CLINICAL ARTICLE

Incidence of syndesmotic injuries in all different types of ankle fractures

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Abstract

Aim: To determine the incidence of syndesmotic injuries in ankle fractures within the division of Orthopaedic Surgery, University of Pretoria.

Methods: A total of 94 serial patients with ankle fractures were assessed for syndesmotic injury by means of ankle mortise stress views and manual traction with a bone hook. Each fracture was classified according to both the Weber and Lauge Hansen classification and the incidence of syndesmosis injury in each group was determined.

Results: In total, 94 patients were evaluated over a 6-month period. There were 54 males and 40 females. The mean age was 39.3 years with a range of 13 to 85 years. An overall incidence of syndesmotic injuries of 32.97% (31 injuries) was found in our series. Of these 31 syndesmotic injuries 3% were Weber A, 29% Weber B, 65% Weber C, and 3% were isolated medial-malleolus fractures. According to the Lauge-Hansen classification, 3% were abduction injuries, 61% pronation-external rotation, 29% supination-external rotation and 7% vertical-compression dorsiflexion injuries.

Conclusion: The overall incidence of 33% of syndesmotic injuries was much higher than expected. Due to the fact that an incidence of 3% in Weber A fractures and 29% in Weber B fractures was found, we suggest that all types of ankle fractures should be stressed in theatre.

Hypothesis

The view has long been held that syndesmotic injuries/ruptures occurring with ankle fractures are almost exclusively associated with pronation-external rotation injuries or Weber type C injuries. It is our hypothesis that syndesmotic injuries are common in all types of ankle fractures and that they are not exclusively limited to pronation-external rotation or Weber type C injuries.

The overall incidence of syndesmotic injuries varies extremely widely

Aim

The aim of this study is to determine the incidence of proven syndesmotic injuries in all types of ankle fractures.

Literature review

The ankle syndesmosis is found in the joint between the distal tibia and the distal fibula. Three main structures provide stability at the level of the syndesmosis, including the interosseous tibio-fibular ligament, the anterior inferior tibio-fibular ligament, and the posterior inferior tibio-fibular ligament. The interosseous tibio-fibular ligament represents the distal continuation of the interosseous membrane. The anterior inferior tibio-fibular ligament arises in the vicinity of Chopart's tubercle and inserts into the most anterior tubercle of the distal fibula. The posterior inferior tibio-fibular ligament originates from the posterior tubercle of the tibia and attaches to the posterior tubercle of the distal fibula.[1] Ogilvie-Harris and colleagues showed in a cadaver study that the anterior inferior tibio-fibular ligament contributes 35% of the strength of the syndesmosis, the posterior inferior tibio-fibular ligament contributes 40%, and the interosseous ligament contributes only 21%.[2] Although this ligament complex is extremely strong, it still allows some degree of motion. The motion at this joint includes a variable amount of translation and external rotation during talar dorsiflexion and plantarflexion to accommodate the asymmetric talus while maintaining joint congruency.[3]

According to Peña and Coetzee, the most likely mechanism of injury involves some component of external rotation and eversion.[1] They state, therefore, that an external-rotation torque applied to the foot is responsible for the tearing of the soft tissue structures that afford stability to the ankle syndesmosis.

The diagnostic imaging studies most commonly used to evaluate the syndesmosis include X-rays and, in more subtle cases, CT scan or MRI. X-rays should include an AP, lateral and mortise view. If the patient is able to weight-bear, it is preferable to obtain standing views and if there is tenderness of the proximal fibula, X-rays of the whole leg. Standard X-rays may, however, be inconclusive and it may be necessary to obtain mortise stress views to diagnose a syndesmosis injury. Beumer *et al* concluded in a cadaver study that fibula overlap and clear space were the most valuable radiological signs of syndesmosis injury.[4] Despite advances in imaging of the ankle, the diagnosis of syndesmotic injury may only be made at the time of surgery or by evaluation under anaesthesia directly prior to surgery. Clinical stress tests for determining the integrity of the syndesmosis ligaments include the squeeze test, the cotton test, the fibula translation test and the external rotation test. These tests have been shown to be unreliable, especially in an acute situation.

The overall incidence of syndesmotic injuries varies extremely widely. Van Dijk states that isolated total ruptures of the syndesmosis are relatively infrequent but that acute syndesmosis injuries are present in all patients with pronation-external rotation ankle fractures.[5] Hopkinson *et al* found an incidence of 1% among US military recruits while Fallat found an incidence of only 0.5% in 639 patients.[6,7] Boytin *et al* conducted a prospective study of 98 ankle injuries and reported a prevalence of 18%.[8] The use of arthroscopy yields even higher incidences of syndesmotic injuries with Lui and Chow reporting an incidence of 66%.[9]

While all these authors report on overall incidences, there is only scant literature on the incidence of syndesmosis injuries in various types of ankle fractures. Jenkinson *et al* reported an overall incidence of 37% in ankle fractures of which 33% of syndesmotic instability was found in supination-external rotation injuries and 57% in pronation external rotation injuries.[10] Weening and Bhandari found similar results in their series of 51 patients with 30% having supination-external rotation injuries and 70% pronation-external rotation injuries.[11] Little or no mention is, however, made in the literature concerning abduction and adduction injuries. Harris and Jones, in a cadaver study, found that not all Weber type C ankle fractures resulted in injury to the syndesmosis, especially if an abduction force was applied to the ankle.[12]

From all of the above, it is evident that there is a wide range of overall incidence of syndesmotic injuries ranging from 0.5% to 66% and there is no consensus as to which mechanism of injury or type of ankle fracture would have a higher incidence of syndesmotic injury. Furthermore, there seems to be very little consensus as to which method of diagnosis is most suited to determining the presence of syndesmotic injuries.

The view has long been held that syndesmotic injuries occurring with ankle fractures are almost exclusively associated with pronation-external rotation injuries or Weber type C injuries. It is our hypothesis that syndesmotic injuries are common in all types of ankle fractures and are not exclusively limited to pronation-external rotation or Weber type C injuries.

Ankle fractures should therefore always be evaluated for syndesmotic injuries and treated accordingly to prevent significant morbidity associated with this type of injury.

Due to pain, the clinical diagnosis of these injuries is difficult and other modalities have been shown to be unreliable in the acute situation. We believe that all ankle fractures should be stressed in theatre to exclude syndesmotic injuries.

The purpose of this study was to determine the incidence of syndesmotic injuries in ankle fractures within the division of Orthopaedic Surgery, University of Pretoria over a 6-month period in 2006.

Materials and methods

All in all, 94 serial patients with ankle fractures were assessed at Kalafong and Pretoria Academic Hospital. All patients with ankle fractures were included in the study.

All patients with ankle injuries received ankle X-rays, including an AP, lateral and mortise view.

A questionnaire was completed for all patients with ankle fractures. Data included the patient's name, age, sex, hospital number, mechanism of injury as well as a clinical examination that documented and included the following parameters: sensation, pulses, pain, swelling, blue colouring (echymosis), tenderness and whether these were medial on the ankle, lateral on the ankle or over the syndesmosis. Informed consent to participate in the study was obtained from all patients.

If the patients could tolerate the pain, the talus was internally and externally rotated to indicate the presence of pain over the syndesmosis, which was taken to indicate a probable syndesmotic injury.

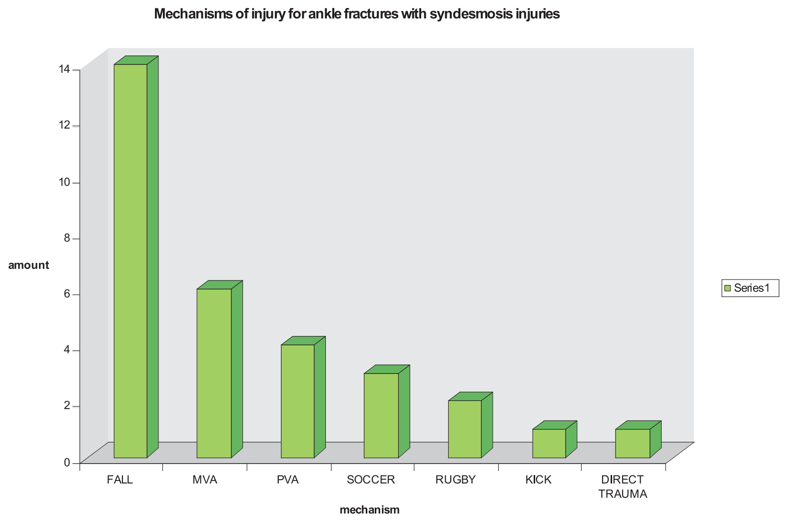
The registrar on call classified the ankle fractures according to the Lauge-Hansen and Weber classifications; this was then confirmed at a later stage by the authors with the help of X-rays.

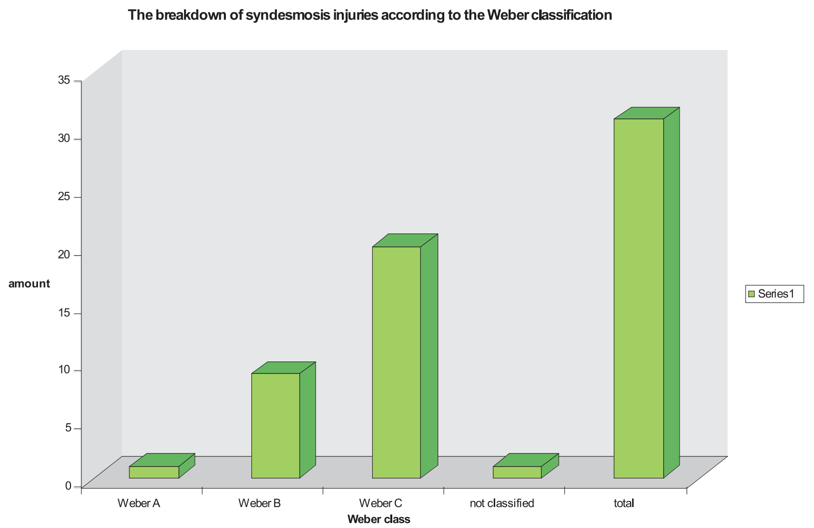
These patients proceeded to theatre, and the syndesmosis was stressed by the registrar on call with a bone hook by applying lateral traction to the fibula at the level of the syndesmosis. If no lateral fixation was done a 1-2 cm antero-lateral incision was made to view the syndesmosis and to place the bone hook. Fluoroscopy was also used to take pre- and post-stress views of the syndesmosis.

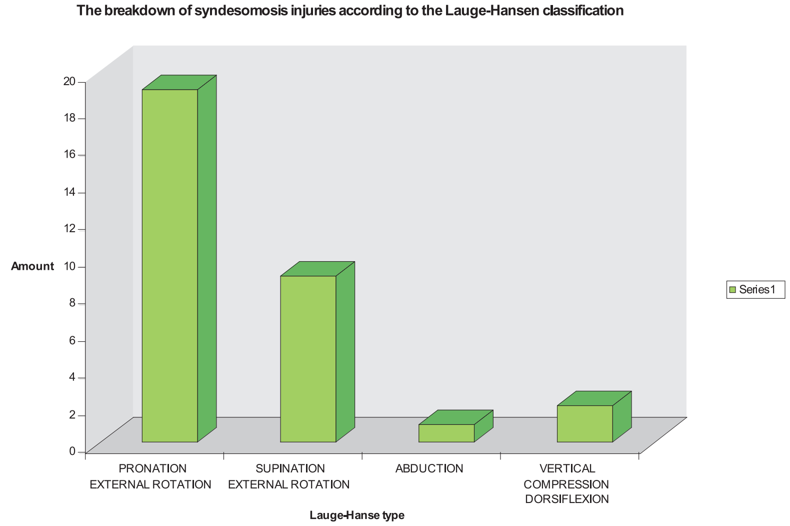
The syndesmosis was classified as unstable if the surgeon could see the syndesmotic opening, and confirmed with fluoroscopic views, of which prints or X-rays were made.

Limitations of the study

It was difficult to determine pre-operatively whether patients might have a syndesmotic injury, mainly due to pain, and therefore it was difficult to determine if tenderness was present at the syndesmosis or not. Most patients could not tolerate internal and external rotation of the talus in the mortise and again it did not really help with the clinical judgement of syndesmotic injuries.







Patients were operated on by different surgeons and this could have led to differences in the judgement of syndesmotic injuries when stressing the syndesmosis, even though all the participating surgeons reported clear instability, when it was present, and furnished X-ray proof thereof.

Results

A total of 94 patients were included in the study. They had a mean age of 39.32 years (range 13-85 years). There were 54 males and 40 females. The mechanisms of injury included motor vehicle accidents (MVA) (15.95%), pedestrian vehicle accidents (PVA) (11.7%), falls (53.19%), soccer injuries (9.57%), rugby injuries (3.19%), kicking (2.12%) and direct trauma (4.25%). Of the total 94 patients, 60 had pain and swelling over both the medial and lateral malleolus, while 12 had involvement of the medial side only and 22 laterally. Fifty-two patients had no echymosis but 17 were found to have it on both sides and five and nine had echymosis on the medial and lateral sides respectively. Thirty-three patients reported having tenderness over the syndesmosis. The ankle fractures were classified according to the Weber classification and nine (9.57%) were Weber A, 50 (53.19%) Weber B and 22 (23.40%) Weber C. A total of 13 (13.83%) patients had fractures of the medial malleolus only and could not be classified. According to the Lauge-Hansen classification, 20 (21.28%) were pronation-external rotation type, 51 (54.26%) supination-external rotation, 13 (13.83%) abduction, three (3.19%) vertical-compression dorsiflexion, and seven (7.44%) adduction types.

We found ankle stress views and traction with a bone hook in theatre, at the time of surgery, to be very effective in making the diagnosis of syndesmotic injuries

A total of 31 patients (32.9%) of the total 94 patients were found to have syndesmotic injuries. All 31 patients had opening of the syndesmosis with stress views as well as excessive movement when stressed with a bone hook in theatre. The mean age of this group was 36.65 years (range 16-67). This group included 21 males and 10 females. The mechanisms in this group included fall 14 (45.1%), MVA six (19%), PVA four (12%), soccer three (9.6%), rugby two (6.45%) kick one(3.2%) and direct trauma one (3.2%).

Only 26 of the 31 patients had tenderness over the syndesmosis (83.87%). According to the Weber classification, one (3.22%) was Weber A, nine (29.03%) Weber B and 20 (64.52%) Weber C as well as one (3.22%) that had a medial malleolus fracture only. According to the Lauge-Hansen classification 19 (61.29%) had pronation-external rotation injuries, nine (29.03%) supination-external rotation, one (3.22%) abduction and two (6.45%) vertical-compression-dorsiflexion. *(See Graphs).*

Discussion

A missed injury to the syndesmosis may result in significant morbidity to the patient as it can lead to chronic ankle pain and early arthritis. It is thus prudent to rule out syndesmotic injuries to the ankle at the time of injury so that the necessary action can be taken (i.e. placement of a syndesmotic screw). In our study, we found ankle stress views and traction with a bone hook in theatre, at the time of surgery, to be very effective in making the diagnosis of syndesmotic injuries. This is evident by the fact that all the patients with syndesmotic injuries had both positive stress views and movement of the syndesmosis when stressed with a bone hook. None of the patients in whom the syndesmosis was found to be normal had a positive finding in either of the above tests. Furthermore, we found that tenderness over the syndesmosis at the time of examination is not completely reliable, as only 26 of the total 31 patients with syndesmotic injuries had tenderness over the syndesmosis.

The overall incidence of 33% of syndesmotic injuries in our study population was higher than we expected it to be. This may be attributed to the fact that the aim of the study was to determine the incidence and that a more focused attempt was made to elicit syndesmosis instability. The fact that every third patient with an ankle fracture had a syndesmotic injury highlights the importance of determining the presence of these injuries, so as to institute the appropriate therapy.

If the classification of the ankle fracture, in those patients with an established syndesmotic injury, is taken into account then it is evident that the largest group remains the Weber C / pronation-external rotation group with 65% and 61% respectively. This leaves the remaining 35% to 39% (depending on the classification used) of patients spread among the other groups of each classification. Most of these patients fell into the Weber B or supination-external rotation groups of either classification, both numbering 29%. It is important to note that even though Weber C and pronation-external rotation injuries made up only 23% and 21% of the total breakdown of ankle fractures respectively, they accounted for 65% and 61% of patients with syndesmotic injuries.

Of the patients with syndesmotic injuries, only 84% reported tenderness over the syndesmosis itself. This suggests that this clinical sign is not entirely reliable for making the diagnosis but is probably reliable as an indicator of the possibility of syndesmotic injury and that further investigation should be instituted. Furthermore, we found swelling and echymosis to be inaccurate as indicators of syndesmotic injury. Pertaining to the mechanism of injury, we found that no one mechanism (i.e. fall, MVA, PVA, soccer, rugby, kick or direct trauma) placed the patient with an ankle fracture at a higher risk for having a syndesmotic injury, as the figures were generally in keeping with those for the overall group of 94 patients.

It is interesting to note that if the incidences of pronation-external rotation and supination-external rotation injuries are combined, it accounts for 91% of patients with syndesmotic injuries. This seems to confirm the view expressed by Peña and Coetzee that syndesmotic injuries are caused by an external rotation force.

Conclusion

The conclusion that one draws is that one-third of patients with syndesmotic injuries do not fall in the traditional Weber C / pronation- external rotation group and that these injuries may be missed if they are not actively excluded or if the diagnosis relies only on the clinical presentation and classification of the fracture. Furthermore, the overall incidence of 33% of ankle fractures having proven syndesmotic injuries was higher than expected. In the light of the fact that missed syndesmotic injuries may lead to significant morbidity, we therefore suggest that all ankle fractures should either have stress views taken or should be mechanically stressed with a bone hook in theatre.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article. This research was not submitted to an ethical committee. This article is free of plagiarism.

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To: Dr Poen Louw
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Date: 13 October 2007

I salute you from Ifakara, Tanzania.

Indeed your leadership through your President Messages has inspired me **ever since I began getting the SAOA journal.**

I do believe we receive in other ways when your term ends.

Thanks with compliments,
Dr P L Kibatala