Gynecology and Obstetrics Clinical Medicine 1 (2021) 68–69

Contents lists available at ScienceDirect

Gynecology and Obstetrics Clinical Medicine

journal homepage: www.keaipublishing.com/en/journals/gynecology-and-obstetrics-clinical-medicine

The evolution of sacrocolpopexy and development of novel techniques via natural orifice transluminal endoscopic surgery

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ARTICLE INFO

Keywords
Sacrocolpopexy
Endoscopic surgery
Transvaginal

Prolapse of one or more pelvic organs through the vagina, such as the uterus, bladder, or rectum, is an increasingly common occurrence in the aging female population, with rates approaching 60% of parous women.[1] Its associated symptoms of vaginal bulge or bladder, bowel, or sexual dysfunction can drastically affect a woman's quality of life. Multiple surgical options for the treatment pelvic organ prolapse exist and may involve autologous tissue repair or the use of biological or synthetic grafts. Abdominal sacrocolpopexy, first described in 1957 by Arthure and Savage, involves using the sacrum as a point of support for the vaginal apex.[2] The technique was further refined by Huguier and Scali by the incorporation of a graft to improve tissue strength and to improve postoperative anatomical cure rates.[3] For many surgeons, abdominal sacrocolpopexy is the preferred surgical technique as it has demonstrated superior outcomes with higher postoperative success rates through restoration of normal anatomy and lower rates of prolapse recurrence and postoperative dyspareunia.[1]

Multiple approaches and techniques to abdominal sacrocolpopexy exist and involve either an open, laparoscopic, or robotic assisted laparoscopic approach, with reported cure rates similar between open and laparoscopic approaches. Over recent decades, a shift from open to minimally invasive surgery has been emphasized due to improved patient outcomes, and in general patients undergoing laparoscopy have decreased postoperative pain and opioid requirements, shorter hospital stay, improved cosmesis, and higher patient satisfaction. Further advancements to the field of laparoendoscopy include newer generation minimally invasive techniques such as single incision laparoscopy, robotic assisted single incision laparoscopy, and natural orifice transluminal endoscopic surgery, which seeks to further improve cosmetic results through fewer abdominal incisions and patient satisfaction.

The application and feasibility of both single incision laparoscopy and natural orifice transluminal endoscopic surgery in the field of gynecologic surgery have been demonstrated through successful hysterectomy, adnexal surgery, myomectomy, sacrocolpopexy, and lymphadenectomy in early stage endometrial cancer.[4–8] Of particular interest to gynecology is the development of vaginal natural orifice transluminal endoscopic surgery (vNOTES), which involves the assimilation of laparoscopic and vaginal surgery through the most minimally invasive approach. When feasible, transvaginal surgery is the preferred route of surgery for benign gynecologic disease – a position that is supported and upheld by the American College of Obstetrics and Gynecology.[9] vNOTES is particularly promising as it can overcome some of the barriers associated with transvaginal surgery, such as limited visualization and inadequate transvaginal surgical training and experience, by incorporating the use the laparoendoscopic camera to improve visualization of adnexal or uterine masses while utilizing a laparoscopic approach that more gynecologists may be comfortable and familiar with.

The first pilot study of vNOTES sacrocolpopexy was described in 2018 in 26 patients with stage II–IV pelvic organ prolapse as classified by the

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Publishing services by Elsevier on behalf of KeAi

https://doi.org/10.1016/j.gocm.2021.04.003
Received 25 April 2021; Accepted 27 April 2021
Available online 10 May 2021

POP Quantification System (POP-Q).[10] Of the 26 patients, 23 underwent successful vNOTES sacrocolpopexy, and the remaining 3 patients had conversion to single-incision abdominal laparoscopic sacrocolpopexy due to dense pelvic adhesions and stage IV endometriosis. Quality of life measurements as characterized through the PFIQ-7 questionnaire before and after surgery, surgical outcomes, and postoperative follow up for up to 14 months were gathered in all patients. Feasibility of this approach was demonstrated through improvement in anatomic prolapse and quality of life scores postoperatively, as well as no postoperative complications of mesh exposure, pain, infection, or new urinary incontinence in this small sample of patients. A more recent study in 2020 of 93 patients undergoing transvaginal vNOTES pelvic reconstruction with Y-shaped mesh, a technique with slight modifications from sacrocolpopexy, demonstrated similar findings without mesh erosion and improvement in postoperative POP-Q and quality of life scores however had 5 patients with de novo stress urinary incontinence with 3 patients requiring reoperation with transvaginal sling, 2 patients with dyspareunia classified as “mild,” and 1 patient with persistent pelvic pain attributed to excessive tension with placement of the mesh.[11] Modifications to ensure tension-free placement during surgery was made by the authors, and no other reports of persistent pain were appreciated in the study sample.

These findings are promising for consideration of vNOTES as an additional platform to successfully perform sacrocolpopexy while eliminating the need for abdominal incisions. However, some challenges to widespread adoption of this technique not only include its novelty but also the need for single incision laparoscopic skills and difficulty with intracorporeal sewing during mesh anchoring. Integration of the robotic platform introduces a solution to this issue by improved dexterity through wristed articulating instruments and improved ergonomic handling.

The incorporation of the da Vinci Xi system in vNOTES sacrocolpopexy as demonstrated through this small case series details its feasibility and efficacy in treating pelvic organ prolapse.[12,13] Two patients with stage II prolapse underwent robotic assisted vNOTES hysterectomy and subsequent sacrocolpopexy for surgical correction of their symptomatic pelvic organ prolapse. They were both discharged home <24 hours after surgery with minimal need for opioid pain medications, and both patients had no notable postoperative complications in the 8 week postoperative period. Postoperative POP-Q staging was performed with both patients demonstrating a physical exam consistent with stage 0. Although the postoperative follow up period in this case series can only be used to determine short-term outcomes, use of the robotic platform to overcome some hurdles of traditional vNOTES sacrocolpopexy is obviously feasible and warrants attention as an alternative surgical approach.

Clearly more comparative studies in evaluating postoperative outcomes of open, single or multiport laparoscopic, robotic assisted laparoscopic, or vNOTES sacrocolpopexy are necessary to completely evaluate the safety and feasibility of all these approaches in the surgical correction of pelvic organ prolapse. However, studies of vNOTES and robotic assisted vNOTES approaches are currently lacking despite their promising results. We believe these approaches are part of the next advancements in the field of minimally invasive surgery as they eliminate the need for abdominal incisions and therefore improve patient satisfaction.

The da Vinci Xi platform's availability is so widespread that it can allow a robotic surgeon to pursue this procedure without hassle.[14] However, this platform can have some limitations due to limited reach of the robotic arms in upper abdominal or anterior abdominal wall pathology. Additionally, an extremely cephalad sacral promontory can pose challenges. In the meantime, emerging new pure single-site surgical platforms such as the da Vinci SP system can potentially overcome these hurdles to further promote vNOTES surgery and its adoptability.[14]

Conflicts of interest

Conflict of Interest was none.

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