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CASE REPORT

Bilateral Patent Processus Vaginalis with Chylous Effusion in a Pediatric Patient: A Rare Case Report and Literature Review

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Background: Chylous effusion is a rare condition characterized by the accumulation of lymphatic fluid in body cavities, often due to trauma, malignancy, or congenital lymphatic abnormalities. The association of chylous effusion with a patent processus vaginalis (PV) in pediatric patients is exceptionally uncommon, presenting unique diagnostic and therapeutic challenges.

Objective: To report a rare case of bilateral patent processus vaginalis with chylous effusion in a pediatric patient, detailing the diagnostic process, surgical management, and outcomes, while contributing to the limited literature on this condition.

Methods: A 1-year-10-month-old male presented with a left inguinal-scrotal swelling. Ultrasonography suggested a hydrocele. Laparoscopic exploration revealed bilateral patent PVs with chylous fluid in the abdominal cavity and tunica vaginalis. The fluid was aspirated and analyzed, confirming chylous effusion. Bilateral high ligation of the PV was performed, and the patient was initially managed with a specialized diet.

Results: The patient underwent successful laparoscopic bilateral high ligation of the PVs with complete resolution of symptoms. Follow-up ultrasonography at one week, one month, and three months post-surgery showed no evidence of fluid accumulation or hydrocele recurrence.

Conclusion: Bilateral patent processus vaginalis with chylous effusion is an extremely rare condition in pediatric patients. This case demonstrates that early surgical intervention with laparoscopic high ligation can effectively resolve the condition without the need for prolonged dietary modifications. Further documentation of similar cases is necessary to better understand and manage this rare clinical presentation.

Keywords: patent processus vaginalis, chylous effusion, pediatric surgery, laparoscopic surgery, hydrocele

Introduction

The processus vaginalis (PV) is an embryological extension of the peritoneum that descends with the testes during fetal development.[1] Normally, it obliterates shortly after birth, but failure to close can result in conditions such as inguinal hernias, hydroceles, or, in rare cases, chylous effusion. Chylous effusion, characterized by the presence of lymphatic fluid in a body cavity, is most commonly associated with trauma or lymphatic system abnormalities but is seldom seen in the context of a patent PV.[2] Chyle is a milky fluid formed in the intestinal lymphatic system, rich in long-chain triglycerides combined with phospholipids, cholesterol, and their esters to form chylomicrons, which are stored in the cisterna chyli at the level of the second lumbar vertebra.[3] Chylous ascites refers to milky or creamy peritoneal fluid caused by leakage of intestinal lymphatic fluid. This case report describes a unique presentation of bilateral patent PV with chylous effusion in a pediatric patient, along with a review of the existing literature.

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Case Presentation

A 1-year-10-month-old male presented to our hospital with a one-month history of a left inguinal-scrotal swelling. The patient had no significant medical history or prior surgeries. Physical examination revealed a non-tender, fluctuant mass in the left inguinal region. Scrotal ultrasound demonstrated a left-sided hydrocele with a free anechoic area measuring approximately 20mm in depth (Figure 1). Given the clinical findings, a laparoscopic exploration was planned.

The patient was positioned head-down, and a 5 mm incision was made along the left umbilical margin for trocar insertion to establish pneumoperitoneum. Laparoscopy revealed an unclosed inguinal hernia on the affected side, with both PVs confirmed patent intraoperatively. A significant amount of milky fluid was observed in both the abdominal cavity and the tunica vaginalis (Figures 2 and 3). The fluid was aspirated and sent for laboratory analysis. The results were positive for Rivalta's test and chyle qualitative test, which are indicative of chylous effusion. Cytological examination of the fluid revealed a large number of lymphocytes, a few mesothelial cells, and lipid-laden macrophages, confirming the diagnosis of chylous effusion. Given the bilateral nature of the patent PV and the presence of chylous effusion, a decision was made to perform bilateral high ligation of the PV. A 3 mm trocar was inserted via a small umbilical incision, and a 9-gauge needle with suture was used to ligate the upper PV (Figure 4). The chylous fluid was carefully drained from both the abdominal cavity and the tunica vaginalis. The milky white fluid was sent for pathological examination. Pathological smear microscopy showed lymphocytes, mesothelial cells, and lipid-laden macrophages (Figure 5). The patient was started on a specialized diet consisting of medium-chain fatty acids, hydrolyzed

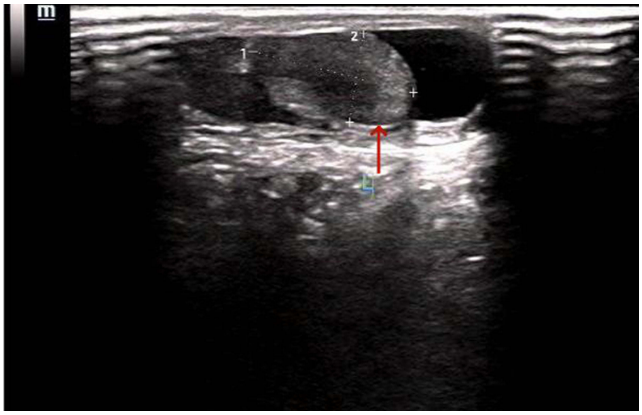

Figure 1 Ultrasound shows anechoic fluid surrounding the left testicle (red arrow), with an approximate size of 2.1×1.0 cm.

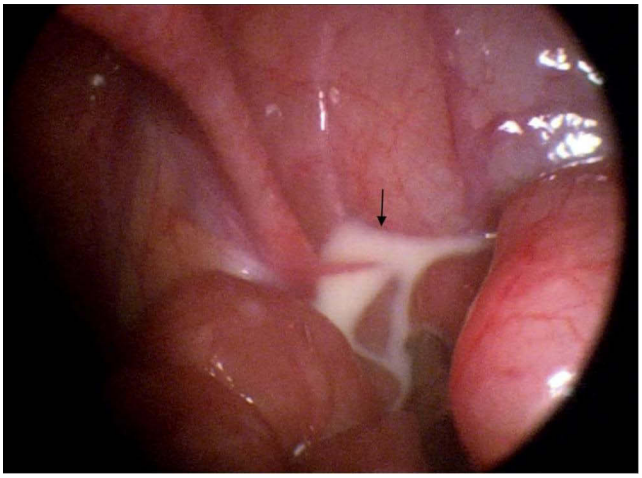

Figure 2 Laparoscopic view reveals milky fluid in the abdominal cavity (black arrow).

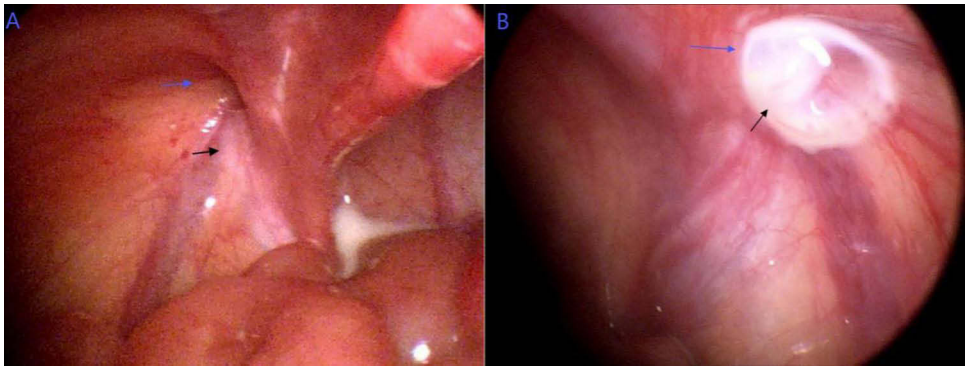

Figure 3 Laparoscopic view shows bilateral patent processus vaginalis (blue arrow), with milky fluid in the tunica vaginalis (black arrow). ((**A**) Left-sided processus vaginalis not closed. (**B**) Right-sided processus vaginalis not closed).

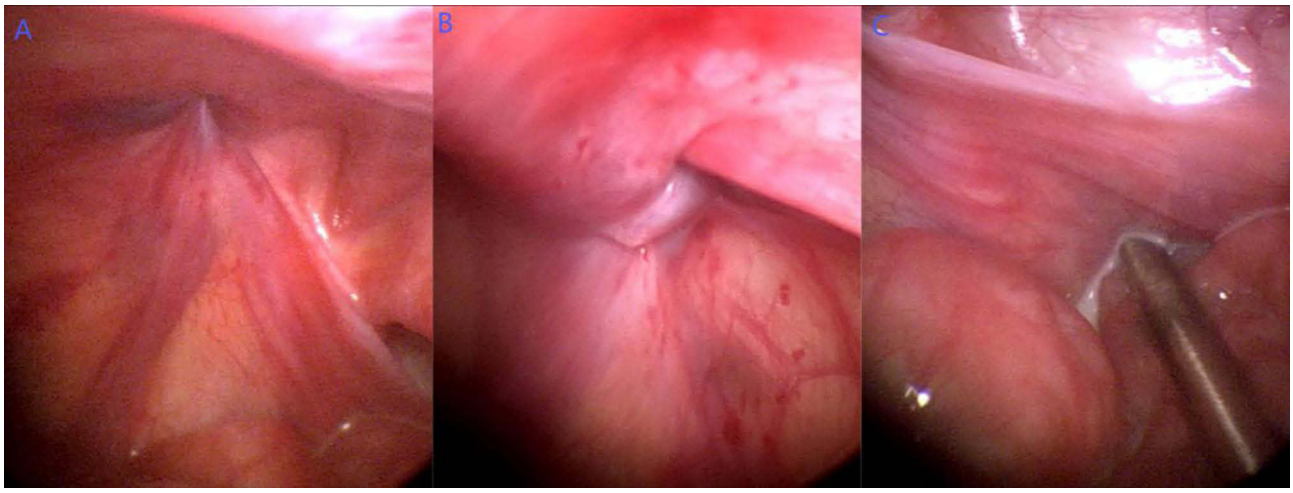

Figure 4 Laparoscopic view of bilateral processus vaginalis ligation and aspiration of milky fluid. ((**A**) Laparoscopic high ligation of the left processus vaginalis. (**B**) Laparoscopic high ligation of the right processus vaginalis. (**C**) Complete aspiration of chylous fluid).

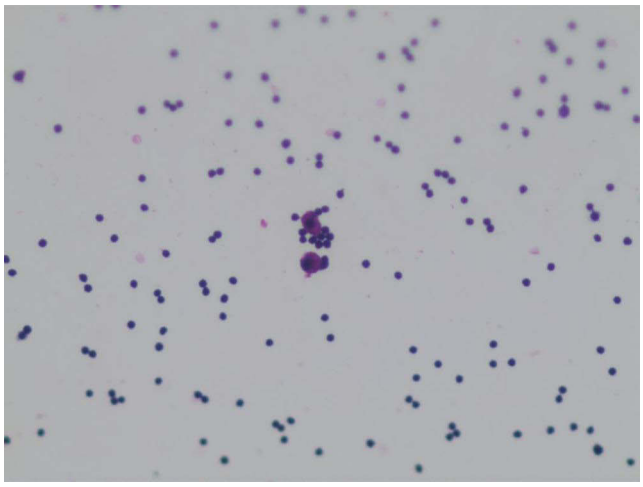

Figure 5 Pathological smear of the milky fluid shows a large number of lymphocytes, a few mesothelial cells, and lipid-laden macrophages. Special staining results: Oil Red O (+).

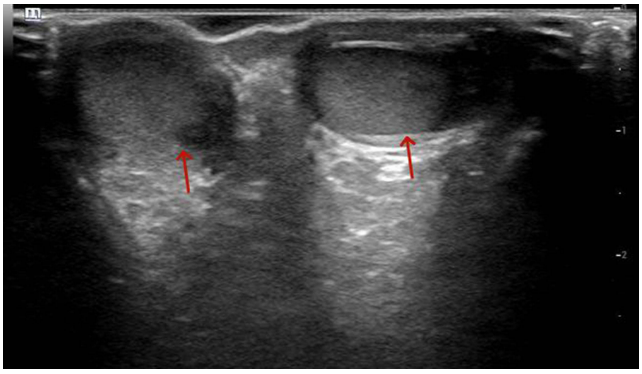

Figure 6 Both testicular capsules are intact (red arrow), with homogeneous parenchymal echogenicity and no surrounding anechoic fluid.

protein formula, and medium-chain triglycerides (MCT) postoperatively. However, the patient refused to continue the specialized diet after two days and was transitioned to a normal diet without any subsequent complications.

The patient was monitored closely in the postoperative period. Follow-up ultrasounds at one week, one month, and three months post-surgery showed no recurrence of hydrocele or abdominal fluid (Figure 6). The patient remained asymptomatic, and there were no signs of recurrent chylous effusion.

Discussion

The processus vaginalis is an outpouching of the peritoneum that descends with the testes into the scrotum during fetal development.[4] Normally, the PV obliterates spontaneously after birth; however, failure to close can lead to conditions such as indirect inguinal hernias or hydroceles.[5] The persistence of a patent PV allows for the communication between the peritoneal cavity and the scrotal sac, which may explain the presence of fluid, such as hydrocele fluid or, in rare cases, chyle. Chylous effusion is an uncommon clinical entity that results from the accumulation of lymphatic fluid in body cavities.[6] It typically contains a high concentration of triglycerides and is characterized by a milky appearance due to the presence of chylomicrons.[7]

The symptoms of chylous ascites are primarily caused by peritoneal fluid accumulation, increased intra-abdominal pressure, intestinal dysfunction, and protein loss. Common manifestations include abdominal distension, poor appetite, vomiting, and progressive bilateral lower limb edema.[8] As the volume of lymphatic fluid in the peritoneal cavity increases, respiratory failure may occur. Intestinal dysfunction leads to malabsorption of nutrients, while the continuous loss of proteins and lymphocytes significantly increases the risk of severe complications associated with mechanical, nutritional, and immune factors.[9] The most common causes of chylous effusion include traumatic injury to the thoracic duct, lymphatic malformations, malignancies, and infections.[10] In the pediatric population, congenital lymphatic malformations, such as lymphangiomas, are more frequently associated with chylous effusion, but its occurrence in conjunction with a patent processus vaginalis (PV) is exceedingly rare.

In this case, the presence of chylous effusion in both the abdominal cavity and tunica vaginalis through a patent PV is particularly unusual and suggests a potential pathophysiological mechanism whereby chyle produced in the abdominal lymphatics could pass into the scrotal sac. The positive Rivalta's test and chyle qualitative test, along with the cytological findings of lymphocytes, mesothelial cells, and lipid-laden macrophages, confirm the diagnosis of chylous effusion. Radiological imaging, including CT and MRI, helps differentiate abdominal masses, fluid collections, and lymphadenopathy, though not specific to chylous ascites.[11] CT density resembles water, making it indistinguishable from other fluids.[12] Lymphangiography, the gold standard for diagnosing lymphatic obstruction, detects leaks and abnormalities but is challenging and risky in children.[13,14]

The pathogenesis of chylous effusion in this case may involve several factors. Firstly, the patent PV provides a conduit for the movement of abdominal fluid into the scrotal sac.[15] Secondly, the presence of milky fluid in the peritoneal cavity suggests that there may be an underlying lymphatic leakage or disruption at the level of the cisterna chyli or thoracic duct.[16] The PV may then act as a pathway for this chyle to migrate from the abdominal cavity into the

scrotum. While trauma is a common cause of chylous effusion in older children and adults, in this infant, congenital factors such as abnormal lymphatic development or increased lymphatic pressure may have contributed to this rare presentation.[17,18]

The mainstay of treatment for patent PV traditionally involves surgical correction, particularly in cases where complications such as hernia, hydrocele, or, as in this case, chylous effusion are present.[19] Laparoscopic high ligation of the PV is a well-established and minimally invasive technique that effectively prevents further communication between the abdominal cavity and scrotal sac, thereby eliminating the potential for recurrence of effusions.[20] In this patient, bilateral high ligation was performed, given the bilateral nature of the patent PV. Intraoperatively, care was taken to aspirate the chylous fluid from both the abdominal cavity and tunica vaginalis.

Chylous effusions are often managed conservatively with dietary modifications aimed at reducing chyle production.[21] Medium-chain triglycerides (MCT) are absorbed directly into the portal circulation, bypassing the lymphatic system and thus reducing the load on the lymphatics. In this case, a specialized diet including medium-chain fatty acids and hydrolyzed protein formula was initially recommended postoperatively.[20] However, the patient's refusal to continue with this diet led to the resumption of a regular diet after two days, without any adverse effects or recurrence of effusion. The prognosis for patients with chylous effusion associated with a patent PV is generally favorable following surgical correction. The risk of recurrence is low when the PV is properly ligated. In this case, the patient remained asymptomatic during follow-up, with no evidence of recurrent effusion on serial ultrasounds. Long-term outcomes are expected to be excellent, with minimal risk of complications related to the chylous effusion or the surgical procedure.

There are limited reports in the literature of chylous effusion associated with a patent PV. Most documented cases involve trauma or congenital lymphatic abnormalities, with chylous ascites being the more common manifestation.[22] Documented cases of chylous effusion associated with a patent processus vaginalis (PV) are extremely rare, with most reports focusing on other PV-related complications. Due to limited data on its prognosis and recurrence, careful postoperative monitoring, including regular physical examinations and auxiliary tests, is essential, particularly in the early postoperative period. Managing risk factors such as elevated intra-abdominal pressure or lymphatic abnormalities can help prevent recurrence. This case contributes to the growing body of literature and highlights the importance of considering chylous effusion in the differential diagnosis of pediatric patients with milky fluid collections, particularly when associated with inguinal-scrotal swelling or hydroceles.

Conclusion

This case of bilateral patent PV with chylous effusion in a pediatric patient illustrates the importance of recognizing unusual presentations and considering a broad differential diagnosis. This rare case of bilateral patent processus vaginalis with chylous effusion in a pediatric patient was successfully treated with laparoscopic high ligation. A low-fat diet or medium-chain fatty acids can reduce the burden on the lymphatic system and promote the recovery of lymphatic vessels. Continued reporting of similar cases will enhance understanding and guide management strategies for this rare condition.

Agreement to Publish Statement

The written informed consent was obtained from the patient's parent for the publication of this case details and accompanying images.

Data Sharing Statement

All data and materials of this article are included in the manuscript.

Ethics Approval and Consent to Participate

All methods in this study were performed by the relevant guidelines and regulations of the Declaration of Helsinki and were approved by the Ethics Committee of the Anhui Provincial Children's Hospital.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

All authors that they have no conflicts of interest or financial ties to disclose.

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