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Surgery Illustrated – Surgical Atlas
Laparoscopic right donor nephrectomy

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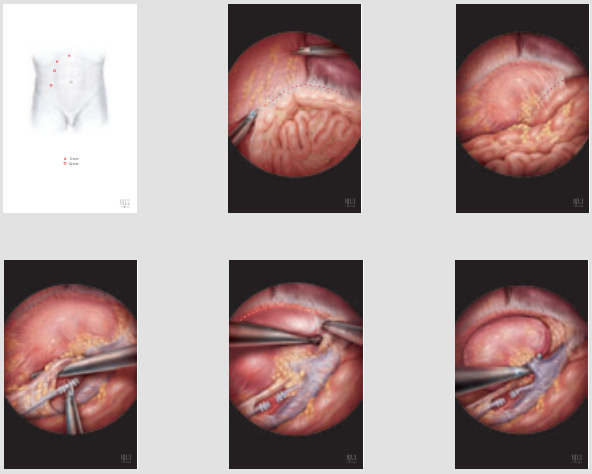

INTRODUCTION

Since the first description of laparoscopic donor nephrectomy (LDN) in 1995 by Ratner *et al.* [1] LDN has become the preferred method of kidney donation at most kidney transplantation centres. The technique for LDN continues to be refined, with advances in laparoscopic instruments, surgical techniques and experience.

Traditionally surgeons have preferred left LDN as the vein on the left side is longer. However, certain instances can preclude the harvesting of the left kidney, like multiple renal arteries or veins, a cystic mass in the right kidney, smaller right kidney or a 10% difference in renal function compared with the left kidney [2]. In many centres the procurement of a right kidney laparoscopically is viewed with reluctance, due to concerns of inadequate renal vein length, and a possible higher incidence of venous thrombosis [3]. Thus the percentage of right DNs done laparoscopically is 0–4%, vs 26–37% in open DN [4].

Newer techniques are required in right LDN that will ensure the safety of the procedure and help to achieve adequate renal vein length. The following is a brief description of the techniques used in a right LDN, their advantages and disadvantages.

PURE LAPAROSCOPIC PROCEDURES

ENDOVASCULAR GASTROINTESTINAL ANASTOMOSIS STAPLING (ENDO GIA) DEVICE

The use of stapling devices for controlling renal vessels during LN has become standard practice [5]. The Endo GIA stapling device

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places two triple staggered rows of staples on the vessels and further divides them with an internal knife. Stapling devices thus transfix the vessels, which is more secure than other methods for vascular control. However, the need to trim the staples off the donor vein results in shortening of the vein by approximately 1 cm [6].

MODIFIED ENDO GIA

A modification of the Endo GIA stapler has been described in which the triple staggered rows of staples from the kidney side are removed [7]. Although this modification has been used by these authors in nine cases, the safety and efficacy of the stapling device after manipulating it before firing is yet to be determined.

ENDOVASCULAR THORACIC ANASTOMOSIS (ENDO TA) STAPLING DEVICE

Abrahams *et al.* [8] described the use of an Endo TA stapling device in 44 cases of right DN. The donor artery was ligated with a single Hem-o-lok™ clip (Teleflex Medical; Weck Closures Inc, Research Triangle Park, NC, USA) and a proximal titanium clip. An Endo TA stapler was placed across the renal vein on the lateral edge of the vena cava, and the renal vein was subsequently cut with laparoscopic scissors. The concern with this technique would be the inability to include an adequate cuff of inferior vena cava (IVC). However, the authors stated that all cases had adequate vessel length for vascular anastomosis with no problems of graft vascular thrombosis.

HEM-O-LOK

The use of Hem-o-Lok polymer clips to control and increase the length of renal vessels during living DN has been described [9]. The potential advantages of using Hem-o-lok clips include secure sealing and low cost [10]. In a published survey, Friedman *et al.* [11] raised questions about the security of these clips as a primary method of ligation. Recently, Teleflex Medical has included live DN as a contraindication for the use of Hem-o-lok clips on the renal artery, as the clips might dislodge [12].

LAPAROSCOPIC SATINSKY CLAMP

In an attempt to duplicate open right DN, Turk *et al.* [13] described the use of a laparoscopic Satinsky atraumatic vascular clamp. In addition to the four standard ports for transperitoneal access, a small incision is made medial to anterior superior iliac spine, and through this a laparoscopic Satinsky clamp was inserted under vision without a trocar. Although this method represents a minimally invasive equivalent of right DN, it risks a slippage or misplacement of the clamp, with disastrous complications.

HAND-ASSISTED/LAPAROSCOPIC-ASSISTED TECHNIQUES

The proponents of hand-assisted techniques (using various commercial ports) advocate it as a means to increase the rate of learning the procedure. The advantages of using a hand-port device include having tactile feedback, shorter operative times and shorter warm ischaemia of the kidneys [14]. However, the method has not shown any marked difference in the outcome of patients.

In a modification of the hand-assisted technique, El Galley [15] described a novel technique for hand-assisted right LDN, in which a new vascular clamp is completely inserted into the peritoneal cavity through the hand-port incision.

Using this vascular clamp, the defect in the IVC is sutured intracorporeally. This technique has been used successfully in 80 cases of hand-assisted right DN. However, this study is limited to the experience of one surgeon, and more studies would be required to confirm the safety and reproducibility of this technique.

In the laparoscopic-assisted technique for right DN described by Lee *et al.* [16] after laparoscopic dissection of the kidney, an 8-cm right upper quadrant incision was made through which a Satinsky clamp was placed across the IVC. Vessels were divided, the kidney removed and the cavotomy repaired through this incision. Although this technique duplicates the open technique, the subcostal incision would negate the advantages of a laparoscopic procedure.

Of all the variables to be considered in right DN, the most important would be the safety of the technique, to prevent bleeding in the donor. The other variables to be considered would be ease of use, rapid application to minimize warm ischaemia time and the length of the donor vessels.

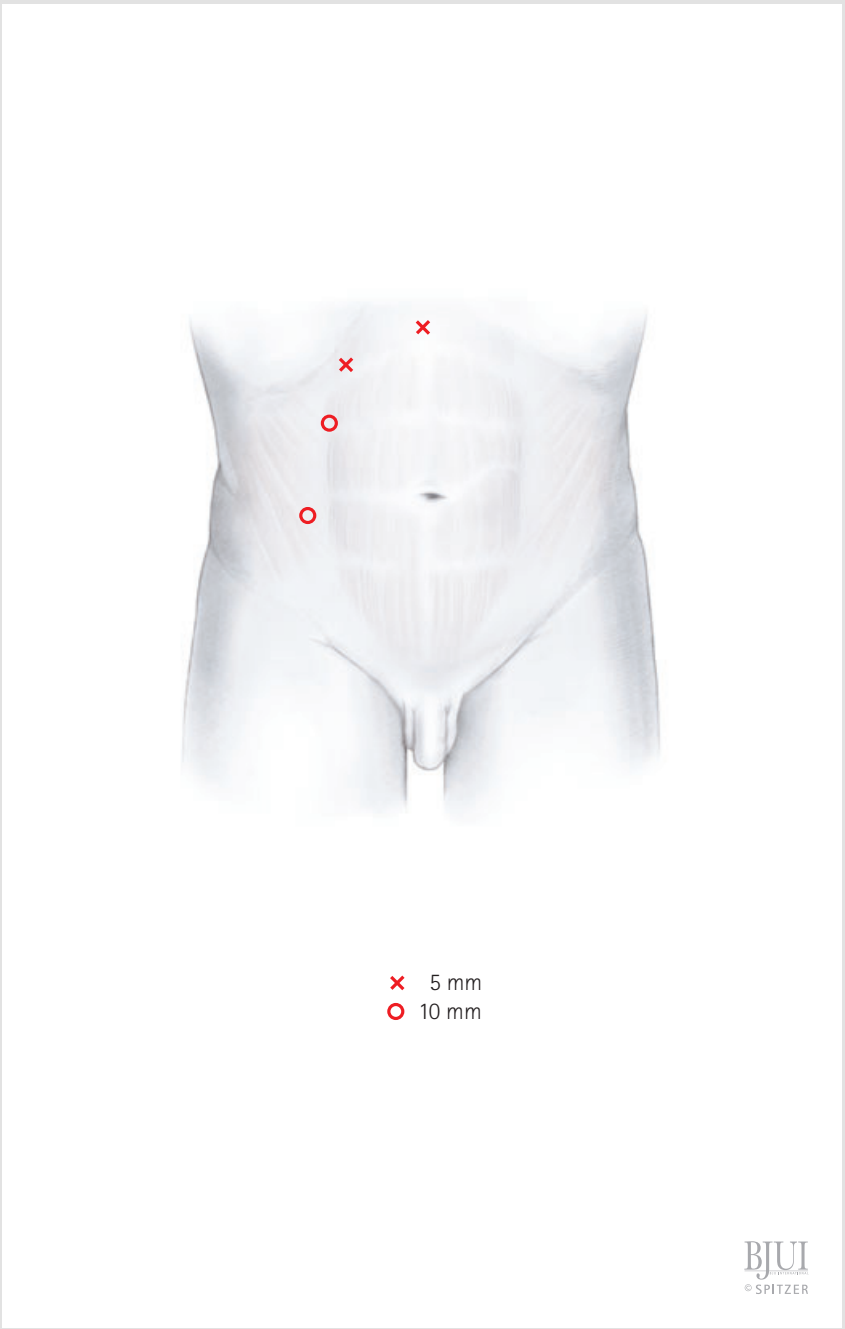
Right DN continues to pose a unique challenge for surgeons, requiring newer methods or techniques to be developed which ensure the safety of the procedure for the donor and do not compromise the graft.

RIGHT LDN: THE MCMASTER UNIVERSITY TECHNIQUE

After anaesthetic induction and Foley placement, a Pfannenstiel incision is marked 3–4 cm cephalad to the pubic bone. The patient in positioned in a 'right-flank up' position (with 45° tilt to horizontal). The patient is secured with adhesive tapes, ensuring adequate padding on the bony prominences. We also use a 'bean bag' to keep the patient in the desired position. The table is then flexed.

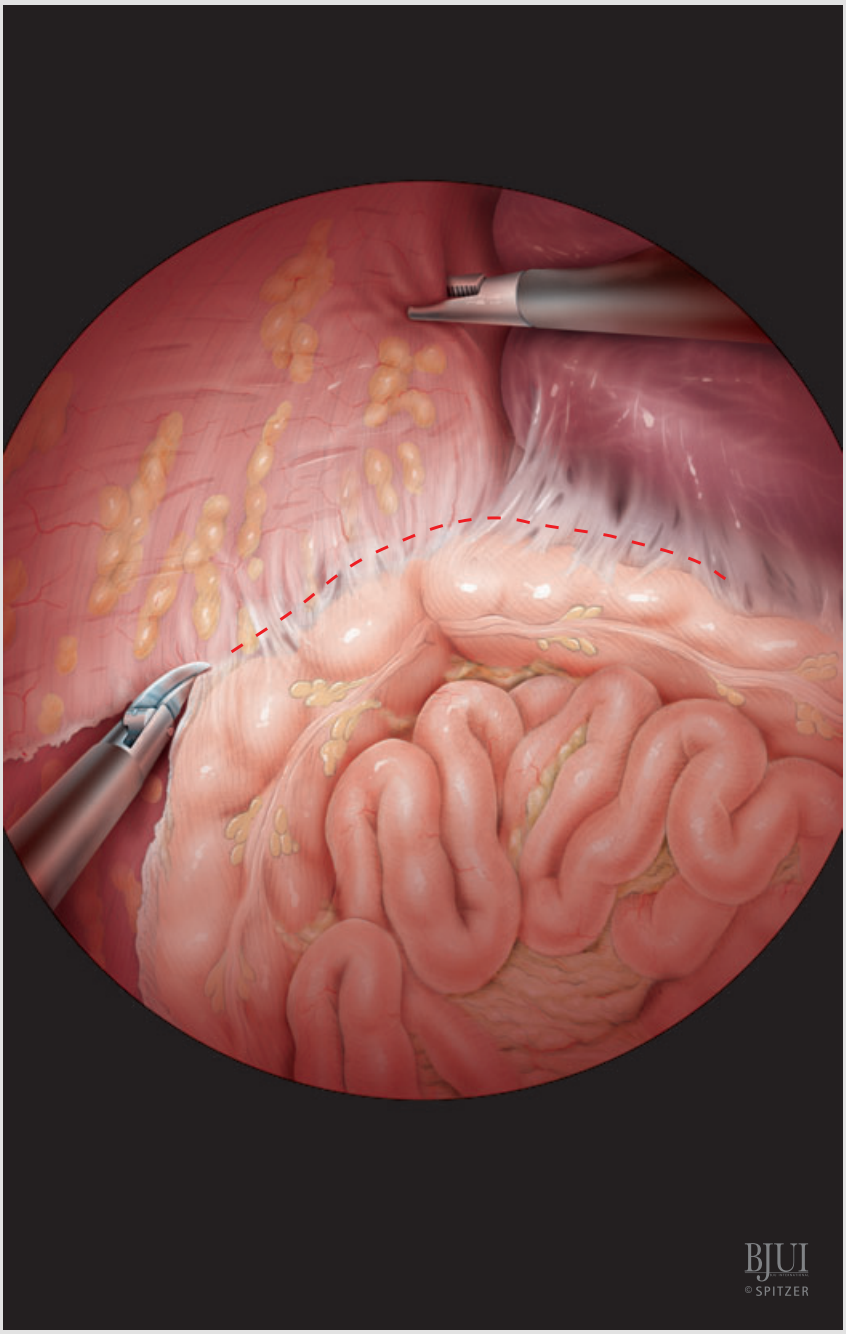
Figure 1

Port placement: pneumoperitoneum is established by placing an infraumbilical Veress needle. The trocar is placed as follows: A 10-mm Optiview (Ethicon EndoSurgery, Cincinnati, OH, USA) is used for camera at the lateral border of rectus muscle in the mid-clavicular line, 4–5 cm superiorly and laterally to umbilicus. Two 5-mm ports, one in the midline below the xiphoid process, used to retract the liver using a rachetted Debakey grasper, and another a few centimetres below the costal margin, is used for the suction cautery. Another 10-mm port is placed for the dissecting forceps lateral to the umbilicus and at an adequate distance to the camera port.



Figures 2 and 3

Right colon mobilization – duodenal mobilization: The colon is mobilized medially by incising the lateral peritoneal fold, allowing exposure of the duodenum and the IVC.



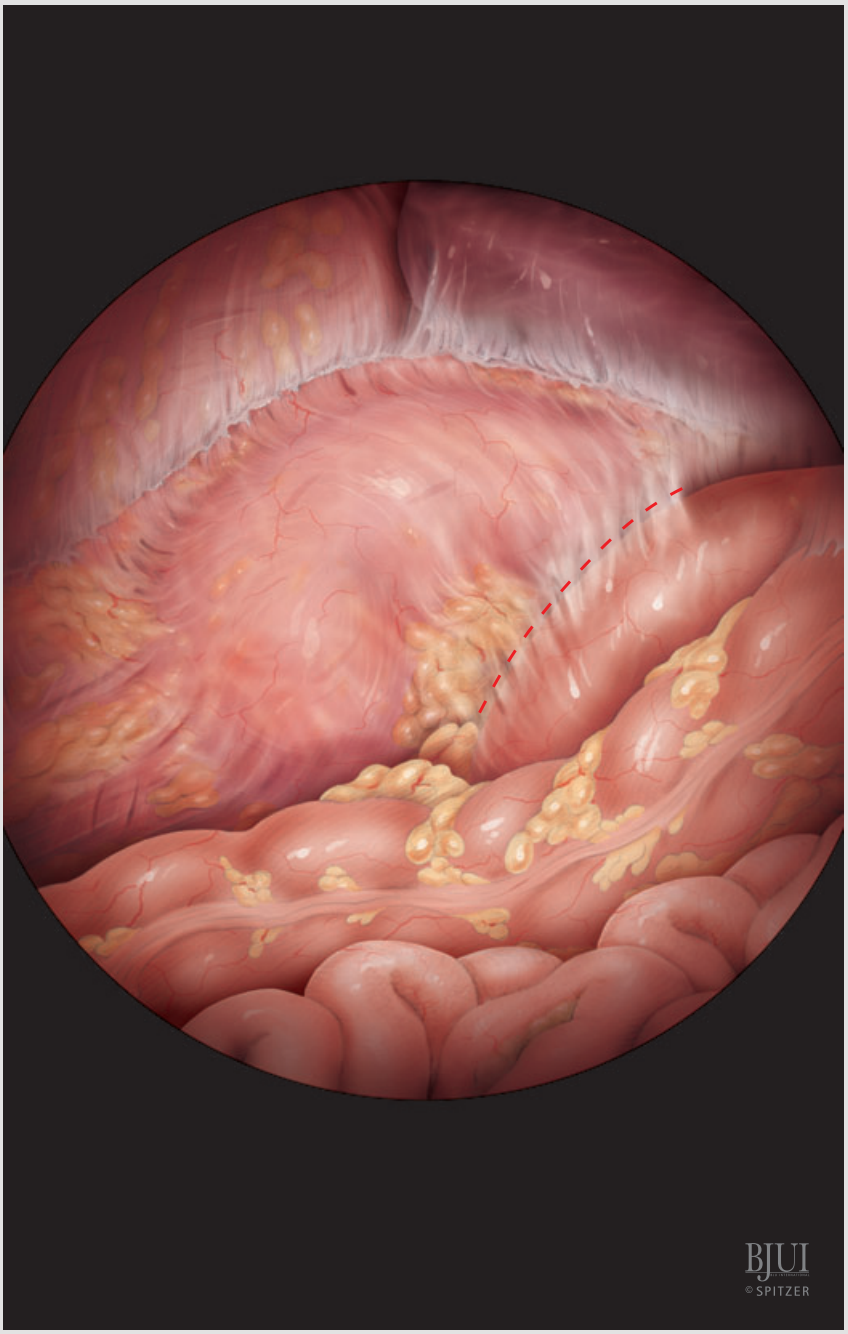


Figure 4

Gonadal vein clipped and divided: The gonadal vein is identified entering the IVC, it is clipped and cut to prevent subsequent injury to the IVC during later dissection. The ureter is now identified between the lower pole of the kidney and IVC, and is mobilized up to the pelvic brim, ensuring that the peri-ureteric sheath is not disrupted.

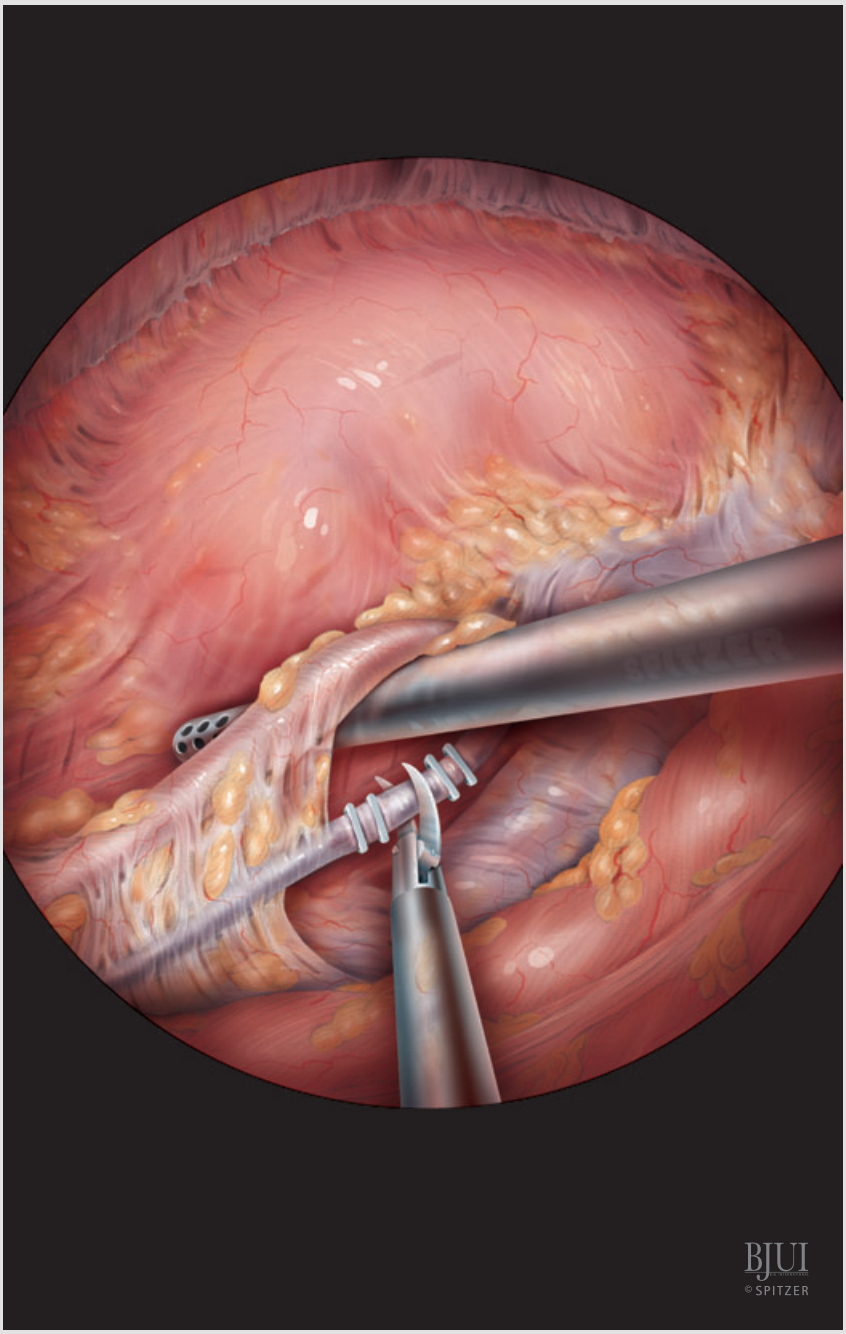


Figure 5

Kidney upper pole dissection: Attention is now turned towards the upper pole, where Gerota's fascia is incised and the adrenal gland is dissected off the upper pole of the kidney. The kidney is also freed laterally.

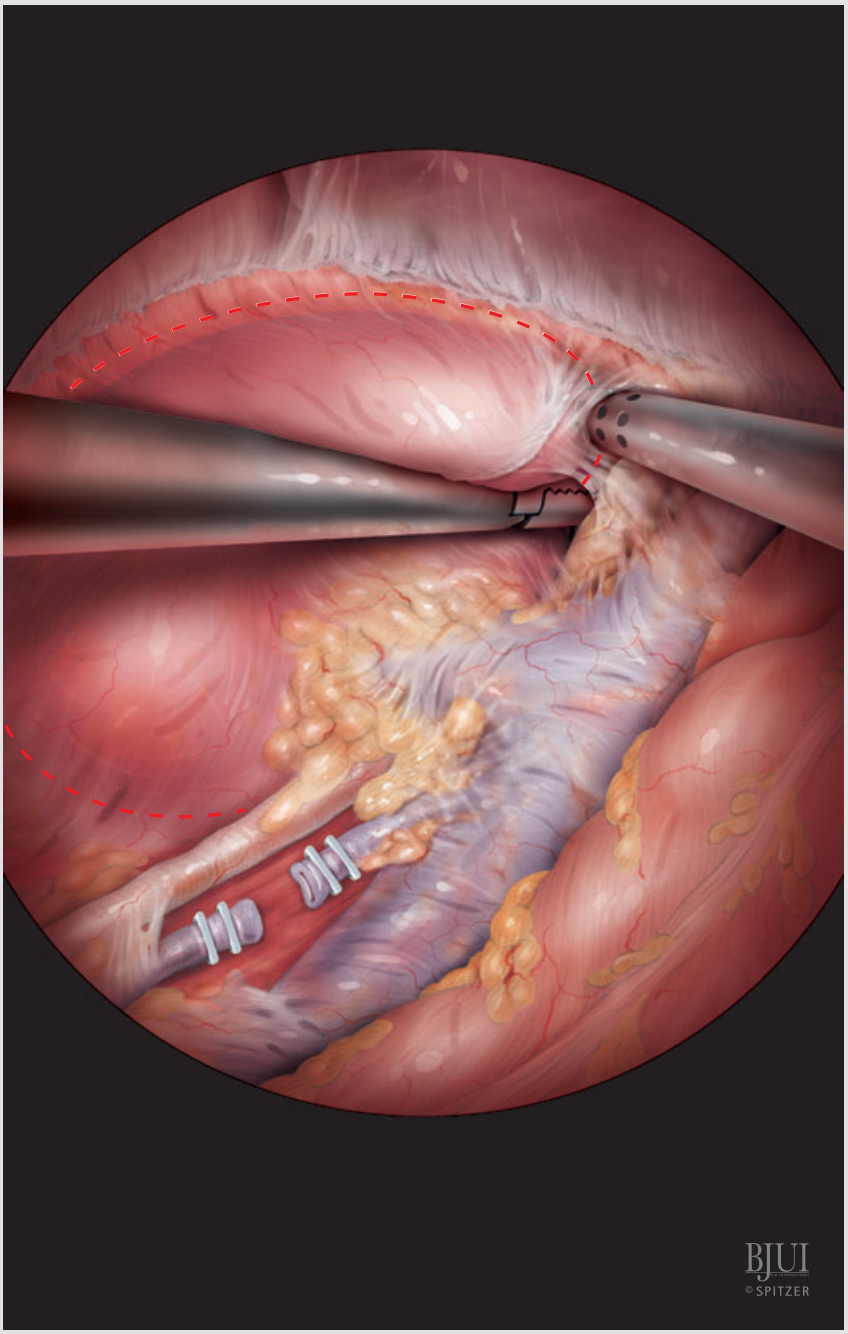


Figure 6

Right renal vein dissection: The renal vein is identified and mobilized completely, a right-angled dissector is placed behind the renal vein to ensure that it is completely freed all around.

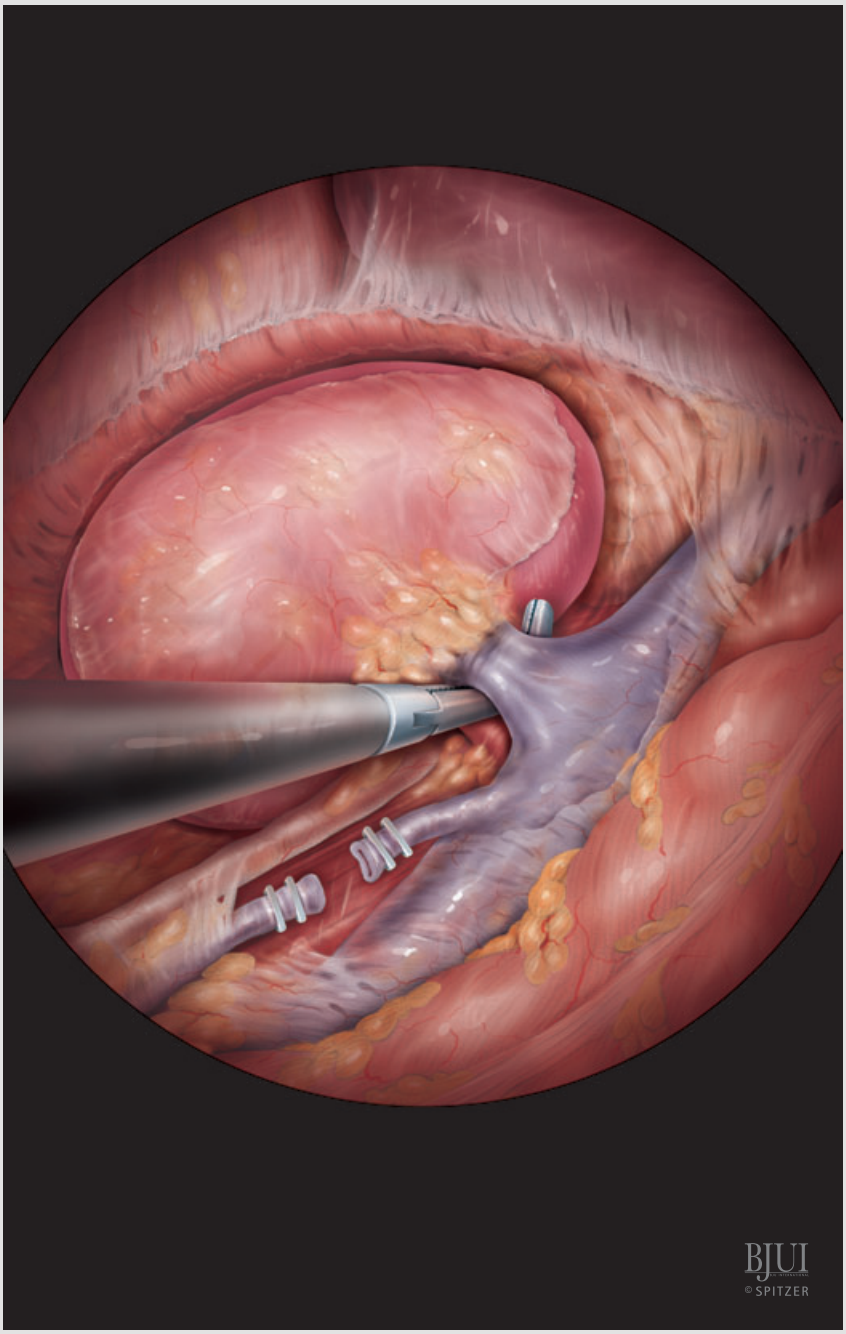


Figure 7

Right renal artery dissection: The renal artery is exposed and dissected for an adequate length behind the IVC. The kidney is thus completely mobilized all around, leaving only vascular structures attached at the hilum.

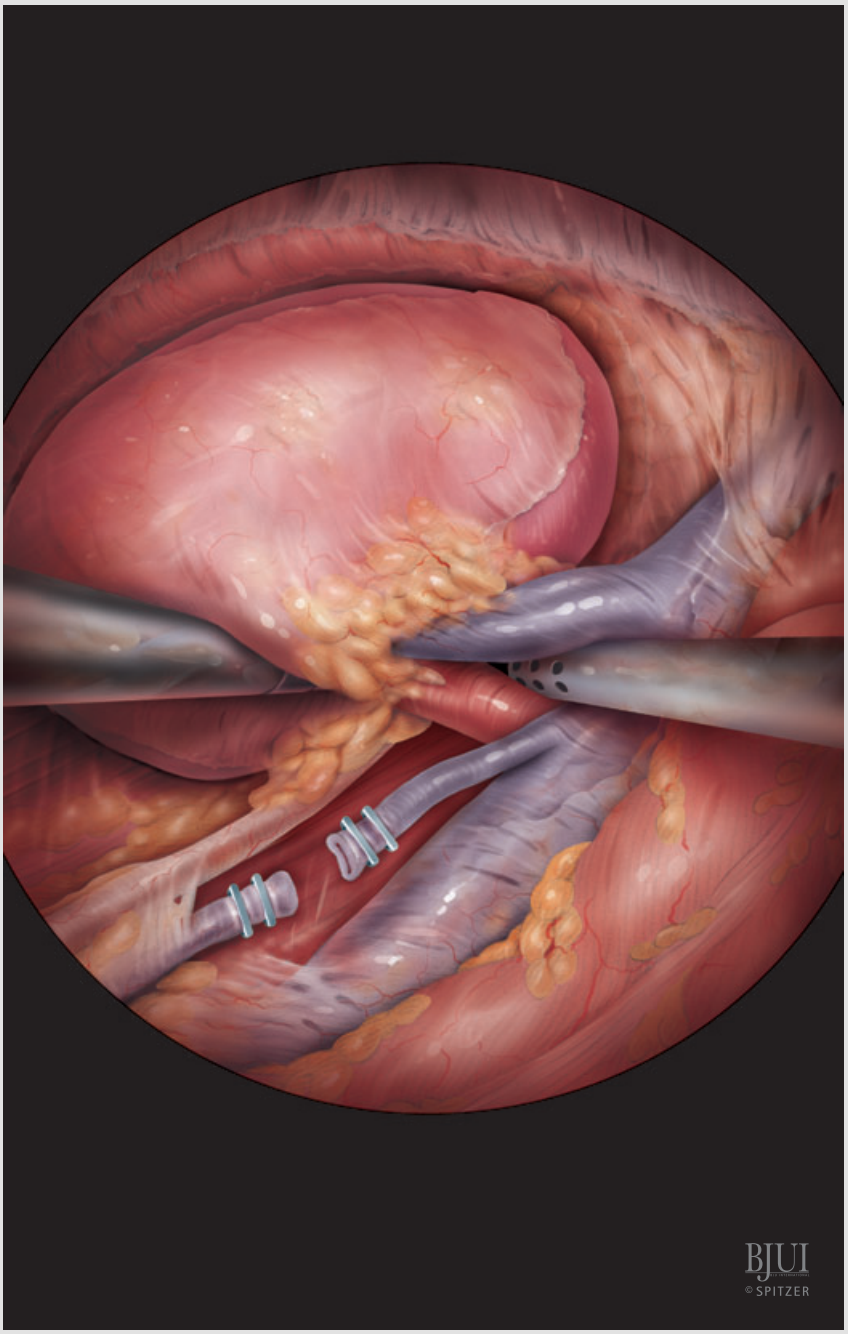


Figure 8

(a) Additional 5 mm port (if required);
(b) Pfannenstiel incision with endocatch bag insertion;

A small modified Pfannenstiel incision is now made (muscle-splitting). The peritoneum is left intact, through which a 12-mm port with a specimen bag is passed into the abdomen. This closed specimen bag also aids in retracting the structures medial to the hilum, thus ensuring proper exposure.

The ureter is now clipped near the iliac vessels and cut. At this point, an additional 5-mm port is inserted laterally to aid in retracting the kidney laterally.

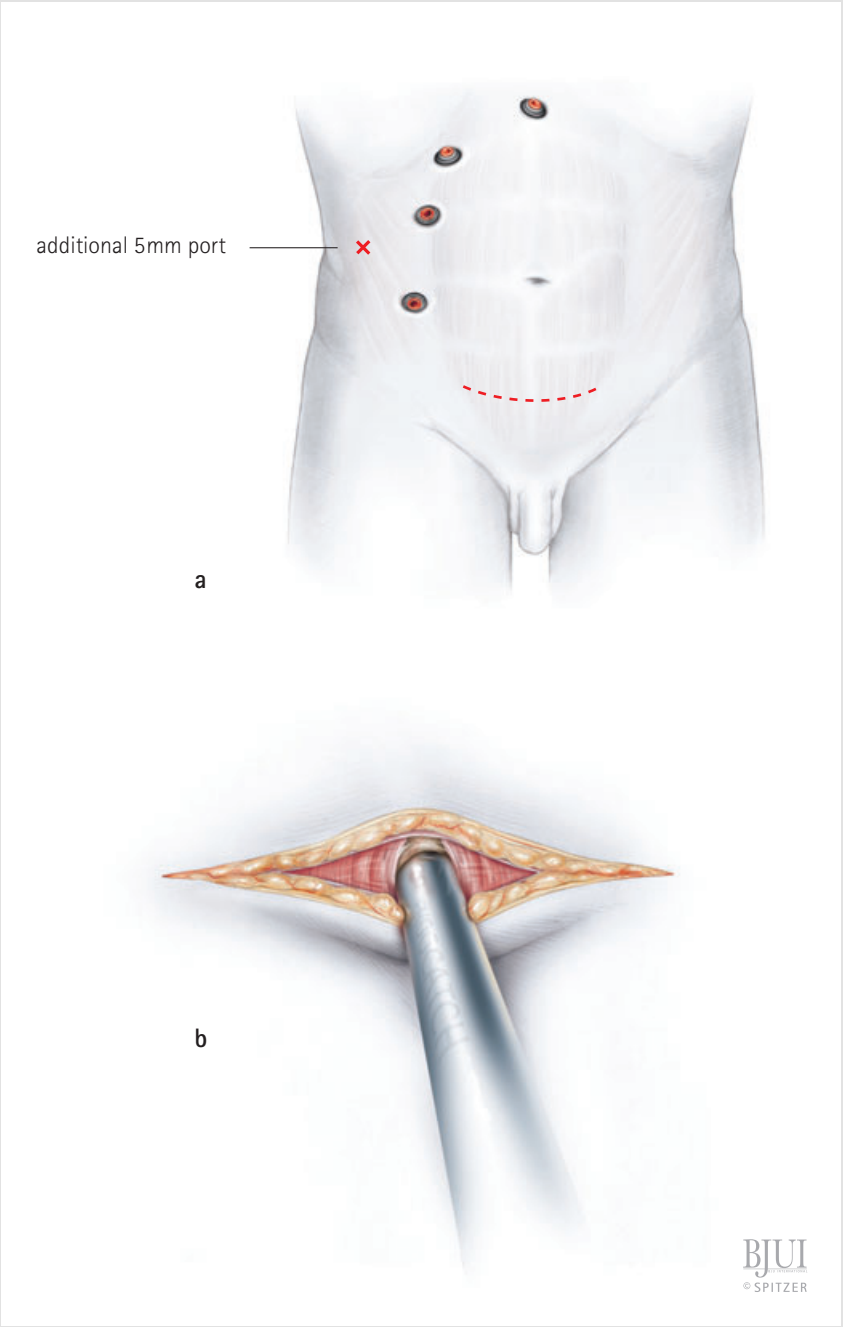


Figure 9

Right renal artery clipped and cut: The renal artery is occluded with three metal clips and sharply cut above the clips.

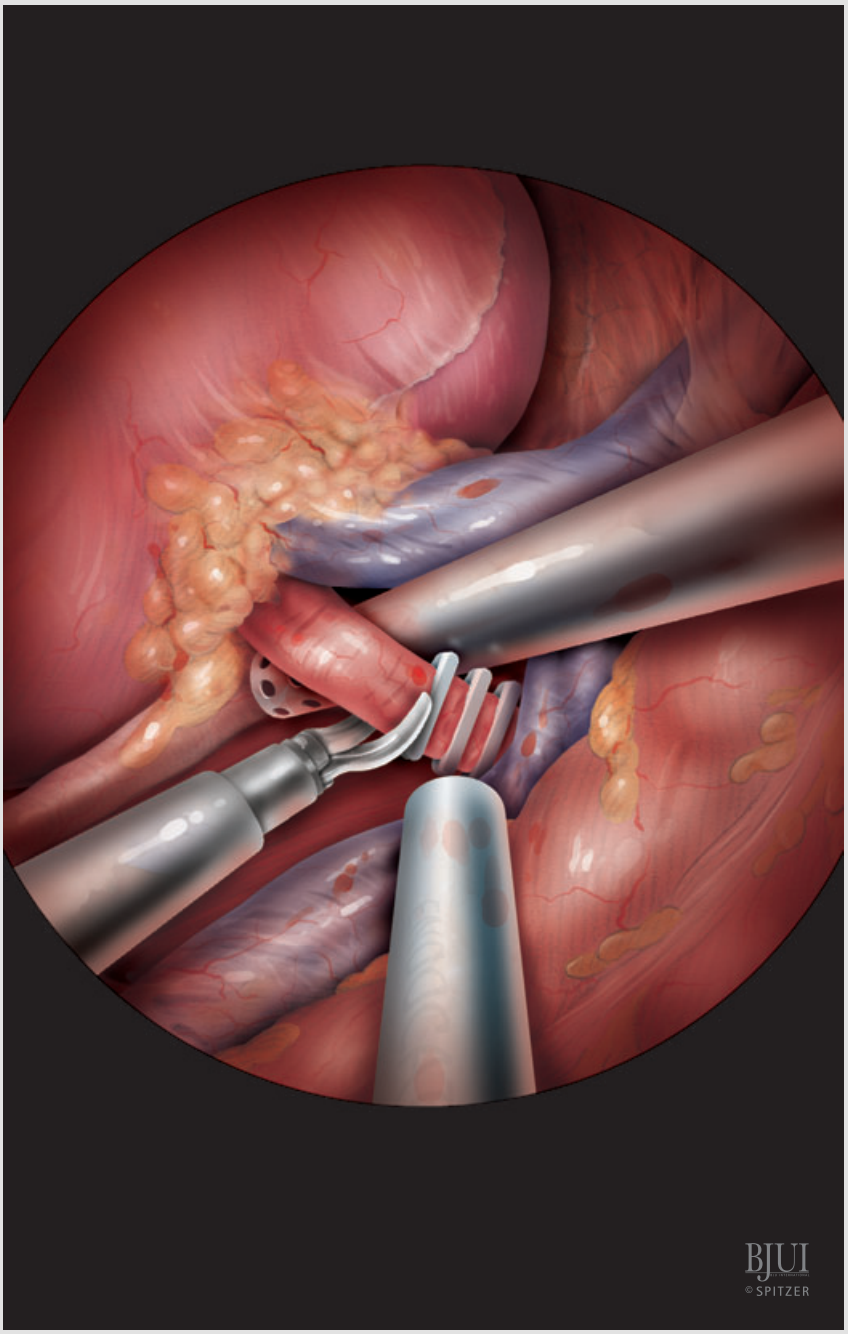


Figure 10

Right renal vein clipped and cut: The renal vein is ligated using Hem-o-lok clip; lateral retraction of the kidney allows the surgeon to gain length on the renal vein.

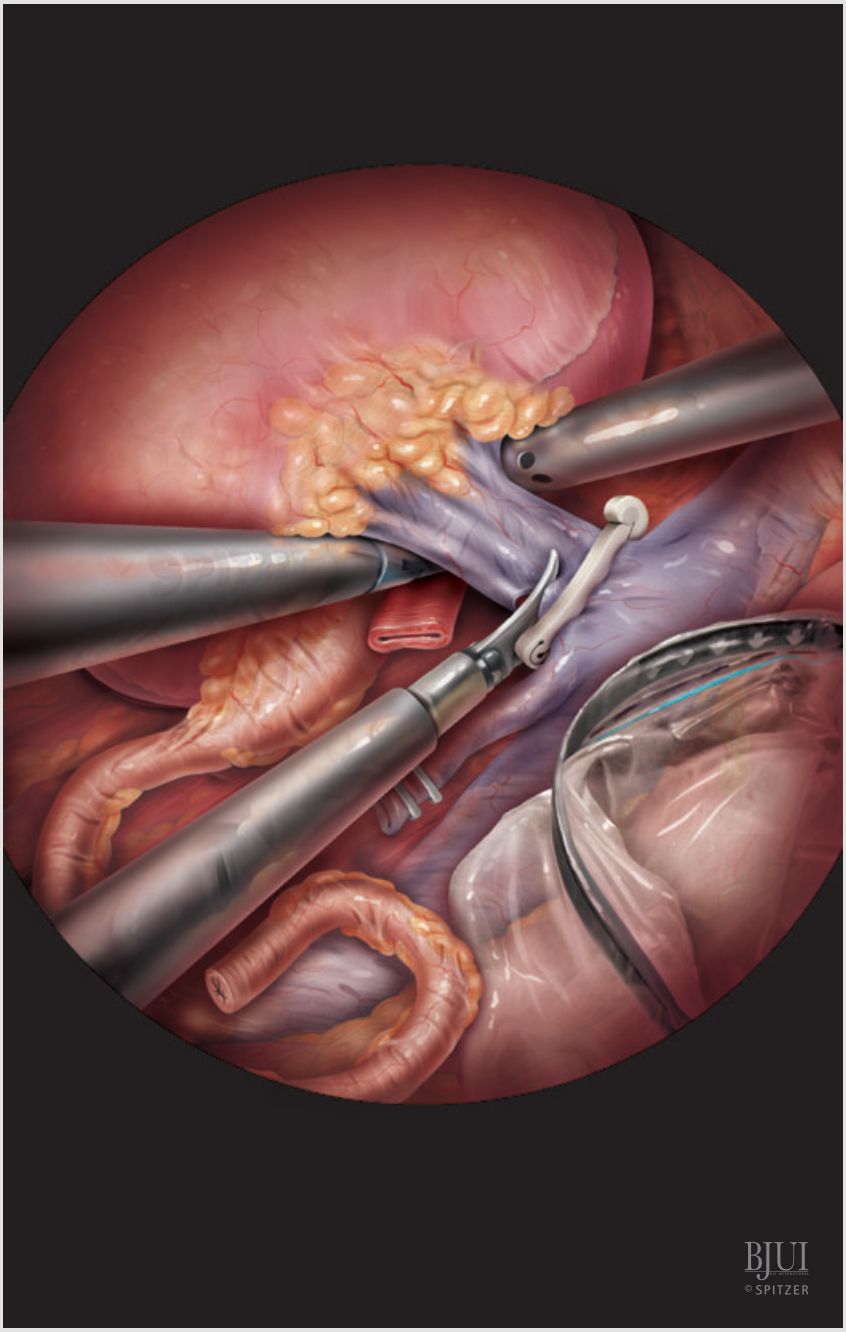


Figure 11

Extraction of kidney through Pfannenstiel incision: The kidney is retrieved through the Pfannenstiel incision using the specimen bag and handed over for irrigation. After closing the peritoneal rent with 2–0 polyglactin and ensuring a good pneumoperitoneum the renal hilar structures are visualized.

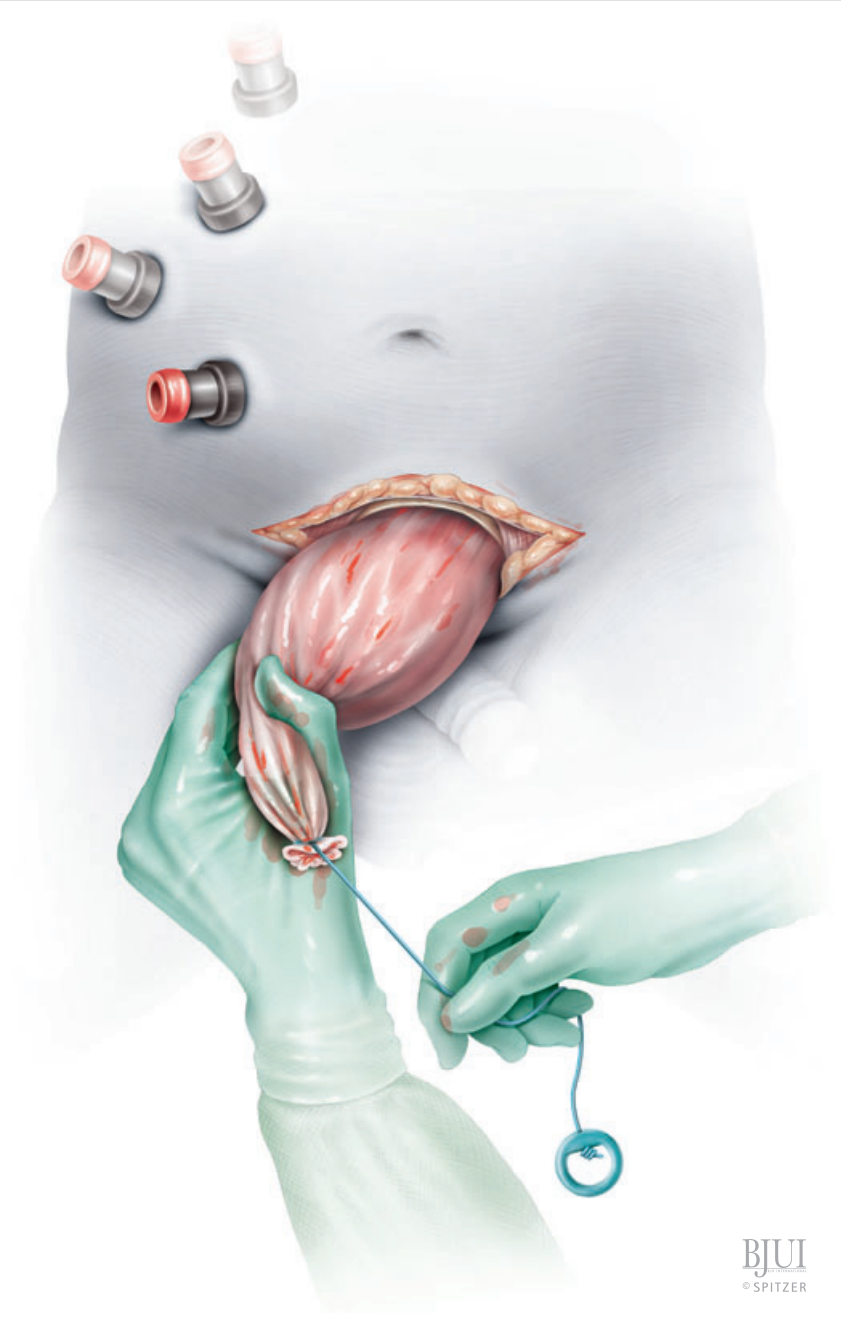


Figure 12

Over-suturing the right renal vein stump: The stump of renal vein above the Hem-o-lok clip is oversutured laparoscopically with 3–0 silk. Laparoscopic inspection is done at a low level of pneumoperitoneum to check for haemostasis.

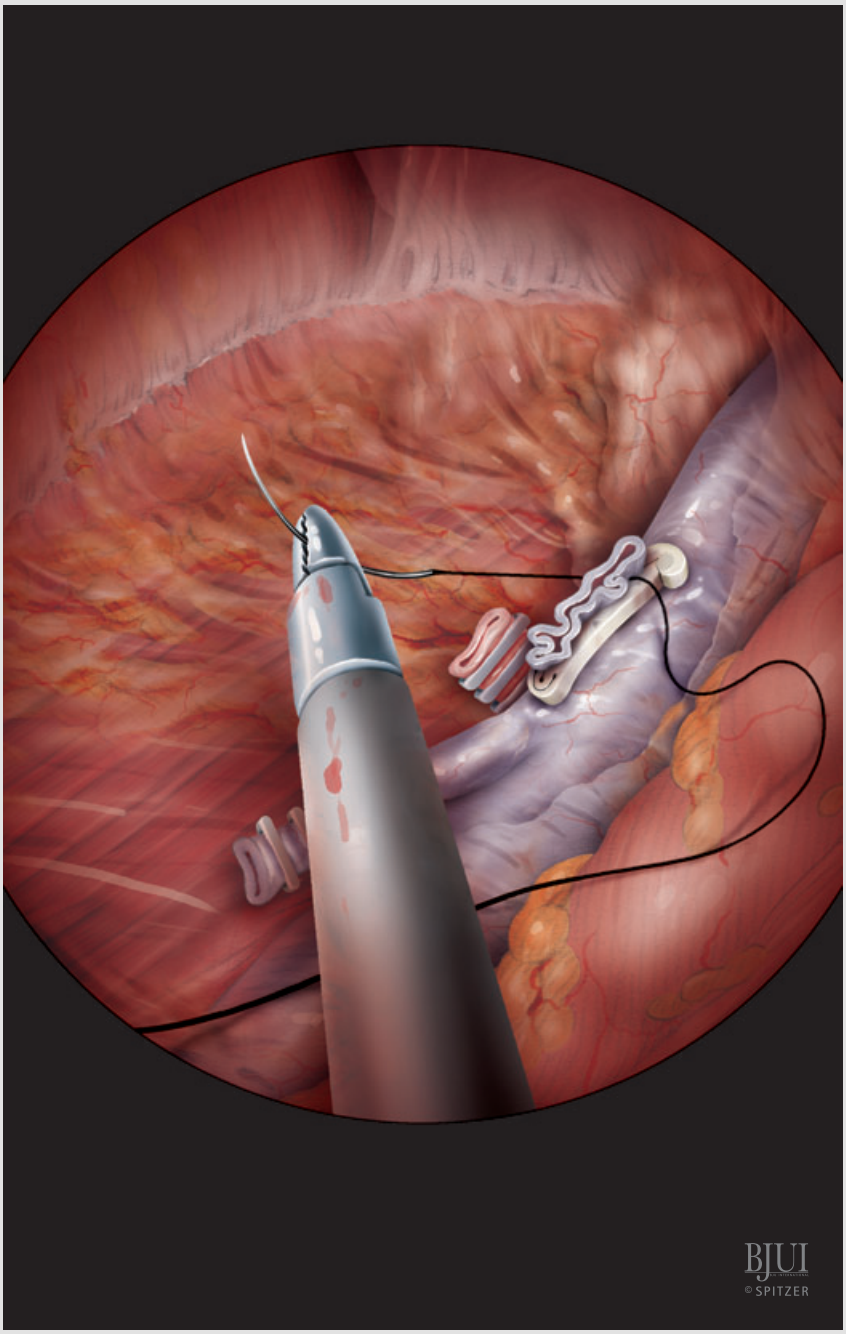
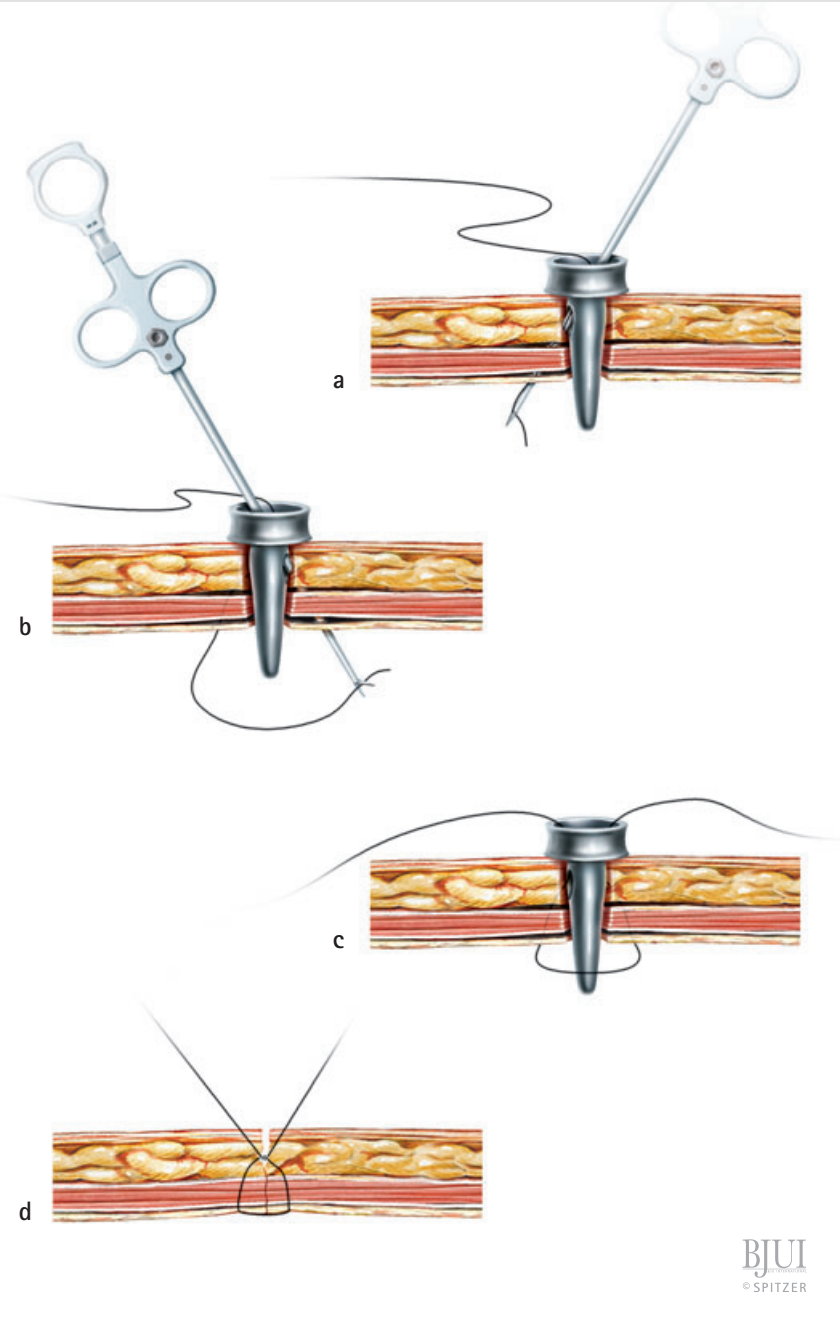


Figure 13

Carter Thomason device for 10 mm port closure: A Carter Thomason device is used for closing the 10 mm ports with #1 polyglactin. The Pfannenstiel extraction incision is closed using #1 polyglactin for the fascia. The skin incision is approximated using staples or subcuticular suture.



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Abbreviations: **(L)DN**, (laparoscopic) donor nephrectomy; **Endo GIA**, endovascular gastrointestinal anastomosis; **Endo TA**, endovascular thoracic anastomosis; IVC, inferior vena cava.