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ORIGINAL ARTICLE

Technical features, perioperative and anatomical outcomes of a standardized suturing pattern for robotic sacrocolpopexy

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Abstract

Introduction and hypothesis Several technical alternatives to repair mesh using laparoscopic sacrocolpopexy exist. We aim to describe the outcomes and surgical technique of robotic-assisted colpo-/cervicosacropexy using a standardized suturing scheme to repair the mesh.

Methods We retrospectively reported data of 60 consecutive cases of robotic-assisted colpo-/cervicosacropexy for advanced multicompartmental prolapse using a standardized suturing design. We placed three non-absorbable stitches on the cervix or three absorbable stitches on the apex of the vaginal vault, six long-term absorbable stitches on the anterior vaginal wall deep to the basis of the vesical trigone, six similar posterior stitches with the deeper row of sutures down to the levator ani plane and three non-absorbable stitches on the sacral promontory as the cranial support for Y-shaped polypropylene mesh.

Results Median operative time was 188 ± 43 min. All the procedures were successfully performed using a Da Vinci Si platform in a three-arm configuration, and no conversion to open or traditional laparoscopic surgery was needed. The length of hospital stay was 1.2 ± 1.7 days, and no readmission within 30 postoperative days was reported. At a follow-up of 12 and 24 months, no case of extrusion or exposure of the mesh occurred, and the retreatment rate was 6.7%.

Conclusions Our suturing technique is safe and effective, with negligible risk of complications and good medium-term results. It is plausible that robotic systems may facilitate precise, accurate and reproducible placement of the stitches, thereby favoring wider diffusion of minimally invasive treatment of advanced prolapse.

Keywords Sacrocolpopexy · Mesh suture · Robotic surgery · Pelvic organ prolapse · Reconstructive surgery

Introduction

Laparoscopic hystero-cervical suspension to the sacral promontory is the gold standard surgery in terms of long-term anatomical and functional outcomes for high stages of apical prolapse; however, it is challenging [1–4]. The robotic-assisted abdominal suspension of the vaginal vault or cervix to the sacral promontory (R-ASC) offers a superior ergonomic set, shortening and facilitating complex laparoscopic steps such as suture placement and precise dissection of anatomical planes [5]. The advantages mentioned above appear particularly useful for R-ASC since they enable or improve the complex surgical steps of this particular pelvic surgery, such as identifying critical anatomical structures or the deep dissection and suture placement in the narrow pelvis. Use of robotic assistance to perform abdominal sacral suspension of the apex has spread considerably among pelvic floor surgeons who believe that the support of the robotic platform not only makes this surgery easier but also that this fluidity in performing the different surgical steps can result in better and more lasting clinical results. However, R-ASC does not reduce the dangers associated with the dissection and suture placement in the pre-sacral area, which may even be worsened by the absence of the tactile feedback typical of the robotic consoles currently used [3, 5, 6]. A recent report indicates that the number of adverse surgical events occurring when performing R-ASC reached the maximum number in 2013 and 2014 and has declined progressively and steadily since then. The decrease in the number of procedures may be due to the operator and operating team's

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increased skill and the improvement of the robotic platforms [7]. However, sacral suspension of the vaginal vault or the cervix is still performed using a wide range of techniques with many variations of the different surgical steps, materials and types of fixation, which need to be made homogeneous and reproducible. Therefore, the placement of the sutures on the anterior and posterior arms of the mesh on the cervix or the vaginal vault to obtain a tailored surgery for each woman's anatomy and clinical needs is still a matter of debate [4, 8]. This article describes the technical features, perioperative, and short- and middle-term anatomic and functional outcomes of a robotic system in a series of patients with advanced-stage multicompartmental defects undergoing a standardized suturing pattern during R-ASC.

Methods

Study population

From November 2015 to November 2018, we performed 60 robotic-assisted abdominal laparoscopic colpo-/cervicosacropexy (R-ASC) procedures in patients with advanced symptomatic prolapse using a particular suturing scheme for mesh fixation. The surgical technique of anchoring the mesh was the same in all women and was performed by the same surgeon (T.S.). We selected procedures performed by the da Vinci Si systems (Intuitive Surgical®, Sunnyvale, CA, USA) in a three-arm configuration and a Y-shaped polypropylene mesh. Surgery was performed in the operating rooms of the Multidisciplinary Center of Robotic Surgery of Cisanello University Hospital of Pisa. Surgeries carried out by traditional laparoscopy or the newer da Vinci Xi system were excluded from the study to standardize all operating parameters avoiding bias concerning technologic features. All patients had a urogynecologic assessment and preoperative clinic evaluation at the Department of Obstetrics and Gynecology of S. Chiara University Hospital of Pisa (a tertiary referral center for the medical and surgical treatment of female pelvic organ diseases). In our center, we used a simplified pelvic organ prolapse quantification (POP-Q) system with three points (points Ba, Bp, C) to define the pelvic organ prolapse (POP). All patients enrolled for surgery have primary or recurrent symptomatic multicompartmental pelvic prolapse POP-Q stage ≥ II.

In this case series, the follow-up for all patients was at least 24 months. The medical history, urogynecologic evaluation and laboratory examinations were collected for all patients before surgical treatment. In patients with urinary symptoms, pre-surgical urodynamic studies were routinely performed. All patients planning to have concomitant supracervical hysterectomy should have regular Papanicolau smears and be informed about the necessity of regular cervical oncologic screening after surgery. Electronic chart review yielded age, biophysical baseline parameters (age, body mass index), preoperative examinations and American Society of Anesthesiologists (ASA) score, and past clinical, obstetric and surgical history. Fertility and menopausal conditions, previous or current menopausal hormonal treatment and symptoms at admission were also investigated. Perioperative data included the overall operative time (OT), described as time from the creation of pneumoperitoneum to the closure of the skin.

Moreover, perioperative data encompassed the report of the estimated blood loss (EBL), use of the full robotic approach, number of robotic arms and technical hitches during robotic surgery. Postoperative parameters were reported and included the days of hospitalization, recovery of urinary and bowel function, need for transfusion, re-operation, readmission, and morbidity and mortality rate. We also accurately observed and reported the perioperative, early and late postoperative complications (respectively within 7 days, from 7 to 28 days and > 28 days after surgery) according to the Clavien-Dindo classification criteria [9]; those not requiring surgical, endoscopic or radiologic re-intervention were graded 1 or 2. Those requiring a surgical re-intervention were graded 3. The adverse events characterized by organ failure needing intensive care treatment were considered grade 4 complications.

The same group of urogynecologists examined the study population 6 months after surgery and yearly after that. During the urogynecologic follow-up visit, the POP-Q score was employed to objectively assess women's postoperative anatomical condition and characterize the prolapse when present. Patients also filled out the Patient Global Impression of Improvement (PGI-I) to assess overall satisfaction about their postoperative status.

Relapse of prolapse was considered significant in case of symptomatic POP-Q ≥ grade II of the anterior, central or posterior compartment. Outcomes of physical evaluations and the questionnaires about functional symptoms were reported after the procedure during 6-month postoperative urogynecologic consultation. Institutional Review Board of the University of Pisa approved this study (protocol no. 808/2015). The present investigation was carried out following the Good Clinical Practice (ICH/GCP) recommendations, Ministerial Decree of 1997. All subjects were counseled about the risks, benefits and alternative surgical procedures and gave written informed consent in accordance with the Declaration of Helsinki.

Technical features of the consistent robotic suture

Surgical steps and the mesh suturing scheme are accurately described in the video.

To enable insertion through the 12-mm left paraumbilical port and intracorporeal mesh maneuvering, the mesh is first rolled and stitched.

The anterior arm of the mesh is modeled over the anterior vaginal wall under the guidance of the vaginal retractor and stitched to the anterior vaginal wall using six stitches (two rows of three stitches) of 2–0 long-term absorbable synthetic monofilament suture of glycolide and trimethylene carbonate (Maxon®, Covidien). A third apical row of three non-absorbable 2–0 polypropylene sutures (Prolene®, Ethicon) is then placed on the right and left sides of the cervix, and the last polypropylene suture is used to fix the Y-shaped graft to the isthmus. In hysterectomized women, the third apical row is performed using three absorbable 2–0 long-term absorbable synthetic monofilament sutures of glycolide and trimethylene carbonate (Maxon®, Covidien) and placed on the vaginal vault apex and the right and left sides of the vault.

Then, the caudal part of the posterior arm of the Y-shaped mesh is secured laterally at the levator ani level and medially at the apex of the central tendon of the perineum with six sutures (two rows of three stitches) of 2–0 long-term absorbable synthetic monofilament suture of glycolide and trimethylene carbonate or 2–0 glyconate suture. The cranial part of the mesh was then fixed with three non-absorbable 2–0 polypropylene stitches to the longitudinal vertebral ligament. The sites of suture placement are schematically described in Fig. 1.

Statistical analysis

Continuous variables were expressed as the mean ± standard deviation, whereas categorical variables were expressed as counts and percentages. Student's *t*-test was used to analyze continuous variables. The chi-square test or Fisher's test was used for categorical variables. Mann-Whitney tests compared pre- and postoperative data. Data obtained for the analysis of the surgeon's learning curve according to the operative time were subjected to an analysis of variance; the Bonferroni multiple comparison test was used to compare different groups of procedures. $P < 0.05$ was taken as significant. Statistical analysis was performed using the SPSS® statistical package, version 17 (SPSS Inc., Chicago, IL, USA).

Results

Patient features

We enrolled 60 patients who successfully underwent R-ASC with the robotic Si system in a three-arm configuration using a pre-designed Y-shaped large-pore polypropylene mesh.

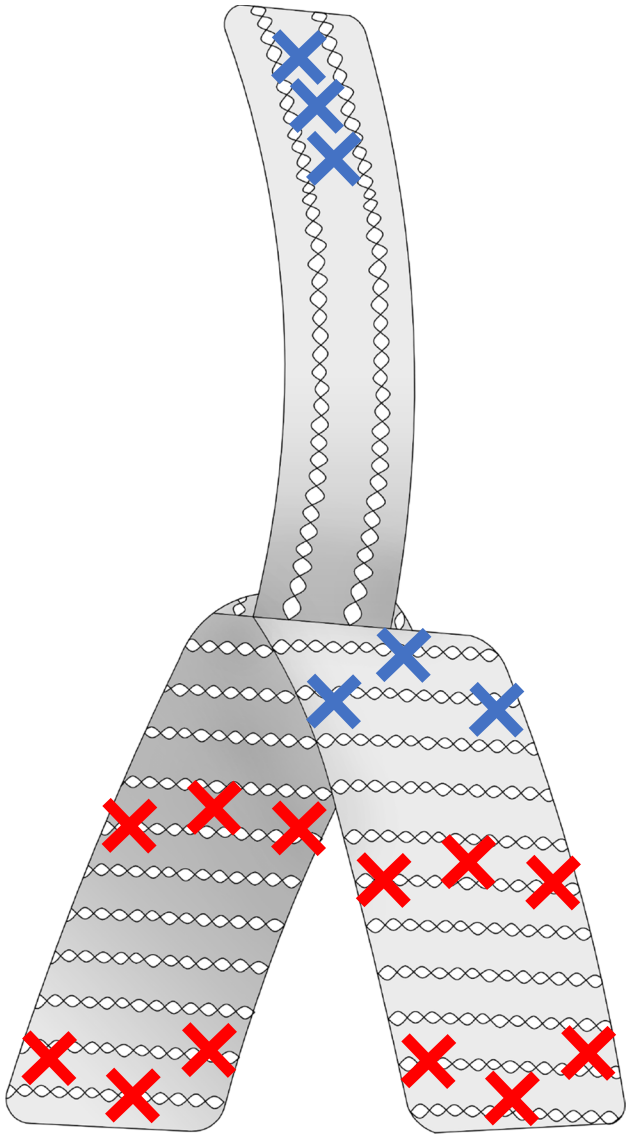

Fig. 1 Graphic representation of the sites of stitch placement on the anterior (vaginal wall, cervix, isthmus), posterior and long arms of the mesh. Red x indicates glycolide and trimethylene carbonate sutures; blue x indicates polypropylene sutures

The mean patient age was 62.2 ± 7 (range 48–77) years old. The mean BMI was 24.8 ± 2 (range 24–29). Two patients were nulliparous (3.33%); 58 patients (96.7%) were in menopause.

In the analyzed sample, 13 patients had previous anterior colporrhaphy POP surgery, 7 (11.6%) posterior colporrhaphy, 1 (1.7%) rectopexy and 4 (6.7%) previous surgery for salpingo-oophorectomy. Twenty-four patients (40%) underwent hysterectomy; thus, they were enrolled for colposacropexy, whereas 36 patients with uteruses were enrolled for supracervical hysterectomy (plus salpingo-oophorectomy) and cervicosacropexy. Six patients (10%) had previous surgery for urinary incontinence; four patients

(6.7%) underwent a Burch procedure, one patient (1.7%) had surgery for the positioning of trans-obturator tape (TOT) mesh and one (1.7%) of transvaginal tape (TVT) mesh. In all cases, patients presented preoperative POP-Q stage ≥ II for the anterior compartment, in 39 cases (65%) for the apical compartment and in 38 cases (63.3%) for the posterior compartment. All women enrolled for surgery complained of significant genitourinary symptoms related to prolapse conditions. All patients had vaginal bulging (100%) as the most significant symptom; 12 (20%) patients had stress urinary incontinence (SUI), 12 (20%) urge incontinence, 5 (8,3%) mixed urinary incontinence (MUI) and 3 (5%) fecal incontinence. A significant post-void residual (PVR) was detected in 17 (28.3%) patients. Preoperative data are reported in Table 1.

Table 1 Demographic data, clinical, baseline anatomic and functional patient characteristics

Age (years), mean ± SD	62.2 ± 7
Nulliparous, *n* (%)	2 (3.33)
BMI (kg/m^2), mean ± SD	24.8 ± 2
Menopause, *n* (%)	58 (96.7)
ASA class, no. (%)	
2	17 (28.3)
3	38 (63.3)
4	5 (8.4)
Previous surgery, *n* (%)	
Anterior colporrhaphy	13 (21.7)
Posterior colporrhaphy	7 (11.6)
Hysterectomy	24 (40)
Salpingo-oophorectomy	4 (6.7)
Rectopexy	1 (1.7)
Previous UI surgery, *n* (%)	
Burch	4 (6.7)
TOT	1 (1.7)
TVT	1 (1.7)
POP-Q at baseline ≥ II	
Anterior	60 (100)
Apical	39 (65)
Posterior	38 (63.3)
Vaginal bulge, *n* (%) at T0	60 (100)
Bladder voiding dysfunction, *n* (%) at T0	17 (28.3)
Stress urinary incontinence, *n* (%) at T0	12 (20)
Urge incontinence, *n* (%) at T0	12 (20)
Fecal Incontinence, *n* (%) at T0	3 (5)

BMI body mass index, *ASA* American Society of Anesthesiologists, *UI* urinary incontinence, *TOT* transobturator tape, *TVT* transvaginal vape

Perioperative, middle-term anatomical and functional outcomes and operating time analysis

Overall operative time (OT) was 188 ± 43 min. Twenty-four (40%) patients underwent robotic sacrocolpopexy and 36 (60%) robotic cervicosacropexy. Blood loss was minimal in all the procedures (mean < 5 ml, range 2–10 ml). From a technical standpoint, resetting robotic arms was necessary in four cases (6.7%). However, no need for robot repositioning, intraoperative complications or extrusion or exposure of the mesh was noted in this series during the perioperative period.

During surgery for the apical suspension to the sacral promontory, 43 (71.7%) patients underwent concomitant salpingo-oophorectomy, 2 (3.3%) hernioplasty, 1 (1.7%) Moschcovitz procedure, 3 (5%) TVT or TOT procedures, and 13 adhesiolysis (21.7%).

The mean postoperative days of hospitalization was 1.2 ± 1.7. There was no readmission within 30 postoperative days. Significant postoperative complications of grade III according to the Clavien-Dindo classification were observed in four (6.6%) cases, thus mirroring the rate of relapse needing surgery for symptomatic post-void residual (PVR) or relevant vaginal bulge. One patient underwent fascial cistopexy, and one patient with concomitant apical relapse underwent laparoscopic lateral suspension. One patient claiming posterior vaginal bulge underwent rectopexy. In only one case did we observe a complete failure of our surgical procedure.

The perioperative outcomes, technical features and postoperative complications according to Clavien-Dindo classification are summarized in Table 2.

The clinical assessment of short- and medium-term follow-up described symptomatic POP-Q ≥ grade II for the anterior compartment in five (8.3%), three (5%) and one (1.7%) patients at 6, 12 and 24 months, respectively. No symptomatic POP-Q ≥ II grade for the central compartment at 6 and 12 months, respectively, was noted, although one (1.7%) patient with apical relapse at 24 months' follow-up needed re-intervention. Symptomatic POP-Q ≥ grade II for the posterior compartment was noted in five (8.3%), one (1.7%) and one (1.7%) patients at 6, 12 and 24 months, respectively (Table 3). The analysis of the voiding function and the urinary incontinence demonstrated a statistically significant reduction ($p = 0.0001$) of post-void residual, urge ($p = 0.0001$) and mixed ($p = 0.0001$) urinary incontinence during the postoperative assessment.

After 2 years' follow-up, the most bothersome symptom was the vaginal bulge that occurred in 13 (11%) patients. Moreover, the 2-year postoperative Patients Global Impression (PGI-I) score assessment suggested a good satisfaction rate in the treated patients, even if the rate of patients who answered the questionnaire was 55% of the sample. Even though the PGI-I is on a scale from 1, being very much

Table 2 Peri- and postoperative data, complications according to Clavien-Dindo classification and medium-term need of re-intervention

Total robotic sacrocolpo-/cervicopexy , *n* (%)	60 (100)
Robotic sacrocolpopexy, *n* (%)	24 (40)
Robotic cervicosacropexy, *n* (%)	36 (60)
Blood loss (ml), mean (range)	< 5 (2–10)
3 robotic arms, *n* (%)	60 (100)
Operating time (min), mean ± SD	188 ± 43
Robotic arm re-docking, *n* (%)	4 (6.7)
Robot repositioning needed, *n* (%)	0 (0)
Intraoperative complications, *n* (%)	0 (0)
Y-shaped large-pore polypropylene graft, *n* (%)	60 (100)
Extrusion or exposure of the mesh, *n* (%)	0 (0)
Length of hospital stay (days), mean ± SD	1.2 ± 1.7
Readmission within 30 postoperative days, *n* (%)	0 (0)
Associated surgery, *n* (%)	
Subtotal hysterectomy	36 (60)
Salpingo-oophorectomy	43 (71.7)
Hernioplastic	2 (3.3)
Moschcovitz procedure	1 (1.7)
TVT or TOT	3 (5)
Adhesiolysis	13 (21.7)
Clavien-Dindo class of complications	
I	55 (91.7)
II	1 (1.7)
III	4 (6.6)
IV	0 (0)
Surgery for relapse, *n* (%)	
Cystopexy	1 (1.7)
Rectopexy	1 (1.7)
Laparoscopic lateral suspension	1 (1.7)
Surgery for complete failure or relapse	1 (1.7)
Surgery for complications related to R-ASC	0 (0)

TOT transobturator tape, *TVT* transvaginal tape, *R-ASC* robotic-assisted abdominal sacrocolpo-/cervicopexy

better, to 7, being very much worse, our study population completed the survey with scores from 1 to 5 (Table 4). The lack of a significant number of questionnaires could limit the patients' evaluation of our procedure. The median operative time dramatically decreased by > 16% over the 2 years. Specifically, operative time decreased from 219 ± 46 min to 192 ± 35 min ($p = 0.045$) after 20 procedures and continued to decrease significantly to 182 ± 41 min ($p = 0.040$) after 20 additional cases (Fig. 2).

Discussion

Laparoscopic abdominal sacrocolpo/cervicopexy (L-ASC) is a technically challenging procedure: identification, dissection and isolation of the pre-sacral area as well as the exposure of the anterior ligament are considered the most technically complex tasks of this procedure, followed by dissection of the posterior vaginal wall and suturing the mesh to the posterior wall [10]. The fixation of the mesh needs positioning of sutures in narrow places in the pelvis that are frequently difficult to access, which may cause technical hitches that can impact long-term outcomes. In 2003, Wattiez et al. emphasized how the placement of the sutures on the promontory area could be technically complex using traditional laparoscopic tools, describing that the mesh could be frequently fixed to the longitudinal ligament with staples or a tacker [11]. However, the use of sacral or vaginal staples, reported to decrease the need for intracorporeal sutures, could be correlated with frailer apical anchorage and more cases of postoperative infection, erosion and dyspareunia [12, 13]. Robotic-assisted surgery provides pelvic surgeons with an ergonomic setting, three-dimensional vision and 360°instrument manipulation to resolve this technical drawback and achieve the ideal perfect stitch [14, 15], and it simplifies the most complex laparoscopic steps such as dissecting or suturing. These technical abilities are

Table 3 Short- and medium-term anatomical outcomes, voiding function, and pre- and postoperative urinary incontinence assessment

R-ASC patients, *n* (%) 60 (100)	Before surgery n, (%)	After surgery *n*, (%)			*p*
	T0	6 months	12 months	24 months	
Anatomical outcomes					
POP-Q anterior ≥ grade II	39 (65)	5 (12.8)	3 (7.7)	1 (2.5)	0.0001
POP-Q central ≥ grade II	60 (100)	0 (0)	0 (0)	1 (1.7)	0.0001
POP-Q posterior ≥ grade II	38 (63.3)	5 (13.1)	1 (2.6)	1 (2.6)	0.0001
Functional outcomes					
PVR	17 (28.3)	2 (3.3)	–	–	0.0001
SUI	3 (5)	1 (1.7)	–	–	n.s.
UUI	12 (20)	0 (0)	–	–	0.0001
MUI	5 (8.3)	0 (0)	–	–	0.0001

R-ASC robotic-assisted abdominal sacrocolpo-/cervicopexy, *PVR* post-voidal residual, *SUI* stress urinary incontinence, *UUI* urge urinary incontinence, *MUI* mixed urinary incontinence

Table 4 Two years' postoperative Patients Global Impression (PGI-I) score and assessment of vaginal bulge as the most bothersome symptom

Postoperative vaginal bulge, *n* (%)	13 (11.3)
Postoperative PGI-I score, *n*, (%) Tot *n* = 33/60	
1: Very much better, *n* (%)	11 (33)
2: Much better *n* (%)	17 (51)
3: A little better *n* (%)	4 (12)
4: No changes *n* (%)	0 (0)
5: A little worse *n* (%)	1 (3)
6: Much worse *n* (%)	0 (0)
7: Very much worse, *n* (%)	0 (0)
No data *n* (%)	27 (45)

PGI-I Patient Global Impression of Improvement

particularly suitable for ASC since they may simplify and improve specific surgical tasks such as identifying anatomical landmarks, dissecting and suturing [3, 4, 6]. We chose to perform R-ASC, because we believe that robotic support improves the flow of surgery compared with standard laparoscopy, leading to more precise and safer dissection and better stitching and mesh fashioning. Our report describes a standardized suture pattern during R-ASC in detail, and we aim to offer a guide for this highly reproducible procedure. None of the previous series offer specific and conclusive information about the correct placement and number of sutures performed. An interesting survey of the American Urogynecologic Society (AUGS) annual meeting and the International Urogynecology Association (IUGA) assessed that there is still significant heterogeneity in most surgical tasks such as number and type of suture in the vaginal wall or type of mesh fixation to the sacrum. This survey results from a cohort of specialty-trained urogynecologists and gynecologists and demonstrates specific differences concerning the level of vaginal suture placement, both anteriorly and posteriorly, between the AUGS and IUGA respondents when performing abdominal sacrocolpopexy. They conclude that the variety in the placement of sutures anteriorly and posteriorly could impact success rates, complication rates and technical difficulty [10]. Literature suggests that prosthesis positioning, the skill in identifying, isolating and placing stitches, number of sutured stitches, suturing modality and number of knots thrown per suture impact mesh placement. Modifications in all of these technical aspects can influence the intraoperative condition, thus requiring more prolonged anesthesia and Trendelenburg position, theoretically leading to augmented overall costs or postoperative adverse events [10].

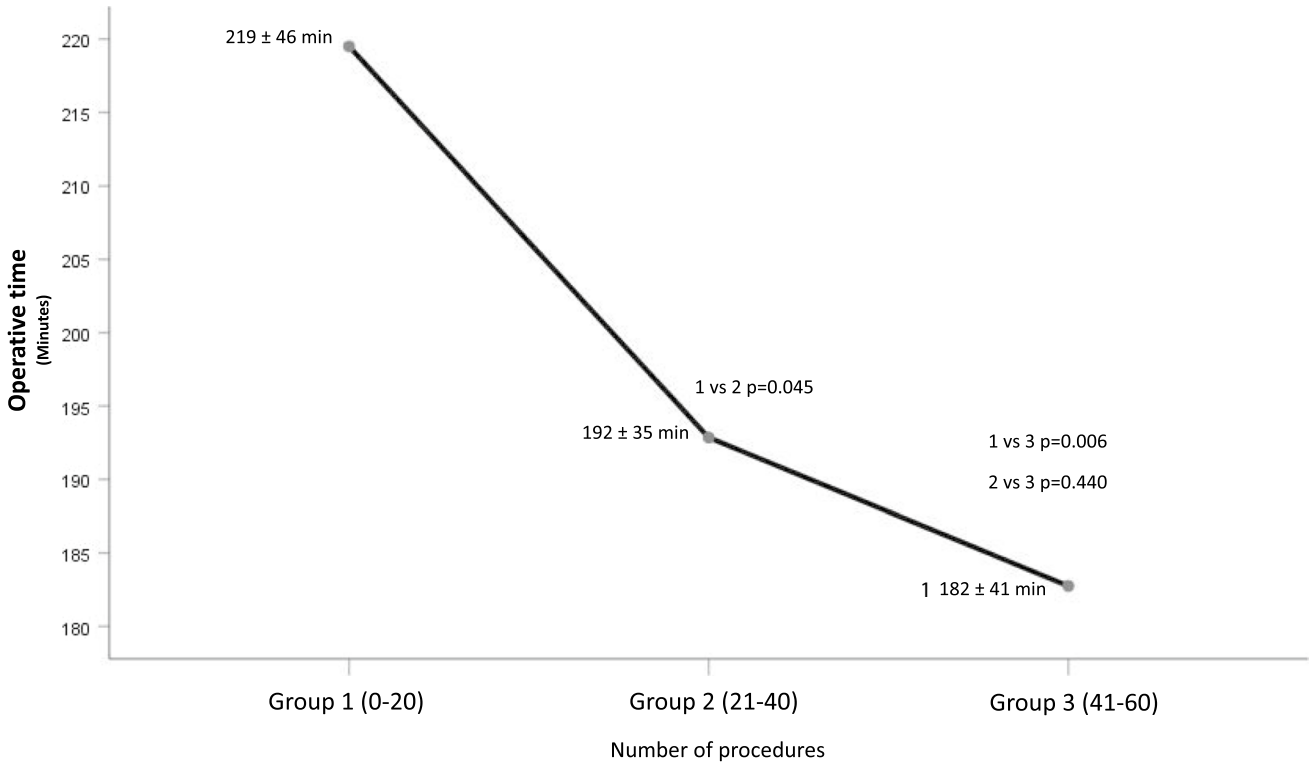

Fig. 2 Analysis of the operating times of the first 60 procedures of a single surgeon in a tertiary referral center for the minimally invasive treatment of pelvic floor diseases using a standardized suturing technique for mesh anchorage

Our initial experience of R-ASC using a standardized suturing pattern confirms that this technical choice is feasible, very reproducible and safe with no perioperative complications or adverse events. In addition, the analysis of the technical features of the first 60 cases of R-ASC performed in our single tertiary referral center for prolapse surgery highlighted that all procedures were entirely completed by full robotic technique with no need for robot repositioning, and only four cases of robotic arm resetting occurred during the initial 20 procedures.

A central aspect of the surgery's efficacy is represented by a solid and homogeneous anchorage of the mesh to the anterior and posterior vaginal wall up to the levator ani plane and the cranial point of mesh anchorage in the sacrum. Robotic stitching allows a simpler, more ergonomic procedure with replicable intracorporeal stitch positioning compared with the traditional laparoscopic approach. Whether this leads to more effective or stable reconstruction is not demonstrated and is still a matter of debate [16–18].

However, R-ASC does not avoid the risks of pre-sacral area dissection and suturing, which may even be worsened by the lack of haptic feedback found in the currently existing robotic platforms [1, 3, 4]. Concerning the operating time for this standardized R-ASC procedure with our particular suturing technique, the median operative time significantly decreased by about 27 min after 20 procedures and continued to significantly decrease for a total of 37 min after 20 additional cases. R-ASC generally has a shorter learning curve according to the data from the current literature, which describes an even more dramatic reduction of operative time during training. It is plausible that the availability of newer robotic platforms and technologies results in more intuitive surgical flow: it might allow gynecologists with limited laparoscopic skills to accomplish a complex surgery using a minimally invasive method. Akl and his research group remarked that the learning curve for R-ASC seems to be relatively short, demonstrating that after the first series of ten cases, the overall operative time reduced by > 25% [19]. Nevertheless, currently robotic-assisted surgery specifically requires expensive equipment.

Our study has some limitations. First, it is a single-center retrospective case series and a descriptive review of the medical records of 60 patients. Furthermore, the number of cases is small, and there is no analysis of surgeon proficiency and skills. We know that the single-surgeon experience should never be an indicator of outcomes [20]. We demonstrated that the operative time for robotic sacrocolpopexy reached the plateau after the first 60 cases of experience, whereas complication rates continued to decrease beyond this. Surgical proficiency, as determined by a risk-adjusted cumulative summation model (CUSUM) analysis for complication rates for a single surgeon, was achieved after performing approximately 84 surgeries [6, 19]. In our series and for our aim, describing the learning curve for robotic sacrocolpopexy by evaluating surgical outcome measures with a risk-adjusted CUSUM is not required. Evaluation of post- and intraoperative complications allowed us to describe the surgical outcomes, safety and efficacy of our procedure using a consistent suturing technique. Lastly, subjective outcomes were investigated with a specific questionnaire, the PGI-I, but we missed about 45% of the information from these questionnaires.

Additional comparative studies with a longer follow-up are ongoing to investigate the validity and the potential role of this suturing technique within many existing surgical approaches to treat high-grade apical defects. In conclusion, robotic support may be hypothetically suitable to attain the best outcomes in this specific surgery. It may encompass the benefits of a minimally invasive approach and the higher effectiveness due to enhanced dissection and suturing skill, making the procedure more efficient and reproducible. However, the wide variance in suturing techniques during abdominal sacrocolpo-/cervicopexy highlighted the need for scientific studies about this excellent procedure. Therefore, further studies are mandatory to define a standard suturing technique.

Author contributions A Giannini: Data Collection, Manuscript writing.
E Russo: Project development, Data Collection, Revision of the manuscript.
G Misasi: Project development, Data collection.
M Falcone: Project development, Data collection.
M Caretto: Data collection, Manuscript writing.
R Morganti: Data elaboration, Statistical analysis.
P Mannella: Project development, Surgeon.
T Simoncini: Project development, Surgeon, Supervisor, Revision of the manuscript.

Declarations

Conflict of interest None.

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