Laparoscopic bilateral anterior transperitoneal adrenalectomy: 24 years experience

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Author Comments:	Rome, November 27, 2018 To the attention of the Editorial Office of Surgical Endoscopy Cover letter of the paper: “Laparoscopic bilateral anterior transperitoneal adrenalectomy: 24 years experience” The present retroprospective study is submitted to your attention for review and possibly for publication in Surgical Endoscopy. The manuscript has not been previously published and is not under consideration for publication in any other journal. This is the first reported series of patients who underwent laparoscopic bilateral adrenalectomy (LBA) via a transperitoneal anterior approach. For this reason, despite the limited sample size, we consider that this paper might be of interest for the readers of the journal due to several advantages that are associated with the anterior approach in bilateral adrenalectomy cases in comparison to the lateral and retroperitoneal routes. All authors have read and approved the manuscript and its submission to the journal. Looking forward to receiving your reply, I remain Sincerely,

	Andrea Balla, MD, (Corresponding author) Department of General Surgery and Surgical Specialties “Paride Stefanini”, Sapienza University of Rome, Italy Azienda Policlinico Umberto I, Viale del Policlinico 155, 00161 Rome, Italy Telephone number: +39.339.4746893 Fax: +39.06.49970549 e-mail: andrea.balla@gmail.com
Response to Reviewers:	Professor George B. Hanna Editor-in-Chief Surgical Endoscopy Dear Professor Hanna, We wish to thank you for having accepted the manuscript entitled “Laparoscopic bilateral anterior transperitoneal adrenalectomy: 24 years experience” for publication. The manuscript has been revised according to the comments made by the reviewers. All comments have been addressed and changes have been made and highlighted in the manuscript, as follows: #Reviewer 1: 1.This manuscript is a review of 21 patients who underwent laparoscopic adrenalectomy via an anterior transperitoneal approach. It provides additional insights regarding surgical approaches but would be greatly enhanced by intraoperative photos of port placement and intraabdominal views (both left and right). The authors should also consider a more robust discussion of limitations of this approach and of their experience; have they attempted any cortical sparing adrenalectomies with this approach and is the view limited at all? what were the outcomes of these approaches? •Seven intraoperative photos were added in the manuscript. Unfortunately, we do not have experience with the cortical sparing adrenalectomy and this was mentioned in the Discussion as follows: “The authors, however, have no experience with this procedure. Although it seems a valuable treatment strategy, larger patient samples are required to reach definitive conclusions. Our approach also has some technical limitations. In some obese patients undergoing right adrenalectomy the liver made heavy and fragile from steatosis occasionally may require a second 5 mm. retractor introduced from an extra right subcostal trocar. During left adrenalectomy the operative field is usually narrow, its boundaries being initially the inferior mesenteric vein medially and the left ascending colic vessels laterally; subsequently and in a more posterior plane the boundaries of the operative field become the body of the pancreas and the splenic vein above, the renal vein below, the aorta medially and the spleen laterally. Recognition of these anatomical landmarks is straightforward. However, gentle dissection along avascular planes is mandatory to avoid blood filling up the narrow operative field and obscuring vision.” #Reviewer 2: 1.This clever piece of research does present a novel series structure. The text is clear concise. Results are clear and endpoint easily identified. The data is sequestrated from the series previously presented more than once. That is why it offers little clinical benefit as far as clinical data is concerned. Also the cases are performed over many years during which surgeon experience, technology, anesthesia and drugs have all dramatically changed. This has its effect on the "homogeneity" of the study sample. •The long period of our experience, as a limitation of the study, has been included in the Discussion as follows: “Moreover, the long time span of our experience could have affected the homogeneity of the study sample.” The revised manuscript is now submitted to your attention for publication in Surgical Endoscopy. Looking forward to receiving your reply, I remain

	Sincerely, Andrea Balla, MD, Department of General Surgery and Surgical Specialties “Paride Stefanini”, Sapienza University of Rome, Italy andrea.balla@gmail.com
Funding Information:	
Abstract:	Background: The aim of this study is to evaluate the feasibility, safety, advantages and surgical outcomes of laparoscopic bilateral adrenalectomy (LBA) by an anterior transperitoneal approach. Methods: From 1994 to 2018, 552 patients underwent laparoscopic adrenalectomy, unilateral in 531 and bilateral in 21 patients (9 females and 12 males). All patients who underwent LBA were approached via a transperitoneal anterior route, and form our study population. Indications included: Cushing’s disease (n=11), pheochromocytoma (n=6), Conn’s disease (n=3) and adrenal cysts (n=1). Results: Mean operative time was 195 ± 86.2 minutes (range 55 – 360 minutes). Conversion was necessary in one case for bleeding. Three patients underwent concurrent laparoscopic cholecystectomy with laparoscopic common bile duct exploration and ductal stone extraction in one. Three postoperative complications occurred in one patient each: subhepatic fluid collection, intestinal ileus and pleural effusion. Mean hospital stay was 6.1 ± 4.7 days (range 2 – 18 days). Conclusions: In our experience transperitoneal anterior LBA was feasible and safe. Based on our results we believe that this approach leads to prompt recognition of anatomical landmarks with early division of the main adrenal vein prior to any gland manipulation, with a low risk of bleeding and without the need to change patient position. Unlike the lateral approach, there is no need to mobilize the spleno-pancreatic complex on the left or the liver on the right. The ability to perform associated intraperitoneal procedures, if required, is an added benefit.

Laparoscopic bilateral anterior transperitoneal adrenalectomy: 24 years experience

Running head: Laparoscopic bilateral anterior adrenalectomy

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ABSTRACT

Background: The aim of this study is to evaluate the feasibility, safety, advantages and surgical outcomes of laparoscopic bilateral adrenalectomy (LBA) by an anterior transperitoneal approach.

Methods: From 1994 to 2018, 552 patients underwent laparoscopic adrenalectomy, unilateral in 531 and bilateral in 21 patients (9 females and 12 males). All patients who underwent LBA were approached via a transperitoneal anterior route and form our study population. Indications included: Cushing's disease (n=11), pheochromocytoma (n=6), Conn's disease (n=3) and adrenal cysts (n=1).

Results: Mean operative time was 195 ± 86.2 minutes (range 55 – 360 minutes). Conversion was necessary in one case for bleeding. Three patients underwent concurrent laparoscopic cholecystectomy with laparoscopic common bile duct exploration and ductal stone extraction in one. Three postoperative complications occurred in one patient each: subhepatic fluid collection, intestinal ileus and pleural effusion. Mean hospital stay was 6.1 ± 4.7 days (range 2 – 18 days).

Conclusions: In our experience transperitoneal anterior LBA was feasible and safe. Based on our results we believe that this approach leads to prompt recognition of anatomical landmarks with early division of the main adrenal vein prior to any gland manipulation, with a low risk of bleeding and without the need to change patient position. Unlike the lateral approach, there is no need to mobilize the spleno-pancreatic complex on the left or the liver on the right. The ability to perform associated intraperitoneal procedures, if required, is an added benefit.

Key words: Laparoscopic bilateral adrenalectomy (LBA); Laparoscopic transperitoneal anterior adrenalectomy; Laparoscopic transperitoneal anterior submesocolic left adrenalectomy

INTRODUCTION

Minimally invasive adrenalectomy has become the gold standard [1-7] since Gagner's first laparoscopic unilateral adrenalectomy in lateral decubitus [2]. Afterwards other approaches have been proposed, including the retroperitoneal with the patient in the prone or lateral decubitus position, the anterior transperitoneal with colonic flexure mobilization and the left submesocolic [6-9]. As of today, no formal superiority of one mini-invasive approach over another has emerged for uni- or laparoscopic bilateral adrenalectomy (LBA) [1-7].

Bilateral adrenalectomy is performed less often than unilateral adrenalectomy [8]: according to the British Association of Endocrine and Thyroid Surgeons only 6% of patients undergoing adrenal gland surgery underwent bilateral adrenalectomy in 2012 [1]. The indications for bilateral adrenalectomy, include adrenocorticotropic hormone (ACTH) dependent hypercortisolism (Cushing's or Conn's disease), hereditary pheochromocytoma [Multiple Endocrine Neoplasia 2 a-b (MEN2), Von Hippel Lindau (VHL) disease] [1] and life-threating conditions such as patients with ectopic Cushing's syndrome due to metastatic disease or ACTH secreting pituitary macroadenomas [9,10].

The aim is to report our 24 year experience with LBA via an anterior transperitoneal approach evaluating its feasibility, safety, advantages and surgical outcomes.

MATERIALS AND METHODS

This study is a retrospective analysis of prospectively collected data, approved by our Institutional review board. Informed consent was obtained from all participants.

From January 1994 to August 2018, 552 patients underwent surgery for adrenal gland disease in two centers (Department of General Surgery and Surgical Specialties "Paride Stefanini", Sapienza University of Rome and Department of General Surgery, Università Politecnica delle Marche, Ancona, Italy) that followed the same treatment protocol and used an identical surgical approach [3-6]. Out of 552 patients, 531 patients (96.2%) underwent unilateral adrenalectomy and

the remaining 21 patients (3.8%) underwent anterior transperitoneal LBA and form our study population. These included nine women and twelve men, mean age 41.9 ± 12.1 years (range 21 - 67 years) with mean BMI of 28.1 ± 3.9 Kg/m^2 (range 21 - 37 Kg/m^2). One patient had undergone a previous appendectomy (Table 1).

Preoperatively, all patients had full endocrinological evaluation including laboratory and imaging tests. Indications for surgery were: Cushing's disease (n=11), pheochromocytoma (n=6), Conn's disease (n=3), large adrenal cysts (n=1).

After surgery, all patients received substitutive therapy according to local policies.

Surgical technique

Similar to our surgical techniques for unilateral right and left adrenalectomy described previously [3-6], candidates for LBA are positioned supine with abducted legs, a 12-13 mmHg pneumoperitoneum is created with a Veress needle and optical trocar above the umbilicus or with an open technique and Hasson cannula, under general anesthesia. A 30° or 45° forward oblique optic is inserted [3-6]. The operating table is in slight anti-Trendelenburg position and with the side opposite the lesion tilted down. The surgeon stands in between the patient's legs for the left side and ipsilateral to the lesion for the right side.

Six trocars are employed (Figure 1): two on the midline, one 12 mm, 2-3 centimeters above the umbilicus (n. 1), and one 5 mm, below the xiphoid process (n. 2) used for exposure on both sides. Two trocars are placed on the right, one 12 mm (n. 3) at the junction between the right anterior axillary line and the transverse umbilical line and one 5 mm (n. 4) along the right midaxillary line (Figure 1). Two 12 mm trocars are placed on the left, one at the junction of the left midclavicular line with the transverse umbilical line (n. 5) and the other along the left anterior axillary line (n. 6) (Figure 1). The optic is alternatively introduced in trocars n. 3 and 5, while trocars 1 - 4 and 1 - 6 are used for the manipulation instruments, on the right and on the left, respectively.

Right adrenalectomy is performed by a direct anterior transperitoneal approach while left anterior adrenalectomy requires opening the root of the left transverse mesocolon to reach the gland behind the pancreas [3-6].

Right adrenalectomy starts by dividing any adhesion between the gallbladder, greater omentum and transverse colon in order to lift the right liver with a Nathanson retractor (Cook Medical, Bloomington, Indiana, USA) or Endo Paddle retractor (Covidien, Mansfield, Massachusetts, USA) introduced from trocar n. 2, so as to expose Morrison's pouch. The posterior parietal peritoneum is then opened longitudinally along the right margin of the inferior vena cava above the duodenum (Figure 2), and the main adrenal vein is identified and divided between clips (Figure 3) [3-6].

For left adrenalectomy, the transverse mesocolon is retracted cephalad by atraumatic forceps introduced from trocar n. 2, in order to identify the arch of the inferior mesenteric vein and to expose the ligament of Treitz after displacing the first jejunal loop to the right of the patient (Figure 4). The posterior parietal peritoneum is then opened over the lower border of the pancreas at the root of the transverse mesocolon, between the first jejunal loop and the inferior mesenteric vein. In some cases, depending on the individual patient anatomy, the peritoneum may be opened lateral to the inferior mesenteric vein, if this is closer to the first jejunal loop. By blunt and sharp dissection, Toldt's fascia is opened and the retro-pancreatic space is entered after raising the body of the pancreas. Gerota's fascia is then incised and the left renal vein is identified. Its superior margin is followed medially until the inferior adrenal vein is identified, prepared and divided between clips (Figure 5 and 6) [3-6].

Care is taken to avoid any manipulation of the adrenal gland prior to division of the main adrenal vein in both right and left adrenalectomy. Surgical dissection is performed with a bipolar diathermy (LigaSure ™ tissue fusion, Covidien, Mansfield, Massachusetts, USA) or ultrasonic (Ultracision, Harmonic Scalpel, Ethicon Endo Surgery, Cincinnati, Ohio, USA) device. The adrenal vein is divided between titanium (AcuClip, Tyco / Healtcare, Norwalk, Connecticut, USA) or Hem-

o-lok (Weck® Hem-o-lok®, Teleflex, North Carolina, USA) clips. Once fully mobilized, the gland is removed with a specimen retrieval bag (Inzii® Retrieval Systems, Applied Medical, Rancho Santa Margarita, California, USA). The residual adrenal cavities are routinely filled with hemostatic facilitators (Floseal, Baxter Healtcare Corporation, Deerfield, Illinois, USA or Surgiflo Hemostatic Matrix Kit, Ethicon Endo-Surgery, Johnson & Johnson, Cincinnati, Ohio, USA) (Figures 7 and 8). Drains are placed in the right and/or left adrenal fossae, based on surgeon's preference [3-6].

Study data

We recorded gender, age, body mass index (BMI), previous abdominal surgery, operative time, associated procedures, conversions, postoperative complications (graded according to the Clavien-Dindo classification [11]), blood transfusions, hospital stay, size of specimen and definitive histology. These were collected in a Microsoft Excel program (Microsoft Corporation, Redmond, Washington, USA).

Analysis

Results are expressed as mean ± standard deviation (SD) for continuous variables and percentages for categorical variables. No statistical tests were used because of the small numbers.

RESULTS

Mean operative time was 195 ± 86.2 minutes (range 55 – 360 minutes). Conversion to open surgery was necessary in one case for bleeding and required postoperative blood transfusions (grade II according to Clavien-Dindo classification [11]).

Three patients underwent concomitant laparoscopic cholecystectomy (LC), which was associated with laparoscopic common bile duct exploration (LCBDE), stones extraction and T-tube placement in one case.

Postoperative complications were observed in three patients: subhepatic fluid collection in the gallbladder bed (Clavien-Dindo grade II) after concurrent cholecystectomy during LBA for pheochromocytoma, intestinal ileus (Clavien-Dindo grade I) and pleural effusion (Clavien-Dindo grade I) in one patient each after LBA for Cushing syndrome. Mean hospital stay was 6.1 ± 4.7 days (range 2 - 19 days). Oral intake was possible on postoperative day one in all patients having an uneventful postoperative course. There were no deaths.

Mean adrenal gland size was 3 ± 2.1 cm (range 0.7 - 9.3 cm) and 3.1 ± 2.1 cm (range 0.5 - 6.6 cm) for right and left glands, respectively. Definitive histology was: adrenal hyperplasia (n=14), pheochromocytoma (n=6) and adrenal cysts (n=1)**.**

DISCUSSION

In the authors' experience laparoscopic anterior transperitoneal bilateral adrenalectomy was feasible, safe and effective; only one conversion was necessary, three patients had grade I-II morbidity and no mortality. All patients were cured of their disease.

Of note, two of 11 patients with Cushing disease had grade I morbidity. This is of interest as Cushing's syndrome is reported to be associated with a higher frequency of postoperative complications, including an increased risk of thromboembolism [12].

There are four available access options for mini-invasive adrenalectomy- the transperitoneal lateral and anterior, retroperitoneal lateral and posterior routes [7] - with no clear superiority of one approach over another [7].

The SAGES guidelines state: "Several approaches to laparoscopic adrenalectomy have been described in the literature. Surgeons should choose the approach they are most familiar with, have had training in, and have the best patient outcomes with (+++, strong recommendation)." [7]. The lateral transperitoneal and the retroperitoneal approaches are the most popular, probably because they are perceived to be advantageous (larger exposition and direct approach, respectively) by some surgeons [3-6].

The anterior transperitoneal approach for bilateral adrenalectomy has been our preference for the last two decades [3-6,13,14]. In open surgery, the submesocolic approach to left adrenalectomy was first proposed by Pierre Delbet, a French surgeon, in 1912 [15] whereas in laparoscopy, this approach was first reported as case reports by Sardi (1994) and Robertson (1995) [16,17]. In our opinion the anterior approach provides unparalleled vision and recognition of the anatomy. It allows secure control and division of the adrenal vein at the beginning of the procedure prior to any gland manipulation, thereby reducing the risk of bleeding and avoiding any hormone release. Should accidental major bleeding occur, it allows quick conversion to open surgery without the need to change patient position. During left adrenalectomy by the submesocolic technique, neither mobilization of the splenic flexure of the colon nor of the spleno-pancreatic complex is required to obtain gland exposure, unlike the transperitoneal lateral approach [3-6]. This should reduce the risk of organ damage, postoperative wandering spleen with potential acute gastric volvulus and left pneumothorax [4,5,18-21]. During right adrenalectomy there is no need for liver mobilization, thereby reducing the risk of bleeding from accessory hepatic veins, and early division of the right adrenal vein before any gland mobilization makes the procedure safer because it increases the working distance between the gland and the inferior vena cava [3-6]. During bilateral adrenalectomy, both the anterior transperitoneal and the posterior retroperitoneal approach allow to complete the operation without repositioning the patient on the operative table [1,22-27]. In the authors' opinion, this is a remarkable advantage compared to the lateral approach because it saves time. The possibility to perform associated procedures, if necessary, without the need to reposition the patient on the operative table [3-6] is perceived by the authors as an additional benefit.

In the literature there are only few reports on LBA [1,22-31], the most popular approach also being lateral (Table 2) [1,22-31]. Comparing our operative outcomes with those in the literature, it seems that the operative time is shorter as compared to the lateral approach, while the conversion and morbidity rates are similar (Table 2) [1,22-31]. Patient samples in some of the reported series,

however, were small and overall surgical approaches were heterogeneous, sometimes multiple and/or in two stages (Table 2) [1,22-31].

As substitutive therapy is mandatory after complete bilateral adrenalectomy, a more conservative surgical approach for the treatment of Cushing's syndrome, including a unilateral adrenalectomy and a partial contralateral adrenalectomy, has also been reported [32]. Lowery *et al.* reported their experience with this approach, showing encouraging results in terms of operative time, conversion and complication rates, without the need for lifelong steroid therapy [32]. The authors, however, have no experience with this procedure. Although it seems a valuable treatment strategy, larger patient samples are required to reach definitive conclusions.

Our approach also has some technical limitations. In some obese patients undergoing right adrenalectomy the liver made heavy and fragile from steatosis occasionally may require a second 5 mm. retractor introduced from an extra right subcostal trocar. During left adrenalectomy the operative field is usually narrow, its boundaries being initially the inferior mesenteric vein medially and the left ascending colic vessels laterally; subsequently and in a more posterior plane the boundaries of the operative field become the body of the pancreas and the splenic vein above, the renal vein below, the aorta medially and the spleen laterally. Recognition of these anatomical landmarks is straightforward. However, gentle dissection along avascular planes is mandatory to avoid blood filling up the narrow operative field and obscuring vision.

The limitations of the present study are its two center, same single team, retrospective nature, the lack of a control group and of a group of patients who underwent cortical sparing adrenalectomy as well as the relatively small sample size. Moreover, the long time span of our experience could have affected the homogeneity of the study sample.

To the best of authors' knowledge, however, this is the first reported series of patients undergoing laparoscopic bilateral adrenalectomy by an anterior approach.

LBA with transperitoneal anterior and submesocolic approaches has proven to be feasible and safe. Relevant technical features of this procedure are early division of the adrenal vein as the

first step of the procedure prior to any gland manipulation, which is important to enhance the safety of the procedure, and the fact that there is no need to mobilize the colonic flexure and the spleno-pancreatic complex on the left, no need to mobilize the liver on the right, reducing the extent of dissection and the surgical risk. The transperitoneal anterior approach with the patient supine allows the surgeon to perform bilateral adrenalectomy and associated intraperitoneal procedures without the need to change patient position on the operation table.

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DISCLOSURES

Dr. Andrea Balla, Dr. Monica Ortenzi, Dr. Livia Palmieri, Dr. Diletta Corallino, Dr. Francesca Meoli, Dr. Pietro Ursi, Dr. Giulia Puliani, Dr. Emilia Sbardella, Prof. Andrea M. Isidori, Prof. Mario Guerrieri, Dr. Silvia Quaresima and Prof. Alessandro M. Paganini declare that they have no conflict of interest or financial ties to disclose.

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Figure 1. Trocar positions for laparoscopic transperitoneal anterior bilateral adrenalectomy.

Figure 2. Right adrenalectomy: the posterior peritoneum prior to longitudinal division along the right margin of the inferior vena cava. The peritoneal division is then extended cranially towards the diaphragm.

Figure 3. Right adrenalectomy: the right adrenal vein has been identified and divided between clips. The adrenal gland is located underneath the grasper.

Figure 4. Left adrenalectomy: the arch of the inferior mesenteric vein is identified at the level of the duodeno-jejunal angle exposing the posterior peritoneum at the insertion of the transverse mesocolon along the inferior margin of the pancreas.

Figure 5. Left adrenalectomy: the inferior adrenal vein has been identified. The left adrenal gland is visible but no manipulation of the gland has yet occurred.

Figure 6. Left adrenalectomy: the inferior adrenal vein has been closed with clips prior to its division.

Figure 7. Right adrenalectomy: the residual cavity immediately prior to its being filled with hemostatic facilitators.

Figure 8. Left adrenalectomy: the residual cavity immediately prior to its being filled with hemostatic facilitators.

Table 1. Results.

Sex ratio (F/M)	9/12
Mean age ± SD, years (range)	41.9 ± 12.1 (21 – 67)
Mean BMI ± SD, Kg/m^2 (range)	28.1 ± 3.9 (21 - 37)
Previous abdominal surgery, n	1
Mean operative time ± SD, minutes (range)	195.0 ± 86.2 (55 - 360)
Associated procedures, n - Cholecystectomy - Cholecystectomy + LCBDE	3 2 1
Conversions, n	1
Complications, n (Clavien-Dindo classification, grade)	3 (2 II, 1 I)
Blood transfusions in patients, n	1
Mean hospital stay ± SD, days (range)	6.1 ± 4.7 (2 – 19)
Mean adrenal gland size ± SD, cm (range) - Right - Left	 3 ± 2.1 (0.7 – 9.3) 3.1 ± 2.1 (0.5 – 6.6)
Definitive histology, n - Adrenal hyperplasia - Pheochromocytoma - Adrenal cysts	 14 6 1

SD: standard deviation. LCBDE: laparoscopic common bile duct exploration.

Table 2. Patient series of laparoscopic bilateral adrenalectomy reported in the literature.

Authors	Number of patients	Approach	Mean age ± SD (years)	Mean operative time ± SD or range (minutes)	Conversion, n	Intra - postoperative complications, n	Mean hospital stay ± SD or range (days)	Mortality, n
Maccora [1]	17 3 3	Lateral Posterior Open	43 ± 4	195 ± 16 151 ± 12 243 ± 44	1 - -	8	8.8	1
Aggarwal [22]	15 one stage 4 two stage	Lateral	25.4	210 (150-240) -	- -	3	n.r.	1
Lan [23]	9 * 17 °	Lateral Posterior	54.9 ± 14.3 59.7 ± 17.7	374 ± 157 334 ± 93	- -	2 2	3.5 ± 2.1 2.7	- -
Gilbert [24]	92	Lateral	40	272 ± 79.2	2	3	n.r.	1
Takata [25]	30	Lateral	44	290 (180 - 480)	-	6	3.5 (1 - 12)	-
Vella [26]	19	Lateral	n.r.	252 (160 - 360)	3	-	2.7 (2 - 5)	-
Hawn [27]	18	Lateral	47 (18 - 72)	296 (160 - 420)	-	3	3 (1 – 18)	-
Porpiglia [28]	13	Lateral	47.2 ± 13	234 ± 39	2	1	5.7 ± 0.9	-
Miccoli [29]	20 14	Lateral Posterior	48.1 38.9	180.6 170	2 1	- -	5.25 8.2	-
Raffaelli [30]	5 11 13	Lateral Posterior Lateral rob	46.8 ± 19.9 41.2 ± 13.1 42.8 ± 13.6	256.0 ± 43.4 157.4 ± 54.6 221.5 ± 42.2	- 1 -	0 4 5	12 ± 5.7 10.8 ± 3.7 4.4 ± 1.7	- - -
Pugliese [31]	7 3 1	Lateral Posterior Combined	45.6 ± 17.8	245 ± 41.3 218 ± 22 405	-	2	5 ± 1.8	-
Present series	21	Anterior	41.9 ± 12.1	195.0 ± 86.2	1	3	6.1 ± 4.7	-

SD: standard deviation. *: two patients underwent two stage adrenalectomy. °: one patient underwent two stage adrenalectomy. n.r.: not reported. Rob: robotic.

Figure 1

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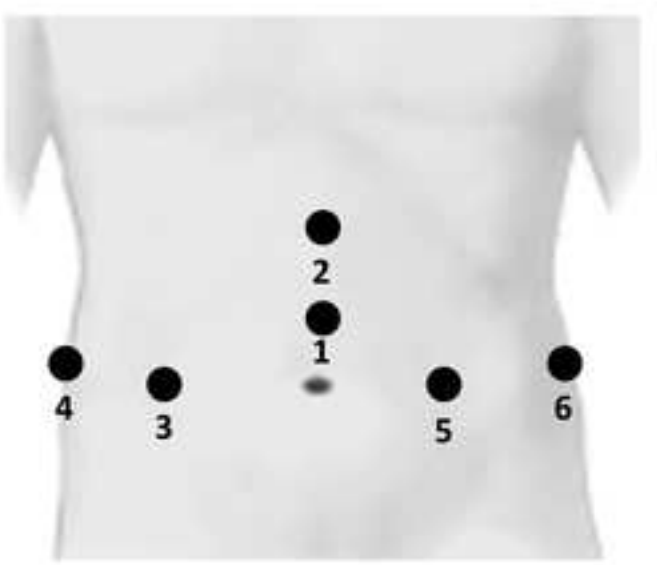

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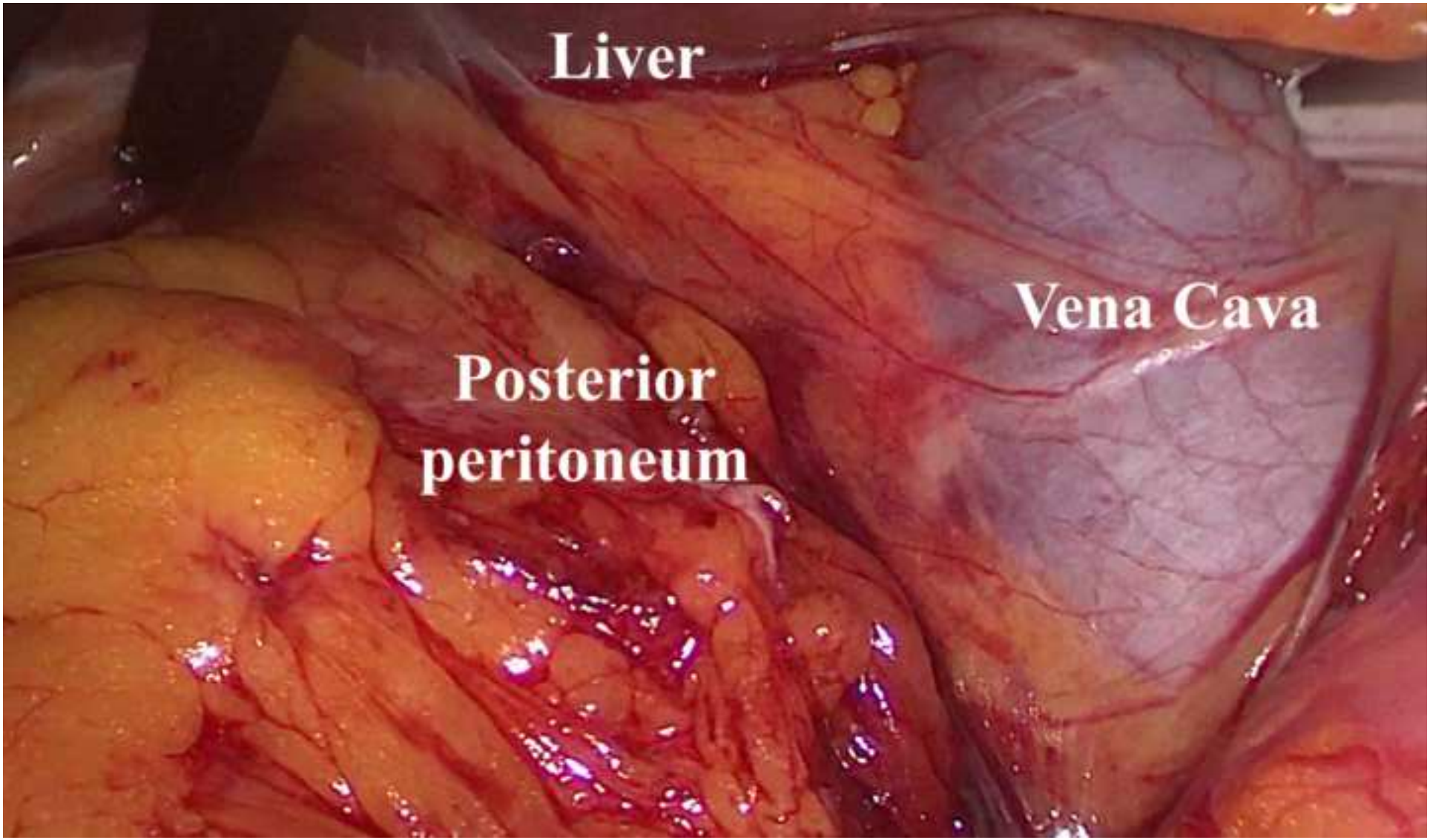

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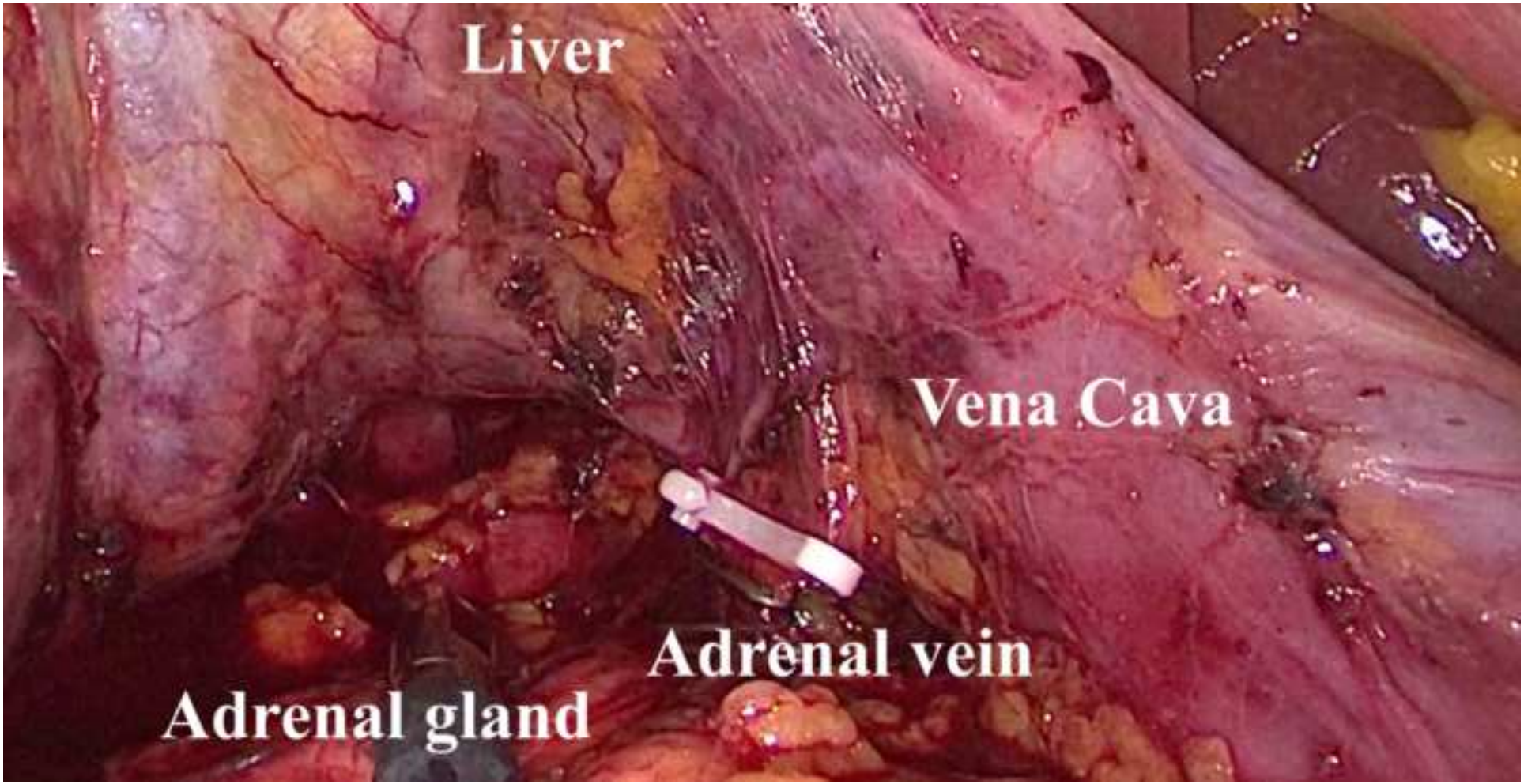

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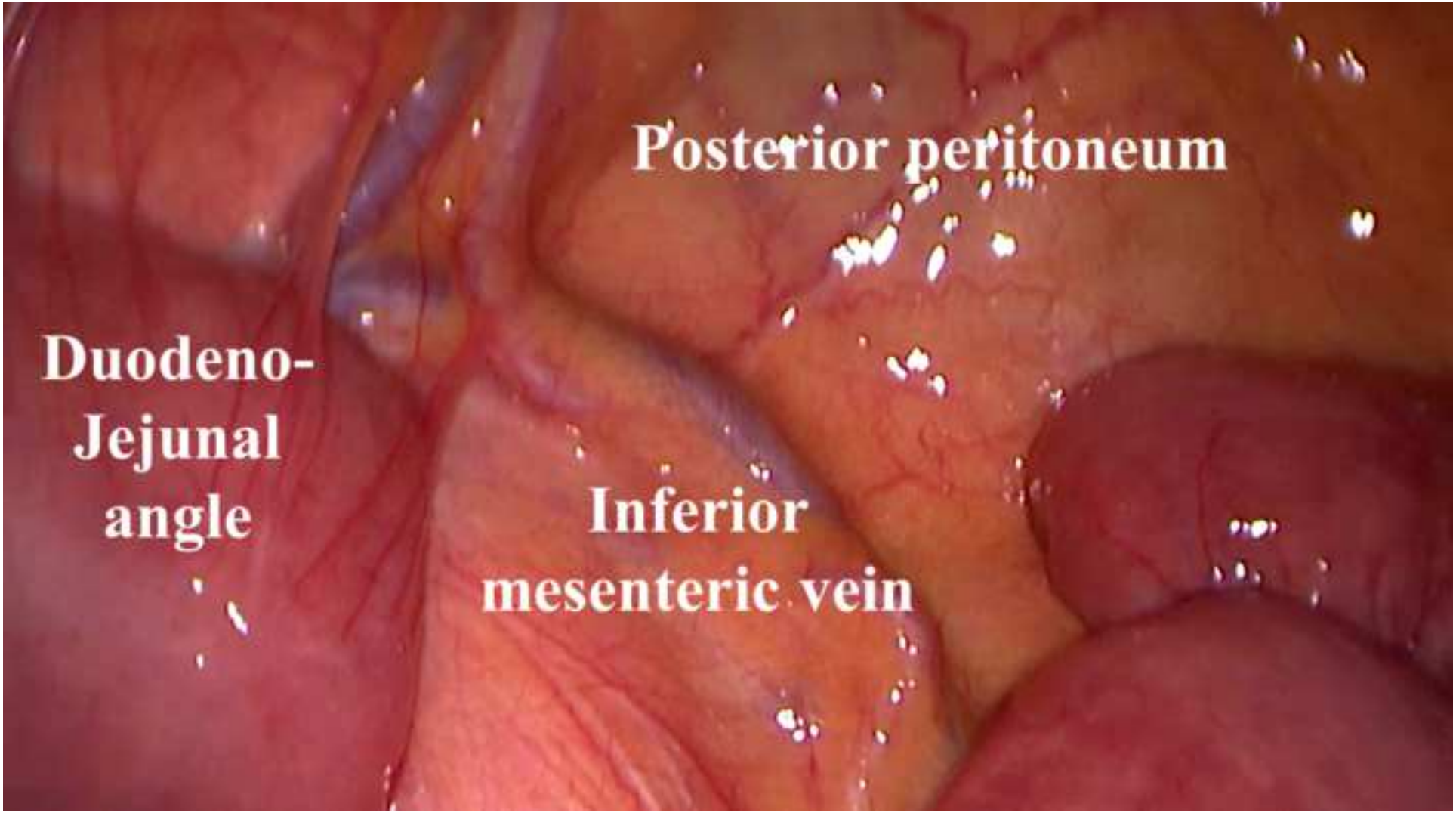

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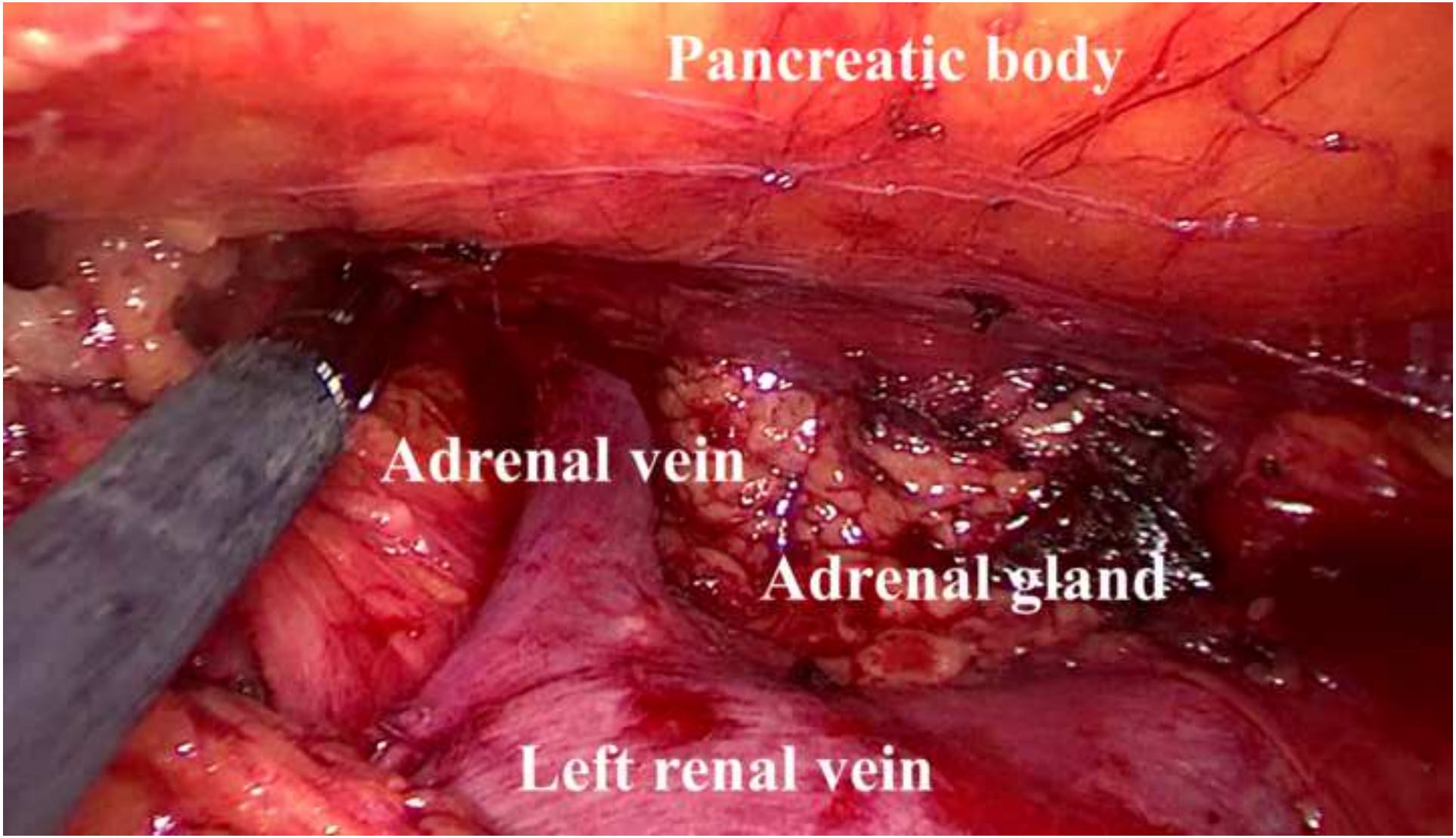

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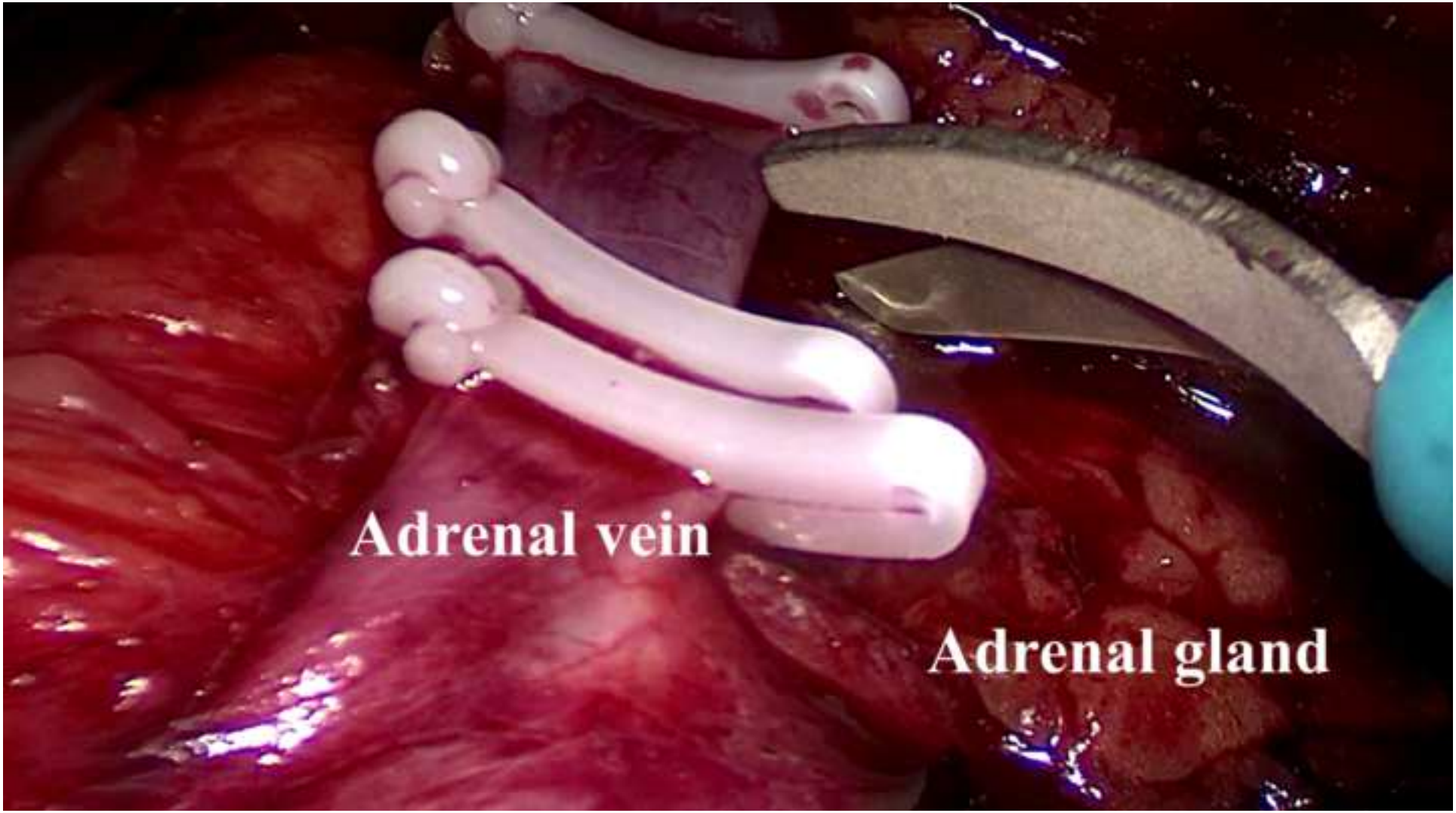

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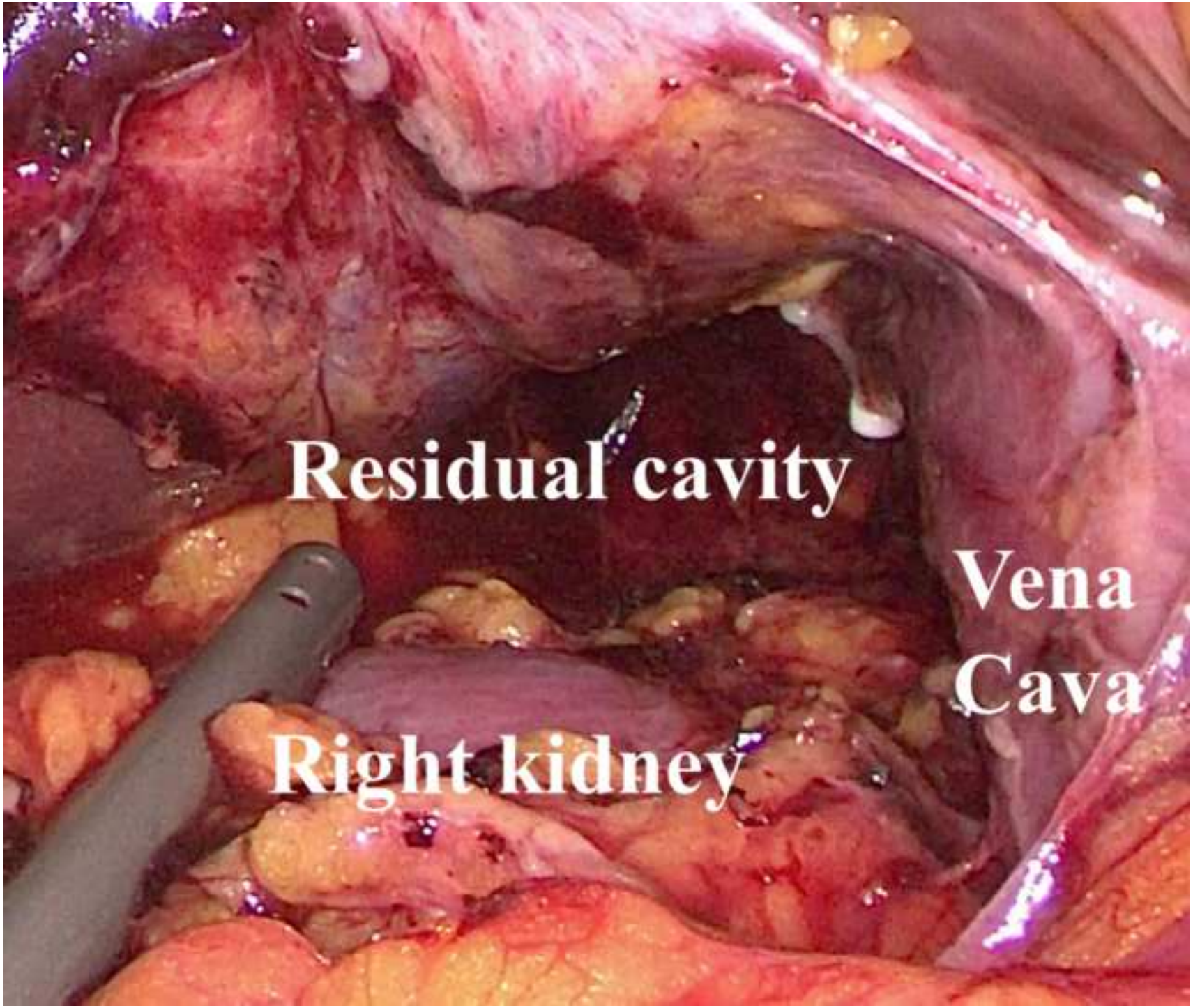

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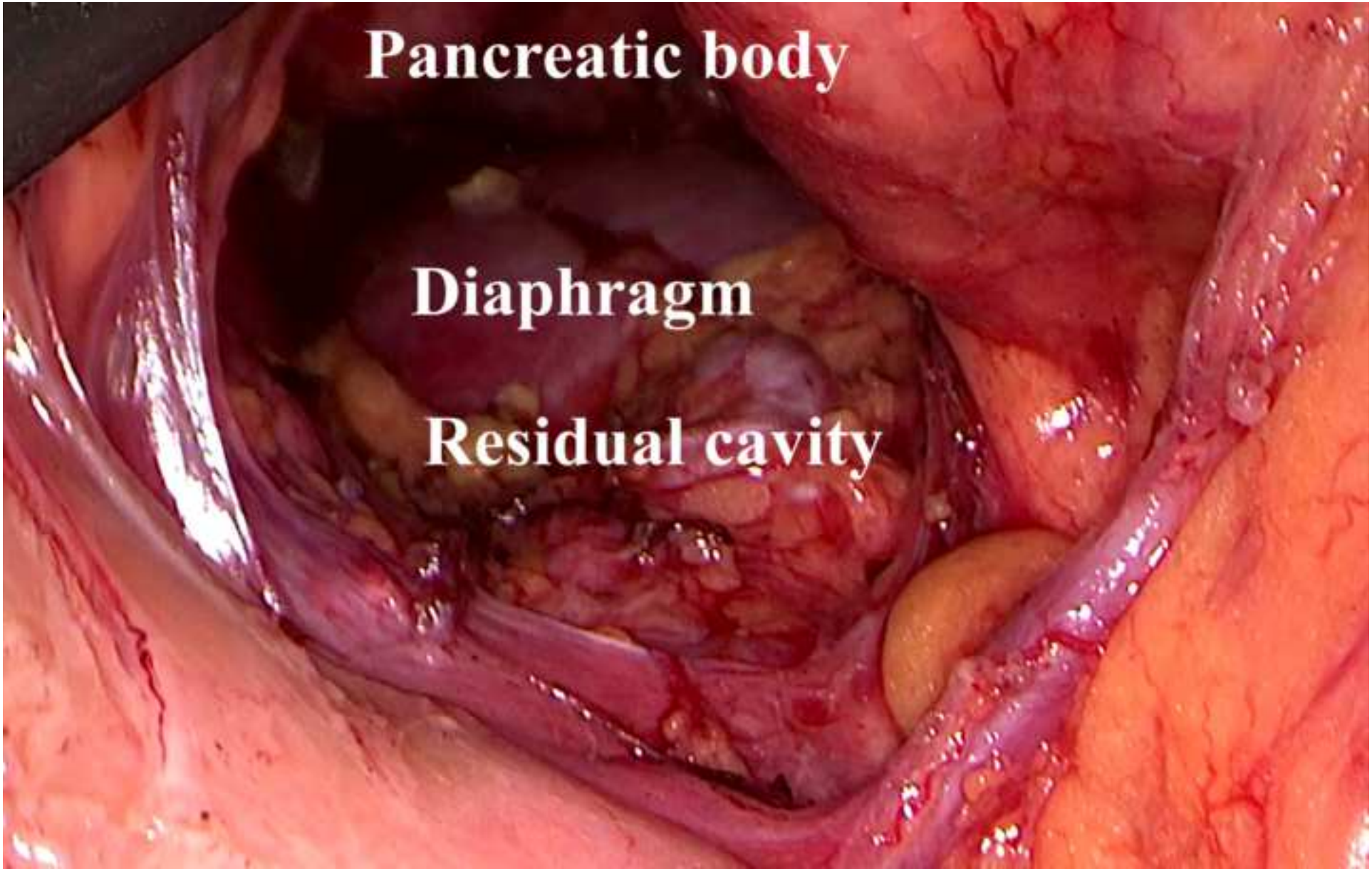

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