

Cheng-Hua Luo and Shiwen Mei

The lower abdomen is comprised of the left lower abdomen, right lower abdomen, and bilateral iliac fossa, with the horizontal line over the umbilicus as the upper boundary and true pelvic inlet as the lower boundary. Lower abdominal retroperitoneal structure includes the lower section of the abdominal aorta and iliac artery and lower segment of the inferior vena cava and bilateral iliac vein, bilateral ureters, and bilateral retroperitoneal muscle nerves. Ileocecum and ascending colon are located in the right lower quadrant whereas descending colon and sigmoid colon in the left lower quadrant. The retroperitoneal tumors (RPTs) in the lower abdomen can involve all of the above structures which may require resection during surgery, making the procedure extremely challenging (Felix et al. 1981).

In our database 108 (13.2%) out of 818 cases of RPTs are located in the lower abdomen, including 24 located in the left lower abdomen exclusively, 26 located in the right lower abdomen exclusively, and 58 located in the lower abdomen simultaneously occupying other parts of the abdomen. Among these 108 cases who underwent RPTs combined with lower abdominal organ resection, 2 received resection of the abdominal aorta and iliac artery, 2 received resection of the inferior vena cava and iliac vein, 12 received resection of the ureter, 3 received resection of the

femoral nerve, and 23 received resection of bowel. Out of these 108 cases, 20 underwent total resection R0, 4 underwent R1 resection, 3 did not undergo resection, and the rest underwent partial resection. The most common pathological types of RPTs in the lower abdomen are liposarcoma, schwannoma, and leiomyosarcoma.

R0 resection is the key to complete removal of RPTs in the lower abdomen with good prognosis. To the best of our knowledge, no studies have been reported on RPTs located in this area about key points for surgery due to the specificity of surgical treatment. In China, RPTs are often not diagnosed until they have grown to a large size. Furthermore, RPTs in lower abdomen can extend to the left upper abdomen, to the right upper quadrant or pelvic presacral space, and even to the bilateral inguinal region and thighs. Retroperitoneal tumors derived from the above sites may also spread to the lower abdomen. Therefore, surgeons are required to receive professional training of typically surgical technique for tumors located in both retroperitoneum and other sites of the abdomen or pelvis (An et al. 2007).

---

## 1 Surgical Indications

1. RPTs in lower abdomens without extensively systemic metastasis.
2. Tumors involving major vessels below the level of renal vessels, preoperative evaluation indicating possible vascular grafts.

---

C.-H. Luo (✉) • S. Mei  
Peking University International Hospital,  
Beijing, China  
e-mail: [luochenghua@pkuwh.edu.cn](mailto:luochenghua@pkuwh.edu.cn)

3. Tumors presenting with lower limb neurological symptoms, intestinal obstruction, or hydronephrosis.
4. Clinically diagnosed as soft tissue tumors after ruling out epithelial cancer peritoneal metastasis.
5. Primary RPTs in the lower abdomen or recurrence in more than 6 months after the operation.
6. Tumors unable to be removed during the exploratory surgery that was performed in another hospital more than 3 months ago, and now the patient has been admitted to the hospital that claims to have the technical capability to make a complete resection.

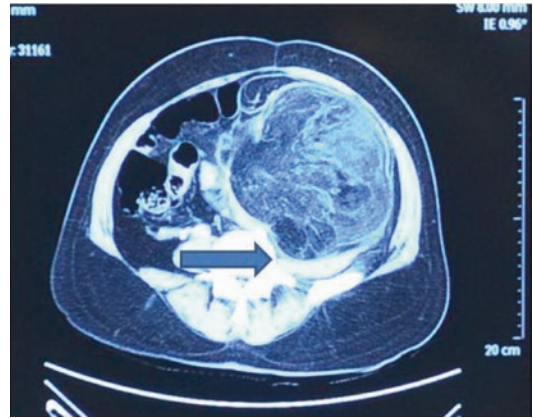
## 2 Surgical Contraindications

1. Evidence has supported that the RPTs in the lower abdomen are metastatic from other sites, and primary tumors cannot be completely resected.
2. RPTs in the lower abdomen invade major retroperitoneal vessels, superior mesenteric artery, portal vein, or other vessels above the renal level, and the separation is impractical.
3. Tumors with widespread systemic metastasis.
4. Patients with concomitant severe cardia, pulmonary, and hematologic diseases, so that they cannot tolerate the surgery.
5. It's impossible to prepare enough blood reserves, artificial blood vessels, equipment, and devices to guarantee the safety of patients for various reasons.

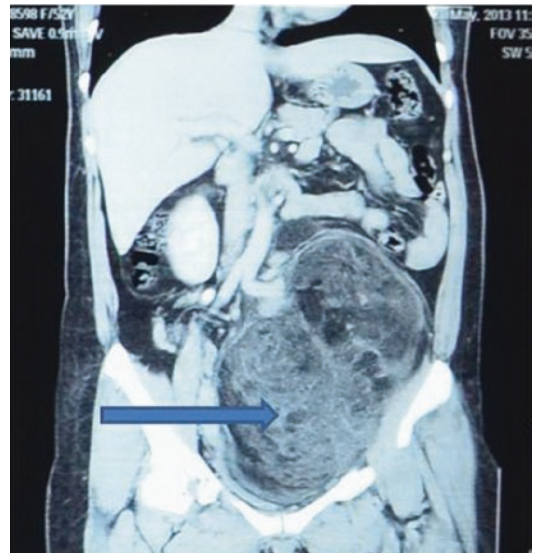
## 3 Preoperative Preparation

Three conventional tests (blood, urine, and stool), blood biochemistry, ECG, and chest X-rays should be performed before surgery.

CT and MRI scans demonstrate the size and location of the tumors, as well as their relationship with adjacent organs. Enhanced CT scanning should be performed in order to clarify the relation of the tumor with abdominal aorta and iliac arteries. If necessary, inferior vena cava angiography or the whole digestive tract imaging should be performed in order to identify potential involvement of retroperitoneal vein and gastrointestinal tract.



**Fig. 11.1** CT image of a liposarcoma in the lower abdomen



**Fig. 11.2** Coronal CT scan image can clearly display the location of the retroperitoneal tumor in the lower abdomen

Predict blood loss based on the condition of tumors, and prepare sufficient red blood cells, plasma, and other components for transfusion.

Prepare postoperative care facilities and custodial staff.

Prepare sufficient artificial blood vessels, stapler, ureteral stents, and necessary materials. Before surgery, it is very important for surgeons to repeatedly interpret imaging findings. For example, CT scan (Fig. 11.1) and coronal scan (Fig. 11.2) display that lower left RPT inwardly

pushes sigmoid colon, thus squeezing forward the iliac vessels. Therefore, imaging diagnosis plays a crucial role in guiding the operation.

#### 4 Anesthesia and Position

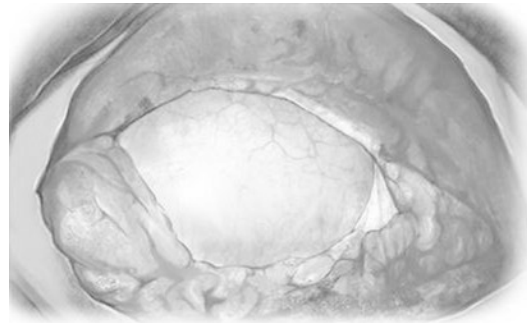
Generally, tracheal intubation is performed under general anesthesia during resection of RPTs located in the lower abdomen. Patients are lying in the supine position and may be elevated on the identical side intraoperatively with the abdomen obliquely facing the surgeon if the tumor spreads from the unilateral lower abdomen posteriorly into the dorsal part of the psoas major. If the removal of the sigmoid colon is expected, descending colon rectal anastomosis will be performed. Patients may lie in “A”-shaped supine position with their legs wide open, thus facilitating the placement of stapler through the anus intraoperatively.

#### 5 Surgical Procedures

1. Incision: straight incision along ventral midline is commonly adopted during resection of RPTs in the lower abdomen and may be extended to xiphoid or pubic symphysis if necessary. If the tumor has deeply invaded into the dorsal structure unilaterally, an additional transverse incision that crosses the midline of the tumor will be performed on the same side, or transverse incision applied bilaterally, making a plus sign (+)-shaped incision. For patients with history of surgical resection, the original incision should be preferred and the scar removed. During skin preparation, disinfection scope should be adequate to cover the entire abdomen, perineum, and 1/3 of upper thighs, extending bilaterally to the posterior axillary line and superiorly to the nipple level (Fig. 11.3).
2. Cut the skin, subcutaneous fat, and white line. If it is a transverse incision, cut *musculus obliquus externus abdominis*, *obliquus internus*, *transversus abdominis*, transverse fascia, peritoneal fat, and peritoneum. For recurrent patients who undergo reoperation, it will take longer time to separate perito-



**Fig. 11.3** An incision for surgery on a retroperitoneal tumor in the lower abdomen



**Fig. 11.4** An intact peritoneum on the surface of a retroperitoneal tumor

neum that is adhered to abdominal organs—such as the bowel and omentum. Tumors extensively adhered to the abdominal wall should be carefully and completely separated. Sharp separation is recommended. The first step is to identify a free area from where the space between peritoneum and abdominal structure is retracted, so that the structure to be separated at the adhesion site may generate tension toward the opposite direction to facilitate the separation. RPTs covered with intact retroperitoneum can often be exposed after cutting the abdominal wall (Fig. 11.4).

3. Protect the incision, and carefully identify surrounding structures of the tumor. In general, firstly dissociate the tumor margin with good exposure, less blood supply, and fewer adjacent vital organs. Surgeons



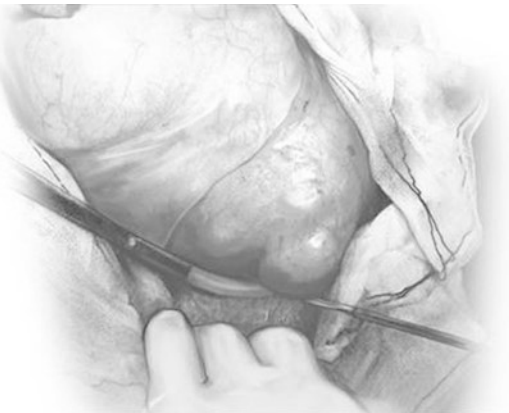
**Fig. 11.5** Start the separation from the relative safe direction outside the tumor margin

should have a strong capability to clarify normal tissue structure of the lower abdomen as well as the displacement direction of surrounding structures pushed by larger tumors (Fig. 11.5).

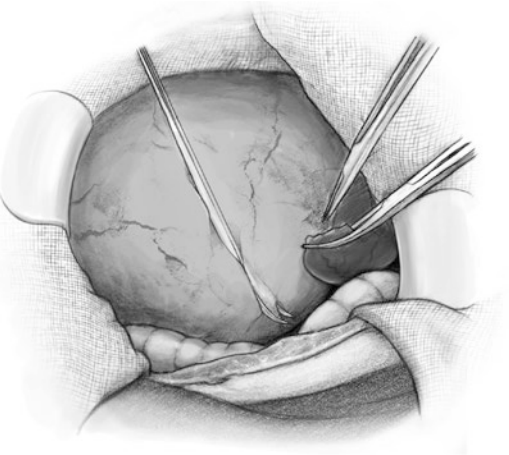
4. Firstly open the retroperitoneum between RPT and normal tissue. Try to incise the normal tissue at the outer margin of the tumor to obtain a distance of about 0.5 cm away from the normal tissue. Most of retroperitoneal sarcoma exhibits expansive growth patterns, and the outer surface of the tumor is often covered with false capsule which must be intact in the process of separation. How to distinguish sarcomas from normal tissue depends on individual nature, e.g., it is sometimes difficult to distinguish liposarcoma from normal adipose tissue, so attention should be paid to the separation process (Fig. 11.6).
5. When dissociating the medial-inferior portion of the tumor, iliac vessels, ureter, and colon are occasionally encountered, which may be pushed by the tumor inwardly, posteriorly, or forwardly, while the tumor grows into the posterior portion of the abovementioned structures. Iliac vessels and ureter are sometimes wrapped within the tumors, making it extremely difficult to separate them (Fig. 11.7).
6. In women, the medial-inferior portion of RPT in the lower abdomen may be adherent to accessories, which should be carefully dissected. The preservation of ovarian is important, especially for young female



**Fig. 11.6** Pay special attention to the tumor resection margin for R0 resection



**Fig. 11.7** Carefully identify the iliac vessels and ureter, and then separate them from the tumor



**Fig. 11.8** Separate the tumor from its adjacent adhesions

patients, so ligation and excision are commonly performed to prevent bleeding during the separation (Fig. 11.8).



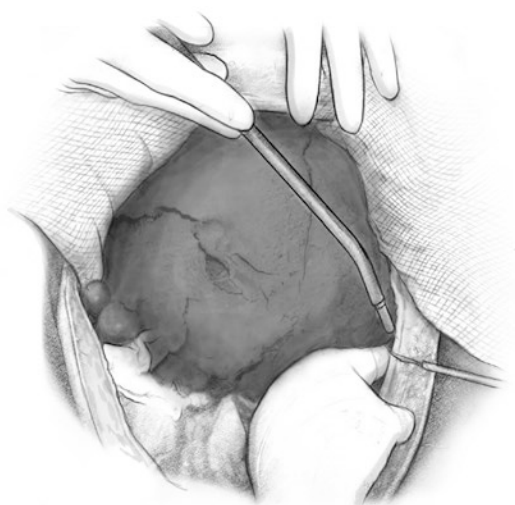


**Fig. 11.9** To separate the lateral aspect of the retroperitoneal tumor in the lower abdomen is relatively safe

7. Dissociation of RPTs in the lower abdomen from medial side is relatively safe (Fig. 11.9). Surgeons firstly cut the peritoneum open at the included angle adjacent to the tumor and lateral abdominal wall and then separate it backward to the surface of the back muscles. For large tumors, it is difficult to separate them from one side to the furthest posterior part at one time. In principle, the separation is shifted from one side to the other side until it cannot be continued. During the surgery, the separation shall always start from the area where the separation is most easily performed.
8. One of the most difficult processes in separating RPTs is the posterior dissociation. Because of large volume, the posterior tumor bed is extensively adhered and attached. The separation cannot be performed under direct vision due to the fact that the tumor body cannot be overturned, which is only feasible after separating the posterior portion of the tumor. In such case, surgeons often apply blunt dissection with the fingers extending into the rear of the tumor (Fig. 11.10). Prerequisite of this operation is that the surgeon should be very familiar with the anatomical relationship of the area to be separated. Based on this, the surgeon needs to confirm whether major blood vessels and other critical structure are located posteriorly to the tumor.
9. RPTs in the lower abdomen vary greatly in size, location, and relationship with surrounding structures. Therefore, the surgical procedure for this type of tumor is not



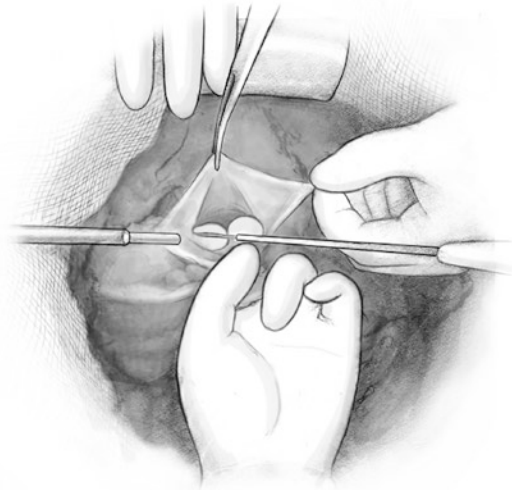
**Fig. 11.10** Blunt separation of the posterior aspect of the tumor can be performed with fingers when encountering a tumor present with expansive growth or a capsule



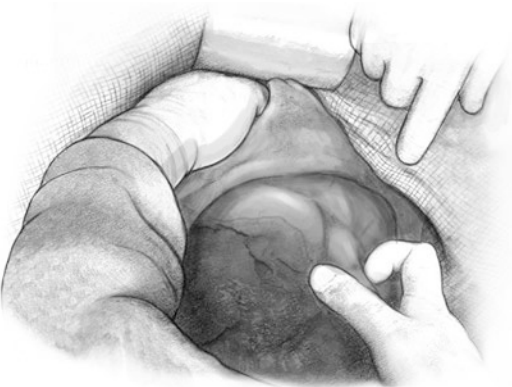
**Fig. 11.11** The incision may be extended based on specific conditions of the tumor during the surgery

entirely consistent. During the surgery, extension of the incision or change in incision direction is often required based on the exposure (Fig. 11.11).

10. Sometimes, iliac vessels pass through the middle of the tumor, which should be carefully identified. To protect these vital structures, it is necessary to dissect the tumor located on their surface. To prevent damages to important structures located deeply in the tumor, putting fingers of the left hand into the rear of the tumor



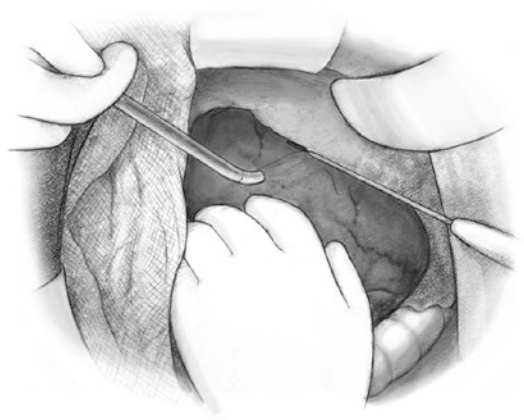
**Fig. 11.12** Cut the tumor to expose the blood vessels which are wrapped by the tumor



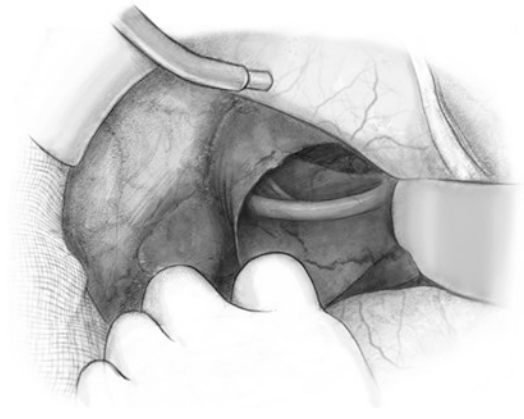
**Fig. 11.13** Sometimes, the tumor is required to be bluntly dissected within the capsule and removed

to be dissected to guide the operation is a quite important skill for the surgeons (Fig. 11.12).

11. If it is difficult to completely separate and resect the tumor from the surrounding, or it is impossible to dissociate and remove the tumor due to vital structures surrounding the tumor, surgeons may alternatively perform blunt dissection to remove part of the tumor within the capsule. If iliac vessels are straddling anteriorly to the tumor, blunt dissociation and resection of the enclosed tumor body should be firstly performed followed by removal of the capsular wall (Fig. 11.13).
12. Due to significant decrease in tumor load after the majority of the tumor has been removed, the



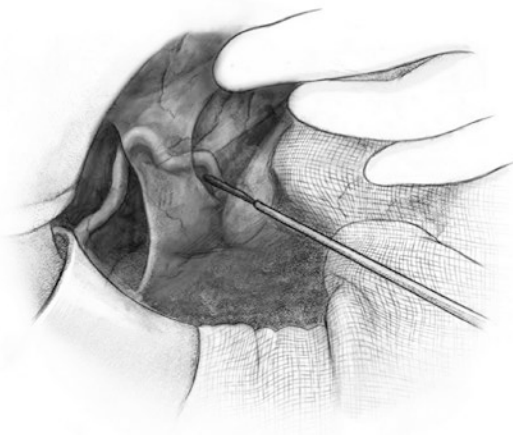
**Fig. 11.14** The outside tumor margin should be separated from the normal tissue space after the central portion of the tumor has been removed



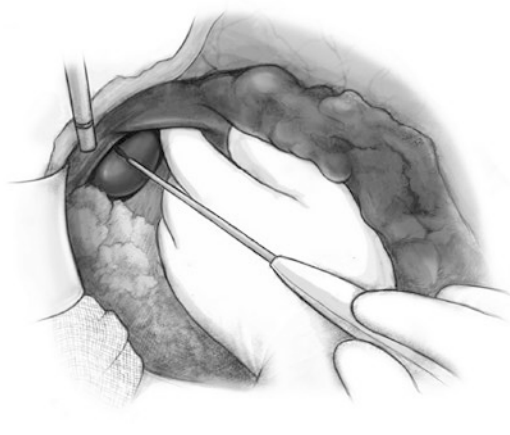
**Fig. 11.15** Carefully separate the femoral nerve posterior to the tumor

space between the surrounding structures of the tumor and normal tissue is exposed clearly, thus making the separation of the surface of the tumor easier (Fig. 11.14). Femoral nerve passing through lateral abdominal RPT is located deeply in the iliac fossa, which may be pushed up by the tumor growing into the rear. During the separation, femoral nerves should be exposed adequately and protected carefully. Any damage to femoral nerves can cause difficulties in raising ipsilateral thigh (Fig. 11.15).

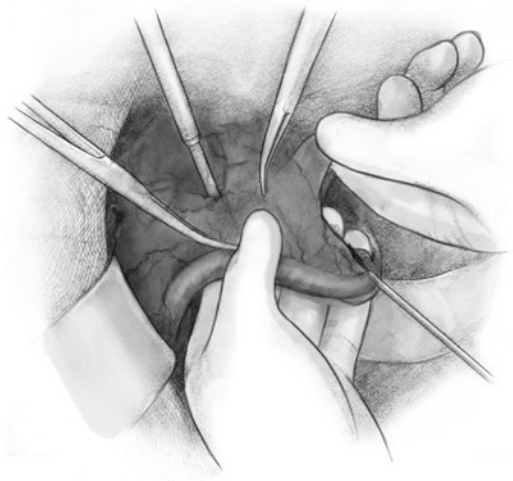
13. Ureter attached to the surface of the tumor (Fig. 11.16) needs to be carefully distinguished. Ureter may be pushed inwardly, posteriorly, laterally, or forwardly by RPTs in the lower abdomen, which should be identified by preoperative angiography. Usually,



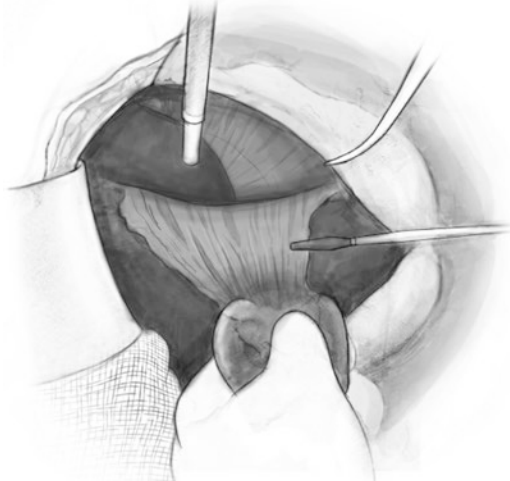
**Fig. 11.16** Separate the ureter



**Fig. 11.18** Separate the superior portion of the retroperitoneal tumor from the kidney



**Fig. 11.17** Separate the femoral artery and vein from the tumor



**Fig. 11.19** Separate the inferior portion of the tumor from the fiber surface of psoas major muscle

ureter is rarely invaded by RPTs, so it can always be separated after careful dissociation. If ureteral injury and poor blood supply are detected, surgeons can place ureteral stents and then repair the ureter.

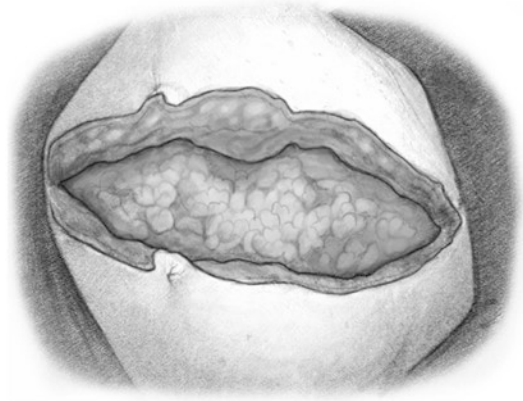
14. Femoral arteries and veins may be wrapped by RPTs, which should be carefully dissociated from the tumors to avoid any damage to the blood vessels. After complete dissociation is performed in other regions, it is advised to dissociate the femoral artery to a safe location based on optimal conditions (Fig. 11.17) before continuing the separation of the tumor. Usually the thin-walled femoral vein located posteriorly is vulnerable to damage, so unilateral liga-

tion should be performed if it is difficult to repair. The collateral circulation is gradually established in 1 month after surgery.

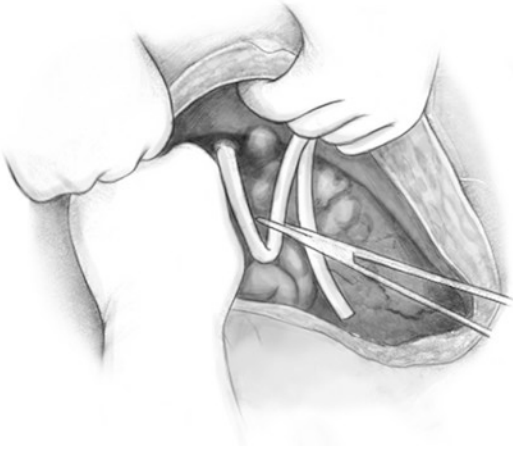
15. Attention should be paid to the space between the tumor and kidney when separating the superior part of lower abdominal RPT in order to avoid any damage to the ureter and blood vessels at renal hilum. It is critical to carefully identify perirenal adipose capsule (Fig. 11.18) because un-identification of kidney can cause renal cortex damage and bleeding.
16. As psoas major is located bilaterally posterior to lower abdominal RPT, surgeons often need to completely resect the tumor (Fig. 11.19) from the surface of the muscle.



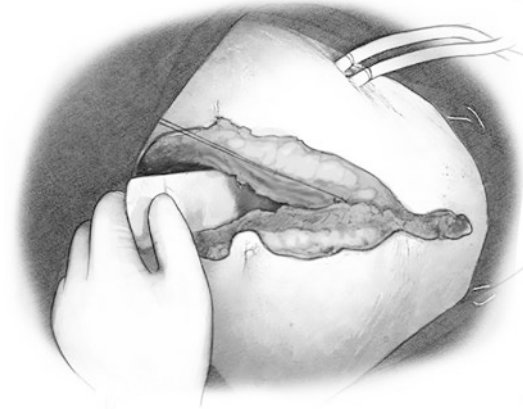
**Fig. 11.20** Flush the wound with normal saline after tumor resection



**Fig. 11.22** Place the greater omentum beneath the incision



**Fig. 11.21** Place the drainage tube in the wound



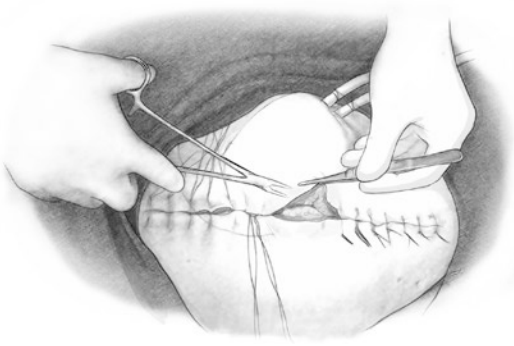
**Fig. 11.23** Close the incision

Sometimes, tumor tissue that spreads into the space between muscle bundles needs to be carefully removed.

17. After the tumor was removed, the surgical field requires an adequate wash with a large amount of normal saline (Fig. 11.20) and repeated checks for residual tumor; if appropriate, complete resection of the residual lesions will be performed successively.
18. The wound generated by RPTs surgery generally requires placement of at least two drainage tubes in the abdominal cavity, especially for larger tumors, wide wound, and combined resection of adjacent organs (Fig. 11.21).

19. Carefully count the gauze sponge and devices after operation. Omentum can generally be placed below the abdominal incision, in order to prevent potential adhesions through direct contact with the intestine and reduce the incidence of postoperative ileus (Fig. 11.22).
20. PDS-II and other powerful sutures will be used for closure of the incision, white line, or rectus sheath (Fig. 11.23); if necessary, relaxation suture will be applied to reduce tension. Subcutaneous adipose tissue and skin will be sutured carefully; ensure that no dead space will be left between the incision and the sutured layers (Fig. 11.24).





**Fig. 11.24** Close layer by layer of the abdominal wall; ensure no dead space has been left

## 6 Postoperative Treatment

See [Chap. 7](#) for postoperative treatment in detail. After a combined resection of organs involved in the surgery of RPTs in the lower abdomen is completed, postoperative care should be implemented appropriately. Patients, if have not undergone artificial vascular graft reconstruction during the resection of inferior vena cava, should

be observed for lower limb edema and asked to lie in bed and raise their affected limbs in order to facilitate lower extremity venous return. Following abdominal aortoiliac artery myotomy and artificial vascular grafts, attention should be paid to close observation of the dorsalis pedis pulse, while systemic half-dose heparinization is performed for the purpose of thromboprophylaxis. If bowel resection and anastomosis are performed simultaneously, the vascular anastomosis must not overlap with the intestinal anastomotic site and should be completely separated by the greater omentum (Weiss and Goldblum 2002).

## References

- An JY, Heo JS, Noh JH, et al. Primary malignant retroperitoneal tumors: analysis of a single institutional experience. *Eur J Surg Oncol.* 2007;33(3):376–82.
- Felix EL, Wood DK, Das Gupta TK. Tumors of the retroperitoneum. *Curr Probl Cancer.* 1981;6:1–47.
- Weiss SW, Goldblum JR. *Soft tissue tumors.* 4th ed. New York: Health Science Asia, Elsevier Science; 2002. p. 10–5.