

Retroaortic Left Renal Vein in Para-Aortic Lymphadenectomy: A Case Report

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Abstract

A retroaortic left renal vein (RLRV) is an anatomical variant in which the left renal vein courses posterior to the abdominal aorta before draining into the inferior vena cava. This variant may be important during para-aortic lymphadenectomy because unexpected venous anatomy can increase the risk of vascular injury. We describe a 44-year-old female undergoing surgical staging for right ovarian mucinous carcinoma whose RLRV was identified on preoperative contrast-enhanced computed tomography (CT). During para-aortic lymphadenectomy, careful blunt dissection was advanced cranially along the left lateral border of the aorta until the inferior border of the RLRV was identified. The left ovarian vein drained into the left renal vein. The procedure was completed without vascular injury; estimated blood loss was 509 mL for the entire operation. Histopathology showed International Federation of Gynecology and Obstetrics (FIGO) stage IA mucinous ovarian carcinoma, with no metastases in 37 pelvic or 11 para-aortic lymph nodes and negative peritoneal washing cytology. No adjuvant chemotherapy was administered, and the patient remained recurrence-free at 15 months. Postoperative three-dimensional CT reconstruction yielded a 180° rotational sequence of 36 images. The reconstruction was not used for surgical planning. This case emphasizes the importance of preoperative review of renal venous anatomy and careful intraoperative identification of vascular landmarks.

Categories: Obstetrics/Gynecology, Radiology, Anatomy

Keywords: ovarian cancer, para-aortic lymphadenectomy, renal vein variant, retroaortic left renal vein, surgical complication, three-dimensional computed tomography

Introduction

The left renal vein usually courses anterior to the abdominal aorta before entering the inferior vena cava (IVC) and serves as an important cranial anatomical landmark during para-aortic lymphadenectomy. A retroaortic left renal vein (RLRV) passes posterior to the aorta; its pooled prevalence has been estimated at approximately 3% [1]. Although often asymptomatic, RLRV is relevant to retroperitoneal surgery because unrecognized venous anatomy may increase the risk of vascular injury [2]. Renal venous variants have been documented in women undergoing para-aortic lymphadenectomy for gynecologic malignancies [2-4]. We report an ovarian cancer staging operation in which preoperative CT identified an RLRV, and describe the surgical steps used to recognize the vein and establish the cranial limit of dissection. This report illustrates the correlation between preoperative CT identification of an RLRV, its intraoperative anatomical relationship to the para-aortic lymphadenectomy field, and postoperative three-dimensional visualization of the vascular anatomy.

Case Presentation

A 44-year-old female was referred to our institution for evaluation and treatment of a right ovarian tumor that had been detected incidentally. She was asymptomatic and had no significant medical history or comorbidities. Her body mass index was 23.3 kg/m², and she was nulligravida and nulliparous (gravida 0, para 0). Magnetic resonance imaging (MRI) demonstrated an approximately 8-cm multilocular right ovarian mass with solid components and contrast enhancement. No ascites was observed. Serum CA125 and CA19-9 levels were 8.0 U/mL and 19.7 U/mL, respectively, both within the normal ranges. Serum carcinoembryonic antigen (CEA) was not measured preoperatively. Contrast-enhanced CT showed no distant metastases or enlarged lymph nodes, and clinical stage I ovarian cancer was suspected. Preoperative contrast-enhanced CT obtained in the portal venous phase with 5-mm reconstructed sections demonstrated the left renal vein coursing posterior to the abdominal aorta and draining into the IVC, consistent with an RLRV (Figure 1).

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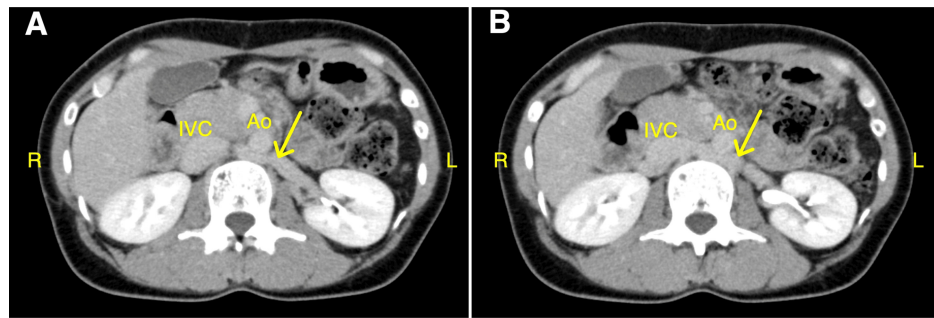


FIGURE 1: Preoperative computed tomography showing a retroaortic left renal vein.

Preoperative portal venous phase contrast-enhanced CT (5-mm sections) demonstrating a retroaortic left renal vein (RLRV). (A) The RLRV (arrow) passes posterior to the abdominal aorta. (B) An axial image obtained 5 mm caudal to (A), again showing the retroaortic course (arrow). Axial images are displayed in standard radiological orientation (patient's right on image left). The abdominal aorta (Ao) and inferior vena cava (IVC) are labeled in both panels. The labels R and L indicate the patient's right and left sides, respectively. The axial CT images are displayed in the standard radiological orientation, with the patient's right side appearing on the left side of the image.

The RLRV was not described in the original radiology report from the referring institution but was identified by the surgical team during preoperative review of the CT images. The RLRV drained into the IVC at the level of the first lumbar vertebra (L1), consistent with type I in the classification described by Nam et al. [5]. Postoperatively, a series of 36 three-dimensional volume-rendered images spanning a 180° rotational range was generated from the preoperative CT dataset using SYNAPSE VINCENT version 5.5 (FUJIFILM Medical, Tokyo, Japan) by a radiologic technologist in the Department of Diagnostic Imaging. Two representative views are shown in Figure 2, and the rotational sequence is provided as Video 1 for anatomical illustration and education. The reconstruction did not inform preoperative planning or intraoperative decision-making. The patient reported no visible hematuria, flank pain, or symptoms suggestive of renal venous compression; urinalysis was not performed.

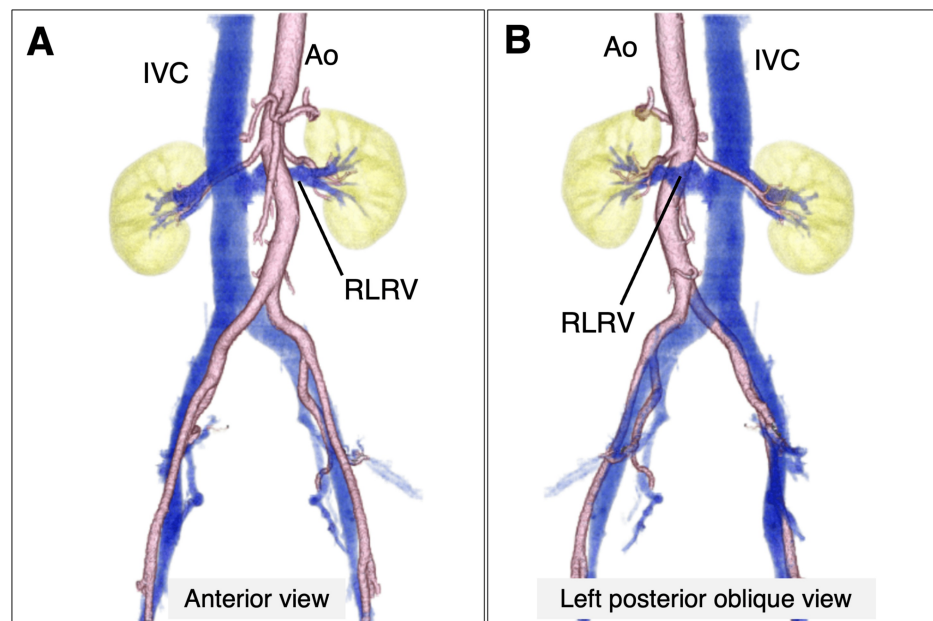
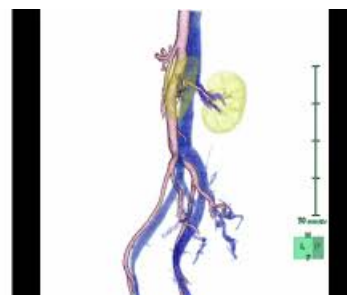


FIGURE 2: Postoperative three-dimensional reconstruction of the retroaortic left renal vein.

Two representative postoperative three-dimensional volume-rendered images selected from a series of 36 images spanning a 180° rotational range. The images were reconstructed from the preoperative contrast-enhanced CT dataset using SYNAPSE VINCENT, version 5.5 (FUJIFILM Medical, Tokyo, Japan), by a radiologic technologist in the Department of Diagnostic Imaging. (A) Anterior view. (B) Left posterior oblique view. The abdominal aorta (Ao), inferior vena cava (IVC), and retroaortic left renal vein (RLRV) are labeled in both panels. These images were generated postoperatively solely for anatomical illustration and educational purposes and were not used for preoperative surgical planning or intraoperative decision-making. The complete rotational sequence is provided as Video 1. The retroaortic course of the left renal vein is also demonstrated on the axial CT images in Figure 1.



VIDEO 1: Postoperative three-dimensional rotational reconstruction of the retroaortic left renal vein.

Rotational three-dimensional visualization of the retroaortic left renal vein. The video presents a 180° rotational sequence of 36 volume-rendered images depicting the spatial relationships among the retroaortic left renal vein, abdominal aorta, and inferior vena cava. The sequence was generated postoperatively from preoperative contrast-enhanced CT data using SYNAPSE VINCENT, version 5.5 (FUJIFILM Medical, Tokyo, Japan), for anatomical illustration and educational purposes; it was not used for surgical planning or intraoperative guidance.

View video here: <https://youtu.be/yroz5PSexA8>

The operative plan was to resect the ovarian tumor and perform an intraoperative frozen-section examination. If malignancy was confirmed, comprehensive surgical staging would be performed. Laparotomy was performed through a midline vertical incision extending to the level of the xiphoid process. Peritoneal washing cytology was performed immediately after entering the abdominal cavity, before any manipulation of the ovarian tumor. An approximately 8-cm right ovarian mass was identified and removed without intraoperative rupture. Intraoperative frozen-section examination revealed mucinous carcinoma. Accordingly, comprehensive surgical staging was performed in accordance with the Japanese guidelines for the treatment of ovarian cancer [6]. The procedure included total hysterectomy, bilateral salpingo-oophorectomy, omentectomy, peritoneal washing cytology, and systematic pelvic and para-aortic lymphadenectomy.

During para-aortic lymphadenectomy, particular attention was paid to the anomalous left renal venous anatomy identified on preoperative CT. Dissection proceeded cranially along the left lateral border of the abdominal aorta.

Retroperitoneal tissue was separated stepwise by blunt dissection with forceps, progressively exposing the deeper tissue plane along the left lateral aspect of the aorta. The aorta was neither encircled with vascular tape nor lifted or retracted. As dissection proceeded cranially and deeper along the left lateral aortic border, the inferior border of the RLRV became directly visible and was used as the cranial anatomical landmark for para-aortic lymphadenectomy (Figure 3).

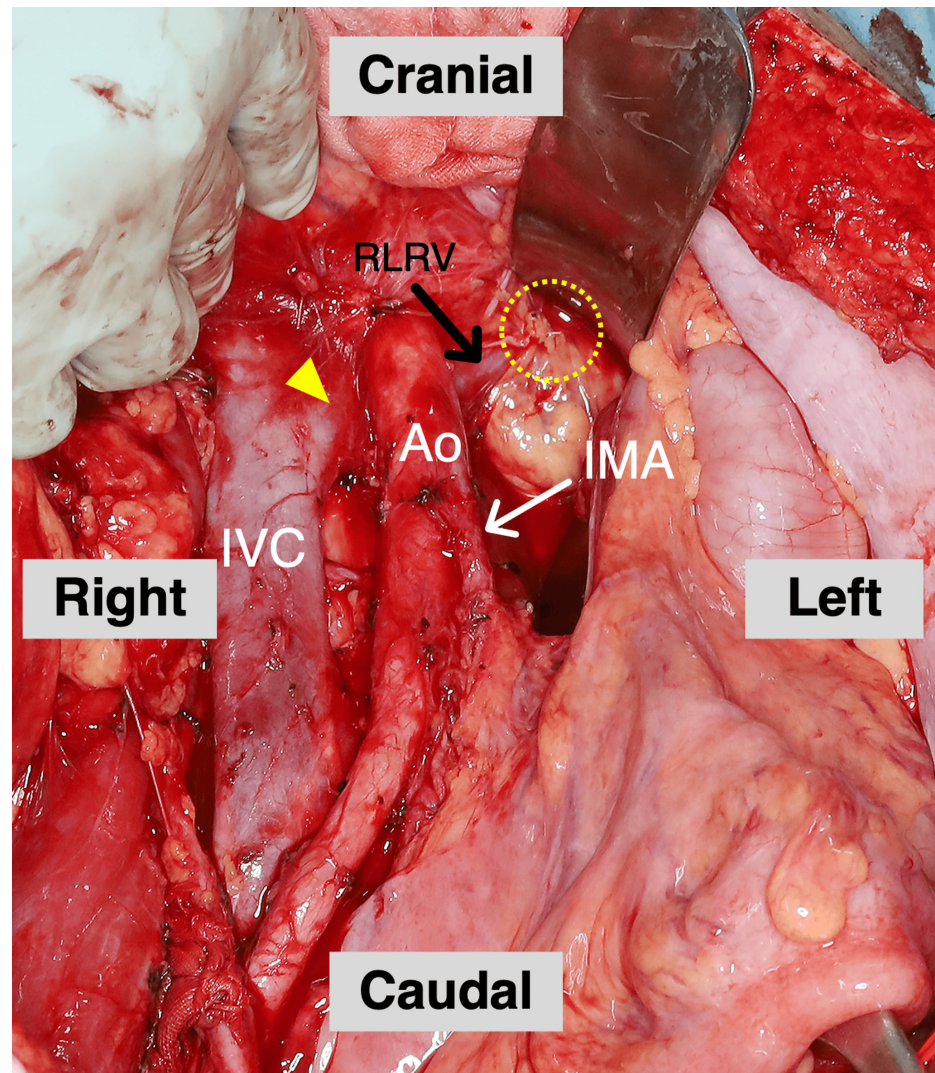


FIGURE 3: Intraoperative identification of the retroaortic left renal vein during para-aortic lymphadenectomy.

The black arrow indicates the visible segment of the retroaortic left renal vein (RLRV) along the left lateral aspect of the abdominal aorta (Ao). The inferior border of the RLRV was used as the cranial anatomical landmark for para-aortic lymphadenectomy. The yellow triangle indicates the region of the junction between the RLRV and the inferior vena cava (IVC). The yellow dotted oval marks the drainage site of the left ovarian vein into the left renal vein. The white arrow indicates the origin of the inferior mesenteric artery (IMA). Cranial and caudal directions and the patient's right and left sides are indicated. The inferior border of the RLRV was used as the cranial anatomical landmark for para-aortic lymphadenectomy.

The left ovarian vein was identified draining into the left renal vein. Para-aortic lymphadenectomy was completed under direct visualization without vascular injury. Estimated blood loss for the entire staging operation was 509 mL, and total operative time was five hours and 49 minutes. Blood loss specifically attributable to para-aortic lymphadenectomy was not separately recorded.

Final histopathological examination of the resected ovarian tumor established a diagnosis of primary ovarian mucinous carcinoma. The ovarian capsule was intact, with no tumor involvement of the ovarian

surface or intraoperative surgical spill. No metastases were identified in the omentum, 37 pelvic lymph nodes, or 11 para-aortic lymph nodes. Peritoneal washing cytology was negative. The final stage was IA according to the 2014 International Federation of Gynecology and Obstetrics (FIGO) staging system for ovarian cancer [7]. The postoperative course was uncomplicated, and the patient was discharged on postoperative day 8. Based on the final diagnosis of FIGO stage IA ovarian mucinous carcinoma, adjuvant chemotherapy was not administered. The patient remained recurrence-free at 15 months after surgery.

Discussion

RLRV is an uncommon venous variant with potential surgical relevance because the left renal vein courses posterior to the abdominal aorta. Recognition of RLRV and associated renal venous anatomical variations is also relevant to other retroperitoneal and vascular procedures, including aortic surgery, endovascular aneurysm repair, nephrectomy, retroperitoneal lymph node dissection, and IVC filter placement. A meta-analysis of 88 studies estimated the pooled prevalence of RLRV at 3.0% (95% confidence interval, 2.4%-3.6%) [1]. Although RLRV is usually asymptomatic, its unexpected location can pose a hazard during retroperitoneal surgery because unrecognized venous anatomy may increase the risk of inadvertent vascular injury and hemorrhage [2].

During embryonic development, the renal venous collar forms around the aorta through anastomoses between the subcardinal and supracardinal veins. The ventral component is derived from the intersubcardinal anastomosis, whereas the dorsal component is derived from the intersupracardinal anastomosis. Persistence of the dorsal pathway with regression of the ventral pathway results in an RLRV, whereas persistence of both pathways results in a circumaortic left renal vein [8].

Nam et al. described four anatomical configurations: type I, a retroaortic vein entering the IVC near the usual renal venous level; type II, a caudally descending retroaortic vein entering the IVC at approximately L4-L5; type III, a circumaortic left renal venous collar; and type IV, a retroaortic vein draining into the left common iliac vein [5]. In the present case, the RLRV joined the IVC at the L1 vertebral level, consistent with type I. The complete accessory tributary anatomy could not be characterized.

Recognition of vascular variants is particularly important during para-aortic lymphadenectomy. Klemm et al. identified arterial or venous abnormalities in 26 of 86 patients (30.2%) undergoing laparoscopic infrarenal para-aortic lymphadenectomy, including retroaortic and circumaortic left renal veins [2]. Although the vascular anomalies in their series were otherwise identified without complication, in two cases an accessory lumbar vein draining into the left renal vein was recognized only after a minor vascular injury (blood loss <50 mL) that was readily managed with bipolar coagulation. These findings underscore the importance of recognizing venous anatomical variations during para-aortic dissection, as unrecognized variants may lead to avoidable vascular injury [2].

Cross-sectional imaging therefore has value not only for evaluating the extent of malignancy but also for identifying surgically relevant vascular anatomy. Kovacevic et al. reported vascular or urinary tract anatomical variants in 11 of 58 women undergoing para-aortic lymphadenectomy for gynecologic malignancies, including two cases of RLRV [3]. Notably, anatomical variants were described in the original preoperative CT reports in only two patients, whereas additional variants were identified intraoperatively [3]. This observation suggests that vascular variants may remain unrecognized unless the para-aortic and renal vascular anatomy is specifically reviewed before surgery.

Importantly, the presence of a renovascular variant does not necessarily result in vascular injury when it is recognized and appropriately managed. In a recent series of 42 patients undergoing para-aortic lymphadenectomy, Ceylan and Aksel identified renovascular variants in nine patients (21.4%), including four cases of RLRV. None of the patients with identified vascular variants sustained vascular injury, and all laparoscopic procedures in patients with variants were completed without conversion [4]. These findings support the importance of preoperative recognition and intraoperative anatomical awareness, rather than suggesting that the variant itself inevitably results in complications.

Previous series have documented RLRV in patients undergoing para-aortic lymphadenectomy for gynecologic malignancies [2-4]. Accordingly, the contribution of this case is not the discovery of a previously unreported variant, but the correlation of preoperative axial CT, a stepwise operative identification technique, an intraoperative photograph, and complementary postoperative three-dimensional reconstructions. The two representative reconstructions in Figure 2 and the 180° rotational sequence in Video 1 were created to illustrate vascular relationships retrospectively and should not be interpreted as evidence that three-dimensional reconstruction guided the operation.

Several practical considerations emerge from this case for surgeons performing para-aortic lymphadenectomy. First, preoperative contrast-enhanced CT images should be reviewed specifically for renal venous variants, even when these are not mentioned in the original radiology report. Second, the relationship of the left renal vein to the aorta and IVC should be assessed to anticipate the location of the cranial dissection boundary. Third, when an RLRV is present, careful, stepwise dissection along the left

lateral aspect of the aorta can facilitate identification of the vein without unnecessary aortic mobilization or retraction. Finally, the cranial extent of lymphadenectomy should be established only after the relevant venous anatomy has been directly visualized, rather than relying solely on the expected position of a normally coursing left renal vein. This anatomical relationship may also be relevant to gynecologic practice, as compression of an RLRV can be associated with left ovarian vein reflux and pelvic venous congestion in patients with posterior nutcracker syndrome [9]. However, ovarian venous reflux, ovarian vein diameter, and pelvic venous congestion were not specifically evaluated in this patient. The postoperative reconstructions facilitate teaching of the spatial relationships but did not guide the surgery.

This case report has several limitations. As a single case without a comparator, it cannot establish whether preoperative recognition of the RLRV reduces the risk of vascular injury. Although the RLRV-IVC confluence was identified at the L1 vertebral level, the complete venous tributary anatomy was not delineated. Furthermore, the three-dimensional reconstruction was performed postoperatively and therefore did not contribute to preoperative surgical planning or intraoperative decision-making. The postoperative follow-up was limited to 15 months. Urinalysis and dedicated Doppler assessment of renal venous flow were not performed; therefore, renal venous compression or associated hemodynamic abnormalities could not be formally assessed. Finally, published case reports may be subject to selection or publication bias favoring uncomplicated cases.

Conclusions

This case highlights the importance of recognizing an RLRV on preoperative CT and confirming its anatomy during para-aortic lymphadenectomy for ovarian cancer. Careful stepwise dissection enabled identification of the inferior border of the RLRV as the cranial anatomical landmark without vascular injury. The combination of axial CT, intraoperative photography, and postoperative three-dimensional reconstruction may serve as an educational reference for surgeons encountering this vascular variant.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Acquisition, analysis, or interpretation of data: Hirokazu Usui, Marie Higashi, Mizue Itoi, Kiyomi Suzuka

Drafting of the manuscript: Hirokazu Usui, Marie Higashi

Critical review of the manuscript for important intellectual content: Hirokazu Usui, Marie Higashi, Mizue Itoi, Kiyomi Suzuka

Supervision: Hirokazu Usui, Kiyomi Suzuka

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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References

1. Hostiuc S, Rusu MC, Negoii I, Dorobanțu B, Grigoriu M: Anatomical variants of renal veins: a meta-analysis of prevalence. *Sci Rep.* 2019, 9:10802. [10.1038/s41598-019-47280-8](https://doi.org/10.1038/s41598-019-47280-8)
2. Klemm P, Fröber R, Köhler C, Schneider A: Vascular anomalies in the paraaortic region diagnosed by laparoscopy in patients with gynaecologic malignancies. *Gynecol Oncol.* 2005, 96:278-82. [10.1016/j.ygyno.2004.09.056](https://doi.org/10.1016/j.ygyno.2004.09.056)
3. Kovačević N, Hočevan M, Vivod G, Merlo S: Vascular and urinary tract anatomic variants relevant to para-

- aortic lymphadenectomy in women with gynecological cancers. *Cancers (Basel)*. 2023, 15:4959. [10.3390/cancers15204959](https://doi.org/10.3390/cancers15204959)
4. Ceylan Ö, Aksel TZ: Intraoperative identification and management of renovascular anatomical variations during paraaortic lymphadenectomy: an illustrated surgical experience. *BMC Surg*. 2026, 26:225. [10.1186/s12893-026-03601-z](https://doi.org/10.1186/s12893-026-03601-z)
 5. Nam JK, Park SW, Lee SD, Chung MK: The clinical significance of a retroaortic left renal vein . *Korean J Urol*. 2010, 51:276-80. [10.4111/kju.2010.51.4.276](https://doi.org/10.4111/kju.2010.51.4.276)
 6. Shoji T, Baba T, Kobayashi Y, et al.: Guidelines for the treatment of ovarian cancer, fallopian tube cancer, and primary peritoneal cancer: 2025 edition by the Japan Society of Gynecologic Oncology. *J Gynecol Oncol*. 2026, 37:e150. [10.3802/jgo.2026.37.e150](https://doi.org/10.3802/jgo.2026.37.e150)
 7. Prat J, FIGO Committee on Gynecologic Oncology: Staging classification for cancer of the ovary, fallopian tube, and peritoneum. *Int J Gynaecol Obstet*. 2014, 124:1-5. [10.1016/j.ijgo.2013.10.001](https://doi.org/10.1016/j.ijgo.2013.10.001)
 8. Macchi V, Parenti A, De Caro R: Pivotal role of the sub-supracardinal anastomosis in the development and course of the left renal vein. *Clin Anat*. 2003, 16:358-61. [10.1002/ca.10151](https://doi.org/10.1002/ca.10151)
 9. St Hilaire C, Paisley M, Greene J, Casey KM: Left renal vein transposition for posterior nutcracker syndrome. *J Vasc Surg Cases Innov Tech*. 2021, 7:243-6. [10.1016/j.jvscit.2021.02.016](https://doi.org/10.1016/j.jvscit.2021.02.016)