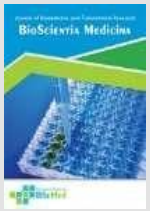
eISSN (Online): 2598-0580



Bioscientia Medicina: Journal of Biomedicine & Translational Research

Journal Homepage: www.bioscmed.com

Acute Urinary Retention and Obstructive Uropathy Secondary to Imperforate Hymen in a Premenarchal Adolescent: A Comprehensive Case Report

Siti Dian Meylani[1], Hervyasti Purwiandari[2], Ernawati[3]*

[1]Medical Professional Program, Faculty of Medicine, Universitas Tarumanagara, Jakarta, Indonesia

[2]Obstetrics and Gynecology Specialist, K.R.M.T Wongsonegoro Hospital, Semarang, Indonesia

[3]Department of Public Health, Faculty of Medicine, Universitas Tarumanagara, Jakarta, Indonesia

ARTICLE INFO

Keywords:
Adolescent gynecology
Hematocolpos
Hymenotomy
Imperforate hymen
Urinary retention

***Corresponding author:**
Ernawati

E-mail address:
ernawati@fk.untar.ac.id

All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.37275/bsm.v10i5.1581

A B S T R A C T

Background: Imperforate hymen, occurring in approximately 1 in 1,000 to 1 in 10,000 female births, is a rare congenital anomaly of the female reproductive tract that frequently remains undiagnosed until menarche. It can present atypically as acute urinary retention due to mechanical pelvic compression. **Case presentation:** A 12-year-old premenarchal girl presented to the emergency department with an 8-hour history of acute urinary retention, cyclic lower abdominal pain, and nausea. Her history revealed a 4-month progression of dysuria and painful defecation. Physical examination demonstrated a bulging, bluish vaginal membrane. Transabdominal ultrasonography revealed a 520 mL hematocolpos severely compressing the bladder neck, resulting in bilateral mild hydroureteronephrosis. The variance between the imaging estimate (520 mL) and the actual surgical yield (480 mL) reflects standard clinical overestimation in ultrasonographic volume calculations. The patient underwent an emergency cruciate hymenotomy with mucosal marsupialization. Postoperative recovery was uneventful. A 3-month follow-up confirmed the complete resolution of the hydroureteronephrosis and the establishment of normal, unobstructed menses. **Conclusion:** Delayed diagnosis of imperforate hymen can precipitate severe obstructive uropathy. Integrating routine external genitalia examinations in premenarchal adolescents presenting with lower urinary tract symptoms is imperative to prevent irreversible urological sequelae.

1. Introduction

An imperforate hymen represents one of the most common obstructive congenital anomalies of the female genital tract, characterized by the absolute failure of the hymenal membrane to perforate during fetal development.[1] To fully comprehend the clinical manifestations and the frequent diagnostic delays associated with this condition, it is imperative to first understand its embryological foundations. The female reproductive tract develops through a highly complex, synchronized orchestration of cellular differentiation, fusion, and canalization involving the paramesonephric ducts and the urogenital sinus. During normal fetal embryogenesis, the paramesonephric ducts fuse in the midline to form the upper female reproductive tract, comprising the fallopian tubes, the uterus, and the upper two-thirds of the vaginal canal. Concurrently, the lower one-third of the vagina develops from the sinovaginal bulbs, which arise from the urogenital sinus. The hymen itself is a thin, membranous vestige situated precisely at the embryological junction where the sinovaginal bulbs meet the urogenital sinus. Under normal developmental conditions, this membrane undergoes

central epithelial degeneration and programmed cell death, known as apoptosis, around the twenty-second week of gestation, thereby creating a patent connection between the internal vaginal canal and the external vaginal vestibule. An imperforate hymen manifests when this specific, highly localized cellular degeneration fails to occur, leaving a solid layer of stratified squamous epithelium and connective tissue that completely occludes the vaginal introitus.[2]

Worldwide, the epidemiological incidence of this specific congenital anomaly is estimated to range from one in every one thousand to one in every ten thousand female births.[3] Despite this relatively high prevalence among the spectrum of obstructive reproductive anomalies, the timely and accurate diagnosis of an imperforate hymen remains a pervasive, persistent, and highly problematic clinical challenge within the fields of pediatric and adolescent medicine. This persistent delay in diagnosis frequently occurs not due to the anatomical complexity of the condition, which is entirely superficial and externally visible, but rather due to a complex convergence of systemic healthcare practices, cultural sensitivities, and cognitive diagnostic biases.

Primarily, there is a recognized systemic lack of routine, comprehensive external genital examinations during standard pediatric wellness visits, particularly as female patients transition from early childhood into late childhood and early adolescence. Pediatricians and primary care providers often omit perineal and genital inspections in asymptomatic prepubertal girls due to time constraints, provider discomfort, or a desire to avoid causing psychological distress to the adolescent patient. Consequently, the optimal window for early, prophylactic diagnosis is routinely missed. Because the obstruction is located at the most distal point of the reproductive outflow tract, the condition typically remains entirely silent and asymptomatic throughout the entirety of childhood. The intact membrane effectively seals the vaginal canal, but without the presence of active hormonal stimulation or glandular secretions, there is no fluid accumulation to cause anatomical distortion or clinical discomfort.[4]

The clinical landscape alters drastically with the onset of puberty. As the hypothalamic-pituitary-ovarian axis matures, increasing levels of circulating estrogen and progesterone stimulate the development of secondary sexual characteristics and initiate the physiological processes leading to menarche.[5] The endometrial lining begins to proliferate and eventually sheds. However, because the vaginal outflow tract is completely obstructed by the imperforate hymen, the desquamated endometrial tissue, unfertilized ova, cervical mucus, and menstrual blood have absolutely no physiological exit route. This marks the insidious beginning of fluid accumulation within the distensible vaginal vault, creating a clinical entity known as a hematocolpos.

During the initial stages of hematocolpos formation, the symptoms are frequently non-specific, intermittent, and deceptively mild. This creates a profound symptom overlap between early hematocolpos and several highly prevalent, benign pediatric conditions.[6] Adolescents may present to primary care clinics with vague complaints of cyclical lower abdominal cramping, pelvic heaviness, or generalized lower back pain. Because these patients have not yet reported a visible first menstruation, providers rarely consider gynecological etiologies. Instead, the clinical presentation is heavily confounded by the mechanical pressure the expanding vaginal vault exerts on adjacent pelvic organs. The anterior rectal wall is frequently compressed, leading to functional gastrointestinal constipation and painful defecation, formally termed dyschezia. Simultaneously, the expanding hematocolpos presses against the posterior wall of the urinary bladder and the delicate pediatric urethra. This low-grade, early compression manifests as highly deceptive lower urinary tract symptoms, including dysuria, an increased frequency of urination, and a noticeably reduced voiding volume.

When a premenarchal adolescent presents with combined abdominal pain, constipation, and dysuria, medical providers overwhelmingly succumb to anchoring bias, attributing the symptoms to

incredibly common childhood ailments such as recurrent bacterial urinary tract infections or functional gastrointestinal constipation. Patients are frequently prescribed repeated courses of empirical antibiotics or osmotic laxatives, which predictably fail to resolve the underlying mechanical obstruction. This misdiagnosis not only prolongs the patient's physical suffering but also entirely obscures the true, rapidly expanding anatomical crisis developing within the pelvic cavity.[7]

As months pass and subsequent menstrual cycles occur, the volume of retained hemorrhagic fluid exponentially increases. The vagina, while highly distensible, eventually reaches its maximum capacity within the confines of the rigid, bony pelvic floor. The retained menstrual blood undergoes slow degradation, forming a thick, dark, viscous fluid characterized by high concentrations of hemosiderin-laden macrophages and sterile inflammatory markers. The physical physics of this expanding mass transition from causing mild irritation to creating a severe space-occupying lesion. The mechanical pressure exerted by this massive hematocolpos has severe local and systemic implications that can rapidly become life-threatening if left unaddressed.[8]

Locally, once the vaginal vault is distended to its absolute limit, the continuous accumulation of menstrual fluid begins to exert severe retrograde pressure upward into the uterine cavity, expanding the uterus to form a hematometra.[9] If the obstruction persists, this high-pressure system forces the retained blood and endometrial tissue backward through the fallopian tubes and into the peritoneal cavity. This retrograde menstruation is recognized as a primary pathological mechanism for the development of pelvic endometriosis. The introduction of sterile, irritating blood into the peritoneal space triggers a massive local inflammatory response, which can lead to the formation of dense pelvic adhesions, chronic pelvic pain syndromes, and a significantly increased lifelong risk of primary tubal infertility.

Clinically, the most dramatic and dangerous manifestation of this mechanical expansion is profound urological compromise. Acute urinary retention in these patients arises directly from the unrelenting physical pressure exerted by the massive hematocolpos on the lower urinary tract. The distended anterior vaginal wall forcefully pushes the urinary bladder anteriorly and superiorly, while simultaneously pinning the urethra against the unyielding pubic symphysis. This extreme anatomical distortion completely alters the normal urethrovesical angle, physically occluding the urethral lumen and rendering the patient entirely unable to void. The resulting acute urinary retention causes rapid, excruciating suprapubic pain and massive bladder distension.

This condition represents a critical urological emergency triggered entirely by a gynecological anomaly. The backward hydrostatic pressure from the overfilled, obstructed bladder is transmitted directly up the ureters to the renal pelvis. This anatomical distortion can progress rapidly to obstructive hydroureteronephrosis, a condition characterized by the swelling and dilation of the ureters and kidneys. If this severe post-renal obstruction is left untreated even for a short duration, the increased pressure within the renal parenchyma can collapse the delicate glomerular capillary beds, leading directly to acute renal impairment, nephron death, and potentially irreversible chronic kidney disease. A comprehensive systematic review of the current medical literature revealed the alarming frequency of these severe complications, noting that acute urinary retention is a primary presenting symptom in precisely 20.3 percent of all imperforate hymen patients, frequently occurring alongside the severe lower abdominal pain that is reported in 54.2 percent of documented cases. Despite the availability of advanced imaging modalities and a broad understanding of pediatric anatomy, the healthcare system continues to fail these young patients by allowing a superficial, easily identifiable membrane to progress to the point of organ-threatening obstruction. Addressing this diagnostic failure requires a fundamental paradigm shift in how primary care providers evaluate

adolescent females presenting with non-specific pelvic, gastrointestinal, or urological complaints.[10]

The primary aim of this study is to report a severe, highly illustrative case of acute urinary retention and bilateral hydroureteronephrosis occurring entirely secondary to an undiagnosed imperforate hymen in a twelve-year-old premenarchal adolescent. The novelty of this study lies in its exhaustive detailing of the pathophysiological correlation between progressive, early-warning lower urinary tract symptoms—which are almost universally mismanaged by frontline healthcare providers—and the eventual, catastrophic acute mechanical obstruction of the pelvic organs. By meticulously mapping this precise clinical trajectory from initial embryological failure to end-stage renal compression, this report establishes a critical, evidence-based framework advocating for earlier, targeted clinical interventions and specifically mandates the absolute inclusion of visual perineal examinations in all primary care settings evaluating pediatric genitourinary complaints.

2. Case Presentation

Written informed consent was obtained from the patient's legal guardian for the publication of this case report, accompanying clinical details, and medical imaging concepts. A 12-year-old premenarchal adolescent was brought by her mother to the emergency department with a chief complaint of being entirely unable to urinate for the past 8 hours. The anuria was accompanied by severe, progressive lower abdominal pain and episodes of acute nausea. The abdominal pain was described as intermittent and cramping in nature, was not alleviated by changes in posture, and was significantly aggravated by any physical pressure applied to the lower abdomen or suprapubic region, registering a Visual Analog Scale score of 7 out of 10.

A detailed retroactive clinical history revealed a 4-month progression of genitourinary and gastrointestinal symptoms. Initially, the patient complained of dysuria, which she described as a burning sensation strictly during micturition, accompanied by a pronounced change in her urination pattern. She reported increased urinary frequency but with vastly reduced voiding volumes, subjectively described as urinating little by little. Concurrently, she developed dyschezia, experiencing significant pain during bowel movements. Crucially, the patient reported experiencing cyclic lower abdominal pain that emerged every month at approximately the same time, lasting for 4 to 5 days, despite never having experienced visual menarche. The patient explicitly denied any history of fever, gross hematuria, hematochezia, prior episodes of acute urinary retention, or sexual intercourse.

Four months prior to the current admission, during the onset of dysuria and dyschezia, the patient's mother had sought care at a primary outpatient clinic (Table 1). Due to an incomplete physical assessment that omitted a perineal evaluation, the patient was presumptively diagnosed with non-specific pelvic pain and functional constipation. She was prescribed oral analgesics, which failed to resolve the underlying symptoms. Her basic immunization history was complete up to the age of 9 months.

Upon admission, the patient appeared moderately ill and in visible distress, though her vital signs remained within normal physiological limits (Blood Pressure: 110/70 mmHg, Heart Rate: 88 beats per minute, Respiratory Rate: 18 breaths per minute, Temperature: 36.8 degrees Celsius). Anthropometric measurements recorded a weight of 39 kg and a height of 150 cm. Secondary sexual characteristics were consistent with Tanner stage B2P1. Ophthalmic examination revealed bilateral pale conjunctivae, indicative of mild anemia. Abdominal examination revealed a visibly distended lower abdomen with marked suprapubic tenderness upon palpation, consistent with a distended bladder and underlying pelvic mass. A targeted gynecological and perineal examination was subsequently performed. No pubic hair was present, and the labia majora and minora were anatomically normal. However, the vaginal canal could not be visualized (Figure 1). The vaginal

introitus was completely occluded by a tense, thin, non-fenestrated membrane that was visibly bulging outward, exhibiting a distinct bluish-purple hue characteristic of an underlying hematocolpos. A digital rectal examination was cautiously performed to evaluate the extent of the pelvic mass. Palpation of the anterior rectal wall revealed a large, smooth, rubbery, and highly tender mass severely compressing the rectal vault (Table 2a).

Table 1. Four-Month Symptom Progression Timeline

Clinical progression from initial onset of symptoms to acute mechanical obstruction

TIMEFRAME	CLINICAL SYMPTOMS	CLINICAL INTERVENTION / ACTION TAKEN
Month 1 (4 months prior to admission)	• Onset of pain during urination, described as a burning sensation (VAS 5). • Changes in urination patterns, becoming more frequent but reduced in volume ("little by little"). • Painful bowel movements (dyschezia). • Cyclic lower abdominal pain begins, appearing at approximately the same time of the month.	• Patient's mother brought the patient to a primary clinic for the painful bowel movements and urination. • Patient was given painkillers, but the symptoms did not improve.
Months 2 - 3 (Progressive Phase)	• Progressive dysuria and painful defecation continued. • Cyclic lower abdominal pain continued to appear every month at approximately the same time. • Notable absence of menarche.	• Symptoms failed to improve despite previous administration of painkillers. • No further medical consultation sought during this immediate period; hematocolpos continued to expand undetected.
Month 4 (Acute) (Emergency Admission)	• Absolute inability to urinate (urinary retention) for the past 8 hours. • Severe lower abdominal pain (VAS 7), aggravated by pressure on the lower abdomen. • Accompanied by acute nausea.	• Patient was brought directly to the emergency room by her mother. • Definitive diagnosis established via physical examination and ultrasonography, leading to emergency surgical intervention.

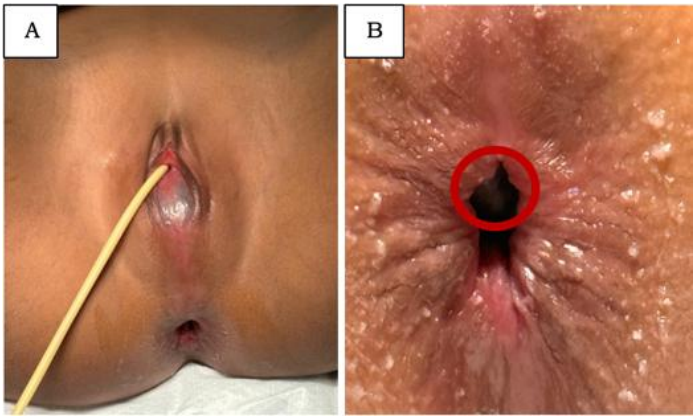


Figure 1. Genital and Anal Examination; (A) A catheter is in place, but the vagina cannot be optimally evaluated due to the presence of a thin membrane surrounding the vaginal introitus, accompanied by hematocolpos; (B) A protruding mass is visible (red ring) and palpable in the anterior rectum with a rubbery consistency, smooth surface, and tenderness.

To rule out a concurrent bacterial infection, a comprehensive metabolic panel and complete blood count were ordered. Laboratory findings confirmed mild anemia with a hemoglobin of 11.3 g/dL and a mild leukocytosis with a white blood cell count of 11,000/mL. From a methodological diagnostic standpoint, a urinalysis and urine culture were immediately performed via a sterile catheterized sample to definitively rule out a urinary tract infection. Both the nitrite and leukocyte esterase tests were negative, and the subsequent 48-hour urine culture showed no bacterial growth. This confirmed that the leukocytosis was a sterile inflammatory response to the prolonged retention of degenerating menstrual blood and the severe distension of local tissues, rather than an infectious process. Renal function tests revealed a slightly elevated serum creatinine of 1.1 mg/dL, indicating early acute kidney injury secondary to post-renal obstruction. A baseline thorax X-ray demonstrated normal cardiopulmonary anatomy.

Table 2a. Summary of Clinical Findings on Admission

Assessment Category	Detailed Clinical Findings
1. GENERAL APPEARANCE & VITAL SIGNS	
General Condition	• Patient appeared moderately ill and in visible distress. • Ophthalmic examination revealed bilateral pale conjunctivae, indicative of mild anemia. Abnormal
Vital Signs	• Blood Pressure: 110/70 mmHg. Normal • Heart Rate: 88 beats per minute. Normal • Respiratory Rate: 18 breaths per minute. Normal • Temperature: 36.8 degrees Celsius. Normal
Anthropometric & Developmental	• Weight: 39 kg; Height: 150 cm. • Secondary sexual characteristics consistent with Tanner stage B2P1.
2. TARGETED PHYSICAL EXAMINATION	
Abdominal Examination	• Visibly distended lower abdomen. Abnormal • Marked suprapubic tenderness upon palpation, consistent with a distended bladder and underlying pelvic mass.
Gynecological & Perineal Exam	• No pubic hair present; labia majora and minora anatomically normal. • Vaginal canal could not be visualized. • Vaginal introitus completely occluded by a tense, thin, non-fenestrated membrane. Critical Finding • Membrane was visibly bulging outward with a distinct bluish-purple hue characteristic of an underlying hematocolpos.
Digital Rectal Exam	• Palpation of anterior rectal wall revealed a large, smooth, rubbery, and highly tender mass. • Mass was severely compressing the rectal vault.

Both transabdominal and transperineal ultrasonography were utilized to precisely map the pelvic anatomy (Table 2b). The imaging revealed a massive, well-defined, echogenic fluid-filled structure located posterior to the bladder and anterior to the rectum, representing a severely distended vagina. The

mass measured 14.5 cm by 8.2 cm by 9.0 cm, yielding an estimated sonographic volume of 520 mL. The bladder was observed to be displaced far anteriorly and superiorly, suffering severe mechanical compression at the trigone and bladder neck, which explained the acute 8-hour anuria. Furthermore, the retrograde pressure from the distended bladder resulted in ultrasonographic evidence of bilateral mild hydroureteronephrosis, corroborating the biochemical evidence of early obstructive nephropathy.

Table 2b. Summary of Clinical Findings on Admission

Assessment Category	Detailed Clinical Findings
3. LABORATORY & RADIOLOGICAL INVESTIGATIONS	
Blood & Urine Laboratory	• Hemoglobin: 11.3 g/dL (mild anemia). Low • White Blood Cell Count: 11,000/mL (mild leukocytosis/sterile inflammation). Elevated • Urinalysis & Culture: Negative for nitrites and leukocyte esterase; no bacterial growth after 48 hours. Negative • Serum Creatinine: 1.1 mg/dL (indicating early acute kidney injury secondary to post-renal obstruction). Elevated
Pelvic Ultrasonography	• Revealed a massive, well-defined, echogenic fluid-filled structure (severely distended vagina). • Mass dimensions: 14.5 cm x 8.2 cm x 9.0 cm (estimated sonographic volume of 520 mL). • Bladder displaced far anteriorly and superiorly, suffering severe mechanical compression at the trigone and bladder neck. • Bilateral mild hydroureteronephrosis observed, corroborating obstructive nephropathy.
Thorax X-ray	• Demonstrated normal cardiopulmonary anatomy. Normal

Based on the convergence of clinical and radiological findings, a definitive diagnosis of acute urinary retention secondary to hematocolpos from an imperforate hymen was established. Immediate relief of the acute urological obstruction was prioritized (Table 3). The patient was catheterized, yielding 600 mL of concentrated urine, which immediately relieved the suprapubic tension. Intravenous fluid resuscitation was initiated with 500 cc of lactated Ringer's solution, and pain was managed via the administration of a generic ketoprofen suppository at a dose of 100 mg. Following multidisciplinary consultation between pediatric and obstetric-gynecology surgical teams, the patient was scheduled for an emergency cruciate hymenotomy.

Under general anesthesia, the patient was placed in the dorsal lithotomy position. A cruciate incision was meticulously made across the bulging hymenal membrane. Upon incision, 480 mL of thick, dark, retained menstrual blood was immediately evacuated under gravity drainage. The minor discrepancy between the pre-operative ultrasound estimation of 520 mL and the actual evacuated volume of 480 mL is a recognized clinical variance resulting from the geometric assumptions inherent in sonographic volume calculations. To prevent post-operative re-adhesion and stricture of the newly created introitus, a marsupialization technique was employed. The four resulting redundant mucosal wedges of the hymen were carefully excised, and the remaining hymenal edges were sutured to the vaginal vestibular mucosa using interrupted 3-0 absorbable polyglactin sutures. Crucially, to prevent the theoretical risk of iatrogenic ascending pelvic inflammatory disease or the retrograde flushing of endometrial tissue through the fallopian tubes, high-pressure vaginal vault irrigation

was strictly avoided. The remaining hematocolpos was allowed to drain entirely by gravity.

The patient experienced a rapid and uneventful postoperative recovery. Renal function markers normalized within 24 hours of the decompression. The indwelling Foley catheter was successfully removed on postoperative day two, followed by a trial of voiding, during which the patient demonstrated normal, spontaneous, and painless micturition with negligible post-void residual volumes. The patient was monitored via outpatient follow-up at one month and three months post-discharge. At the one-month follow-up, the hymenal ring was well-healed with no signs of re-adhesion or stricture. At the three-month follow-up, the patient reported experiencing regular, unobstructed menstrual cycles lasting 5 days, with complete resolution of her previous dysmenorrhea and cyclic pelvic pain. A repeat renal ultrasound at three months confirmed the absolute resolution of the bilateral hydroureteronephrosis, with both kidneys returning to normal dimensions and corticomedullary differentiation.

Table 3. Diagnosis, Treatment, Follow-up, and Outcome Summary

Phase of Care	Clinical Details & Interventions
I. DEFINITIVE DIAGNOSIS	
Diagnosis	• Acute urinary retention secondary to hematocolpos originating from an imperforate hymen. • Early acute kidney injury secondary to post-renal obstruction. • Bilateral mild hydroureteronephrosis.
II. INITIAL EMERGENCY MANAGEMENT	
Acute Relief	• Immediate relief of acute urological obstruction was prioritized. • Patient was catheterized, yielding 600 mL of concentrated urine, which immediately relieved suprapubic tension. • Intravenous fluid resuscitation initiated with 500 cc of lactated Ringer's solution. • Pain managed via the administration of a generic ketoprofen suppository at a dose of 100 mg.
III. SURGICAL INTERVENTION	
Surgery	• Patient was scheduled for an emergency cruciate hymenotomy following multidisciplinary consultation. • Procedure performed under general anesthesia with the patient in the dorsal lithotomy position. • A cruciate incision was meticulously made across the bulging hymenal membrane. • 480 mL of thick, dark, retained menstrual blood was evacuated under gravity drainage. • Marsupialization technique employed: the four redundant mucosal wedges were excised, and remaining hymenal edges were sutured to the vaginal vestibular mucosa using interrupted 3-0 absorbable polyglactin sutures. • High-pressure vaginal vault irrigation was strictly avoided to prevent theoretical risk of ascending pelvic inflammatory disease.
IV. FOLLOW-UP AND CLINICAL OUTCOMES	
Immediate Post-Op	• Renal function markers normalized within 24 hours of decompression. • Indwelling Foley catheter successfully removed on postoperative day two. • Patient demonstrated normal, spontaneous, and painless micturition with negligible post-void residual volumes.
1-Month Follow-Up	• Hymenal ring was well-healed with no signs of re-adhesion or stricture.
3-Month Follow-Up	• Patient reported experiencing regular, unobstructed menstrual cycles lasting 5 days. • Complete resolution of previous dysmenorrhea and cyclic pelvic pain. • Repeat renal ultrasound confirmed absolute resolution of bilateral hydroureteronephrosis. • Both kidneys returned to normal dimensions and corticomedullary differentiation.

3. Discussion

The clinical trajectory of the pediatric patient detailed in this current report perfectly encapsulates the diagnostic paradox inherent to an imperforate hymen: a simple, highly visible superficial anatomical defect that frequently masquerades as a complex urological or gastrointestinal pathology. The diagnostic challenge lies not within the complexity of the anatomical malformation itself, which is located at the most superficial aspect of the female reproductive tract, but rather within the profound and cascading systemic effects it exerts upon the adjacent pelvic organ systems. When frontline healthcare providers are confronted with a premenarchal adolescent presenting with severe abdominal pain, functional constipation, and voiding dysfunction, the cognitive anchoring bias heavily favors common childhood conditions over rare congenital anomalies. Consequently, the failure to perform a basic visual inspection of the external genitalia transforms a relatively straightforward anatomical variant into a severe, multi-organ clinical emergency.[11]

To fully comprehend the diverse clinical manifestations and the delayed diagnostic timeline associated with this condition, it is absolutely essential to examine its foundational embryological origins. An imperforate hymen is fundamentally an embryological failure of cellular degeneration.[12] An imperforate hymen results from the failure of the hymen to perforate during fetal development, creating a complete obstruction of the vaginal introitus. During the complex process of normal fetal development, the female reproductive outflow tract forms through a highly synchronized canalization and fusion process involving the paramesonephric ducts and the urogenital sinus. The hymen itself is a membranous tissue remnant situated precisely at the critical embryological junction where the developing vaginal plate meets the urogenital sinus. Under standard physiological conditions, the hymen typically opens or perforates around the 22nd week of gestation. According to the most widely accepted embryological theory, an imperforate hymen occurs when the hymen fails to properly canalize along with the developing vagina. In essence, an imperforate hymen develops when the vaginal plate does not canalize successfully, and the hymenal epithelial cells fail to degenerate as they should during embryonic development. Because this absolute physical obstruction is situated at the most distal point of the reproductive tract, the condition typically remains entirely asymptomatic until menarche, at which point accumulated menstrual blood distends the vagina and uterus. Throughout infancy and early childhood, the female reproductive axis is dormant; there are no active glandular secretions or endometrial desquamation to accumulate behind the imperforate membrane.[13]

However, the clinical paradigm shifts drastically upon the onset of ovarian function and the initiation of the hypothalamic-pituitary-ovarian axis. As the adolescent female begins her physiological transition through puberty, cyclic hormonal fluctuations stimulate the proliferation and subsequent shedding of the endometrial lining. Because the distal outflow tract is completely sealed by the imperforate hymenal membrane, the desquamated endometrial tissue, unfertilized ova, and menstrual blood have absolutely no physiological route of escape. This leads to the gradual, unrelenting expansion of the vaginal vault, creating a massive hematocolpos. The vaginal tissue is highly distensible and accommodating, allowing for the slow accumulation of a significant volume of fluid over many months before producing catastrophic mechanical compression on the surrounding pelvic architecture.[14]

An imperforate hymen causes vaginal outflow obstruction, leading to hematocolpos accumulation after menarche begins. The pathophysiology underlying the urological complications observed in this condition is dictated entirely by the close proximity and shared fascial boundaries of the anterior vaginal wall, the posterior wall of the urinary bladder, and the delicate pediatric urethra (Figure 2).[15] The distended vagina compresses the urethra and bladder neck, creating mechanical obstruction that explains the patient's 8-hour anuria and

suprapubic tenderness. As the hematocolpos expands anteriorly, it forcefully displaces the urinary bladder superiorly and anteriorly, fundamentally altering the normal anatomical urethrovesical angle. The massively distended anterior vaginal wall acts as a rigid, space-occupying lesion that pins the urethra against the unyielding bony structure of the pubic symphysis, creating a severe, physical mechanical outflow obstruction.

Acute urinary retention in these patients arises from mechanical pressure exerted by the expanding hematocolpos on the lower urinary tract, sometimes progressing to hydronephrosis or renal impairment if untreated. A comprehensive systematic review of the literature revealed urinary retention in 20.3 percent of imperforate hymen patients, often alongside abdominal pain in 54.2 percent of documented cases, highlighting its role as a key presenting symptom. Furthermore, this current case provides critical, actionable insight into the early-warning prodromal signs of this condition. In this patient, complaints of dysuria and urinary frequency disorders for four months reflect the possibility of urethral irritation as a result of pressure from the hematocolpos that has begun to form, a presentation often mistaken for a urinary tract infection.[15]

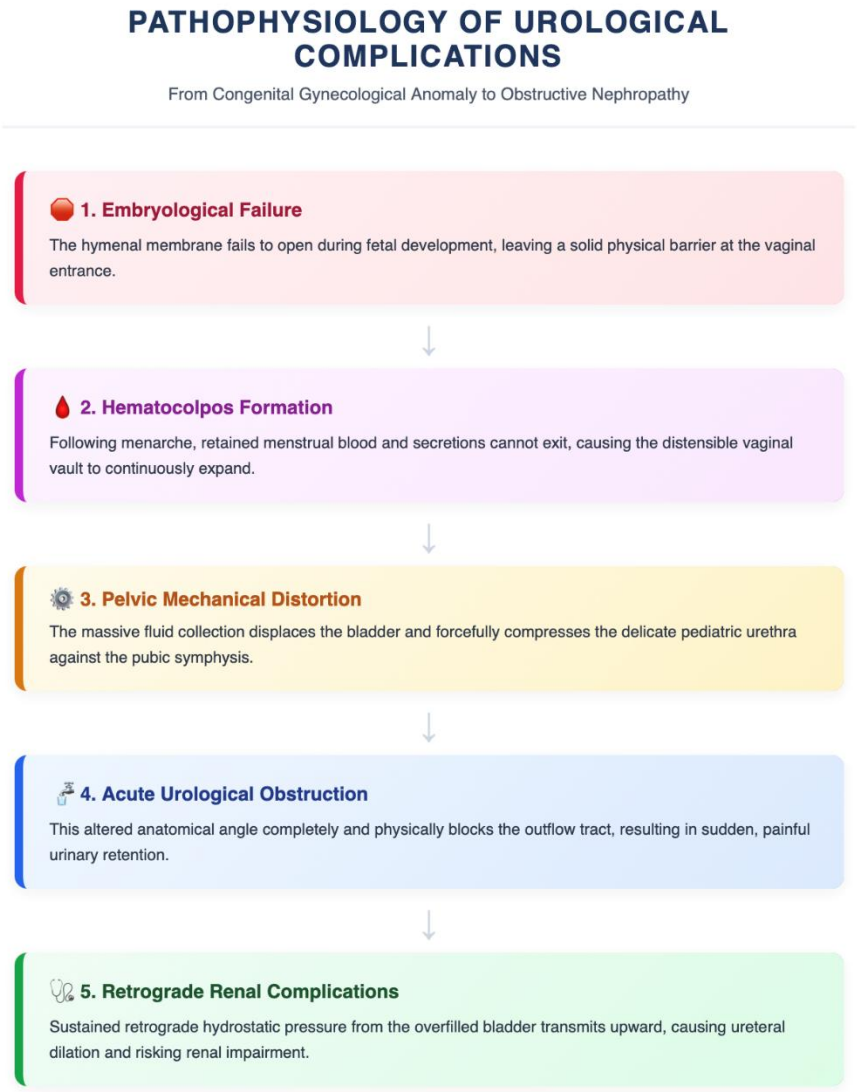


Figure 2. Pathophysiology of urological complications.

This specific four-month prodromal phase is of paramount clinical importance. The initial, low-grade mechanical compression generated by the nascent hematocolpos does not immediately cause total occlusion. Instead, it partially compresses the urethral lumen, resulting in a significantly reduced voiding volume and a compensatory increase in urinary frequency as the bladder attempts to overcome the heightened outflow resistance. The resultant stasis and mechanical irritation manifest subjectively as dysuria. These symptoms are almost universally misinterpreted by primary care providers as bacterial cystitis.[16] The cognitive anchoring bias toward diagnosing a common bacterial urinary tract infection often completely precludes the attending physician from performing the one diagnostic maneuver that would instantly yield the correct physiological answer: a simple visual inspection of the external genitalia.

Untreated imperforate hymen carries serious consequences beyond acute urinary retention. When the capacity of the vaginal vault is exceeded, the sustained, high-pressure accumulation of menstrual fluid exerts severe retrograde pressure. The retained fluid is forced upward, expanding the uterine cavity to create a hematometra. If the distal obstruction remains unresolved, this high-pressure fluid dynamic inevitably forces retrograde menstruation backward through the fallopian tubes directly into the peritoneal cavity. This retrograde menstruation increases the risk of endometriosis and infertility. The introduction of sterile, highly inflammatory menstrual blood into the abdominal cavity triggers a profound localized immune response, vastly increasing the adolescent's lifelong risk of developing dense intra-abdominal adhesions, chronic pelvic pain syndromes, and primary tubal infertility. Simultaneously, the continuous retrograde hydrostatic pressure from the overfilled, mechanically obstructed bladder is transmitted superiorly up the ureters to the renal collecting systems. Chronic ureteral compression may lead to hydronephrosis; acute renal failure occurs in 2 percent of cases. This cascade underscores the fact that a seemingly benign, superficial membrane anomaly can rapidly deteriorate into a life-threatening scenario involving permanent parenchymal renal damage if the clinical signs of progressive obstructive nephropathy are ignored.[17]

The definitive and standard treatment for an imperforate hymen involves surgical intervention, most commonly hymenectomy or hymenotomy. However, the specific choice of surgical technique remains heavily debated within the specialized field of adolescent gynecology. The overarching goal of any surgical intervention must be to achieve complete, immediate drainage of the retained hematocolpos, relieve the mechanical compression on the urinary and gastrointestinal tracts, and ensure long-term patency of the vaginal introitus to facilitate unobstructed future menstruation.

Simple, rudimentary linear incisions or blind needle aspirations of the bulging membrane are universally condemned within modern surgical practice. These inadequate approaches carry an unacceptably high risk of postoperative tissue re-adhesion and stricture formation, leading directly to a recurrent hematocolpos.[18] Furthermore, inadequate drainage creates a stagnant pool of necrotic blood within the vaginal vault, which serves as an ideal culture medium for exogenous bacteria, drastically increasing the risk of pyometra, systemic sepsis, or iatrogenic pelvic inflammatory disease. In the presented case, under general anesthesia, the emergency cruciate incision of the imperforate hymen immediately evacuated 480 mL of thick, dark retained menstrual blood.

Currently, the cruciate incision technique, combined with the deliberate surgical excision of the redundant mucosal tissue wedges and the careful marsupialization of the remaining hymenal edges to the vaginal vestibular mucosa, is widely considered the gold standard of care. This specific reconstructive technique ensures a permanently patent introitus, prevents postoperative stricture, and allows the thick, viscous, chocolate-like hematocolpos fluid to drain efficiently via natural gravity without the need for high-pressure internal irrigation, which could

theoretically force infectious material retrograde through the fallopian tubes.

Recently, highly conservative, virginity-sparing techniques have been proposed and debated within specific cultural contexts where an intact hymenal ring holds significant sociocultural and psychosocial importance. These alternative techniques often involve making micro-incisions or utilizing small-caliber Foley catheters to slowly drain the hematocolpos fluid over an extended period while attempting to preserve the gross architectural integrity of the hymenal ring. However, these highly conservative approaches inherently carry a significantly higher risk of inadequate fluid drainage and subsequent ascending pelvic inflammatory disease. Therefore, such conservative measures were entirely contraindicated for the specific patient in this report, who was already presenting with emergent acute urinary retention, severe physical distress, and early biochemical and radiological evidence of renal compromise. The immediate relief of the obstructive uropathy necessitated definitive, expansive surgical fenestration.[19]

While this case provides a robust clinical and pathophysiological analysis, there are inherent limitations to single-patient case reports regarding generalizability. The isolated nature of a single clinical narrative cannot definitively represent the broad epidemiological spectrum of this congenital anomaly. Furthermore, long-term longitudinal data detailing the patient's future fertility outcomes and definitive risk of endometriosis following delayed intervention are not currently available within the scope of this acute presentation. The true longitudinal impact of the retrograde menstruation experienced by this patient during her four-month diagnostic delay will require years of careful gynecological monitoring to accurately assess.[20]

Regarding future clinical and diagnostic directions, some previous literature has suggested the routine use of advanced imaging modalities to evaluate complex pelvic anatomy. Specifically, advanced imaging studies utilizing dynamic pelvic MRI could provide deeper insights into the precise fascial distortion patterns causing urethral compression in hematocolpos, potentially guiding minimally invasive, virginity-sparing surgical techniques. However, this current study strongly argues against the routine application of magnetic resonance imaging for the initial evaluation of a suspected imperforate hymen. Advanced pelvic Magnetic Resonance Imaging is highly resource-intensive, financially prohibitive, and functionally unnecessary for diagnosing this specific, superficial pathology. As clearly demonstrated in this case, a standard, low-cost transabdominal and transperineal ultrasound is highly sensitive, readily accessible, and entirely sufficient for definitively diagnosing a massive hematocolpos, mapping its mechanical relationship to the bladder, and thoroughly evaluating any concomitant renal complications. Future research must pivot toward prospective, multicenter observational studies evaluating the efficacy of standardized pediatric screening protocols. The scientific community must move beyond reporting the physiological consequences of delayed diagnosis and instead focus heavily on preventative clinical methodologies. Specifically, studies analyzing the diagnostic yield of mandated external genital examinations in premenarchal females presenting to primary care with lower urinary tract symptoms or functional constipation are critically needed. By systematically quantifying the number of diagnostic errors that could be prevented through mandated perineal inspections, future research can drive fundamental policy changes in pediatric clinical assessment guidelines.

4. Conclusion

This case of acute urinary retention secondary to an imperforate hymen in a 12-year-old premenarchal girl highlights the importance of a comprehensive clinical assessment. The complex downstream physiological devastation caused by this simple structural anomaly serves as a profound reminder that localized anatomical defects rarely exist in

physiological isolation. A systematic physical examination and a detailed menstrual history are key considerations in evaluating adolescents with genitourinary complaints. Healthcare providers must overcome cultural hesitations and diagnostic anchoring biases to ensure that every premenarchal adolescent presenting with lower pelvic symptoms receives a thorough physical evaluation that explicitly includes the external genitalia. Although an imperforate hymen is relatively rare, its initial presentation with dysuria followed by acute urinary retention can easily be mistaken for more common conditions, resulting in delayed diagnosis and missed opportunities for early intervention. The insidious, four-month progression of voiding dysfunction experienced by the patient in this report perfectly illustrates how easily early-warning signs are dismissed as routine pediatric ailments. Earlier recognition would have prevented this period of diagnostic uncertainty and allowed for timely definitive treatment. Earlier recognition of the visually obvious bulging hymenal membrane during the patient's initial clinic visit four months prior would have completely prevented the excruciating pain of absolute urinary retention, the prolonged exposure to retrograde menstruation, and the severe risk of permanent renal parenchymal damage.

Therefore, a single, definitive, and unyielding clinical recommendation must be established for all pediatric and primary care providers: integrating routine external genitalia examinations in premenarchal adolescents presenting with lower urinary tract symptoms is imperative to prevent irreversible urological and gynecological sequelae. A brief, visual perineal inspection must become an absolute mandatory requirement for any premenarchal female presenting with recurrent urinary retention, persistent dysuria that remains unresponsive to standard antimicrobial therapies, or unexplained, cyclic lower abdominal pain. Only through the rigorous application of comprehensive physical examinations can the medical community prevent this easily correctable embryological anomaly from progressing into a devastating urological and reproductive emergency.

5. References

1. Williams C, Santiago D, Cravey C, Rosenzweig D, Isagba E, Jackson M, et al. Imperforate hymen with bicornuate uterus in an adolescent patient. Open J Obstet Gynecol. 2025; 15(10): 1628–33.
2. Chang Y, Lin Y, Hung C, Chai W. A young girl with bilateral buttock pain accidentally finding of imperforate hymen - A case report. In: ISMRM Annual Meeting. Concord, CA: ISMRM; 2025.
3. Kadohisa M, Horiike M, Fujino H, Nonogaki T, Takada N. Clinical features, diagnostic approach, and outcome of imperforate hymen: a single institution case series. Pediatr Int. 2025; 67(1): e70011.
4. Franjic S. Imperforate hymen is the most common obstructive vaginal anomaly. Mathews J Gynecol Obstet. 2025; 9(3).
5. Shahi D, Khanal A, Nagarkoti N, Yamuna, Upadhaya S. Rare presentation of imperforate hymen in a 16-year-old: a case report from Nepal. Authorea Inc. 2025.
6. Hanson C, Hanson B, Miller M, Kumar P, Arnold T. Delayed diagnosis of congenital imperforate hymen resulting in obstructing hematometrocolpos. North American Proceedings in Gynecology and Obstetrics – Supplemental. 2025.
7. Alghanim H, Aldraihem K, Alenaze B, Alrabah Y, Alageel A, Alosaimi A, et al. Early diagnosis of imperforate hymen in a pediatric patient: a case report. Cureus. 2025; 17(4): e83121.
8. Bian W, Gu J, Yang J, Wang Y. Intra- and extra-uterine diagnosis and treatment of peripartum imperforate hymen: a case report. Front Pediatr. 2025; 13: 1546721.
9. Parikesit PG, Kirani DT, Triroso CD, Kusumosih TAR. Diagnostic dilemma of an imperforate hymen: a rare case with atypical

symptoms. Cureus. 2025; 17(4): e83179.
10. Millennie HE, Sunur YR. Unveiling a hidden condition: managing imperforate hymen in a rural setting. Intisari Sains Medis. 2025; 16(2): 593–6.
11. Casey SR, Fang ME, Goytia K, Monestime G, Dietrich JE. Diagnostic accuracy of imperforate hymen at a single referral center. J Pediatr Adolesc Gynecol. 2025; 38(4): 521–4.
12. Owolabi BO, Owolabi JI, Amode O, Oruade O. Imperforate hymen a cause of acute abdomen and hydronephrosis in a 15 year old girl. A case report. Med J Zambia. 2025; 52(4): 696–700.
13. Sakhifa SA, Priyadharshini M, Jayanthi. A case series of imperforate hymen. Int J Reprod Contracept Obstet Gynecol. 2025; 14(9): 3111–3.
14. Kato RN. A pubertal girl with urinary obstructive symptoms and overflow incontinence due to imperforate hymen: a case report. Eur J Obstet Gynecol Reprod Biol. 2025; 313(114415): 114415.
15. Podleśna M, Zgodzińska M, Sieńko C, Brodowska J, Torres A, Rybojad B, et al. Imperforate hymen with renal complications? A case of 2-day-old patient with hydrometrocolpos. J Pre-Clin Clin Res. 2025; 19(3): 96–8.
16. Benben A, Nesi L, Suson K. Home deliveries and hydrocolpos: a rare case presentation of imperforate hymen diagnosed at 4 months of age. Spartan Med Res J. 2025; 10(2).
17. Kleina J, Wieczorek M, Markowska K, Nierzwicka K, Leszkowicz J, Szlagatys-Sidorkiewicz A. Severe abdominal pain mimicking appendicitis caused by imperforate hymen: Case report and narrative review. Pediatr Rep. 2026; 18(1): 10.
18. Inoue A, Otsuki T, Ishizuka K, Ikegami K, Isono R, Ie K, et al. Hematocolpometra due to imperforate hymen. Clin Case Rep. 2026; 14(2): e71938.
19. Almoustafa F, Almustafa NE, Farag A, Al Chamy H, Haddad S, Jabaly S. Congenital imperforate hymen in a newborn presenting with vaginal protrusion and abdominal distension: a rare case report. J Surg Case Rep. 2026; 2026(2): rjag047.
20. Kulasinghe KANA, Natallia K. Diagnostic tactics of hematocolpos following imperforate hymen mimicking a large ovarian cyst: a case report and a literature review. Surgery Case Reports. 2026; 7(100163): 100163.