



Heavy uterine bleeding as an unusual presentation of posterior nutcracker syndrome in an adolescent

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ABSTRACT

Posterior nutcracker syndrome results from compression of the left renal vein between the aorta and the spine, secondary to an anomalous and rare anatomical location of the vein. The typical clinical presentation includes hematuria and chronic pain. We present the case of a 14-year-old female patient with a 20-day history of heavy uterine bleeding requiring a red blood cell transfusion. An abdominal ultrasound was performed, revealing dilation of the left gonadal and ovarian veins. CT angiography and phlebography confirmed ovarian varices and dilation of the left gonadal and renal veins, revealing a posterior left renal vein location suggestive of posterior nutcracker syndrome. We performed surgical correction by transposing the left renal vein, with a favorable medium-term outcome.

Keywords: renal nutcracker syndrome; congenital anomalies; renal circulation; uterine hemorrhage.

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INTRODUCTION

Nutcracker syndrome is defined as the set of signs and symptoms resulting from compression of the left renal vein (LRV), with impaired blood flow to the inferior vena cava (IVC).¹⁻³ Its prevalence remains unclear because diagnostic criteria are not uniform and LRV compression is often asymptomatic.^{3,4} In the posterior variant, the LRV runs retroaortically and is compressed by the aorta and the vertebral body. This anatomical presentation is rare, with few reported cases.^{2,3,5-7}

The most common symptoms include hematuria, abdominal pain, and proteinuria.^{1,3,4,6} Gynecological symptoms are rare and have been reported primarily in adults; they include chronic hypogastric pain, dyspareunia, dysmenorrhea, and, less frequently, abnormal uterine bleeding (AUB).^{2,4,8} The International Federation of Gynecology and Obstetrics defines AUB as excessive menstrual bleeding that affects the patient's physical, social, and/or emotional quality of life, and it must be characterized by its frequency, regularity, duration, and volume.⁹ In pediatrics, its occurrence is rare and has not previously been described as a primary clinical sign.¹⁰ We report the case of an adolescent with this variant and atypical clinical presentation.

CLINICAL CASE

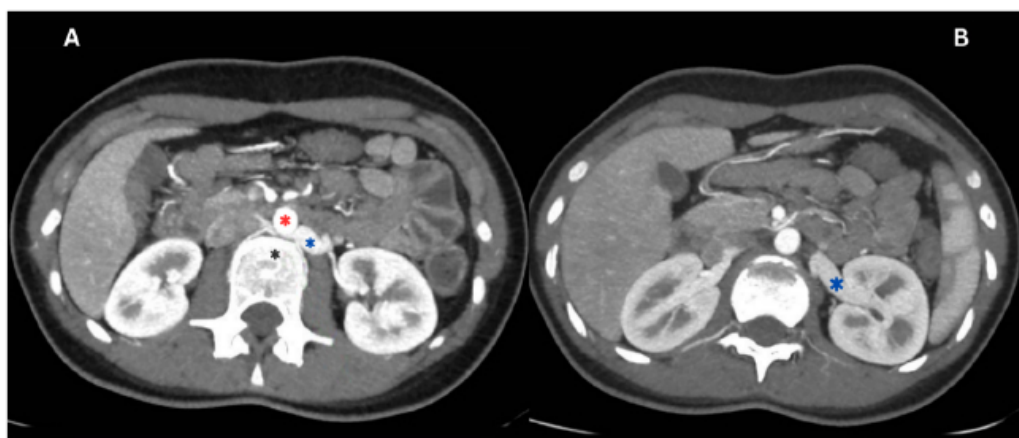
A 14-year-old girl, previously healthy, presented with an episode of AUB and severe

abdominal pain that had been ongoing for 10 days. She reported heavy menstrual periods since menarche, with increased bleeding during her last period and the need to change her sanitary pads every 20 minutes. She had no significant family history.

Upon admission, she was in fair general condition, alert, with a blood pressure of 92/58 mmHg, marked pallor of the skin and mucous membranes, tachycardia (heart rate 124 bpm), and moderate active genital bleeding. The gynecological examination revealed trophic breasts, a vulva without lesions, a coral-shaped hymen without lesions or bleeding, and a healthy vulvar fornix. She presented with anemia (hematocrit of 21% and hemoglobin of 7.1 g/dL), requiring a red blood cell transfusion. The Pediatric and Adolescent Gynecology team conducted a comprehensive evaluation, ruling out platelet disorders and coagulopathies, and prescribed combined oral contraceptives (estradiol valerate/dienogest), to which she adhered well.

Due to persistent abdominal pain and acute upper abdominal pain, additional tests were ordered. A gynecological ultrasound revealed varicose veins in the left ovary, and a CT angiogram showed a retroaortic left renal vein and gonadal vein dilation, suggestive of posterior nutcracker syndrome (*Figures 1 and 2*). Phlebography confirmed dilation of the LRV

FIGURE 1. Angiotomography



A) The left renal vein (blue asterisk) is visible, running retroaortically and compressed between the abdominal aorta (red asterisk) and the spine (black asterisk), a finding consistent with posterior nutcracker syndrome.

B) Dilatation of the left renal vein (blue asterisk) compared to the right renal vein.

and the uterine vein, with varicose veins along their course (*Figure 3*). We measured pressure in the LRV and the inferior vena cava (IVC), with a venous gradient of 2 mmHg.

Once we confirmed the suspected diagnosis, we decided on the surgical approach. We made a midline supraumbilical incision, dissected the IVC, and identified the LRV, which ran retroaortically from the renal hilum (*Figure 4*). To prevent renal congestion, we controlled the renal hilum and clamped the renal artery. We transected and mobilized the LRV for anastomosis to the IVC, anterior to the aorta, using two continuous 7-0 PDS sutures, with a total warm ischemia time of 40 minutes. Intraoperative heparin was administered at 100 IU/kg, with no reversal or hemorrhagic complications. Finally, we visually confirmed adequate left kidney vascularization and placed a tubular drain.

A renal Doppler ultrasound performed 24 hours after surgery showed normal resistance indices. The patient's course was favorable, with drain removal on the seventh day and discharge on the eighth day. During outpatient follow-up, the patient reported a significant reduction in pain and menstrual bleeding, requiring approximately three changes of sanitary pads per day. A Doppler ultrasound performed one month later showed

adequate renal perfusion and reduced ovarian varices. From a gynecological standpoint, given the improvement in bleeding following surgical treatment, medical therapy continued with low-dose combined oral contraceptives (30 µg ethinyl estradiol and 100 µg levonorgestrel), with good adherence and ongoing clinical and hematological follow-up.

DISCUSSION

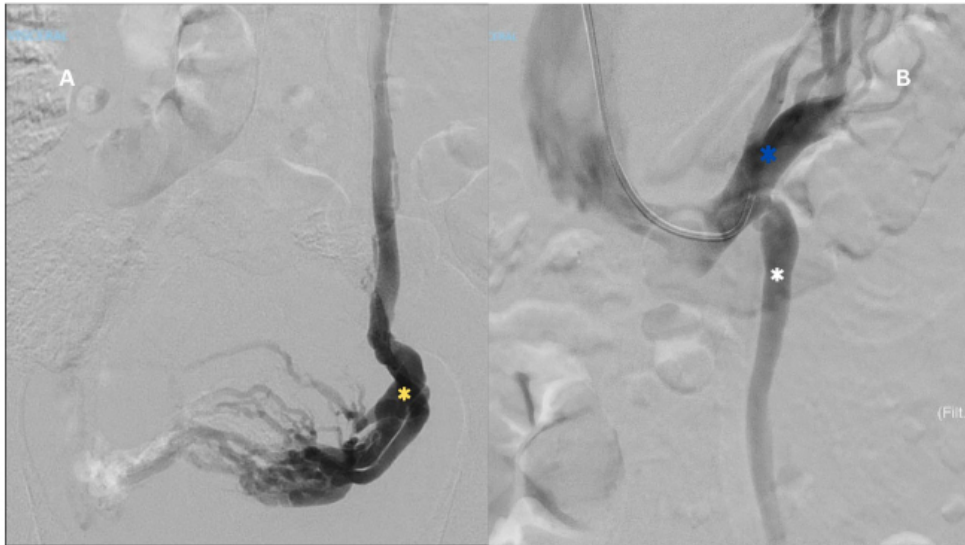
Nutcracker syndrome is classified as anterior, posterior, or combined based on the anatomical relationship between the LRV and the aorta.^{1,6,7} In the anterior variant, the LRV is compressed along its course between the aorta and the superior mesenteric artery; in the posterior variant, the LRV travels into the retroaortic space and is compressed between the aorta and the vertebral column; whereas the combined, or collar-like, form is associated with duplication of the LRV, with both anterior and posterior compression.⁶ The posterior nutcracker syndrome is particularly rare, and its diagnosis is more complex. However, the clinical manifestations may overlap between the two forms, making them difficult to differentiate.³

Given its low prevalence, it is usually diagnosed in patients with chronic abdominal pain after other causes have been ruled out.^{2,4}

FIGURE 2. Three-dimensional reconstruction from computed tomography angiography

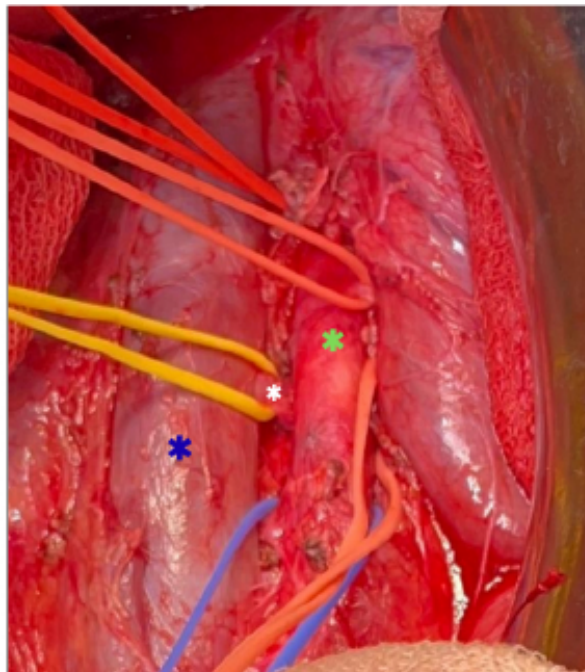


A) and B) The abdominal aorta (red asterisk), the left renal vein (blue asterisk) with a retroaortic course, and the dilated left gonadal vein (white asterisk) are identified; these findings are consistent with posterior nutcracker syndrome.

FIGURE 3. Phebography

A) Dilatation of the left gonadal vein with varicose veins at the level of the ovarian vein (yellow asterisk).

B) Dilated left renal vein (blue asterisk) and left gonadal vein (white asterisk). Venous manometry measured pressures in the left renal vein and the inferior vena cava, revealing a venous gradient of 2 mmHg.

FIGURE 4. Intraoperative image

Intraoperative image showing the aorta (green asterisk), the inferior vena cava (blue asterisk), and the left renal vein (white asterisk), which runs from the retroaortic space to its opening into the inferior vena cava.

Its classic clinical manifestations include hematuria^{1,3,6} and proteinuria as the predominant signs.^{3,7} Gynecological manifestations are rare and include pelvic congestion syndrome, dyspareunia, dysmenorrhea, chronic hypogastric pain, and, exceptionally, AUB.^{4,8} In pediatrics, onset with gynecological symptoms is rare, and AUB as the predominant manifestation has not been previously described.¹⁰ This presentation highlights the need to consider this condition in adolescent patients with AUB who have an unsatisfactory response to hormonal treatment.

The initial management of AUB in adolescents is primarily medical, involving hormonal therapy and supportive measures.^{11,12} In our patient, the initial management stabilized her condition and partially controlled the bleeding. Still, the persistent pain and the finding of pelvic varicose veins led to the identification of an underlying vascular cause that required surgical treatment.

Abdominal Doppler ultrasound is usually the first diagnostic method used to assess LRV diameter and changes in flow velocity, with a proposed cutoff value greater than 4.2 for the diameter ratio and greater than 4.7 for the peak velocity ratio.^{2,4,7} Angiotomography allows for the detection of the position of vascular structures, their diameter and relationship to the dilated portion of the vessel, the presence of collaterals, and the measurement of the aortomesenteric angle, which should be less than 35°. ²⁻⁴ Phlebography with measurement of the pressure gradient between LVR and the inferior vena cava (IVC) has been considered the gold standard, with a gradient greater than 3 mmHg being highly suggestive.^{2,3,5} However, the presence of collateral circulation can reduce the gradient; therefore, lower values do not rule out the diagnosis when findings such as pelvic varicose veins and venous dilation are present.¹ Its diagnostic value remains controversial due to the lack of controlled trials, variability in cutoff points, and factors such as the patient's position.^{1,4} Consequently, diagnosis is challenging and requires the integration of clinical and imaging findings.

Initial treatment should be conservative, with symptomatic management, with follow-up for up to 2 years.^{1,2,7} In pediatrics, weight gain and an increase in retroperitoneal fat may alleviate vascular compression, with resolution rates of up to 75 %, ^{1,2,7} a phenomenon not clearly documented in the posterior variant.³ Surgery is reserved for cases where conservative treatment has failed or where there are severe symptoms,

such as anemia or disabling pain.^{2,5}

LRV transposition is considered the gold-standard surgical strategy.^{1,2,4,5} Other alternatives, such as endovascular stenting, have gained popularity due to their minimally invasive nature; however, a recent review showed a 92% improvement in symptoms among patients who underwent LRV transposition, compared with 76% among those who underwent endovascular stenting, with an increased risk of thrombosis in the posterior variant.² Furthermore, the Delphi consensus (2025) adds uncertainty due to the risk of stent migration, vascular growth, and long-term durability in the pediatric population.^{1,2} On the other hand, their use in the posterior variant is limited and rarely described in the pediatric literature.^{5,6} Extravascular prostheses show encouraging initial results but require validation through larger series and long-term follow-up.^{13,14} Laparoscopy and robotic surgery have gained acceptance due to their lower morbidity,^{2,10,15} although there is insufficient evidence of superiority over open surgery.¹ Renal autotransplantation can alleviate symptoms, especially pain, but its primary indication remains controversial.²

We present an exceptional case of posterior nutcracker syndrome in a pediatric patient with predominant AUB, which broadens the clinical spectrum of this condition and highlights the importance of considering it in the differential diagnosis of abnormal gynecological bleeding in adolescents, especially in atypical cases or when there is an inadequate response to conventional treatment. ■

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