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Fate of the syndesmotic screw—Search for a prudent solution

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ABSTRACT

Introduction: Ankle fractures are common injuries. Since the recognition of the importance of syndesmotic injury in ankle fractures, much of the scientific work has been focused on concomitant syndesmotic injury. Despite the invention of novel devices for restoration and maintenance of the congruent syndesmosis following syndesmotic injury, the metallic syndesmotic screw is still considered to be the "gold standard". The aim of this study was to compare the clinical results in patients who retained the syndesmosis screw with those in whom the screw was removed following open reduction and internal fixation of the malleolar fracture associated with syndesmosis disruption.

Materials and methods: This was a retrospective study of 82 patients. Minimum follow-up was 12 months. Clinical evaluation included American Orthopaedic Foot and Ankle Society (AOFAS) score and Visual Analogue Scale (VAS) for patient general satisfaction. The condition of the screw (removed, intact or broken), presence of radiolucency around the syndesmotic screw and the tibiofibular clear space were recorded using final follow-up radiographs.

Results: Three cortices were engaged in 66 patients (80%) and quadricortical fixation was performed in the remaining 16 patients (20%). The number of engaged cortices did not correlate with the clinical outcome and screw fracture. A single syndesmotic screw was used in 71 patients (86%. The mean AOFAS score in the group with intact screw (I) was 83; the scores in the group with broken screw (B) and removed screw (R) were 92.5 and 85.5, respectively. There was a statistically significant difference between the three groups: this was due to the difference between groups I and B; the difference between groups I and R and groups B and R were not statistically significant. There were no statistically significant differences in VAS results.

Conclusion: There were no statistically significant differences in clinical outcome between the group with the screw retained and the group in which the screw was removed; however, the group with broken screws had the best clinical outcome based on AOFAS score. Widening of the syndesmosis after screw removal was not evident. We do not recommend routine syndesmosis screw removal.

Introduction

Ankle fractures are common injuries, accounting for 9% of all fractures [1], and represent the most common intraarticular fracture of the weight-bearing joint [2]. During the past decades, there has been a three-fold increase in the incidence of ankle fracture in elderly females [3], which makes these injuries even more of a challenge. Approximately 23% of ankle fractures are thought to be associated with injury to the distal tibiofibular syndesmosis [4]. Widening of the ankle mortise by 1 mm decreases the contact area of the tibiotalar joint by 42%, which leads to joint instability and early osteoarthritis [5]. Subsequently, much of the scientific work regarding ankle fractures has been focused on the concomitant injury to the syndesmosis. Tibiofibular transfixation is a mandatory step in cases of syndesmotic instability after malleolar fracture repair [6]. Although syndesmotic disruption is essentially ligamentous injury, the standard treatment is not focused on ligamentous

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repair, but on placement of the positioning syndesmotic screw. Despite the invention of novel devices for restoration and maintenance of the congruent mortise (bioabsorbable screws, suture-button device) [7,8], application of the metallic syndesmotic screw is still considered the "gold standard" [9–12]. However, although the strength of fixation stabilises the joint, it eliminates the normal motion between the tibia and fibula. A cadaver study showed that there is a significant limitation of the fibula relative to the tibia in the presence of the syndesmotic screw [13] and confirmed the findings of a biomechanical study by Needleman [14]. Although there is no doubt of the contribution of the discrete tibiofibular motion in the normal biomechanics of the ankle [15,16], the clinical importance of syndesmotic screw removal after a certain time and its effect on clinical outcome is still obscure [17,18]. Current scientific knowledge does not offer a definitive solution for the fate of the syndesmosis screw and many practising surgeons just follow expert opinion.

The aim of this study was to compare the clinical results in patients who retained the syndesmosis screw with those in whom the screw was removed following open reduction and internal fixation of the malleolar fracture associated with syndesmosis disruption.

Materials and methods

The institutional review board approved the study before any patients were enrolled. Patients who underwent syndesmotic screw fixation from January 2011 to December 2012 were identified from a patient information database at the university hospital. Patients were excluded from the study if their charts or radiographs were unavailable or incomplete. Inclusion was limited to patients who had undergone open reduction and internal fixation of the ankle fracture with screw fixation of the disrupted syndesmosis that was confirmed at the operation. Exclusion criteria were postoperative infection, postoperative hardware failure, additional surgery due to postoperative complications, delayed syndesmosis repair, open fracture, direct crush injury and age under 18 years. Patients in whom the syndesmotic screw was retained because of advanced age, limited mobility or sedentary lifestyle were also excluded. Patient characteristics (age, sex), mechanism of injury (low energy trauma, high energy trauma), fracture characteristics (affected side, fracture type according to AO/Weber classification, number of fractured malleoli) and surgical characteristics (screw diameter, number of screws, tri- or quadricortical placement and time of screw removal) were extracted from the database and reviewed.

Surgery was performed during the first 6 h after injury. Internal fixation was conducted according to AO principles, using a one-third tubular plate for fibula fracture and either one or two 4.0 mm cancellous screws for medial malleolar fracture. Syndesmotic injury, if not obvious, was tested using the hook test under intraoperative fluoroscopy and subsequently reduced and fixed with either one or two 3.5 mm cortical screws. Reduction of the fibula into the incisura fibularis was checked in both anteroposterior and profile views and the positioning screw placed through the plate hole at a dorsal angle of 30°, 2.5 to 4 cm above the syndesmosis with the ankle in dorsiflexion to avoid undue compression of the joint.

The postoperative protocol consisted of splint application for 10 to 14 days. After removal of the stitches, partial-weight bearing was allowed for 6 weeks, then additional weight-bearing for another 2 weeks and full weight-bearing after 8 weeks. Syndesmotic screw was removed at 8 to 12 weeks post injury, depending on individual surgeon preference. Single dose antibiotic prophylaxis and thromboprophylaxis were given for 6 weeks post injury. According to hospital postoperative protocol, routine follow-up was undertaken at 4 weeks, 10 weeks, 3 months, 6 months and 12 months postoperatively.

Clinical review

A total of 136 patients who met the enrolment criteria were sent a letter in which the nature of the study was explained and the date and time of outpatient clinic check-up was proposed. Eighty-two of these patients (60%) agreed to take part in the study and returned for a formal clinical and radiological examination. Minimum follow-up was 12 months post index procedure. Clinical evaluation included the American Orthopaedic Foot and Ankle Society (AOFAS) score and Visual Analogue Scale (VAS) for patient general satisfaction with outcome regarding their injury (10 points denotes maximal satisfaction). AOFAS score consists of nine questions subdivided into three categories: pain, function and alignment. The best possible score is 100 points. The patients completed all the questions, apart from those that related to alignment and range of motion, which were completed by the surgeon. The patients in which the syndesmosis screw was retained were also assessed for tenderness over the screw.

Radiological review

Anteroposterior, lateral and mortise view radiographs were ordered as part of final follow-up. The condition of the screw (intact or broken), presence of radiolucency around the syndesmosis screw and the tibiofibular clear space were recorded.

Statistical analysis

All data (demographics, injury classification, mechanism of injury and time of surgery) extracted from the database and collected during the final outpatient clinic examination were entered into a database (Microsoft Excel). Descriptive statistics (mean, median, SD, percentage) were calculated. Non-parametric tests (Kruskal–Wallis and Mann–Whitney *U*) were used to compare the distributions of the defined groups of patients. Statistical analysis was undertaken using SPSS for Windows, version 18.0. Statistical significance was defined as p value of <0.05.

Results

A total of 82 patients took part in the study (attendance rate 60%). Fifty-four patients (66%) were male and 28 (34%) were female. Mean age at the time of injury was 49 years (range 19 to 71 years). Immediate post-injury radiographs extracted from the hospital database were used for fracture classification. Thirty-three patients sustained Danis–Weber B type fractures; the remaining patients had Danis–Weber C fractures. Based on the state of the syndesmosis screw, the patients were separated into three groups: group I (intact screw) comprised 46 patients (56%), group R (removed) included 23 patients (28%) and group B (broken) contained the remaining 13 patients (16%). There were no statistically significant differences in demographic features between the three defined groups.

Radiological outcome

Fully threaded 3.5 mm stainless steel screws were used in all patients to fix the injured syndesmosis. In 66 patients (80%), three cortices were engaged and in the other 16 patients (20%) quadricortical fixation was performed. The distribution of tricortical and quadricortical fixation in all three groups was almost