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Case Report

Robotic partial nephrectomy in a child with kidney tumor

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ABSTRACT

Robotic surgery is gaining wider utility in adults; however, few reports have addressed the applicability of robotic surgery for renal tumors in children. The aim of this report is to share our experience in an 8-year-old child with metanephric stromal tumor. To our knowledge, besides being a rare tumor, this is the youngest case reported in the literature whose kidney tumor has been successfully removed with robotic partial nephrectomy. There is a worldwide tendency to perform minimal invasive surgery for kidney tumors. In the presence of an experienced team and proper conditions, we believe that robotic partial nephrectomy will be the preferred option in future.

Keywords: Metanephric stromal tumor; partial nephrectomy; robotic surgical procedures.

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Introduction

Robotic surgery is gaining wider utility in adults; however, very few reports have addressed the applicability of robotic surgery for renal tumors in children. The aim of this report is to share our experience in an 8-year-old child with a renal tumor. To our knowledge, this is the youngest pediatric case in the literature whose kidney tumor has been successfully removed with robotic partial nephrectomy.

Case presentation

A previously healthy 8-year-old girl presented with abdominal pain. Ultrasonography revealed a mass in the upper pole of the left kidney. Tumor markers and all other laboratory tests were within normal limits. Magnetic resonance imaging showed a 24x23x19 mm solid tumor with cystic areas located in the upper pole of the left kidney. There were no other tumors, enlarged lymph nodes or metastases. The mass was well-demarcated showing benign features without any signs of a malignant tumor or angiomyolipoma. The tumor had considerably lower heterogeneity and intensity compared to Wilms' tumor. The family was well informed about the risks and benefits of minimally invasive techniques and opted for robotic surgery. Informed consent was obtained from the family for the surgery as well as the case presentation.

After general anesthesia, the patient was placed in a 30-degree modified right decubitus position. Initially four ports were inserted: a 12-mm camera port from the umbilicus, two 8-mm robotic trocars, and a 10-mm trocar for assistance (Figure 1). An additional infraumbilical trocar for the insertion of an endobuldog clamp was introduced later during surgery. The robotic surgical system (da Vinci Surgical System, Intuitive Surgical, Sunnyvale, CA) was docked. Pneumoperitoneum was maintained at a pressure of 12 mmHg during the surgery. Descending colon was reflected medially to reach the retroperitoneal space. Careful hilar

Figure 1. Trocar placement

Figure 2. Hilar artery and vein dissected

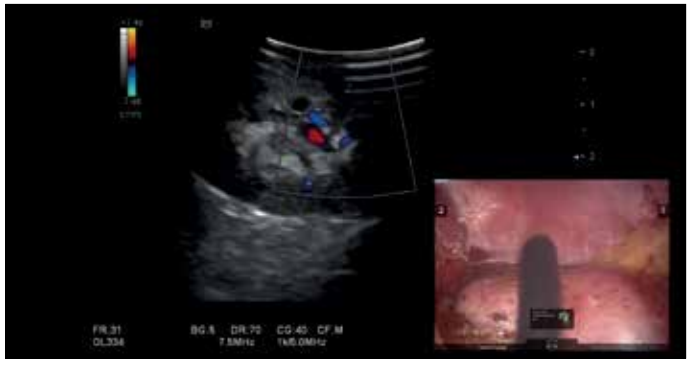

Figure 3. Intraoperative ultrasonography

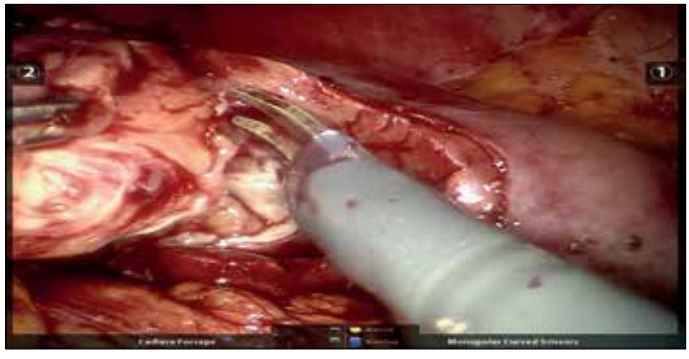

Figure 4. Excision of the tumor with a safe rim of parenchyma

dissection was performed and hilar vessels were prepared for individual clamping (Figure 2). Perirenal fat was dissected to reveal the entire tumor margin. Resection margins were marked with electrocautery and confirmed with intraoperative ultrasonography (Figure 3). Laparoscopic ultrasonography device (Hitachi Noblus, Tokyo, Japan) with a 7.5-Mhz flexible probe inserted through the 10-mm trocar was used. Both gray scale and color flow Doppler US capability were used to demonstrate tumor margins by the probe tip applied to the renal capsule. Renal artery was controlled using a single laparoscopic bulldog clamp (Aesculap, Tuttlingen, Germany) to maintain the patency of the renal venous flow. Mannitol was not used prior to clamping. Mass was totally resected leaving a safe rim of renal parenchyma using robotic scissors (Figure 4). Renal reconstruction was performed in two layers. The internal layer was repaired with the continuous renorrhaphy technique using 3/0 V-Loc™ sutures (Covidien, Mansfield, MA, USA) (Figure 5). The outer layer was repaired with the sliding-clip technique using 3/0 vicryl sutures and Weck Hem-o-lok clips® (Teleflex, Research Triangle Park, NC, USA). The clamp was then removed after a total warm ischemia time of 21 minutes. The surgical site was explored for confirmation of hemostasis after clamp removal. Floseal® matrix hemostatic agent (Baxter Healthcare Corporation, Freemont, CA, USA) was applied to the recontruction site. The mass was placed in a 10 mm endobag and removed through enlarging the umbilical port incision.

Operative time and robotic console time were 160 mins and 110 mins, respectively. The warm ischemia time was 21 minutes and estimated blood loss was 20 mL. The patient recovered uneventfully without any complications and was discharged home on the 3rd postoperative day. There were no postoperative complications and postoperative ultrasonography showed no urinoma or any other collection in the surgical field. Histopathological evaluation revealed a 35x25 mm metanephric stromal tumor with negative surgical margins. Postoperative 3rd-month dimercaptosuccinic acid (DMSA) scan revealed a split function of 38% on the left side (Figure 6). Postoperative 1-year follow-up showed no recurrence.

Discussion

Minimally invasive partial nephrectomy for kidney tumors is well defined and widely used in adult patients[1]; however, data regarding children is scarce. To our knowledge, the only report in the English literature for robotic partial nephrectomy in a child is related to a 14-year-old girl with renal cell carcinoma.[2]

The main reason for this is the diversity of tumor pathology and their behavior. Wilms' tumor constitutes the majority of kidney tumors in childhood and renal cell carcinoma in adulthood. Partial nephrectomy is regarded as the gold standard technique for

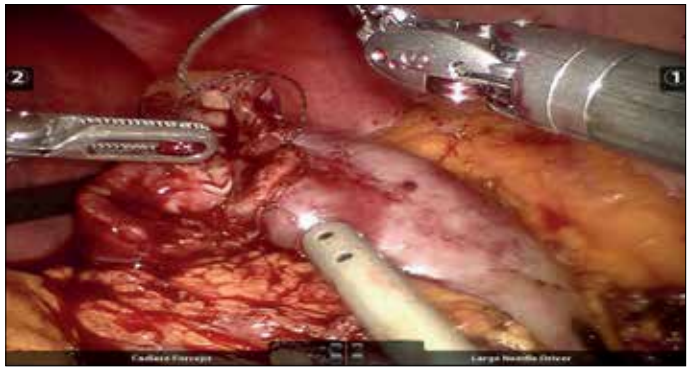

Figure 5. Internal renorrhaphy suture

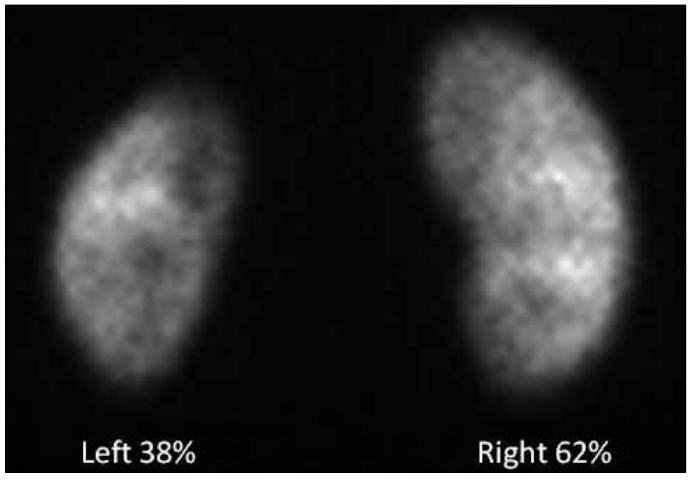

Figure 6. Dimercaptosuccinic acid Scan in the postoperative 3rd month

Figure 7. Port site scars in the postoperative 3rd month

small kidney tumors in adulthood.[2] On the other hand, radical nephroureterectomy with lymph node sampling is still accepted as the essence for the treatment of Wilms' tumor.[3] However, partial nephrectomy has recently become an option for small polar masses after the experience gained for bilateral Wilms' tumors.[3] Not being regarded as a standard technique; the International Society of Paediatric Oncology (SIOP) admits the feasibility of partial nephrectomy in a highly selected group of patients despite not being recommended in the SIOP WT-2001 protocol.[4] Additionally, tumor rupture during surgery increases the stage of the disease for Wilms' tumor, therefore minimally invasive surgery is considered applicable only if the surgeon can ensure total tumor excision with no spill.[3] Therefore, deciding the best management for small kidney tumors in children is a challenging issue.

The metanephric stromal tumor has been recently described[5] as a rare kidney tumor in childhood.[6-8] All reported cases had a benign course with no metastases or recurrence, so surgical excision is regarded sufficient.[7] Unfortunately, there are no obvious radiological features of the metanephric stromal tumor so most of these children undergo radical nephroureterectomy with a presumption of either Wilms' tumor or congenital mesoblastic nephroma.[5] We also did not estalish an absolute diagnosis of the metanephric stromal tumor but preoperative imaging resembling a benign tumor led us to perform partial nephrectomy.

We performed radical nephroureterectomy with lymph node sampling in the majority of our patients with kidney tumors for the optimal management of Wilms' tumor. This patient's condition was extraordinary for her atypical age and the radiological features of the tumor. The well-demarcated tumor with relatively low heterogeneity and intensity was considered as a strong indicator for a benign tumor. The benign-looking features of the tumor in imaging studies, the location and size of the tumor and the possibility of saving the kidney in an 8-year-old girl led us to consider robotic partial nephrectomy for this patient. For this operation, surgeons experienced in pediatric laparoscopy (IU) and in robotic partial nephrectomy (BT) worked in collaboration.

Laparoscopic partial nephrectomy is the preferred surgery for a nonfunctional upper pole in a duplex system in our institution. It is a straightforward procedure due to the thin renal parenchyma, limited blood supply, and the distinct excision margins.[9] On the other hand, minimally invasive partial nephrectomy for renal tumors requires greatly sophisticated performance with high level of difficulty.

One feature of this case that led us to perform robotic surgery was the location of this endophytic tumor. The challenge of reconstruction of an endophytic mass located in the upper pole of the kidney prompted us to opt for robotic surgery instead

of conventional laparoscopy. Besides the advantages of three-dimensional view with higher definition, the flexibility of the robotic arms helped us to perform this surgery in a minimally invasive manner.

Despite the very limited experience in robotic partial nephrectomy in children, robotic surgery is now gaining wider acceptance in pediatric urology especially for pyeloplasty. Large series in pyeloplasty confirm the applicability of robotic urologic surgery even in infants.[10] Supporting the literature, we didn't encounter any problems during the surgery. Lastly, the abdominal cavity of an 8-year-old child did not cause any problems in terms of clashing the working ports.

In the largest series of robotic partial nephrectomy performed by three surgeons experienced in minimally invasive surgery, shorter ischemia time, less bleeding and shorter hospital stay with no difference in complications were reported.[11] A literature review comparing robotic versus laparoscopic surgery for kidney tumors has shown no difference in the primary outcomes in any of the parameters including complications, operative time, warm ischemia time or bleeding once the learning curve has been overcome.[1] Despite the lack of literature comparing robotic versus open partial nephrectomy, there are considerable reports for pyeloplasty. Several reports comparing robotic and open pyeloplasty in children and infants have revealed decreased hospital stay and narcotic use.[12,13] Cosmetic advantage of minimally invasive surgery against open surgery is indisputable. We removed the mass by slightly enlarging the umbilical port site which also caused less visible scars (Figure 7).

Robotic partial nephrectomy is feasible in small children in the presence of an experienced team and proper conditions. Robotic partial nephrectomy may be the preferred option in pediatric kidney tumors that are amenable to partial nephrectomy.

Informed Consent: Informed consent was obtained from the family for the surgery as well as the case presentation.

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