

Advanced Management of Distal Lower Extremity Congenital Constriction Bands for Foot Salvage

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Summary: Constriction ring syndrome is a rare congenital condition characterized by the formation of fibrous amniotic bands, which can result in limb or digit deformation, malformation, or autoamputation. Surgical intervention is necessary for patients with progressive or severe forms of constriction banding, but the timing and operative approach vary widely. Here, the authors present a case report detailing the successful removal of multiple congenital constriction bands (CBs), uniquely affecting the distal ankle and foot in an infant meeting Patterson type-2 criteria. This type is characterized by CBs resulting in distal deformation with or without swelling. In this case, urgent intervention was prompted by concerns of vascular compromise, and amputation was considered due to the severity of the banding. However, the authors advocated for a staged approach, with the aim of preserving the patient's limb. A series of three separate procedures tailored to the patient's banding pattern and subsequent tissue complications were required to achieve restoration of ankle and foot functions, as well as satisfactory cosmesis. This case report underscores the importance of a customized surgical approach in addressing complex CBs and emphasizes the need for proactive consideration of salvage interventions by surgeons. (*Plast Reconstr Surg Glob Open* 2024; 12:e6181; doi: 10.1097/GOX.00000000000006181; Published online 18 September 2024.)

Constriction ring syndrome (CRS) is a rare condition characterized by fibrous amniotic bands that ensnare the developing fetus, leading to deformations, malformations, compromised vascularity, and, in some instances, distal amputations of extremities.¹ Despite its clinical impact, the etiology of CRS remains incompletely understood, likely stemming from a multifactorial origin.² The reported incidence of CRS ranges from one in 1,200 to one in 15,000 live births.³

This case report presents an infant born with complex CRS affecting the distal ankle and dorsum of the foot. Existing literature addresses the removal of simple constriction banding.⁴⁻⁶ The unique anatomical presentation of the bands necessitated discussion of custom surgical management. Despite recommendations for amputation, limb salvage was pursued. The outcomes demonstrated restoration of motor and sensory function and good aesthetic appearance of the foot. The presumed preservation

of the patient's quality of life highlights the significance of timely and effective management of this congenital condition.⁷

CASE REPORT

Patient History

A female infant was delivered by cesarean section at 37 weeks, 5 days due to breech presentation. The mother was a 26-year-old gravida 1, para 0 whose pregnancy was complicated by gestational diabetes and hypertension. A prenatal ultrasound revealed the presence of a right foot mass. Postdelivery, the newborn was transferred to our neonatal intensive care facility due to concerns about CRS in the distal limb but was otherwise healthy.

Examination revealed soft tissue swelling of the right ankle and foot, with concern for vascular compromise and lymphatic obstruction. There were two amniotic constriction bands (CBs) at the ankle and a CB at the dorsum of the foot. A fluid-filled mass obliterated normal foot anatomy (Fig. 1). The foot was warm with normal capillary refill, but the mass displayed a gray-bluish discoloration. The patient's neuromotor function was intact. With

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Fig. 1. Initial presentation on day 1 of life demonstrating a large, multilobulated mass on the dorsum of the foot with two amniotic constrictions bands located more proximally at the ankle.

these findings, the patient met criteria for Patterson type-2 constriction rings.⁸ X-ray demonstrated normal bony anatomy, whereas the magnetic resonance imaging revealed areas of restricted venous flow, edema, and potential cystic changes and ischemia surrounding the great toe and ankle. Venous duplex showed no thrombosis but prominent varices over the foot dorsum.

Surgical options, including limb salvage versus amputation, were discussed among the team, including pediatric orthopedic surgery and the patient's parents. Reconstruction was pursued to preserve function and quality of life.

Surgical Intervention

The patient underwent three procedures. The initial procedure, at 3 days old, released two full-thickness CBs at the ankle, extending from skin down to the muscle fascia, with tissue removal between the first and second proximal CBs for decompression of the distal ankle. After local anesthetic administration, circumferential incisions were made around the CBs at the ankle, aiding drainage of lymphoserosus fluid and decompression of the anterior and posterior compartments of the right leg. The incision was closed with 5-0 Monocryl for the deep tissue and 5-0 plain gut for the skin. This resulted in improved foot perfusion, which was confirmed by Doppler postoperatively (Fig. 2).

Initially, the plan was to allow for 6–8 weeks of healing before addressing the foot CB. However, symptoms of vascular and lymphatic compromise appeared 6 weeks after the first surgery, necessitating intervention. (See figure, Supplemental Digital Content 1, which shows 6 weeks after the first procedure, the patient returned with significant swelling and congestion, requiring immediate intervention to decompress the foot. <http://links.lww.com/PRSGO/D517>.) Excision of the CB overlying the foot was performed and serial Z-plasties involving adipocutaneous flaps for adjacent tissue transfer were used. Closure required 4-0 Monocryl for the deep dermis and 5-0 plain



Fig. 2. Intraoperative view demonstrating effective decompression of the distal ankle after removal of two full-thickness CBs.



Fig. 3. Six weeks postoperative visit after the second decompression surgery where the constriction band overlying the dorsum of the foot was successfully removed.

gut for the skin. Lymphoserosus decompression of the foot was noted with good distal perfusion of the toes immediately and at the 6-week follow-up (Fig. 3). Compression therapy was administered for 1 year post second surgery to aid decompression and tissue remodeling. (See figure, Supplemental Digital Content 2, which shows the results after completion of 1 year of skin compression therapy. Notably, excess skin remained. <http://links.lww.com/PRSGO/D518>.)

After 14 months, the patient had normal motor and sensory functions of the foot, but the excess skin inhibited footwear and required a final operation. This involved excision of adipocutaneous tissue and closure with a rotation advancement flap, using 5-0 Monocryl for the deep dermis and 5-0 Chromic for the skin. This improved foot contour, allowing for footwear (Fig. 4).

Outcomes

Return of range of motion at the ankle and foot improved throughout follow-up visits (6 weeks, 16 months, and 23 months). At 6-week postsurgery, plantarflexion



Fig. 4. Two months postoperative after the third and final procedure during which excessive skin was resected.

and dorsiflexion were observed with satisfactory capillary refill. The third surgery, performed 14 months after the second operation, addressed excess skin. Normal foot movements were observed at 2 months postoperative. At the final follow-up, 23 months after the first procedure, full range of motion, adequate perfusion, and satisfactory foot contour were observed.

DISCUSSION

This case report demonstrates the removal of multiple congenital constriction ring bands affecting the distal ankle and foot through a series of procedures. Delaying intervention until 6–12 weeks is typically advocated, but this patient presented with an active, unstable form of constriction banding.⁹ Given the progressive swelling, concerns arose regarding vascular compromise. Amputation was considered as an option due to the complex nature of the bands and concern for future function. However, surgical planning and a multidisciplinary approach resulted in salvage of the patient's foot.

Three separate procedures were tailored to meet the requirements of this patient. The initial procedure involved the circumferential release of both CBs of the ankle, removal of the nonviable tissue between them, fluid decompression, and direct straight-line closure using circumferential fasciocutaneous flaps. Serial Z-plasties were unable to be performed due to inadequate tissue after resection. This methodology aligns with previous literature.^{1,5} The subsequent procedure targeting the distal band followed a similar initial step of CB excision. However, closure was done with serial Z-plasties¹⁰ and adjacent tissue transfer employing adipocutaneous flaps,

a technique akin to the approach advocated by Mutaf and Sunay.⁶ Both techniques, ours and theirs, shared the common objective of achieving secure closure, minimizing dead space, and preventing an hourglass deformity. The final surgery removed excess skin and soft tissue, allowing the patient to wear shoes.

CONCLUSIONS

This case report suggests that adopting a personalized strategy for removing complex CB could help optimize outcomes. Surgeons are recommended to consider salvage interventions and commit to multiple procedures, potentially preserving the patient's overall quality of life.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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