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Review article

Laparoscopic sacrocolpopexy: A comprehensive literature review on current practice

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ABSTRACT

Sacrocolpopexy is considered the preferred treatment for vaginal vault. However, numerous technical variants are being practiced.

We aimed to summarize the recent literature in relation to technical aspects of laparoscopic sacrocolpopexy (LSC). We focused on surgical technique, mesh type, concomitant surgeries, and training aspects.

We performed 2 independent literature searches in Medline, Scopus, the Cochrane library, and Embase electronic databases including the keywords: 'sacrocolpopexy', 'sacral colpopexy' and 'promontofixation'. Full text English-language studies of human patients, who underwent LSC, published from January 1, 2008 to February 26, 2019, were included. Levels of evidence using the modified Oxford grading system were assessed in order to establish a report of the available literature of highest level of evidence.

Initially, 953 articles were identified. After excluding duplicates and abstracts screening, 35 articles were included.

Vaginal fixation of the mesh can be performed with barbed or non-barbed (level 1), absorbable or non-absorbable sutures (level 2).

Fixation of the mesh to the promontory can be performed with non-absorbable sutures or non-absorbable tackers (level 2).

The current literature supports using type 1 mesh (level 2).

Ventral mesh rectopexy can safely be performed with LSC while concurrent posterior repair has no additional benefit (level 2).

There is no consensus regarding the preferred type of hysterectomy or the benefit of an additional anti urinary incontinence procedure.

A structured learning program, as well as the number of procedures needed in order to be qualified for performing LSC is yet to be established.

There are numerous variants for performing LSC. For many of its technical aspects there is little consensus.

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Contents

Introduction

In 1957 Arthur and Savage first reported using the sacrum as the point to support the vaginal apex by suturing the uterus to the sacrum and thus recreating the natural vaginal axis [1]. One year later, Huguier and Scali [2] described the utilization of a graft to suspend the vault following hysterectomy. In the following 60 years, surgery for pelvic organ prolapse (POP) changed tremendously. As a principle consideration for functional surgery, indications and management strategies have to be tailored to the individual patient and circumstances; For numerous surgeons, sacrocolpopexy is the treatment of choice for post hysterectomy vaginal vault prolapse [3]. Success rates between 74–98 % have been reported, with lower rates of recurrent prolapse (2.3–4 % vs. 4.3–18 %) and dyspareunia (4–9 % vs. 10–50 %) when compared with native tissue repair or vaginal mesh procedures [3,4]. In 1994, Nezhat et al. [5] reported the first case series of 15 patients undergoing laparoscopic sacrocolpopexy (LSC), demonstrating an objective cure rate of 100 %. LSC aims to provide similar outcomes as abdominal sacrocolpopexy, whilst offering the benefits of faster recovery and reduced post-operative pain typically associated with minimally invasive techniques. In addition, the laparoscopic approach provides easier access and better visualization of the posterior aspect of the vagina and deeper pelvis compared to the open approach, which subsequently aids placement and suturing of the mesh to the posterior vaginal wall [5]. A literature review by Ganatra et al. [6], summarizing 11 retrospective studies including 1197 patients with a mean follow-up of 24.6 months, reported overall objective anatomical and subjective success rates of 92 % and 94.4 % respectively for LSC. Although the basic principle of sacrocolpopexy is the suspension of the vaginal vault on to the anterior longitudinal ligament at the level of the sacrum using a prosthetic material, many technical variants have been developed [7].

The purpose of this report is to review the recent literature comprehensively regarding the surgical aspects of LSC, and report the existing literature of the highest level of evidence.

Materials and methods

The following review was developed by a group of urogynecological surgeons. After thematic saturation from discussions within the group, the following issues regarding LSC were defined as the most important to be addressed in a comprehensive review: surgical technique, mesh type, concomitant surgery, and training aspects. For each issue, we reported the available literature of the highest level of evidence.

Since the last comprehensive literature review on sacrocolpopexy, by Ganatra et al. [6] provides data from studies published up to January 1, 2008, it was an unanimous decision by the working group members to conduct the current review based on articles published from that point of time to date. Two of the co-authors (OG and MB), assigned by the group members, independently performed structured literature searches in Medline, Scopus, the Cochrane library, and Embase electronic databases using the keywords: ‘sacrocolpopexy’, ‘sacral colpopexy’, and ‘promontofixation’. The date of the last search was February 26, 2019. Full text English language articles, published since January 1, 2008 were included. Additional inclusion criteria were studies of human-female patients, who underwent LSC (at least part of the study’s population). We did not apply comparison or outcome restriction, nor a minimal number of patients or a certain age, as exclusion criteria. The searches included systematic reviews with or without meta-analyses, comprehensive reviews, randomized trials, controlled, observational, or descriptive studies and case reports. Editorial letters, comments, and other clinical opinion articles were excluded.

In addition, systematic and literature reviews which were identified in the original search were screened to ensure that all

Table 1
Level of evidence grading methodology, according to the modified Oxford system.

Level of evidence	Included studies
Level 1	Systematic reviews of RCTs, or good quality RCTs
Level 2	Systematic reviews of cohort studies, cohort studies, or low quality RCTs (<80 %follow up)
Level 3	Systematic reviews of case-control studies, case-control studies, or case series without a comparison control group
Level 4	Expert opinion or clinical experience

relevant citations (which met the inclusion criteria) were included in the current review.

After electronic database search was performed individually, the two co-authors jointly excluded duplicates and screened titles and abstracts. The purpose of this screening was to identify articles that met the inclusion criteria and provided evidence for the predefined issues to be addressed by the working group. After the exclusion of papers that did not meet the inclusion criteria and/or did not provide relevant data, the content of the remaining articles was fully assessed. In the full-text assessment, additional papers were excluded. The remaining studies were independently evaluated for their level of evidence (LE: 1, 2, 3, 4) by the two screening co-authors using the modified Oxford grading system, as recommended by The International Consultation on Urological Diseases (ICUD) (Table 1) [8]. Since the current report based on the available evidence of the highest level, papers of low LE were then excluded when papers of higher LE were available for the same topic. For each topic, all the papers with the highest available LE were mentioned, except for studies that were included in systematic reviews of the same level (in that case the systematic reviews were presented rather than the individual papers). The results of both literature reviews and LE grading were compared, and discrepancies (which existed for 3 manuscripts) were settled after obtaining an agreement between both screening co-authors under the arbitration of a third co-author (NV) with experience in systematic reviews. The result of the literature search including the LE assessment was then reviewed and amended by all co-authors.

Results

Following the electronic database search 953 articles were identified. After excluding 131 duplicates, titles and abstracts screening was performed, in which we excluded additional 728 papers for not meeting the inclusion criteria or not providing evidence for the addressed topics. A total of 94 articles remained for a full text assessment. Screening of references lists of identified reviews resulted in 11 additional eligible full-text articles. The content of a total of 105 articles was fully assessed. In the full text assessment, 34 papers were excluded for not providing relevant data and/or not meeting the inclusion criteria. Additional 36 studies were excluded for being of lower level of evidence. Finally, 35 articles were included in our report. Fig. 1 illustrates the structured literature search and the list of included articles according to their LE is summarized in Table 2. Table 3 summarizes the LE available surgical approach, surgical technique, type of mesh, concomitant surgery, and training aspects.

Surgical technique

Dissection of the recto- and/or vesico-vaginal space

There are no high-quality data in the literature, nor is there consensus regarding the extent of dissection down the recto-vaginal space [7]. The majority of papers describe the placement and securing of the posterior mesh uniquely by laparoscopic route, with no vaginal incisions, as the mesh is better tolerated with the absence of vaginal opening [9]. The extent of dissection into the vesicovaginal space also varies between different authors [7]. One study in 121 women with 33 months follow up showed that anchoring the meshes only to the vaginal apex even in the presence of multi-compartmental vaginal prolapse was efficient, time saving and sufficient to correct other vaginal compartments (LE: 3) [10]. Another study of 144 patients described a technique of limited mesh attachment to the vagina without dissection into the vaginal planes (LE: 3) [11]; There were no cystotomies and no vaginal mesh exposures, while anatomical success rate were 97 % in a 32 months follow up (LE: 3) [11]. Another series of 63 patients found that 1 month after surgery, symptoms such as de novo stress urinary incontinence, dysuria, pain and constipation, increase with

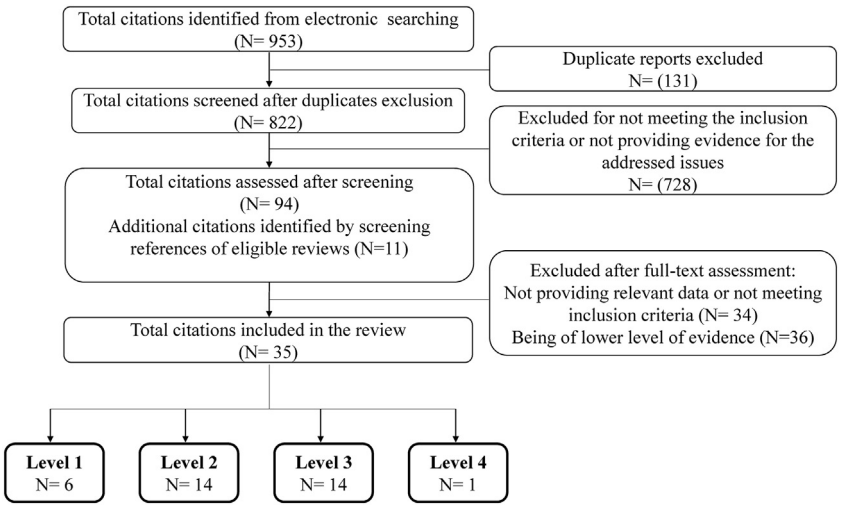

Fig. 1. Literature search flowchart.

Table 2
Included articles according to their level of evidence.

Level of evidence 1: systematic reviews and meta-analyses of RCTs

Year	Title	Author
2018	Prolapse surgery with or without incontinence procedure: a systematic review and meta-analysis.	Van der Ploeg et al. [39]
2018	Surgery for women with pelvic organ prolapse with or without stress urinary incontinence	Baessler et al. [42]

Level of evidence 1: Randomized controlled trials

Year	Randomization	Follow up (months)	No of patients	Author
2015	Non-barbed and barbered sutures for vaginal mesh attachment	12	64	Tan-Kim et al. [18]
2018	Interrupted and continuous locked sutures	12	90	Morciano et al. [19]
2013	Porcine dermis and polypropylene mesh	12	115	Culligan et al. [28]
2017	Training by 2 dimensions and 3 dimensions optic systems		277	Spille et al. [44]

Level of evidence 2: Non-randomised cohort studies

Year	Title	Follow up (months)	No. of patients	Author
2014	A pilot study comparing anatomic failure after sacrocolpopexy with absorbable or permanent sutures for vaginal mesh attachment	24	193	Tan-Kim et al. [15]
2017	Titanium Surgical Tacks: Are They Safe? Do They Work?	12	231	Shatkin-Margolis et al. [23]
2018	Sacrocolpopexy with polyvinylidene fluoride mesh for pelvic organ prolapse: Mid term comparative outcomes with polypropylene mesh	94	136	Balsamo et al. [26]
2009	Medium Term Outcome of Laparoscopic Sacrocolpopexy With Xenografts Compared to Synthetic Grafts	33	129	Deprest et al. [27]
2011	Randomized trial of fascia lata and polypropylene mesh for abdominal sacrocolpopexy: 5-year follow-up	60	58	Tate et al. [29]
2015	Mesh sacrocolpopexy compared with native tissue vaginal repair: a systematic review and meta-analysis			Siddiqui et al. [30]
2019	Does Mesh Weight Affect Time to Failure After Robotic-Assisted Laparoscopic Sacrocolpopexy?	22	461	Askew et al. [33]
2011	Prevalence and risk factors for mesh erosion after laparoscopic-assisted sacrocolpopexy	5	188	Tan-Kim et al [34]
2015	Differences in recurrent prolapse at 1 year after total vs supracervical hysterectomy and robotic sacrocolpopexy	24	83	Myers et al. [35]
2018	Safety of laparoscopic sacrocolpopexy with concurrent rectopexy: peri-operative morbidity in a nationwide cohort	1	8915	Weinberg et al. [36]
2018	Combined rectopexy and sacrocolpopexy is safe for correction of pelvic organ prolapse	N/A	3600	Geltzeiler et al. [37]
2012	Anatomic and functional outcomes of sacrocolpopexy with or without posterior colporrhaphy	12	258	Kaser et al. [38]
2014	Two-year urinary outcomes of sacrocolpopexy with or without transobturator tape: results of a prolapse-reduction stress test-based approach	24	223	Jeon et al. [40]
2018	Laparoscopic sacrocolpopexy with or without midurethral sling insertion: Is a two- step approach justified? A prospective study	2	62	Christmann-Schmid et al. [41]

Level of evidence 3: Case control studies and Case series

Year	Title	Follow up (months)	No of patients	Author
2018	Simplified laparoscopic sacropexy avoiding deep vaginal dissection	33	121	Cosma et al. [10]
2016	A Streamlined Surgical Approach to Laparoscopic Sacrocolpopexy for Post-Hysterectomy Vault Prolapse	32	144	Zebede et al. [42]
2019	Laparoscopic promontofixation: Where to stop the anterior dissection?	1	63	Habib et al. [12]
2017	Laparoscopic sacrocolpopexy: how low does the mesh go?	36	97	Wong et al. [13]
2017	Assessment of Synthetic Glue for Mesh Attachment in Laparoscopic Sacrocolpopexy: A Prospective Multicenter Pilot Study	12	70	Lamblin et al. [16]
2017	Glue mesh fixation: Feasibility, tolerance and complication assessment. Results 24 months after laparoscopic sacrocolpopexy	24	42	Panel et al. [17]
2017	How to reduce the operative time of laparoscopic sacrocolpopexy?	4	34	Hoshino et al. [20]
2015	Satisfaction, quality of life and lumbar pain following laparoscopic sacrocolpopexy: Suture vs. tackers.	12	100	Vieillefosse et al. [24]
2017	Polypropylene Mesh Predicts Mesh/Suture Exposure After Sacrocolpopexy Independent of Known Risk Factors: A Retrospective Case-Control Study	N/A	394	Durst et al. [31]
2011	Mid-term outcome of laparoscopic sacrocolpopexy with anterior and posterior polyester mesh for treatment of genito-urinary prolapse	34	116	Sergent et al. [32]
2012	mplementation of laparoscopic sacrocolpopexy: establishment of a learning curve and short-term outcomes	1	47	Mustafa et al. [46]
2010	Laparoscopic sacrocolpopexy for female genital organ prolapse: establishment of a learningcurve	1	48	Akladios et al. [47]
2013	Introduction of laparoscopic sacral colpopexy to a fellowship training program	1	180	Kantartzis et al. [48]
2008	Medium-Term Anatomic and Functional Results of Laparoscopic Sacrocolpopexy Beyond the Learning Curve	13	132	Claerhout et al. [49]

Level of evidence 4: Expert opinion and/or Clinical experience

Year	Title	Author
2017	Can the Learning Curve of Laparoscopic Sacrocolpopexy Be Reduced by a Structured Training Program?	Mowat et al. [45]

Table 3
Issues addressed with the level of available evidence.

Issues	Level of evidence
Surgical technique	
Dissection of the recto- and/or vesico-vaginal space	3
Site of vaginal fixation of the mesh	N/A
Mode of fixation of the mesh to the vagina	
Delayed-absorbable vs. Non-absorbable sutures	2
Synthetic glue	3
Barbed vs. Non-barbed sutures	1
Continuous locked vs. Interrupted sutures	1
Absorbable tackers	3
Site of fixation of the mesh to the promontory	N/A
Mode of fixation of the mesh to the promontory	2
Peritonealiization	N/A
Type of mesh	
Synthetic mesh	2
Biological protheses	1
Light-weight mesh	3
Concomitant Surgery at the time of laparoscopic sacrocolpopexy	
Concomitant hysterectomy and type of hysterectomy	2
Concomitant ventral mesh rectopexy for rectal prolapse	2
Concomitant posterior repair (colporrhaphy/ perineorrhaphy)	2
Concomitant surgery for stress urinary incontinence	1
Training-relevant aspects	
The role of a pelvic trainer	1
The critical number of surgeries needed in order to be proficient	3

a deeper dissection (LE: 3) [12]. On the other hand, in a study of 97 patients with an average follow up of 3 years it was evident that the more distal the mesh was placed in the anterior compartment, that is the closer the mesh was placed to the bladder neck, the less likely it was for prolapse to recur in the anterior compartment (LE: 3) [13].

Vaginal fixation of the mesh

Site of vaginal fixation of the mesh. The majority of papers describes fixation of mesh to the posterior aspect of the vagina. Although fixation of the mesh to the levator ani muscle has been described [6,14], recent papers tend to prefer fixation of the mesh to the posterior vaginal surface alone [7]. There are no data on the outcomes of rectal pain or defecatory symptoms. Similarly, there is no consensus as to the level of fixation for the anterior arm of the mesh.

Mode of fixation of the mesh to the vagina. One retrospective study, with a follow-up of 10–25 months, compared delayed-absorbable and non-absorbable sutures, and found no differences in failure rate (LE: 2) [15]. The main concerns around using non-absorbable sutures on the vagina is the possible higher risk of mesh/ suture exposure and sexual dysfunction [15]. In two case series, synthetic glue attachment of the mesh was shown to be safe, time efficient, and effective up to 2 years after surgery (LE: 3) [16,17]. One RCT found the use of barbed sutures to be approximately 16 min faster than with non-barbed sutures, while anatomic outcomes at 12 months were comparable (LE: 1) [18]. Another study showed that continuous locked suture guaranteed a faster and effective alternative to multiple interrupted sutures (LE: 1) [19]. The use of absorbable tackers has also been described, but has not been compared to other modes of fixation (LE: 3) [20].

Fixation of the mesh to the promontory

Site of fixation of the mesh to the promontory

No comparative data were found regarding the precise place of fixation [21]. Yet, most authors recognize the concern of discitis which, although rare, represents a significant problem when it occurs [22].

Mode of fixation of the mesh to the promontory

There is no consensus regarding the preferred method of attachment to the promontory: the use of non-absorbable sutures, staples, and tackers has been described [7,21]. One retrospective cohort study reported that no significant differences were found between permanent tackers and non-absorbable sutures, in regard to operative time, estimated blood loss, complication rates, and rates of recurrence or reoperations (LE: 2) [23]. One case control study comparing tackers and sutures found that the use of tackers does not increase the incidence of post-operative dorso-lumbar pain, but may increase its intensity (LE: 3) [24]. Sutures have the disadvantage of requiring a user-dependent skillset to ensure adequate and safe placement and fixation, so the use of tackers may be an attractive surgical approach for surgeons who feel less comfortable with their suturing ability [23].

Peritonealization

In light of the potential complication which may occur in patients in whom peritonealization is not performed this issue was not studied in LSC. Yet, most of the authors recommend peritonealization of the mesh [6,7,21]. Attention should be paid to avoid catching or kinking of the right ureter during peritonealization, as well as to observe peristalsis of ureter after peritonealization [6]. The role of cystoscopy during sacrocolpopexy has not been assessed recently [7].

Type of mesh

Synthetic mesh

Almost all recent publications on sacrocolpopexy, although uncontrolled for mesh type, describe the use of a polypropylene mesh [7,21]. Expanded polytetrafluoroethylene (PTFE) has been shown to be associated with an almost 4-fold risk for mesh exposure [25]. Polyvinylidene fluoride (PVDF) and polypropylene meshes have also been compared in one retrospective study, which found that both meshes can be safely and effectively used (LE: 2) [26].

Biological protheses

A prospective cohort study comparing polypropylene mesh with porcine grafts, found xenografts to be associated with more

apical failures and reoperations than with a polypropylene mesh, with no difference in functional outcome (LE: 2) [27]. A 1 year follow up RCT showed no difference in outcomes comparing synthetic mesh with acellular porcine dermis (LE: 1) [28]. Polypropylene mesh was superior to cadaveric fascia Lata after 5 years in a low-quality RCT (LE: 2) [29]. A systematic review with non-RCT studies predominance has concluded that when anatomic durability is a priority, the use of synthetic mesh may be the preferred surgical option, and when minimizing adverse events or reoperation is the priority, there is no strong evidence supporting one approach over the other (LE: 2) [30].

Light-weight mesh

In one case control study women with mesh exposure were less likely to have had lightweight mesh (LE: 3) [31]; In one uncontrolled observational study heavy weight polyester mesh was reported as an effective treatment, in terms of anatomical and functional outcomes, while the rates of mesh exposure or infection were no higher than those described in light-mesh series (LE: 3) [32]. However, a recent retrospective study reported that women receiving light-weight mesh are more likely to experience earlier anatomic failure in the anterior compartment, compared to heavier weight mesh (LE: 2) [33].

Concomitant Surgery at the time of laparoscopic sacrocolpopexy

Concomitant hysterectomy and type of hysterectomy

The role of uterine preservation versus hysterectomy and colpopexy is contentious, as the main concern of concomitant hysterectomy is a greater risk of mesh exposure [21]. It has been hypothesized that vaginal hysterectomy may have less risk of subsequent mesh exposure, possibly due to less thermal energy damage, less tissue necrosis and better revascularization of the vault repair compared with total laparoscopic hysterectomy [34]. One retrospective cohort study reported a six fold increase risk of mesh exposure when total hysterectomy was performed at the time of sacrocolpopexy, compared to subjects who had sacrocolpopexy with or without sub-total hysterectomy (LE: 2) [34]. Conversely, another retrospective study reported that women who underwent sub-total hysterectomy at the time of sacrocolpopexy were 2.8 times more likely to have recurrent prolapse, defined as greater than or equal to stage II, at 1 year, compared with those who underwent total hysterectomy (LE: 2) [35]; There were no significant difference in rate of mesh exposure (LE: 2) [35].

Concomitant ventral mesh rectopexy for rectal prolapse

Two retrospective studies found that concurrent LSC and ventral mesh rectopexy may be appropriate in well-selected patients, and it is not associated with higher risk for adverse events when compared to either procedure alone (LE: 2) [36,37].

Concomitant posterior repair (colporrhaphy/ perineorrhaphy)

Historically, a concomitant posterior colporrhaphy may have been performed to reduce posterior compartment prolapse, especially in the early studies where abdominal sacrocolpopexy was often combined with Burch colposuspension. As the laparoscopic approach makes posterior dissection and deep mesh fixation easier, sacrocolpopexy became, in most cases, a technique utilizing both anterior and posterior prostheses [6]. One retrospective cohort study of 258 patients, comparing women who underwent sacrocolpopexy alone to those who underwent sacrocolpopexy with concurrent vaginal posterior colporrhaphy after 1 year follow up, concluded that sacrocolpopexy with concurrent posterior repair had no additional benefit (LE: 2) [38].

Concomitant surgery for stress urinary incontinence

One systematic review found that combining Burch with sacrocolpopexy, whether stress urinary incontinence is pre-existing or not, does not appear to reduce the rate of post-operative stress urinary incontinence (LE: 1) [39]. One later prospective observational study did show that performing a trans obturator tape sling concurrently with sacrocolpopexy, in cases of pre-existing proven stress incontinence, reduced the risk of postoperative stress urinary incontinence, with no additional intraoperative complications (LE: 2) [40].

In a prospective study, comparing sacrocolpopexy with and without concurrent tension free vaginal tape for women with pre-existing stress urinary incontinence, it was shown that most symptomatic women (89 %) would not need an additional anti-incontinence operation after having only sacrocolpopexy (LE: 2) [41].

These data, in addition to the 2018-cochrane review, suggests insufficient evidence on whether sacrocolpopexy with an additional procedure for stress urinary incontinence improves urinary leakage after surgery (LE: 1) [42].

Training-relevant aspects

The role of a pelvic trainer

One drawback of LSC is the longer operating time and the long learning curve needed to perform the procedure laparoscopically [43]. One RCT reported that the use of 3D pelvic trainer may offer advantages over 2D pelvic trainer (in terms of speed and fewer mistakes) (LE: 1) [44]. A structured learning program for LSC, developed for “suturing and dissection naïve" fellows, which included training in laparoscopic suturing and knot tying for 2 h per week, resulted in an acceptable operating time (90 min), without compromising outcomes and complications rates after a 9-months period of training (LE: 4) [45].

The critical number of surgeries needed in order to be proficient

Various training programs describe the need for assisting in 20 LSCs and be mentored in at least 30 surgeries [28] to achieve an operation time comparable to that of the mentor, with no difference in rate of complications. The number of procedures needed for full independent proficiency in LSC is debatable. Some studies have shown that operation times are reduced after an individual has performed 10–30 cases (LE: 3) [46–48]. Some surgical teams have reported a need for 60 cases to acquire appropriate independent competency (LE: 3) [49].

Comment

With our structured literature review of the most recent studies, we confirmed that numerous technical variants for LSC exist and that there is still little consensus on various issues regarding the technique.

Based on our findings, we report that the following evidence are exist:

Vesico-vaginal space dissection: there are conflicting low-quality evidence regarding the extent of dissection.

Vaginal fixation of the mesh can be performed with absorbable or non-absorbable, barbed or non-barbed sutures, including or not the levator ani muscle posteriorly.

Fixation of the mesh to the promontory can be performed with non-absorbable sutures or non-absorbable tackers

Type of mesh: the current literature supports using type 1 mesh.

Concomitant surgeries: the preferred type of hysterectomy is yet to be determined, ventral mesh rectopexy can safely be performed with LSC, concurrent posterior repair has no additional benefit, and

there is insufficient evidence to evaluate the role of an additional procedure for stress urinary incontinence.

Training-relevant aspects: A structured learning program, as well as the number of procedures needed in order to be qualified for performing LSC is yet to be established.

There are no evidence regarding the following surgical steps of LSC: dissection of the promontory, dissection of the recto-vaginal space, the use of Y-shaped mesh, the site of fixation of the mesh to the promontory, tensioning of mesh, and peritonealization.

It is important to address concerns regarding the use of synthetic mesh and the risks of mesh complications. Concern about transvaginal mesh has recently led to banning its use for transvaginal surgeries in several countries. However, a recent statement from the Food and Drug Administration (FDA) reported the use of mesh in LSC is characterized by high efficacy and low rate of complications [50].

To our knowledge, it is the largest literature review about the technical aspects of LSC to be performed so far; However, we are aware to the possibility of missed articles, as we limited the search results to articles written in English only which were published from the beginning of 2008. However, we made efforts to minimize the extent of missing data by including systematic reviews that contained also non-English articles and articles that were published prior to our time limitation.

In conclusion, many technical and clinical aspects of LSC seems unstandardized, with little consensus. Given the numerous technical variants that have been developed over the years, it seems important to regularly review the existing literature in an attempt to establish evidence-based recommendations in the future.

We suggest further research to address variations in technique: dissection of the promontory, dissection of the recto-vaginal space, site of promontory fixation, and tensioning of mesh, and the role of peritonealiization.

Disclaimer

This manuscript was established by key opinion leaders in the field of laparoscopic surgery in urogynecology. The information is designed to aid practitioners in making decisions about appropriate urogynecological care and should not be perceived as dictating an exclusive course of treatment or procedure. Variations in practice may be warranted based on the needs of the individual patient, surgeon expertise and training, resources and limitations unique to the institution or type of practice.

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Declaration of Competing Interest

The authors declare that they have no conflict of interest.

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