Application of botulinum toxin in the repair of a complex ventral hernia

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ABSTRACT

Introduction. Preoperative application of botulinum toxin type A has demonstrated to be safe and effective in the closure of complex ventral hernias in adults. However, its use in pediatrics has been little documented.

Clinical case. We present the case of a 22-month-old girl with a complex abdominal wall ventral hernia secondary to multiple neonatal laparotomies. In a first procedure, botulinum toxin was administered using an intramuscular approach at six sites of the muscle layers surrounding the defect, under general anesthesia and ultrasound control. 4 weeks later, an open hernia repair was conducted, without complications.

Discussion. Botulinum toxin at low doses could facilitate the surgical treatment of complex ventral incisional hernias in children. Even though it is important to adjust dosage and anatomical reference points according to hernia type and patient age and weight, further studies are required to optimize these variables.

KEY WORDS: Ventral hernia; Incisional hernia; Botulinum toxin type A.

APLICACIÓN DE TOXINA BOTULÍNICA EN LA REPARACIÓN DE UNA HERNIA VENTRAL COMPLEJA

RESUMEN

Introducción. La aplicación preoperatoria de toxina botulínica A ha demostrado ser segura y efectiva en el cierre de hernias ventrales complejas en adultos. Sin embargo, se ha documentado poco su uso en pediatría.

Caso clínico. Se presenta el caso de una niña de 22 meses con una hernia de pared abdominal ventral compleja secundaria a múltiples laparotomías neonatales. En una primera intervención se administró por vía intramuscular toxina botulínica en seis puntos de las capas musculares alrededor del defecto bajo anestesia general y control ecográfico. Cuatro semanas después, se realizó una reparación abierta de la hernia, sin complicaciones.

Comentarios. La toxina botulínica a dosis bajas podría facilitar el tratamiento quirúrgico de hernias incisionales ventrales complejas en niños. Es importante ajustar la dosis y los puntos de referencia anatómicos según el tipo de hernia, la edad y el peso del paciente, aunque se requieren más estudios para optimizar estas variables.

PALABRAS CLAVE: Hernia ventral; Hernia incisional; Toxina botulínica A.

INTRODUCTION

Complex incisional hernias are difficult to repair as a result of location, defect size, hernia sac dimensions, or associated local processes. They prove especially challenging in children, where they are rare, and sometimes, the most common closure techniques –such as direct closure or component separation, which are associated with greater complications and recurrence rates– do not suffice[1,2].

Botulinum toxin type A is used as a blocker of acetylcholine release in the motor endplate, thus preventing muscle contraction. Its use to facilitate abdominal wall closure has been widely described in adult patients[2-4]. There is evidence regarding safety in children, and it is widely used in other areas such as certain voiding disorders, spasticity, or strabismus[5,6].

There are very few publications available regarding the use of botulinum toxin in the closure of the abdominal wall in children. Its use has been described in neonates with giant omphaloceles both as a single treatment and in combination with progressive pneumoperitoneum techniques, but not in ventral hernias[7,8].

Our objective was to demonstrate our experience in the treatment of a complex ventral incisional hernia in a 22-month-old patient where the injection of botulinum toxin in the abdominal wall muscles was used to facilitate surgical closure.

DOI: 10.54847/cp.2024.03.16

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This work was accepted as a poster at the 61st Congress of the Spanish Pediatric Surgery Society held in Tenerife (Spain) in May 2024.

Date of submission: April 2024 *Date of acceptance:* June 2024

CLINICAL CASE

We present the case of a 22-month-old, 8kg girl with a history of extreme prematurity (gestational age: 24+1 weeks; weight at birth: 542 g) and idiopathic intestinal perforation at 48 hours of age requiring diverting ileostomy, which was reconstructed at 3 months of age. During outpatient follow-up, a complex ventral hernia was observed as a complication of abdominal wall closure.

On physical exploration, a soft tumor was observed in the right iliac fossa, with an underlying 3.5cm diameter wall defect and an 8x4 cm subcutaneous extension of the exteriorized loops (Fig. 1) as identified by ultrasonography. Intramuscular administration of botulinum toxin was decided upon to facilitate the repair and closure of the important abdominal wall defect.

Under general anesthesia, the patient was placed in a supine position. A high-resolution ultrasound device was used to identify the external, internal, and transverse oblique abdominal muscles, and puncture sites were established on both flanks on the sides of the aponeurotic defect. A vial with 50 IU of botulinum toxin (Botox Allergan®) was diluted in 6 ml of saline solution, and 1 ml was injected in each muscle using a 50 mm, 20 G echogenic needle, which equals to a 6.25 IU/kg dose (Fig. 2). The patient was discharged once she had recovered from anesthesia on the same day, with oral analgesia.

The patient came back to hospital 28 days later, as scheduled, to undergo the surgical closure of the ventral hernia. Cefazolin was used as an antibiotic prophylaxis. Under general anesthesia, the patient was placed in a supine position, and in aseptic conditions, the hernia and the incision limits were marked. A transverse incision was carried out on the previous scar. The bowel was reduced to the abdominal cavity, and the strong adhesions of the intestinal loops to the borders of the ventral hernia were freed. A 6 cm double aponeurotic defect –separated by a fibrous bridge, which was divided– was observed. The muscle layers of the abdominal wall were dissected, and a two-layer closure – transverse and internal oblique muscle aponeurosis, and external oblique muscle aponeurosis – was carried out using a 2/0 absorbable suture, which was left without tension. Subsequently, a preaponeurotic acellular absorbable mesh (EGIS Acellular Dermal Matrix®) was placed, with a 2cm margin with respect to the defect, and it was sutured to the fascia itself using the same suture (Fig. 3). The closure was completed in a layered manner using intradermal suture on the skin. The patient was discharged with oral analgesia on the same day.

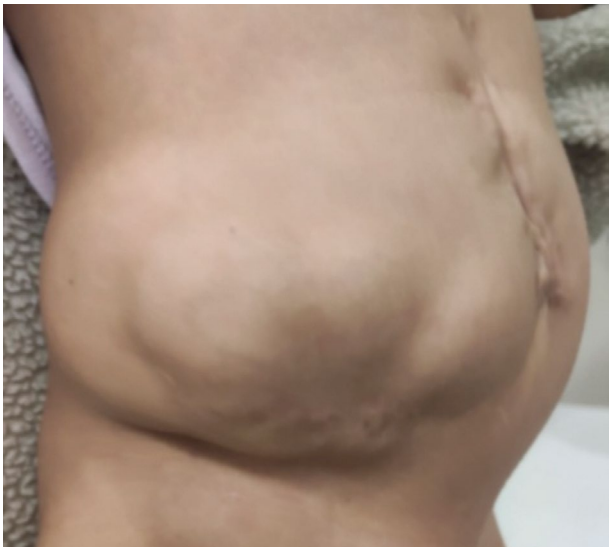

Figure 1. Complex ventral hernia in a 22-month-old patient.

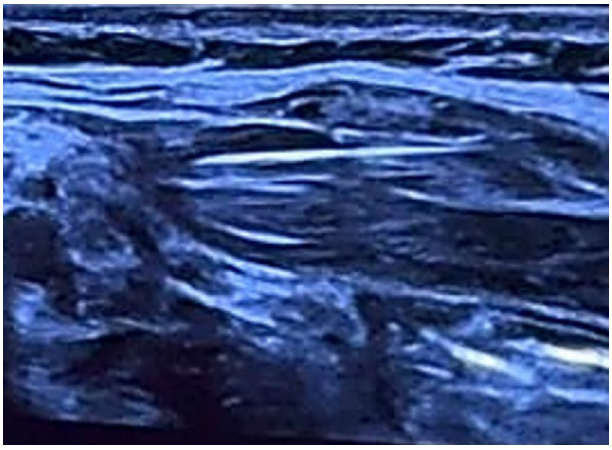

Figure 2. Injection of BTA under ultrasound control.

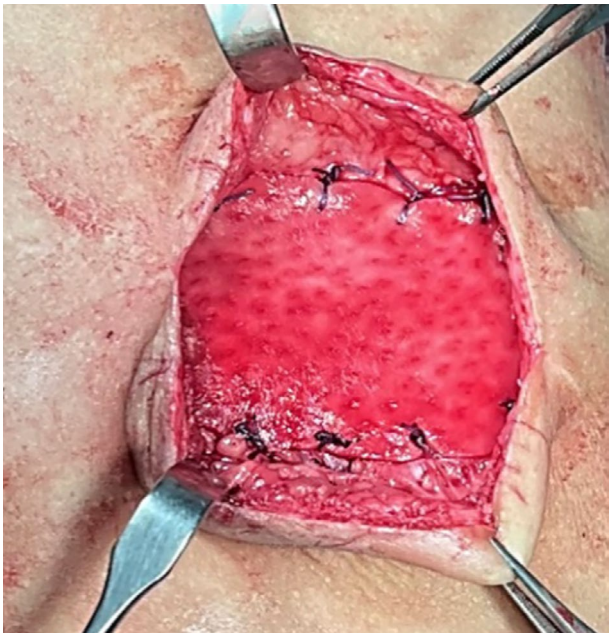

Figure 3. Open repair with reinforcement mesh.

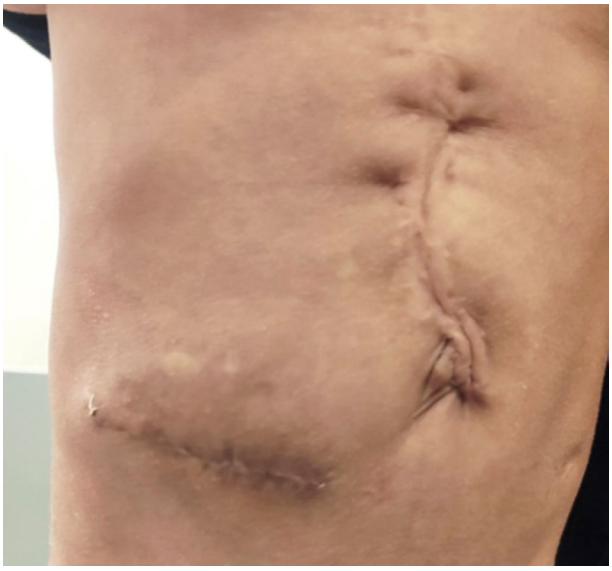

Figure 4. Outpatient control after one month of follow-up

At check-up one week later, immediate postoperative progression was good, without complications. The patient underwent subsequent check-ups after 1 and 3 months of follow-up (Fig. 4), with no weakness, recurrence, or wound infection, and with a satisfactory cosmetic result.

DISCUSSION

The treatment of ventral hernias remains a true challenge for pediatric surgeons. Complications are frequent, especially in complex cases, where there may be a conflict between the volume of herniated organs and the reduced peritoneal cavity. Primary closure of the abdominal wall is the ideal surgical technique for treatment purposes, but in cases of extremely large hernias, it can lead to excessively high intra-abdominal pressure, with the resulting risk of recurrence and complications.

Various surgical strategies, such as expanders, component separation, or several types of meshes, have been used to reduce abdominal wall pressure following closure and to help in the reconstruction of complex abdominal wall defects[9,10].

The application of botulinum toxin type A in children has been well documented in pediatric surgery. It has proved useful in patients with spastic paralysis, sialorrhea, hyperhidrosis, strabismus, voiding disorders, or defecation pathologies[5,6,11]. In addition, the use of botulinum toxin to facilitate the closure of large abdominal wall defects has been widely described in adults[10,12], but in children, it has only been reported in the closure of omphaloceles in two cases[7,8]. The experience in adults leads to think it may be a promising tool to facilitate the closure of ventral hernias in selected pediatric patients.

Another important, non-standardized issue is the recommendable botulinum toxin dosage, as well as time to repair. In adults, total 200-300 IU doses injected at 3-5 locations bilaterally are recommended[9,10,12,13]. In children, dosage should be age- and weight-dependent in order to reach an efficacy-safety balance. The maximum pediatric dosage recommended by the US Food and Drug Administration (FDA) is 8 IU/kg or 300 IU[14]. In our case, a 6.25 IU/kg dose of toxin diluted in saline solution was injected.

To determine time to surgical repair, the studies regarding the use of this toxin in adults were considered. Botulin toxin is known to cause muscles to relax, which allows maximum wall lengthening to be achieved one month following the injection[9,15]. In our case, definitive repair was carried out 4 weeks following the injection, with reduced wall tension being noted at the time of definitive closure.

For definitive repair purposes, decision was made to reinforce the wall with an absorbable mesh. Incisional hernia repair with mesh is seemingly associated with a lower recurrence rate in adults, where its use has been well established. The fact wall physiology in children is different –since the wall keeps growing– limits its use in the pediatric population, which explains why there is little experience with it. However, closures with tension should be avoided as they are associated with an increased risk of recurrence[16]. Bridged mesh repair offers worse results, with high costs and greater recurrence rates than mesh-reinforced abdominal wall closure[10,17].

There is no consensus regarding the indications of the various techniques available for the closure of complex incisional hernias in children. In our case, this patient was selected as a result of the defect's extension and the associated comorbidity, while trying to avoid closure tension to prevent recurrences and achieve an effective surgical solution. There is little experience available regarding abdominal wall relaxation with botulinum toxin type A to facilitate surgical closure in children, and subsequent studies are required to respond to the many questions that still remain unsolved today. However, the experience in adults leads to think it may stand as a promising tool to facilitate the closure of ventral hernias in pediatric patients.

In conclusion, the use of BTA is a promising strategy that could facilitate the surgical treatment of complex ventral incisional hernias in children. It is important to adjust dosage and anatomical reference points according to hernia type and patient age and weight, but further studies are required to optimize these variables.

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