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Consensus Statement

Paediatric ankle cartilage lesions: Proceedings of the International Consensus Meeting on Cartilage Repair of the Ankle



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ABSTRACT

Background: The evidence supporting best practice guidelines in the field of cartilage repair of the ankle are based on both low quality and low levels of evidence. Therefore, an international consensus group of experts was convened to collaboratively advance toward consensus opinions based on the best available evidence on key topics within cartilage repair of the ankle. The purpose of this article is to report the consensus statements on “Pediatric Ankle Cartilage Lesions” developed at the 2019 International Consensus Meeting on Cartilage Repair of the Ankle.

Methods: Forty-three international experts in cartilage repair of the ankle representing 20 countries convened to participate in a process based on the Delphi method of achieving consensus. Questions and statements were drafted within four working groups focusing on specific topics within cartilage repair of the ankle, after which a comprehensive literature review was performed and the available evidence for each statement was graded. Discussion and debate occurred in cases where statements were not agreed upon in unanimous fashion within the working groups. A final vote was then held, and the strength of consensus was characterised as follows: consensus: 51–74%; strong consensus: 75–99%; unanimous: 100%.

Results: A total of 12 statements on paediatric ankle cartilage lesions reached consensus during the 2019 International Consensus Meeting on Cartilage Repair of the Ankle. Five achieved unanimous support, and seven reached strong consensus (>75% agreement). All statements reached at least 84% agreement.

Conclusions: This international consensus derived from leaders in the field will assist clinicians with the management of paediatric ankle cartilage lesions.

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Introduction

Ankle cartilage lesions in the paediatric population are often found incidentally, and conservative management is typically preferred as the first-line treatment strategy [1–4]. By comparison, surgical management in the paediatric patient is controversial but often reserved for patients with symptomatic and/or unstable lesions or in those who have failed primary nonsurgical management [5–9]. However, there is a paucity of literature specific to the management of ankle cartilage lesions in the paediatric population, as much of the literature reports on adults. Most injuries in the adult population are thought to be traumatic in origin, whereas in the paediatric population, osteochondritis dissecans is believed to represent the most common aetiology [6]. Studies evaluating the surgical outcomes after operative management of paediatric ankle cartilage lesions have shown reoperation rates as high as 25% at shorter-term follow-up [10].

There are several factors specific to the paediatric population that warrant consideration when managing ankle cartilage lesions, including the status of the physes, which may predict the ability for spontaneous healing and may also determine whether an osteotomy can be safely performed during surgical repair, if required [8,9]. Moreover, hindfoot alignment may play a role in symptomatic ankle cartilage lesions and may be an important factor to consider addressing surgically [6,8,9,11–13].

As a whole, the current body of evidence regarding ankle cartilage repair is based on both low level and low quality of evidence [14]. In fact, most studies are of Level IV evidence and consist of short-term follow-up periods. Therefore, an international, multidisciplinary group of experts was assembled to develop expert- and evidence-based consensus statements to assist clinicians in managing this difficult pathology. The purpose of this article is to report the results of the working group on Pediatric Ankle Cartilage Lesions that were developed at the 2019 International Consensus Meeting on Cartilage Repair of the Ankle.

Methods

Forty-three national and international multidisciplinary experts in cartilage repair of the ankle were convened to participate in a 1-year consensus building effort, which culminated with the International Consensus Meeting on Cartilage Repair of the Ankle at the Royal College of Surgeons in Dublin, Ireland. This consensus effort followed the previous 2017 initiative in Pittsburgh, the results of which have been published previously [15–25]. Delegates from 20 countries encompassing six continents were represented in the initiative. Experts were assigned to one of four working groups defined by specific subtopics within cartilage repair of the ankle, including “Pediatric Ankle Cartilage Lesions.”

Each working group was assigned two liaisons who served as the primary point of contact and dealt with communication and the distribution of surveys. In addition, liaisons were the responsible for writing the surveys, performing data analysis, and carrying out literature reviews. To reduce the potential for bias in the data analysis and/or literature review, liaisons did not submit answers to the questionnaires or partake in the voting process. One individual (C.D.M.) maintained oversight of the consensus process to ensure consistency across the working groups. A modification of the Delphi format previously described by Linstone and Turoff was used to pursue agreement among the experts on each question. A detailed explanation of the modification to this process as used for this effort has been described by our group previously [26]. Blinded, electronic surveys were distributed, through which no identifying information was collected. Initially, participants within each working group were asked to submit a list of questions that they felt would contribute meaningfully to areas of current controversy within the specific working group. These lists were then curated for clarity and the removal of duplicates, and a total of 12 questions were formalised on “Pediatric Ankle Cartilage Lesions,” at which point the process to answer the questions and develop consensus statements was

initiated.

Participants were then asked to provide their answer to each question in an open-ended format. These initial open-ended answers then facilitated the development of a more structured questionnaire, with emphasis on identifying areas of common ground and resolving aspects of disagreement. Using the results of the third questionnaire, preliminary consensus statements were developed, and a comprehensive literature review was performed to identify, where possible, whether each statement was supported or refuted by the best available evidence. In addition, the available evidence for each statement was graded (Table 1). After the literature review, each group had the opportunity to amend the preliminary statements. Thereafter, a fourth questionnaire requested that each participant “agree” or “disagree” with each preliminary statement. For questions that were agreed upon unanimously within the working group, these were progressed to a final vote among all 43 members of the consensus group. For questions that did not achieve unanimous agreement within the working group, these were advanced to an in-person discussion among all participants at the meeting in Dublin.

Eight questions in this working group were agreed upon unanimously, and four questions were not; those four were therefore advanced to the full group, with in-person discussion based on a standardised format. Briefly, each question and proposed answer was presented to the group, after which an opportunity for amendments was provided. Each proposed amendment required two additional participants to second and third the motion. If the amendment was successfully furthered, an opportunity for rebuttal was provided, followed by a vote of agreement or disagreement. In cases where 66% (2/3's supermajority) or greater of the total votes received were in favour of the proposed amendment, the statement was amended accordingly. This process was repeated for any further amendments that were desired. After this, a final vote on the statement was undertaken. Voting was conducted using electronic keypads. Similar to the survey data that were collected, all votes were anonymous and of equal weight among participants.

After the final votes for each question occurred, the degree of agreement was expressed using a percentage rounded to the nearest whole number. Consensus was defined as 51–74%, whereas strong consensus was defined as 75–99%, and unanimous was indicated by receiving 100% of the votes in favour of a proposed statement.

Results

Of the 12 total questions and consensus statements in this group, five achieved unanimous consensus and seven achieved strong consensus.

Question: How can a pediatric cartilage lesion of the ankle be defined? Is it by age, or skeletal maturity, etc.?

Answer: A pediatric cartilage lesion of the ankle should be defined in terms of skeletal maturity.

Vote: Agree: 100%; Disagree: 0% (Unanimous)

Grade of Evidence: E

Question: What is the difference between osteochondritis dissecans and a traumatic osteochondral lesion of the talus (OLT) in the pediatric population?

Answer: Osteochondritis dissecans is a disorder primarily affecting subchondral bone in the form of a subchondral fragment and clear sclerotic layer, whereas a traumatic OLT primarily affects the cartilage.

Table 1

Grades of evidence. RCT, randomised controlled trial.

A1	Multiple (two or more) level I RCTs with similar findings, or a meta-analysis
A2	A single level I RCT
B1	Prospective cohort study
B2	Any comparison group that is not level I (e.g., case control)
C	Case series
D	Case report
E	Expert opinion/basic science

Vote: Agree: 95%; Disagree: 5% (Strong Consensus)

Grade of Evidence: E

Question: What prognostic factors should be considered in the management of ankle cartilage lesions in the pediatric population?

Answer: The following prognostic factors should be considered in the management of pediatric ankle cartilage lesions: 1) lesion size, 2) integrity of the overlying cartilage, 3) hind foot alignment, 4) lesion containment, 5) ankle stability and 6) previous treatment(s).

Vote: Agree: 100%; Disagree: 0% (Unanimous)

Grade of Evidence: E

Question: Which symptomatic pediatric ankle cartilage lesions may be initially managed non-operatively?

Answer: Initially, all may be managed non-operatively except when there is a displaced fragment.

Vote: Agree: 89%; Disagree: 11% (Strong Consensus)

Grade of Evidence: E

Question: For which pediatric symptomatic osteochondral lesion may surgery be considered?

Answer: The following cases may be treated with surgery in the pediatric population:

- 1) Any lesion with failed primary conservative management
- 2) Unstable lesions

Vote: Agree: 98%; Disagree: 2% (Strong Consensus)

Grade of Evidence: C

Question: Should consideration be given to delaying surgery until physal closure if an osteotomy is needed?

Answer: Yes. However, in cases of unstable or significantly symptomatic lesions, surgical treatment may be warranted prior to physal closure.

Vote: Agree: 100%; Disagree: 0% (Unanimous)

Grade of Evidence: E

Question: What surgical procedures may be considered in the treatment of pediatric ankle osteochondral lesions?

Answer: The following surgical procedures may be considered in the treatment of pediatric ankle osteochondral lesions:

- 1) Internal fixation with or without bone grafting
- 2) Retrograde drilling
- 3) Debridement with or without bone marrow stimulation

Vote: Agree: 93%; Disagree: 7% (Strong Consensus)

Grade of Evidence: E

Question: Are there cases in which fixation techniques can be considered?

Answer: Cases of an acute traumatic lesion or an osteochondral fragment are amendable to fixation techniques in the pediatric population.

Vote: Agree: 100%; Disagree: 0% (Unanimous)

Grade of Evidence: E

Question: By comparison to ankle cartilage lesions in the adult population, what special considerations can be considered in the pediatric population?

Answer: By comparison to the adult population, special consideration should be given in the pediatric population to: 1) the status of the physes, 2) surgical access to the joint and 3) hindfoot alignment.

Vote: Agree: 100%; Disagree: 0% (Unanimous)

Grade of Evidence: C

Question: If an osteotomy is required to access an OLT in the pediatric population, what are the appropriate approaches?

Answer: If necessary, a tibial or fibular osteotomy can be utilized, but every effort should be made to avoid an osteotomy until the physis is closed.

Vote: Agree: 97%; Disagree: 3% (Strong Consensus)

Grade of Evidence: E

Question: What role does alignment play in the management of pediatric ankle cartilage lesions?

Answer: In the management of pediatric ankle cartilage lesions, addressing malalignment can be considered a priority. In cases with mild deformity or in more significant deformities with open physes, orthotics can be utilized initially prior to surgical correction.

Vote: Agree: 98%; Disagree: 2% (Strong Consensus)

Grade of Evidence: E

Question: Is there a role for biologics and/or scaffolds in the management of pediatric ankle OLTs?

Answer: The use of biologics and/or scaffolds can be considered in the management of certain pediatric ankle OLTs.

Vote: Agree: 84%; Disagree: 16% (Strong Consensus)

Grade of Evidence: E

Discussion

A total of 12 statements on “Pediatric Ankle Cartilage Lesions” reached consensus during the 2019 International Consensus Meeting on Cartilage Repair of the Ankle. Of the 12 consensus statements, five received unanimous support and seven achieved strong consensus (> 75% agreement). All statements achieved at least 84% agreement among the participants.

To date, there has been a paucity of literature to assist in the management of ankle cartilage lesions in the paediatric patient. Moreover, the lack of a standardised definition of paediatric lesions has resulted in discrepancies in reporting, with osteochondritis dissecans, traumatic osteochondral injuries and osteochondral fractures often being combined [27–31]. In light of these discrepancies, the consensus group sought to better define these injuries, which was unanimously agreed upon both with respect to skeletal maturity, as well as for the distinct clinical entities of osteochondritis dissecans versus a traumatic lesion. It should be noted that the term osteochondritis dissecans has been confusing in some instances. In fact, osteochondritis dissecans and avascular necrosis have both been terms used for OLTs and can, in some cases, result in ‘urgent’ referrals if they are confused with traumatic injuries.

Traditionally, indications for the treatment of paediatric ankle cartilage lesions have been evaluated in relation to the adult-based Berndt and Harty staging system, with no such standardised system or treatment algorithm for the paediatric population previously described [13,27,32]. Similar to Berndt and Harty, the participants in the current consensus initiative reached strong consensus that all symptomatic paediatric ankle cartilage lesions can be managed conservatively for 6 months initially, except in cases where a displaced fragment is present [5,6,8,9,32]. The potential for biological healing in paediatric lesions must also be considered. In this regard, Kärrholm et al. reported that there is increased healing potential of lesions in patients with open physes, which close at approximately 16 years of age in the talus [11]. For this reason, some studies have suggested conservative treatment for up to 1 year, even in symptomatic paediatric OLT [5,8,9]. Despite no high-level evidence to support one form of management over another, satisfactory functional outcomes have been reported for nonsurgical management in a number of series [7–9].

There was strong consensus that unstable lesions or failure of nonsurgical management warrant surgical intervention. This is supported by a number of studies that have reported outcomes following surgical intervention for the management of OLT in the paediatric population [5–9,13,28,32–35]. However, these studies are limited by small sample sizes, discrepancies in chronological ages, short duration of final follow-up time, as

well as heterogeneous operative treatment protocols. Benthien et al. have previously suggested that operative treatment of paediatric lesions appear similar to outcomes in the adult population [36].

The status of the physes is of utmost importance to consider when pre-operative planning for a paediatric patient [36]. A strong consensus was reached by the group that internal fixation (with or without bone grafting), as well as retrograde drilling or debridement (with or without bone marrow stimulation) may be used for treating paediatric lesions; every effort should be made to avoid an osteotomy until the physes are closed. The particular method of intervention is not yet known in the paediatric population and warrants further study but is often surgeon and lesion dependent, as various series have reported satisfactory functional outcomes following fixation, drilling or debridement in the paediatric ankle [36–38].

The use of biologic adjuvants continues to be debated, and despite evidence to support use in the adult population, further work is necessary in the paediatric population [39,40]. Pagliuzzi et al. postulated that bone marrow-derived cells obtained through concentrated bone marrow aspirate may be a key element for a successful outcome in the paediatric patient with an OLT, as skeletally immature patients have even greater potential to heal [40]. In a series of seven paediatric patients, Pagliuzzi found that the use of a collagen scaffold, an autologous platelet-rich fibrin and bone marrow aspirate from the posterior iliac crest resulted in significant improvements in pain and function at 4-year follow-up postoperatively [40]. In the absence of high-level data for the use of biological augmentation in ankle cartilage lesions in the paediatric population, the current consensus group suggested that its use may be warranted in certain cases, which ultimately require further characterisation.

This consensus effort is not without limitations. By definition, consensus statements are considered level V evidence and represent a blend of expert opinion and the best available evidence [41]. Nonetheless, the lack of high-quality clinical evidence to date in this field encouraged us to seek alternative methods for developing best practice guidelines in conjunction with leaders in the field. Further high-level studies should be required to substantiate the statements that have been developed as part of this initiative. The consensus will be updated in the event that further evidence for or against a current statement becomes available.

These consensus statements on ankle cartilage lesions in the paediatric population may assist clinicians in the management of this difficult pathology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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