

Review

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The infant with a clubfoot and amniotic bands: a comprehensive understanding and the role of the Ponseti method

El bebé con pie equino varo y bandas amnióticas: una comprensión integral y el papel del método Ponseti

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ABSTRACT. Amniotic band syndrome (ABS) and clubfoot are distinct congenital musculoskeletal conditions that can occasionally co-occur, creating unique challenges in their management. This paper summarizes the comprehensive discussion on the management of amniotic band syndrome (ABS) and clubfoot, emphasizing the critical role of the Ponseti method and the challenges faced in treatment, thereby providing a basis for further research and improved patient care.

Keywords: clubfoot, amniotic band syndrome, Ponseti method, deformity, children.

RESUMEN. El síndrome de banda amniótica (ABS) y el pie zambo son afecciones musculoesqueléticas congénitas distintas que ocasionalmente pueden coexistir, creando desafíos únicos en su manejo. Este artículo resume la discusión exhaustiva sobre el tratamiento del síndrome de bandas amnióticas (ABS) y el pie zambo, enfatizando el papel fundamental del método Ponseti y los desafíos que enfrenta el tratamiento, proporcionando así una base para futuras investigaciones y una mejor atención al paciente.

Palabras clave: pie equino varo, síndrome de bandas amnióticas, método de Ponseti, deformidad, niños.

Introduction

Amniotic band syndrome (ABS) is a rare condition that occurs during fetal development. This syndrome is recognized by various names, including amniotic disruption sequence, amniotic deformity and mutations complex, annular defects, Simonart's band, congenital ring-constriction, limb-body wall malformation complex, early amnion rupture sequence, intrauterine or fetal amputation, constriction band syndrome, and Streeter's dysplasia.¹ ABS is believed to result from the separation

of the amnion from the chorion. This separation can lead to the formation of fibrous bands that float in the amniotic fluid.² These bands can entangle parts of the fetus, particularly the limbs, fingers, or toes, potentially causing various congenital anomalies. The severity of ABS can vary significantly, ranging from mild to severe, and the effects can be minimal or extremely impactful, depending on the area of the body affected.

Amniotic band syndrome can cause a wide array of structural abnormalities, including constriction rings, deformities, and, in more severe cases, amputations or

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adhesions of limbs or digits. Amniotic bands can affect any part of the body but most commonly affect the extremities, with a predilection for the distal segments. The condition can present as a single occurrence or as part of a collection

of other congenital anomalies. Clubfoot is one of the most common congenital orthopedic anomalies, occurring in about 1-2 per 1,000 live births.³ The exact cause of clubfoot is not entirely understood, but it's believed to result from

Table 1: Data from studies evaluating patients with clubfeet associated with amniotic bands.

Author	Journal (year)	Patients (feet)	Casts	Initial correction %	Relapses %	Final outcome
Ozkan et al ⁷	Cases J (2009)	2 (2)	NR	100.0	0.0	100% satisfactory
Zionts & Habel ⁸	J Pediatr Orthop (2013)	5 (6)	6 (4-8)	100.0	83.0	100% satisfactory
Agarwal et al ⁹	Foot Ankle Spec (2015)	3 (3)	13	100.0	33.0	Not reported
Carpiaux et al ¹⁰	J Pediatr Orthop (2016)	12 (21)	6 (3-11)	95.2	33.0	95.2% supple plantigrade feet
Esparza et al ¹¹	J Pediatr Orthop (2021)	32 (43)	4.2	93.0	62.8	41.9% good, 34.9% fair, 23.3% poor

NR = not reported.



Figure 1:

Clinical case: **A)** a female newborn at three weeks of age presenting with multiple congenital anomalies: left clubfoot with normal neurological function, an incomplete ring formation above the ankle, intrauterine amputation of the first toe on the left foot, and syndactyly of digits 2-3 and 4-5 on the left foot, along with polysyndactyly in both hands. **B)** The patient underwent a series of four Ponseti casts and percutaneous tenotomy, followed by full-time bracing for the first three months, and part-time bracing until reaching five years of age. **C)** At three years of age, the patient's foot displayed a plantigrade and supple appearance. **D)** By nine years of age, the patient remained asymptomatic and could comfortably wear any type of shoes.



Figure 2:

One-stage circumferential limb amniotic band release.

a combination of genetic and environmental factors. The resultant oligohydramnios from fetal membrane disruption in ABS is often linked to the development of concurrent clubfoot, with reported co-occurrence rates as high as 56%.^{4,5}

Evaluation

The evaluation of patients with amniotic bands and clubfoot requires a thorough assessment encompassing various aspects. This assessment involves identifying the location of the amniotic band, evaluating vascular status, checking for neurological deficits, examining associated foot conditions (such as acrosyndactyly, partial or complete toe amputations, and lymphedema), assessing foot stiffness, and determining leg length discrepancy.

Treatment

The treatment strategy for these subset of patients has followed a path similar to idiopathic clubfeet shifting from historical approaches involving casting and extensive releases⁶ to a more contemporary method. This modern approach incorporates gentle manipulations and serial casting using the Ponseti method,³ with surgery reserved for addressing any remaining deformities or muscle imbalances. Series from different centers have reported satisfactory outcomes with the Ponseti method (*Table 1*), highlighting a high initial correction rate. However, management challenges often involve casting issues, brace fitting complexities, and a notably high rate of recurrence.

Insights from experience and literature

Based on practical experience and extensive literature review, we identified some key insights that pertain to our current understanding of employing the Ponseti method for ABS clubfeet.

1. Safe application of Ponseti manipulation and casting before ABS release is feasible in cases without compromised

vascularization or severe lymphedema. If there are signs of functional disorder, urgent surgical band release is necessary and clubfoot correction must be postponed (*Figures 1 and 2*).

2. Typically, these feet are rigid and frequently demand a higher number of casts to attain an adequate correction. Persistence and patience are crucial to achieving the best possible correction. Stay committed as long as progress is being made; perseverance is key.
3. The presence of an ipsilateral band does not significantly impact the success rate of the Ponseti method.^{10,11}
4. Effectiveness of the Ponseti method extends even to cases with neurological deficits secondary to an ipsilateral band.¹¹
5. Achieving comfortable and effective brace fitting poses challenges, especially in patients with additional anatomical complexities. Innovative solutions, such as unilateral braces or custom-made options, might be necessary.
6. Some patients, whether previously treated or not, may not achieve complete correction with Ponseti manipulation and casting, requiring tailored «a la carte» procedures. It's advisable to steer clear of extensive releases that could potentially result in stiffness, weakness, and reduced functionality.
7. Patients with ABS and clubfoot are at an increased risk of deformity recurrence.^{8,11} An effective communication and vigilant care are pivotal in managing expectations and maintaining ongoing treatment.

Conclusion

In conclusion, ABS and clubfoot are distinct musculoskeletal conditions that occasionally concur, leading to unique management challenges. Employing an early intervention approach with the Ponseti method, remains a cornerstone in enhancing outcomes and improving the quality of life for affected children. While the Ponseti method shows effectiveness, proactive awareness about potential relapses and a multidisciplinary approach are crucial in ensuring comprehensive and sustained care.

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