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CLINICAL CASE

Persistent omphalomesenteric duct with umbilicus polipus and Meckel's diverticulum

Persistencia del conducto onfalomesentérico con hallazgo de pólipo y divertículo de Meckel

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What do we know about the subject matter of this study?

Umbilical pathology is one of the congenital malformations found in the pediatric population. It includes several possible anatomical alterations, such as different forms of persistent omphalomesenteric duct (vitelline duct remnant) and urachal duct (allantoic remnant).

What does this study contribute to what is already known?

The clinical suspicion of lesions in relation to the umbilicus, such as granulomas or polyps, one should consider as a differential diagnosis the different forms of persistence of the omphalomesenteric duct which, although infrequent, require suspicion, study, and in many occasions adequate surgical treatment.

Abstract

The persistence of the omphalomesenteric duct (OMD) is an uncommon presentation within the embryological alterations of the vitelline remnant. Its clinical presentation varies according to the underlying anatomical malformation, which is difficult to diagnose as complementary imaging studies can be negative. **Objective:** To report the clinical case of an infant with a long-standing moist navel, in whom a persistence of the OMD associated with Meckel's diverticulum was evidenced intraoperatively; highlighting the importance of proper suspicion and management of this type of lesions. **Clinical Case:** A 1-month-old male infant with a round, reddish, and moist umbilical lesion, previously diagnosed as umbilical granuloma. He was referred to pediatric surgery for evaluation and management of the lesion, where an umbilical polyp was diagnosed, and a complementary study was performed looking for other embryological abnormalities. Abdominal and soft tissue ultrasound was negative for other abnormalities, reporting an umbilical granuloma. Due to the persistence of the lesion and its highly suggestive appearance of a polyp and moist navel, surgical resolution was decided. Surgery was performed at 7 months, and during the operation, a persistence of the OMD with Meckel's diverticulum was found. Resection surgery of the remnant

Keywords:
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was performed, with good postoperative evolution. **Conclusions:** The case presented highlights the importance of diagnostic suspicion and timely referral before complications arise. When faced with umbilical lesions that are characterized by prolonged evolution and associated with periumbilical moisture, embryological alterations that require a correct study and surgical management should be suspected.

Introduction

The omphalomesenteric duct (OMD) or vitelline duct is an embryonic structure that communicates the yolk sac with the midgut, obliterating between the 5th and 9th week of intrauterine life[1,2,3].

OMD embryology is a complex and crucial process in embryonic development. During these early stages of fetal development, it undergoes 5 main phases[2,3,4].

The first phase is the initial formation that occurs around the third week of fetal development when the yolk sac is formed. This sac is a temporary structure that plays a critical role in the early nutrition of the embryo. In the second stage, as the embryo develops, the OMD forms from the endoderm. This duct connects the yolk sac to the middle portion of the primitive intestine. Eventually, the third stage occurs, in which the OMD extends into the allantois, a tubular structure that connects the hindgut to the posterior part of the embryo. Allantois is essential for the subsequent development of the urinary system. In the fourth phase, normal regression and closure continue; as fetal development proceeds, the yolk sac decreases in importance, while the embryo obtains nutrients from other sources[2,3]. The fifth phase develops in those cases in which it does not close completely, which may result in abnormal persistence of the OMD[2,3,4].

We can find different classifications of OMD anomalies that vary according to the source and author[1,2,3,5]. One form of classification is based on the different embryological disorders and ways in which OMD can persist or give rise to these anomalies, including umbilical cysts, fistulas, diverticula, or even the formation of fibrous bands[6,7] (Table 1). Table 2 summarizes these different types of anomalies and their clinical characteristics.

As can be seen in these tables, as there is a wide spectrum of malformations, the clinical presentation is highly variable, but some of the common symptoms and signs associated with this condition include persistent umbilical discharge or wet umbilicus. This discharge may be a clear exudate, urine-like fluid, purulent, or even fecaloid, varying in amount depending on the malformation[8].

Unfortunately, the wide spectrum of malformations, many times with varied and non-specific clinical manifestations, associated with the scarce knowledge of these umbilical embryonic pathologies result in poor suspicion, with the consequent delay in the diagnostic process and treatment establishment. Understanding these embryological events is crucial to managing the possible complications associated with the persistence of OMD in infancy[1,3].

The objective of this work is to report the clinical case of an infant with a long-standing wet umbilicus, where intraoperative diagnosis revealed a persistent OMD associated with Meckel's diverticulum, highlighting the importance of proper suspicion and management of this type of lesion.

Clinical Case

Male infant, 1 month and 9 days old, firstborn, with a well-controlled pregnancy. He was born via vaginal delivery at 40 weeks with a low birth weight (2,785 kg). He was evaluated by pediatric surgery due to an umbilical lesion, which appeared polypoid, bright red, with regular edges, without secretion or signs of infection (Figure 1). A differential diagnosis of umbilical granuloma vs. umbilical polyp was made, and conservative management with topical medication (Polymyxin B/Bacitracin) was empirically prescribed to evaluate response.

Abdominal and abdominal wall ultrasound showed a nodular image with umbilical granuloma signs and minimal umbilical hernia. It was decided to maintain a conservative approach to evaluate the evolution of the lesion. Silver nitrate cauterization was not indicated, as the lesion was suggestive of an umbilical polyp.

The patient was reevaluated at 2 months and 11 days of life, showing persistence of the lesion with the same characteristics and no signs of regression; there was only scarce, self-limited, and occasional bleeding in the affected area. Then, due to the persistence of the lesion, which was strongly suggestive of an umbilical polyp and remained unchanged during the follow-up period, a new ultrasound was requested. The result again indicated umbilical granuloma, with no signs of communication or fistulization.

Due to the persistence of the exudative umbilical lesion, with no improvement, and its clinical characteristics highly suggestive of a polyp, despite inconclu-

Table 1. Types of Embryological Disorders Related to OMD Remnants

Type of Remnant	Description
Entero-umbilical fistula	Fully patent omphalomesenteric duct forming a direct connection between the intestine and the umbilicus (fistula). This is very rare, with few cases reported in the literature
Partially patent omphalomesenteric duct	Varies depending on the section that remains patent - Peripheral portion: Umbilical sinus - Intermediate portion: Vitelline cyst - Intestinal portion: Meckel's diverticulum
Mucosal remnant/ Umbilical polyp	Persistence of mucosal tissue in the umbilical region, forming a polyp
Congenital band or strand	Obliterated omphalomesenteric duct that becomes a fibrous band with a potential risk of congenital intestinal obstruction

Table 2. Clinical Features Associated with Different Types of Omphalomesenteric Duct Anomalies

	Meckel's Diverticulum	Cyst	Polyp	Fistula	Congenital Band
Age of Presentation	First 10 years (peak at 1–2 years of age)	4 months	1-3 years	0-2 years	Any age
Imaging Findings	*US:* Blind tubular structure, "gut signature sign."	*US:* Cystic lesion within the duct's extension. Variable echogenicity (anechoic to hyperechoi).	*US:* Lesion resembling a cyst with an echogenic inner wall representing intestinal mucosa.	*US:* Hypoechoic tubular structure connecting the umbilicus to the antimesenteric border of the ileum. May or may not show the "gut signature sign."	Difficult to represent with imaging. Mostly identified intraoperatively.
	CT: Pouch-like tubular structure with a blind end, similar to fat	*CT:* Tubular or cystic structure related to the antimesenteric border of the ileum.	*CT:* Not utilized.	*CT:* Not utilized.	
Complications	*Neonates:*-Intestinal obstruction. *Children:* Bleeding, diverticulitis *Adults:* Obstruction.	Infection (may form abscess), torsion, ischemia.	Infection, bleeding.	Infection.	Volvulus, congenital intestinal obstruction.
Differential Diagnosis	Acute appendicitis, infectious conditions, neoplasms, GI bleeding (HVD), intestinal duplication	Gynecological conditions (complex ovarian cyst, ovarian torsion, PID).	Gynecological conditions (complex ovarian cyst). Intestinal duplication, urachal cyst.	Umbilical granuloma, umbilical hernia, patent urachal remnant.	-

US: Ultrasonography; CT: Computed Tomography; HVD: Gastrointestinal hemorrhage; PID: Pelvic Inflammatory Disease.

sive studies, elective surgery was scheduled for umbilical polyp removal and correction of possible underlying omphalomesenteric malformation.

A periumbilical approach was used for surgery, showing a fibrous cord from the umbilical area into the abdominal cavity. Dissection and resection of the polyp was performed (Figure 2). Upon further inspection, a fibrous cord was confirmed, compatible with persistent OMD in communication with a structure compatible with Meckel's diverticulum (Figure 3 and Figure 4), along with a partially obliterated urachal remnant. Resection of the persistent OMD and wedge resection of Meckel's diverticulum were performed, with intestinal suturing using vicryl sutures. In addition, ligation of the urachal remnant was performed.

The patient presented good postoperative course without complications, was fully feeding orally, and was discharged 5 days after surgery. He completed antibiotic prophylaxis with Metronidazole and Amikacin for contaminated surgery (intestinal suture).

Figure 1. Rounded, red lesion at the level of the umbilical scar, suggestive of an umbilical polyp.

The biopsy confirmed the diagnosis of a 1.5 x 1 cm umbilical polyp, in addition to persistent permeable OMD and the presence of a tubular segment, Meckel's diverticulum with the intestinal mucosa. Finally, there was also evidence of fibroadipose tissue corresponding to a urachal remnant.

The patient had a satisfactory evolution, maintaining outpatient check-ups, without complications (Figure 5).

Discussion

Different congenital anomalies can arise from omphalomesenteric remnants. Therefore, the clinical presentation of patients with some degree of persistent OMD may vary considerably depending on the specific embryologic defect and type of anomaly. Clinical history and a thorough physical examination are crucial, with special emphasis on identifying warning signs, such as a history of discharge or wetness, gas or urine

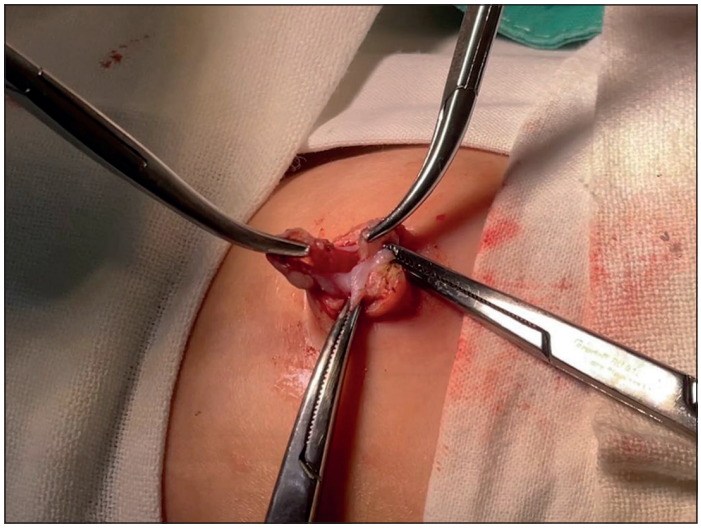

Figure 2. Elliptical resection of the umbilical polyp.

Figure 3. Exteriorization through the umbilicus of a fibrous cord with minimal lumen, connecting the umbilical polyp to Meckel's diverticulum.

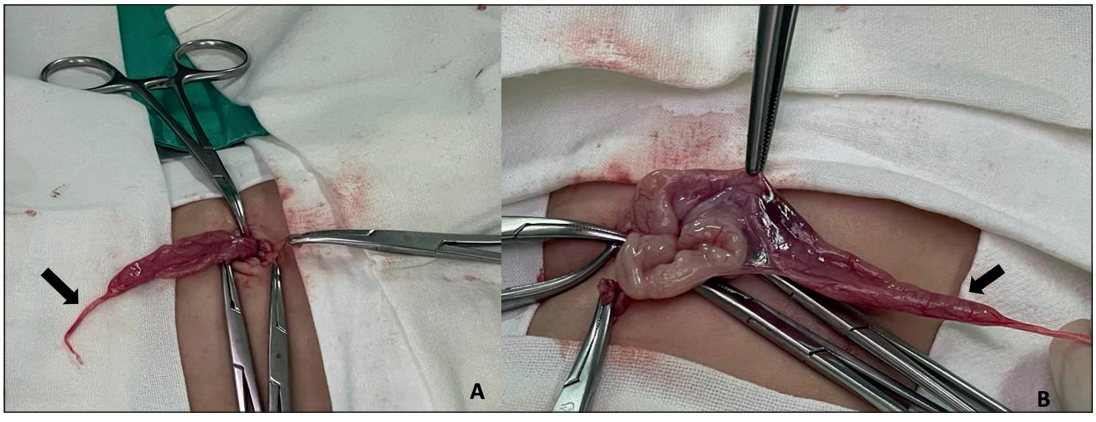

Figure 4. Resection showing persistence of the omphalomesenteric duct (OMD). **A:** Fibrous cord. **B:** Meckel's diverticulum.

Figure 5. Postoperative evolution. Umbilical scar.

discharge through the umbilicus, signs of peritonitis, and/or fever[8,9].

In the reported case, the referral and initial suspected diagnosis was an umbilical granuloma, a condition not associated with persistent OMD and typically managed conservatively[8,10]. However, a thorough clinical history revealed exudate or permanent discharge of clear fluid from the umbilical region. This, associated with a correct physical examination, which showed a very rounded and bright red polypoid lesion (Figure 1), led to suspect an embryologic alteration of the umbilicus[8].

The umbilical polyp, like the case presented, is an infrequent lesion within the omphalomesenteric remnants. It corresponds to the exposure of gastrointestinal mucosa through the umbilicus and its main differential diagnosis is umbilical granuloma, whose distinction is clinical, so it is essential to know the appearance and variety of malformations to consider them as differential diagnosis[8,10]. In addition to the clinical characteristics, ultrasound is a tool that allows differentiating these two entities through the evaluation of the vascularization and the depth of the lesions. Umbilical granulomas are identified as solid and superficial nodules, highly vascularized, while the umbilical polyp appears as a deep nodule, with thick echogenic walls, and with hypovascularity or sonographic avascularity[10].

The frequency of association of the umbilical polyp with other omphalomesenteric remnants is variable; some studies report around 50-56%[8,10], however, other studies have not seen this relationship[6,11]. In the authors' experience, a polyp is an infrequent malformation that, due to insufficient reliable statistics, does not allow for ruling out its association. For this reason, such alterations must always be suspected, investigated, and surgically resolved with a periumbilical diamond-shaped incision and mini-laparotomy to ensure that no other associated remnants are present. Obliterated remnants without a wet umbilicus, such as congenital omphalomesenteric bands, are a potential cause of pediatric intestinal obstruction and are an important reason for further surgical exploration[9].

Regarding the study of the different omphalomesenteric remnants, as a complement to the clinical characteristics, various imaging studies can also be used. Ultrasound is used as a first-line examination due to its non-invasive nature and its ability to provide real-time evaluation of abdominal structures. Regarding the study of intestinal remnants, such as Meckel's diverticulum, ultrasound can help identify abnormal structures in the context of complication, such as in cases of intestinal obstruction caused by a band or the diverticulum itself[9,10,12]. In addition, ultrasound is useful to visualize intraluminal masses, as in cases of intussusception where Meckel's diverticulum can act as a guide point for invagination[10,12]. However, it does not have the same accuracy in the diagnosis of uncomplicated asymptomatic remnants, for which it is likely necessary to resort to more complex studies[10,12,13].

Another study alternative is fistulogram, a study with water-soluble contrast media instilled through the umbilicus, under radiological vision to visualize the trajectory and connection of the fistula. This method is especially useful in cases in which the clinical picture suggests a fistula, but cannot be confirmed by other imaging methods[12,14]. In case of anatomical doubts, an intraoperative fistulogram can be performed and a remnant and its trajectory can be searched for. An example of its use can be to differentiate urachal remnants from omphalomesenteric remnants[10]. In our case, although the polyp was highly suggestive of a remnant, there was no identifiable fistulous orifice to perform this study preoperatively.

In the specific case of uncomplicated Meckel's diverticulum, it can be visualized in contrast-enhanced upper gastrointestinal studies, if there is expertise and thoroughness in performing the examination. It appears as a blind, tubular sac originating from a bowel loop, generally in the lower right quadrant or pelvis[10,12,13,14].

CT scan is a test with variable utility in these cases. It is a robust diagnostic tool to evaluate serious complications of the remnants such as intestinal obstruction, diverticulitis, and perforation, but its usefulness

decreases in uncomplicated remnants[11,12]; in addition to considerable irradiation exposure for the patient.

MRI could be useful, but it is an examination that is not widely available, complex, and always requires sedation and even general anesthesia in small patients[10,13,14].

Regarding the treatment of these remnants, in the presence of well-founded clinical suspicion and lesions highly suggestive of persistent OMD, surgical resolution should be considered, being surgically prepared for the eventual resection of remnants and intestinal lesions that will require enterorrhaphy or intestinal anastomosis, followed by the corresponding postoperative hospitalization[9,11,15]. Surgical resection of omphalomesenteric remnants is indicated in cases of symptomatic lesions that present a certain possibility of future complications. These complications may vary in severity and include inflammatory and infectious processes, intestinal perforation, intestinal obstruction, and other acute conditions that complicate the surgical procedure[8,9,16].

Regarding the surgical technique, the umbilical approach allows good access to the peritoneal cavity, allowing the manipulation and exteriorization of the small bowel loops (ileum) and then the resection and intestinal anastomosis without difficulty; besides having very good esthetic results (Figure 5) compared to other more aggressive approaches such as wide laparotomies. It is also feasible to perform a minimally invasive laparoscopic approach, both as a diagnostic (exploratory laparoscopy) and therapeutic method which was not considered in the case reported, due to the exophytic lesion of the umbilicus, which required an open approach (diamond-shaped incision). Most of the cases have a very good postoperative evolution and a complete recovery without sequelae[7,8,9,11].

In a different spectrum of malformations, there are embryological alterations of the allantoic duct, which gives rise to alterations of the urachal duct. These types of anomalies can also present as wet umbilicus since they share the embryological beginnings. However, in these cases, once the diagnosis is suspected, evaluation by pediatric urology should also be considered, since there may be communications to the bladder, such as bladder diverticulum, and more invasive studies will likely be necessary to determine the exact pathology[12,14].

Conclusions

In the presence of umbilical lesions characterized by a prolonged course associated with periumbilical wetness, embryologic anomalies, such as persistent omphalomesenteric remnants, should be suspected. Thorough clinical history, detailed physical examination, and the use of complementary imaging tests, although they may be negative, are crucial to identifying these anomalies. Surgical resection is indicated in symptomatic cases to prevent serious complications. Most patients have complete postoperative recovery without significant sequelae, underlining the importance of adequate and timely intervention.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed according to the Declaration of Helsinki and the World Medical Association regarding human experimentation developed for the medical community.

Data confidentiality: The authors state that they have followed the protocols of their Center and Local regulations on the publication of patient data.

Rights to privacy and informed consent: The authors have obtained the informed consent of the parents (tutors) of the patients and/or subjects referred to in the article. This document is in the possession of the correspondence author.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

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