

Use of posterior radial nephrotomy in laparoscopic enucleation of renal hilar tumors

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ABSTRACT

Centrally located completely endophytic renal hilar tumors pose a technical challenge, especially during a minimally invasive surgery. Relation of the tumor to the renal vasculature decides the approach. Tumors placed anterior to the vasculature can be approached in the anterior trans-hilar manner. However, tumors placed posterior to the vasculature need a posterior approach, which is quite a difficult maneuver during transperitoneal laparoscopy. Adequate exposure to access the resection plane is the key principle. We describe a laparoscopic technique for enucleation of such tumors, applying the surgical principle of radial nephrotomy in the intersegmental plane which is usually performed to remove renal stones.

INTRODUCTION

There has been a steady increase in the incidence of renal cell cancer and at the same time, the average size of tumors at presentation has reduced. This phenomenon can be explained by the rise in the incidental detection of renal tumors due to widespread utilization of imaging modalities.^[1,2] As a result, nephron-sparing surgery has gained popularity, as it is associated with a reduced risk of chronic kidney disease and decreased cardiovascular morbidity.^[3,4]

In the earlier days, laparoscopic partial nephrectomy (LPN) was reserved for small, exophytic, and peripherally located tumors. Recent refinements in the techniques and technology have enabled the application of LPN to more complex tumors. The key to manage these tumors is adequate exposure and planning of the resection plane.^[4,5] Anteriorly placed intrahilar tumors can be approached directly in transperitoneal laparoscopy. However, approaching the posterior renal hilar tumors is difficult during the transperitoneal minimally invasive procedures.

We describe the application of the traditional principles of renal stone surgery, i.e., radial nephrotomy at the arterial intersegmental plane, to access the posteriorly placed intrahilar renal tumors, during trans-peritoneal laparoscopic partial nephrectomy.

METHODS

Surgical technique

After placing the patient in the modified flank position with the operative side up and adequate padding, pneumoperitoneum is created with the Veress needle and ports are placed in the baseball diamond configuration to triangulate the working arms. The camera is directed towards the hilum to ensure optimal access to the renal vessels. After initial inspection of the peritoneal cavity, the colon is mobilized along the white line of Toldt and the mesocolon is reflected away from the Gerota's fascia [Figure 1a and b]. We practice the "Two-window technique" to facilitate hilar dissection. The lower window is a plane developed between the uretero-gonadal complex and the psoas fascia. The plane between the superior pole of the kidney and the adrenal is the upper window. This technique helps to keep the hilar

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vessels under stretch, which facilitates their skeletonization and also helps in the subsequent clamping.^[6] We follow the “Polar Flip” technique, i.e., the kidney is rotated by around 45°–60° after freeing from its lateral attachments, so that the lower pole faces anteriorly and the upper pole faces posteriorly, thereby exposing the posterior surface for maneuverability. The polar flip is primarily performed to gain access to the posterior surface of the kidney. This rotation also aids in venous occlusion, which is an additional advantage and can be replicated in either of the renal units.^[7] A flexible intraoperative ultrasound probe is used to precisely locate the renal tumor and to evaluate its relationship with the segmental vessels as well as the pelvicalyceal system.^[8]

The traditional principles of nephrolithotomy can assist in the dissection of intrahilar renal tumors. Gilvernet’s approach is used to dissect along the renal pelvis and its ramifications high into the renal sinus [Figure 1c].^[9]

The dissection in the Gilvernet’s plane is performed up to the maximum possible extent before the vascular clamping. The remaining part of the dissection is performed in warm ischemia. The posterior radial nephrotomy incision line is planned at an arbitrary plane between the posterior arterial segment and the lower arterial segment of the kidney, which is parallel to the lower calyceal infundibulum. Hence, the lower calyceal infundibulum is an important landmark to plan the incision at this point of time.^[10] Renal vessels are then clamped, preferably the renal artery alone,

and the terminal part of the dissection in the Gilvernet’s plane is performed. Posterior radial nephrotomy incision is made along the preplanned incision line and deepened sharply through the parenchyma till the cleavage plane between the renal parenchyma and the tumor is identified. Atraumatic blunt dissection is performed around the tumor pseudocapsule, thus, completing the enucleation of the tumor [Figure 1d and 1e]. The specimen is inspected at a glance for any gross violation of pseudocapsule and is sent for frozen section to confirm negative surgical margins. Bleeding vessels at the tumor bed are ligated with figure of eight sutures. Calyceal rents are suture repaired. Renorrhaphy is performed using the sliding clip technique with absorbable barbed sutures [Figure f]. Renal vessels are unclamped and hemostasis is confirmed. The kidney is placed back into its anatomical position and nephropexy is done. The specimen is extracted through a muscle splitting modified mini-Gibson’s incision. A tube drain is placed depending on the surgeon’s discretion.^[7] We routinely perform postoperative ultrasonography with Doppler in all the cases of partial nephrectomy before discharge to look for significant collections as well as to assess the renal Doppler flow.

DISCUSSION

With the advent of shock wave therapy and the other minimally invasive procedures for the renal stones, open-stone surgery has become limited only to large, complex renal stones which are not amenable to the less invasive procedures. These antagonistic open-stone surgical principles such as the dissection in the Gilvernet’s plane and the radial nephrotomy incision parallel to the interlobular arteries allow maximum stone clearance.^[9,10]

While applying the above-mentioned stone surgery principles during laparoscopic enucleation of renal hilar tumors, we also took the advantage of renal segmental vascular anatomy. The intrarenal arteries, veins, calyces, and pyramids fan out in a radial fashion from the renal sinus towards the convex border of the kidney. Hence, the radial nephrotomy incision, especially in the intersegmental plane, allows the surgeon to enter the close vicinity of the renal tumor.

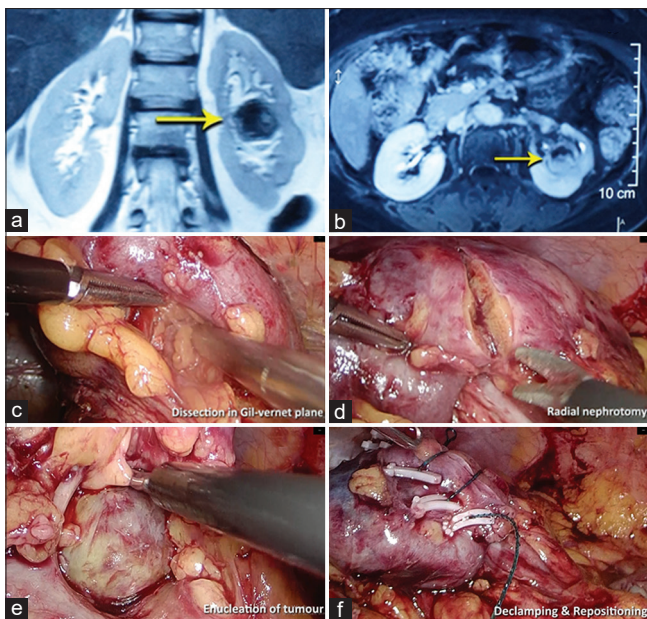
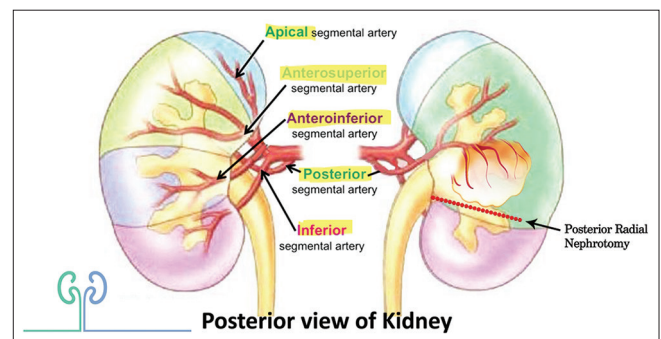


Figure 1: A 55-year-old female, was found to have left intra-hilar renal tumour. (a and b) Intra-operatively, Dissection in the Gilvernet’s plane was performed. (c) Posterior radial nephrotomy in the intersegmental plane was done after the renal arterial clamping, (d) tumor was dissected around the pseudocapsule, enucleated in-toto, (e) and renorrhaphy was performed, (f) Blood loss was minimal with a decent warm ischemia time of 18 min. Intra- and peri-operative periods were uneventful. There was no significant drop in the estimated glomerular filtration rate during post-operative period. Histopathology- renal hamartoma with clear margins. Currently, the patient is on regular follow-up with stable renal function



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The kidney–tumor interface, the so-called pseudocapsule, also lends itself as a favorable surgical plane for blunt dissection with less bleeding and parenchymal damage.^[8] Patients with intrahilar tumors, which are suspected to lack the pseudocapsule based on the preoperative imaging, are counseled for conversion to radical nephrectomy. We proceed with the enucleation only if the cleavage plane between the renal parenchyma and the tumor is identified intraoperatively. Once enucleation is completed, we send the specimen for frozen section to confirm the clear surgical margins.

Radial nephrotomy is already being practiced during the superselective or the minimal margin robotic partial nephrectomy.^[8] However; the literature reporting the utilization of the Gilvernet’s approach and radial nephrotomy for the enucleation of the renal hilar tumors is sparse.

CONCLUSION

We have assessed the utility of open-stone surgery techniques in LPN, especially for renal hilar tumors, which carry a higher risk of collecting system as well as vascular injury. Dissection in the Gilvernet’s plane followed by radial nephrotomy in the inter-segmental plane facilitates the access to the kidney tumor–parenchyma interface while minimizing the vascular injury and subsequent deterioration of the renal function. We hope that these approaches would enable the surgeon to perform a technically superior partial nephrectomy for the complex renal hilar tumors.

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