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Matter for Debate

The isolated lateral malleolar fracture: Where are we and how did we get here?

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ABSTRACT

Despite the isolated lateral malleolar ankle fracture being one of the most common injuries treated by orthopaedic surgeons it remains an injury that is widely misunderstood. Treatment protocols are compounded by the contemporary literature being divided on its optimal management. This review takes the reader through a process of how the historical literature on this subject has been formed, it critiques the main responsible papers and leads one to question the current dogma attached to both this injury and to current research in general.

The ankle fracture

Can you remember your first night operating alone? I distinctly remember mine. Booked on the evening list was an isolated lateral malleolar ankle fracture. The ageing consultant turned to me and said, 'Right I'm off, with the ankle ORIF do not accept any fibula displacement as the talus always follows the lateral malleolus and just 1 mm of talar shift will result in a 42% drop in ankle joint contact area.'

How can the talus displace when the deltoid is intact?

Whilst struggling to reduce the fibula anatomically I began to consider these studies, wondering whether the authors knew their 'take-home-messages' were going to have far reaching consequences and be quoted for years to come. What if, however, their work was flawed or indeed misunderstood – for these discoveries have clearly dictated clinical practice and set the scene for future research.

The problem

This 'scene setting' is what we all do when writing a research paper. The problem is discussed, the reasons why this problem is important are analysed and then we elaborate on how our findings solve the problem. What happens however if the problem you thought was there never really existed? What if the previous work had been flawed or misquoted or worse still embedded in orthopaedic folklore? There may not actually be

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a problem to be solved. What happens then? By statistical chance (or by working the statistics in favour of a positive finding) a type I (or indeed an actuary may argue a type III) error ensues and the propagation of the problem continues.

To illustrate this point I would like to discuss the management of one of the most common of all orthopaedic injuries, the isolated lateral malleolar (Lauge Hansen[1]:Supination External Rotation (SER) II) ankle fracture. Despite its wide criticism and non-reproducible findings [2–5] the Lauge Hansen classification is still regarded as the basis for understanding the wide variety of possible ankle fractures.[6] The SER II injury implies external rotation of a supinated foot with an injury that propagates clockwise from the anterior inferior tibiofibular ligament to the lateral malleolus without injury to the medial side. With an intact deltoid ligament it is an injury that should not result in any talar shift. The evidence for the conservative management of this injury is compelling. Kristensen and Hansen[7] followed 94 conservatively managed isolated lateral malleolar fractures for an average of 20 years. They demonstrated good clinical results in 95% with no patients requiring ankle fusion. Bauer[8] only found one patient out of 49 with an SER II injury had symptoms after an average of 29 years. Yde and Kristensen[9]identified no difference in outcome at three years between closed treatment in a plaster cast and open reduction and internal fixation. Michelson[10] assessed the radiographs of this fracture population to union without finding any loss of position.

In fact there appears to be no evidence that has shown a benefit to operative fixation of the isolated lateral malleolar fracture. Why is it then that some clinicians advocate surgery for all[11] and others have gone to the effort of comparing different fixation methods[12,13]?

The reason may be traced back to two key papers – those of Ramsey and Hamilton[14] and Yablon et al.[15] From these papers I believe one can illustrate the two main problems with scientific research – work that is potentially flawed and work that is misquoted.

Ramsey and Hamilton's study may, or may not (as we shall discuss), represent the changes in tibiotalar contact area with lateral displacement of the talus – but the majority of orthopaedic surgeons can accurately quote the results of their work. This however is not the case with the influential work by Yablon et al. True the talus does appear to 'faithfully follow the lateral malleolus' however Yablon et al. demonstrated this with bimalleolar ankle fractures – a totally different beast from the isolated lateral malleolar fracture for which it is regularly quoted.

A tale of two citations

So how has this affected orthopaedic practice? To illustrate I would like to take you on a journey, a journey of two papers. From 1976 to 2011 the Ramsey and Hamilton paper has been quoted 360 times (putting it in the top 100 classical articles according to the criteria set by Kelly et al.[16]) and the Yablon et al. paper 177 times. I will try to show how these studies have affected and later shaped the work of others. You may wish to draw your own conclusion as to the importance of conducting accurate research and what can happen if a study is misquoted.

Lets start with looking more closely at the Ramsey and Hamilton paper.[14] They took 23 cadaveric ankles and removed the talus, smeared carbon black onto the under side of the tibia and then loaded the tibia with 70 kg. They then calculated the contact area by the amount of carbon black that had been transferred to the talus. They found that 1 mm of lateral talar displacement resulted in a 42% drop in tibiotalar contact area. What is not however widely known about this research is that metallic spacers were placed in the medial malleolus – effectively 'jacking' the talus in the direction of the excised fibula. Such wedges could surely only serve to create a block to the normal movement of the ankle.

A feature not appreciated about this paper is the 42% drop in the tibiotalar contact region is not from an initial 100% but in fact much less. On the basis of the original photographs of the charcoal left on the talus I traced out (on transparent graph paper) the actual contact area and the available contact area for each of the illustrated tests samples. The drop of 42% is from an initial contact area of about 30% to a contact area of 16%. Are we therefore to believe that the 'normal' tibiotalar contact is only 30% or was there an error in the testing apparatus? Were the spacers preventing movement of the talus? Those of you who have witnessed an ankle arthroscopy or dissected an ankle know that an ankle articulation has a congruency considerably greater than 30%.

The second paper we will discuss is by Yablon et al.[15] They famously demonstrated that the talus 'faithfully follows the lateral malleolus.' This cadaveric and clinical study appears to have evolved from the authors' experience of intraoperative problems in reducing unstable ankle fractures. Of the initial 17 patients surgically treated with a bimalleolar ankle fracture 14 had the medial malleolus fixed prior to the lateral side with subsequent incomplete reduction of the talus and lateral malleolus. They found reduction could only be achieved by removing the medial sided fixation and correcting the lateral side position. They followed these findings by devising a cadaveric study to assess the effect of progressive sectioning of ankle structures on rotary and sagittal stability. This demonstrated substantially more instability was generated by sectioning of both the lateral malleolus and the lateral collateral ligaments in comparison to the deltoid ligament. From this the authors formulated the two famous quotations from their paper, namely 'the talus faithfully follows the lateral malleolus' and the 'key role of the lateral malleolus in displaced fractures of the ankle'.

Why has this research, carried out solely on bimalleolar ankle fractures, been subsequently quoted in conjunction with its isolated lateral malleolar counterpart? Potentially it is because ankle fractures encompass a multitude of injuries which can be extremely confusing to the inexperienced surgeon. This study provides a simple, memorable finding which is easy to accept, albeit inappropriately, as a general rule for ankle fracture management.

The genealogical study

The search started with the Internet site 'Wheeless'. It is a favourite of orthopaedic trainees providing a comprehensive summary of all orthopaedic procedures and the seminal supporting evidence. Wheeless quotes Thordarsonet al.,[17] 'displacement of the fibula more than 2 mm will lead to significant increases in joint contact pressure,' as an

indication for surgery for SER ankle fractures in general. This study by Thoradarson et al. illustrates just how the papers of Yablon et al. and Ramsey and Hamilton have shaped later research. Thordarson et al. set the scene for their study by quoting Yablon et al. stating the lateral malleolus is the key to the reduction of the ankle joint. They also quoted the importance of preventing lateral talar displacement due to the decreased tibiotalar contact areas seen by Ramsey and Hamilton. In their study they used a bimalleolar equivalent cadaveric model (fibula fracture plus deltoid ligament section) to demonstrate increased tibiotalar contact pressures with various degrees of fibula displacement. They noted displacement (or shortening) of the fibula of more than 2 mm will lead to significant increases in joint contact pressure. They concluded that displacement of the fibula is not to be accepted. What they failed to stress in the discussion and conclusion was the bimalleolar equivalent nature of the study. Sectioning of the deltoid ligament would allow relatively free talar movement that understandably created abnormal joint pressures. Their findings are not, and should not be taken as an indication for fixing displaced isolated lateral malleolar fractures.

Even the American Academy is responsible for propagating the misquotation from the Yablon et al. paper. In an Instructional Course Lecture[18] they noted that in recent years there has been a trend towards fixing isolated lateral malleolar fractures. To quote, 'this approach has been based, in part, on the finding that displacement of the talus follows displacement of the lateral malleolus'. Once again the study by Yablon et al. has been incorrectly linked to its isolated lateral malleolar counterpart.

At some point over the last four decades the papers of Yablon et al. and Ramsey and Hamilton have been indoctrinated into orthopaedic folklore. This must be the case, because if not I am unable to explain a recent article[19]in which the authors, quoting a paper by Phillips et al.[20] state, 'the lateral malleolus plays the key role in the stability of the ankle because 1 mm lateral displacement of the talus decreases the tibiotalar contact surface by 42%.' In this study there was not a single mention of the work by Yablon et al. or Ramsey and Hamilton. Interestingly the Phillips et al. paper[20](a clinical study of ankle fractures) does not even itself reference the Yablon et al. paper (however I would not bet against the authors of its missing (number 26) reference). This illustrates quite how the work of Ramsey and Hamilton and Yablon et al. has transcended peer reviewed orthopaedic literature – they have been quoted so many times we have actually forgotten who did the original research.

It is not only in the orthopaedic literature that these studies are cited. They can also be found in teaching forums,[21] 'due to Ramsay and Hamiltons work any more than 1 mm is unacceptable for lateral malleolar displacement in the young.' This exemplifies the misunderstanding of whether it is the fibula or talar displacement that is important.

Current understanding

So where do we stand with the current literature concerning the management of the isolated malleolar fracture? Does greater fibula displacement result in a poorer outcome? In a review of lateral malleolar fractures,[22] Lesic and Bumbarisevic stated that displacement greater than 2 mm is an indication for fixation. Typical of the dogma attached to this injury the reasoning behind this statement was not quantified.

With over 5000 'hits' for an 'ankle fracture' search in pubmed this is clearly a well-researched topic. Within this search however there appears to be no clinical evidence against fixing displaced isolated fibula fractures, likewise there is no strong evidence advocating surgery. The combination of contradictory clinical and biomechanical studies is confusing and easily misinterpreted. As previously noted, the absence of evidence is not however evidence of absence.[23] This is clearly an area still ripe for further investigation.

Interestingly other studies appear to show fibula displacement as nothing more than an optical illusion due to internal rotation of the proximal fibula.[24–26] Are we in fact basing our surgical management on what amounts to nothing more than a misinterpretation of tungsten generated shadows on the background of some poorly conducted and poorly understood research?

Why has there been so much ambiguity in the management of what appears to be a benign injury? Personally I believe a lot stems from a 'catch phrase' generation of orthopaedic surgeons. Sound bites, one-liners and take-home-messages are all the craze. The journals want simple messages that can be taken from research. The papers of Ramsey and Hamilton and Yablon et al. have very memorable findings which, partly due to the multifaceted nature of the ankle fracture, have been not fully understood. The resultant propagation of this misunderstanding has almost certainly resulted in numerous unnecessary operations.

Epilogue

As clinicians we surely have a responsibility to understand and critically evaluate the research we use to base our practice on. It is too easy (some might say lazy) to read abstracts, listen to podcasts, read reviews and pretend that we understand; we do not. We, as orthopaedic trainees, tend to treat published research as gospel. We are at the mercy of journal editors to provide us with valid papers and opinions. In the current climate of increased service provision the time to critique a paper is rarely available. The dangers of this are evident. Likewise we also have a responsibility to ensure our own research is accurate, to ensure that the reasons we do research are just. Are we fully aware of quite how far reaching our work can be?

So how can we, as accountable surgeons, improve the abstruseness that shrouds the management of the isolated malleolar ankle fracture? The current evidence is undoubtedly robust enough to support non-operative treatment of undisplaced isolated lateral malleolar fractures.[7–10] With some surgeons advocating surgery for all displaced fractures the results of a potentially contradictive study would need to be watertight – beyond the fiercest critique – to stand a chance of changing established practice. The CONSORT checklist[27] was initially introduced to aid clinicians in the design of such trials. Subsequently it has been criticised in the surgical

literature due to inadequate reporting of the blinding method, surgical expertise or volume of the participating units.[28–30] A more recent checklist that takes into account these shortcomings (the Checklist to Evaluate a Report of Non Pharmacological Trial – CLEAR NPT) has subsequently been developed.[31] This is a simple and quick checklist which, if applied correctly, would enable future researchers to plan and execute studies of the upmost quality – robust enough to change practice. This should allow a future generation of surgeons to operate, or not, on displaced isolated lateral malleolar ankle fractures with the underlying knowledge that they are doing so with strong supporting evidence. Until then one can expect the decision to operate will continue to be frustratingly dictated by the surgeons understanding of an evidence pool littered with poorly conducted, poorly understood and poorly quoted research.

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