Robotic Excision of Recurrent Renal Cell Carcinomas With Laparoscopic Ultrasound Assistance

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OBJECTIVE To report our experience with the first application of minimally invasive robotic resection of solitary recurrences of renal cell carcinoma (RCC) and our use of laparoscopic ultrasound to localize such tumors.

PATIENTS AND METHODS Three patients presented with isolated retroperitoneal recurrences of RCC on surveillance imaging up to 5 years after previous nephrectomy. One patient who originally had caval extension of RCC to the right atrium presented with retrocaval lymphadenopathy consistent with RCC on biopsy. The second patient had a growing lesion in the renal fossa that could not be found during open exploration before referral. The third patient had an enlarging retroaortic mass resected 2 years after left nephrectomy with negative lymphadenectomy. A transperitoneal robotic approach was used in all cases with laparoscopic ultrasound localization.

RESULTS Procedures were completed robotically in 194, 191, and 85 minutes. Recurrent RCC tumors were resected with negative margins. The first patient had 10 benign nodes removed, the second patient underwent robotic mesh repair of a flank hernia, and the third patient had a retroaortic lesion excised despite benign pathology on prior biopsy. Both ambulated and tolerated diet immediately and were discharged on the first postoperative day without complications. Neither patient had recurrence with at least 2 years of follow-up.

CONCLUSION Isolated RCC recurrences are rare with the limited available data advocating surgical resection. We describe the first report of robotic resection of these tumors with excellent surgical and midterm oncologic outcomes. UROLOGY 85: 1206–1210, 2015. © 2015 Elsevier Inc.

Isolated recurrences of renal cell carcinoma (RCC) after nephrectomy are rare, with several reports recommending surgical resection but traditionally using open surgery.[1-8] Systemic chemotherapy, immunotherapy, radiation, and observation have yielded results inferior to surgical excision with negative margins, whereas radiofrequency ablation has also been advocated.[4,9-11]

Hand-assisted and standard laparoscopic approaches for the resection of isolated RCC recurrences have been reported in limited fashion, but use of robotic instrumentation has yet to be described.[12-14] We report the first 3 cases of robot-assisted laparoscopic excision of such isolated RCC recurrences after previous nephrectomy and describe technical aspects and clinical outcomes. In addition, we demonstrate the utility of intraoperative laparoscopic ultrasonography (ILUS) in localizing recurrent tumors in a previous operative field.

PATIENTS AND METHODS

Case 1: Solitary Nodal Recurrence After Caval Thrombectomy

A 74-year-old male patient with hypertension and diabetes presented 5 years after nephrectomy for a right-sided RCC with extension into the vena cava (IVC) and the right atrium. The original surgery was performed through a chevron incision with sternotomy. Surveillance imaging revealed an approximately 2-cm nodal recurrence posterior to the IVC surrounded by surgical clips. There were no other identifiable recurrent tumors on chest and abdominal computed tomography (CT) scans. Percutaneous CT-guided needle biopsy confirmed clear-cell RCC, and because of the patient's advanced age, he was referred to discuss the option of excision by a minimally invasive approach.

Because of the expectation of intra-abdominal adhesions and scarring around the previously opened and reconstructed IVC, he was offered a robot-assisted laparoscopic approach with the understanding that open conversion may be necessary. The patient was positioned in the full flank position. A transperitoneal approach was used with access obtained periumbilically away from previous scars (Supplementary Fig. 1). A total

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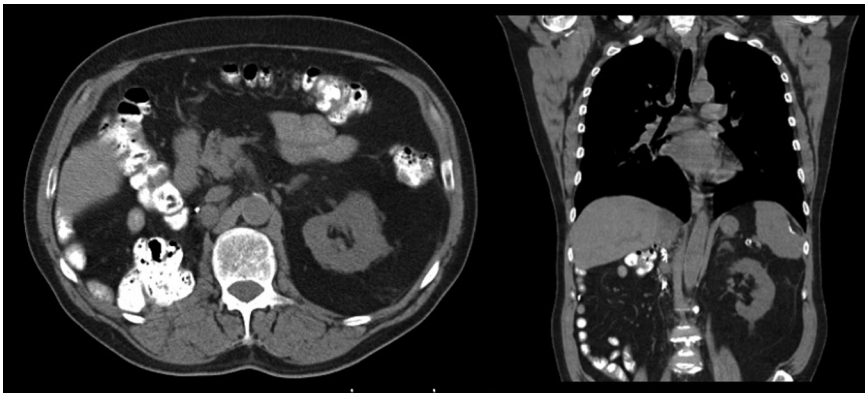

Figure 1. Preoperative imaging revealing retrocaval mass (left) confirmed to be recurrent renal cell carcinoma by percutaneous biopsy and surrounded by surgical clips used during original open nephrectomy (right).

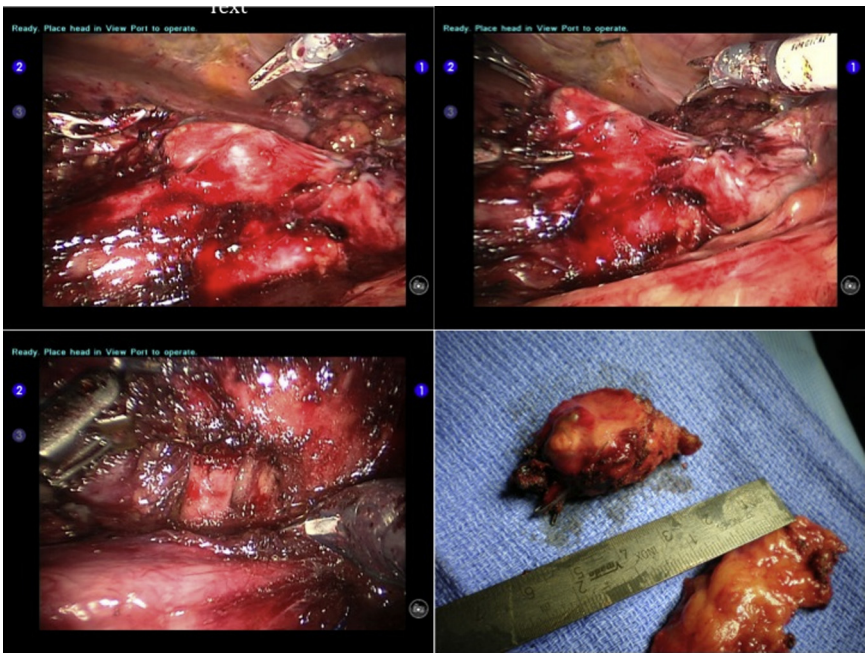

Figure 2. Intraoperative view of the first patient with mass identified after initial difficult dissection to define lateral vena cava border (upper left) with lateralization of tumor to allow delivery from behind the adherent vena cava using the prograsp (upper right). Tumor was found to be located at the level of the renal artery stump (lower left). Tumor and nodal tissue after resection (lower right).

of 4 ports were used, including a 12-mm port for the robotic camera at the umbilicus, two 8-mm ports for robotic instruments, and a 12-mm port used to introduce the laparoscopic ultrasound probe and later for use of the fourth robotic arm. Robotic cautery scissors and Maryland bipolar were primarily used with a robotic prograsp for retraction.

After laparoscopic adhesiolysis to allow port placement followed by robotic adhesiolysis to reflect the bowel away from the underlying IVC, ILUS was used to confirm the location of the retrocaval tumor as a thick layer of scar tissue surrounded the cava along the length where cavotomy had been performed. The edge of the IVC was carefully defined with meticulous dissection to prevent inadvertent violation, but sutures for repair were ready in the event this occurred. Eventually, the IVC could be rolled medially and anterior, given that the patient was in the flank position, to access the retrocaval space. The tumor was pulled laterally with the robotic prograsp to deliver it from behind the IVC and eventually found to be immediately adjacent to the stump of the right renal artery (Fig. 1). After widely excising the tumor, a regional lymphadenectomy was performed, including the remaining pericaval, interaortocaval, and retrocaval nodes in the region.

The operative time was 184 minutes, with estimated blood loss of 20 mL. The involved retrocaval node measured 1.6 cm on final pathology, with negative margin of resection and 10 other nodes resected that were free of malignancy (Fig. 2). The patient ambulated the same day as surgery, with diet advanced as tolerated. He was discharged home on the first postoperative day and experienced no

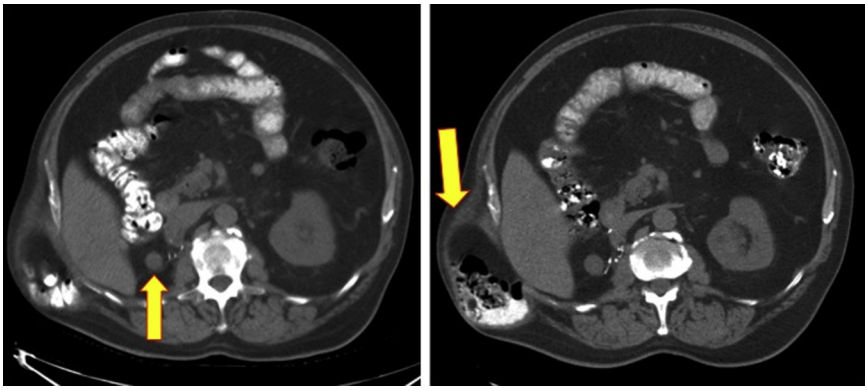

Figure 3. Preoperative images of locally recurrent RCC in nephrectomy bed with initially identified mass (left) and then 6 months later following a failed attempt at open resection with enlargement of resulting flank hernia containing colon (right). (Color version available online.)

Figure 4. Postoperative view of patient in flank position (left) with incisions used for robotic resection of recurrent RCC and flank hernia repair with mesh (right). (Color version available online.)

complications. The patient had no further recurrences on surveillance imaging 40 months after his procedure.

Case 2: Solitary Nephrectomy-bed Recurrence With Failed Exploration

A 73-year-old male patient with a history of coronary artery disease presented nearly 4 years after open right radical nephrectomy through a flank incision. Surveillance imaging revealed a 2-cm lesion located in the right renal fossa (Fig. 3). No other lesions were identified, and an attempt was made to surgically excise the lesion through the same flank incision used at the time of nephrectomy. The mass was unable to be localized at the time such that surveillance was recommended.

Subsequent imaging 6 months later showed growth of the mass to 3 cm, which prompted referral for another attempt at resection. After the unsuccessful exploration, the patient's flank incisional hernia had progressed and become bothersome such that he requested repair at the time of surgery and favored a minimally invasive approach, if possible (Fig. 4).

Because open exploration had previously failed, the decision was made to offer the patient an attempt at laparoscopic excision but with robotic assistance given the uncertainty regarding intraoperative findings. A transperitoneal approach was used and included a 12-mm port at the umbilicus for the robotic camera, an 8-mm right upper quadrant robotic port, and a 12-mm port in the right lower quadrant that was used for a robotic instrument, as well as for the ILUS probe, by temporarily undocking 1 robotic arm during ILUS.

After laparoscopic followed by robotic lysis of adhesions to fully access the right retroperitoneum, which included reduction of the hernia contents robotically, a large amount of retroperitoneal fat was encountered and felt the likely reason for failure to localize the tumor on open exploration. ILUS was then used to survey the entire region until the recurrent tumor was located (Supplementary Fig. 2). A wide excision of the tumor and surrounding fat was then performed with final pathology confirming RCC with negative margins. Subsequently, the hernia was repaired robotically using permanent mesh and sutures (Fig. 4). The total operative time was 191 minutes, including 71 minutes for the hernia repair, and estimated blood loss was <25 mL. No complications occurred, and the patient was discharged on the first postoperative day. The patient remains without cancer or hernia recurrence 24 months after his procedure.

Case 3: Resection of Recurrent Retroaortic RCC Despite Prior Negative Biopsy Result

A 67-year-old female patient with a history of mitral valve prolapse, atrial fibrillation, hypertension, and cholecystectomy underwent left robotic nephrectomy in August 2009, for pT3a, Fuhrman grade 2 RCC. Sixteen lymph nodes were excised at that time and were negative for malignancy. Surveillance imaging 8 months later revealed a 1.5-cm retroaortic mass, but subsequent percutaneous CT-guided needle biopsy did not suggest recurrent RCC. After continued surveillance, the lesion continued to grow to 2.1 cm, and robotic extirpative biopsy was recommended and performed, at that time 2 years after the original surgery.

A transperitoneal approach was used with a 12-mm port at the umbilicus for the robotic camera, an 8-mm left upper quadrant robotic port, and a 12-mm port in the left lower quadrant for a robotic instrument, as well as for the ILUS probe as previously described. The lesion was identified with laparoscopic ultrasonography and carefully dissected along with the adjacent fat from behind the aorta in the field of the previous lymphadenectomy with no other significant nodal tissue seen. Final pathology demonstrated RCC with negative margins. Total operative time was 85 minutes, and estimated blood loss was 10 mL, with overnight stay and no complications. No other radiographic recurrence has been found at 4.5 years after the original nephrectomy and 2.5 years after resection of the recurrence.

COMMENT

Solitary recurrences of RCC are rare and often have a poor prognosis, but the time to recurrence may be important, as a longer time before recurrence may improve the likelihood of success with resection. When local renal fossa recurrence occurs in addition to metastatic disease elsewhere, only 40% of patients were alive at 1 year according to Dekernion et al,[3] but in the absence of other detectable disease, surgical resection of the solitary tumor appears to offer the best oncologic control.[1] Although patient series of open surgical resection have been associated with 5-year cancer-specific survival of 51%, perioperative complications are as high as 42%[4,7] with some sources reporting an 18% mortality rate.[5]

Open surgical management has been most extensively documented, but the feasibility of laparoscopic management with or without hand assistance has been described only on a limited basis.[12,15] To our knowledge, a robotic-assisted laparoscopic approach for these uncommon cases has not been previously reported. Additionally, we present the first description of minimally invasive surgical excision of both local, nodal recurrences, as well as a renal fossa recurrence.

We chose to use robotic assistance owing to the unique nature of these cases and our expectation that they would be challenging beyond simply the adhesions often encountered in reoperative procedures, although it is difficult to speculate whether standard laparoscopy would have been as successful in these cases. Because of previous caval tumor extraction in case 1 and failed previous open exploration with a large flank hernia requiring repair in case 2, we opted to take advantage of robotic instrumentation, which has allowed us to perform complex procedures in the past that have never been successfully performed laparoscopically.[16-18]

These cases also highlight the advantages and feasibility of using ILUS to localize lesions that otherwise might be obscured by fibrosis or altered anatomy from previous surgery. Intraoperative ultrasonography has been used in open surgery to locate tumors obscured by inflammation, cicatrix, or aberrant anatomy and is commonly used in routine open and minimally invasive partial nephrectomies.[19,20] Intraoperative ultrasonography is a technology that should be exploited by urologists not only in routine cases such as nephron-sparing surgery but also in unusual procedures like those describe here. Additionally, with the availability of a "drop-in," robotic, surgeon-controlled, ultrasound probe, the use of ILUS during robotic surgery may be even simpler now.

Furthermore, our third case illustrates the need for close follow-up after a negative percutaneous biopsy result. Given the excellent sensitivity and specificity, there is a well-documented role for needle biopsy in patients with a history of RCC.[21] Nevertheless, even after a negative biopsy result, these patients warrant continuing surveillance given the rare but potentially still curable scenario of a false-negative result. In addition, it is interesting that this patient had a negative retroperitoneal lymphadenectomy result with a yield of 16 nodes at the time of her original nephrectomy. Although it is possible that the only involved node was missed at the time even though it was within the template of node dissection performed, it is also possible that $\geq$1 of the resected nodes may have harbored micrometastatic disease too small to detect on routine histopathology.[22,23]

We report the feasibility of approaching isolated recurrences of RCC with robotic surgery in selected cases but do not suggest that all such procedures require robotic assistance or that all can be managed avoiding open surgery. Case series of open surgical patients have typically included larger tumors, occasionally invading adjacent organs. Additionally, the surgeon involved had performed several hundred robotic procedures before the first of these cases in 2008, such that the decision to use robotic assistance may have been a reflection of comfort with robotic surgery and may not be generalizable to surgeons less experienced with robotics.

Of note, we had no other patients with the same condition to whom we did not offer robotic surgery or who required conversion to open surgery. We had only few patients simply because of the rarity of this situation, but we offered robotic surgery to all with the understanding that conversion to open surgery might become necessary. Fortunately, we achieved oncologic control robotically in each of these cases (without any adjuvant

therapy). Had this goal or the safety of the operation been threatened at any point, conversion to an open approach would have been preferable, but we have not needed to do this as yet.

Certainly, a minimally invasive approach will not be possible or appropriate for all such cases. Surgeons considering robotic management of such recurrences should consider their comfort and experience with robotic surgery and potential barriers that may arise during surgery or may be predictable preoperatively. Examples would include access issues such as extensive adhesions, if the original procedures involved a large incision (eg, chevron), in which case conversion to open surgery could become necessary depending on the comfort level of the surgeon.

Other challenges might also preclude a robotic approach such as previous involvement of the IVC requiring reconstruction as in 1 of our cases or a previous node dissection that might obliterate the normal fatty planes around the great vessels as in 2 of our cases. Fortunately, these did not prevent us from completing the procedures robotically, but preoperative imaging in some cases might suggest consideration of an open approach if the surgeon is concerned about safety. An example of this might include if preoperative imaging suggested a recurrence encasing the great vessels or invading contiguous organs. In our experience with metastatic RCC, including synchronous cases, this is less often the case, and when metastatic lesions appear well circumscribed on imaging, they are usually found to be so intraoperative and are resectable. Of course, if the original tumor at the time of nephrectomy was invading contiguous organs and required a more complex and major resection, this might also be a reason for pause before considering a robotic approach.

Nevertheless, this report should not be viewed as a comparison to open or pure laparoscopic surgery but rather an exploration into the potential benefits of the robotic platform in rare and challenging procedures. We encourage our colleagues to consider a minimally invasive robotic approach for such cases where standard laparoscopy may be limiting before committing all such patients to open surgery.

CONCLUSION

Robotic surgery is a feasible option for selected patients with isolated RCC recurrence as demonstrated by successful application in 2 challenging cases. Because of the rarity of such cases, additional long-term studies with larger cohorts are needed to determine the ideal candidates and likelihood of cure, but when surgical management is pursued, robotic surgery can be considered.

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APPENDIX

Supplementary Data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.urology.2015.01.036.