

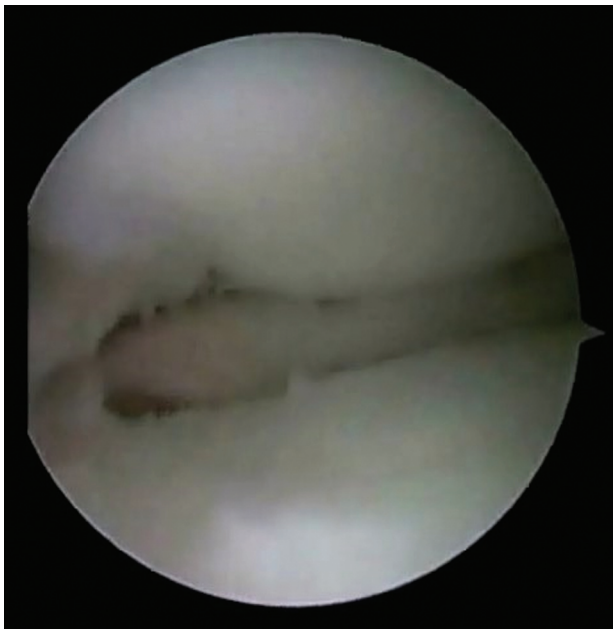
Postoperative assessment was done clinically based on the 2000 subjective IKDC score, as well as the objective 2000 IKDC grading system. Lysholm score system was also used for postoperative assessment. Clinical examination was done in the immediate postoperative period, at 2 weeks, at 6 months, and then at the end of follow-up.

The duration of the follow-up ranged from 22 to 36 months, with a mean±SD of 26.40±3.42 months.

Statistical analysis of the data

Data were fed to the computer and analyzed using IBM SPSS software package, version 20.0. Qualitative data were described using number and percent. Quantitative data were described using range (minimum and maximum), mean, and SD. Significance of the obtained results was judged at the 5% level. To compare between two groups in categorized variables, χ^2-test was used, and in comparing between normally quantitative variables, the Student *t*-test was used. Pearson's correlation coefficient was used to find the association between two variables.

Figure 2



After arthroscopic partial meniscectomy of the torn central part of the discoid lateral meniscus.

Results

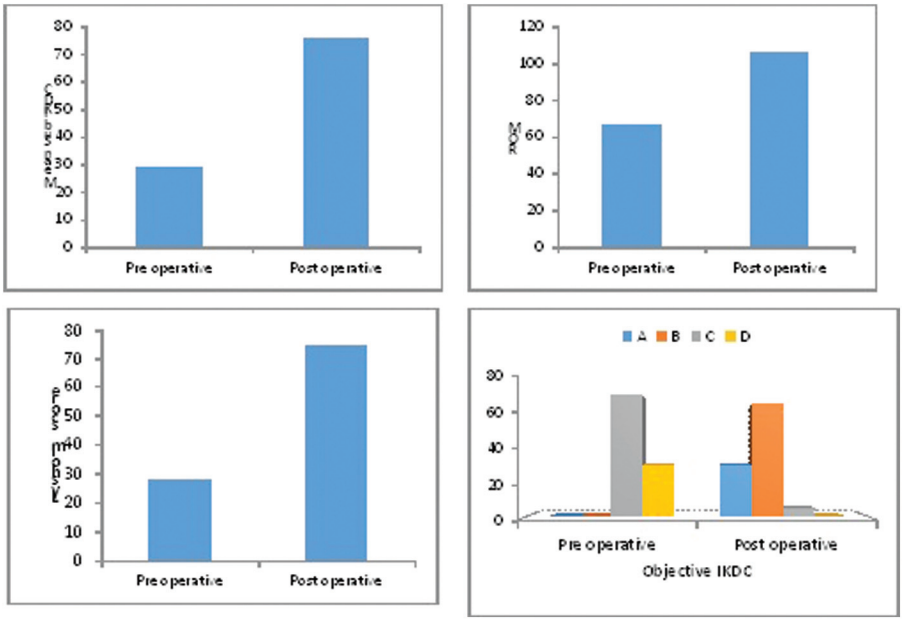
All the patients showed dramatic improvement regarding pain relief, subsidence of swelling, and disappearance of the mechanical symptoms with concomitant improvement of the range of movement. There was highly statistically significant difference when comparing of the preoperative and post-operative assessment parameters (Table 3 and Fig. 4).

Postoperatively, there is almost no extension lag with complete restoration of the full range of movements as compared with the preoperative status, whereby there was extension lag ranging from 15° to 45° with an average of 33.25°±8.47° SD. With disappearance of pain and swelling and restoration of the full range of movement, patients managed to resume their usual daily activities with possible return to sports from 2 to 5 months postoperatively (Fig. 5).

Discussion

The most important finding in this study is that torn discoid meniscus is an important potential cause of symptomatic knee in children and should not be overlooked. The second important finding is that arthroscopy is the gold standard management

Figure 3



Showing improvement of the assessment parameters postoperatively with highly statistically significant difference.

Table 3 Comparison between the preoperative and postoperative assessment parameters

Parameters	Preoperative	Postoperative	*P*
Sub IKDC			
Range	20–50	65–90	0.001*
Mean±SD	29.25±9.63	76.0±6.61	
ROM			
Range	50–85	90–125	0.001*
Mean±SD	66.25±9.58	106.25±10.11	
Lysholm score			
Range	20–45	65–85	0.001*
Mean±SD	28.0±6.6	74.50±6.86	
Objective IKDC [*n* (%)]			
A	0 (0.0)	6 (30.0)	0.0001*
B	0 (0.0)	13 (65.0	
C	14 (70.0)	1 (5.0)	
D	6 (30.0)	0 (0.0)	

IKDC, International Knee Documentation Committee; ROM, range of motion. *$P<0.05$ significant.

tool of these cases as it confirms the diagnosis and classification of the tear type. In addition, arthroscopy is the only way to diagnose instability. Finally, arthroscopic reshaping of the meniscus by partial central meniscectomy regardless of the tear configuration yields good short-term results in the management of torn discoid meniscus in children.

Although the accepted treatment of symptomatic discoid meniscus in the past has been open total meniscectomy, several long-term studies have noted some degree of radiographic degenerative changes after total meniscectomy [13,14].

Figure 4

Pre-operative locked knee due to torn discoid lateral meniscus.

Based on that and the accumulated knowledge on the importance of meniscal preservation, the generally recommended procedure for symptomatic torn discoid meniscus is arthroscopic partial central meniscectomy, or the so-called saucerization procedure or meniscoplasty. In this procedure, resection of the central portion of the meniscus is performed until the remaining rim is established to the width of a normal meniscus. The preserved portions of the meniscus act as shock absorber and load distributers of the joint. According to Kim *et al.* [15], partial meniscectomy showed less degeneration concerning radiological results compared with total meniscectomy after a follow-up of 5 years. Ahn *et al.* [16] showed that arthroscopic reshaping for

Figure 5

Postoperative knee in full extension after arthroscopic lateral meniscoplasty.

symptomatic DLM in children led to satisfactory clinical outcomes after a mean of 10.1 years. However, progressive degenerative changes appeared in 40% of the patients. The subtotal meniscectomy group had significantly increased degenerative changes compared with partial meniscectomy with or without repair [16].

Adachi *et al.* [16] tried to do repair of peripheral tears associated with DLM to avoid resection of larger part of the meniscus along the tear. However, the results were not satisfactory, and one patient out of five developed severe degenerative changes in the meniscus and the repair site was not united requiring additional partial meniscectomy during second-look arthroscopy. On the contrary, Ahn *et al.* [17] conducted a retrospective study on 23 patients (28 knees) with symptomatic DLM associated with a peripheral tear that was treated by partial central meniscectomy in conjunction with peripheral suture repair. The mean age at operation was 9 years, and the mean follow-up period was 51 months. Assessment was done using the HSS scores and Lysholm knee scores. Significant improvement was noted on comparison of preoperative and postoperative assessment parameters. In our study, repair was not feasible, meanwhile partial central meniscectomy offered two advantages, which are excision of the torn part of the meniscus and reshaping the meniscus to restore the normal semilunar shape of the meniscus.

In our study, all of the discoid menisci were of the complete type covering almost the whole lateral tibial plateau. Although we have not encountered the hypermobile, Wrisberg type, this could be because of the limits of arthroscopic studies compared with anatomic dissections.

The most difficult challenge during arthroscopy is to differentiate between longitudinal tear of a DLM and a displaced bucket handle tear of a non-DLM, despite the fact that treatment is almost the same. However, the incidence of bilaterality of meniscal pathology in discoid meniscus might necessitate screening for the other side. In addition, the DM is not only wider than a normal meniscus but is also thicker, and its ultrastructure significantly differs from that of a normal meniscus. According to Atay *et al.* [18], the DM collagen network is altered in both the number of fibrils, which appear decreased, and the way they are aligned. The altered collagen network weakens its architecture and may contribute to its increased tendency to tearing. Consequently, the outcome of the arthroscopic management might be expected to be better in torn menisci of normal morphology than torn discoid menisci.

Most of the discoid menisci are either asymptomatic or incidental arthroscopic findings [1,2]. However, in symptomatic cases, the symptoms are highly variable depending on the type of DM, its location, the presence or not of a tear, and rim stability. All cases with symptomatic torn discoid meniscus were associated with pain and swelling. Only cases with displaced bucket handle tear of the DLM experienced mechanical symptoms such as locking, catching, and extension lag.

According to Choi *et al.* [19], several plain radiographic findings in symptomatic DLM in children were significantly different from those in normal control. These findings would be helpful in screening tool of DLM for children. However, MRI remains a good tool for sorting out the etiology of symptomatic knee in children and excluding etiologies other than meniscal pathology such as osteochondral lesions like those associated with osteochondritis dessicans or traumatic avulsion of the tibial spine. The exclusion of these etiologies is important as most of our cases (90%) were preceded by a definite history of traumatic event [20–23].

In this study, the commonest type of tear is bucket handle tear in 17 (85%) cases, whereas the second commonest type is the complex tear in two (10%) cases. No signs of instability were encountered during arthroscopic examination.

All of the cases showed dramatic improvement immediately postoperatively with subsequent good

short-term results following the arthroscopic procedure.

A relative drawback of this study is the small number of cases, which were 20 cases collected over 5 years, owing to the paucity of these cases in our community. This relatively small number of cases might not give a true impression about the tear type and configuration. Despite the satisfactory short-term to midterm results during the follow-up period which ranged from 22 to 36 months, longer duration of follow-up might be needed to study the long-term effects of this procedure.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1 Monllau JC, Aguilar LL, Espiga J, Ribau MA, Cugat R, Ballester J. Menisco externo discoideo. Rev Ortop Traumatol 1999; 5:347–351.

2 Wong T, Wang CJ. Functional analysis on the treatment of torn discoid lateral meniscus. Knee 2011; 18:369–372.

3 Yaniv M, Blumberg N. The discoid meniscus. J Child Orthop 2007; 1:89–96.

4 Aichroth PM, Patel DV, Marx CI. Congenital discoid lateral meniscus in children: a follow up study and evaluation of management. J Bone Joint Surg Br 1991; 73:932–939.

5 Bellier G, Dupont JY, Larrain M, Caudron C, Carlioz H. Lateral discoid meniscus in children. Arthroscopy 1989; 5:52–56.

6 Pellacci F, Montanari G, Prosperi P, Galli G, Celli V. Lateral discoid meniscus: treatment and results. Arthroscopy 1992; 8:526–530.

7 Chen LX, Ao YF, Yu JK, Miao Y, Leung KKM, Wang HJ, Lin L. Clinical features and prognosis of discoid medial meniscus. Knee Surg Sports Traumatol Arthrosc 2013; 21:398–402.

8 Fu F, Bartz M. Meniscal injuries. In: DeLee JC, Drez DJ, editors. Orthopaedic sports medicine: principles and practice. Philadelphia, PA: WB Saunders; 1994. pp. 1146–1162.

9 Shieh A, Bastrom T, Roocroft J, Edmonds EW, Pennock AT. Meniscus tear patterns in relation to skeletal immaturity: children versus adolescents. Am J Sports Med 2013; 41:2779–2783.

10 Stilli S, Reggiani LM, Muccioli GMM, Cappella M, Donzelli O. Arthroscopic treatment for symptomatic discoid lateral meniscus during childhood. Knee Surg Sports Traumatol Arthrosc 2011; 19:1337–1342.

11 Kramer DE, Micheli LJ. Meniscal tears and discoid meniscus in children: diagnosis and treatment. J Am Acad Orthop Surg 2009; 17:698–707.

12 Stanitski CL, Bee J. Juvenile osteochondritis dissecans of the lateral femoral condyle after lateral discoid meniscus surgery. Am J Sports Med 2004; 32:797–801.

13 Watanabe M, Takeda S, Kieuchi H. Atlas of arthroscopy. 3rd ed. Tokyo: Igaku shoin; 1979. p. 88.

14 Fujikawa K, Iseki F, Mikura Y. Partial resection of the discoid meniscus in the child's knee. J Bone Joint Surg Br 1981; 63:391–395.

15 Kim SJ, Chun YM, Jeong JH, Ryu SW, Oh KS, Lubis AM. Effects of arthroscopic meniscectomy on the long-term prognosis for the discoid lateral meniscus. Knee Surg Sports Traumatol Arthrosc 2007; 15: 1315–1320.

16 Ahn JH, Kim KI, Wang JH, Jeon JW, Cho YC, Lee SH. Long-term results of arthroscopic reshaping for symptomatic discoid lateral meniscus in children. Arthroscopy 2015; 31:867–873.

17 Ahn JH, Lee SH, Yoo JC, Lee YS, Ha HC. Arthroscopic partial meniscectomy with repair of the peripheral tear for symptomatic discoid lateral meniscus in children: results of minimum 2 years of follow-up. Arthroscopy 2008; 24:888–898.

18 Atay OA, Pekmezci M, Doral MN, Sargon MF, Ayvaz M, Johnson DL. Discoid meniscus: an ultrastructural study with transmission electron microscopy. Am J Sports Med 2007; 35:475–478.

19 Choi SH, Ahn JH, Kim K Il, Ji SK, Kang SM, Kim JS, Lee SH. Do the radiographic findings of symptomatic discoid lateral meniscus in children differ from normal control subjects. Knee Surg Sports Traumatol Arthrosc 2015; 23:1128–1134.

20 Asik M, Sen C, Taser OF, Alturfan AK, Sozen YV. Discoid lateral meniscus: diagnosis and results of arthroscopic treatment. Knee Surg Sports Traumatol Arthrosc 2003; 11:99–104.

21 Good CR, Green DW, Griffith MH, Valen AW, Widmann RF, Rodeo SA. Arthroscopic treatment of symptomatic discoid meniscus in children: classification, technique, and results. Arthroscopy 2007; 23:157–163.

22 Mayer-Wagner S, Liebe AV, Horng A, Scharpf A, Vogel T, Mayer W, *et al.* Discoid lateral meniscus in children: magnetic resonance imaging after arthroscopic resection. Knee Surg Sports Traumatol Arthrosc 2011; 19:1920–1924.

23 Adachi N, Ochi M, Uchio Y, Kuriwaka M, Shinomiya R. Torn discoid lateral meniscus treated using partial central meniscectomy and suture of the peripheral tear. Arthroscopy 2004; 20:536–542.