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Review

The role of intramedullary fixation in ankle fractures – a systematic review

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ABSTRACT

Background: Ankle fractures are one of the most commonly occurring fractures in the elderly population. The overall incidence has been reported to be up to 184 fractures per 100,000 persons per year, of which 20–30 percent occur in the elderly. Medical co-morbidities, osteoporosis, suboptimal skin quality and poor toleration of non-weight bearing status all contribute to difficulties in managing these injuries in this population. Intramedullary implants are advantageous as they utilise smaller incisions, minimise soft tissue disruption and may allow early weight bearing. This systematic review aims to analyse the use of both fibula nails and talo-tibial-calcaneal (TTC) implants in the management of fragility ankle fractures.

Methods: We conducted a systematic review of the literature using the online databases Medline and EMBASE on 26th December 2015. Only studies assessing ankle fractures that were treated with either an intramedullary fibula nail or TTC implant were included. Studies must have reported complications, patient mobility status or a functional outcome measure. Studies were excluded if the intramedullary device utilised was an adjunct to plate fixation or where a variety of surgical treatments were included in the study. The included studies were appraised with respect to a validated quality assessment scale.

Results: Our search strategy produced 350 studies although only 17 studies met inclusion criteria; ten assessed a fibula nail and seven assessed a standard hindfoot nail, a TTC implant. 15 studies were case series, the overall quality of the studies was low and only one randomised controlled trial was reviewed. The mean Olerud and Molander Ankle Score for fibula nail studies ranged from 58 to 97 and the complication rate from 0 to 22%. Two comparative studies reported a statistically significant increase in complication rate with plate fixation but similar functional outcomes. Studies assessing TTC implants reported a mean Olerud and Molander Ankle Score of 50–62 and complication rate from 18 to 22.6%.

Conclusion: The studies reviewed suggest that fibula nails may be capable of producing similar functional outcomes with lower rates of complications to plate fixation. TTC implants produce lower functional outcomes but this may be acceptable in a subgroup of patients at high risk or with reduced pre-injury mobility. However, the low quality of evidence reviewed, the variation in patients included, implant used and outcome scores measured restricts the ability to draw definitive conclusions. Further comparative studies are required to explore the role of these implants further.

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Contents

1. Introduction	000
2. Methods	000
2.1. Results	000
2.2. Summary of evidence	000
2.2.1. Fibula intramedullary nail	000
2.3. TTC implant	000

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2.4. Steinmann pin.....	000
2.5. Intramedullary devices.....	000
3. Discussion.....	000
4. Conclusion.....	000
References.....	000

1. Introduction

Ankle fractures are one of the most commonly occurring fractures in the elderly population. The total incidence has been reported to be up to 184 per 100,000 persons per year, of which 20–30 percent occur in the elderly [1]. The incidence is increasing and epidemiological studies have reported a three-fold increase in the incidence of ankle fractures in the elderly over the last 30 years [2]. A combination of the rising age of the population and the high activity level in this age group will see this increase continue [2,3]. Ankle fractures are more common with female gender, obesity and diabetes [4]. The majority are isolated lateral malleolar fractures (50.8%) with bimalleolar (27.4%), trimalleolar (14.2%) and isolated medial malleolar fractures (7.6%) being less common [3]. Reports suggest that a higher age is associated with a lower functional outcome [5].

Outcome after ankle fractures in the elderly is unpredictable because of co-morbidities such as diabetes, skin problems, peripheral vascular disease, cardiovascular disease and osteoporosis [6]. These factors and other elderly-related co-morbidities predispose the elderly to complications [3,7]. The diabetic population is particularly at risk of complications with rates as high as 46% [8], which can be four times higher than in the non-diabetic population [9].

The majority of fractures, whether treated non-operatively or operatively, are treated with a period of non-weight bearing, which is poorly tolerated by the elderly population. A prolonged immobilisation can be detrimental to overall recovery and ability to regain previous level of function [10]. Non-operative treatment has been recommended in patients over 50 years [6,11], but this is associated with a higher rate of mal-union, non-union, lower range of motion and poorer outcomes [6,12–15]. Osteoporotic bone creates a surgical challenge for fixation with unsatisfactory results in 42% of cases with standard fixation. In addition, Anderson et al. report a statistically significant rise in the complication rate in patients over 65 years from 11% to 40% if internal fixation is performed [16]. However comparative studies have shown an improved outcome when compared to non-operative treatment [17,18].

Even when surgical fixation is used, the choice of implant remains controversial. The locking plate is theoretically stronger in osteoporotic bone [12,19] and cadaveric studies have confirmed this in ankle specimens [19–21]. A fibula nail is advantageous as it utilises a smaller incision, requires less soft tissue stripping, and minimises disruption of the biology at the fracture site [22]. The use of a tibio-talar-calcaneal (TTC) intramedullary device can be considered in patients with poor bone stock and/or a poor soft tissue envelope and may provide the greatest advantage in patients who are unable to follow non-weight bearing instructions. The main advantages of this technique are relatively smaller wounds and the ability to immediately weight bear post-operatively [22]. The aim of this systematic review was to assess the use of intramedullary devices in the management of ankle fractures; this included both the intramedullary fibula nail and TTC devices.

2. Methods

We conducted a systematic review of the literature using the online databases Medline and EMBASE. The search terms used for the Medline search are shown in Table 1 and this strategy was

modified for searching the other database. The searches were carried out on the 26th December 2015 and were not limited by year of publication. Only papers available in English were considered for review.

We included only studies assessing ankle fractures that were treated with either an intramedullary fibula nail or TTC implant. Treatment could include additional surgical intervention such as medial malleolus fixation and any post-operative rehabilitation programme was acceptable. Although the aim of the study was to assess elderly or at risk patients, such as diabetics, the decision to include all studies involving adults of all ages was made as the majority of patients in these studies were still likely to be elderly and this would maximise the data available for review. The study must have reported either complications, patient mobility or a functional outcome measure. Studies were excluded if the intramedullary device utilised was an adjunct to plate fixation or where a variety of surgical treatments were included in the study. In addition, only primary research was considered for review with any abstracts, comments, review articles and technique articles excluded. Eligibility of studies was assessed independently by two authors (RJ and DB) and any disagreements resolved by discussion.

The included studies were appraised by three independent reviewers (RJ, DB and AC) with respect to a validated quality assessment scale for clinical studies developed by Rangel et al. [23]. This tool allows identification of the most rigorous evidence by characterising 16 baseline criteria that define thorough and accurate reporting of non-controlled studies. The single eligible randomised controlled trial was assessed with respect to the criteria detailed in the CONSORT statement [24].

2.1. Results

Our search strategy produced 350 studies. After exclusion of duplicates and implementation of inclusion and exclusion criteria 44 studies were included for full paper review and a flow diagram of this process is demonstrated in Fig. 1. Of the 17 studies included; 10 assessed the use of a fibula intramedullary nail and seven analysed a TTC implant. Concise details of these studies are given in Tables 2 and 3 respectively. The reporting criteria met by included studies with respect to the critical appraisal tool proposed by Rangel et al. [23] are presented in Table 4 and the CONSORT statement [24] in Table 5.

2.2. Summary of evidence

2.2.1. Fibula intramedullary nail

Ten studies were identified that assessed the use of an intramedullary fibula nail in ankle fractures [25–34]. A total of

Table 1
Search strategy of Medline.

Number	Search term	Results
1	exp Ankle Injuries/or exp Ankle Fractures/	8389
2	exp Bone Nails/or exp Fracture Fixation, Intramedullary/	13,709
3	1 and 2	207
4	Limit 3 to (English language and humans)	134

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