CASE REPORT

Robotic Nephroureterectomy with Partial Duodenectomy for Invasive Ureteral Tumor

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ABSTRACT

Robotic surgery is gaining acceptance in the management of diverse urological disorders. Any minimally invasive procedure carries a risk of open conversion either for complications or unexpected intraoperative findings, but the additional dexterity of robotic instrumentation may allow even complex situations to be managed laparoscopically. We report the case of an upper tract transitional cell carcinoma discovered at the time of robotic nephroureterectomy to be invading the duodenum that was successfully excised robotically.

Key Words: Robotics, Laparoscopy, Ureteral neoplasms, Duodenum.

INTRODUCTION

The applications of robotic technology in the management of urological diseases are becoming more diverse and gaining acceptance. Robotic surgery for upper tract disorders, such as ureteropelvic junction obstruction, renal cell carcinoma, and nephroureterectomy for transitional cell carcinoma (TCC), have all been reported by multiple authors.[1-5] As with all minimally invasive procedures, conversion to an open surgery can become necessary when complications or unexpected intraoperative findings are encountered. Nevertheless, the additional dexterity of robotic instrumentation may allow even complex situations to still be treated in a laparoscopic fashion.

The standard of care for upper tract TCC is nephroureterectomy,[6-8] but TCC only rarely involves adjacent bowel due to the kidney's retroperitoneal location. In such cases, resection is indicated even when the duodenum or pancreas is invaded,[9] but this has not been previously reported in minimally invasive fashion. We report a case of successful completion of right robotic nephroureterectomy for upper tract TCC of the renal pelvis and upper ureter with invasion of the duodenum. After identifying duodenal invasion intraoperatively, partial duodenectomy and reconstruction of the duodenum was performed robotically with a favorable operative outcome.

MATERIALS AND METHODS

Patient Presentation

A 70-year-old male underwent a right open partial ureterectomy through a retroperitoneal Gibson incision for an obstructing midureteral transitional cell carcinoma one year previously at an institution in another state. Pathology revealed a stage T3, high-grade TCC with negative resection margins. After this initial procedure, the patient was treated with adjuvant chemotherapy and followed by a medical oncologist. Computed tomography (CT) scan of the abdomen was not performed until 11 months later and revealed a tissue-density mass within the renal pelvis and stranding around the proximal ureter with hydronephrosis for which the patient sought an opinion at our institution. **(Figure 1)**.

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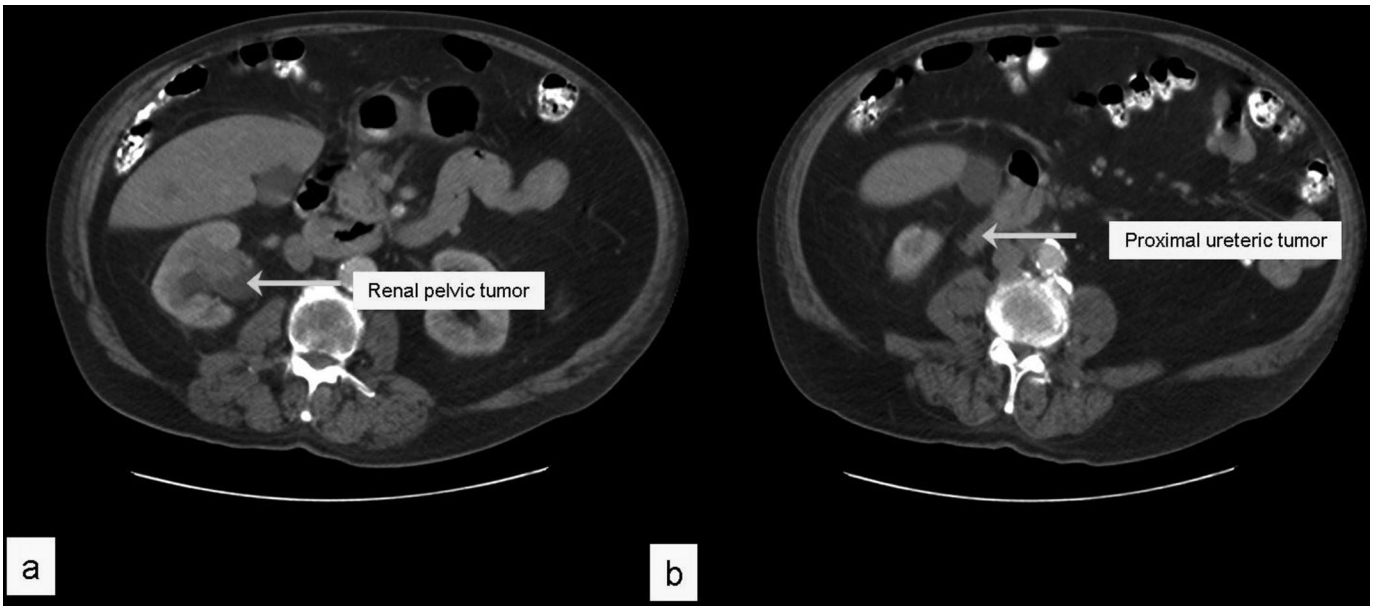

Figure 1. CT scan showing (a) mass in the right renal pelvis and (b) proximal ureteral abnormality in close proximity to the duodenum.

Ureteroscopy was suggested to better characterize the CT findings. On ureteroscopy, the ureter appeared normal except for the questionable area on CT, which ureteroscopically appeared white and was stiff for a distance of >1cm. A large necrotic mass was seen in the renal pelvis where biopsies were taken. The biopsies revealed necrotic TCC. A ureteral stent was left in place.

Although only necrotic TCC was found in the renal pelvis and the ureteral lesion appeared to be a benign stricture from the previous surgery rather than a second TCC lesion, the patient understood that the chemotherapy he received could not be relied on to have completely eradicated the renal pelvic tumor. Therefore, he consented to nephroureterectomy as recommended. A robotic approach was offered with the understanding that scarring from his previous procedure might necessitate open conversion.

Procedure and Technique

Per our routine, the patient was positioned in a supine position with a bump under the right side and legs in stirrups. A 4-port approach was used with a 12-mm camera port at the umbilicus and three 8-mm robotic ports in the right upper, the right lower, and the left lower quadrants **(Figure 2)**. The left lower quadrant port was for use by the assistant during the 3-arm robotic renal portion of the procedure with the table rotated leftward and the robot approaching from the patient's right. The bed was then repositioned into a steep Trendelenburg and rotated to allow the robot to approach between the legs for the pelvic portion of the procedure as typically performed for robotic prostatectomy.

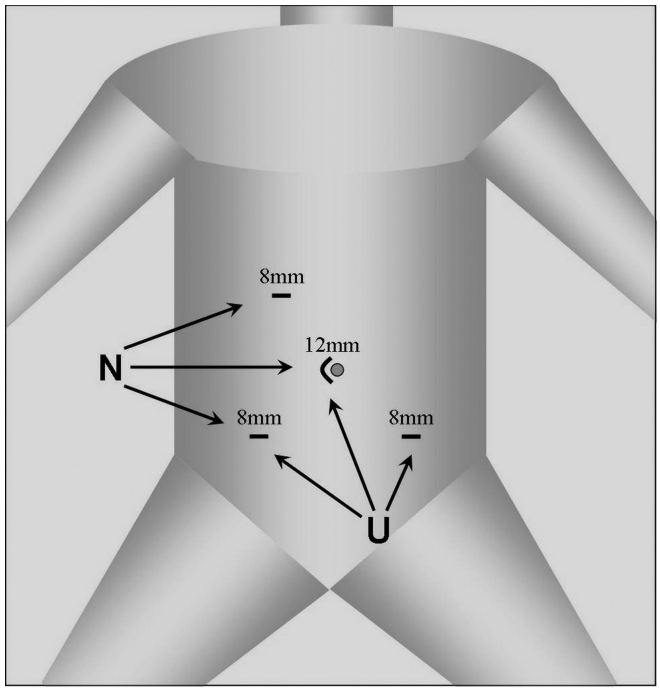

Figure 2. Representative port placement used for robotic right nephroureterectomy with 3 ports used for nephrectomy (N) and 2 ports reused for ureterectomy and bladder closure along with 1 additional port on left (U), which can be used by an assistant during nephrectomy if necessary.

After reflection of the colon, the Kocher maneuver for reflection of the duodenum was begun until it became apparent that the third portion of the duodenum was densely adherent to the tissue immediately lateral. Although initially it was suspected that this might be scarring from the previous ureteral surgery, manipulation of the region with the robotic instruments revealed a large, hard mass extrinsic to the ureter **(Figure 3)**. The dissection was therefore shifted to the kidney first, which was completely mobilized after the hilum was divided.

Attention was then redirected to the area of the ureteral tumor, which could not be freed from the duodenum. The decision was made to resect the involved portion of the duodenal wall, which was approximately 2cm in size. The procedure was continued robotically as the surgical principles of wide resection were followed closely without any complications to warrant open conversion. The defect was then primarily closed perpendicular to the length of the duodenum in Heineke-Mikulicz fashion to avoid luminal compromise in 2 layers using chromic suture to approximate the mucosa followed by interrupted silk suture in the serosa **(Figure 4)**. The remainder of the ureter was then excised from the bladder, which was then closed, and the specimen extracted by extending the periumbilical port incision.

A nasogastric tube was left overnight and removed the following day to allow for a clear liquid diet. A regular diet was initiated the following day, and the patient was discharged later on the second postoperative day in good condition.

Pathology revealed a viable high-grade TCC in the renal pelvis invading the renal parenchyma and perinephric fat. The second mass in the proximal ureter found intraoperatively was also TCC and was predominantly extraluminal and invading the duodenal serosa but not the mucosa **(Figure 5)**. All surgical margins, including the edges of the resected duodenum, were uninvolved by cancer, but unfortunately, the patient was also found to have nodal involvement by TCC in 1 of 2 interaortocaval nodes excised and was referred for but declined salvage chemotherapy. With 20 months of follow-up, the patient has had no gastrointestinal symptoms or complications and continues to undergo close radiologic surveillance.

DISCUSSION

Upper tract TCC accounts for 5% of all urothelial tumors with nephroureterectomy as the standard of care. Laparoscopic nephroureterectomy is an accepted alternative to open surgery and may reduce perioperative morbidity and convalescence.[10,11] Robotic nephroureterectomy is an extension of the laparoscopic technique taking advantage of the enhancements of robotic instruments over those of standard laparoscopy, including additional degrees of freedom, motion scaling, and 3-dimensional visualization.[12] These benefits may augment the ability to perform complex procedures and address unexpected intraoperative findings as in this case.

This initial report of the application of robotic surgery to resection of an upper ureteral TCC invading the duodenal wall illustrates the potential advantage of robotics. While the finding of duodenal involvement might have prompted open conversion if during a purely laparoscopic surgery,

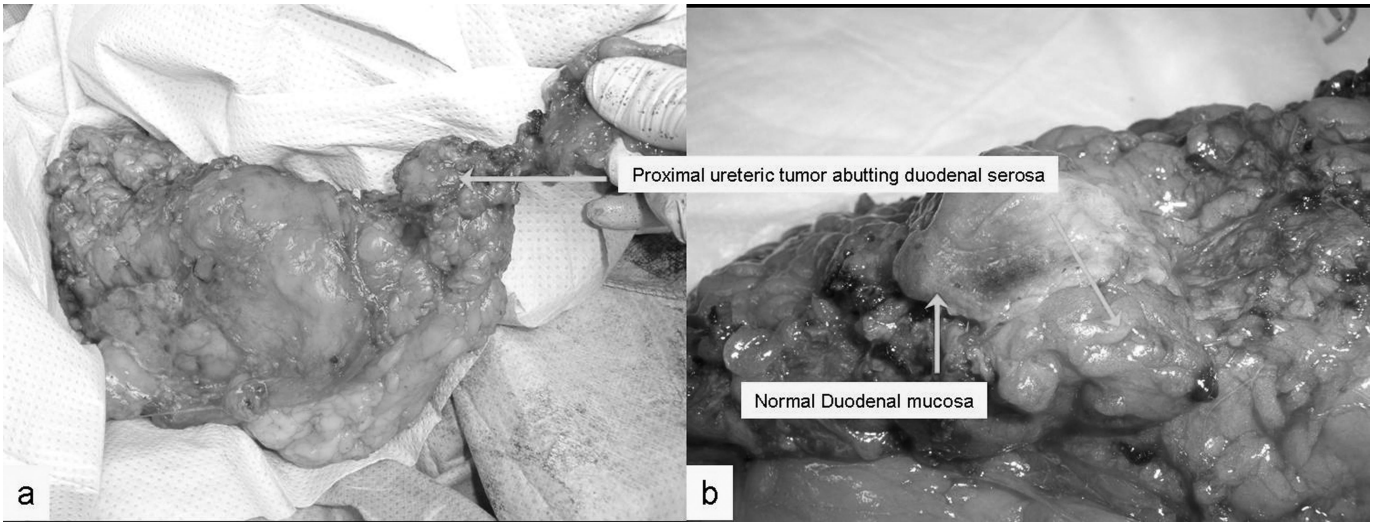

Figure 3. Gross specimen demonstrating (a) proximal ureteral tumor and portion of resected duodenum and (b) adherent portion of duodenum without transmural gross mucosal involvement.

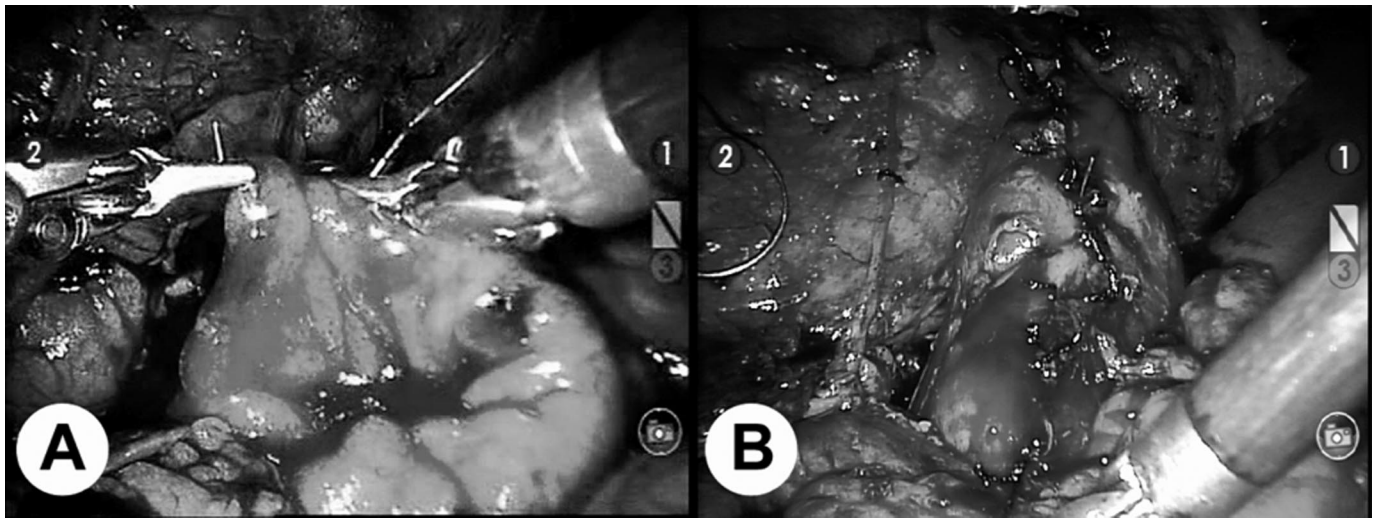

Figure 4. Robotic view of (a) duodenal resection and (b) sutured closure.

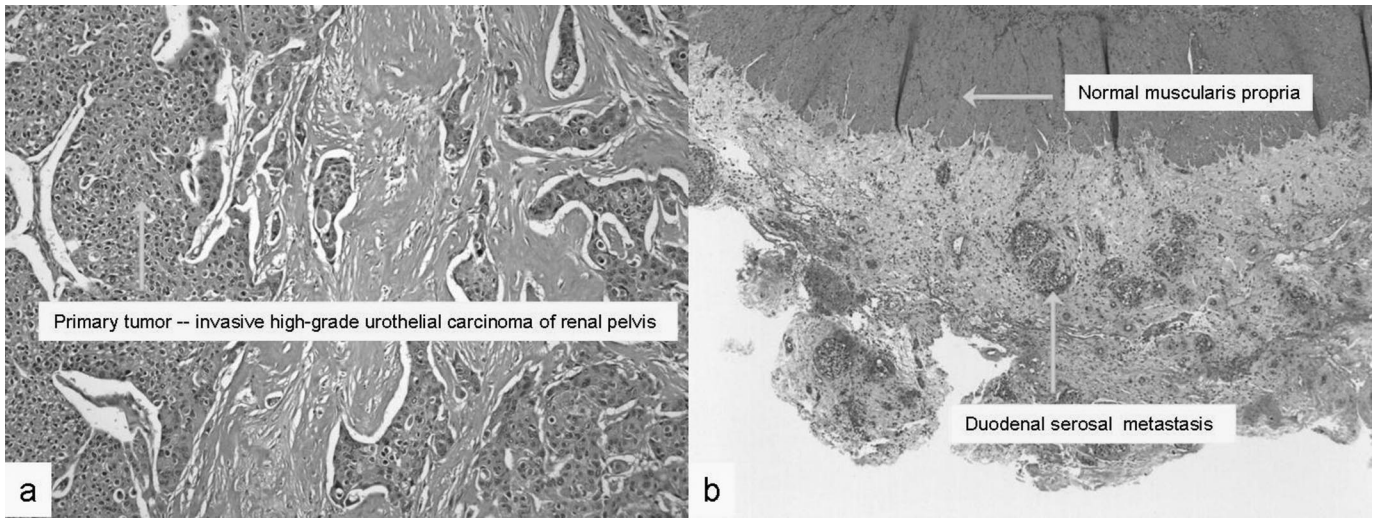

Figure 5. Representative H&E stains of (a) renal pelvic TCC with lymphatic and perineural invasion and (b) duodenal wall with tumor foci in involving serosa.

the robotic approach allowed for completion of a minimally invasive procedure without compromise of the principles of cancer surgery. Additionally, as evidenced by the patient's favorable outcome, the duodenal reconstruction was also successfully performed in robotic fashion without compromising the functional luminal diameter and without leakage.

CONCLUSION

Although laparoscopic nephroureterectomy is an accepted technique and robotic nephroureterectomy continues to evolve, the robotic approach allowed for successful treatment of a ureteral TCC invading the duodenum. Although this extent of disease might otherwise have required open conversion, this initial such case was successfully completed in minimally invasive fashion.

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