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CASE REPORT

Rare use of robotic surgery for removal of large urachal carcinoma

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Abstract Minimally invasive surgery has been used traditionally for removal of colorectal, gastric and gallbladder disease pathologies with great success. Many advantages have been demonstrated with the addition of robotic surgery, such as 3-D visualization, articulation of instruments and improved surgeon ergonomics while operating. These benefits have allowed the implementation of robotic surgery into new areas. We describe here a rare case of a robotic resection of an urachal carcinoma. A 53-year-old female patient presented to her primary care physician (PCP) with a chief complaint of recurrent urinary tract infections. An initial urinary bladder ultrasound showed a large mass anterior and superior to the bladder, thus prompting an abdominal/pelvic MRI, which confirmed a large complex cystic mass anterior to and abutting the urinary bladder (5.4 × 6.7 × 5.9 cm). A follow-up cystoscopy showed no abnormal findings within the bladder. Based on the patient's symptoms and imaging, a careful evaluation by her PCP, oncology and surgical team prompted for the removal of the mass. Because of the uncertainty, complexity and location of the mass the patient was offered surgical treatment with the da Vinci robot. Histopathology revealed an urachal adenocarcinoma, well differentiated. We present that surgical resection of an urachal tumor can be performed with the da Vinci robot. Robotic surgery can add to the benefits seen with the conventional laparoscopic approach and thus can be an accepted method for treatment of abdominal wall masses.

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Introduction

Since its introduction, minimally invasive surgery (MIS) has been used in various surgical specialties, significantly resulting in better patient outcomes [1–3]. With the advancement of technology, many surgeons have begun incorporating the da Vinci robot in MIS. This progress is due to the advantages inherent to the robot: 3-D visualization, articulation of instruments and improved surgeon ergonomics while operating. These characteristics have powered the implementation of robotic surgery into new areas (i.e. gynecology, urology, thoracic surgery, general surgery, pediatric surgery) [3]. Use of the robot has been shown to be beneficial mainly in technically difficult cases and in those with limited space to work such as radical prostatectomy and low anterior colonic resections. In 2006, Madeb et al. [4] published their experience regarding five cases of robotic cystectomy for urachal anomalies. Their findings validated the safety, feasibility and effectiveness seen with the use of the da Vinci robot for removal of urachal tumors. We present a case report of a robotic resection of a large abdominal wall/pelvic mass using the da Vinci robot.

Case report

A 53-year-old female patient with a past history of diabetes mellitus and dyslipidemia presented with a chief complaint of recurrent episodes of urinary tract infections (UTI). Upon further investigation by the primary care physician (PCP), a renal/bladder ultrasound (U/S) and an MRI of the abdomen were requested. Initially, the U/S demonstrated a solid mixed echogenic mass of uncertain etiology that was anterior and superior to the urinary bladder. The MRI

showed a large complex cystic mass (5.4 × 6.7 × 5.9 cm) in the anterior abdominal wall, abutting and inseparable from the anterior superior bladder wall, with areas of internal enhancement (Fig. 1a).

Since the mass appeared to be close to the bladder, a preoperative cystoscopy was performed revealing no abnormalities within the urinary bladder. After careful evaluation of the patient and review of all pertinent studies, the patient was offered a robotic resection of anterior abdominal wall mass.

Surgical technique

Under general anesthesia, the patient was placed in lithotomy position using Allen stirrups. A Foley catheter was inserted. The abdomen was prepped and draped in a standard sterile fashion. Access into the abdomen was obtained with an optical trocar (ENDOPATH®Xcel Ethicon, Inc.) in the supraumbilical region. Robotic 5 mm trocars were placed along the right and left midclavicular lines above the umbilicus. A 12 mm assistant port was placed on the right midaxillary line below the costal margin. The robot was docked between the patient's legs. Peritoneum was incised and the dissection of the mass was begun. Using electrocautery the mass was separated from the abdominal wall and rectus muscles. Macroscopically, it was found to be intimate with the bladder but neither attached nor invading. After completely excising the mass, it was placed in a large specimen bag and was extracted by extending the 12 mm trocar site. At the end of the procedure, the bladder was distended with 300 ml of methylene blue and saline and no leaks were observed. Foley catheter was left in place. Post-operatively, the patient recovered uneventfully with a hospital stay of 3 days. Seven days post-operatively, a retrograde cystogram was preformed prior to the removal of the Foley.

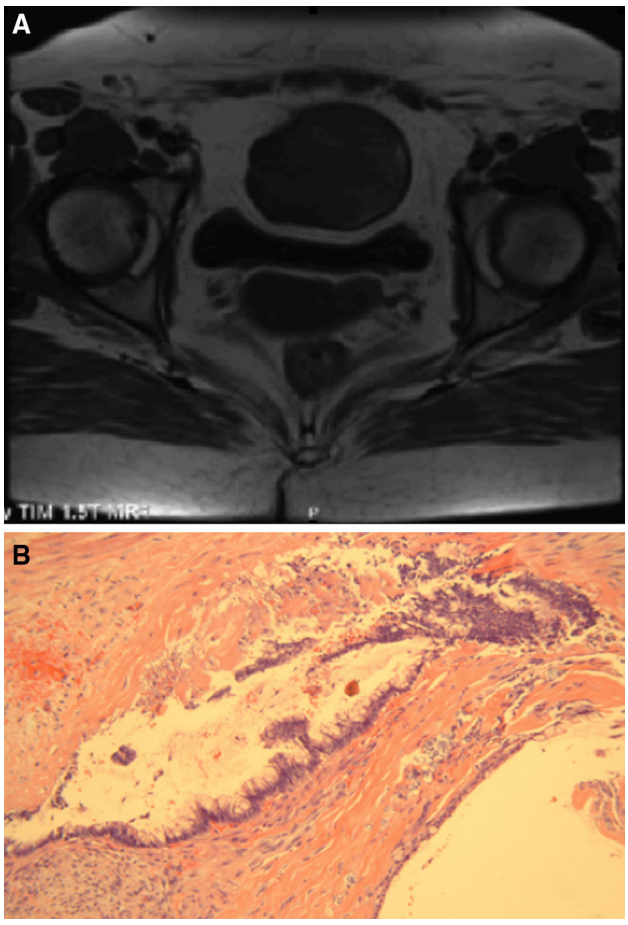

Fig. 1 **a** MRI of pelvis showing urachal mass anterior to and abutting the urinary bladder. **b** Mucinous adenocarcinoma—colloid pattern of mucus

Pathology revealed a 6 × 4.5 × 3 cm pale tan cystic structure. Cross sections revealed a multiloculated cystic cavity filled with a yellow mucoid material with a central osseous area measuring 2 × 1.5 × 1.5 cm. Histologically, the tumor focally involved the smooth muscle, consistent with muscularis propria of the bladder. The tumor cells were found to only express cytokeratin 20 and CDX-2 (Fig. 1b). Viable tumor is exceeding close (<1 mm) to the margin of resection. Final diagnosis was primary urachal mucinous adenocarcinoma, well differentiated. The case was presented at tumor board to a multidisciplinary team composed of her PCP, oncologist and surgeon. After a thorough discussion, the decision was made to perform a resection of the umbilicus, urachal remnant and bladder dome; this procedure was performed 4 months later (Fig. 2a, b). The recovery was uneventful.

Pathology of the second operation revealed resections of the left bladder margin (0.7 × 0.5 × 0.3 cm) and en bloc resection of the umbilicus, urachal and dome of bladder (4 × 2.5 × 0.2 cm). Final diagnosis reported no tumor present. The patient recovered uneventfully with a hospital stay of 2 days. Seven days post-operatively a retrograde cystogram was performed prior to the removal of the Foley.

Discussion

Urachal carcinomas are rare tumors, representing 0.01 % of all adult cancers and 0.07–0.34 % of all bladder tumors [5]. Embryologically, the urachus is a functionless remnant connecting the bladder of the fetus with the allantois, (which contributes to the formation of the umbilical cord). Typically closure occurs around the 32nd week of gestation, but occasionally, inadequate closure can lead to various abnormalities (i.e. urachal sinus, urachal cyst, urachal carcinoma or vesicourachal diverticulum); the most rare presentation is an urachal carcinoma. Most cases occur in the fifth to sixth decade of life and are seen more

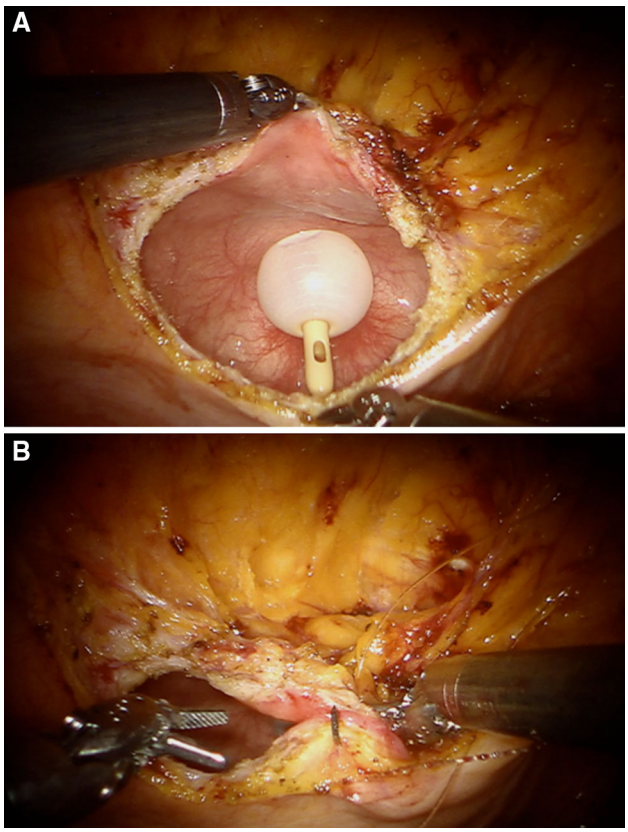

Fig. 2 **a** Shows resection of the bladder dome with the robotic platform. **b** Shows closure of the bladder wall with the robotic arms

commonly in males, with a ratio of 1.8:1 [5, 6]. The most common type of urachal carcinoma is adenocarcinoma [7].

To date, surgery is the preferred treatment of choice for urachal carcinomas, traditionally via open surgical resection. However, similarly to other abdominal/pelvic surgeries, the former approach, an open resection, has been replaced with the laparoscopic approach. The extent, spread and organ involvement influences whether patients undergo a partial cystectomy or a radical cystectomy with broad excision of the umbilical remnant [7, 8]. In 1993 Trondsen et al. [9], was first to document the advantages seen with laparoscopic removal of an urachal carcinoma. Accordingly, as new advances in technology continued to emerge, a constant determination to achieve better results for both the patient and surgeon alike have lead to the introduction of the da Vinci robot for removal of rare abdominal/pelvic tumors (i.e. urachal carcinomas).

In 1985, Kwoh et al. [10] reported the first robotic surgery; this achievement laid the groundwork for the da Vinci robotic system. Since then, minimally invasive robotic surgery has been used traditionally for the removal of colorectal, gastric, gallbladder, gynecologic, and urologic disease pathologies with great success [3, 11]. Numerous advantages have been demonstrated with the addition of robotic surgery: binocular 3-dimensional visualization (entailing dual three chip cameras and two optical channels, which produce two separate images broadcasted binocularly to the surgeon's eyes) allowing the surgeon to recover depth perception lost with standard laparoscopy, seven degrees of freedom enabling better articulation of instruments when compared to four degrees of freedom seen with laparoscopy, increased sense of dexterity, restored proper hand-eye coordination and improved surgeon ergonomics leading to less fatigue and potentially better results while operating [12]. Additionally the daVinci software is able to purify and filter movements up 1,500 times per minute, eliminating physiologic tremors allowing for increased precision with minimal manipulation of the instruments. Essentially, we felt that these advantages would allow optimal results in our patient.

In early 2012, Yazawa et al. [13] reported on 10 cases of urachal carcinomas and their survival rates at 3.5 years follow up. Nine of the 10 patients underwent laparoscopic surgery as the treatment of choice. At the 3.5-year follow-up there were six patients that remained disease free. With a 30 % recurrence rate in these patients at less than 4 years post-operatively, it is not clear whether negative margins or the lack there of, could have played a role in its recurrence. The 3-dimensional visualization with its ability to magnify the field of view 10 times could have assisted in better identification of these margins. In our case, we felt even though the initial operation showed negative margins <1 mm, it was still necessary to re-operate in order to minimize the chance of recurrence by obtaining margins of greater than 2 mm.

In a retrospective review performed by Siefker-Radtke et al. [14], on all cases of urachal adenocarcinoma resections, demonstrated a 5-year disease-free survival rate of 44 %. One key factor influencing the long-term survival was the presence of negative margins [4, 14].

In 2009, Spiess and Correa [15] presented an abstract with video showing the removal of a large urachal adenocarcinoma. They concluded that the use of the da Vinci robotic system leads to less morbidity in terms of post-operative pain, improved cosmesis and a faster recovery time when compared to the open approach.

We felt that the numerous advantages seen with the robot merit its use for the surgical treatment of urachal carcinomas and could be an acceptable alternative to the traditional laparoscopic approach. Importantly, due to the scarceness and low 5-year survival rate of urachal carcinomas, there is still a need for an attentive follow-up by the PCP, surgeon and oncologist involved.

In conclusion, as robotic surgery becomes more widely used, its benefits, versatility, effectiveness and safety can be expanded to surgery of the abdominal wall and removal of many types of abdominal/pelvic pathologies, such as this rare documented case report of a robotic resection of an

urachal carcinoma. Additional studies with larger numbers, longer follow-up and evaluation of patient satisfaction are still needed.

Conflict of interest None.

Consent section Written informed consent was obtained from the patient for publication of this Case Report/any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

References

1. Ionescu S, Andrei B, Filip S, Nicoară DC (2008) The role of minimally invasive surgery in the diagnosis and treatment of tumors in children. Chirurgia (Bucur) 103(5):503–508
2. Perigli G, Cortesini C, Lenzi E, Boni D, Cianchi F (2008) Benefits and limits of minimally invasive techniques in thyroid surgery. Chir Ital 60(2):213–220
3. Palep Jaydeep H (2009) Robotic assisted minimally invasive surgery. J Minim Access Surg 5(1):1–7
4. Madeb R, Knopf JK, Nicholson C, Donahue LA, Adcock B, Dever D, Tan BJ, Valvo JR, Eichel L (2006) The use of robotically assisted surgery for treating urachal anomalies. BJU Int 98(4):838–842
5. Tavassoli FA, Devilee P (eds) (2003) World Health Organization classification of tumours. Pathology and genetics of tumors of the breast and female genital organs, IARC Press, Lyon
6. MacLennan GT (2012) Hinman's Atlas of UroSurgical Anatomy, 2nd edn. Elsevier Saunders, Philadelphia
7. Sheldon CA, Clayman RV, Gonzalez R, Williams RD, Fraley EE (1984) Malignant urachal lesions. J Urol 131(1):1–8
8. Herr HW (1994) Urachal carcinoma: the case for extended partial cystectomy. J Urol 151(2):365–366
9. Trondsen E, Reiertsen O, Rosseland AR (1993) Laparoscopic excision of urachal sinus. Eur J Surg 159:127–128
10. Kwoh YS, Hou J, Jonckheere EA, Hayall SA (1988) Robot with improved absolute positioning accuracy for CT guided stereotactic brain surgery. IEEE Trans Biomed Eng 35(2):153–161
11. Yu HY, Friedlander DF, Patel S, Hu JC (2012) The current status of robotic oncologic surgery. CA Cancer J Clin. doi:10.3322/caac.21160
12. Albani JM (2007) The role of robotics in surgery: a review. Mo Med 104(2):166–172
13. Yazawa S, Kikuchi E, Takeda T, Matsumoto K, Miyajima A, Nakagawa K, Oya M (2012) Surgical and chemotherapeutic options for urachal carcinoma: report of ten cases and literature review. Urol Int 88(2):209–214. doi:10.1159/000334414
14. Siefker-Radtke AO, Gee J, Shen Y et al (2003) Multimodality management of urachal carcinoma: the MD Anderson Cancer Center experience. J Urol 169:1295–1298
15. Spiess PE, Correa JJ (2009) Robotic assisted laparoscopic partial cystectomy and urachal resection for urachal adenocarcinoma. Int Braz J Urol 35(5):609