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CASE REPORT

Robotic-assisted laparoscopic apical suspension: description of the spiral technique

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Abstract

This video's objective was to describe our spiral technique and surgical steps of robotic-assisted laparoscopic apical suspension (RALAS) in the treatment of patients with symptomatic apical vaginal prolapse. A 70-year-old Caucasian woman, gravida 3, para 2 had symptomatic pelvic organ prolapse (POP) apical/anterior stage III. At pelvic ultrasound evaluation, the uterus was small and normal appearing of adnexa bilaterally. She failed pessaries and is sexually active. The most relevant complaints were vaginal bulging and pressure. She denied urinary incontinence. During the surgery, we used (1) 3-0, V-Loc™ (Covidien) and we reinforced these absorbable sutures with (2) 2-0, GORE-TEX® Suture (Gore Medical). The Si da Vinci Surgical System was used with 4 arms and 5 trocars configuration, docked on the patient's left side. On the right/left apical support, we used V-Loc and Gore-Tex and these provided the initial 2 points suspension on the uterosacral ligaments (USL). We like to attach the left to the right USL. We then developed the space between the bladder and vagina and proceed with a plication of the pubocervical fascia with V-loc sutures. Two anterior apical support sutures were taken from the vagina to the transversalis fascia on the anterior abdominal wall and then hid behind the bladder peritoneum. The tension of these sutures was maintained with Hem-o-lock (TeleFlex) and LAPRA-TY (Ethicon). With the spiral technique, we secured these sutures through aponeurosis of abdominal muscle inside-outside-inside using a Carter-Thomason (Cooper Surgical) laparoscopic port closure system. This technique may provide a better long-term support for the anterior apical compartment.

Keywords Apical prolapse · Vaginal prolapse · Pelvic anatomy · Robotic surgery · Uterosacral ligament · Cardinal ligament

Introduction

Pelvic Organ Prolapse (POP) is a common condition with an estimated incidence of up to 40% of women with growing prevalence in Western countries due to increased life expectancy [1]. 30% of women aged 50–89 years require a consultation for pelvic floor dysfunction and the life-time risk of surgical repair is estimated at 11%, with almost one-third of the patients requiring repeat surgery. In 2008, the large number of reported adverse events with the transvaginal placement of mesh to correct POP prompted the FDA to issue a Public Health Notification outlining the potential serious consequences of such placement [2]. Due to concerns regarding the safety of vaginal meshes, there was a 7% decrease in mesh use during vaginal surgery for POP in the 2 years following the 2011 FDA safety communication [3].

Laparoscopic sacrocolpopexy has been adopted by many pelvic surgeons as a way to minimize surgical morbidity and quicken patient recovery [4–6]. Abdominal sacrocolpopexy (ASC) has been shown to have one of the highest long-term anatomic success rates (78–100%) among procedures for pelvic organ prolapse repair [7] with minimal complications [8]. During ASC identification of the pre-sacral ligament can be difficult, particularly in obese patients. This area is surrounded by critical structures, such as the right ureter,

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where injuries happen during ASC in 1.0% of the procedures (0.8–1.9%) [9]. The middle sacral vessels, the left iliac vein and the caval bifurcation are also near the area where the mesh needs to be placed. Bleeding management can be particularly difficult in this area and accidental lesions of these vessels can result in blood loss, which is described in 4.4% of the procedures (0.18–16.9%) [9]. Awareness of these challenges may discourage the use of ASC, therefore, limiting the access of women with advanced apical prolapse to the most effective surgical strategy available. An additional concern with open or minimally invasive ASC is its association with mesh erosion 2–7% [8, 9].

We recently described our mesh-free surgical technique using non-absorbable sutures for the correction of apical POP. We performed a series of cases with robotic and laparoendoscopic single-site utero-sacral ligament suspension and 92% of patients had good anatomic support at 12 months after surgery [10]. In addition, we recently published the description of our technique for robotic-assisted laparoscopic apical suspension with 4 point suspension (RALAS-4) [11]. We believe that a 4-point support is more anatomical, due to the uterosacral ligaments (USL) and cardinal ligaments (CL) providing 4 points support at the apex. With this additional step (spiral technique) to our RALAS approach, we are exploring an additional anchoring point around the aponeurosis of the abdominal muscle, which may provide better long-term support. The aim of this report is to describe our surgical technique of robotic-assisted laparoscopic apical suspension with spiral (RALAS-4s) technique.

Patient characteristics

In January 2018, a postmenopausal 70-year-old Caucasian woman, gravida 3, para 2 had symptomatic POP apical/anterior stage III. At pelvic ultrasound evaluation, the uterus was small and normal appearing of adnexa bilaterally. She failed pessaries and is sexually active. The most relevant complaints were vaginal bulging and pressure with no complaints of urinary incontinence. Her symptoms were evaluated with the pelvic floor distress inventory (PFDI-20), 54%, 9% and 25%. We used the da Vinci Si systems (Intuitive Surgical, Sunnyvale, CA, USA) to perform the procedure. Patient was counseled about the risks, benefits, and alternative treatments with signed informed consent. Patient refused any mesh-enhanced surgery.

Surgical technique and results

At induction of anesthesia, the patient was placed in dorsal lithotomy position and bladder, 3 way Foley catheter was inserted. Once the trocars were inserted, using 5 trocar, "W" configuration a 15 mmHg pneumoperitoneum was established. After introducing the Da Vinci camera (0 degree) and performing diagnostic laparoscopy, the patient was positioned in Trendelenburg position and the Da Vinci robot was laterally docked allowing us easy access to the vagina during surgery. We proceeded with RALAS-4s. Robotic-assisted laparoscopic USL suspension procedure was performed following our technique recently published [10, 11]. In brief, we used V-Loc 3-0, CV-23(Covidien) sutures (absorbable) on the right and left USL and these were reinforced with Gore-Tex 2-0, CV-2 (non-absorbable, Gore Medical), which served as the first 2 points suspension. We like to attach the left USL to the right USL (Fig. 1a, b). Then, we developed the space between the bladder and vagina and proceeded with the plication of the pubocervical fascia with V-loc sutures (Fig. 1c, d). The following 2 anterior apical support sutures (Gore-Text, non-absorbable) were taken from the vagina to the transversalis fascia on the anterior abdominal wall. In selected cases, plication of the cardinal ligaments (right to left) would have been performed during this step.

Before proceeding with the spiral technique, we need to discuss an important anatomic reference: below the arcuate line, the following structures are over the rectus abdominis muscle: The aponeurosis of (a) transversus abdominis muscle, (b) internal, (c) external abdominal oblique muscles and (d) anterior rectus sheath. The only structure behind the rectus abdominis muscle is the transversalis fascia (Fig. 2a). The tension of these anterior sutures was maintained with Hem-o-lock (TeleFlex) and LAPRA-TY (Ethicon) (Fig. 2b). These 2 sutures were taken from the vagina to the transversalis fascia (we changed the robotic camera for 30° up), 4 cm above the pubic bone and 4 cm lateral to the midline on the right and left (Fig. 2c). Now with the new spiral technique, we secured these sutures through the rectus abdominal muscle inside–outside–inside using a Carter-Thomason (Cooper Surgery) laparoscopic port closure system (Fig. 2d) (video). Cystoscopy was performed at the end of the surgery to rule out ureteral or bladder injuries. The postoperative course was unremarkable. The catheter was removed the following morning after surgery. The patient reported minimal postoperative pain and was discharged from the hospital 24 h after surgery. At discharge, the patient had appointments scheduled at 2 and 4 weeks, and then at 3 months. There was no POP recurrence at 3 months.

Discussion

Robotic-assisted laparoscopic apical suspension, with this new mesh free spiral technique (RALAS-4s), is an innovative approach with promising results for the treatment of advanced anterior and apical prolapse. Our previous experience using RALAS-4 points [11] approach shows that the

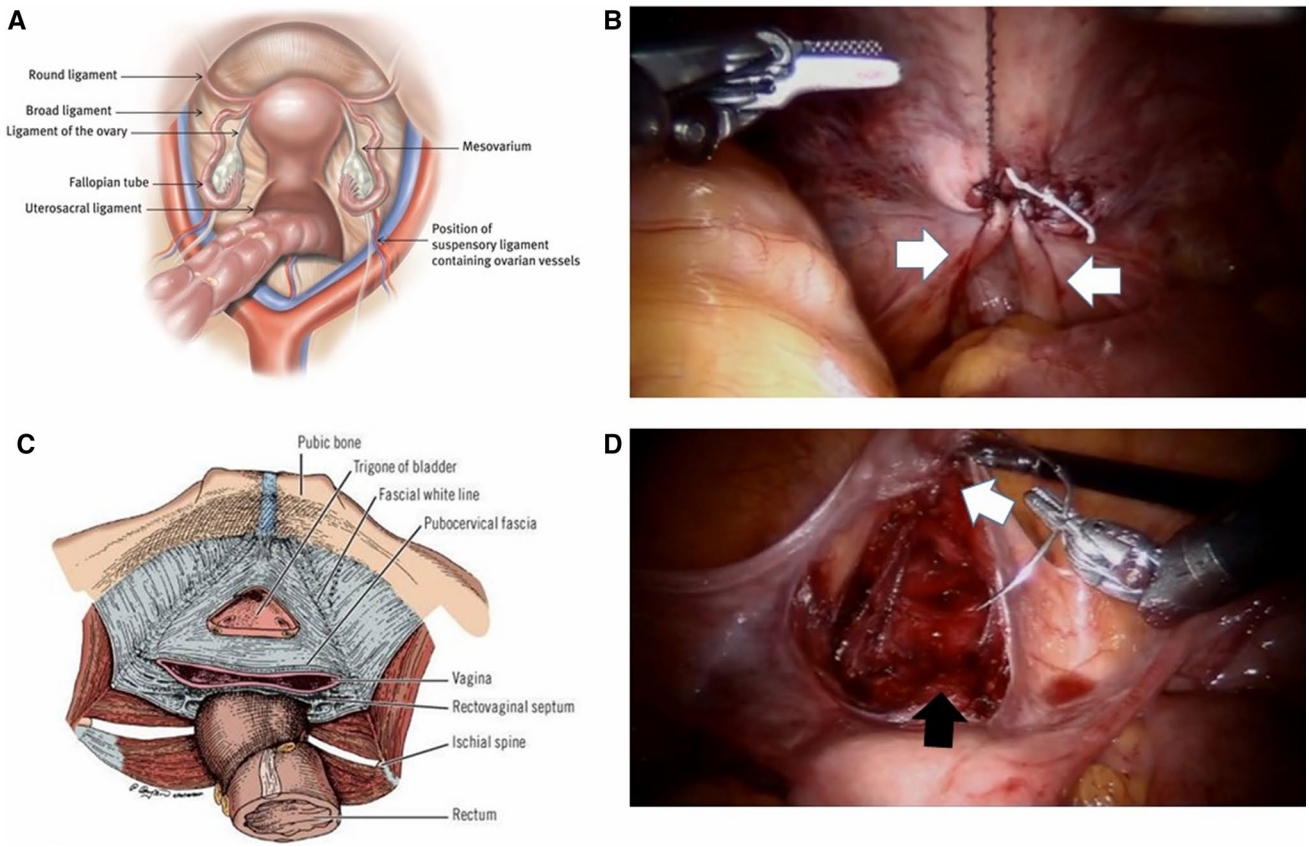

Fig. 1 Uterosacral Ligament (USL) and Pubocervical fascia (PCF) identification during robotic-assisted laparoscopic apical suspension (RALAS). **a** Posterior view of the uterus and relation to right/left USL, **b** after completing right USL suspension, left USL is attached to the right. White arrows: left/right USL, **c** identification of the PCF and relation to the trigone of the bladder, **d** holding the bladder up (white arrow), in preparation for the PCF plication (black arrow)

procedure is feasible, safe, and similar to our previous experience on a series of cases performed with robotic and laparoscopic single site USL suspension platform [10]. However, using these mesh-free approaches in our patients, we have seen a recurrence rate of 12% at 12 months [10] and 20% at 24 months (unpublished data). The recurrence rate is higher at 5 years as shown in other publications, 45–55% after sacrospinous or uterosacral ligament suspension [12]. It was due to these high recurrence rates that we decided to develop the spiral technique, described in this report, to provide better long-term support.

The addition of the spiral technique to our previously described RALAS-4 [11] potentially provides a better long-term apical support by anchoring the anterior sutures around the aponeurosis of the abdominal muscles. Others steps that we are describing here are the following: (a) attachment of the left to right USL, (b) plication of the pubo-cervical fascia, a common place of weakness in apical POP and (c) passing the anterior sutures behind the peritoneum covering the bladder. We are also able to maintain the advantages of minimally invasive surgery including increased dexterity, range of motion, instrument and scope stability, ergonomics, 3D visualization of pelvic structures, surgical field magnification, easy dissection and suturing. All these technical improvements may shorten the learning curve and might represent the basis for wider utilization of this surgical technique.

Anatomically, apical support is provided by the combined action of the USL and CL [13]. The structure of these ligaments has been described based on cadaveric dissections and cross-sectional anatomy [14]. Therefore, we are proposing this 4 points technique; to try to simulate the similar support given by the USL and CL (right and left side). However, there are some arguments to consider in this study. Firstly, surgery was performed on Trendelenburg dorsal lithotomy position; this may not accurately reflect the pelvic floor anatomy in the upright position. Secondly, we performed the 2 anterior apical suspensions with a pneumoperitoneum pressure of 15 mmHg to avoid over-tension of these sutures and allows movement when patients are in upright position and during micturition, this organ movement is important as described in the integral theory [15]. Finally, the length

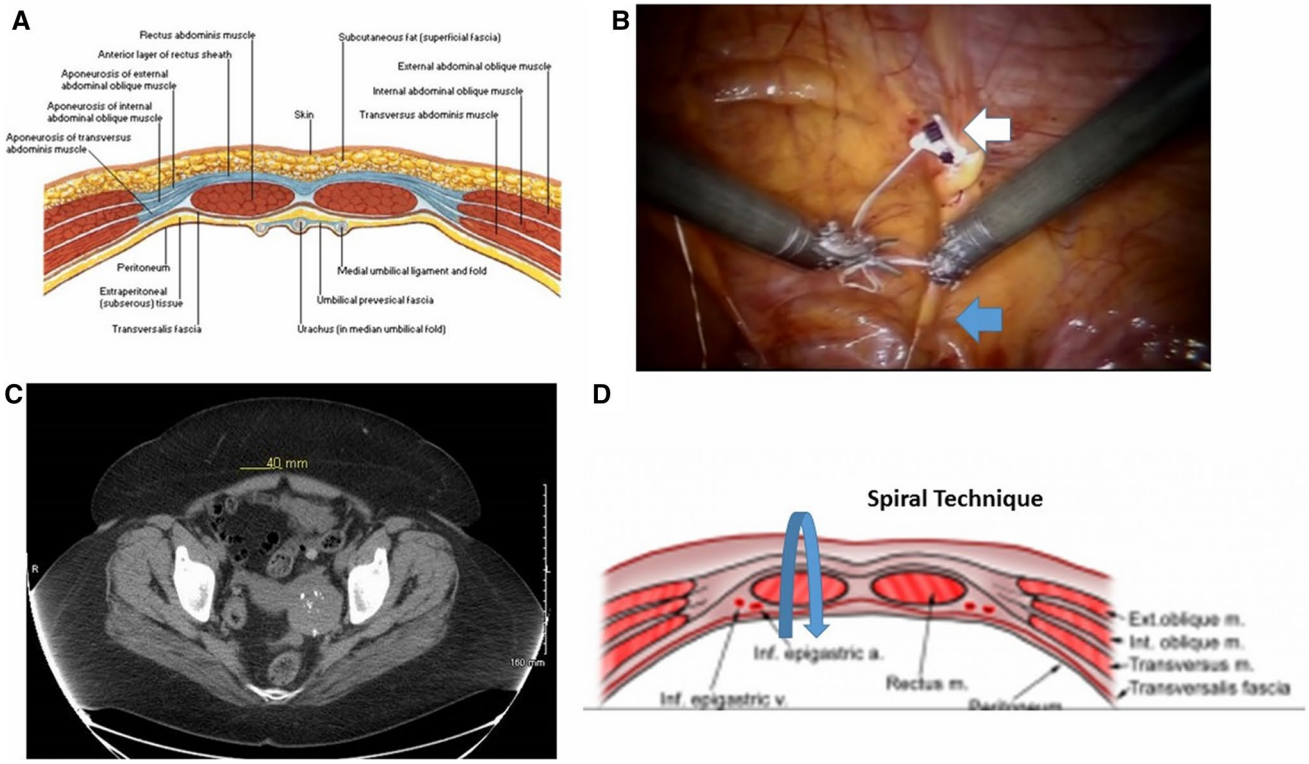

Fig. 2 Anatomy below the arcuate line and location of the spiral technique sutures during robotic-assisted laparoscopic apical suspension. **a** Cross section below the arcuate line, **b** anterior apical suspension. Blue arrow: suture behind peritoneum. White arrow: Hem-o-lock (TeleFlex) and LAPRA-TY (Ethicon) to keep suture tension, **c** computed tomography of the pelvis, 4 cm above the pubic symphysis. 4 cm lateral to the midline, placement of the spiral sutures, **d** diagram of spiral sutures location, identification of the inferior epigastric

of these anterior sutures can vary (25–30 cm) depending on the patient's anatomy, which needs to be evaluated during surgery.

Conclusion

In our opinion, RALAS-4 spiral may represent an alternative to robotic or laparoscopic ASC. This new approach simulates the 4 points support given by USL and CL, with the additional steps: pubo-cervical fascia plication, anterior sutures hid behind the peritoneum, attachment of the right USL to the left USL for additional support, anterior sutures are through the aponeurosis of the abdominal muscles, and finally no mesh and no dissection on the sacrum promontory close to the iliac vessels and right ureter. With this RALAS-4 spiral technique, we are chasing the Trifecta: (1) no mesh, (2) no complications and (3) good long-term anatomic support. We are continuously collecting data for the evaluation of the long-term operative outcomes of this technique compared to our robotic sacrocolpopexy or sacrohysteropexy.

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Compliance with ethical standards

Conflict of interest Hugo H Davila, MD, Karisa Brown MS, Prajwal Dara MS, Lindsey Bruce MD, Lindsey Goodman MD and Taryn Gallo MD. Declare that they have no conflict of interest.

Informed consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

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.

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