

# A “Dangerous Vessel”—Description of a Potentially Hazardous Vein During Para-aortic Lymphadenectomy

Nikolaus de Gregorio<sup>1</sup> Florian Ebner<sup>2</sup> Amelie de Gregorio<sup>1</sup> Wolfgang Janni<sup>1</sup> Peter Widschwendter<sup>1</sup>

<sup>1</sup>Department of Obstetrics and Gynecology, University of Ulm, Ulm, Germany

<sup>2</sup>Department of Obstetrics and Gynecology, Amper Hospital Dachau, Dachau, Germany

**Address for correspondence** Nikolaus de Gregorio, MD PhD, Department of Obstetrics and Gynecology, University of Ulm, Prittwitzstr. 43, Ulm 89075, Germany (e-mail: Nikolaus.de-gregorio@uniklinik-ulm.de).

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## Abstract

**Background and Objectives** Tributaries of inferior vena cava (IVC) are not completely described. As IVC has a complex developmental origin, variations in the feeding vessels are common. The main objective of this study was to report the occurrence of any ventral tributary in the level 1 region of IVC. During the study, origin of such ventral tributary and course was also noted.

**Methodology** In a retrospective/prospective observational study from 2015 to 2018, comprising 168 para-aortic lymphadenectomy (PLA) procedures conducted at Department of Gynaecological Oncology, University Hospital of Ulm, Germany, the presence of ventral tributaries of IVC was evaluated.

**Results** Out of 148 retrospective cases of PLA, the presence of a prominent ventral tributary within 2 cm distance from the bifurcation of aorta was assumed in more than 60% cases. Within 20 prospectively assessed cases, the vein could be identified in 17 patients and was located within the right mesoureter. Only on one patient, this feeding vessel was draining into IVC at the level below the aortic bifurcation.

**Conclusion** In 85% of the prospectively assessed patients considered in the study, there was a constant ventral tributary feeding the IVC within 2 cm from the bifurcation of the aorta.

## Keywords

- ▶ endometrial cancer
- ▶ ovarian cancer
- ▶ para-aortic lymphadenectomy
- ▶ surgical complications

## Introduction

During development, inferior vena cava (IVC) forms from a complex network of veins related to the posterior body wall.<sup>1</sup> As abdominal and pelvic veins undergo various modifications, several anatomical variations can be expected. Usually, anatomical understanding of the IVC is restricted to its segments, major tributaries, and most common anomalies. Possover<sup>2</sup> and Turyna<sup>3</sup> divided these tributaries into four levels. Tributaries at the area of bifurcation of IVC are considered as level 1. Level 2 tributaries comprises of minute veins between bifurcation and inferior mesenteric artery (IMA). Level 3 comprises of those draining into IVC between IMA and right ovarian vein. Each individual possesses 2 to 3 ventral tributaries.<sup>2,3</sup>

Lymph node status is an important prognostic indicator of the treatment outcomes among common gynecological cancers (cervical and endometrial cancers).<sup>4</sup> Para-aortic lymphadenectomy (PLA) is a standard procedure in gynecologic oncology and is used for the treatment of ovarian, endometrial, and cervical cancers.<sup>5,6</sup> While it is most often performed for staging reasons and to define the extend of the disease, which has an impact on adjuvant treatment, some data suggest it might also be beneficial for prognosis to remove bulky nodes.<sup>7</sup>

The para-aortic lymph nodes are divided into b1 and b2 groups. The former group, b1 nodes are located between left renal vein and IMA. The latter group, b2 nodes, are located between IMA and aortic bifurcation.<sup>8</sup> The right-sided PLA is

done by carefully dissecting all the lymph nodes of precaval and paracaval area up to the right ovarian vein draining into IVC. The left PLA is done by dissecting lymph nodes on the abdominal aorta from its bifurcation up to the left renal vein. The PLA procedure, particularly laparoscopic method, is challenging and needs a thorough understanding of IVC tributaries, aorta branches, and surrounding structures. During these procedures, care must be taken not to cut IVC tributaries, as the hemorrhage from such instances is difficult to control. The main objective of this study was to report the occurrence of any ventral tributary in the level 1 region of IVC. An attempt was made to demonstrate the origin of such large vessel particularly on the right side.

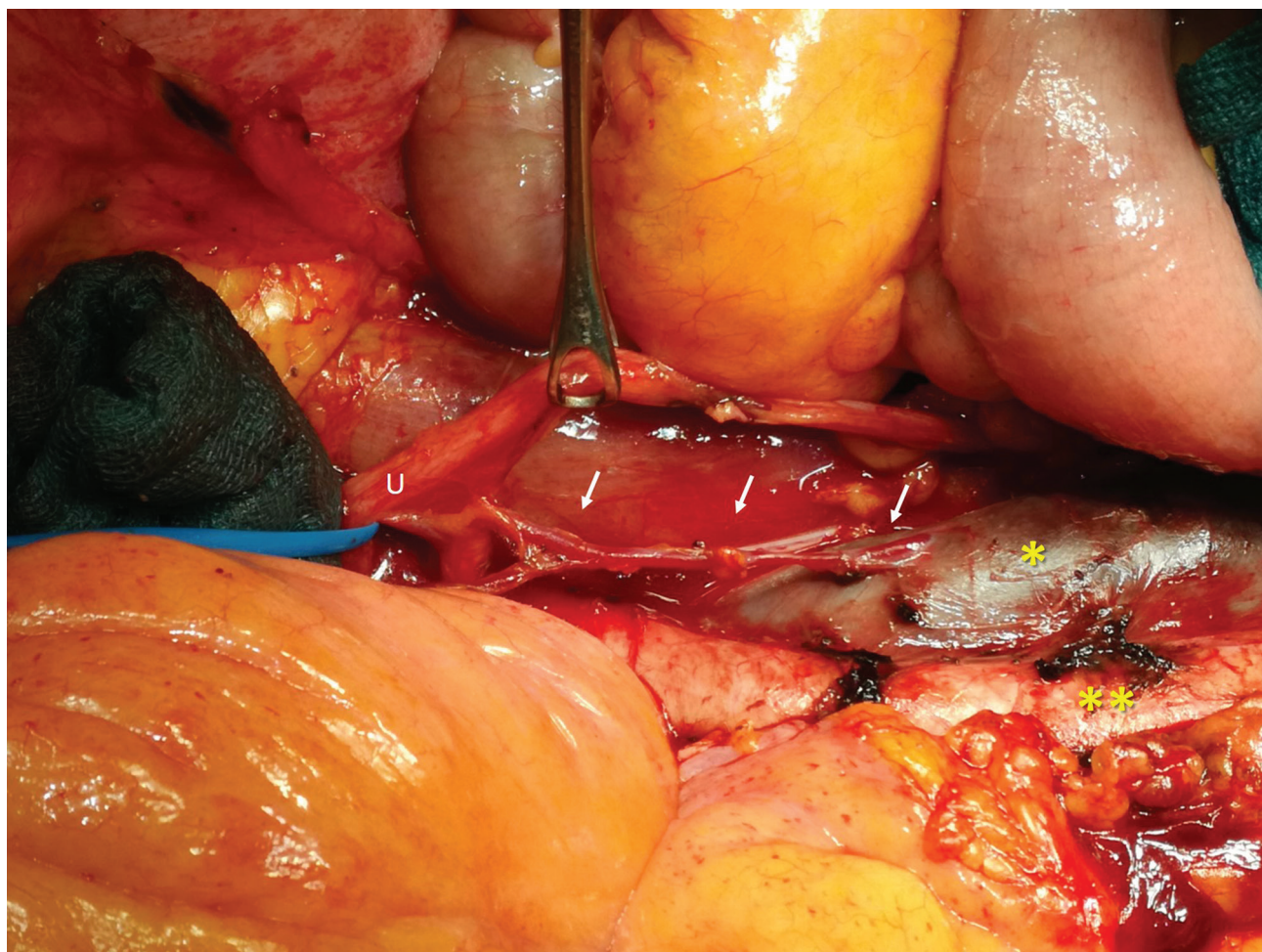
## Methodology

In a retrospective-prospective observational study from 2015 to 2018, comprising all the para-aortic lymphadenectomy (PLA) procedures conducted at Department of Gynaecological Oncology, University Hospital of Ulm, Germany, the presence of ventral tributaries of IVC was evaluated. A total of 168 patients underwent PLA for various gynecological oncological

conditions. In this report, presence of ventral feeding tributary of IVC particularly within 2 cm above the bifurcation of the aorta was noted in all consecutive PLA procedures through assessment of surgical reports as we assumed presence of this vein in more than 60% of 148 retrospectively reviewed PLA cases.

## Results

Out of the 20 prospectively assessed cases, the vein could be clearly dissected in 17 cases and was located within the right mesoureter (→ Fig. 1). Only on one patient, this feeding vessel was draining into IVC at the level below the aortic bifurcation. Of specific note, in two of the retrospective cases, there was extensive hemorrhage. Both patients underwent laparoscopic PLA for with endometrial cancer. Accidental dissection of the vessel right on the level of the adventitia of the IVC led to a bleeding that could not be controlled by compression, endoclipping, or electrocautery. In one case, the malfunction of an endoclip clamp led to an increase of the vascular lesion. Both patients had an emergency conversion to laparotomy. IVC suturing was done followed by transfusion of blood



**Fig. 1** Intraoperative picture of anatomy during open PLA for ovarian cancer with the specific vein (→) originating from the right ureteral meso and feeding into the inferior vena cava (IVC). Ureter (U), inferior vena cava (\*), and aorta (\*\*\*) are shown as well. The head of the patient would be at the right side.

products. Both cases were managed without any residual morbidity.

## Discussion

Several authors have described the anatomy of the ureter<sup>9</sup> and anatomical variations in major venous vessels without mentioning a vein specifically at this location.<sup>10</sup> After consulting several anatomy atlases, we conclude that to our best knowledge this vessel has not been separately described yet. While the Turyna et al were able to describe multiple veins feeding into the IVC and their different frequency of occurrence in cadaver specimens,<sup>3</sup> we did trace our vein back to its origin on living patients.

However, the numbers of the prospective assessed patients are low and thereby represent a limiting factor of our analysis. Nevertheless, this is related to the fact that numbers of performed PLA are declining even in large oncological centers. As several surgeons performed the retrospective PLA and presence/absence of the observed vessel was not clearly noted in all surgical reports, a major strength of the presented work is that all 20 prospective cases were operated on by the same surgeon. Thus, preparation, surgery, and documentation was consistently done and thereby potential confounding due to dissection techniques and so forth was limited.

The clinical significance of our finding lies in the fact that while para-aortic lymphadenectomy is from a surgical perspective a technically demanding procedure,<sup>8</sup> this procedure will probably be performed less infrequently in future.<sup>11,12</sup> The current guidelines allow the sentinel lymph node biopsy in cervical and endometrial cancers in early stages and it is expected that sentinel node biopsy will replace large numbers of PLA in future.<sup>4,13</sup> In 2017, the presentation of the Lymphadenectomy in Ovarian Neoplasms (LION) study at the annual meeting of the American Society of Clinical Oncology (ASCO) paved way for another major change in therapy of ovarian cancer patients.<sup>14</sup> This study showed no major benefits of PLA in patients without bulky lymph nodes. The Endometrial Cancer Lymphadenectomy Trial (ECLAT) compares the outcomes of surgical treatment and adjuvant chemotherapy with or without PLA.<sup>15</sup> The results are yet to be published, but may lead to omission of PLA in endometrial cancer.

Unfortunately, many of the remaining PLA procedures will be the ones with bulky nodes and therefore even more difficult to manage. In addition, as more of these procedures will be performed laparoscopically, aspects of hemorrhage control will gain further importance.<sup>16</sup>

Very little data exist on learning curves of laparoscopy versus laparotomy for PLA. From our own experience, teaching of PLA needs some time as this is one of the most difficult procedures. Skill training in laparoscopic PLA procedure is strenuous. Even a moderate vascular injury, which could be easily controlled by finger compression during open surgery, can lead to a serious event during laparoscopy. In addition, trainees in future will most likely have less experience in open surgery, limiting their ability or at least exposition for successful managing of those situations. Alkatout reports high

rate of complications due to vascular or bowel injury during those learning phases.<sup>17</sup>

Gynecologic oncologists and trainees should be aware of a venous vessel above the aortic bifurcation and the potential hazard of hemorrhage by accidentally cutting it. We recommend a careful dissection with a safety margin of 1 to 2 mm above the adventitia of the IVC to maintain a vessel-stump that can be coagulated or clipped.

## Conclusion

More than 85% of the prospectively considered patients in the study have a constant ventral tributary feeding the IVC within 2 cm from the bifurcation of the aorta.

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### Conflict of Interest

Dr. de Gregorio reports personal fees from Roche, Tesaro, Astra Zeneca, PharmaMar, Clovis, Amgen, Novartis, Pfizer, and Eisai, outside the submitted work.

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