CASE REPORT

Robot-Assisted Excision of a Large Retroperitoneal Schwannoma

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ABSTRACT

Introduction: There are few case reports of retroperitoneal tumor excision using the robotic technique. We describe a case of a 13 × 9 × 7–cm retroperitoneal schwannoma that was excised using robot-assisted surgery to provide a minimally invasive benefit to the patient.

Case Report: A 45-year-old woman presented with a right paracaval retroperitoneal lump with well-defined margins displacing the inferior vena cava, the right kidney, the head of pancreas, and the duodenum. She underwent a robot-assisted excision of the tumor using the da Vinci Si HD surgical system using three robotic arms. The biopsy results revealed a well-encapsulated schwannoma diffusely positive for S100. The patient was discharged on the third postoperative day and was still doing well at 1-month follow-up.

Conclusion: Use of robotic technology assists in providing minimally invasive benefits to the patient. It is a safe and effective technique for retroperitoneal surgery.

Key Words: Retroperitoneal tumor, Retroperitoneal schwannoma, Robotic surgery, Robotic retroperitoneal schwannoma excision.

INTRODUCTION

Retroperitoneal schwannoma is a rare, often painless tumor that derives from Schwann cells of peripheral nerve sheaths and predominantly occurs in girls and women between the second and fifth decades of life.[1] Schwannomas usually do not exceed a diameter of 5 to 6 cm. but larger tumors have been reported.[2] They are rarely located in the retroperitoneum, and the usually affected structure is the cranial or peripheral nerve.[3] Complete surgical excision is the mainstay of therapy.

Robotic surgery provides the advantages of three-dimensional high-definition vision, 7 degrees of freedom with endowristed instruments, tremor filtration, scaling of motion, and ergonomic comfort to the surgeon. It is helpful in cases where precise dissection is required in difficult-to-access areas like the retroperitoneum. We used robotic technology to provide a minimally invasive advantage to a patient who presented with a large retroperitoneal tumor on the right side.

CASE DESCRIPTION

A 45-year-old woman presented with complaints of heaviness in the right side of her abdomen. She had a history of hypohidrosis of the right lower limb for 2 years. A retroperitoneal lump was palpable in the right hypochondrium and lumbar region. Abdominal computed tomography and magnetic resonance imaging revealed a 12.2 × 8.5 × 8.2–cm well-defined, rounded, heterogeneous enhancing mass lesion with foci of calcification and necrosis medial to the right kidney and lateral to the inferior vena cava (IVC), displacing both of them and the renal vessels anteriorly **(Figure 1 [A, B]).** There was no cervical/axillary/inguinal lymphadenopathy. Serum α-fetoprotein, β-human chorionic gonadotropin, and lactate dehydrogenase levels were within normal limits. A provisional diagnosis of retroperitoneal tumor (neurogenic/leiomyoma/sarcoma) was made.

Taking into consideration the precarious location of the tumor, the patient was scheduled for robot-assisted tumor excision. Because the preoperative diagnosis was unclear, diagnostic laparoscopy was planned before resection. The plan was to excise the tumor completely, without breach-

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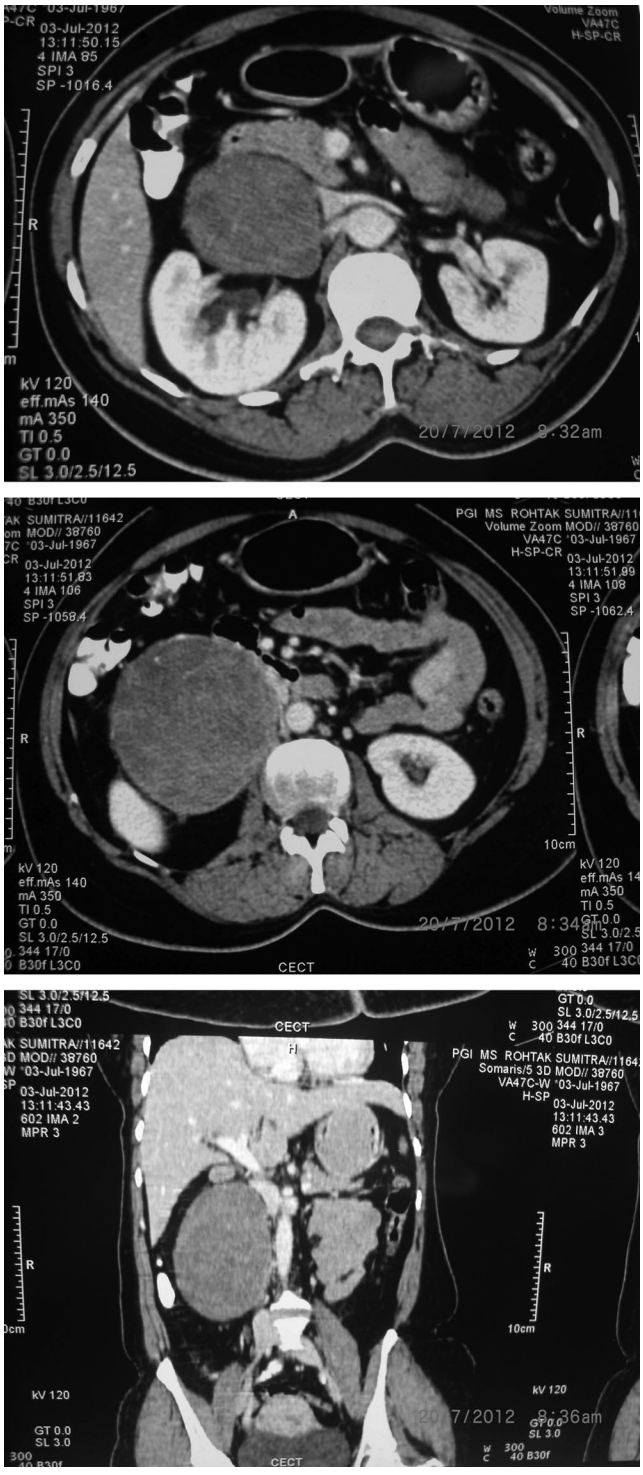

Figure 1. Computed tomographic images showing a 12.2 × 8.5 × 8.2–cm well-defined, rounded, heterogeneous enhancing mass lesion with foci of calcification and necrosis medial to the right kidney and lateral to the IVC, displacing both of them and the renal vessels anteriorly.

Figure 2. The patient is placed in the left lateral position with the retroperitoneal lump marked.

ing the capsule with a low threshold for conversion. With the past experience of the surgical team with laparoscopic and open excision of retroperitoneal tumors, the robotic approach was thought to be fitting because of the varied advantages of robotic surgery in this particular situation.

Technique

The patient was placed in the left lateral position, and a transperitoneal approach was selected **(Figure 2).** The da Vinci Si HD surgical system (Intuitive Surgical, Sunnyvale, CA) was used. The patient cart was placed toward the back of the patient. Initial access was made at the right lateral border of the rectus muscle with the closed technique using a Veress needle and a 12-mm Endopath Xcel trocar with Optiview (Ethicon/Johnson & Johnson, Somerville, NJ) . Diagnostic laparoscopic surgery revealed a large lump in the right retroperitoneal region pushing the colon anteriorly, resulting in a reduced working space. There was no free fluid, and the liver surface was normal upon gross examination.

Three 8-mm da Vinci ports were placed:

- R1: Right midclavicular line below the costal margin (>10 cm away from the camera port).
- R2: Right spinoumbilical line (10 cm away from the camera port).
- R3: Right flank (10 cm away from R2).

An assistant port was placed in the midline for suction and irrigation **(Figure 3 [A, B]).** An intuitive harmonic scalpel was used in R1; fenestrated bipolar forceps were used in

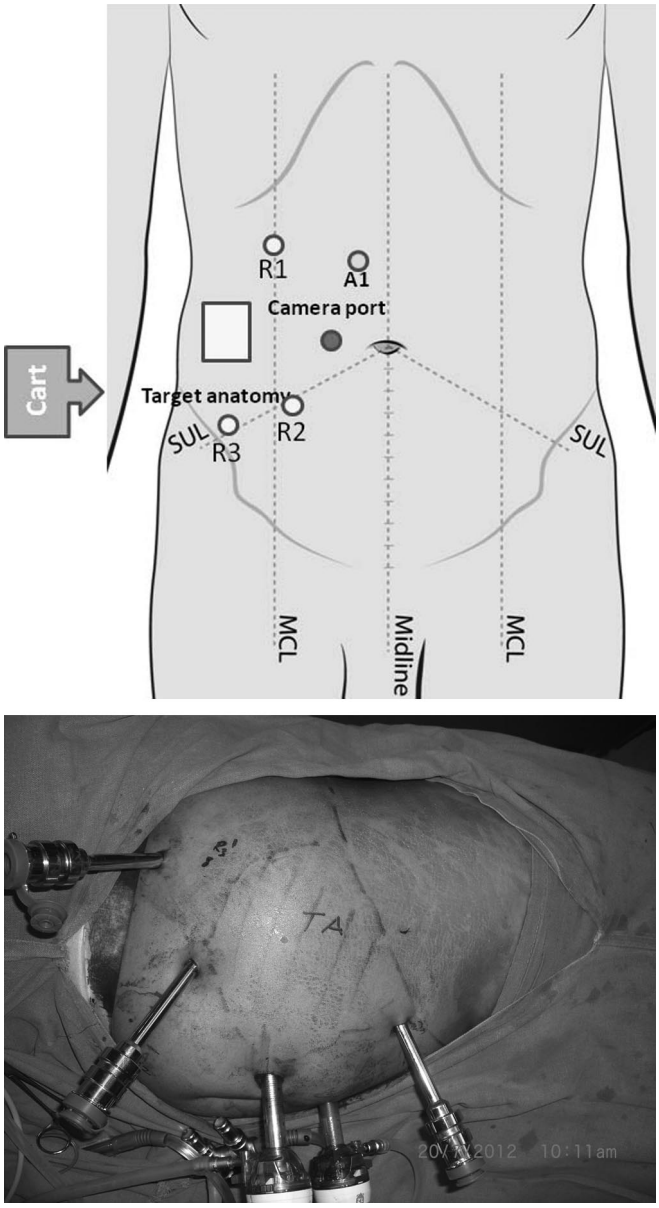

Figure 3. Diagram showing the port position, target anatomy, and patient cart position.

R2; and Prograsp forceps were used in R3 (all from Intuitive Surgical). The colon was mobilized medially by scoring the peritoneum, and the duodenum was kocherized. The tumor was visualized, and a plane was developed around its capsule. It was dissected from the IVC, duodenum, head of pancreas, and right kidney without any breach of tumor capsule **(Figure 4 [A–C]).** After the dissection was completed, the tumor was extracted completely through a right flank incision **(Figure 5 [A, B]).**

The operative time was 240 minutes including robotic docking time of 10 minutes. Blood loss was approximately 200 mL. There was no intraoperative or postoperative complication, and the patient was discharged on the third postoperative day. The histopathology report described a 13 × 9 × 7–cm well-encapsulated tumor suggestive of benign schwannoma, diffusely positive for S100, and negative for smooth muscle antibody, CD117, and CD34.

DISCUSSION

Minimally invasive surgery is now being applied to retroperitoneal disease with increasing frequency, but resection of retroperitoneal tumors using this method is rare. There are various reports citing laparoscopic resection of retroperitoneal tumors,[4–6] but the use of robotic technology is still nascent in this area. To the best of our knowledge, there is only one case report of robot-assisted resection of a retroperitoneal schwannoma.[7]

The challenges faced in minimally invasive resection of retroperitoneal tumors are proximity to major vessels, which can lead to uncontrollable hemorrhage; proximity to the ureters and kidney; restricted working space; unfamiliar anatomy; and lack of surgeon experience.[8] It is also essential to resect the tumors completely without any breach in the tumor capsule. The use of robotics allows certain subtle advantages over laparoscopic surgery, such as three-dimensional envisioning of the tumor, endowristed instruments with 7 degrees of freedom (compared with 5 degrees of freedom in laparoscopic surgery), motion scaling, tremor filtration, and ergonomic comfort for the surgeon. These advantages help in performing minimally invasive surgery, even for large retroperitoneal tumors that are difficult to resect using conventional laparoscopy.

Placing the patient in the lateral position helps in retracting the intraperitoneal viscera away from the surgical field by gravity. The port position for robotic surgery is chosen to minimize the external arm clashing by keeping the distance between ports >8 cm. The target anatomy, camera port, and patient cart center column should be in the same straight line. An assistant port is used for suction and irrigation, and clipping vessels if required. A hand port can be used for assistance if an incision to remove the specimen is needed. Much care is taken to ensure that there is no breach of the tumor capsule.

Dissection of the tumor from the IVC should be done by using a harmonic scalpel[9] or monopolar hook/scissors. Several feeding vessels originating from the retroperitoneum and draining from the tumor into the IVC must be carefully

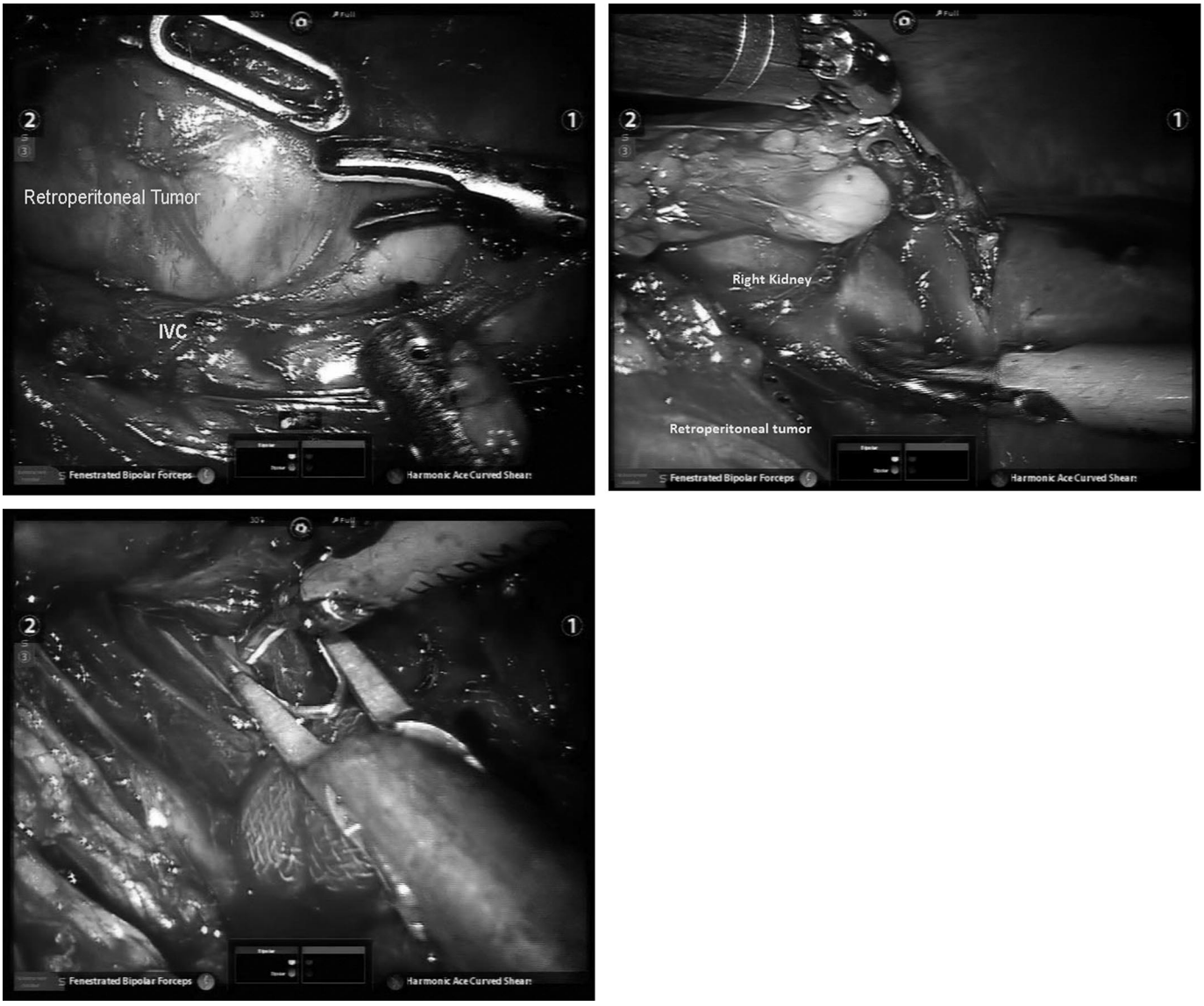

Figure 4. (A) Tumor being dissected off of the IVC using harmonic scalpel. (B) Tumor being dissected off of the right kidney. (C) Feeding vessels of the tumor being clipped and divided.

ligated and divided.[10] In the event of massive intraoperative bleeding from a major vessel, emergency undocking of the patient cart can be done within less than a minute, and the procedure can be converted to the laparoscopic or open method. Thus, instruments should always be kept ready for an open procedure in case of any such adverse event.

The three-dimensional, high-definition vision definitely adds to the detailed view appreciated by the surgeon. Usually, these masses are well-circumscribed and do not invade adjoining tissues. Finding a surgical plane around the tumor is important, and the dissected tumor is easily removed if one remains in that particular plane. Complete surgical excision is the only valid treatment for schwannomas, and incomplete excision is the most common cause of recurrence.[11] The robotic technique definitely provides an advantage over the standard laparoscopic technique in terms of providing better vision, endowristed instruments, motion scaling, and tremor filtration, which lead to a more precise procedure. To date, the major limitation to robot-assisted surgery is the additional cost incurred, but that is offset in part by fewer blood transfusions required, shorter hospital stays, and earlier returns to work for patients.

Figure 5. Resected specimen: 13 × 9 × 7–cm well-encapsulated schwannoma.

We believe that these advanced procedures should be attempted by surgeons only after gaining sufficient experience in robotic surgery and in the resection of retroperitoneal tumors. One should not hesitate to convert to an open procedure if there is any difficulty in complete resection of the tumor because the biopsy can reveal malignancy. The tumor bed should be marked with metallic clips to aid in postoperative radiotherapy if required. Patient safety should always be the first priority in the surgeon's mind.

CONCLUSIONS

Use of the robotic technique can make removal of retroperitoneal tumors amenable to minimally invasive resection in a safe and effective manner. This is possible because of three-dimensional vision of the tumor, endowristed instruments, tremor filtration, and motion scaling technology.

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