Partial nephrectomy (PN) is the current standard of care for localized renal cell carcinoma (RCC), especially in patients with tumors <4 cm (1,2). The retroperitoneal laparoscopic partial nephrectomy (RLPN) becomes popular due to the direct access to retroperitoneum, renal artery and less interference to abdominal organs (3). However, the retroperitoneal approach is technically challenging for surgeon because of the limited workspace and less anatomic landmark (4). Many researches reported that peritoneal tear is the most common intraoperative complication during the retroperitoneal operation, this may occur when inserting trocars or dissection. Once the integrity of peritoneum is broken, the CO$_2$ in posterior space leaks into interior space and increase the intraperitoneal pressure. Consequently, the posterior space would be compressed and more limited workspace further increases the difficulty of the surgical procedures. Moreover, after the lateroconal fascia incised longitudinally, the edge of lateroconal fascia blocks the sight like a “curtain”, which called curtain effect (5,6). In this study, for management of peritoneal tear and curtain...
effect, we described an efficient method called lateroconal fascia suspension (LFS) for junior surgeons. We present the following article in accordance with the STROBE reporting checklist (available at https://tcr.amegroups.com/article/view/10.21037/tcr-21-2467/rc).

Methods

Patients information

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by Ethics Board of Ruijin Hospital, Shanghai, China (No. 2020-381) and informed consent was taken from all the patients. Between October 2018 and December 2020, we performed LFS procedure in 28 cases of RLPN in our hospital (17 left and 11 right). The 28 patients included 20 male and 8 female, mean age was 57 [interquartile range (IQR), 47–66] years old. Median tumor size was 3.1 (IQR, 2.4–4.0) cm, 18 tumors were located posterior side and 10 were anterior, median radius-exophytic/endophytic-nearness-anterior/posterior-polar line (R.E.N.A.L) score was 6 (IQR, 5–8). Median preoperative hemoglobin (Hb) was 140 (IQR, 132–146) g/L, median serum creatinine (SCr) was 76 (IQR, 68–88) μmol/L and the estimated glomerular filtration rate (eGFR) was 91 (IQR, 46–109) μmol/L (Table 1).

Table 1 Patients characteristics

| Parameter                  | Value                  |
|----------------------------|------------------------|
| Sex                        |                        |
| Male                       | 20                     |
| Female                     | 8                      |
| Age (years old)            | 57 (IQR, 47–66)        |
| Side                       |                        |
| Right                      | 11                     |
| Left                       | 17                     |
| Tumor size (cm)            | 3.1 (IQR, 2.4–4.0)     |
| R.E.N.A.L                   | 6 (IQR, 5–8)           |
| Anterior/posterior         |                        |
| Anterior                   | 10                     |
| Posterior                  | 18                     |

IQR, interquartile range; R.E.N.A.L, radius-exophytic/endophytic-nearness-anterior/posterior-polar line.

Surgical techniques

After general anesthesia, the patient was positioned in lateral decubitus position and the tumor side was upward and vertical to the bed. The skin and subcutaneous tissue was incised at about 2 cm above the iliac crest on the mid-axillary line. Using a vessel clamp, the muscles and lumbodorsal fascia were split through the retroperitoneal space. Retroperitoneal workspace was created with finger by pushing forward the peritoneum and pressure-balloon from surgical glove mounted on a red catheter (diameter was 4 mm). The other two ports were inserted at anterior and posterior axillary line close to costal line under the direct view (3,7,8). The CO₂ pressure was maintained at 15 mmHg during the surgical procedure.

Once all ports were placed, we removed the extraperitoneal fat and dissected the renal fascia longitudinally. In all cases, the free edge of lateroconal fascia and peritoneum partially blocked the sight of surgeon. We perform LFS to manage the curtain effect for getting better operation view.

We prepared a Hem-o-lock clip tie which bound with 2-0 suture (Figure 1A) and clamp the free edge of lateroconal fascia with prepared Hem-o-lock clip tie (Figure 1B), pulled out the suture from the anterior trocar (Figure 1C). Open the blocked sight by pulled the suture tightly and clipped with vessel forceps (Figure 1D). At the end of operations, the suture would be cut and taken out.

Statistical methods

Descriptive statistics were used to describe demographic variables, assessments of renal function, and other clinical outcomes. Continuous variables were expressed as median and IQR. All data was analyzed using SPSS version 20.0 (SPSS Inc., Chicago, IL, USA).

Results

RLPN for renal tumor was successfully performed in all cases with no conversions to open surgery and other interruptions. Though the peritoneal tear was not occurred in any case, the curtain effect occurred in all cases. We performed LFS in all cases and got a satisfying field of view for subsequent surgical procedure (Figure 1). The mean duration time of LFS procedure was 2 min.

Postoperative pathology results shows that 25 patients were clear cell carcinoma, the other three were papillary RCC, angiomyolipoma and eosinophilic solid cystic
RCC respectively. The median operation time was 142 (IQR, 110–164) min, median estimated blood loss was 93 (IQR, 50–100) mL. Median warm ischemia time was 29.0 (IQR, 22.0–30.5) min. Postoperative hospitalization and ambulation time were 4.1 (IQR, 4.0–5.0) and 5.1 (IQR, 5.0–6.0) days respectively which presented on Table 2. The examination results before discharge and 3 months after surgery showed that there was no significant renal hypofunction in all patients (Table 2).

**Table 2 Clinical outcomes of retroperitoneal PN**

| Parameter                                         | Value                  |
|---------------------------------------------------|------------------------|
| Operation time (min, median)                      | 142 (IQR, 110–164)     |
| Warm ischemia time (min, median)                  | 29.0 (IQR, 22.0–30.5)  |
| Blood loss (mL, median)                           | 93 (IQR, 50–100)       |
| Recovery of gastrointestinal function (day)       | 1.0                    |
| Postoperative ambulation time (days, median)      | 4.1 (IQR, 4.0–5.0)     |

**Preoperative**

| Preoperative                                      | Value                  |
|---------------------------------------------------|------------------------|
| SCr (μmol/L, median)                              | 75.9 (IQR, 67.8–84.3)  |
| eGFR (mL/min/1.73 m², median)                     | 91.1 (IQR, 87.6–98.0)  |

**Postoperative (1 day after surgery)**

| Postoperative                                      | Value                  |
|---------------------------------------------------|------------------------|
| SCr (μmol/L, median)                              | 86.2 (IQR, 69.8–98.3)  |
| eGFR (mL/min/1.73 m², median)                     | 80.8 (IQR, 70.6–88.6)  |

**Three months after surgery**

| Postoperative                                      | Value                  |
|---------------------------------------------------|------------------------|
| SCr (μmol/L, median)                              | 80.2 (IQR, 68.0–91.3)  |
| eGFR (mL/min/1.73 m², median)                     | 86.0 (IQR, 75.7–94.2)  |

PN, partial nephrectomy; IQR, interquartile range; SCr, serum creatinine; eGFR, estimated glomerular filtration rate.

**Discussion**

Renal cancer represents 2% to 3% of all cancers (9). The incidental detection of renal masses is increasing according to more frequent utilization of ultrasonography, computed tomography (CT) and other imaging techniques (10). Laparoscopic partial nephrectomy (LPN) is the current standard of treatment for renal carcinoma, especially in patients with tumors <4 cm (1,2,11,12), we perform laparoscopic radical nephrectomy when there is no possibility for preserving the kidney. Laparoscopic renal surgery can be performed either transperitoneally (TP) or...
Since the Gagner firstly described the retroperitoneal approach in 1992 when performing adrenalectomy (4). The RP approach slowly became the prior choice for adrenal and renal surgery due to its inherent advantages (13-15). The direct access to the retroperitoneum without the need to violate the peritoneal cavity minimize the risk of intraperitoneal injury and postoperative adhesion, resulting in quicker gastrointestinal recovery and shorter hospital stay. Avoidance of obviating adhesions from previous interventions, can help surgeon minimize the risk of bleeding and save time. Moreover, the RP approach has the advantage of avoiding peritonitis and the incidence of hernia (6,16,17).

Though the RP approach has many advantages, it is challenging due to the limited workspace and less anatomical symbols. In transperitoneal approach there is plenty of space with familiar landmarks. The peritoneal tear and curtain effect are the most common problem when performing retroperitoneal surgery (6). Rassweiler et al. (18) described a blunt finger-dissection technique to create a retroperitoneal space. We can get relatively adequate space by inflating a surgical glove in peritoneal which created by finger previously. This way can greatly minimize the incidence of peritoneal tear.

The curtain effect is the other factor making the operation further challenging by blocking the sight of surgeon. When Gerota fascia was incised longitudinally close to the dorsal side, the remaining fascia was retracted to the ventral side and affect exposure of ventral field of view. Yin et al. (7) reported that they performed LFS procedure in 30 cases of retroperitoneal laparoscopic surgery including adrenalectomy (12 cases), PN (9 cases) and radical nephrectomy (9 cases). The average operation time of PN in LFS group and control group is 134±26 versus 130±23 min (P>0.05). In our study, the primary surgeon was the doctor who had just started the operation independently for 2 years. We performed LFS during 28 cases of RLPN and effectively managed the curtain effect. Full exposure of surgical view helped us to shorten the operating time and warm ischemia time and got a better perioperative outcome.

Some limitations of this study are un-avoidable for clinical setting nature. There is only a small amount of data analyzed in this study, because the aim of our study is to show the specific technique for facilitating surgical approach which worth further promotion.

Conclusions

In conclusion, it is important to keep integrity of peritoneum and minimize the curtain effect for a successful retroperitoneal renal surgery. LFS is a simple, economical and less invasive procedure and we can get better efficiency with little consumption. It is easy to operate and helpful for junior surgeons to manage exposure and limited workspace during the RLPN approach.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://tcr.amegroups.com/article/view/10.21037/tcr-21-2467/rc

Data Sharing Statement: Available at https://tcr.amegroups.com/article/view/10.21037/tcr-21-2467/dss

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://tcr.amegroups.com/article/view/10.21037/tcr-21-2467/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by Ethics Board of Ruijin Hospital, Shanghai, China (No. 2020-381) and informed consent was taken from all the patients.

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