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Management of tibial non-unions according to a novel treatment algorithm

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ABSTRACT

Tibial non-unions represent a spectrum of conditions that are challenging to treat. The optimal management remains unclear despite the frequency with which these diagnoses are encountered. The aim of this study was to determine the outcome of tibial non-unions managed according to a novel tibial non-union treatment algorithm. One hundred and eighteen consecutive patients with 122 uninfected tibial non-unions were treated according to our proposed tibial non-union treatment algorithm. All patients were followed-up clinically and radiologically for a minimum of six months after external fixator removal. Four patients were excluded because they did not complete the intended treatment process. The final study population consisted of 94 men and 24 women with a mean age of 34 years. Sixty-seven non-unions were stiff hypertrophic, 32 mobile atrophic, 16 mobile oligotrophic and one true pseudoarthrosis. Six non-unions were classified as type B1 defect non-unions. Bony union was achieved after the initial surgery in 113/122 (92.6%) tibias. Nine patients had failure of treatment. Seven persistent non-unions were successfully retreated according to the tibial non-union treatment algorithm. This resulted in final bony union in 120/122 (98.3%) tibias. The proposed tibial non-union treatment algorithm appears to produce high union rates across a diverse group of tibial non-unions. Tibial non-unions however, remain difficult to treat and should be referred to specialist units where advanced reconstructive techniques are practiced on a regular basis.

Introduction

The clinical entity of tibial non-union incorporates a variety of conditions that range from mobile to stiff, hypertrophic to atrophic, with deformity or without and even large segmental bone defects with or without limb length discrepancy [1–3]. The proposed management of these subdivisions are almost as numerous as the variation in non-unions themselves and even within groups the management can be affected by host factors, condition of the surrounding soft tissues and the non-union morphology itself [2,4].

The treatment of tibia non-unions is mostly based on small series of cases that frequently include a variety of non-union subtypes and even infected cases [2,5,6]. Fixation methods vary from internal fixation including conventional compression plating, locked plating, reamed intramedullary nailing to external fixation with either mono-lateral fixators, circular fixators and hybrid fixators [2,5,7,8]. Some authors have proposed cast immobilisation and isolated fibula osteotomy [9]. Adjuvants to surgical management include the use of autogenous bone graft, autologous bone-marrow aspirate, bone morphogenic proteins (BMPs), low intensity ultrasound and hyperbaric oxygen [10–15]. This lack of uniformity in the available literature has rendered the establishment of an evidence-based, reproducible protocol for the management of tibial non-unions difficult, if not impossible.

In this retrospective review we report the results of the management of uninfected tibial non-unions treated according to our proposed tibial non-union treatment algorithm. In addition, we expand on the concept of mechano-biology and its role in the management of tibial non-unions.

Materials and methods

Between January 2010 and December 2014, 122 consecutive adult patients with uninfected tibial non-unions were treated according to our tibial non-union treatment algorithm (Fig. 1). This

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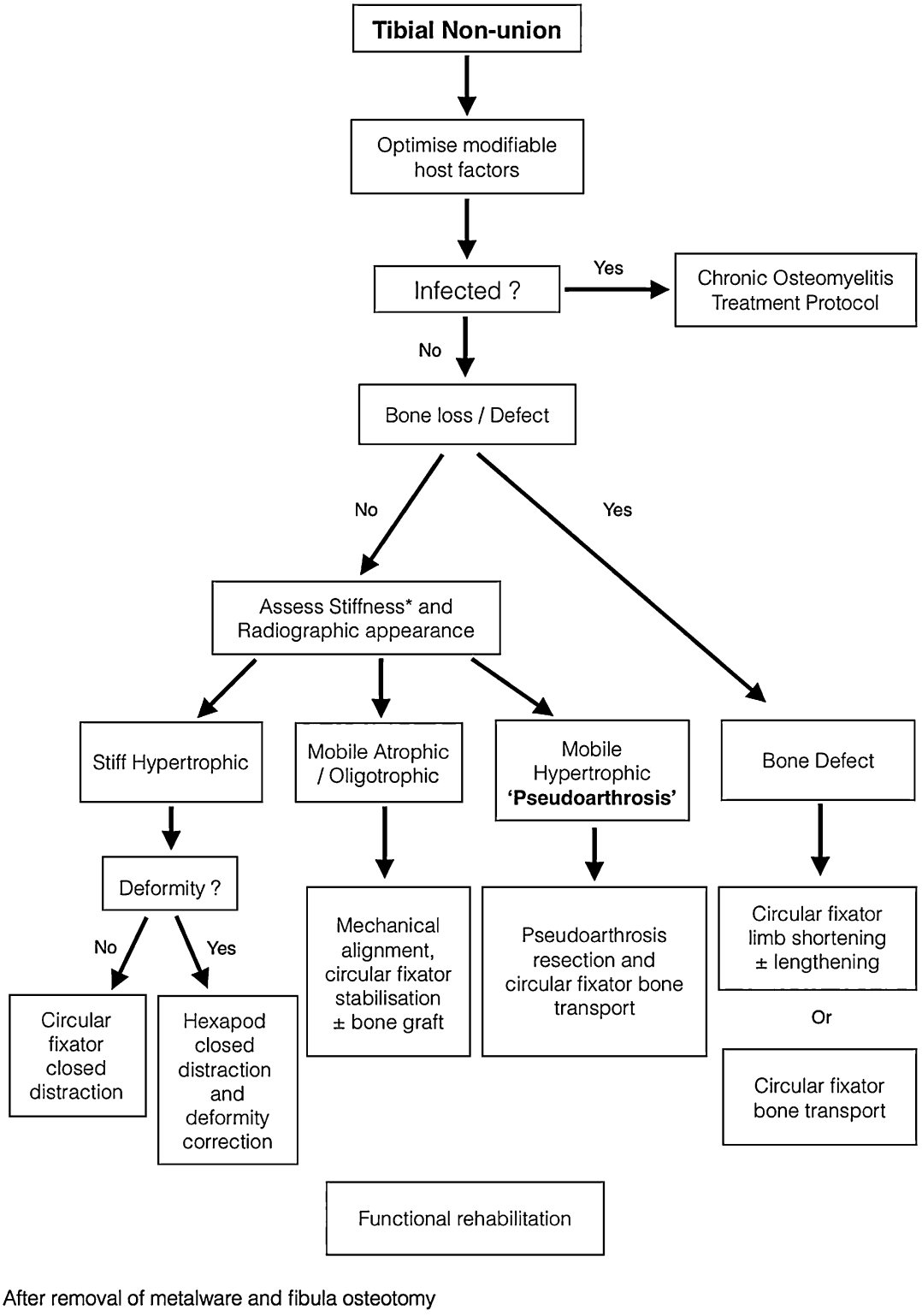

Fig. 1. Tibial non-union treatment algorithm.

treatment strategy represents our current standard of care for tibial non-unions. Four patients were excluded because they did not complete the proposed treatment. These included a 33-year-old male and a 44-year-old female, both who died of systemic complications of chronic disease. Both these patients were HIV positive and developed non-union following open fractures. One patient was unwilling to continue reconstruction after 12 weeks in a circular external fixator and requested amputation. This patient presented to our unit three years after sustaining an open fracture. He was a chronic smoker and his previous treatment included three different external fixators, cast immobilisation, internal fixation and surgery for metal ware removal. The fourth patient was excluded because his treatment was still ongoing at the time of analysis; this patient had a defect non-union and was undergoing bone transport.

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