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Nail changes in casted and braced clubfoot: A preliminary study

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ABSTRACT

Background: The study aimed at finding whether there are any nail changes specific to treatment in clubfoot.
Methods: Sixty new, 26 undergoing serial corrective casting, and 247 clubfoot patients using foot abduction braces were prospectively studied. The casted and braced group formed the basis of the study to observe nail changes, if any. The new patients and opposite normal foot (in unilateral casted cases) were taken as controls.
Observations: Acute paronychia, ingrown toe nail, onychoshizia, onychorrhexis, nail plate concavity, latent onychomadesis, and distal onycholysis were observed in feet undergoing corrective casting and bracing. Micronychia, malalignment and thinning of nail plate were the observed congenital nail anomalies.
Conclusions: Nail changes in clubfeet are not infrequent. Certain nail changes might be etiologically linked to casting and bracing. Some of nail changes might require urgent medical care.

1. Introduction

Ponseti casting method has revolutionized the management of both idiopathic and syndromic clubfoot. In its weekly cast change protocol, the foot is manipulated and casted till foot is ready for tenotomy [1]. The typical bracing protocol involves using the foot abduction brace during nap and night time after an initial full time use for 2–3 months till 3–4 years of age [1]. The number of casts required for correction varies depending upon several factors including Pirani score and age [2]. Dyer and Davis reported that for a foot with Pirani score of 4 or more, the number of casts is at least 4 [3]. With older children, the number of casts required probably shows a trend to increase. In the series by Khan and Kumar, in children with mean age 8.9 years, the average number of casts was 12.1 [4]. Clearly, the clubfoot is exposed to several weeks of casting and many years of bracing. Although some congenital nail changes associated with syndromic type of clubfoot are known [5,6] (e.g., nail patella syndrome), parents often present with worries over additional nail altercation noticed during casting and bracing period. This study aimed at finding whether there are any nail changes specific to treatment (casting or bracing) of idiopathic clubfoot. If yes, what were these nail changes?

2. Materials and methods

This study included 333 patients of idiopathic clubfoot presenting to CURE clubfoot clinic at our tertiary health care pediatric institute during 3 months (July and September, 2014). Parents/guardian approval was obtained prior to enrolling child in the study. Among these, 60 were new patients (unilateral 22; bilateral 38), 26 were already enrolled and undergoing serial corrective casting/post tenotomy casts (unilateral 08; bilateral 18), and 247 were using foot abduction braces (FAB) (unilateral 103; bilateral 144) and reported for follow-up. Syndromic and neurological clubfeet were excluded from the study. The casted ($n = 26$ patients) and patients using brace ($n = 247$, both feet included) formed the study group to observe nail changes, if any (total 538 feet). Ponseti corrective casts were applied by either of two trained orthopedics surgeons (AK, AS). FAB braces used were of Steenbeek type. The new patients ($n = 60$, unintervened) and opposite uncasted normal foot (unilateral casted group; $n = 08$) were taken as controls (total 106 feet). All these patients were screened for obvious/reported nail changes in the foot/feet and

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confirmation of a definitive nail condition was established in consultation with a pediatric dermatologist.

3. Observations

Significant nail changes were observed in total 43 feet (31 patients) (Table 1). Nail conditions observed were namely malalignment (the longitudinal axis of the nail is laterally deviated), micronychia (small nails), onychoschizia (distal peeling and lamellar separation of layers of nail plate at free edge), thinning of nail plate, onychorrhexis (longitudinal ridges and splits in nail), concavity of nail surface, paronychia (inflammation and/or infection of nail folds), ingrown toe nail or onychocryptosis (a condition where nail plate embeds, to varying degrees, into the periungual tissue), latent onychomadesis (shedding of nails), and distal onycholysis (separation of nail plate from underlying nail bed) [7–9].

The overall nail changes were not infrequent as they were observed in about 9% (31/333) patients with clubfeet. The number of feet affected by nail changes was about 6.7% (43/644). Nail changes were present in 8 new clubfeet, 20 casted clubfeet and 8 affected clubfeet in brace, and 7 normal feet in brace. Micronychia, malalignment, and thinning of nail plate were congenital nail anomalies as they were present in all groups, including unintervened, casted and braced clubfeet (Fig. 1).

Average number of casts was 6.61(range, 3–12) including post tenotomy cast. In casted clubfeet, acquired nail changes, such as onychoshizia, paronychia, ingrown toe nails, onychomadesis and onycholysis were observed (Figs. 2–4). Overall acquired changes were seen more commonly in the casted group of patients. Among the observed acquired changes; ingrown toe nail, distal onycholysis and latent onychomadesis were exclusively found only in casted feet. Acute paronychia and onychoschizia also predominantly occurred in the casted feet. In braced group, both affected and normal feet showed affection. Onychoshizia was seen in four feet and onychorrhexis, nail concavity, and paronychia was observed in one case each in contralateral normal feet being kept under brace. In affected clubfoot under brace, onychoshizia was the most common observed nail change. None of new enrolled patients or uncasted normal feet had these acquired nail changes.

4. Discussion

Clubfoot is considered the most common congenital orthopedic disease and though several pathological associations [5,6] has been described, any association with nail changes specific to treatment modalities has been scantly studied so far. Our study was conducted at northern Indian state run center located in subtropical region (28.61̊ N latitude) with humid to semiarid weather conditions. Patients belonged to varied economical strata. Among the patients significant nail changes were seen in 43 feet (including 7 normal braced feet) out of total 644 observed feet (combined study and control group).

Recent advances have identified that a proper epithelial–mesenchymal interaction at different developmental stages is crucial for normal development of epidermal appendages, such as nail and hair. Therefore, it is not surprising that there are many alterations of nail shape that are linked with distant or underlying malformations of bone [10,11]. Nail changes like anonychia and hypoplasia of nails have been known for syndromic associations

Table 1
Nail changes observed in all categories (new/casted/bracing group).

Sl. No.	Nail altercations*,#*$	New unintervened clubfoot (98 feet)	Casted clubfoot (44 feet)	Braced clubfoot (391 feet)	Normal foot in brace (103 feet)
1	**Malalignment** (0.47%)	1 (1)^	0	2 (0.5)	0
2	**Micronychia** (2.64%)	7 (7.14)	9 (20.45)	1 (0.25)	0
3	**Onychoschizia** (2.64%)	0	8 (18.18)	5 (1.25)	4 (3.88)
4	**Thinning of nail plate** (1.09%)	1 (1)	5 (11.36)	1 (0.25)	0
5	**Onychorrhexis** (0.3%)	0	0	1 (0.25)	1 (0.97)
6	**Concavity** (0.3%)	0	0	1 (0.25)	1 (0.97)
7	**Acute paronychia** (0.62%)	0	3 (6.81)	0	1 (0.97)
8	**Ingrown toe nail** (0.47%)	0	3 (6.81)	0	0
10	**Latent onychomadesis** (0.16%)	0	1 (2.27)	0	0
11	**Distal onycholysis** (0.16%)	0	1 (2.27)	0	0

* Not mutually exclusive groups e.g., acute paronychia and ingrown toe nails found in same foot.
\# Percentage calculated per 644 observed feet.
^ Percentages in brackets besides actual number.
$ For description of terms please see text.

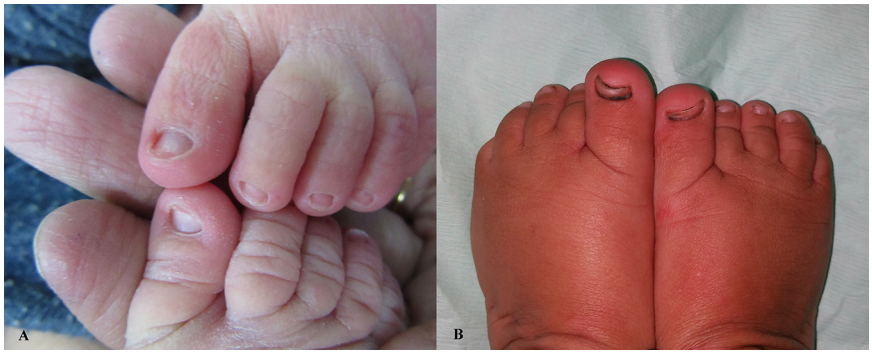

Fig. 1. Congenital nail associations. (A) Micronychia in both great toes of a neonate with bilateral unintervened clubfoot, (B) Congenital bilateral great toenail mal-alignment seen in an infant with bilateral clubfoot using braces.

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