Robotic intra-abdominal vasectomy reversal: A new approach to a difficult problem

Yagil Barazani, MD; Jihad Kaouk, MD; Edmund S. Sabanegh Jr, MD

Glickman Urological and Kidney Institute, Cleveland Clinic Foundation, Cleveland, OH

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Abstract

The management of obstructive azoospermia resulting from intra-abdominal vasal obstruction poses a formidable surgical challenge. A number of surgical methods have been described to address this problem, including both open and laparoscopic approaches to mobilize and sometimes even re-route the abdominal vas deferens prior to performing a re-anastamosis. We present the first report, to our knowledge, of robotic intra-abdominal vasectomy reversal used to repair obstructive azoospermia resulting from prior laparoscopic vasectomy. In doing so, we summarize the techniques described previously in the literature and build upon this body of surgical experience by combining robotic-assisted laparoscopic mobilization of the vas with robotic vasovasostomy. We believe this novel approach for repairing intra-abdominal vasal defects minimizes morbidity, while at the same time obviating the need for the operating microscope, and thus represents a practical alternative to existing techniques.

Introduction

The management of obstructive azoospermia resulting from intra-abdominal vasal obstruction is an uncommonly encountered and challenging surgical problem. Most commonly, intra-abdominal vasal obstruction results from iatrogenic vasal injury occurring during inguinal hernia repair[1-3] in both pediatric and adult patients.[4] With the rising popularity of the laparoscopic approach to inguinal hernia repair, the potential for vasal injury during this approach is becoming of greater concern, and is further complicated by the use of polypropylene mesh during this procedure.[1,4] Moreover, some men intentionally undergo a laparoscopic vasectomy concurrently with laparoscopic inguinal hernia repair; this represents a similar clinical challenge when they elect to undergo vasectomy reversal.[4]

Men with intra-abdominal vasal obstruction desiring fertility may be offered sperm aspiration from the epididymis or testis in conjunction with in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI). For those men desiring vasal reconstruction, a number of techniques have been described.[4] Surgical reconstruction may also alleviate obstructive post-vasectomy pain, as in the present case.

Case report

A 34-year-old male presented to our institution for the evaluation of chronic scrotal pain as well as restoration of fertility. He had undergone a laparoscopic vasectomy 10 years earlier at the time of a diagnostic pelvic laparoscopy to evaluate for possible left inguinal hernia. Of note, his vasa were clipped and cut bilaterally as part of this case. He reported intermittent bilateral scrotal content pain since the procedure, with discomfort occurring several times a week and worse with prolonged sitting and intercourse. The patient was married and had 3 children with his current partner (age 30), and he denied any prior attempts at vasal reconstruction or sperm retrieval. The genitourinary history was otherwise negative. On physical exam, the patient's testes were descended without masses bilaterally, measuring 24 ccs on each side. The epididymides were mildly full bilaterally, with minimal tenderness to palpation of the right epididymis. The scrotal segments of the vasa deferentia were intact without palpable defects. The chronic intermittent scrotal pain was likely due to his prior pelvic vasectomy and the patient was offered referral to a chronic pain service, as well as restoration of fertility by a robotic intraabdominal vasovasostomy.

After a discussion of surgical alternatives, the patient chose a bilateral vasovasostomy performed via a robotic assisted intra-abdominal approach. A daVinci SI surgical system (Sunnyvale, CA) was used with 5 ports placed in a W configuration (Fig. 1). With the patient in full trendelenberg, the right vas deferens was identified at the level

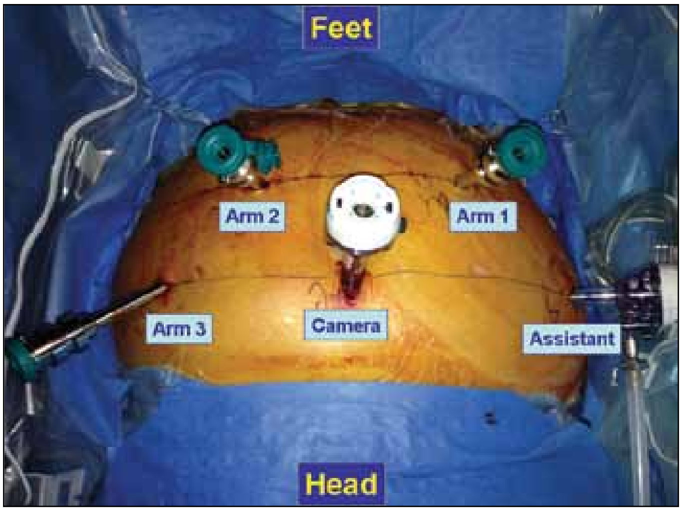

Fig. 1. Port placement for the daVinci SI Surgical system. The W configuration includes three 8-mm robot working ports (Arm 1, Arm 2, and Arm 3), one umbilical port for the camera, and one 12-mm assistant port to the right of the umbilicus (as shown).

of the internal inguinal ring and noted to have multiple clips. Because the vasa had been clipped and cut during the patient's prior laparoscopic vasectomy, the 2 vasal ends were noted not to be in apposition. The vas was mobilized proximally and distally to the clipped portion of the vas. Of note, upon transection of the vas deferens there was no return of effluent. Using a 0 prolene suture, we cannulated the vasal lumen and passed several centimetres to ensure patency of the proximal and distal portions of the cut vas prior to proceeding with reconstruction. A formal 2-layer, watertight vasovasostomy was performed using 6 interrupted 10-0 nylon stitches (using a double armed needle) for the mucosal anastomosis and 8 interrupted 9-0 nylon sutures for the seromuscular layer (using a single-armed needle), similar in technique to that utilized in scrotal vasectomy reversal.[5] The left vas deferens was similarly identified, mobilized, examined for patency with suture, and re-anastamosed using a formal 2-layer technique.

A semen analysis performed 3 months postoperatively demonstrated a sperm concentration of 30 million sperm/mL. An evaluation 3 months postoperatively confirmed near complete resolution of the patient's chronic intermittent pelvic pain and physical exam demonstrated bilaterally flat epididimydes.

Discussion

Intra-abdominal vasal obstruction presents a unique surgical challenge, but the predictive factors for success are similar to those reported for traditional scrotal vasovasostomy (e.g., post-vasectomy interval and length of missing vas).[4] Various techniques have been reported discussing the restoration of vasal patency in these cases; all of these techniques relied on adequate mobilization of the abdominal vas to allow for a tension-free anastamosis. This is because one of the major reasons for failure in such cases is the presence of significant missing vasal length resulting from prior excision which precludes the reanastamosis altogether.[4] Fortunately, significant vasal segment lengths are available for the mobilization in these complex cases of obstructive azoospermia, as demonstrated by Buch and colleagues.[6] In fact, by measuring anatomic distances along the retroperitoneal, inguinal, and infrainguinal segments of the vas deferens in recently postmortem males, these authors demonstrated that a mean length of 5.83 ± 0.65 cm is gained from retroperitoneal mobilization of the vas deferens.[6]

Several different surgical approaches have been described for the performance of vasal anastamosis in cases of injury above the internal inguinal ring. Pryor and colleagues described a technique for open repair using long microsurgical instruments and a modified 2-layer approach. Alternatively, the authors have also suggested simply placing a 2 to 3-cm 3-0 chromic suture within the vasal lumen to act as a stent (which will maintain luminal patency and ultimately dissolve) along with several seromuscular sutures to hold the 2 vasal ends together.[4] Kramer and colleagues cite Ross' similar reconstruction, approaching the vas via a Gibson incision or a Pfanenstiel incision to remain extraperitoneal.[4]

Others have described techniques to mobilize the retroperitoneal vas using the laparoscopic approach to allow anastamosis to the scrotal segment. In Kramer's paper, Marmar is cited using a low midline incision to expose the retropubic space, followed by transection of the abdominal vas at the level of the internal ring. Dissection of the vas from surrounding tissues at this level allows for the redirection of the abdominal portion of the vas straight down toward the external inguinal ring. Straightening the abdominal vas in this manner shortens the distance required for the short segment of abdominal vas to reach the pubic ramus, allowing the vas to be pulled through to meet the testicular end of the vas at the external ring. Because the abdominal vas has been redirected along a straighter course, it can more easily reach the testicular vas allowing traditional vasovasostomy or vasoepididymostomy to be performed. Moreover, a low midline incision has the advantage of providing exposure to both sides and allowing bilateral procedures to be performed through a single incision.[4]

Inguinal and retroperitoneal approaches in men with inguinal vasal obstruction require larger incisions and extensive dissection, particularly in cases where polypropylene mesh has resulted in significant fibrosis.[7] Laparoscopy has been described to assist in situations involving extensive retroperitoneal vasal damage. For example, laparoscopy has been used to mobilize the retroperitoneal vas in a case of vasal obstruction resulting from a segment of inguinal vas encompassed in fibrotic tissue and polypropylene mesh. By laparoscopically mobilizing the "virgin" retroperitoneal vas deferens (as one would do for an orchidopexy) and delivering it through the abdominal wall to the healthy testicular vasal end, it is possible to perform a traditional tension-free microsurgical repair without compromising the hernia repair or manipulating the mesh.[1] Others have similarly reported a novel laparoscopic approach to mobilizing the abdominal vas by creating a tunnel bluntly for the vas to exit through the transversalis fascia and out the external inguinal ring,[7] again preserving the integrity of the hernia repair and minimizing the extent of dissection compared to open approaches. Alternatively, in cases where mesh is not present in the inguinal canal, the abdominal vas deferens may be mobilized via the laparoscopic approach, poking it through the external ring, and performing a vasovasostomy in the scrotum.[4]

Robot-assisted scrotal vasovasostomy offers several potential advantages over traditional microscopic techniques, including attenuation of normal physiologic tremor, decreased fatigue, greater ease and precision of suture placement, a quicker learning curve, magnified 3-dimensional visualization, and less need for microsurgical skills.[8,9] These advantages are tempered by system expense and lower magnification power with robotic use limiting its use in scrotal surgery, although offering significant benefit for difficult-to-reconstruct retroperitoneal vasal obstruction. To our knowledge, no group has previously reported the use of the robotic surgical system to repair an intra-abdominal vasal injury or defect. Our experience therefore builds upon the body of literature, advancing the minimally invasive approach to vasectomy reversal in these exceptionally challenging cases of intra-abdominal vasal obstruction.

Conclusion

The management of intra-abdominal vasal obstruction resulting from iatrogenic vasal injury, encasement in inguinal hernia mesh, or prior laparoscopic vasectomy poses a formidable surgical challenge. While earlier attempts at repair were performed through various open approaches, recent improvements in laparoscopic techniques have allowed for the mobilization and re-routing of the abdominal segment of the vas deferens with minimal morbidity. Meanwhile, widespread adoption of the robotic surgical system has resulted in multiple recent reports of robot-assisted scrotal vasovasostomy, which offers some potential advantages including elimination of physiologic tremor, ease of suture placement, ergonomic comfort, and a faster learning curve than that required for traditional microscopic vasovasostomy. Our case is the first to combine these 2 techniques (robot-assisted laparoscopic mobilization of the vas as well as robotic vasovasostomy). In doing so, it combines the strengths and advantages of each approach. The present case demonstrates that intra-abdominal vasal defects can be repaired using the robotic system in a manner that minimizes morbidity and accomplishes the retroperitoneal vasal reconstruction in situations where conventional microsurgical reconstruction is not feasible.

Competing interests: Dr. Barazani, Dr. Kaouk and Dr. Sabanegh Jr. all declare no competing financial or personal interests.

This paper has been peer-reviewed.

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Correspondence: Dr. Yagil Barazani, Glickman Urological and Kidney Institute, Cleveland Clinic Foundation, 9500 Euclid Avenue, Q10, Cleveland, OH 44195; barazay@ccf.org