

Incarcerated Persistent Vitelline Duct in a Paraumbilical Hernia: An Uncommon Cause of Bowel Obstruction in an Adult

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Abstract

Persistent vitelline duct (VD) is a rare embryologic anomaly that occurs when the VD fails to regress completely during fetal development, leading to potential complications such as Meckel's diverticulum, omphalomesenteric fistula, and bowel obstruction. Although most cases are diagnosed in childhood, adult presentations are extremely uncommon and pose significant diagnostic challenges. This report describes the case of a 50-year-old male who presented with acute abdominal pain, distension, and a lump at the umbilicus. The abdominal X-ray showed features of intestinal obstruction while the ultrasound revealed a small paraumbilical hernia. Had no clue of a persistent VD. Due to the features of bowel obstruction, exploratory laparotomy was done. Intraoperatively, a persistent VD was discovered as a fibrous, tubular structure extending from the ileum to the umbilicus, incarcerated within the hernia sac and causing partial bowel obstruction. The VD was excised with a segment of ileum, and the hernia was repaired. Histopathological examination confirmed the presence of the persistent VD, with no evidence of malignancy. This case emphasizes the rarity of persistent VD in adults and underscores the limitations of ultrasound in detecting such anomalies. It also highlights the importance of maintaining a high index of clinical suspicion even in adult patients with abdominal complaints, particularly those involving paraumbilical hernias and bowel obstruction. Timely surgical intervention can lead to favorable outcomes, as demonstrated in this case. This report contributes to the growing body of literature on adult presentations of persistent VD and provides insights into its diagnosis and management in complex clinical scenarios.

INTRODUCTION

The vitelline duct (VD), an embryologic structure, serves a crucial role during early fetal development by connecting the midgut to the yolk sac(1,2). This connection facilitates the delivery of nutrients to the developing embryo until the placenta becomes functional(3). As fetal development progresses, the placenta gradually assumes the responsibility of nutrient and oxygen supply to the developing embryo, while the VD begins its regression. In ruminants, this process typically culminates around the 8th week of gestation, transforming the once-tubular structure into a fibrous cord extending from the ileum to the umbilicus(4).

In some cases, the VD fails to regress properly, resulting in persistent structures that can lead to a range of clinical complications. These anomalies, resulting from incomplete involution, may give rise to conditions such as omphalomesenteric fistula, enterocyst, and umbilical polyp(2,4,5). Among these, the least common and most

challenging to diagnose is the complete patency of the VD, a rare phenomenon in which the duct does not undergo full regression(2). Persistent VD is typically diagnosed in neonatal life and early childhood, although it is extremely rare in adults. Previous literature has suggested that the risk of symptomatic persistent VD increases with duct length exceeding 2 cm(6,7). The severity of complications often correlates with the size, location, and extent of the persistent duct(7).

The most frequent manifestation of a persistent VD is Meckel's diverticulum, a congenital anomaly resulting from partial obstruction of the VD (8). This condition is often observed in children beyond the age of 2 years and typically presents with symptoms such as abdominal pain, rectal bleeding, umbilical hernia, discharge, and, in severe cases, life-threatening intestinal obstruction.

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The full spectrum of complications can pose a significant diagnostic challenge, especially in adults, where complete patency of the VD is an exceedingly rare occurrence(9). In fact, only a small fraction approximately 2.5% of VD cases are diagnosed in adults, with the majority remaining asymptomatic(10).

The diagnosis of patent VD is particularly difficult during clinical assessment and preoperative evaluation, especially in adults. In most cases, persistent VD is detected incidentally, often during imaging studies conducted to investigate other pathologies. For instance, imaging may reveal the VD as a tubular structure during the evaluation of suspected intestinal obstruction or when assessing periumbilical or umbilical hernias(11). In fact, the majority of VD cases are discovered as incidental findings, with 90% of diagnoses occurring during imaging or intraoperative procedures such as laparotomies(9,12). Given its rarity, patent VD poses a diagnostic challenge that requires high clinical suspicion and comprehensive imaging studies for accurate identification and management.

In the context of patient management, advanced imaging modalities such as abdominal ultrasound and computed tomography (CT) play a pivotal role in detecting persistent VD. These imaging techniques are invaluable in confirming the presence of the VD as a tubular structure, aiding clinicians in determining the site, size, and extent of the duct's persistence(13). Consequently, imaging serves as an essential tool for both preoperative assessment and surgical planning, providing critical information that influences management decisions and outcomes. Thus, a high degree of clinical vigilance and the appropriate use of imaging are paramount in the diagnosis and management of this rare but significant condition.

CASE PRESENTATION

A 50-year-old male with no significant medical history presented to the emergency department with complaints of acute abdominal pain, distension, and vomiting that

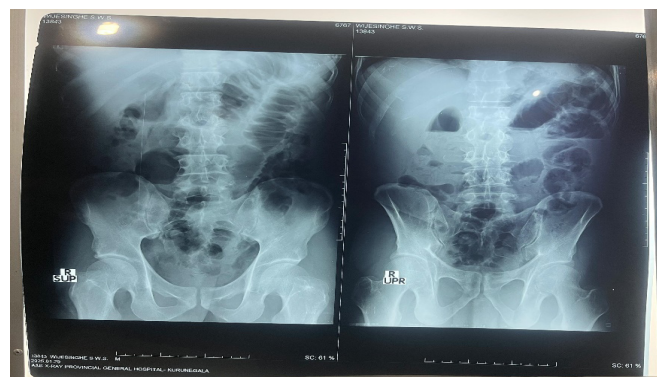


Figure1. Abdominal X-ray showing dilated bowel loops

had persisted for 24 hours. On further questioning patient was apparently well 4 days ago where patient developed constipation 4 days ago which was progressively discomforting the patient. Though he had no vomiting initially one day before the admission he developed several episodes of bile stained vomiting .patient seek medical advice due to worsening severe abdominal pain associated with abdominal distention with discomfort. On physical examination, abdomen was distended and tender to palpation along with non-reducible mass in the paraumbilical region. He had no features of peritonism. During auscultation exaggerated bowel sounds were noted which raise the concern of bowel obstruction . the clinical work up was supported by empty rectum in digital rectal examination. The patient had experienced intermittent mild discomfort in the same area over the past several years, but there had been no prior surgical interventions. Clinical evaluation suggested a bowel obstruction and the patient was admitted for further management.

Initial laboratory investigations revealed mild leukocytosis, while abdominal plain x-ray showed distended bowel loops suggesting bowel obstruction but didn't show gas under the diaphragm which ruled out intestinal perforation (Figure 1). An abdominal ultrasound (USS) was performed revealed a small paraumbilical hernia, had no clue of a persistent VD. With this back ground surgical exploration was planned

During surgery, a persistent vitelline duct was discovered as a tubular, fibrous structure originating from the ileum and extending towards the umbilicus. The VD was found to be incarcerated within the paraumbilical hernia sac, causing bowel obstruction(Figure 2,3). The hernia was reduced, and the VD was carefully dissected with portion of ileum(Figure 4).

Postoperative recovery was uneventful, and the patient was discharged on the 5th postoperative day. Histopathological



Figure2. Persistent vitelline duct attached to the mid gut

examination of the excised tissue confirmed the presence of a persistent vitelline duct, with no evidence of malignancy.

This case highlights the diagnostic challenge of a persistent vitelline duct in adults, as it was not identified on commonly used imaging modality. The unusual presentation of the



Figure 3. Persistent vitelline duct causing obstruction proximal to the mid gut attachment

DISCUSSION

Persistent vitelline duct (VD) anomalies are a rare but important consideration in the differential diagnosis of abdominal pathologies, particularly when unusual findings such as paraumbilical hernias or bowel obstructions are present. The VD, an embryologic structure, connects the midgut to the yolk sac during early development, serving a vital role in nutrient delivery to the developing embryo. It typically regresses by the 8th week of gestation, with the remnants usually forming a fibrous cord (1,2). However, in some cases, the VD fails to regress completely, resulting in a spectrum of clinical manifestations, including Meckel's diverticulum, omphalomesenteric fistula, enterocyst, and, more rarely, persistent VD (2,4). While persistent VD is most commonly diagnosed in the neonatal period or early childhood, it remains an infrequent diagnosis in adults, presenting significant diagnostic challenges, especially when complicated by other abdominal issues like hernias (9).

In this case, a 50-year-old male presented with acute abdominal pain, distension, and vomiting associated with a paraumbilical hernia. Although the clinical examination and plain X-ray showed evidence of bowel obstruction, the ultrasound (USS) failed to reveal any clear evidence of a persistent VD. This underscores the limitations of USS, particularly when assessing rare and subtler anomalies such as a patent VD, especially when it is fibrous or adherent to surrounding structures, as observed in our patient. Previous literature has reported that ultrasound may not always provide definitive details about uncommon

VD as part of a paraumbilical hernia and the subsequent bowel obstruction underscores the importance of maintaining a high index of suspicion, especially in cases where imaging findings are inconclusive. Timely surgical intervention resulted in a positive outcome for the patient.



Figure 4. Excised vitelline duct

entities like the VD, particularly when it is partially fibrous or adherent (13). This finding is consistent with the challenges encountered in our case, where the diagnosis remained elusive until surgical exploration.

The diagnosis of persistent VD in adults is exceedingly rare, with only a few case reports describing such presentations (9). While Meckel's diverticulum, a common manifestation of persistent VD in children, was considered as part of the differential diagnosis, the location of the VD within the paraumbilical hernia and its relationship to the bowel obstruction made persistent VD a more likely diagnosis in this adult case. Meckel's diverticulum typically presents with symptoms such as abdominal pain, rectal bleeding, and, in severe cases, intestinal obstruction or diverticulitis, but it generally occurs in younger patients (8). In adults, persistent VD is often asymptomatic or diagnosed incidentally during surgery, as was the case in this patient (10).

In this case, the persistence of the duct was identified intraoperatively, and the patient's clinical signs and symptoms pointed to an obstructed bowel caused by the VD being incarcerated within the hernia sac. This highlights the importance of maintaining a high index of clinical suspicion when managing cases with paraumbilical hernias that present with atypical features or severe symptoms such as bowel obstruction. Despite the absence of a clear diagnosis on imaging, surgical intervention and excision of the persistent VD resolved the patient's bowel obstruction, with histopathological examination confirming the diagnosis.

The pathophysiology of symptoms in cases of persistent VD is often attributed to complications such as bowel obstruction, volvulus, or inflammation, resulting from the herniation or fibrous nature of the VD (6,7). Although imaging techniques like ultrasound are valuable in detecting many abdominal conditions, they may not always detect the VD, particularly when the duct is fibrous or adherent to surrounding tissues. Therefore, when clinical signs suggest an obstructed hernia or atypical abdominal pathology, the possibility of a persistent VD should remain a part of the differential diagnosis, especially in adults (12).

This case further reinforces the notion that, in rare instances like this, intraoperative findings may be essential for diagnosing persistent VD. Advanced imaging modalities such as computed tomography (CT) may be useful in these scenarios, as they can better visualize the site, size, and extent of the duct's persistence (13). However, as illustrated in this case, surgical exploration may still be required to make a definitive diagnosis and achieve successful treatment.

CONCLUSION

Persistent vitelline duct is a rare congenital anomaly that can present with a variety of clinical symptoms, including bowel obstruction and complications arising from its association with paraumbilical hernias. Although imaging techniques like ultrasound are helpful, they may not always detect the VD, especially when it is fibrous or adherent to surrounding tissues. In adults, where complete patency of the VD is exceptionally rare, clinical suspicion should remain high, especially when symptoms involve unusual hernia presentations or bowel obstruction. Surgical exploration, when indicated, can provide definitive diagnosis and successful treatment. This case illustrates the diagnostic challenge posed by persistent VD in adults and highlights the importance of recognizing its potential to contribute to more complex abdominal conditions. Early surgical intervention, as in this case, can lead to favorable outcomes and prevent further complications.

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