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Case Report

Achilles tendon rupture in previously treated clubfoot: Is there a correlation? A pediatric case report and a literature review

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ABSTRACT

Backgrounds: Achilles tendon rupture in children is very rare. The cause could be traumatic or non-traumatic such as clubfoot deformity, auto-immune, infectious or genetic diseases with collagen alterations. Regarding clubfoot, only a few case reports of Achilles tendon injury in previously treated feet diagnosed with this deformity are available in the literature. The most accepted treatment for clubfoot is represented by the Ponseti method which includes manipulations, corrective casts and Achilles tendon tenotomy. After surgery, the tendon fibres appear to heal properly.

Case report: We present the case of a 14-year-old girl who was referred to the emergency department for intense right ankle pain aroused while running, which resulted in a ruptured Achilles tendon. She had a history of bilateral clubfoot previously treated in her neonatal age with the Ponseti method including Achilles tendon tenotomy. The actual tendon lesion was treated surgically with an open terminus-terminal tenorrhaphy and immobilisation with a cast. Full recovery occurred after 2 months.

Discussion and conclusions: This study presents a rare case of Achilles tendon injury in previously treated clubfoot. Treatment of clubfoot is necessary to avoid invalidating sequelae. Achilles tenotomy is a widely accepted and effective procedure and studies have shown that tendon quality and muscle strength at week 12 are comparable to those of a normal tendon and the remodelling process continues up to three years later. Further studies are needed to investigate the possible link between clubfoot treatment and the later rupture of the Achilles tendon.

1. Introduction

Achilles tendon rupture at a young age is a rare event. It may be due to direct trauma or traumatic tensile forces leading to fibre injury, or to non-traumatic conditions such as clubfoot deformity, auto-immune, infectious, genetic or neurological diseases leading to collagen alterations [1].

Only four case reports are available in the literature describing an Achilles injury in children with a previous history of clubfoot [2–4], one had blunt trauma [5].

Clubfoot is a congenital complex deformity of the foot whose incidence is between 0.5 and 2 cases per 1000 births [6].

It consists of "CAVE" deformity (Cavus, forefoot Adductus, hindfoot Valgus, Equinus) and it is reported to be bilateral in 50 % of cases [7].

In most cases the specific cause is unknown. When the aetiology appears to be multifactorial and to be due to genetic predisposition, intrauterine mechanical causes and environmental factors, the clubfoot is therefore termed idiopathic. Secondary clubfoot is rarer and can be associated with other abnormalities such as spina bifida, hip dysplasia, systemic conditions such as arthrogryposis, or neuropathy.

Soft tissues in clubfoot are different from those of normal feet as they are fibrotic, less elastic, and retracted. In particular, some studies found that the Achilles tendon, posterior tibial tendon, deltoid ligament, and calcaneus-navicular are thickened and shortened [8].

If not corrected, clubfoot can result in pain, reduced range of motion, stiffness and tendon retractions that can lead to altered gait, problems wearing footwear, discomfort, limitation in sports activities, reduced quality of life and early arthrosis.

The most accepted treatment is the Ponseti technique. It consists of a corrective phase of foot manipulations followed by the application of serial long leg casts, which should be renewed every week [9,10].

The aim is to gradually stretch the capsular ligamentous structures,

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beginning with correction of the cavus, until an abduction of 60° is achieved. The orthopedist should use the head of the talus as a pivot in the manoeuvres, taking care not to touch the calcaneus and not to over-abduct. Manipulation is then followed by the application of a cast with the knee flexed 90° maintaining the correct position.

Achilles tenotomy is often proposed (80–85 % of cases in the literature) if abduction achieved is at least 60° and if dorsiflexion is less than 15–20° [11]. Much has been written about the different methods that can be used: percutaneous, mini open, with scalpel or needle [12–14], under ultrasound guidance [15], under local anesthesia [16] or under general anesthesia [17]. All appear to be safe and effective methods.

Even, according to some authors, tenotomy can be performed at the initial stage of treatment, as it decreases pressure across the tibio-tarsal and subtalar joints and facilitates correction [18].

After tenotomy, the healing process starts. The initial gap-filling tissue is ultrasound visible from the second or third postoperative week [19,20].

This occurs through an extrinsic process that involves first the formation of a haematoma, then its organisation and then the appearance of fibroblasts that give rise to a fibrous tissue receiving a high vascular supply. There exists also an intrinsic process, which includes a biochemical signal cascade, whose purpose is to promote the rearrangement of fibres [21,22]. Around the sixth week, a connective tissue of fusiform aspect is visible [23,24].

Thereafter, the maturation of the connective tissue continues, leading to the formation of linearly oriented fibres, comparable to a normal tendon, around the twelfth postoperative week [25,26]. Tendon remodelling appears to continue until two to three years postoperatively [27]. Calf muscle strength at four years post-operatively was found to be normal in Aroojis' study [28].

The literature debates whether there is a relationship between the ankle's range of motion and Achilles tendon rupture. Some authors state that reduced dorsiflexion can increase the tensile forces to which the tendon is subjected during load, as it limits the anterior translation of the tibia on the foot which would be compensated by pronation, resulting in altered forces on the tendon [29,30]. Furthermore, reduced ankle excursion could predispose to mechanical alterations during jumps and landings, increasing the risk of injury [31,32]. According to other authors, there would be no significant differences between normal, reduced, and increased dorsiflexion [33]. Usgu suggests that ankle hypermobility may lead to altered functioning of the hip adductors in internal rotation, putting tension on the iliotibial band and the Achilles tendon. In our clinical case, the patient did not report altered dorsiflexion before the Achilles tendon rupture [34].

2. Case report

We report the case of a 14-year-old girl admitted to our Paediatric Emergency Department for a traumatic injury of the right ankle that occurred during a football match. In detail, she felt acute pain when she started to run. No traumas were reported. On clinical examination, she was not able to walk and weight weight-bearing. There was moderate swelling of the right ankle without skin lesion. The range of movement of the ankle was reduced. The anatomical profile of the Achilles tendon was interrupted with a palpable discontinuity and a positive Thompson sign. The patient had a previous history of bilateral clubfoot treated with Ponseti casting and percutaneous Achilles tenotomy surgery at the age of 8 months. No sequelae or functional limitations of the ankle and the foot were reported after the operation. The patient didn't have other known pathologies. The clinical suspicion was a ruptured Achilles tendon and the diagnosis was confirmed by an ultrasound examination of the calf (Fig. 1).

Surgery was performed three days after the trauma. Preoperative intravenous antibiotic prophylaxis with cefazolin was administered. The patient was placed in a prone position under general anesthesia. An antiseptic washing of the leg was done and the sterile field settled. A

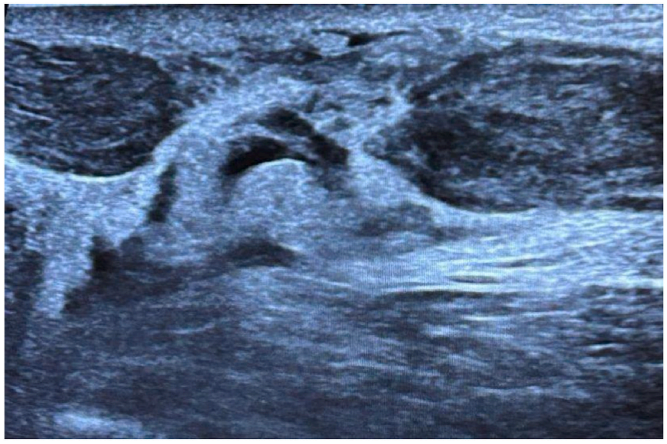

Fig. 1. Ultrasound image of Achilles tendon rupture.

lateral para-Achilles skin incision of about 7 cm was performed on the right ankle. The soft tissues were dissected. The Achilles tendon appeared completely disrupted with frayed margins and the proximal part cranially rose of about 2,5 cm (Fig. 2).

The tendon was well exposed and its margins regularised. A terminus-terminal tenorrhaphy with reinforcement of the tendon cord and a suture of the aponeurosis was done. Additionally, a biopsy of tendon tissue was performed. Ankle flexion-extension dynamic tests were carried out to assess the proper tightness of the tendon. A knee-high plaster cast was applied in order to maintain the correct position and promote tendon healing (Fig. 3).

The patient had a good post-operative course and she was discharged two days after surgery.

The result of the anatomopathological examination reported haemorrhagic extravasation with fibrin-leukocytic material, granulocytes, neutrophils and vascular reactive proliferation. The patient underwent outpatient clinical controls. After one month the wound was completely healed and the plaster cast was removed. Subsequently, a progressive

Fig. 2. Intraoperative view of the Achilles tendon.

Fig. 3. Suture of Achilles tendon.

weight bearing was allowed, to regain the correct walking pattern. No vascular and nervous peripheric deficits were reported. Two months after surgery the patient properly recovered the correct gait pattern and a full range of movement of the ankle, showing no residual pain and claudication.

3. Discussion

Achilles tendon lesion in the paediatric age is rare, and it is usually found in active adults.

The association between paediatric Achilles tendon lesion and previously treated clubfoot is even rarer, so our case holds particular interest.

To our knowledge, only a few reports of paediatric Achilles tendon injuries in clubfoot patients are available in the literature: Aretakis reported the case of an adolescent with previous treated clubfeet and with a left Achilles tendon lesion at the age of 16 years old and a contralateral lesion two years later [29]; Chen described the case of a 13-year-old girl with tendon lesion and history of clubfoot surgery [3]; Egger showed the case of f a 15-year-old girl treated by Ponseti casting and Achilles tenotomies who had an acute Achilles tendon rupture on the left and tendinosis on the right [4].

Regarding clubfoot treatment, the Ponseti method is widely accepted.

Many studies have shown that the tendon section has no late effects in terms of weakening or ruptures, making Achilles tenotomy appear a safe and effective procedure.

As revealed by the scientific literature, tendon healing and gap filling seems to appear about 2–3 weeks after surgery. The achievement of new tissue with orderly oriented fibres occurs at week 12 and the remodelling process continues for some years. Complete section of the Achilles tendon did not result in triceps surae weakness as shown by Goksan et al. [35].

For the sake of completeness, we report here the evidence of five paediatric cases of tendon lesions due to traumatic events or infections, without a previous history of clubfoot, were found in the scientific literature [2,3,32–34].

Furthermore, in adulthood, Pedrotti et al. reported two cases of atraumatic Achilles tendon injury and subcutaneous rupture in patients treated with a corrective postero-medial release surgery at the age of 1 year old [36].

In the clinical case we presented, the patient did not complain of any ankle range of motion alterations before the Achilles tendon injury. We should consider that the Achilles tendon tenotomy the girl underwent for the equinus of clubfoot, promoted an increase in ankle dorsiflexion, as stated by Ozyalvac [11].

This study allows us to wonder about the rarity of the Achilles tendon lesion in pediatric age and makes us raise the question of the possible influence of precedent clubfoot treatment on tendon fibre quality.

4. Conclusions

The importance of this study lies in the rarity of the association between Achilles tendon injury in children and previous clubfoot treatment. Actually this is only the fourth study on the subject available in the literature. We can state that Achilles tendon tenotomy is a useful intervention in selected cases and must be properly proposed and executed.

It is important to adequately inform parents about the possible short- and long-term risks, including the rarer outcomes. Further studies are needed to investigate the possible existence of a link between the treatment of clubfoot and the subsequent rupture of the Achilles tendon.

In particular, imaging and histological evaluations are necessary to understand the biological and mechanical properties of the regenerated tendon.

Ethical statement

Considering the retrospective nature of the analysis, the current study did not require the approval of the local ethics committee according to current legislation, but a notification was sent to the ethics committee of the authors affiliated institution (n. 3381/2024, approved April 17, 2024). The study was conducted by the Declaration of Helsinki. The informed consent was obtained by the parent of the patient.

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Declaration of competing interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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