April 14th, 2021

To Editor-In-Chief

WJO World Journal of Orthopedics

Dear Colleague,

we read all comments provided by the Reviewer after our first submission. Please find attached our responses. In the main text all the modifications and additions are underlined (except new references). We believe to have answered as precisely as possible to all comments. We remain available, to further feedback on behalf of yourself or the reviewers and, if needed, provide you with additional information on our paper.

Sincerely,

Francesco Pogliacomi, MD

Comments as Reviewer 1:

Scientific Quality: Grade C (Good)

Language Quality: Grade B (Minor language polishing)

Conclusion: Major revision

Specific Comments to Authors: This is a partially complete review of the latest concepts of syndesmotic injury. It needs a major revision.

Surgical treatment

Comment 1; no mention of ORIF of the posterior malleolus, indications for ORIF with a post. mall. injury.

Response 1; we agree with Reviewer and we have added a chapter in the "Surgical treatment and postoperative care" section about this topic.

Comment 2; what if the PTFL is ruptured but the syndesmosis is accurately reduced by ORIF of a post. mall. fracture?

Response 2; we consider these cases really uncommon (PITFL rupture associated with posterior malleolar fracture) according to our personal experience. PITFL is a major stabilizer of DTS as well demonstrated by Ogivle-Harris et al. (Disruption of the ankle syndesmosis: biomechanical study of the ligamentous restraints. Arthroscopy. 1994;10(5):558-560) who concluded that this ligament alone makes up 42% of the strength of the syndesmosis. Some studies examined syndesmotic stabilization in rotationally unstable ankle fractures through fixation of the posterior malleolus with its intact PITFL [Gardner MJ, et al. Fixation of posterior malleolar fractures provides greater syndesmotic stability. Clin Orthop Relat Res. 2006; 447: 165-171, Miller AN, et al. Posterior malleolar stabilization of syndesmotic injuries is equivalent to screw fixation. Clin Orthop Relat Res. 2010; 468(4): 1129-1135, Miller AN, et al. Direct visualization for syndesmotic stabilization of ankle fractures. Foot Ankle Int. 2009; 30(5): 419-426, Duan X, et al. Operative Treatment of Posterior Malleolar Fractures. The Open Orthopaedics Journal, 2017; 11 (Suppl-4, M14): 732-742, Verhage SM, et al. Open reduction and internal fixation of posterior malleolar fractures using the posterolateral approach. Bone Joint J 2016; 98-B: 812-17, Van Hoff CCD et al., Influence of Fragment Size and Postoperative Joint Congruency on Long-Term Outcome of Posterior Malleolar Fractures. Foot & Ankle International® 2015; Vol. 36(6): 673–678)] with satisfactory results in terms of stability of DTS. These results highlighted the importance of the PITFL for the biomechanical function of the syndesmosis and suggested that restoration of the PITFL in rotationally unstable ankle fractures through a stable fixation of the posterior malleolus could be considered an alternative for syndesmotic stabilization. Warner et al. [Analysis of PITFL Injuries in Rotationally Unstable Ankle Fractures. Foot & Ankle International® 2015;, Vol. 36(4): 377–382] instead studied PITFL injuries in the absence of a posterior malleolar fracture. They found that most PITFL injuries occur as a delamination of the ligament from its attachment to the posterior malleolus and suggested that repair techniques to fix the PITFL back to its footprint on the posterior malleolus may provide an effective and reproducible means to stabilize the syndesmosis. In these cases, this approach potentially could obviate the need for further DTS stabilization.

In conclusion we consider of primary importance the fixation of the posterior malleolus also in those rare cases of PITFL rupture associated with posterior malleolar fracture. The decision of an additional syndesmotic fixation depends on intraoperative DTS stability and must be evaluated manually and fluoroscopically during surgery. In this context (PITFL rupture associated with posterior malleolar fracture or PITFL rupture without posterior malleolar fracture) alternative techniques for restoring syndesmotic integrity by reapproximating the intact but delaminated ligament and reattaching it to its bony bed may be considered.

Comment 3; what if the PTFL is not ruptured but there is a big post. mall. fracture? How to reduce this and treat this entity? Then syndesmotic fixation is avoided. This needs to be added.

Response 3; these are the most frequent cases. The indications for posterior malleolus fixation have enlarged and have modified as written in the Surgical treatment section. As explained in response number 2 some studies examined syndesmotic stabilization in rotationally unstable ankle fractures through fixation of the posterior malleolus with its intact PITFL (see previous references in Response 2) with satisfactory results in terms of stability of DTS. These results highlighted the importance of the PITFL for the biomechanical function of the syndesmosis and suggested that restoration of the PITFL in rotationally unstable ankle fractures could be considered an alternative for syndesmotic stabilization.

We consider of primary importance the reduction and fixation of the posterior malleolus. In these context we believe that a precise classification of posterior malleolar fractures is crucial, as well demonstrated by Haraguchi and Bartonicek [Haraguchi N, et al. Pathoanatomy of Posterior Malleolar Fractures of the Ankle. THE JOURNAL OF BONE & JOINT SURGERY; MAY 2006; VOLUME 88-A · NUMBER 5: 1085-1092. Bartonıcek j, et al. Anatomy and classification of the posterior tibial fragmentin ankle fractures. Arch Orthop Trauma Surg (2015); 135: 505-516].

The surgical approach and type of fixation available have been described in the “Surgical treatment and postoperative care” section.

The decision of an additional syndesmotic fixation depends on intraoperative DTS stability and must be evaluated manually and fluoroscopically during surgery.

Authors preferred surgical method

Comment 4; no mention of the order of fixation when there is a trimalleolar fracture with syndesmotic injury (usually fibula first, then post. mall. and then medial mall, then syndesmosis).

Response 4; we agree with the Reviewer and we have added the order in “Authors preferred surgical method” section.

Other components missing in paper

Comment 5; what about indications for CT scan preop?

Response 5; we agree with the Reviewer of the importance of CT scan in preoperative evaluation of such lesions. We have added indications for CT scan preop in “Clinical and instrumental examination” and in “Surgical treatment and postoperative care” chapters.

Comment 6; what about Heterotopic bone forming in syndesmosis postop and complications of such?

Response 6; heterotopic bone formation is encountered as one of the complications of DTS stabilization even if functional consequences of this complication are often limited without need of special treatments. We have added a chapter on heterotopic bone formation in the Discussion.

Comment 7; what about diferent approaches posterior medial or posterior lateral to approach the different Haraguchi type posterior mall. injuries?

Response 7; we have introduced Haraguchi and Bartonicek classification system in the “Surgical treatment and postoperative care” chapter and explained the different surgical approaches available on the basis of the different type of fracture.

Comment 8; what about overcompression of the syndesmosis with a syndesmotic screw if the foot is dorsiflexed and a clamp is put on too tight?

Response 8; overcompression of the syndesmosis has been reported in literature. It can be the consequence of an excessive force of compression applied with the forceps and an overtight syndesmotic screw.

The influence of foot position on reduction is still unclear. Cadaveric studies have demonstrated that syndesmotic fixation alters normal ankle motion and mechanics, and this has led investigators to recommend syndesmotic fixation with the ankle in maximum dorsiflexion. This recommendation is based on the concept that ankle dorsiflexion brings the wider dimension of the talus into the ankle mortise and minimizes the risk of fibular overreduction during syndesmotic fixation [Olerud C. The effect of the syndesmotic screw on the extension capacity of the ankle joint. Arch Orthop Trauma Surg. 1985; 104: 299-302. Needleman RL, et al. Effect of the syndesmotic screw on ankle motion. Foot Ankle. 1989; 10: 17-24]. More recently, however, the concept that the syndesmosis can be overtightened on the basis of foot position has been challenged. In a cadaveric study, Tornetta and colleagues (Overtightening of the ankle syndesmosis: is it really possible? J Bone Joint Surg Am. 2001;83:489-492) compressed the syndesmosis in plantar flexion and found no significant change in ankle dorsiflexion or plantar flexion.

The optimal force that should be applied with a clamp to reduce the syndesmosis is currently unknown, but overcompression is possible.

Fluoroscopy is typically used for intraoperative assessment of the reduction of the syndesmosis. However, the use of other intraoperative imaging studies has been evaluated (intraoperative CT).

Obtaining intraoperative mortise and perfect lateral fluoroscopic views of the talar dome of both ankle before fixation could help in determining the relationship between fibula and tibia in the ankle and to reduce the risk of overcompression.

In the original manuscript “overcompression” was described in the “Surgical treatment and postoperative care” chapter. We have completed this description in the same chapter.

Comment 9; what about the pain that is resolved when an "overtight" syndesmotic screw is removed as the syndesmosis results in the position that it should have been reduced in (rather than over compressed)?

Response 9; the use of screws for DTS stabilization could be characterized by discomfort (intolerance to metallic device) or pain (overtight of the syndesmotic screw). Rupp [Overcompression of the Syndesmosis During Ankle Fracture Fixation: A Case Report. Am J Orthop. 2008; 37(5): 259-261] described a case report of overcompression of the syndesmosis during ankle fracture fixation in which pain and reduced ROM due to overtight screw. All the signs and symptoms resolved following screw removal after adequate healing of the ligaments. This case report supports the concept of anatomic reduction of the disrupted syndesmosis and neutralization screw fixation, thus avoiding overcompression of the distal tibiofibular space as consequence of an overtight screw.

References

Comment 10; Ref. 80 is a good prospective RCT. You are missing others that are of the few solid studies in the literature and should be included.

A) D. Sanders, C. Tieszer, B. Korbett, for COTS, Operative versus Non operative treatment of unstable lateral malleolar fractures: A randomized multi-center trial, JOT, 26:129-134, 2012

B) Sanders D, Schneider P, Taylor M, Tieszer C, Lawendy A-R. Improved Reduction of the Tibiofibular Syndesmosis with Tightrope compared with Screw Fixation: Results of a RCT. 2019 JOT 33; 11:531-537.

Response 10; we agree with the Reviewer and we have added these 2 articles and others and we have consequently modified the chapter “References”.

Comment 11; Fig 6 shows soft tissue windows and needs to be changed to show bone windows.

Response 11; we agree with the Reviewer and we have changed the figure 6 thus showing the bone window.

Comment 12; Need a new Figure that shows posterior mall. fixation that deals with the syndesmotic widening as the PTFL is not ruptured with a trimalleolar fracture that is treated well with ORIF.

Response 12; we have added a new figure (figure 10). The previous figure 10 is now figure 11 in the text.