

Canal of Nuck cyst: surgical management and lymphatic preservation in three cases

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Abstract

The canal of Nuck cyst is a rare but clinically relevant pathology, often mistaken for inguinal hernias or other soft tissue anomalies. It results from the incomplete obliteration of the processus vaginalis during fetal development. In this report, we describe three cases of adult women with this condition and highlight diagnostic approaches, surgical treatment, and, crucially, the intraoperative strategy for lymphatic preservation. We emphasize the relevance of venous and lymphatic anatomy in surgical planning and propose a refined diagnostic and therapeutic framework for this under-recognized pathology. This benign condition arises from the persistence of the processus vaginalis, an embryonic structure that normally obliterates during fetal development. In this paper we share our experience managing three clinical cases with a comprehensive overview of the condition, including its embryology, anatomy, clinical manifestations, differential diagnosis, and therapeutic options.

Key words: cyst, canal of Nuck, inguinal mass.

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Introduction

The cyst of Nuck is a rare condition that occurs in females and is anatomically similar to hydroceles in males. It originates from an embryological remnant of the canal of Nuck, a peritoneal extension that accompanies the round ligament through the inguinal canal. Normally, this canal obliterates after birth, but if it remains patent, it can lead to fluid accumulation and cyst formation.

From a biological perspective, the canal of Nuck is analogous to the processus vaginalis in males, which develops into the tunica vaginalis surrounding the testes. When the obliteration process fails, peritoneal fluid may accumulate, forming a cystic mass in the inguinal region. This condition is uncommon and often misdiagnosed as a hernia or lymphadenopathy due to its similar presentation.

Clinically, the cyst of Nuck manifests as a painless or mildly painful swelling in the inguinal or labial region. Diagnosis typically involves ultrasound or Magnetic Resonance Imaging (MRI), which help distinguish it from other inguinal masses. Treatment is usually surgical, involving cyst excision to prevent recurrence and confirm histopathological diagnosis.

Understanding the embryological origin of this condition is essential for accurate diagnosis and management, as it highlights the importance of developmental remnants in clinical pathology.

Case Report

Between 2021 and 2024, we treated three women presenting with swelling in the inguinal canal and right labium majus. The patients' mean age was 43 years, and all reported progressive mass enlargement. One patient experienced cyclical pain correlated with menstruation. All patients had previously undergone ultrasound imaging. In one case, an MRI was performed due to associated lymphadenopathy (Figures 1 and 2). Surgical excision was performed in all three cases. During surgery, we used Patent Blue Violet dye (PBV) to preserve satellite lymphatics, minimizing the risk of complications and preventing secondary lymphedema (Figure 3). Histopathological examination confirmed the diagnosis in all cases (Figures 4-6).

Discussion

Lymphatic and venous considerations in diagnosis and surgery

The close anatomical proximity of the canal of Nuck to the inguinal lymphatic vessels and superficial veins requires careful surgical planning. In our series, we used Patent Blue Violet dye to

identify and preserve lymphatic channels, minimizing the risk of post-operative lymphatic complications, such as seroma or secondary lymphedema. Particularly in cases with suspected lymphadenopathy, distinguishing between cystic masses and nodal pathology is essential. Imaging modalities like MRI, although not universally necessary, provided clarity in one patient by delineating lymphatic structures involved. We recommend such approaches when lymphatic involvement is suspected or when ultrasound findings are inconclusive.

The cyst of Nuck is a rare but important differential diagnosis for inguinal or labial masses in females. Due to its embryological origin, it shares similarities with hydroceles in males, as both result from the persistence of a peritoneal extension that should normally obliterate after birth. When this process fails, fluid

accumulation leads to cyst formation, which may be isolated (non-communicating) or connected to the peritoneal cavity (communicating). Because of its low prevalence, a cyst of Nuck is often misdiagnosed as an inguinal hernia, lymphadenopathy, lipoma, or Bartholin's cyst. Clinical examination alone may not be sufficient, as the mass is usually soft, fluctuant, and non-reducible, characteristics that overlap with other conditions. Ultrasound is the preferred first-line imaging modality, while MRI is useful for differentiation from other soft tissue masses. Computed Tomography (CT) scans are rarely required but may be considered if hernia, infection, or malignancy is suspected.

Although asymptomatic in some cases, the cyst can enlarge over time, causing discomfort, secondary infections, or confusion with other pathologies. In communicating cysts, fluid fluctuation can lead to size variation, making the clinical picture more complex. Early and accurate diagnosis prevents unnecessary interventions and ensures appropriate surgical planning.



Figure 1. Magnetic Resonance Imaging (MRI) revealing a cyst of the canal of Nuck localized within the inguinal canal.



Figure 2. Preoperative diagram depicting the cyst's extension into the inguinal canal.

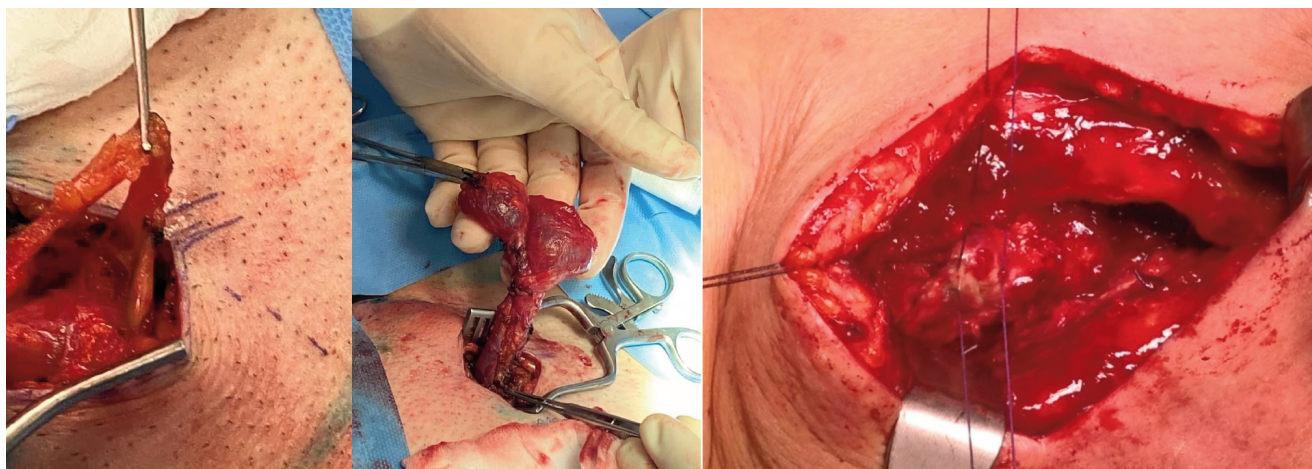


Figure 3. Surgical treatment of three clinical cases using Patent Blue Violet (PBV) dye to preserve lymphatic structures.

Embryology and anatomy

The canal of Nuck is an embryological structure that forms as an extension of the parietal peritoneum, following the round ligament through the inguinal canal towards the labia majora. It is the female equivalent of the processus vaginalis in males, which later develops into the tunica vaginalis surrounding the testes. Normally, the canal of Nuck undergoes obliteration during fetal development or shortly after birth. However, when this process is incomplete or fails, a patent canal remains, predisposing to the formation of a cyst or even an inguinal hernia. Anatomically, the round ligament originates from the uterus at the uterine horns and extends through the inguinal canal to attach to the labia majora. It serves as a support structure for the uterus, especially during pregnancy. The persistence of the canal of Nuck creates a potential space where fluid can accumulate, leading to a cystic mass. In some cases, this persistence can also allow abdominal organs to herniate, mimicking an inguinal hernia.

The cyst of Nuck is typically located in the inguinal region but may extend into the labia majora. The cyst is non-communicating when it is completely isolated, while in communicating cases, there is still a connection with the peritoneal cavity, leading to periodic size variations.¹⁻³

Clinical presentation

The cyst of Nuck typically presents as a painless or mildly painful swelling in the inguinal region or labia majora. The swelling is usually soft, fluctuant, and non-reducible, distinguishing it from an inguinal hernia, which may change in size with activity or pressure. In some cases, patients report tenderness or discomfort, particularly if the cyst becomes inflamed or infected. The size of the cyst can vary, and in communicating cases, the swelling may fluctuate due to periodic fluid accumulation. Some patients may experience a feeling of heaviness or pressure in the groin, especially after prolonged standing or physical activity. Unlike hernias, these cysts do not typically cause bowel obstruction or other gastrointestinal symptoms. On physical examination, the mass is well-defined, firm yet compressible, and usually does not transilluminate like a hydrocele. If the cyst becomes infected, signs of erythema, warmth, and tenderness may appear, sometimes accompanied by fever.

Diagnosis

The diagnosis of a cyst of Nuck can be challenging due to its rarity and similarity to other inguinal masses, such as inguinal hernias, lymphadenopathy, lipomas, Bartholin's cysts, or abscesses. A thorough clinical examination combined with imaging studies is essential for accurate identification.

During physical examination, the cyst typically appears as a soft, non-reducible, fluctuant mass in the inguinal or labial region. It may be painless or cause mild discomfort, particularly if inflamed or infected. Unlike hernias, the cyst does not change in size with coughing or straining (Valsalva maneuver) and is usually non-tender unless infected.

Imaging studies

Ultrasound

This is the first-line imaging modality, as it is non-invasive, widely available, and cost-effective. The cyst appears as an anechoic or hypoechoic fluid-filled lesion, often well-defined, with no internal vascularity on Doppler imaging. If the cyst is communicating, fluid movement between the peritoneal cavity and the cyst

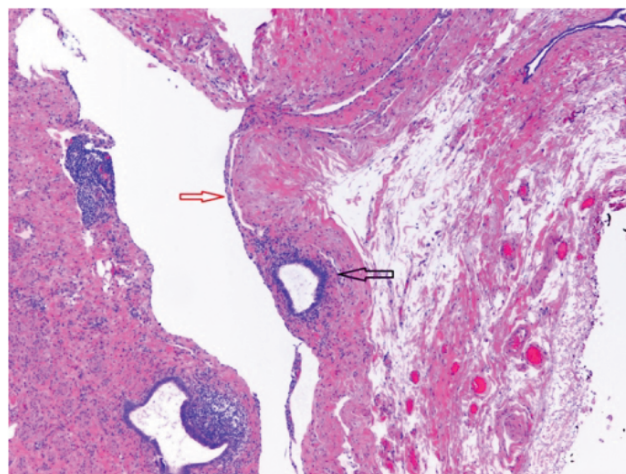


Figure 4. Cystic area lined with mesothelium (red arrow) and adjacent endometriotic glands (black arrow).

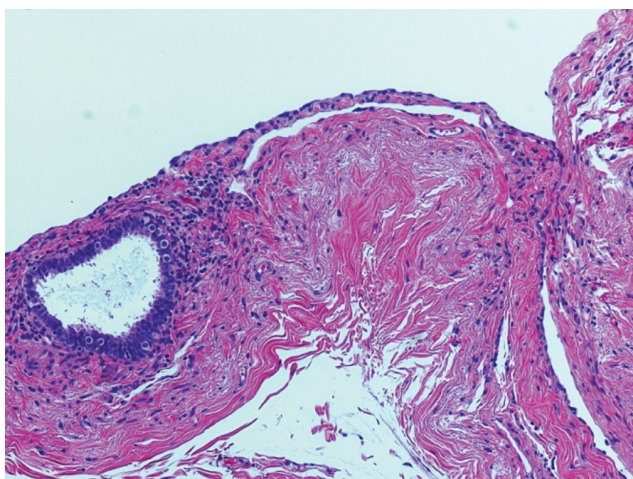


Figure 5. Close-up view of the cyst wall, showing endometriotic glands.

may be observed.

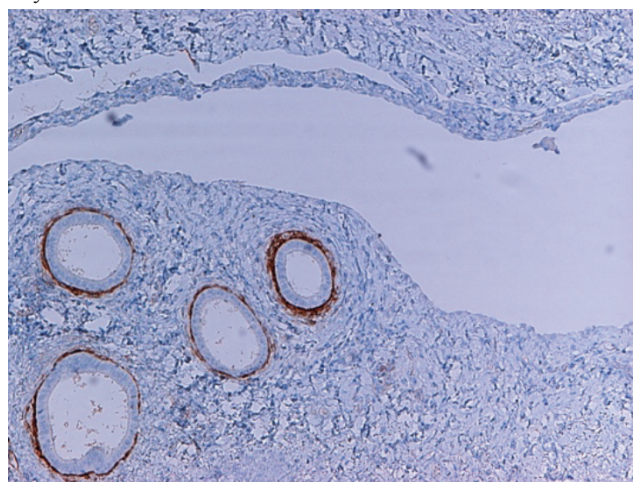


Figure 6. Immunohistochemical staining with CD10, highlighting the thin stromal rim surrounding the endometriotic glands within the cyst wall.

Magnetic Resonance Imaging

MRI provides greater anatomical detail and is particularly useful in complex or unclear cases. The cyst appears as a homogeneous fluid-filled structure with high signal intensity on T2-weighted images and low signal intensity on T1-weighted images. MRI can help distinguish the cyst from other soft tissue masses, especially in cases where infection or inflammation is suspected.

Computed Tomography

Although not typically required, CT scans may be useful if a hernia or malignancy is suspected. However, due to its radiation exposure, CT is not the preferred imaging modality, especially in younger patients.

Differential diagnosis

The cyst of Nuck must be differentiated from conditions such as: i) inguinal hernia, a reducible mass that may contain bowel or fat; ii) lymphadenopathy, a firm, non-fluctuant mass, often associated with infection or malignancy; iii) lipoma, a soft, fatty tumor with no fluid content; iv) Bartholin's cyst, a mass near the vaginal opening, typically associated with duct obstruction.⁴

Definitive diagnosis

A definitive diagnosis is confirmed through histopathological examination after surgical excision, which reveals a benign cystic structure lined with mesothelial or cuboidal epithelium, consistent with a remnant of the canal of Nuck.

Treatment

The primary treatment for a cyst of Nuck is surgical excision, as spontaneous resolution is rare. Surgery is recommended for symptomatic cases, cases with infection or enlargement, or when the diagnosis is uncertain. The standard procedure involves a small inguinal incision to expose and excise the cyst completely. If the cyst is communicating, the connection to the peritoneal cavity is carefully ligated to prevent fluid reaccumulation. Infected cysts may require drainage and antibiotic therapy before definitive surgery. In selected cases, laparoscopic excision may be performed, offering faster recovery, reduced scarring, and less postoperative pain. However, it is less commonly used due to the superficial location of the cyst. Surgical excision is curative, with a low

risk of recurrence. Early intervention prevents complications such as infection, secondary herniation, or discomfort.

Conclusions

The cyst of the canal of Nuck is a diagnostic and therapeutic challenge due to its resemblance to other inguinal pathologies. Beyond embryological and anatomical curiosity, this condition intersects with the clinical management of lymphatic and venous structures in the inguinal-genital region. Preservation of these structures is crucial during surgery to avoid complications such as lymphedema. Our experience demonstrates the value of meticulous surgical technique, imaging when indicated, and heightened awareness among clinicians. A multidisciplinary approach, integrating phlebological and lymphological expertise, enhances diagnostic accuracy and surgical safety. Although rare, a cyst of Nuck should always be considered in female patients presenting with an inguinal or labial mass, ensuring timely and optimal outcomes.

Awareness of this condition is crucial for surgeons, gynecologists, and radiologists, as delayed diagnosis can lead to mismanagement or unnecessary treatments. Although rare, a cyst of Nuck should always be considered in female patients presenting with an inguinal or labial mass, ensuring timely intervention and optimal patient outcomes.

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