

APKASS Consensus Statement on Chronic Syndesmosis Injury, Part 1

Clinical Manifestation, Radiologic Examination, Diagnosis Criteria, Classification, and Nonoperative Treatment

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Background: Clinical manifestation, radiologic examination, diagnostic criteria, classification, and nonoperative treatment strategies regarding chronic syndesmosis injury remain unclear.

Purpose: An international group of experts representing the fields of sports injuries in the foot and ankle area were invited to collaboratively advance toward consensus opinions based on the best available evidence regarding chronic syndesmosis injuries. All were members of the Asia-Pacific Knee, Arthroscopy and Sports Medicine Society (APKASS).

Study Design: Consensus statement.

Methods: From November to December 2020, a total of 111 international experts on sports medicine or ankle surgery participated in a 2-stage Delphi process that included an anonymous online survey and an online meeting. A total of 13 items with 38 statements were drafted by 13 core authors. Of these, 4 items with 15 clinical questions and statements were related to the clinical manifestation, radiologic examination, diagnostic criteria, classification, and nonoperative treatment strategies for chronic syndesmosis injury and are presented here. Each statement was individually presented and discussed, followed by a general vote. The strength of consensus was characterized as follows: consensus, 51% to 74%; strong consensus, 75% to 99%; unanimous, 100%.

Results: Of the 15 questions and statements, 5 reached unanimous support and 10 achieved strong consensus.

Conclusion: This APKASS consensus statement, developed by international experts in the field, will assist surgeons and physical therapists with diagnosis, classification, and nonoperative treatment strategies for chronic syndesmosis injury.

Keywords: syndesmosis injury; ankle; clinical manifestation; diagnosis; consensus

Ankle syndesmosis injury, also called a high ankle sprain, is a frequent athletic trauma accounting for 1% to 18% of all ankle sprains.^{21,33} However, a previous radiographic study suggested that about 20.3% of ankle sprains were combined with a syndesmosis injury.²³ This result manifested that because of insufficient recognition, lack of awareness, and misdiagnosis, the incidence of syndesmosis injury may be underestimated. Without prompt and proper treatment, the chronic syndesmosis injury remains symptomatic for >6 months after the initial trauma, with persistent pain, functional disability, and early-stage ankle arthritis.^{20,36,38}

Despite a large number of radiographic studies having been published focusing on this disorder, the radiographic diagnostic criteria and classification criteria remain under debate. In addition, it is difficult to decide whether a patient with chronic syndesmosis injury should undergo nonoperative management or proceed to surgery, as there is still a lack of conclusive evidence.

Experts from the Asia-Pacific Knee, Arthroscopy and Sports Medicine Society (APKASS) convened to develop evidence-based consensus statements in order to assist surgeons and physiotherapists manage this challenging disorder. The purpose of this article was to report the results of discussions regarding clinical manifestation, radiologic examination, diagnostic criteria, classification, and nonoperative treatment that took place at the 2020 APKASS

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international consensus meeting on chronic syndesmosis injury.

METHODS

A core group of 13 authors drafted and refined 13 items consisting of 38 clinical questions and statements, which were then assigned to at least 1 of the authors to research and summarize the currently available evidence. Our consensus methodology was designed using a 2-stage Delphi process, which included an online survey (November 20, 2020; stage 1) and an online meeting (December 20, 2020; stage 2). The final document we sent out for stage 1 of the consensus process featured 8 items and 29 statements (available as Supplemental Material). Each statement was individually presented and discussed, followed by a general vote.

Stage 1

We invited 21 experts to fill out the online questionnaire (www.surveymonkey.com). For each of the 29 statements, the experts could respond with *agree*, *disagree*, or *don't know/not sure*, as well as submit optional comments. One author (Y.S.) compiled the survey results and shared them with the core author group for analysis. Statements that achieved consensus (67%, or a two-thirds supermajority) were not discussed further. Consensus was reached on 19 of the 29 initial statements.

Stage 2

Besides the core group of 13 authors, 98 experts in the field attended the online meeting via Zoom. The remaining 5 items (9 statements) underwent voting per stage 1, then all statements that did not achieve consensus after the online survey were displayed and discussed using PowerPoint (Microsoft Corp) by each responsible author, after which 1 of the following 2 steps was taken:

Step 1. If inconsistent opinions were proposed and supported by 2 additional participants during the discussion, modification was required and an amendment motion was made, and the statement was modified if the proportion of votes in favor of doing so was $\geq 67\%$.

Step 2. When the participating 111 experts did not propose any further modifications, the group voted for or

against the statement. If the proportion of favorable votes was $\leq 50\%$, the statement was excluded from the overall consensus statement. If the proportion of favorable votes was $> 50\%$, the statement was passed and was included in the overall consensus statement. The strength of consensus was characterized as follows: 51% to 74% indicated consensus; 75% to 99% indicated strong consensus; and 100% indicated unanimous consensus.

A draft of the manuscript was circulated to all 13 core authors, and all comments/edits were incorporated.

RESULTS

Four items with 15 clinical questions are included in this section. Of these 15 questions, 5 reached unanimous support and 10 achieved strong consensus.

Item 1: Clinical Manifestation and Presentation

Statement: Signs and symptoms of chronic syndesmosis injury are nonspecific. A high index of suspicion is warranted for symptomatic post-traumatic ankle pain. Radiological syndesmosis malreduction may be underreported, but its clinical significance is debated.

Vote: Agree 100% (unanimous)

Item 2: Imaging Examination Including Radiography, Computed Tomography, Ultrasonography, and Magnetic Resonance Imaging

Question 1: How to reveal latent instability at the syndesmosis?

Response: Magnetic resonance imaging (MRI) combined with the other imaging modalities could have the possibility of diagnosing instability less invasively compared with arthroscopy.

Vote: Agree 95.2% (strong consensus)

Question 2: What is known about ultrasonography to diagnose syndesmosis injury?

Response: There have been few reports about ultrasonography. It could be a reliable method because dynamic stress examination could be performed to detect a disruption of the anterior inferior tibiofibular ligament (AITFL) by experienced sonographers and doctors. However, it may be less effective for assessing the interosseous membrane and posterior inferior tibiofibular ligament (PITFL).

Vote: Agree 100% (unanimous)

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Question 3: Is MRI the most reliable imaging method?

Response: MRI is one of the most reliable methods. Combined with other examinations, MRI is helpful to diagnose chronic syndesmosis instability. However, the detection of the injured ligaments on MRI becomes less reliable with time.

Vote: Agree 95.7% (strong consensus)

Item 3: Diagnosis Criteria, Types, and Classifications for Chronic Syndesmosis Injury

Question 1: How to classify chronic syndesmosis injury through medical history and physical examination?

Response: No definite diagnosis and classification can be made for chronic syndesmosis injury based on medical history and physical examination.

Vote: Agree 90.5% (strong consensus)

Question 2: How to classify chronic syndesmosis injury based on the involved structures?

Response: The grading and the classification of chronic syndesmosis injury can be made based on the involved structures. The structures include the AITFL, interosseous ligament, interosseous membrane, PITFL, and the deltoid ligament.

Vote: Agree 85.7% (strong consensus)

Question 3: What are the criteria to select the radiological examination for chronic syndesmosis injury?

Response: Radiographs should be the first option for evaluating chronic syndesmosis injury. With significantly higher sensitivity, MRI should be done for the suspected syndesmosis injury, which cannot be detected on radiograph or computed tomography (CT).

Vote: Agree 96.4% (strong consensus)

Question 4: How to diagnose and classify chronic syndesmosis injury on radiographs?

Response: Tibiofibular clear space (TFCS) and tibiofibular overlap (TFO) on radiography can be used to aid in the diagnosis of syndesmosis injury, but should not be solely relied on for determining syndesmotically stability and treatment strategies.

Vote: Agree 100% (unanimous)

Question 5: What are the criteria for CT and weightbearing CT?

Response: Published studies have used different measurements of linear distance to identify an increased separation across the syndesmosis or a malalignment between the tibia and fibula.

Vote: Agree 90.5% (strong consensus)

Question 6: What are the criteria for chronic syndesmosis injury on MRI?

Response: The direct criteria include absent ligament, abnormal course, wavy, irregular thickening, and abnormal increased signal on axial MRI and lambda sign on coronal MRI.

Vote: Agree 100% (unanimous)

Question 7: How to define chronic syndesmosis injury?

Response: A syndesmotically injury can be classified as acute, subacute, and chronic based on the time duration of the symptoms.

Vote: Agree 95.2% (strong consensus)

Question 8: How to define the type of chronic syndesmosis injury?

Response: Under the traditional classification standard, chronic syndesmosis injury can be categorized into stable sprain, latent diastasis, and frank diastasis on the basis of radiography. However, with the popularization of MRI and arthroscopy, it is important to build an adapted classification system, which requires further research and clinical validation.

Vote: Agree 95.2% (strong consensus)

Question 9: How to diagnose and classify chronic syndesmosis injury via arthroscopy?

Response: The cutoff for the diagnosis of syndesmosis instability is recommended as 3.0 mm of the length of the opening in the dissector. A grading system should be easily applicable and should help predict the clinical outcomes to play a guiding role in choosing surgical treatment options.

Vote: Agree 76.2% (strong consensus)

Item 4: Indications, Methods, and Outcomes for Non-operative Treatment

Statement 1: Regarding management of syndesmotically injuries without an ankle fracture, symptomatic syndesmotically sprains without diastasis and evidence of joint instability on imaging should be managed nonoperatively with a non-weightbearing cast.

Vote: Agree 100% (unanimous)

Statement 2: Syndesmotically injuries without a fracture that are treated nonoperatively mostly take longer to heal.

Vote: Agree 75% (strong consensus)

DISCUSSION

Of the 15 questions and statements associated with clinical manifestation, radiologic examination, diagnosis criteria, classification, and nonoperative treatment for chronic syndesmosis injury, 5 questions reached unanimous support and 10 achieved strong consensus.

The clinical presentation of chronic syndesmosis injury is similar to that for chronic ankle instability caused by a lateral ankle ligament injury, which usually involves a history of ankle sprain, persistent pain, swelling, and a giving-way sensation.^{2,13,21} However, syndesmosis injury typically has a trauma history mechanism of ankle external rotation, which can provide clues to suspect this differential diagnosis.^{13,21} To date, several special tests on physical examination help to diagnose syndesmosis injury: squeeze test; palpation test; fibular translation test; Cotton test; external rotation test; and dorsiflexion compression test. A study by de César et al⁵ compared MRI with clinical tests including external rotation test and squeeze test and found the sensitivity and specificity were 30% and 93.5% for the squeeze

test, and 20% and 84.8% for the external rotation test, respectively. Sman et al³⁰ reviewed 8 clinical diagnostic tests and found that only the squeeze test had clinically important results while other clinical tests showed low diagnostic accuracy and reliability. Therefore, the signs and symptoms of chronic syndesmosis injury are nonspecific. Additional diagnostic tests, such as MRI and arthroscopy, should be considered before making a final diagnosis and formulating a treatment strategy for chronic syndesmosis injury.

Radiologic examination including radiographs, CT, ultrasonography, and MRI are widely used in the diagnosis and classification of a chronic syndesmosis injury. Chun et al³ systematically reviewed and concluded that compared with MRI, CT and radiography had significantly poor sensitivity and similar specificity in diagnosing syndesmosis injury, which helps to distinguish ankle fracture, but there are concerns about radiation exposure. Therefore, MRI should be considered in diagnosing syndesmosis injury as a standard method for comparing arthroscopic findings for syndesmosis injury. The signs of syndesmotic ligament injury and tearing can be seen directly on the MRI scan. The positive findings consist of previously reported criteria: (1) no visualization of syndesmotic ligament; (2) abnormal course, wavy, irregular thickening of the distal tibiofibular ligament; (3) increased signal of the distal tibiofibular ligament on T2- and T1-weighted images; and (4) high-intensity signal seen on coronal MRI inside the tibiofibular space (lambda sign).^{9,17,24,35} According to Han et al,⁹ the sensitivity, specificity, and accuracy of MRI were 90.0%, 94.8%, and 93.4%, respectively. Axial MRI is known to be the most useful and recommended tool in the noninvasive diagnosis of a syndesmosis injury. However, Randell et al²² found that MRI was positive for detecting a syndesmosis injury in chronic injuries after 12 weeks in 83.3% of patients, compared with 100% if done within 6 weeks, which demonstrated that the detection of the injured syndesmotic ligaments on MRI may become less reliable with time.

Compared with MRI, radiographs are less costly and more time saving; they can show indirect signs of a syndesmotic ligament injury on anteroposterior (AP) view and mortise view. Among several parameters, the TFCS and the TFO are emphasized by previous studies.^{10,19,24,27,28,39} Harper and Keller¹⁰ proposed the following criteria to be consistent with a normal tibiofibular relationship: (1) a TFCS <6 mm on AP and mortise radiographs; (2) TFO at the incisura fibularis tibiae ≥ 6 mm or $\geq 42\%$ of the fibular width; and (3) TFO >1 mm on the mortise view. However, Ryan and Rodriguez²⁵ found the average of TFCS was 5.6 mm in syndesmosis injury patients, which manifested that reducible syndesmotic instability may not be detectable on radiography according to the criteria of Harper and Keller. Shah et al²⁸ also proposed that lack of TFO on the mortise view can also represent a normal variant, and the radiographic criteria may lead to unnecessary operative intervention. This evidence suggests that radiographs can only aid in the diagnosis of syndesmosis injury rather than determine the treatment strategy.

As for CT and weightbearing CT, linear and area measurement on the axial plane assists with the diagnosis of a syndesmosis injury. Ahn et al¹ measured syndesmosis widening on CT and concluded that widening >2 mm had a high likelihood of a syndesmosis lesion. Hagemeyer et al⁸ considered the syndesmotic area as one of the most applicable parameters for detecting syndesmosis instability in the axial plane. In addition, Malhotra et al¹⁴ measured the angle subtended by 2 lines drawn tangent to the anterior and posterior surfaces of the distal tibia and lateral malleolus 1 cm above the talar dome, which decreased in patients with diastasis of the syndesmosis.

Ultrasonography may allow visualization of the AITFL but Milz et al¹⁶ found ultrasound only correctly diagnosed 66% of patients with MRI-diagnosed AITFL injury. Meidan et al¹⁵ found the specificity and sensitivity of dynamic ultrasound was 89%. However, ultrasonography is highly dependent on the sonographers' and doctors' skill, and there were still a limited number of reports regarding ultrasonography.

Previous researchers have emphasized the importance of arthroscopy in the diagnosis and differentiation of syndesmosis instability.^{31,37} Under arthroscopy, torn parts of the syndesmotic ligament can be directly seen. On the other hand, to evaluate the degree of instability, an arthroscopic probe can be inserted between the tibia and fibula and rotated to measure the widening and movement between the individual joint sections. Normally, the ankle mortise widens about 1 mm as the intact ankle joint moves from full plantarflexion to full dorsiflexion²⁶; however, injury of the syndesmosis results in widening of the syndesmosis. Colcuc et al⁴ semiquantitatively assessed the grade of dislocation through the length of the opening: grade 1 (1.0-1.5 mm), grade 2 (1.5-2.5 mm), and grade 3 (2.5-3.5 mm). Compared with grades 1 and 2, grade 3 showed worse clinical outcomes after reconstructive surgery at follow-up. According to the arthroscopic syndesmotic assessment (ASA) tool by Lubberts et al,¹¹ an ASA value ≥ 3.1 mm is defined as an unstable syndesmosis. Turkey et al³² established a grading system as follows: grade 0, ≤ 2 mm (normal); grade 1, ≤ 2 to 4 mm; and grade 2, ≥ 5 mm; and the results were labelled as "xAxP" (A, anterior; P, posterior). The diagnosis criteria and grading of arthroscopic assessment of syndesmosis injury are areas still under discussion.

In general, patients without diastasis or joint dynamic instability can be treated nonoperatively. Lubberts et al¹² systematically reviewed the previous study and suggested stable grade 2 syndesmosis injury could be treated nonoperatively. Nussbaum et al¹⁸ treated 60 patients with stable syndesmosis injury nonoperatively and achieved an overall good result. It was emphasized that the rehabilitation protocol, including rigid immobilization, as well as functional and proprioceptive exercises, played an important role in the recovery of sporting function. However, it should also be mentioned that although nonoperative treatment could achieve satisfactory outcomes in patients without diastasis, an overly conservative treatment strategy may result in sprain recurrence, persistent ankle pain, and formation of heterotopic ossification. Compared with lateral ankle ligament injury, syndesmotic ligament injury

generally takes longer to heal. Wright et al³⁸ analyzed the ankle sprain injury in National Hockey League players and found syndesmosis sprains represented a significant injury in hockey players with an extended time lost.

The classification system of chronic syndesmosis injury plays important roles in the treatment strategy. Classically, Edward and DeLee⁶ divided syndesmotic sprains into stable ankle sprain and unstable ankle sprain on the basis of radiography, with the latter further divided into latent diastasis and frank diastasis. According to this classification system, stable ankle sprains were recommended to undergo conservative treatment. However, this system was based on the observation of just 6 cases, and MRI and arthroscopy were not applied in this system, which limited the accuracy of the injury assessment.³⁴ Gerber et al⁷ proposed the West Point Ankle Grading System based on clinical examinations. Sikka et al²⁹ classified syndesmotic ankle sprains into 4 grades on the basis of MRI examination. However, current classifications remain insufficient for differentiating between injury and instability to guide treatment strategy, and thus this represents an area in need of further scientific investigation.³⁶

CONCLUSION

The 4 items with 15 clinical questions and statements of this APKASS consensus statement, developed by experts in the field, focused on the clinical manifestation, radiologic examination, diagnosis criteria, classification, and nonoperative treatment of chronic syndesmosis injury and will assist surgeons and physical therapists in the management of this challenging disorder.

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