PROGRESS IN ORTHOPEDIC SCIENCE, 2021
VOL 7, NO. 1, PAGE 1 – 4
DOI: doi.org/10.47363/POS/2021(7)141

RESEARCH ARTICLE

Open Access

Trends in Managing Ankle Fracture with Diastasis Radiological Assessment

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ABSTRACT

Introduction: The ankle diastasis fixation includes screw or tightrope fixation. The radiological improvement, the debates about the complication of either methods of fixation, continue. The current paper studies the trend followed in our area.

Material and methods: This is a retropsective study on fifty one patients who have had syndesmotic fixation for ankle fracture with diastasis treated in Scarborough-York Hospitals between 2011-2014. Radiological assessment of the ankle mortice before and after fixation, the clinical outcome following surgery are studied by going through the electronic medical notes and the picture archive and communicaton system (PACS) a mean follow-up period of 2.9 years.

Results: The mean number of tight ropes used were 2 (1-3), inserted 2 cm above tibial articular surface was used in 15 patients, persistent pain and swelling was encountered n 3 patients. In 36 cases, syndesmotic screw fixation was used for diastasis. Eight patients with high fibular fracture were treated solely with syndesmotic screw(s) without plate fixation of fibula, in the remaining cases the diastasis screw were inserted through fibular plate. In regards to the number of diastasis screws, one screw was used in all but seven patients. in three patients, the screw size was 4.5 and cortical; the remaining patients had 3.5 mm screws. The diastasis across was quadricortical in two patients only. Average distance of the diastasis screws from the tibial articular surface was 2.39 (1-5) cm. Seventeen diastasis screws were eventually removed, among which 14 screws were broken. There was minimal radiological deterioration of reduction following screw removal. The screws were removed at an average time of 31 weeks (6-133).

Conclusion: Both methods of diastasis fixation are popular, removal of screw and complications related to this remained to be a cause of concern, however, diastasis screw fixation remains to be a popular option to secure the syndesmosis after ankle injury. 47% of these cases, needed to have the screws removed. Localised swelling and pain was associated to tight ropes (20%). Cost implications and learning curve for using tightrope need to be taken in consideration.

ARTICLE HISTORY

Received Feb 07, 2021
Accepted Feb 16, 2021
Published Feb 19,2021

KEYWORDS

Ankle, Fracture, Diastasis, Screw, Tightrope

Introduction

Approximately one in seven ankle fractures is accompanied by a distal tibiofibular syndesmotic disruption. When, after stable fixation of the fractured malleoli, persistent instability of the distal tibiofibular joint is identified perioperatively, additional stabilization is indicated. In most cases the syndesmotic ligaments are left untouched and a so-called 'syndesmotic positioning screw' is placed to restore and maintain a congruent mortise [1].

The theoretical and technical aspects of syndesmotic screw placement have been subject to numerous clinical and biomechanical investigations, in an attempt to solve some of the controversies concerning syndesmotic screw usage. There appears to be no difference in stainless steel versus titanium screws [2]. A 4.5-mm screw apparently provides greater resistance to shear stress than a 3.5-mm screw; however, this does not implicate a biomechanical advantage [3,4]. Bioabsorbable screws

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are biomechanically and clinically equivalent to stainless steel syndesmotic screws [5]. The level of syndesmotic screw does not affect outcome [6]. Two syndesmotic screws provide more stability than one, which seems beneficial in more proximal fibular (Dupuytren and Maisonneuve) fractures and neuropathic fracture dislocation in the diabetic patient [7-15]. Three-cortical versus four-cortical screw placement does not affect biomechanical stability [10], or influence outcome [4]. The use of a suture device seems to provide equal [14] or improved [16] outcome compared to a four-cortical syndesmotic screw. The position of the foot during insertion of the syndesmotic screw does not influence the range of motion or outcome [17-20].

Whether or not the syndesmotic screw has to be removed prior to weight-bearing is debatable. Proponents of this policy state that tibiofibular movement is affected by leaving the screw in place and dorsiflexion is hampered. This is accompanied by the possibility of breakage of the screw when left in place [19]. It is advocated that the screw should be removed prior to weight-bearing at 6–8 weeks [19]. However, this statement has been disputed.

The tightRope device is reported to compare favourably with two, 3.5-mm, 3-cortex screw fixation for syndesmosis injuries without the concerns mentioned in regards to syndesmotic screw fixation [20-21]. The aim of the current paper is to evaluate the ankle diastasis fixation and the associated debates.

Methods

Between January 2011 and July 2014, 51 patients with ankle fracture and diastasis were reviewed; they all underwent internal fixation. The study was conducted in Scarborough hospital, North Yorkshire, UK. Demographic data and clinic notes retrieved from the PACS. The radiographic analysis of the x-ray and the electronic medical records of these patients were reviewed. The type of the fracture was classified according to AO classification. The radiographs taken were anteroposterior, lateral, sometimes mortice views. The lateral malleolar fractures were Weber C fractures. X-rays reviewed on PACS. Radiographs taken for these patients were on admission, and was repeated at time of review following the removal of cast in the fracture clinic review, and after the potential removal of the syndesmosis screw.

Radiographic assessment aimed at measuring the ankle mortice, fibular shortening and overall reduction. (Figure: 1).

Figure 1: Plain anteroposterior radiograph of the ankle with ankle mortice disruption, demonstrating different radiographic analysis used in this paper. Tibio- fibular clear space (a) (>6mm),Ti b fib overlap (b) (<1mm), Medial mortise width (e) (>4mm), Talocrural angle (c) (7+- 4^{o}) and Talar tilt angle (d) (0-5^{o}).

Results

The radiographs and medical notes were reviewed. Average follow up of our patients was 2.9 years (1.1 – 5.03). Average age 44.7 (16-91). There were 20 male and 31 female patients. The right ankle was broken in 26 patients and the left in 25 patients.

The average screw placement above the tibial articular line was 2.26 cm (1.1 – 5.2 cm). None of the tight ropes needed removing. were left unremoved; however 17diastasis screws among the cases were removed, among which there were 14 broken screws. There were no radiological deterioration after screw removal. The radiological reduction of the ankle fracture are assesed (Table 1).The complications encountered were higher in the screw group (Table 2).

Table 1: Radiological assessment comparing screw syndesmosis fixation vs tightrope

	Pre					Post				
	Clear space	Overlap	Medial mortise	Talocrural angle	Talar tilt	Clear space	Overlap	Medial mortise	Talocrural angle	Talar tilt
Screw, n = 36	7 (2.9 – 15.2)	1.1 (-4.9 – 7.2)	6 (1.4 – 11.2)	8.3 (0.5 – 17)	3.3 (0.1 – 12.6)	4.9 (2.3 – 9.3)	3.2 (-2.2 – 7.9)	3.2 (1.7 – 5.9)	11.6 (3.1 – 16.5)	1.5 (0 – 4.8)
Tightrope, n = 15	6.3 (3.2 – 11)	2.3 (-4.1 – 8.5)	6.6 (4.1 – 9.5)	9.2 (2.1 – 15.6)	2.1 (0.3 – 6.1)	4.4 (2 – 8.3)	4.1 (0 – 7)	3.3 (1.5 – 6.9)	10.1 (3.3 – 15.2)	1.9 (0.1 – 7.4)

Table 2: Complications

Complication	Syndesmosis screw, n = 36	Tightrope, n = 15
Screw loosening	1 (2.8%)	0
Syndesmosis screw broke	12 (13.9%)	0
Paraesthesia	4 (11.1%)	0
Pain over metalwork	5 (13.9%	2 (13.3%)
Infection	1 (2.8%)	0
Osteopenia	2 (5.6%)	0
Stiffness/ Reduced ROM	3 (8.3%)	1 (6.7%)

Persistent swelling	3 (8.3%)	1 (6.7%)
Ankle impingement	1 (2.8%)	0
Scar pain	0	0

Discussion

There are areas for debate in regards to syndesmotic fracture fixation. Tightropes have added to the armamentarium of the syndesmotic fixation, controversies about the benefits, draw back and expenses. The advantages are that it rarely required removal, and allows for physiologic motion of the syndesmosis. The knotes can however cause local reaction [20-22]. There were no failure, however there were cases of localised pain and swelling at the tight rope area and joint stiffness.. The radiological reduction of syndesmosis in our series were superior using tightropes. Our results comparing screw versus tightrope was similar in regards to mortice reduction.

In regards to screw removal, we had a significant number of our cases requiring screw removal (17 cases among total 36). The indications were occasionally because of pain, some screw breakage and loosening, and ritual practice; based on anecodtoes. It is our current practice not to have the screws removed. There is a concern about radiological deterioration following screw removal. In a study on 166 mature patients with ankle fractures with syndesmotic disruption undergoing fixation with diastasis screw, which eventually was removed at mean period of 3 months following surgery, the mortice remained intact when the screw(s) were removed. Radiographic assessment at this stage showed a slightly lower tibia-fibula overlap (OL) of less than 1mm and slightly greater tibia-fibula clear space (CS) of 0.5mm compared to when the screw was retained [1]. Radiological assessment reveals that there seem to be a high correlation of loss of the integrity of the syndesmotic parameters after screw removal; however, the medial clear space of the ankle changed an insignificant amount, suggesting that although there appears to be some loss of maintenance, the talus did not shift laterally at the expense of a mobile syndesmosis, similar results is reported by other autohrs [3]. We have had similar experience, hence currently, we only remove the diastasis screw in sypmtomatic patient. In a comprehensive literature search conducted in the electronic databases of the Cochrane Library, Pubmed Medline and EMbase from January 2000 to October 2010. A total of seven studies were identified in the literature on diastasis screw and have found no difference in outcome between retained or removed screws. Patients with screws that were broken, or showed loosening, had similar or improved outcome compared to patients with removed screws. Removal of the syndesmotic screws, when deemed necessary, is usually not performed before 8–12 weeks [5].

Tightropes might need removing as well, because of soft tissue inflammation and osteomylitis [23].

Financial analysis comparing the use of diastasis screw or tightropes, and learning curve associated with the use of tightrope is in favour of using screws, if further surgery is not contemplated to remove the screws.

Limitations of this study: This was a retrospective study with unequal groups and the limited number of cases, however, it has been helpful in guiding the clinicians in making choices.

Conclusion: There is no significant benefit using any of the techniques in the fixation of the diastasis of the ankle. On balance screw fixation without routine removal of the diastasis screw seem to be a practical approach.

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