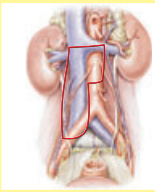
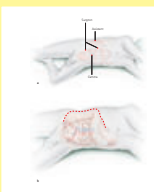
Surgery Illustrated





Surgical Atlas

Laparoscopic retroperitoneal lymph node dissection: technique

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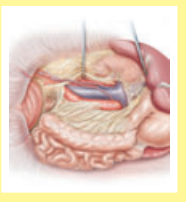
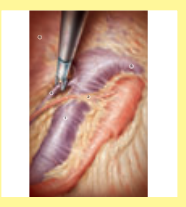
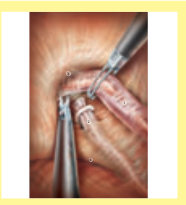
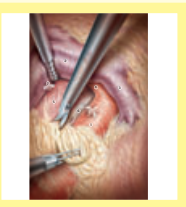








INTRODUCTION

Laparoscopy has been applied in increasingly complex urological procedures, from radical nephrectomy to radical prostatectomy. Certainly, retroperitoneal lymph node dissection (RPLND) for testicular germ cell tumours (GCTs) is one of the most challenging laparoscopic interventions in urology. However, it has been shown to be feasible, with a sound oncological rationale and outcome. Furthermore, laparoscopic RPLND provides a significant benefit in quality of life compared to the more invasive open procedures using the xypho-pubic incision.

We describe the standardized technical approach to laparoscopic RPLND stemming from our 10 years of experience with the technique. We present step-by-step manoeuvres and illustrated key points sequentially.

PLANNING AND PREPARATION

INDICATIONS

Laparoscopic RPLND is indicated in stage I, IIa (before and after chemotherapy), IIb (before chemotherapy) and in selected patients with larger tumours (IIc). It is used mainly as a diagnostic procedure to confirm lymph-node involvement before delivering chemotherapy.

PATIENT SELECTION

All patients presenting with stage I, IIa or IIb nonseminoma (NS) GCT are candidates for laparoscopic RPLND. Indeed, although observation remains an option for low-risk stage I disease, patients with high-risk stage I NSGCT might benefit from RPLND instead of chemotherapy regimens. The surgical approach not only provides a definite pathological diagnosis, but also causes significantly less morbidity than the systemic approach, especially when long-term complications are considered. Moreover, with primary chemotherapy more than half the patients might be treated systemically without ever having had regional metastasis.

Only small stage IIC tumours can be considered for laparoscopic RPLND. We do not suggest a size threshold as we think this depends on surgical skill, experience and the anatomical presentation of the tumour to be resected.

SPECIFIC EQUIPMENT/MATERIAL

The equipment used for laparoscopic RPLND is basically the same as that used for a radical nephrectomy; it consists of a 30° lens with a three-chip camera, which are manoeuvred by a robotic arm. The robotic arm provides a stable image and avoids assistant fatigue related to long procedures. A high flow rate insufflator (>12 L/min), a bipolar electrocoagulating forceps, and an Endoshear are also essential. The harmonic scalpel, whenever available, can be very helpful to expedite the dissection. Vessels can be dissected using an endoscopic right-angle. Haemostatic clips are not routinely needed as the lumbar vessels are not routinely dissected or ligated. Finally, a small surgical sponge held with a traumatic grasper is used for retraction and haemostasis.

SPECIFIC PATIENT PREPARATION

The preparation of the patient follows the same principles as with open surgery. A complete history and physical examination is indicated to exclude any medical condition that might preclude surgery. A basic evaluation of blood status, including a full blood count and a biochemistry panel, is indicated. Special attention should be paid to the patient who has had previous chemotherapy with bleomycin, as pulmonary toxicity might ensue after oxygen administration during anaesthesia. In such cases a preoperative consultation with the anaesthesia team, and pulmonary function tests, might be required.

SPECIFIC PATIENT POSITIONING

Right-sided dissection: Similar to laparoscopic radical nephrectomy, the lateral tilted position is used in this situation; the patient is thus placed at 45° so that rotating the operating table allows frank lateral decubitus or supine positioning without having to reposition the patient. We also routinely flex the table at the level of the umbilicus. Padding is used at pressure points, as with any other extended surgery.

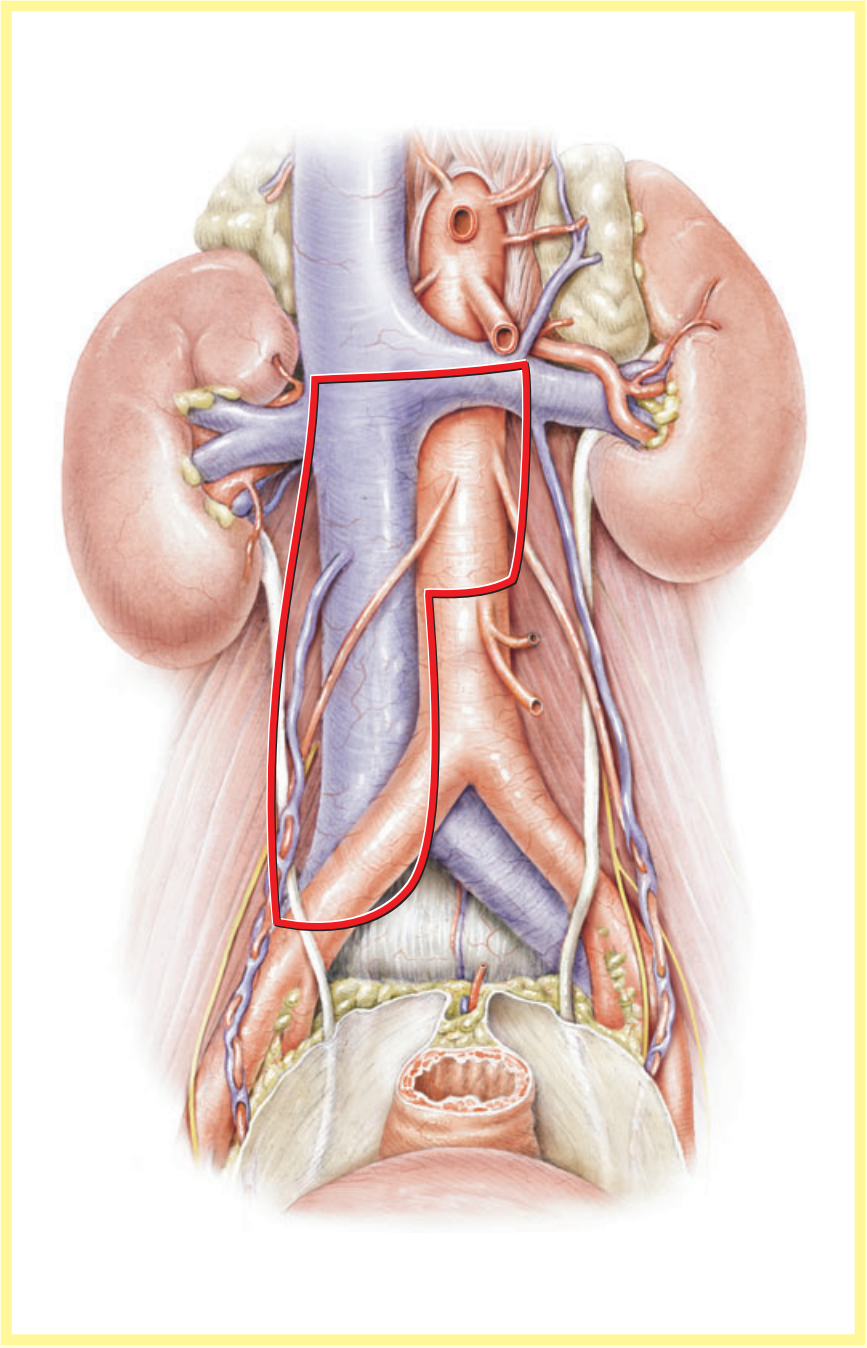
Left-sided dissection: An identical mirror-image position is used.

SURGICAL STEPS

The surgical steps are illustrated in the figures and basically emulate the open approach. Once a pneumoperitoneum is established through a standard approach, we start by incising the line of Toldt for either a right or left dissection. The colon is reclined extensively to afford maximum exposure. Then the major landmarks are identified, including the ureter laterally, the aorta or cava medially and the renal hilar vessels rostrally. Tissue within the confines of the template is resected using standard laparoscopic techniques of blunt and sharp dissection, as illustrated. Haemostatic clips are used liberally where lymphatic vessels are suspected.

Figure 1

The right-sided template: The upper limit of dissection is the renal pedicle. The right lateral limit is the ureter, and the left lateral limit is the edge of the aorta. Note that this vessel is exclusively dissected above the inferior mesenteric artery. The lower limit of dissection is the crossing of the ureter and the iliac artery. Tissue behind the vena cava is not resected, because we have shown that the primary depositing sites for metastases from testicular cancer are ventral to the lumbar vessels, and because our procedure is used for diagnostic and not necessarily curative purposes.



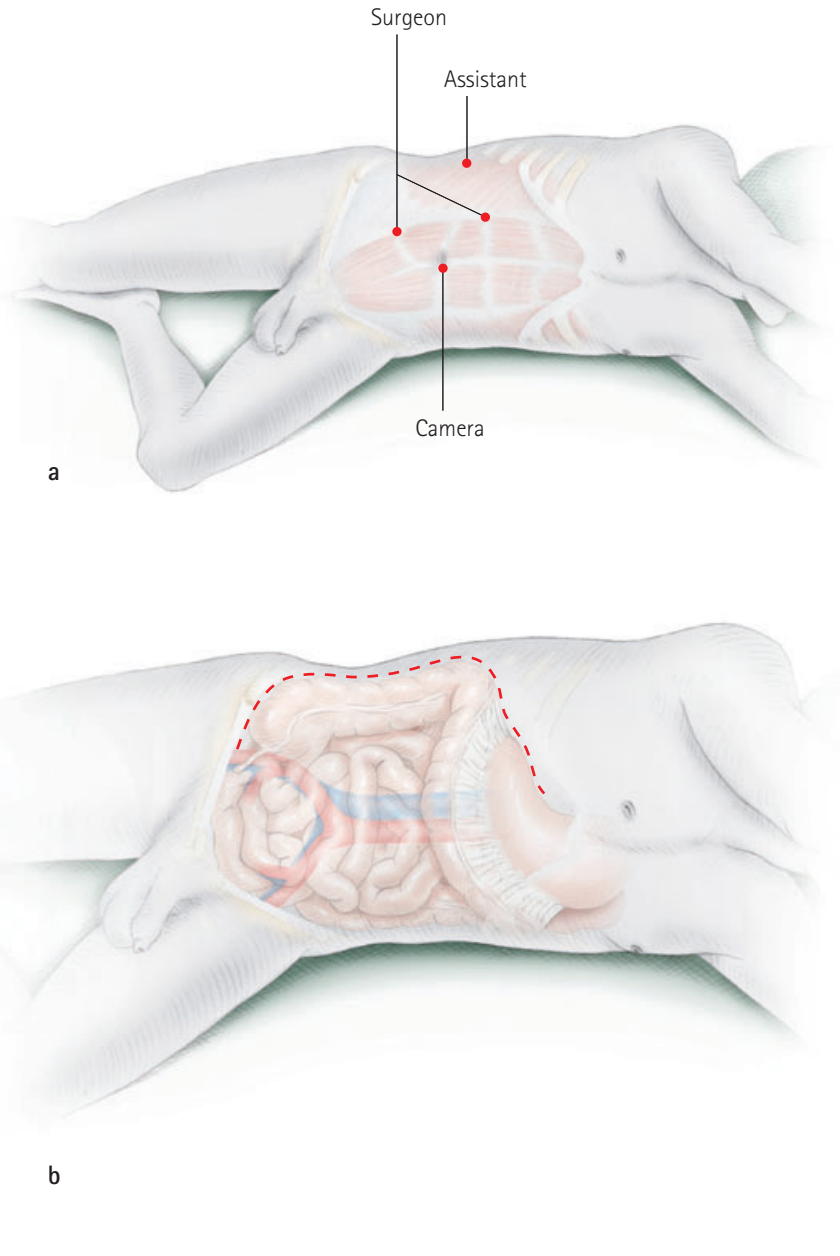
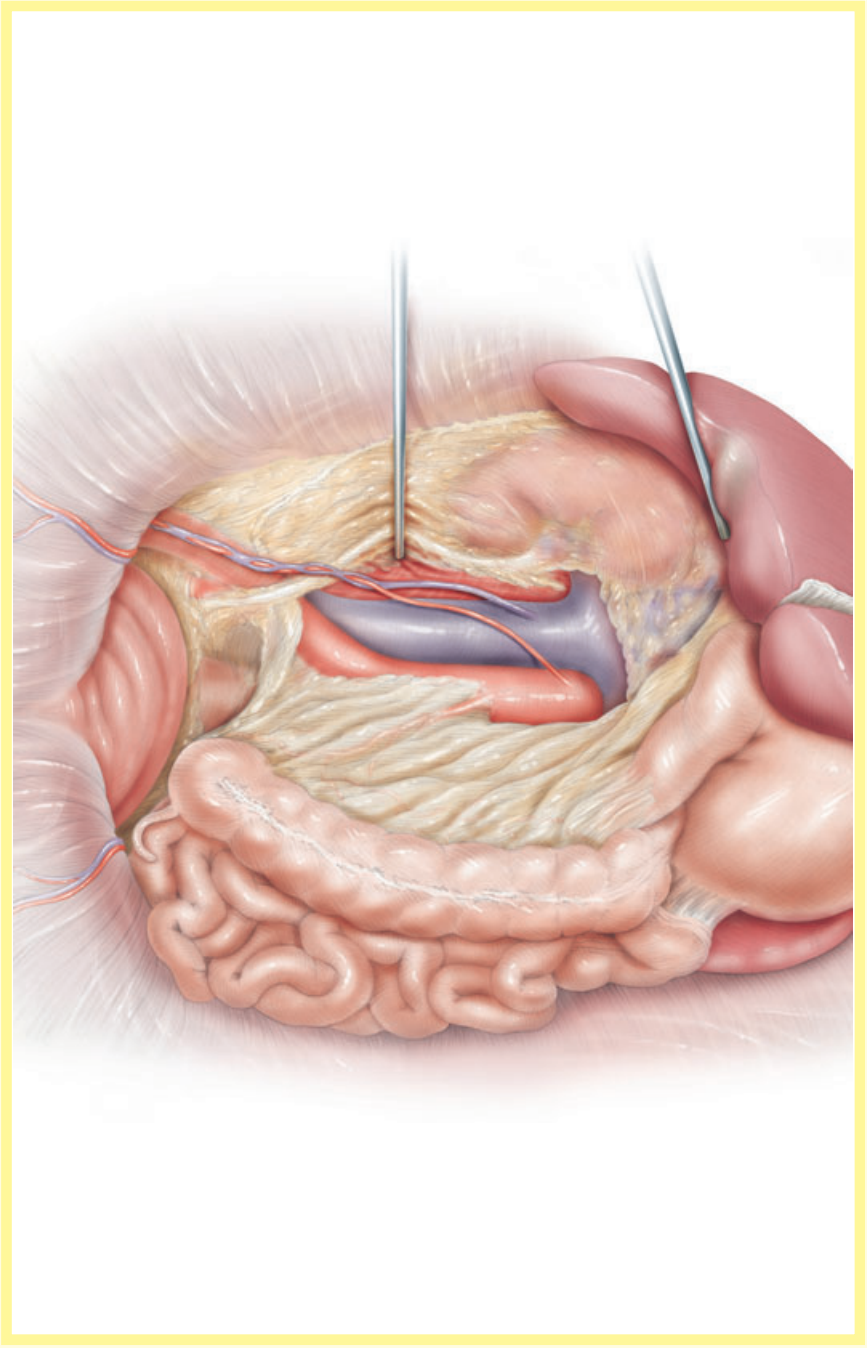


Figure 2

A) Port positioning for a right-sided dissection: The camera port is positioned at the umbilicus. Two working ports for the surgeon are placed in triangulation, lateral to the rectus muscle. A retraction port is placed in the right flank a few centimetres medial to the tip of the 12th rib. B) Peritoneal incision for a right-sided dissection; the line of Toldt lateral to the ascending colon is incised in a standard fashion from the hepatocolic flexure down to the caecum, to afford maximal exposure.

Figure 3

A schematic of the retroperitoneum on completion of the dissection (right template). Note that the inferior mesenteric artery is not dissected. Also note that the gonadal vessels have been dissected down to the inguinal ring and will be excised as part of the template.



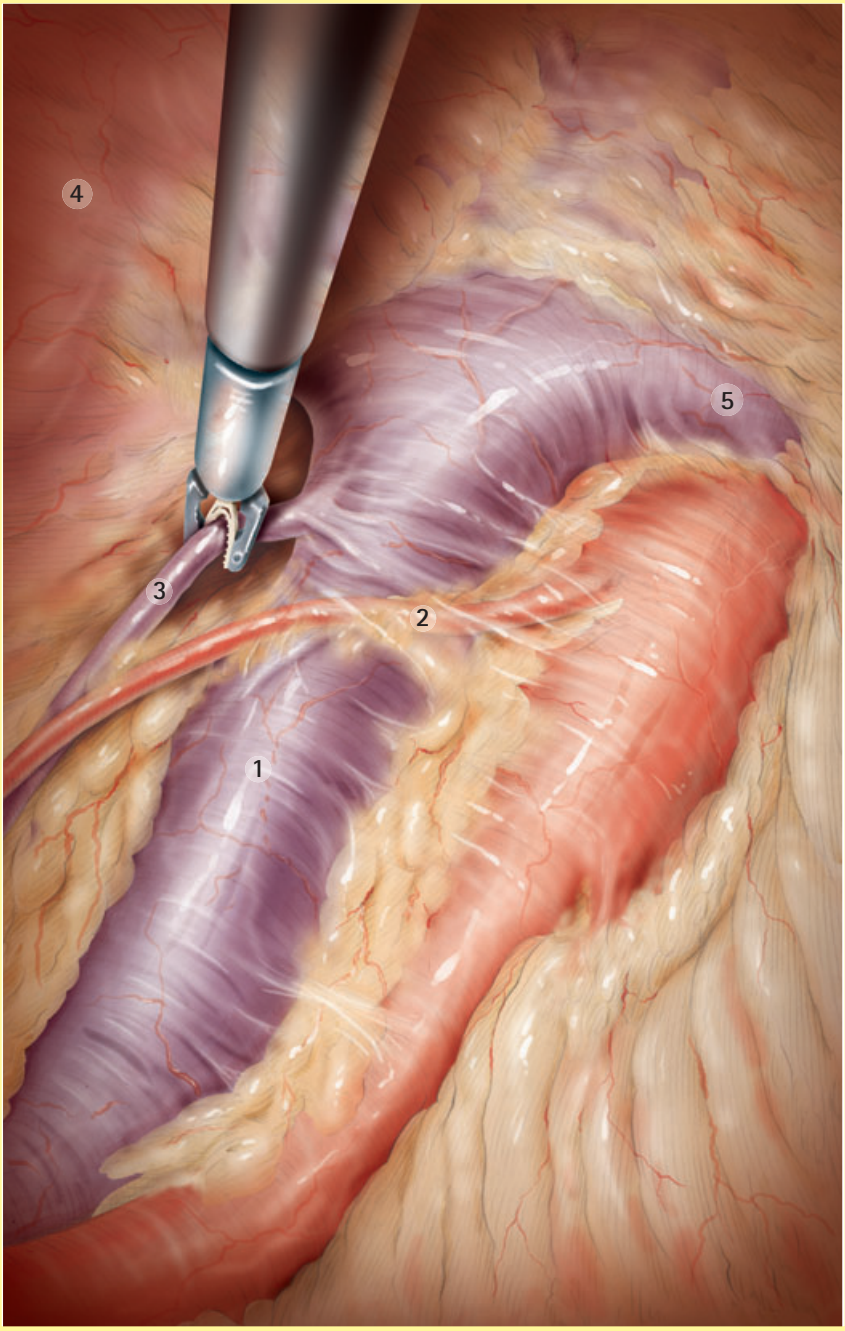


Figure 4

Proximal dissection of the gonadal vessels in a right sided template.

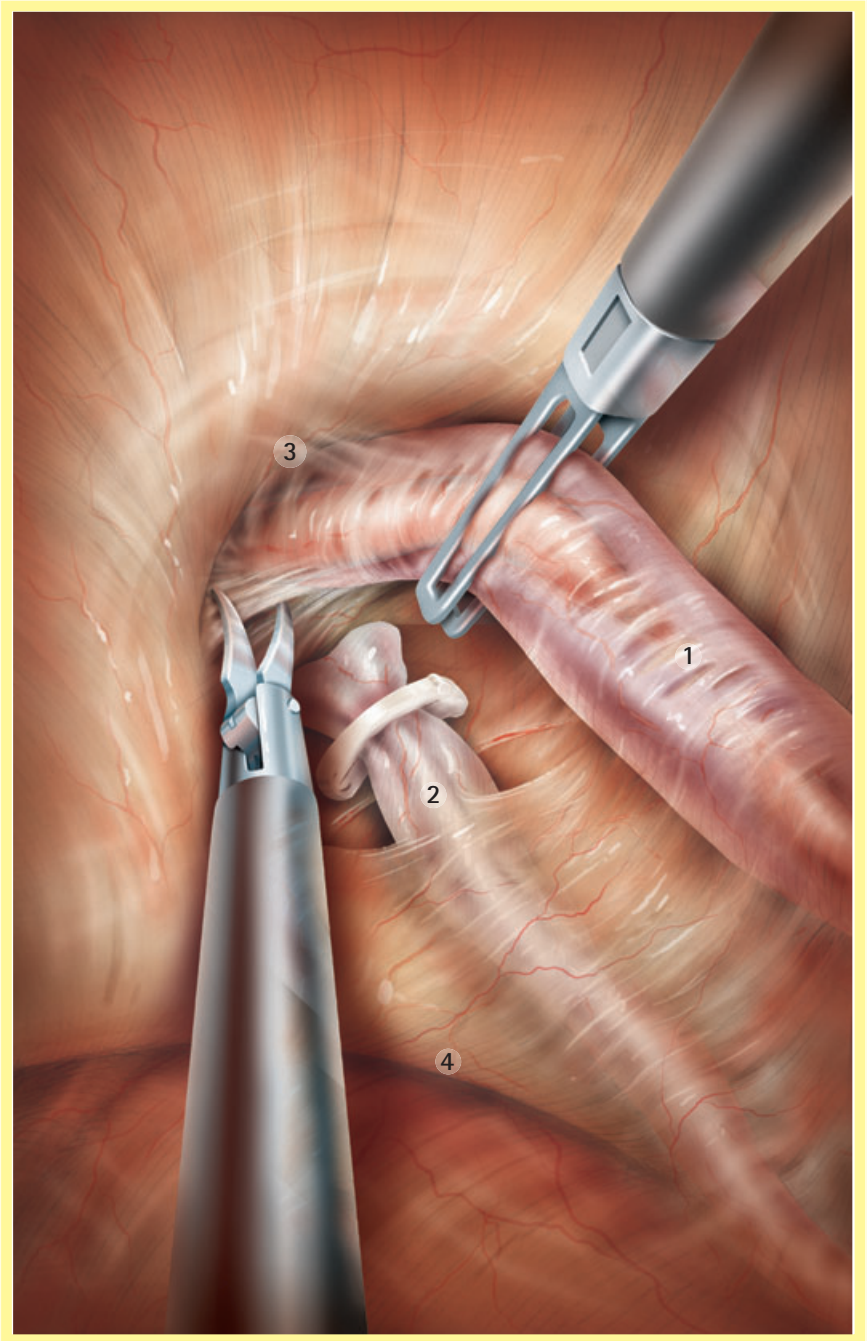
1 Cava
2 Right gonadal artery
3 Right gonadal vein
4 Right Gerota's fascia
5 Left renal vein

Figure 5

Distal dissection of the gonadal vessels in a right sided template

1 Gonadal vessels
2 *Vas deferens* (clipped and transected)
3 Internal inguinal ring
4 Right pelvic brim

Dissection should be carried out down to the internal inguinal ring, thus joining the silk suture placed during the radical orchidectomy.



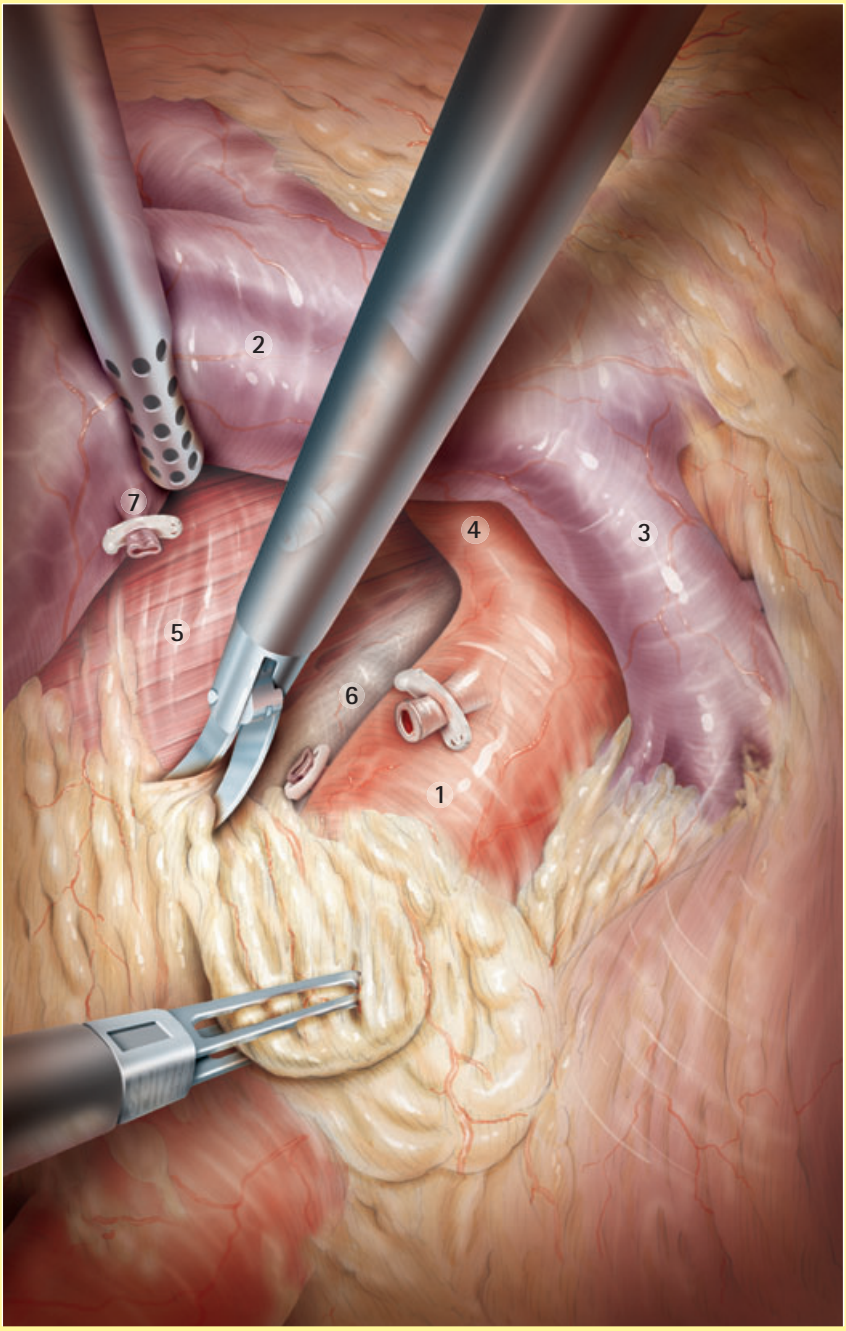


Figure 6

Inter-aortocaval dissection for a right-sided template

1 Aorta
2 Inferior vena cava (retracted)
3 Left renal vein
4 Right renal artery
5 Psoas muscle
6 Anterior spinal ligament
7 Lumbar vein (clipped and transected)

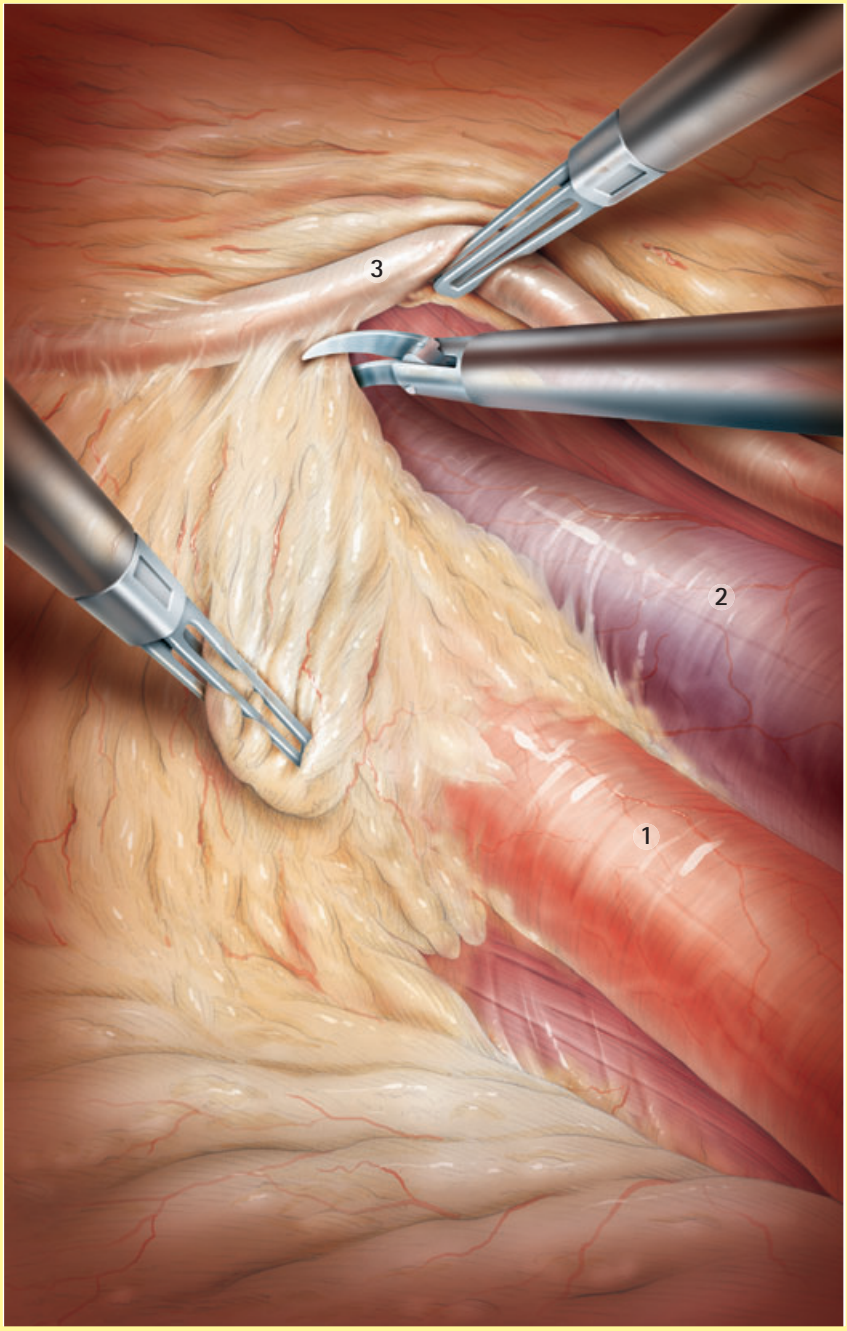
Note the clipped gonadal artery on the anterior aspect of the aorta, and the clipped lumbar vein on the edge of the laterally retracted inferior vena cava.

Figure 7

Ureteric dissection in a right-sided template

1 Aorta
2 Inferior vena cava
3 Right ureter

Once the lateral border of the inferior vena cava is found, the plane leading to the psoas muscle is developed. The ureter is thus retracted laterally, and all the fibro-fatty tissue medial to it is resected and included in the final specimen.



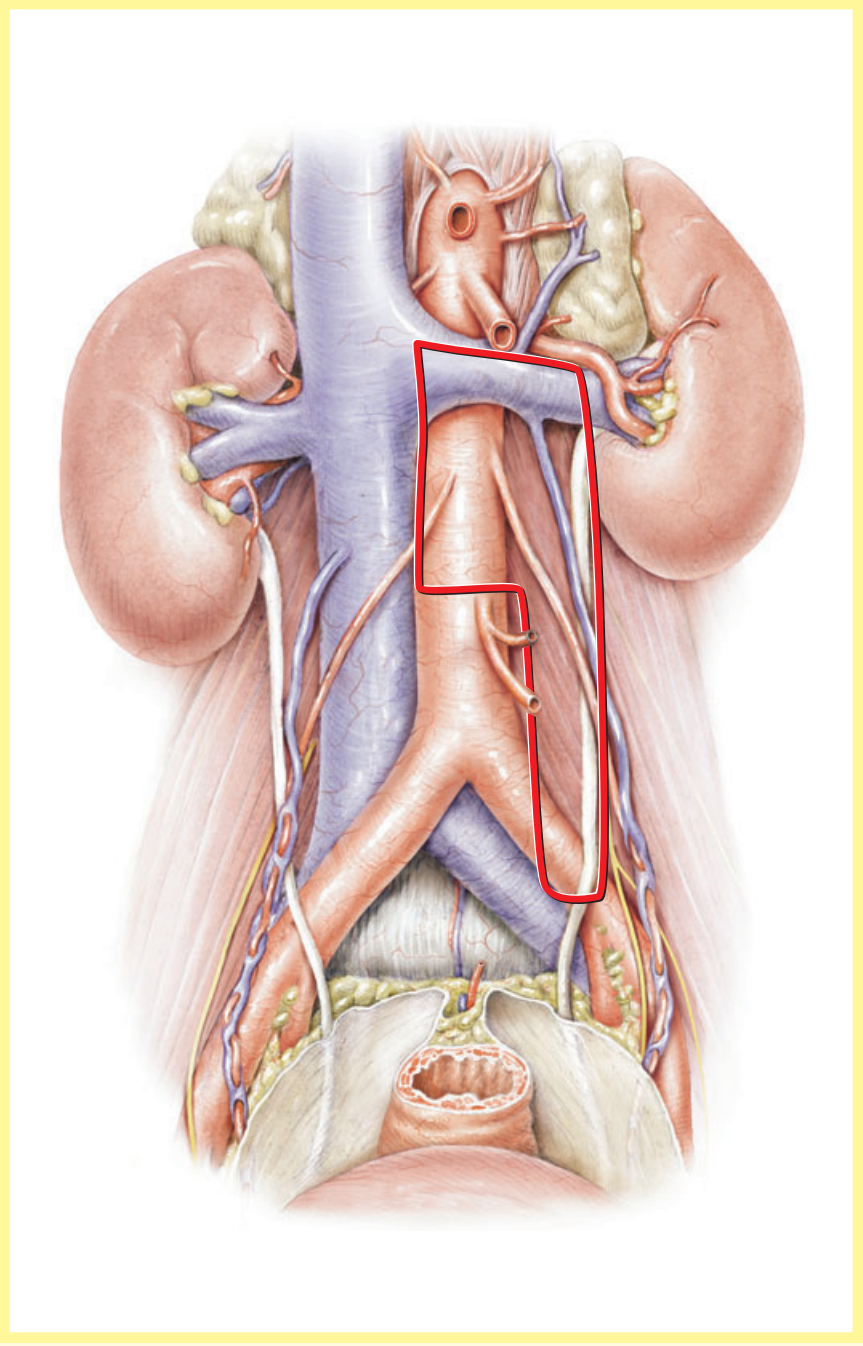
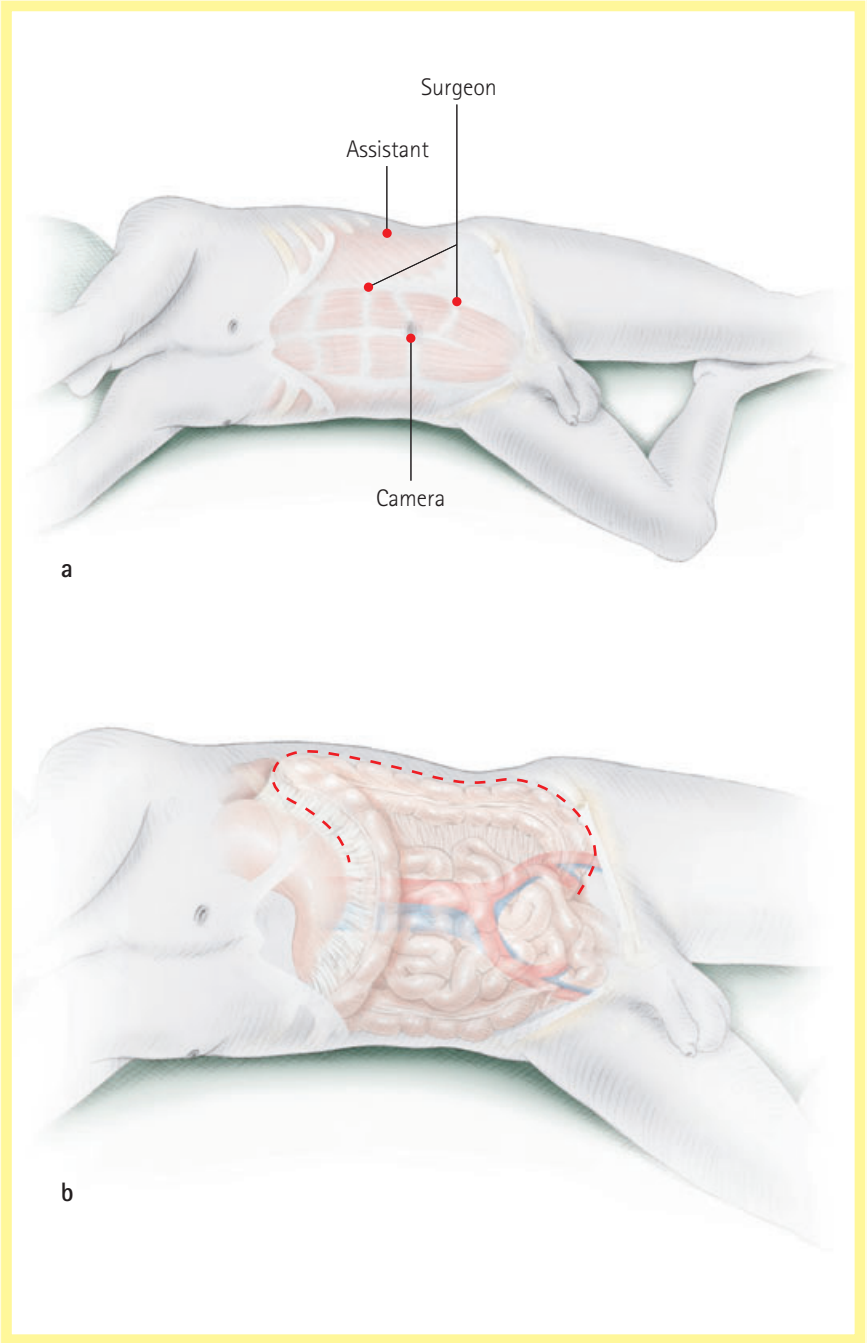


Figure 8

Illustration of a left-sided template. As in the right sided template, dissection keeps to the portion of the aorta that is cephalad to the inferior mesenteric artery. Note that neither inter-aortocaval nor retro-aortic dissection is used in this template.

Figure 9

A) Port placement for a left-sided RPLND: Ports are placed in a mirror image to the right-sided dissection. B) Peritoneal incision for a left-sided template. The line of Toldt is incised in a standard fashion. Note that the incision does not cut through the lineo-renal ligament but through the lineo-colic ligament. Extra care is required to avoid pancreatic injury during this dissection.



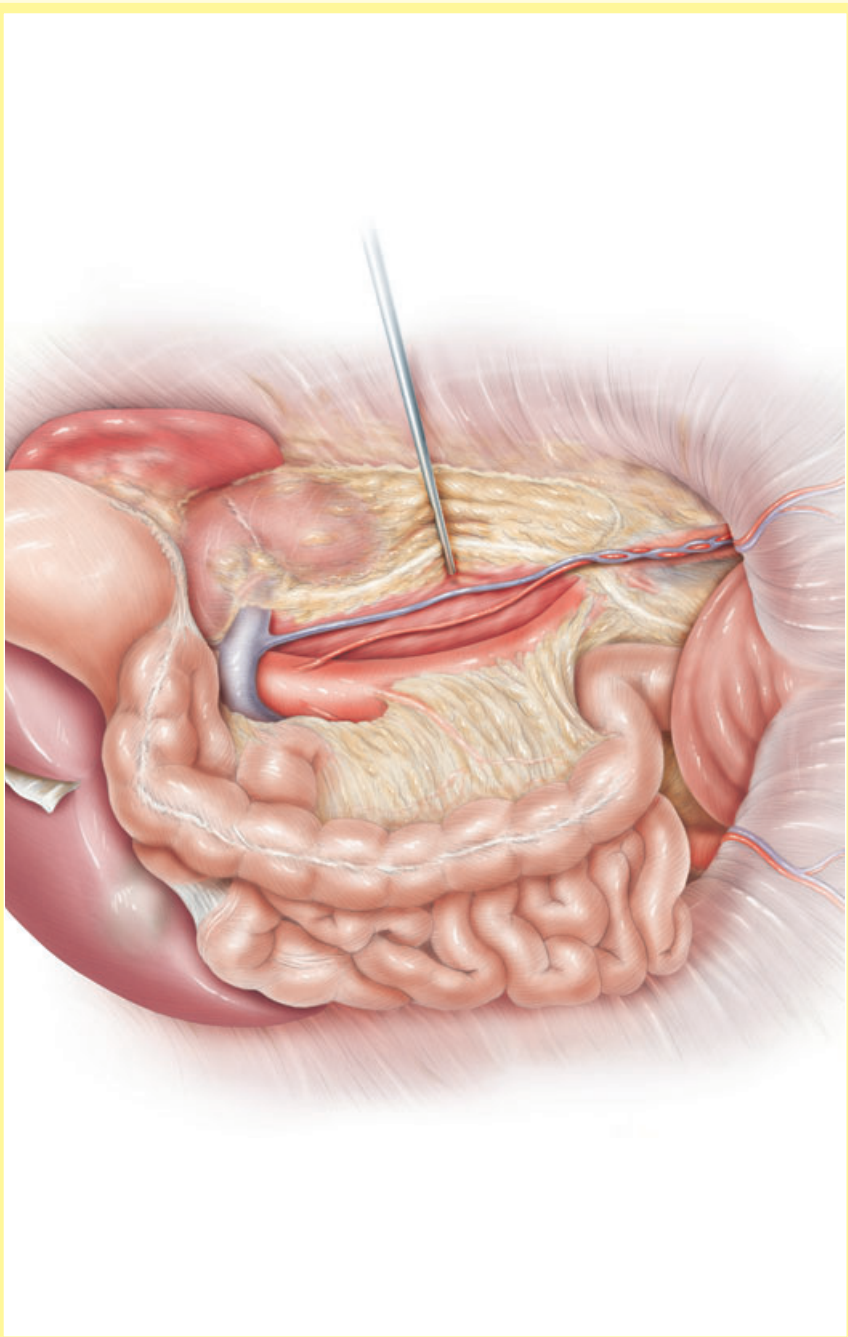


Figure 10

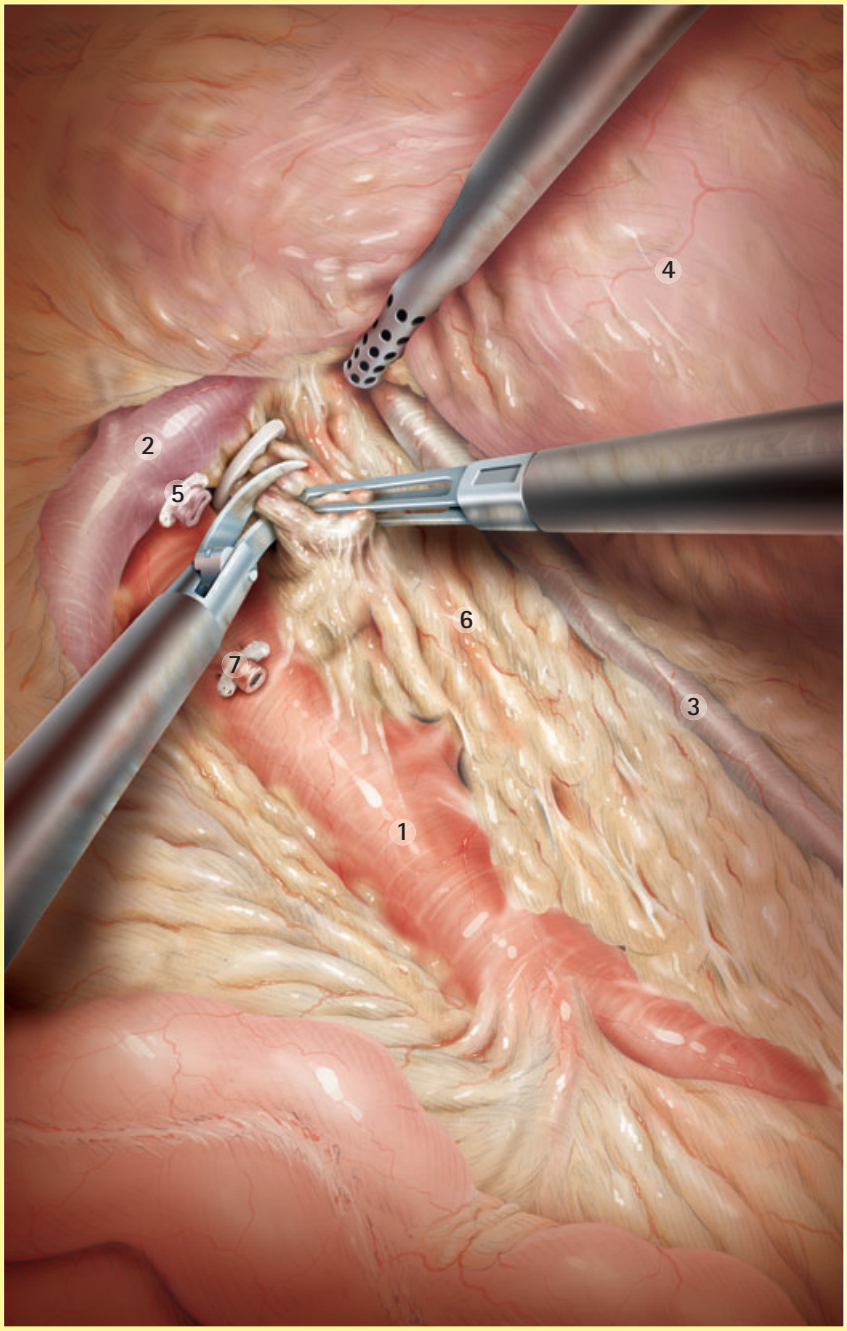
Schematic of the retroperitoneum on completion of the dissection (left template). Note that, as for the right-sided template, the inferior mesenteric artery is not dissected. The gonadal vessels are also included in the specimen.

Figure 11

Retroperitoneum during a left-sided dissection

1 Aorta
2 Left renal vein
3 Left ureter
4 Left gerota's fascia
5 Left gonadal vein (clipped and transected)
6 Lymph node packet
7 Left gonadal artery (clipped and transected)

Tissue anterior to the aorta has been dissected. The lymph node packet is separated from the renal hilum using clips and sharp dissection, given the abundance of small lymphatic vessels in this region.



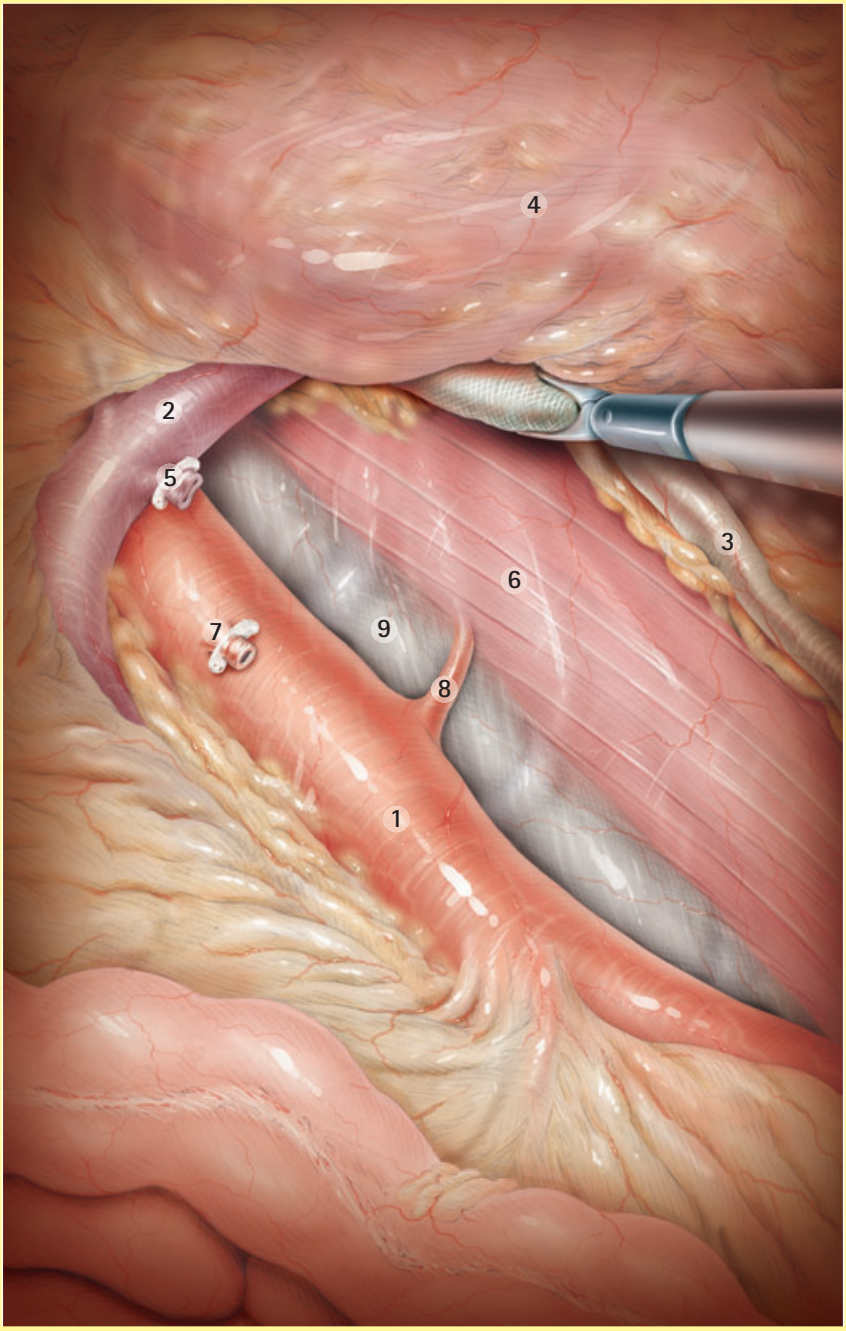


Figure 12

The retroperitoneal bed when the dissection is completed

1 Aorta
2 Left renal vein
3 Left ureter
4 Left gerota's fascia
5 Left gonadal vein (clipped and transected)
6 Psoas
7 Left gonadal artery (clipped and transected)
8 Lumbar artery
9 Anterior spinal ligament

Note the skeletonized lumbar artery running over the vertebral bodies and inserting behind the psoas muscle. Also note that no dissection is done medial to the aorta.

POSTOPERATIVE CARE

Dressings used for laparoscopic RPLND are the same standard dressings used after a laparoscopic nephrectomy. Basically, a sterile 2 × 2 gauze placed over each port incision, covered with a sterile transparent adhesive dressing, is sufficient. The dressing should be removed 24–48 h after surgery with the subsequent application of sterile strips.

Specific medication after surgery is limited to standard analgesia and subcutaneous thromboprophylaxis. Patient instruction: Oral intake is resumed on the first day after surgery and the patient is encouraged to ambulate soon after surgery.

The urinary catheter is removed on the first day after surgery if the urinary output is adequate.

FROM SURGEON TO SURGEON

There is no 'point of no return' for laparoscopic RPLND, as no vital or functional structure is intentionally sacrificed. It is therefore always possible to abort the procedure at any point during the operation.

HIDDEN SECRETS

As with any surgical procedure, gaining exposure is of utmost importance. For laparoscopic RPLND, this is achieved through wide mobilization of the colon on either side, allowing free access to the retroperitoneum without even having to retract the bowel later during the procedure.

To avoid iatrogenic organ injury, the surgeon should maintain clear dissection borderlines by remaining on the vessels at all times during dissection. The use of clips on the resected margins of tissue should help to minimize lymphocele formation.

PITFALLS

A few are worth emphasizing: first, while mobilizing the left colon for exposure, the surgeon should beware not to enter the plane behind the kidney, thus reclining it and making further dissection almost impossible. Second, the surgeon must be very careful while handling the opening of the right gonadal vein, as this structure is very friable and can tear off easily. Third, while splitting the tissue overlying the aorta in the cephalad direction, the surgeon should be alert to the presence of the left renal vein, as this structure could be inadvertently injured. Similarly, accessory arteries to the kidney might be encountered during the dissection between the aorta and the kidney; their severing can result in troublesome bleeding and potential loss of renal function.

TROUBLESHOOTING

From the above considerations, haemostasis is probably the problem that the surgeon faces most frequently during laparoscopic RPLND. Generally, the best solution for haemostasis is prevention, using good patient preparation, appropriate preoperative imaging and good surgical technique with excellent exposure. If there is still bleeding despite the previous measures, the following manoeuvres might be very helpful.

The first thing to do in case of brisk bleeding is to apply pressure using the suction device. This will allow the surgeon to gain time and thus gain better exposure, assess the situation and adopt an optimum strategy. The use of tissue sealants such as fibrin glue might be very helpful; however, it is inappropriate for active arterial bleeding. In such cases, clips can be extremely useful. Alternatively, using a suture bolstered with LapraTy(r) clips (Ethicon Endosurgery, Cincinnati, OH, USA) might allow the closing of significant defects quickly without wasting time on intracorporeal knot-tying. Finally, the surgeon should not hesitate to add an extra 5-mm trocar to manage the situation, as this might make the difference between a laparoscopic procedure and a conversion.

Lymphocele formation can be another troublesome postoperative complication. Again, the best treatment in this situation is prevention; we usually never leave a suction drain and never retroperitonealize the great vessels at the end of the procedure. We think these two measures contribute to reduced lymphocele formation.

THE DIFFICULT CASE

Obesity is certainly one factor that renders laparoscopic RPLND more demanding technically, but we have never had to convert a procedure because of this factor. Other difficulties are related to anatomical anomalies, e.g. ectopic or horseshoe kidneys and multiple polar arteries to the kidneys. Finally, in patients after chemotherapy, just as with open surgery, the planes might be obliterated by the treatment, rendering dissection more challenging, especially around the great vessels. However, we have that the degree of difficulty in RPLND after chemotherapy depends not on the amount of chemotherapy received, but on the tumour type. For example, tumours that respond very well to chemotherapy regimens, e.g. embryonal NSGCT, are likely to present with extremely obliterated planes compared with tumours that do not respond well (e.g. teratoma).

THINGS TO MAKE LIFE EASIER

Before surgery, appropriate imaging can help to identify anatomical difficulties and help to avoid them, especially for vascular variations of the renal hilum. During surgery exposure remains the cornerstone of a safe procedure and probably the best means to avoid the pitfalls mentioned previously.

LOWS

Our personal low was a case where the left renal vein was inadvertently injured during a right RPLND. The case had to be converted and an open repair of the renal vein carried out. Unfortunately the injured renal vein was the site of a thrombosis after surgery, leading to a functional loss in the renal unit during the long-term follow-up.

HIGHS

Probably our single most helpful aspect is adequate intraoperative exposure. A very clean and bloodless dissection can be carried out only when adequate exposure is obtained.

BACKUP STRATEGIES

As already mentioned, the surgeon should never hesitate to use an extra port when necessary. This might make the difference between a laparoscopic and a converted procedure. Ultimately, converting might be the wisest decision in certain situations and should always be entertained as an alternative.

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Abbreviations: **RPLND**, retroperitoneal lymph node dissection; **(NS)GCT**, (nonseminoma) germ cell tumours.