International Urogynecology Journal (2019) 30:1433–1454
https://doi.org/10.1007/s00192-019-04001-z

ORIGINAL ARTICLE

Surgical interventions for posterior compartment prolapse and obstructed defecation symptoms: a systematic review with clinical practice recommendations

Cara L. Grimes[1] · Megan O. Schimpf[2] · Cecilia K. Wieslander[3] · Ambereen Sleemi[4] · Paula Doyle[5] · You (Maria) Wu[6] · Ruchira Singh[7] · Ethan M. Balk[8] · David D. Rahn[9] · for the Society of Gynecologic Surgeons (SGS) Systematic Review Group (SRG)

Received: 16 March 2019 / Accepted: 28 May 2019 / Published online: 29 June 2019

Abstract

Introduction and hypothesis Several posterior compartment surgical approaches are used to address posterior vaginal wall prolapse and obstructed defecation. We aimed to compare outcomes for both conditions among different surgical approaches.

Methods A systematic review was performed comparing the impact of surgical interventions in the posterior compartment on prolapse and defecatory symptoms. MEDLINE, Embase, and ClinicalTrials.gov were searched from inception to 4 April 2018. Randomized controlled trials, prospective and retrospective comparative and single-group studies of women undergoing posterior vaginal compartment surgery for vaginal bulge or bowel symptoms were included. Studies had to include both anatomical and symptom outcomes both pre- and post-surgery.

Results Forty-six eligible studies reported on six surgery types. Prolapse and defecatory symptoms improved with native-tissue transvaginal rectocele repair, transanal rectocele repair, and stapled transanal rectocele repair (STARR) surgeries. Although prolapse was improved with sacrocolpoperineopexy, defecatory symptoms worsened. STARR caused high rates of fecal urgency postoperatively, but this symptom typically resolved with time. Site-specific posterior repairs improved prolapse stage and symptoms of obstructed defecation. Compared with the transanal route, native-tissue transvaginal repair resulted in greater improvement in anatomical outcomes, improved obstructed defecation symptoms, and lower chances of rectal injury, but higher rates of dyspareunia.

Conclusions Surgery in the posterior vaginal compartment typically has a high rate of success for anatomical outcomes, obstructed defecation, and bulge symptoms, although these may not persist over time. Based on this evidence, to improve anatomical and symptomatic outcomes, a native-tissue transvaginal rectocele repair should be preferentially performed.

Presented at the Society of Gynecologic Surgeons Annual Scientific Meeting, Orlando, Florida, March 2018

Study registration Registration with PROSPERO and full protocol can be found at: http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42018093099

✉ Cara L. Grimes

[1] Department of Obstetrics and Gynecology, New York Medical College, Valhalla, NY, USA

[2] Department of Obstetrics and Gynecology, University of Michigan, Ann Arbor, MI, USA

[3] Department of Obstetrics and Gynecology, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

[4] International Medical Response, Brooklyn, NY, USA

[5] Department of Obstetrics and Gynecology, Department of Urology, University of Rochester School of Medicine and Dentistry, Rochester, NY, USA

[6] Department of Obstetrics and Gynecology, London Health Sciences Centre, London, Ontario, Canada

[7] Department of Obstetrics and Gynecology, University of Florida College of Medicine—Jacksonville, Jacksonville, FL, USA

[8] Center for Evidence Synthesis in Health, Brown School of Public Health, Brown University, Providence, RI, USA

[9] Department of Obstetrics and Gynecology, University of Texas Southwestern Medical Center, Dallas, TX, USA

Keywords Obstructed defecation · Rectocele · Surgery · Systematic review

Introduction

Obstructed defecation is a form of defecatory dysfunction that includes a spectrum of abnormal evacuation symptoms such as straining, incomplete emptying, splinting (needing to digitally replace prolapse or otherwise apply manual pressure to the vagina or perineum), and manual evacuation/digitation (needing to place fingers in the vagina or rectum to evacuate stool) [1]. There are multiple potential etiologies of defecatory dysfunction, including pelvic floor dyssynergia, rectal prolapse, intussusception, and pelvic organ prolapse. Specifically, posterior vaginal wall prolapse, or a rectocele, is known to contribute to obstructed defecation [2]. Thus, surgery to correct rectocele is a common treatment option targeted toward correction of anatomy and symptoms of bulge and obstructed defecation. Various surgical approaches have been developed to achieve these goals, including vaginal, transanal, and abdominal approaches. Most surgeries focus on correcting the defect in the anatomy, with a secondary aim of improving obstructed defecation symptoms. A wide variety of surgeries are described in the literature, including various vaginal approaches with and without graft or mesh augmentation, transanal approaches, use of kits/instruments, and abdominal approaches.

The objective of this review was to create evidence-based recommendations to identify the best surgical approach to address posterior vaginal wall prolapse in patients with symptomatic obstructed defecation.

Materials and methods

The Society of Gynecologic Surgeons (SGS) Systematic Review Group includes members with clinical and surgical expertise in performing posterior vaginal compartment surgery and in the conduct of systematic review and guideline development. No Institutional Review Board approval was required for this work. Registration with PROSPERO and full protocol can be found at: http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42018093099.

Data sources

MEDLINE, Embase, and ClinicalTrials.gov were searched from their inception through 4 April 2018. The searches included numerous MeSH terms for posterior vaginal wall prolapse and obstructed defecation such as "rectocele," "defecation," "constipation," and associated words, and filters for primary studies conducted in humans (Appendix 1). Conference abstracts and non-human studies were excluded. Authors were not contacted for additional information.

Study selection

Studies of women at least 18 years of age who were having posterior vaginal compartment surgery either for vaginal bulge/prolapse or for obstructed defecation symptoms were included. Studies were excluded if the surgeries were performed for apical prolapse other than colpocleisis and laparoscopic sacrocolpoperineopexy, which were deemed to have a substantial impact on the posterior wall. Studies were excluded if >25% of the surgeries included were being carried out for obstructed defecation related to cancer, volvulus, rectal prolapse, hemorrhoids, or anal incontinence not secondary to obstructed defecation.

Studies had to report both pre- and post-operative anatomical measures of vaginal bulge/prolapse and symptom measures of obstructed defecation. Vaginal bulge/prolapse could be defined by the Pelvic Organ Prolapse Quantification System (POP-Q) [3], Baden–Walker [4], clinical examination, imaging study, or patient reported symptom. Obstructed defecation symptoms could be defined by validated questionnaires such as the Pelvic Floor Distress Inventory (PFDI-20), specifically questions 3, 4, 7, and 8 on the Colorectal-Anal Distress Inventory Subscale (CRADI); Wexner/Cleveland Clinic Constipation score; or Longo Obstructed Defecation Syndrome score [5, 6]. Obstructed defecation could also be determined by patient-reported symptoms, including splinting, straining, manual evacuation, and constipation. Success was defined as a measure of overall cure, satisfaction, or improvement. Data were recorded on surgical complications including blood transfusion, organ injury, readmission, reoperation for adverse events, death, venous thromboembolism, wound infection, post-operative bleeding or transfusion, mesh erosion or exposure, and new-onset or persistent post-operative pain or dyspareunia. Randomized controlled trials (RCTs), prospective comparative studies, prospective single-group studies, and retrospective non-randomized comparative studies were included. Retrospective single-group studies were included if more than 30 subjects were involved. An attempt was made to review all languages and expertise in Russian, German, and Chinese translation was sought as needed.

Seven reviewers independently screened abstracts and potentially relevant full-text articles in duplicate. Discrepancies were resolved by a third reviewer (MOS or CLG). Abstract screening was conducted using Abstrackr (http://abstrackr.cebm.brown.edu) [7]. Data extraction was completed in duplicate by the same seven independent reviewers into customized forms. Study and participant characteristics, intervention details, outcome definitions, and results were extracted. The risk of bias and the methodological quality of each study based on the Cochrane risk of bias and other questions from the Newcastle Ottawa Scale were assessed [8, 9]. Based on these potential biases, each study was graded as good (A), fair (B), or poor (C) quality. For each intervention, an "evidence profile" was generated by grading the quality of evidence for each outcome according to a modified Grades for Recommendation, Assessment, Development, and Evaluation (GRADE) system [10, 11]. The process considered the study qualities such as consistency, directness of evidence, and the methodological quality to determine an overall quality of evidence. Four evidence quality rating categories were possible: high (A), moderate (B), low (C), and very low (D).

Individual surgical approaches were examined to determine if surgery had an impact (improved, no change, worsened) on posterior vaginal wall anatomy and symptoms of bulge and obstructed defecation. Comparisons between surgeries were made. Meta-analyses were not feasible because of the small number of studies in some comparison groups and the lack of comparable outcomes across other groups.

Clinical practice recommendations were developed (see Table 2) incorporating the risks and benefits of the interventions compared and after each intervention when there was sufficient evidence (of high, moderate, or low strength) to support these statements [10, 11]. Each guideline statement was assigned an overall level of strength of the recommendation (1 = "strong," 2 = "weak") based on the quality of the supporting evidence and the size of the net benefit.

The initial findings were presented at the SGS Annual Scientific Meeting in March 2018. The draft guideline was presented to the SGS Executive Committee and circulated to the SGS Membership in January 2019 for member comment prior to submission for publication.

Results

The literature search identified 3404 abstracts; 297 full-text papers were retrieved and assessed in detail. In total, we included 46 studies that met the eligibility criteria (Fig. 1). The analyses was categorized into six individual surgeries and three comparisons between surgeries. Five studies were comparative and thus are listed twice.

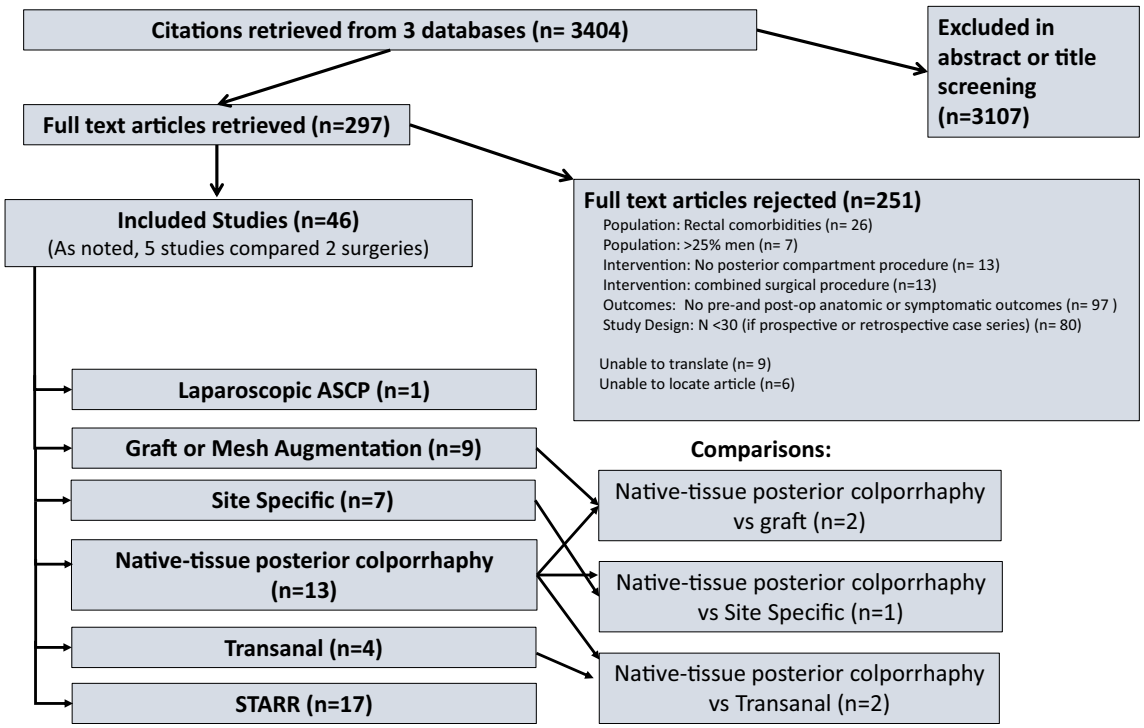

Fig. 1 Study selection process. Five studies are included twice as they are comparative studies of two surgical approaches. *ASCP* abdominal sacrocolpoperineopexy, *STARR* stapled transanal rectal resection

Surgical approaches

The individual surgical approaches were examined to determine if surgery had an impact (improved, no change, worsened) on posterior vaginal wall anatomy and symptoms of bulge and obstructed defecation.

Laparoscopic sacrocolpoperineopexy

The effect of laparoscopic sacrocolpoperineopexy on the posterior vaginal wall anatomy and defecatory symptoms was assessed in one prospective single-group study of 90 women with moderate quality of evidence [12] and median follow-up of 30.7 months (range 7–101; see Appendix Table 6). Overall, posterior vaginal wall anatomy improved after laparoscopic sacrocolpoperineopexy, but defecatory symptoms worsened or did not change.

The POP-Q stage of the posterior wall (determined by point Bp) improved with a recurrence rate of 2.2%. The women with recurrence did not require further intervention. Defecatory symptoms measured by a total CRADI score worsened after laparoscopic sacrocolpoperineopexy, although no change was seen in the life impact of these symptoms measured by the Colorectal-Anal Impact Questionnaire (CRAIQ) [13]. Specifically, there was no improvement in straining or splinting (19 and 7.8% of women prior to surgery; 17 and 5.7% after).

Graft augmentation

Transvaginal posterior colporrhaphy augmented by biologic graft or synthetic mesh was evaluated in nine studies (see Appendix Table 7). These included 1 RCT [14], 3 comparative retrospective [15–17], 3 single-group prospective [18–20], and 2 single-group retrospective studies [21, 22], which included a total of 974 patients with 6 weeks to 157 months of follow-up. Seven studies examined biologic grafts, including porcine subintestinal submucosal graft, porcine dermal xenograft, human dermal allograft, cadaveric fascia lata, and collagen grafts [14–17, 19, 22]. Three studies examined synthetic meshes including polyglycolic mesh, composite Vicryl–Prolene mesh, and Prolene mesh [18, 20, 21]. Overall, women who had placement of a biologic or synthetic mesh in the posterior compartment had improved posterior vaginal wall anatomy and obstructed defecation symptoms, but with accompanying adverse events.

Women who had graft or mesh placement in the posterior compartment had improved posterior vaginal wall stage by POP-Q measurements (7 studies, 547 patients, 12–157 months' follow-up) [14, 16–20, 22]), and by defecography in about half of patients post-operatively (1 study [19], 29 patients, 10–14 months' follow-up).

For symptom measures, women with graft or mesh placement in the posterior compartment had improved sensation of bulge in 3 studies (240 patients, 12–24 month follow-up) [14, 18, 21]. Overall, most obstructed defecation symptoms improved in women with graft or mesh placement. Four studies reported improved splinting [14, 15, 18, 22], 1 [16] reported worsening of splinting, and 1 reported no change [19]. The most common adverse events following graft placement included de novo and persistent dyspareunia, ranging from 10 to 69% [16, 17, 19–22]. In terms of adverse events in the studies involving biologic grafts, a 0–12% wound dehiscence/erosion rate was reported across 4 studies (363 patients, 10–43 months' follow-up) [14–17]. One study reported a 17–22% rate of post-operative dyspareunia [16] and 2 studies reported no change/persistent dyspareunia [17, 19], and 1 reported improved dyspareunia [22]. In terms of adverse events in the studies involving mesh, a 0–13% erosion rate was reported across 3 studies [18, 20, 21]. One study [20] reported worsening dyspareunia from 6 to 69% and 1 study [21] reported improved dyspareunia.

Site-specific defect repair

Site-specific defect repair entails identifying and repairing discrete defects in the support of the posterior vaginal wall. These repairs were evaluated in 7 studies, most of which were single-group retrospective (3) [18, 23, 24] or prospective (3) [25–27], with one comparative retrospective study (see Appendix Table 8) [28]. Together there were a total of 561 patients with 3–68 months' follow-up. Site-specific repair improved posterior vaginal wall anatomy and most obstructed defecation symptoms, but the effects on constipation were less clear.

Site-specific defect repair objectively improved POP-Q stage (5 studies [23, 25–27, 29], 365 patients) and mean point Bp (3 studies [26, 28, 29], 244 patients) with a follow-up of 3–47 months. Similarly, this repair improved posterior vaginal wall anatomy measured by Baden–Walker grade (2 studies, 249 patients) [24, 28] or via ultrasound (1 study; 137 patients) [23].

For symptom measures, women receiving a site-specific defect repair uniformly had improved symptoms of vaginal bulge in all 7 studies (561 patients) [18, 23–28]. Defecatory symptoms such as evacuation difficulties (1 study, 42 patients) [27], stooling difficulties (1 study, 125 patients) [24], difficulty emptying (1 study, 51 patients) [26], and obstructed defecation defined as digitation, splinting, or straining (1 study, 137 patients) [23] improved in women receiving a site-specific defect repair. Splinting improved in 3 studies (331 patients) [23, 24, 29]. Constipation did not improve postoperatively in 3 studies [24, 25, 28], improved in another 2 studies [26, 29], but worsened in no studies (3–47 months' follow-up). Validated symptom measures were not used in any of these studies.

Subjective measures of cure and satisfaction were infrequently used. Site-specific defect repair resulted in a high subjective cure rate (i.e., being cured or improved by patient report in a non-validated, standard patient interview) of 85% in 1 study (137 patients with 3–68 months' follow-up) [23]. Similarly, patient satisfaction was improved in 1 study (69 patients with 3–47 months follow-up) [29].

The most common adverse events were dyspareunia (2–11%) [19, 23–26], and tenesmus (3%) [29].

Native-tissue posterior colporrhaphy

Traditional native-tissue posterior colporrhaphy was assessed in 13 studies (see Appendix Table 9). This included 3 RCTs [14, 30, 31], 6 prospective single-group [1, 32–36], 2 retrospective comparative [16, 28], and 2 retrospective single-group studies [37, 38], which included a total of 1,337 patients with 3–41 months' follow-up. Overall, anatomy and obstructed defecation symptoms improved after posterior colporrhaphy with a low incidence of adverse events.

Most studies evaluated anatomical improvement using the POP-Q system. Five studies (793 patients) [1, 14, 16, 28, 35] demonstrated improvement in posterior vaginal wall prolapse using point Bp, 2 (110 patients) [14, 30] by Ap, and 6 [1, 14, 33, 35–37] (672 patients) by posterior vaginal wall stage. Two studies (367 patients) [28, 38] evaluated –the posterior vaginal wall using Baden–Walker. Four studies (130 patients) [30–32, 34] reported on rectocele by defecography and 2 (154 patients) [1, 30] on rectocele detected on clinical examination. All studies demonstrated improvement in objective measures of posterior vaginal wall anatomy, with 11 studies with a medium-term follow-up (more than 12 months) [14, 16, 28, 30, 32–38] and 2 with short-term follow-up (3 and 6 months) [1, 31].

A wide range of obstructed defecation symptoms improved after native-tissue posterior colporrhaphy. Eight studies [14, 30–34, 37, 38] (445 patients) reported improvements in patient-reported outcomes of digitation, straining, splinting, incomplete evacuation, and difficult evacuation. Two studies (293 patients) [35, 36] used validated questionnaires, which also demonstrated improvement in splinting, straining, and incomplete evacuation. The symptoms of constipation and hard stools did not consistently improve after surgery, with 1 study of 307 patients [28] demonstrating no improvement, 4 studies (165 patients) [1, 31, 33, 34] showing improvement, and 1 study (124 patients) [16] showing worsening of constipation.

Dyspareunia was the most commonly reported adverse event (ranging from 0 to 19%), but most studies did not report on the duration or whether further intervention was needed.

Transanal approach

The transanal approach to rectocele repair was assessed in 4 studies (see Appendix Table 10). These were 2 RCTs [30, 31], a prospective single-group [39], and a retrospective single-group study, which included a total of 153 patients with 6–25 months' follow-up with mostly low- to moderate-quality evidence [30, 31, 39, 40]. Overall, the transanal approach improved posterior vaginal wall anatomy and obstructed defecation symptoms.

Rectocele seen on defecography was improved at 2–92 months postoperatively (most up to 12 months) in all 4 studies. Further, 1 study [30] demonstrated improvement in POP-Q point Ap and rectocele by clinical examination; this included 30 patients at 12 months' follow-up. Obstructed defecation symptoms also demonstrated improvement at 1–50 months' follow-up, including patient-reported symptoms of digitation and incomplete evacuation. No study used a validated questionnaire to evaluate obstructed defecation.

The most common adverse events were wound infection (1 out of 15 and 1 out of 45 subjects in 2 studies) and dyspareunia when performed with a concomitant levatorplasty (29%).

Stapled transanal rectal resection

The stapled transanal rectal resection (STARR) consists of a double circular stapler with a disposable circular anal dilator and a purse-string suture anoscope. The device is used via a transanal approach to perform an anterior and posterior full-thickness rectal wall resection producing a circumferential transanal resection of the rectum. The impact of STARR on posterior compartment anatomy and symptoms was evaluated in 17 studies, more than any other procedure in this review (see Appendix Table 11) [41–59]. The majority of these were prospective single-group studies, ranging from 30 to 123 patients with 3–60 months' follow-up. Two studies [43, 51] were RCTs between two different types of staplers; in both of these, as their findings were the same for the compared devices and the overall surgical approach was similar, we combined the results together. Overall, STARR appears to have a positive impact on posterior wall anatomy and obstructed defecation symptoms.

As measured by defecography, STARR was effective in improving posterior compartment anatomy. POP-Q was not used in any study, and defecography was the most common measure of anatomy. Clinical examination was used in 1 study [52]; 1 showed positive results for STARR and 1 showed no difference, with small patient numbers in both studies. Similarly, 1 MRI study showed a positive impact of STARR on anatomy, and another was not significant. Again, patient numbers were small.

For symptom measures, all of these studies used at least one validated questionnaire, such as the Wexner/Cleveland Clinic Constipation Scale, the Longo Obstructed Defecation

Syndrome score, or the Altomare score. All studies supported a significant improvement in obstructed defecation by these validated measures. Symptomatic improvement extended to high rates of patient satisfaction and perceived overall improvement.

The most common adverse events following STARR were fecal urgency, minor bleeding, and postoperative pain. Fecal urgency, which was as high as 40% in the first week, typically improved or resolved by about 3 months postoperatively without intervention. No study reported a transfusion, and often the bleeding resolved with additional suturing during the original procedure. Major bleeding was reported in up to 4.4% [51].

Comparisons of surgical approaches

Based on available studies, we were able to analyze three comparisons between surgeries (Fig. 1; Table 1) to see if one surgical approach demonstrated superior improvements in posterior vaginal wall anatomy or symptoms of bulge and obstructed defecation.

Traditional native-tissue posterior colporrhaphy versus biologic graft augmentation

Two studies compared traditional native-tissue posterior colporrhaphy versus augmentation by biologic graft in the posterior compartment (see Appendix Table 3). These included one RCT [14] of native-tissue posterior colporrhaphy versus porcine intestinal submucosal graft and one retrospective comparative study [16] of native-tissue posterior colporrhaphy versus various transvaginal biologic grafts, which together included 313 women with overall length of follow-up (range 10–71 months across all groups). The overall quality of evidence from these studies was moderate to high. No comparative studies in our review used a synthetic mesh implant.

Both studies evaluated anatomy using POP-Q points Ap and Bp. There was no difference in improvement in these points between surgical interventions. Sung et al. demonstrated that the native-tissue posterior colporrhaphy arm had 6 out of 70 rectoceles (9%) at 12 (range 10–43) months after surgery defined by Ap or Bp greater than or equal to 1, whereas there were 8 out of 67 (12%) in the graft arm, which was not a statistically significant difference [14]. Grimes et al. demonstrated that 120 out of 124 (97%) women in the native-tissue vs 67 out of 69 (97%) in the graft group had Bp greater than or equal to 0 [16]. Similarly, there was no difference between groups for posterior vaginal wall stage, with a median stage of 0 (0,3) in both groups.

Neither of the studies found a difference in validated bulge symptoms (including straining and splinting, incomplete emptying, or patient-reported vaginal bulging) between the two approaches (moderate to high quality of evidence). Postoperative obstructed defecation symptoms across these studies ranged from 3 to 7% for sense of a bulge, 32–33% for

Table 1 Summary of comparative studies

Comparison	Number studies (total *N*)	Study quality	Follow-up duration	Anatomical outcomes	Symptom outcomes	Adverse events
Native-tissue PC vs graft	2 (313) [14, 16]	1 A, 1 C	12–35.8 months	NS: Ap/Bp Posterior vaginal wall Stage	NS: Vaginal bulge Straining Splinting Incomplete evacuation Constipation	NS: Hemorrhage Rectal injury Bladder injury Wound infection Dyspareunia Erosions
Native-tissue PC vs site-specific defect repair	1 (307) [28]	1 C	12 months	Favor PC: Baden–Walker Mean point Bp	Favor PC: Symptomatic bulge NS: Constipation	NS: De novo dyspareunia Intraoperative blood loss Hemorrhage Wound infection Medical complications
Native-tissue PC vs transanal approach	2 (78) [30, 31]	2 A	6–12 months	Favor PC: Point Ap Rectocele by clinical examination NS: Rectocele by defecography	Favor PC: Constipation Incomplete evacuation Straining NS: Need to digitate	NS: Wound infections De novo dyspareunia

All comparisons are native-tissue posterior colporrhaphy (*PC*) vs other arm

Study quality A = good, B = fair, C = poor

NS no significant difference between arms

straining, 10–85% for splinting and 21–85% for sense of incomplete evacuation. Furthermore, no differences were seen in patient satisfaction or adverse events, including rectal injuries, bladder injuries, wound infections, or dyspareunia. Only 1 study [16] reported on graft erosions, with an incidence of 1 out of 69. Sung et al. found significantly greater blood loss in the graft group (125 cc [range 25–400] vs 100 cc [range 10–500] in the native tissue group, $p = 0.005$), although this may not be considered clinically significant [14].

Taken together, the addition of a graft to the posterior compartment repair afforded no significant improvement in posterior compartment anatomy or symptoms of obstructed defecation, and no significant difference in adverse events.

Traditional native-tissue posterior colporrhaphy versus site-specific defect repair

A study carried out by Abramov et al. retrospectively compared the effects of traditional native-tissue posterior colporrhaphy versus site-specific defect repair (302 patients; see Appendix Table 4) [28]. At 12 months' follow-up, in terms of anatomical outcomes using Baden–Walker grade and POP-Q point Bp, traditional native-tissue posterior colporrhaphy was superior to site-specific defect repair with a lower objective recurrence rate both past the midvaginal plane (14 vs 33%, $p = 0.001$) and past the hymenal ring (4 vs 11%, $p = 0.02$). Results were similar measured by postoperative Bp measurement (−2.7 vs −2.2 cm, $p = 0.001$).

For subjective outcomes, traditional native-tissue posterior colporrhaphy was also superior to site-specific defect repair. For the sense of a symptomatic vaginal bulge, posterior colporrhaphy had a statistically significant lower subjective recurrence rate (4% vs 11%, $p = 0.02$). Neither procedure significantly improved constipation post-operatively. Splinting, straining, and incomplete evacuation were not studied.

There was no difference in blood loss or perioperative complications including hemorrhage, wound infection, and medical complications. Both procedures had similar rates of de novo dyspareunia of 11%. Patient satisfaction was not studied.

In summary, native-tissue posterior colporrhaphy demonstrated greater improvements in posterior vaginal wall anatomy and symptoms of bulge compared with site-specific repair. Rates of post-operative dyspareunia at 1 year were similar. Data are insufficient regarding any differences in symptoms of obstructed defecation.

Traditional transvaginal native-tissue posterior colporrhaphy versus transanal approach

Transvaginal native-tissue posterior colporrhaphy versus the transanal approach was assessed in 2 RCTs [30, 31], with a total of 78 patients (see Appendix Table 5). There was an overall moderate quality of evidence.

Nieminen et al. [30] evaluated 30 patients and found that native-tissue posterior colporrhaphy improved anatomical outcomes more than the transanal approach measured by POP-Q point Ap (-2.8 ± 0.56 vs -1.36 ± 1.12, $p = 0.01$), rectocele by clinical examination (7% vs 40%, $p = 0.04$), and rectocele by defecography at 12 months (depth of rectocele improved significantly from 6.00 ± 1.6 to 2.73 ± 1.87, $p < 0.0001$ for the transvaginal group, $5.60\ \text{cm} \pm 1.8$ to $4.13\ \text{cm} \pm 2.10$, $p = 0.07$ for the transanal group, $p = 0.06$ across group comparison). However, Farid et al. [31] evaluated rectocele by defecography with 48 patients and identified improvements in both arms compared with preoperative values, but no significant difference between approaches.

In terms of symptoms, Farid et al. [31] showed that native-tissue posterior colporrhaphy, when compared with the transanal approach, resulted in greater improvement in symptoms of constipation (25% vs 50%), incomplete evacuation (25% vs 56%), digitation (25% vs 50%), and straining (19% vs 50%), at 6 months' follow-up. At 12 months, Nieminen et al. [30] showed improvement in the need to digitally assist rectal emptying after surgery in both groups (11 out of 15 [73%] to 1 out of 15 [7%], $p = 0.01$ in the vaginal group vs 10 out of 15 [66%] to 4 out of 15 [27%], $p = 0.02$ in the transanal group, with no difference in the improvements across groups, $p = 0.17$).

For adverse events, rates of wound infection were low (6% in the transanal arm vs 0% in the native-tissue arm in one study [30], 0% vs 9% in the other [31]). There was no de novo dyspareunia in either group.

In summary, comparing traditional native-tissue posterior colporrhaphy with transanal repair, native-tissue posterior colporrhaphy demonstrated greater improvements in posterior vaginal wall anatomy by examination, but not on defecography. Constipation, incomplete evacuation, and straining improved more with native-tissue posterior colporrhaphy, but digitation was inconsistent in these two studies. Rates of adverse events were low in both approaches.

Discussion

Surgery in the posterior vaginal compartment, regardless of technique, often improves posterior vaginal wall anatomy and sometimes improves symptoms of obstructed defecation, although few studies have comprehensive long-term follow-up beyond 24 months. Additionally, there are few high-quality trials directly comparing surgical approaches to give direction as to whether there is a superior surgery for correcting symptomatic posterior vaginal wall prolapse and obstructed defecation.

The highest quality data reviewed were for traditional native-tissue posterior colporrhaphy, both in single-group

and comparative studies with graft- and mesh-augmented, site-specific, and transanal approaches. This permitted the creation of a single clinical practice recommendation (Table 2). Overall, we suggest that for women with rectocele and obstructed defecation symptoms requiring surgical intervention, traditional native-tissue posterior colporrhaphy via the vaginal approach might be considered first to improve anatomy and symptoms of obstructed defecation. Based on limited available comparative data from only two studies exclusively using biologic grafts, we conclude that use of biologic grafts in the posterior compartment does not provide an advantage anatomically or symptomatically compared with a traditional native-tissue posterior colporrhaphy repair. This is consistent with prior work from our group [60–62] regarding anatomical outcomes, but now in this review we add the finding that there were no differences in obstructed defecation symptoms and adverse events between the approaches in the two comparative studies. When looking at all nine studies using graft and mesh that met our inclusion criteria, additional adverse events were reported that demonstrate that mesh complications are possible, both with mesh and graft augmentation. This further underscored our suggestion to prioritize the native-tissue approach over graft augmentation. The site-specific approach had inferior anatomical outcomes compared with traditional posterior colporrhaphy, and there was insufficient evidence to comment on any difference in obstructed defecation symptoms. Finally, the transanal approach was inferior to transvaginal repair for anatomy and effect on obstructed defecation symptoms (incomplete emptying, digitation and incomplete evacuation).

Table 2 Clinical practice guideline

For women presenting with posterior vaginal wall prolapse and obstructed defecation symptoms, compared with traditional native-tissue transvaginal posterior colporrhaphy

- Augmentation by graft materials (synthetic mesh) is not superior for anatomical or symptomatic outcomes, but adds and compounds potential complications, including dyspareunia and mesh erosions. Complications are not increased with biologic grafts, but these do not appear to enhance efficacy (moderate- to high-quality evidence)
- Site-specific posterior repairs have a higher rate of anatomical recurrence and bulge symptoms with similar rates of post-operative dyspareunia. We do not recommend site-specific defect repair for patients whose main symptoms are constipation and splinting (low-quality evidence)
- A transanal approach to a posterior repair is associated with higher rates of anatomical recurrence and inferior resolution of obstructed defecation symptoms (moderate-quality evidence)
- Therefore, we suggest that for women with rectocele and obstructed defecation symptoms requiring surgical intervention, a transvaginal native-tissue posterior colporrhaphy might be performed; patients should be informed that dyspareunia remains a commonly reported adverse event (2C)

The STARR procedure was most commonly evaluated, although no study compared it with other surgical approaches. We found overall improvement in posterior vaginal wall anatomy (primarily measured radiologically) and symptoms of obstructed defecation after the STARR procedure. The STARR procedure is a distinct from the other procedures included in our review. First, it is mainly performed by colorectal surgeons and second, is primarily performed for symptom relief with little attention to anatomical concerns, as demonstrated by no POP-Q data and radiology (MRI and defecography) used to characterize anatomy. However, the studies included in this review met our patients, intervention, comparator, outcomes, study design criteria and thus we felt that it was important to include it. In contrast to studies of other procedures, all of the STARR articles came from outside the USA. Furthermore, the inclusion criteria and study conditions offered to patients participating in these trials with highly experienced surgeons may not replicate outcomes performed in routine practice. High rates of bleeding, infection, and stenosis have been reported. Fecal urgency, although common, often self-resolves within a few months. The adverse events we identified are similar to those from larger registries [63]. However, our study selection criteria may have excluded some studies further detailing rates and types of complications. Additionally, higher rates of complications may have come from papers describing the learning curve with the procedure.

The least-studied surgery was laparoscopic sacrocolpoperineopexy, for which just one study met our inclusion criteria. This is the only eligible study that reported primarily an apical support procedure (as we elected not to include vaginal vault suspensions and sacrocolpopexies without extension of the posterior arm to the perineal body). Furthermore, only 43.3% of this population had stage 2 or greater prolapse, with 19% reporting straining and 8% digital assistance. This study showed a worsening of obstructed defecation symptoms, by overall CRADI score. Ramanah and others have theorized that the technique of laparoscopic sacrocolpoperineopexy may injure autonomic nerves during the presacral dissection and could also cause outlet obstruction by altering the anorectal angle and rectal compliance by attaching the posterior mesh into the levator ani fascia bilaterally [12]. However, we cannot be sure that the change in symptoms is not simply due to correction of apical weakness. For this reason and the lack of quality studies, we cannot recommend sacrocolpoperineopexy in patients whose goal is to improve defecatory problems, as symptoms of constipation worsened, with no improvement in straining or splinting.

The strengths of this review include our methods, experience with the conduct of systematic reviews, and advanced experience and training in gynecological surgery. We included a focused study question inclusive of both anatomical and symptomatic outcomes for obstructed defecation. Studies were only included if both types of data were available before

and after surgical intervention, which allowed a uniform and focused analysis. However, it may also have resulted in an inclusion bias, leaving out studies with high-quality data on just anatomy, symptoms of obstructed defecation, or a broader picture of adverse events.

There are limitations to the review, some of which stem from the literature available to us. There was considerable variability in the way posterior vaginal wall prolapse was defined. We attempted to address this by grouping the ways of measuring posterior vaginal wall anatomy into POP-Q, Baden–Walker, clinical examination, and imaging; however, this still allows for variability in how to define clinical posterior vaginal wall prolapse or a rectocele on imaging. Furthermore, it is unclear whether a rectocele found on defecography or felt by the patient are the same as posterior vaginal wall prolapse on POP-Q clinical examination. Additionally, obstructed defecation can be defined in various ways. Although traditionally, urogynecologists defined obstructed defecation as symptoms of straining, splinting, and manual evacuation, we included difficult defecation and constipation, as many (especially older) studies used these definitions. We eliminated sacrocolpopexies that did not include sacrocolpoperineopexy, as we did not want to assess the role of apical prolapse in this review. We only included rectopexies performed for intussusception, not exclusively for rectal prolapse. Symptom outcome reporting was heterogeneous, precluding meta-analyses. As with other prior surgical reviews, assessing adverse events was challenging given the heterogeneity of reporting and small, short-term studies on a range of procedures. We included studies with subjects having surgery for vaginal bulge/prolapse and/or obstructed defecation symptoms; thus, some of the studies we included had low rates of obstructed defecation (under 50%). We deemed that including posterior compartment surgeries that could potentially have an impact on bulge and defecatory dysfunction and had both of these measures available pre- and post-operatively would give us a greater view of the impact of surgery on these symptoms, even if the population included was not overtly symptomatic.

Regardless of the data here, each surgeon should only perform a procedure they feel expert in performing. We do not have sufficient evidence in most cases to suggest that one surgery or approach is better than another. For example, this study does not support training in STARR for gynecologists to best address obstructed defecation. STARR was an extensively studied surgery in our review, with high-quality evidence, largest numbers, and longest follow-up, but the lack of comparative data with gynecological surgeries limits our ability to draw conclusions about its overall place in this treatment of obstructed defecation symptoms.

In summary, it is reasonable to counsel patients that most of the surgeries described here improve anatomy and symptoms of obstructed defecation, with no single type of surgery demonstrating a remarkably superior impact. Nonetheless, data support a recommendation that for women with rectocele and obstructed defecation symptoms requiring surgical intervention, native-tissue traditional posterior colporrhaphy via the vaginal approach should be considered first to improve anatomy and symptoms of obstructed defecation. Although the anatomical effect of surgery for prolapse may persist over time, the improvement in symptoms was seen to wane in some studies by longer follow-up points across surgical approaches. More comparative and longer-term studies would help to inform the decision as to which surgery should be considered primarily.

Funding Funding provided by the Society of Gynecologic Surgeons (SGS) supports assistance by a methods expert in systematic reviews and other logistics.

Compliance with ethical standards

Conflicts of interest CG provides expert testimony for Johnson and Johnson. The other authors declare that they have no conflicts of interest.

Appendix 1: Search terms

(**PubMed Search**

((“Pelvic Organ Prolapse”[Mesh] OR “Cystocele”[Mesh] OR “Rectal Prolapse”[Mesh] OR “Uterine Prolapse”[Mesh]) OR “Visceral Prolapse”[Mesh]

OR

(prolapse OR fallen) AND (pelvic OR pelvis OR urogenital OR visceral OR viscera OR vagina OR vaginal OR bladder OR urinary OR uterine OR rectal OR rectum OR anus OR anal OR uterine OR uterus OR gynecologic* OR gynaecologic* OR cystocele OR cystocoele OR rectocele OR rectocoele OR proctocele OR proctocoele OR (posterior AND colporrhaphy) OR ((rectocele OR rectocoele) AND repair) OR sacrocolpopexy OR sacrocolpoperineopexy OR perineorrhaphy OR (levator AND plication) OR rectopexy OR (sigmoid AND resection)))

AND

(“Defecation”[Mesh] OR “Fecal Incontinence”[Mesh] OR “Constipation”[Mesh] OR Defecate OR defecation OR (fecal AND incontinence) OR Constipation OR dyschezia OR diarrhea OR obstruction OR obstructed OR splinting OR evacuation OR evacuate)

AND

((“Cohort Studies”[Mesh] OR cohort OR “Clinical Trial” [Publication Type] OR “Clinical Trials as Topic”[Mesh] OR (follow-up or followup) OR longitudinal OR “Placebos”[Mesh] OR placebo* OR “Research Design”[Mesh] OR “Evaluation

Studies" [Publication Type] OR "Evaluation Studies as Topic"[Mesh] OR "Comparative Study" [Publication Type] OR ((comparative or Intervention) AND study) OR Intervention Stud* OR pretest* OR pre test* OR posttest* OR post test* OR prepost* OR pre post* OR "before and after" OR interrupted time* OR time serie* OR intervention* OR (("quasi-experiment*" OR quasiexperiment* OR quasi or experimental) and (method or study or trial or design*)) OR "Case-Control Studies"[Mesh] OR (case and control)) OR ("Random Allocation"[Mesh] OR "Double-Blind Method"[Mesh] OR "Single-Blind Method"[Mesh] OR random* OR "Clinical Trial" [Publication Type] OR "Clinical Trials as Topic"[Mesh] OR "Placebos"[Mesh] OR placebo OR ((clinical OR controlled) and trial*) OR ((singl* or doubl* or trebl* or tripl*) and (blind* or mask*)) OR rct OR crossover OR cross-over OR cross over) OR (systematic[sb] OR meta-analysis[pt] OR meta-analysis as topic[mh] OR meta-analysis[mh] OR meta analy* OR metanaly* OR metaanaly* OR met analy* OR (systematic AND (review* OR overview*)) OR "Review Literature as Topic"[Mesh] OR cochrane[tiab] OR embase[tiab] OR (psychlit[tiab] or psyclit[tiab]) OR (psychinfo[tiab] or psycinfo[tiab])OR (cinahl[tiab] or cinhal[tiab]) OR science citation index[tiab] OR bids[tiab] OR cancerlit[tiab] OR reference list*[tiab] OR bibliograph*[tiab] OR hand-search*[tiab] OR relevant journals[tiab] OR manual search*[tiab] OR selection criteria[tiab] OR data extraction[tiab]) OR ("Epidemiologic Studies"[Mesh] OR "Case-Control Studies"[Mesh] OR "Cohort Studies"[Mesh] OR "Case control" OR cohort OR (observational and (study or studies)) OR Longitudinal OR Retrospective OR "Prospective Studies"[Mesh] OR "Longitudinal Studies"[Mesh] OR "Follow-Up Studies"[Mesh] OR ((follow-up or followup or "follow up") and (study or studies))))

NOT

(("addresses"[pt] or "autobiography"[pt] or "bibliography"[pt] or "biography"[pt] or "case reports"[pt] or "comment"[pt] or "congresses"[pt] or "dictionary"[pt] or "directory"[pt] or "editorial"[pt] or "festschrift"[pt] or "government publications"[pt] or "historical article"[pt] or "interview"[pt] or "lectures"[pt] or "legal cases"[pt] or "legislation"[pt] or "letter"[pt] or "news"[pt] or "newspaper article"[pt] or "patient education handout"[pt] or "periodical index"[pt] or "comment on" or ("Animals"[Mesh] NOT "Humans"[Mesh]) OR rats[tw] or cow[tw] or cows[tw] or chicken*[tw] or horse[tw] or horses[tw] or mice[tw] or mouse[tw] or bovine[tw] or sheep or ovine or murinae))

Appendix 2: Summary of comparative studies

All comparisons are native-tissue posterior colporrhaphy versus comparative arm (Tables 3, 4, and 5).

Table 3 Traditional native-tissue posterior colporrhaphy versus biologic graft augmentation

Reference, study design, country	Total number of participants	Study quality	Follow-up duration	Arm	Anatomical changes	Symptom changes	Adverse events
[14], RCT, USA	120	A	12 (10–43) months	Native-tissue posterior colporrhaphy (70) vs porcine intestinal submucosal graft (67)	NS: Ap or Bp ≥ −1: 6/70 (9%) vs 8/67 (12%), $p = 0.5$	NS: Vaginal bulge: 4/58 (7%) vs 2/64 (3%), $p = 0.4$ Straining: 18/57 (32%) vs 21/64 (33%), $p = 0.9$ Splinting: 9/58 (16%) vs 6/62 (10%), $p = 0.3$ Incomplete evacuation: 12/57 (21%) vs 15/63 (24%), $p = 0.7$	Favors PC: EBL: 100 mL (10–500) vs 125 mL (25–400), $p = 0.005$ NS: Rectal injury: 0/80 (0%) vs 1/80 (1%), $p = 1.0$ Bladder injury: 1/80 (1.3%) vs 0/80 (0%), $p = 1.0$ Wound infection: 4 (5%) vs 2 (3%), p-0.7
[16], comparative retrospective, USA	193	C	35.8 months (6–157 months)	Native-tissue posterior colporrhaphy (124) vs transvaginal biologic graft (multiple types) (69)	NS: Bp ≥ 0: 120/124 (97%) vs 67/69 (97%), $p = 0.90$ Median (range) posterior vaginal wall stage: 0 (0,3) vs 0 (0,3), $p = 0.63$	Favors PC: Splinting: 42/62 (68%) vs 35/41 (85%), $p = 0.04$ Incomplete evacuation: 39/61 (64%) vs 33/39 (85%), $p = 0.03$ NS: Constipation: 22/65 (34%) vs 13/41 (32%) Straining: 43/65 (66%) vs 33/41 (80%)	NS: Dyspareunia: 16/44 (36%) vs 5/23 (22%) Erosions: NA vs 1/69 (1%)

NS no significant difference, *PC* native-tissue posterior colporrhaphy, *RCT* randomized controlled trial, *NA* not applicable (not looked at), *EBL* estimated blood loss

Appendix 3: Summary of surgical approaches and impact on anatomical and symptom changes after surgery

Table 4 Traditional native-tissue posterior colporrhaphy versus site-specific defect repair

Reference, study design, country	Total number of participants	Study quality	Follow-up duration	Arms	Anatomical changes	Symptom changes	Adverse events
[28], comparative retrospective, USA	307	C	12 months	Traditional native-tissue posterior colporrhaphy vs site-specific defect repair	Favor PC: Baden–Walker Past midvaginal plane/grade 2: 26/183 (14%) vs 41/124 (33%), $p = 0.001$ Past hymenal ring/grade 3: 7/183 (4%) vs 14/124 (11%), $p = 0.02$ Mean point Bp (cm): 2.7 + −0.4 vs −2.2 +/ 0.3, $p = 0.001$)	Favor PC: Symptomatic bulge: 7/183 (4%) vs 14/124 (11%), $p = 0.02$ NS: Constipation: 46/124 (37%) vs 62/183 (34%), $p = 0.66$	NS: De novo dyspareunia: 12/114 (11)% vs 18/168 (11)%, $p = 1.00$ Intraoperative blood loss: 314 mL ±39 vs 298 mL ±48 Hemorrhage: 3% vs 3% Wound infection: 1% vs 1% Medical complications: 2% vs 2%

Table 5 Traditional native-tissue posterior colporrhaphy versus transanal approach

Reference, study design,	Total number of participants	Study quality	Follow-up duration	Arm (for comparative)	Anatomical changes	Symptom changes	Adverse events
[30], RCT, Finland	30	A	12 months	Native-tissue posterior colporrhaphy vs transanal	Favor PC: Mean point Ap (cm): −2.8 ± 0.56 vs −1.36 ± 1.12, $p = 0.01$ Rectocele by clinical exam: exam 7% vs 40%, $p = 0.04$ Rectocele by defecography: depth of rectocele 6.00 cm ± 1.6 cm to 2.73 ± 1.87, $p < 0.0001$ in the PC group, and 5.60 cm ± 1.8 to 4.13 cm ± 2.10, $p = 0.07$ in the transanal group; $p = 0.06$ between groups	NS: Need to digitate: 1/15 (7%) vs 4/15 (27%), $p = 0.17$	NS: Wound infections: 0/15 (0%) vs 1/15 (7%) No de novo dyspareunia in either arm
[31], RCT, Egypt	48	A	6 months	3 arms (2 arms analyzed together as a native tissue arm): Transperineal repair With ($n = 16$) and without ($n = 16$) levatorplasty (total $n = 32$) vs transanal repair ($n = 16$)	NS: Rectocele size by defecography: improves in both arms after surgery, but not between arms	Favor PC: Constipation: 8/32 (25%) vs 8/16 (50%) Incomplete evacuation: 8/32 (25%) vs 9/16 (56%) Digitation: 8/32(25%) vs 8/16 (50%) Straining: 6/32 (19%) vs 8/16 (50%) NS: Modified obstructed defecation syndrome questionnaire	Favors transanal: Wound infections: 3/32 (9%) vs 0/16 (0%) NS: Rectal perforation: (0% vs 0%) Hemorrhage: (0% vs 0%)

Table 6 Laparoscopic sacrocolpoperineopexy

Reference, study design, country	Total number of participants	Study quality	Follow-up duration	Anatomical changes after surgery	Symptom changes after surgery	Adverse events
[12], prospective, France	90	B	Median 30.7 months (7–101 months)	Improved: Posterior POP-Q stage ≥ stage 2: 39/90 (43.3%) ➔ 2/90 (2.2%)	Worsened: CRADI score: median 0 (0–40.6) ➔ 6.2 (0–40.6), $p = 0.02$ No change: CRAIQ score: median 0 (0–38.1) ➔ 0 (0–42.9), $p = 0.37$ Straining: 17/90 (19%) ➔ 15/90 (17%), $p = 0.69$ Digital assistance: 7/90 (7.8%) ➔ 5/90 (5.7%), $p = 0.55$	Not reported

POP-Q Pelvic Organ Prolapse Quantification, *CRADI* Colo-rectal Anal Distress Inventory, *CRAIQ* Colo-rectal Anal Impact Questionnaire,

Table 7 Graft augmentation

Reference, study design, country	Total number of participants	Study quality	Follow-up duration	Implant	Anatomical changes	Symptom changes	Adverse events
[14], RCT, USA	67	A	12.2 months (range 10–43 months)	Porcine subintestinal submucosal graft	Improved: POP-Q stage ≥2: 80/80 (100%) ➔8/67 (11%) Ap: 0 (−1 to 3) ➔ −3 (−3 to 3) Bp: 0 (−1 to 4) ➔ −3 (−3 to 3)	Improved: Vaginal bulge: 48/74 (65%) ➔ 4/68 (6%), $p < 0.001$ Straining: 48/74 (65%) ➔ 21/64 (33%), $p = 0.005$ Splinting: 38/74 (51%) ➔ 6/62 (10%), $p < 0.001$ Incomplete evacuation: 59/74 (80%) ➔ 15/63 (24%), $p < 0.001$	EBL: 125 mL (25–400) Rectal injury: 1/80 (1%) Bladder injury: 0/80 (0%) Wound infection: 2/80 (3%)
[15], comparative retrospective, USA	32	C	12 months	Transperineal porcine bioprosthetic graft (Surgisis ES, Cook Surgical)	Improved: Rectocele by clinical exam: 32/32 (100%) ➔ 0/32 (0%)	Improved: Obstructed defecation Validated Questionnaire (BBUSQ-22): Straining –3.22 ± 0.43 ➔ 1.52 ± 0.696 Incomplete emptying: 2.93 ± 0.39 ➔ 1.94 ± 1.10 Splinting:2.28 ± 0.56 ➔ 1.68 ± 0.30	Wound dehiscence: 0%
[20], single-arm prospective, Italy	31	B	Mean 17 months (range 3–48 months)	Permanent polypropylene (Prolene, Ethicon, Somerville, NJ, USA) monofilament mesh with diamond-shaped pores	Improved: Posterior POP-Q ≥ stage 2: 31/31 (100%) ➔ 0/31 (0%)	Improved: Constipation: 14/31 (45%) ➔ 9/31 (9%), (30%), $p < 0.05$	Mesh erosion: 2/31 (6%) Worsened: Dyspareunia: 2/31 (6%) ➔ 21/31 (69%), $p < 0.05$
[16], comparative retrospective, USA	69	C	38 months (native tissue) or 71 months (graft)	Biologic grafts:	Improved:	Improved:	Graft erosion: 1/69 (1%) Worsened:

Table 7 (continued)

Reference, study design, country	Total number of participants	Study quality	Follow-up duration	Implant	Anatomical changes	Symptom changes	Adverse events
				31/ 69 (44%) cadaveric dermis (Repliform™) 34/69 (50%) porcine dermis (Pelvicol™) 4/69 (6%) had porcine dermis (Xenoform™)	Bp > 0: 45/69 (65%) ➔ 3/69 (3%), $p < 0.01$ Median Bp: 0 (−3,9) ➔ −3 (−3,3) Median (range) posterior POP-Q stage: 2 (0,4) ➔ 0 (0,3), $p < 0.01$	Constipation: 20/41 (49%) ➔ 13/41 (32%) Worsened: Splinting: 33/69 (48%) ➔ 35/41 (85%)	Dyspareunia: 5/30 (17%) ➔ 5/23 (22%)
[21], 2004, single arm retrospective, Australia	90	C	12–14 months	Composite Vicryl-Prolene mesh	Improved: Baden–Walker ≥ grade 1: 86/90 (95%) ➔ 1/90 (1%)	Improved: Bulge: 43/54 (80%) improved, <0.001 Constipation: 21/33 (64%) improved, $p < 0.001$ Defecation difficulties: 28/43 (65%) improved, $p < 0.001$	Mesh erosion: 4/31 (13%) Improved: Dyspareunia improved: 19/23 (83%)
[17], comparative retrospective, USA	95	B	Mean 8 months	Porcine dermal xenograft graft (Pelvicol)	Improved: Mean Ap: 0.5 ± 1.5 ➔ −2.8 ± 0.4, $p < 0.05$ Mean Bp: 0.9 ± 2.0 ➔ −2.8 ± 0.5, $p < 0.05$	Improved: Constipation: 51% ➔ 20%, $p < 0.05$	Incision dehiscence: 12% No change: Dyspareunia: 9/37 (24.3%) ➔ 13/37 (35.1%), $p = 0.34$
[17], comparative retrospective, USA	100	B	Mean 13.8 months	Human dermal allograft	Improved: Mean Ap: 0.3 ± 1.7 ➔ −2.6 ± 0.8, $p < 0.05$ Mean Bp: 1.0 ± 2.1 ➔ −2.6 ± 0.9, $p < 0.05$	Improved: Constipation: 68% ➔ 20%, $p < 0.05$	Incision dehiscence: 5.3% No change: Dyspareunia: 17/31 (54.8%) ➔ 13/31 (41.9%), $p = 0.42$
[18], single-arm prospective, Turkey	83	B	Median 14 months, (range, 6–36)	Polyglycolic acid mesh (Soft PGA Felt)	Improved: Posterior POP-Q stage ≥2: 83/83 ➔ 9/83 (10.8%) ➔	Improved: Watson scores (Bulge): 2.3 ± 0.67 ➔ 0.28 ± 0.55, $p = 0.0001$ Vaginal/perineal digitation: 2.62 ± 0.62 ➔ 0.12 ± 0.38, $p = 0.0001$ Straining: 2.54 ± 0.59 ➔ 0.68 ± 0.68, $p = 0.0001$ Incomplete evacuation: 2.43 ± 0.85 ➔ 0.55 ± 0.65, $p = 0.0001$	Mesh erosion: 0% Hemorrhage: 3/83 (3.6%); Wound infection: 4/83 (4.8%)
[22], single arm retrospective, USA	73	C	Mean 13.7 months (range 6-23)	Cadaveric fascia lata graft	Improved: Posterior vaginal wall prolapse grade ≥ 2: 70/73 (96%) ➔ 3/73 (6%)	Improved: Stool trapping: 53/62 (85.5%) ➔ 9/62 (14.5%) Vaginal splinting: 38/62 (61.3) ➔ 4/62 (6.4%)	Improved: Dyspareunia: 14/39 (35.9) ➔ 9/39 (23.1%)
[19], single arm prospective, Sweden	29	C	Mean 12.2 months (range 10–14)	Collagen graft	Improved: Posterior POP-Q stage ≥2: 29/29 (100%) ➔ 7/29 (24%), $p < 0.001$ Rectocele on defecography: 29/29 (100%) ➔ 15/29 (52%)	Improved: Rectal emptying difficulties: 23/29 (79%) ➔ 13/29 (45%), $p < 0.01$ Incomplete rectal evacuation: 29/29 (100%) ➔ 16/29 (55%), $p < 0.01$ No change: Splinting: 9/29 (31%) ➔ 4/29 (13%) Manual evacuation: 3/29 (10%) ➔ 5/29 (17%)	No change: Dyspareunia: 16/19 (84%) ➔ 13/15 (87%)

Bp points reported in cm

Data reported as before surgery ➔ after surgery

Watson Scoring System: 0 = never/absent, 1 = occasionally/mild, 3 = usually/moderate, 4 = always/severe

BBYSQ-22 Birmingham Bowel and Urinary Symptoms Questionnaire: each question ranges from 1 (never) to 4 (always),

Table 8 Site-specific defect repair

Reference, study design, country	Total number of participants	Study quality	Follow-up duration	Anatomical changes after surgery	Symptom changes after surgery	Adverse events
[25], prospective single group, USA	66	C	12 months	Improved: POP-Q stage by point Ap > −2: 66/66 (100)% ➔ 10/44 (23%)	Improved: Bulge: 55/64 (86%) ➔ 4/39 (10%), $p < 0.0005$ Difficult defecation: 34/64 (53%) ➔ 10/24 (42%), $p < 0.0005$ No change: Constipation: 26/64 (41%) ➔ 12/21 (57%), $p = 0.021$ Manual evacuation: 19/64 (30%) ➔ 7/11 (64%), $p = 0.125$	Dyspareunia: 18/66 (28%) ➔ 11/12 (8%), $p = 0.021$
[29], single-group retrospective, USA	69	C	3–48 months	Improved: Posterior POP-Q stage ≥ stage 2: 54/68 (79%) ➔ 6/43 (14%) Bp: 0.2 ➔ −2.7 Ap: −0.4 ➔ −2.7	Improved: Constipation: 32/68 (47%) ➔ 8/61 (13%) Splinting: 27/68 (40%) ➔ 15/61 (25%) 4% new-onset constipation 7% new-onset splinting	0% de novo dyspareunia 3% new-onset tenesmus
[26], single-group prospective, Denmark	51	C	26.7 months (17-45 months)	Improved: Mean Bp point: 0.04 (−1 to +2) ➔ −2.0 (−3 to 0), $p < 0.001$ Posterior POP-Q ≥ stage 2: 51/51 (100%) ➔ 16/51 (31%), $p = 0.0002$	Improved: Bulge: 51/51 (100%) ➔ 14/51 (27%), $p < 0.0001$ Difficulty emptying the rectum: 30/51 (59%) ➔23/51 (45%), $p = 0.0233$ Constipation: 30/51 (59%) ➔23/51 (45%), $p = 0.0233$	2% de novo dyspareunia
[23], retrospective single group, Australia	137	C	12 months (mean 18 months)	Improved: Posterior POP-Q stage ≥2: 134/137 (98%)➔ 19/137 (14%) Rectocele by imaging (ultrasound): 124/137 (91%) ➔ 27/137 (20%)	Improved: Bulge: 112/137 (82%) ➔ 34/137 (25%) Obstructed defecation (digitation, splinting, or straining): 96/137 (70%) ➔ 47/137 (34%), $p < 0.0001$	No bowel injuries 12/137 (9%) de novo dyspareunia
[28], comparative retrospective, USA	124	C	12 months	Improved: Mean Bp: −0.4 cm ➔ −2.2 cm Baden–Walker second degree: 72/124 (58%) ➔ 41/124 (33%) Baden–Walker third degree: 52/124 (42%) ➔ 14/124 (11%)	Improved: Bulge: 124/124 (100%) ➔ 14/124 (11%) No change: Constipation: 41/124 (33%) ➔ 46/124 (37%)	12/114 (11%) de novo dyspareunia
[24], single-group retrospective, USA	125	C	6–36 months (mean 18 months)	Improved: Baden–Walker past the hymen: 79/125 (63%) ➔ 16/89 (18%)	Improved: Bulge: 27/72 (38%) ➔ 10/72 (14%), $p = 0.0026$ Stooling difficulties: 44/72 (61%) ➔ 32/72 (44%), $p = 0.0052$ Splinting: 17/72 (24%) ➔ 10/72 (14%), $p = 0.0074$ No change: Constipation: 43/72 (60%) ➔ 36/72 (50%), $p = 0.0755$	8% de novo dyspareunia (73% improvement in dyspareunia)
[27], single-group prospective, UK	42	C	18 months	Improved: Stage 2 or greater: 42/42 (100%) ➔ 2/33 (6%)	Improved: Bulge: 33/42 (79%) ➔ 2/26 (8%), $p < 0.01$ Evacuation difficulties: 24/42 (57%) ➔ 9/24 (38%)	0% de novo dyspareunia

Table 9 Traditional posterior colporrhaphy

Reference, study design, country	Total number of participants	Study quality	Follow-up duration	Anatomical changes after surgery	Symptom changes after surgery	Adverse Events
[30], RCT, Finland	30	A	12 months	Improved: Point Ap: −0.1 ➔ −2.8, <0.0001 Rectocele by clinical exam: 15/15 (100%) ➔ 1/15 (7%) Rectocele by defecography: 15/15 (100%) ➔ 1/15 (7%)	Improved: Need to digitally assist rectal emptying: 10/15 (67%) ➔ 1/15 (7%), $p = 0.01$	No de novo post-op dyspareunia No post-op infections
[14], RCT, USA	80	A	12.5 months (range 10.3–38)	Improved: POP-Q stage ≥2: 80/80 (100%) ➔ 6/70 (9%) Ap: 0 (−1 to 3) ➔ −3 (−3 to 1) Bp: 0 (−1 to 5) ➔ −3 (−3 to 1)	Improved: Vaginal bulge: 63/73 (86%) ➔ 4/58 (7%), $p < 0.001$ Straining: 46/71 (65%) ➔18/57 (32%), $p = 0.001$ Splinting: 42/73 (58%) ➔ 9/58 (16%), $p < 0.001$ Incomplete evacuation: 54/71 (76%) ➔ 12/57 (21), $p < 0.002$	EBL: 100 mL (10–500) Rectal injury: 0/80 (0%) Bladder injury: 1/80 (1.3%) Wound infection: 4 (5%) Vaginal stricture or band: 1/70 (1%) Dyspareunia: 4/70 (^%)
[32], prospective single group, Japan	30	C	Median 38 months	Improved: Depth of rectocele (cm): 3.9 ➔ 0.5, <0.0001	Improved: Difficult evacuation: 30/30 (100%) ➔ 21/30 (70%) Splinting: 21/30 (70%) ➔ 6/30 (20%)	Wound infection: 0/30 (0%) Rectovaginal fistula: 0/30 (0%) Rectal injury: 0/30 (0%)
[28], retrospective comparative, USA	307	C	12 months	Improved: Mean Bp: −0.3 cm ➔ −2.7 cm Baden–Walker second degree: 104/183 (57%) ➔ 26/183 (14%) Baden–Walker third degree: 78/183 (43%) ➔ 7/183 (4%)	Improved: Bulge: 183/183 (100%) ➔ 7/124 (6%) No change: Constipation: 55/183 (30%) ➔ 62/183 (34%)	18/168 (11%) de novo dyspareunia
[16], retrospective comparative, USA	124	C	38 months anatomical, 86 months symptom outcomes	Improved: Bp > 0: 53/124 (43%) ➔ 4/124 (3%) Median Bp: −1 (−3, 5) ➔ −3 (−3, 3) Median (range) posterior POP-Q stage: 2 (0,3) ➔ 0 (0,3), $p < 0.01$	Worsened: Splinting: 39/108 (36%) ➔ 42/62 (68%) Constipation: 24/64 (38%) ➔ 20/41 (49%)	No significant difference in dyspareunia
[33], prospective single group, USA	52	C	30 months (24–25)	Improved: Posterior POP-Q stage: 60/60 (100%) ➔ 10/60 (17%)	Improved: Bulge: 59/60 (98%) ➔ 10/60 (17%), $p = 0.0049$ Constipation: 44/60 (73%) ➔ 27/60 (45%) Incomplete emptying: 45/60 (75%) ➔ 20/60 (33%)	Improved: Dyspareunia: 29/60 (48%) ➔ 5/60 (8%)
[34], prospective single group, Brisbane, Australia	38	C	12.5 months	Improved: Rectocele by defecography, mean (SD) depth (cm): 4.3 (0.3) ➔ 1 (0.2), $p < 0.001$	Improved: Bulge: 38/38 (100%) ➔ 2/38 (5%), $p < 0.001$ Obstructed defecation: 38/38 (100%) ➔ 5/38 (13%), $p < 0.001$	Bowel injury: 1/38 (3%) Rectovaginal hematoma: 1/38 (3%) Dyspareunia requiring surgical intervention: 1/38 (3%)

Table 9 (continued)

Reference, study design, country	Total number of participants	Study quality	Follow-up duration	Anatomical changes after surgery	Symptom changes after surgery	Adverse Events
					Digitation: 38/38 (100%) ➔ 6/38 (16%), $p < 0.001$ Straining: 27/38 (71%) ➔ 4/38 (11%), $p < 0.001$ Constipation: 29/38 (76%) ➔ 9/38 (24%), $p < 0.001$	
[35], prospective single group, The Netherlands	239	C	14 months (12–35)	Improved: Posterior POP-Q stage: 160/233 (67%) ➔ 21/208 (11%) Bp mean (SD) cm: 0.5 (1.2) ➔ −2.2 (1.2)	Improved: DDI constipation mean score: 16.8 (20.4) ➔ 12.2 (19.3), $p = 0.002$ DDI obstructed defecation mean score: 17.5 (20.6) ➔ 11.2 (15.1), $p < 0.001$	19% de novo dyspareunia
[36], prospective single group, Switzerland	54	C	Median 22 months	Improved: Posterior POP-Q stage ≥2: 38/38 (100%) ➔ 3/38 (8%) Mean (SD) POP-Q stage: 2.24 (0.43) ➔ 0.45 (0.65), $p < 0.001$	Improved: No bother from bulge: 0/87 (0%) ➔ 28/54 (52%) Obstructed defecation by VAS mean cm (SD): 5.32 (2.6) ➔ 2.01 (2.48), <0.001	5.2% dyspareunia
[38], retrospective single group, UK	60	C	41 months (19–77)	Improved: Baden–Walker stage 3: 38/58 (66%) ➔ 3/58 (5%) Baden–Walker stage 1–3: 58/58 (100%) ➔ 12/58 (21%)	Improved: Bulge: 53/60 (88%) ➔ 19/60 (32%), $p < 0.001$ Digitation to defecate: 18/60 (30%) ➔ 6/60 (10%), $p = 0.003$ Constipation: 24/60 (40%)➔ 22/60 (637%), $p = 0.819$	
[37], retrospective single group, South Africa	123	B	12 months	Improved: Posterior POP-Q stage ≥2: 132/139 (95%) ➔ 14/123 (11%)	Improved: ODS symptoms: 49/123 (35%) ➔ 17/123 (14%)	None reported
[1], prospective single group, USA	43	B	12 weeks	Improved: Bp: 0 (−2, −9) ➔ −3.4 (2.1)	Improved: Constipation: 24/64 (38%) ➔ 22/65 (34%) Worsened: Splinting: 39/108 (36%) ➔ 42/62 (68%)	Worsened: Dyspareunia: 13/51 (25%) ➔ 16/44 (36%)
[31], RCT, Egypt	32	A	6 months	Improved: Rectocele size by defecography: 3.99 cm ➔ 0.94 cm	Improved: Constipation: 24/32 (75%) ➔ 8/32 (25%) Incomplete evacuation: 25/32 (78%) ➔ 8/32 (25%) Digitation: 24/32 (75%) ➔ 8/32 (25%) Straining: 24/32 (75%) ➔ 6/32 (19%)	8/32 post-op dyspareunia No intra-op rectal injury or blood transfusion 3/32 wound infection

DDI Digestive Disease Institute, *VAS* visual analog scale, *ODS* obstructed defecation syndrome

Table 10 Transanal repair

Reference, study design, country	Total number of participants	Study quality	Follow-up duration	Anatomical changes after surgery	Symptom changes after surgery	Adverse events
[30], RCT, Finland	30	A	12 months	Improved: Point Ap: −0.03 ➔ −1.36, <0.0001 Rectocele by clinical exam: 15/15 (100%) ➔ 10/15 (67%), Rectocele by defecography: 15/15 (100%) ➔ 10/15 (67%),	Improved: Need to digitally assist rectal emptying: 10/15 (67%) ➔ 4/15 (27%), $p = 0.02$	1/15 post-op infections No post-op dyspareunia
[31], RCT, Egypt	48	B	6 months	Improved: Rectocele size by defecography: 3.45 cm ➔ 2.08 cm, $p = 0.002$	No changes: Constipation: 12/16 (75%) ➔ 8/16 (50%), $p = 0.125$ Incomplete evacuation: 13/16 (82%) ➔ 9/16 (57%), $p = 0.89$ Digitation: 12/16 (75%) ➔ 8/16 (50%), $p = 0.125$ Straining: 12/16 (75%) ➔ 8/16 (50%), $p = 0.125$	No significant adverse events noted including no wound infections, blood transfusion, rectal injury or de novo dyspareunia
[40], retrospective single group, Italy	30	C	Mean 25.7 months	Improved: Rectocele by defecography: 20/30 (67%) ➔ 9/30 (30%) Rectocele by defecography: % had significant improvement after 3 months	Improved: Incomplete evacuation: 25/30 (83%) ➔ 5/30 (17%), <0.05 Digitation (splinting): 13/30 (43%) ➔ 0/30 (0%), <0.01 No changes: Constipation: 6/30 (20%) ➔ 2/30 (7%), NS	None reported
[39], prospective single group, England	45	B	Median 24 months (range 2–50 months)	Improved: Rectocele by defecography: (% evacuation of contrast) 14% ➔ 9%	Improved: Bulge: 43/45(96%) ➔ 10/45 (22%), $p = 0.001$ Straining: 40/45 (89%) ➔ 16/45 (36%), $p = 0.001$ Incomplete evacuation: 40/45 (89%) ➔ 27/45 (60%), $p = 0.001$ Vaginal digitation: 28/45 (62%) ➔ 6/45 (13%), $p = 0.001$ Perineal digitation: 22/45 (49%) ➔ 10/45 (22%), $p = 0.004$	One wound infection No increase in dyspareunia

Table 11 Stapled transanal rectal resection (STARR)

Reference, study design, country	Total number of participants	Study quality	Follow-up duration	Anatomical changes after surgery	Symptom changes after surgery	Adverse events
[42], single group prospective, China	86	C	12 months	Improved: Rectocele by defecography: 62/64 (97%%) ➔ 22/62 (34%)	Improved: ODS score: 18.17 ± 4.68 ➔ 7.36 ± 3.52, $p < 0.0001$	35% bowel urgency rate in first week, 7% bleeding, no change FI
[41], single group prospective, Egypt	40	C	12 months	Improved: Rectocele by defecography: 90% ➔ 15%, $p < 0.001$	Improved: ODS score: 14.2 ± 9.13 ➔ 2.3 ± 2.9, $p < 0.001$ Constipation: Improved in 90%	10% bowel urgency rate at 3 months, 10% postop minor bleeding, 10% persistent postop pain
[44], single group prospective, Italy	68	B	3–6 months	Improved: Rectocele by defecography: Mean depth 36.0 ± 14.0 mm ➔ 15.4 ± 7.6 mm, $p < 0.0001$	Improved: ODS score: 15.1 ± 2.8 ➔ 5.1 ± 2.9 @ 6 months, $p < 0.0001$ CSS score: 17.0 ± 0.6 ➔ 7.9 ± 0.7 @ 6 months, $p < 0.001$	4% bowel urgency rate at 3 months, 0% at 6 months
[48], single group prospective, Italy	90	B	16.3 months	Improved: Entrapping contrast on defecography: 79/90 (87.8%) ➔ 12/79 (15%)	Improved: CSS score: 13.02 ± 0.04 ➔ 4.52 ± 0.05 @ 12 months, $p < 0.001$	17.8% fecal urgency at 1 month decreased to 1% at 12 months, 4% major bleeding requiring repair, 5.6% postop urinary retention
[49], single group prospective, Egypt	84	C	12 months	Improved: Rectocele by defecography: 83/84 99%) ➔ 0/84 (0%)	Improved: ODS score: 12 ± 4.4 ➔ 3 ± 2.1 94% success rate based on improvement in constipation PAC-QoL Dissatisfaction index: 42.43 ➔ 8.81, $p < 0.00001$	8.3% bowel urgency rate at 1 week, 2.4% dyspareunia, 1.2% rectovaginal fistula requiring surgery
[50], single group retrospective, Italy	123	C	20 months	Improved: Rectocele by defecography: 102/102 (100%) ➔ 31/102 (30%)	Improved: 65% subjective improvement Preoperative ODS symptoms all significantly improved except laxative use, $P < 0.0001$	8% bowel urgency rate at 12 months, 1% dyspareunia, 19% reoperation rate (9% for recurrence)
[43], randomized controlled trial (included as single arm study here) Italy	100 STARR and similar curved stapler (TRANSTAR)	A	36 months	Improved: Rectocele size on defecography: 3.90 ± 0.32 ➔ 2.12 ± 0.52, $p < 0.001$ 4.03 ± 0.29 ➔ 1.93 ± 0.36, $p < 0.001$	Improved: ODS score: 20.60 ± 1.84 ➔ 3.52 ± 1.72, $p < 0.001$ 20.88 ± 1.35 ➔ 3.14 ± 1.63, $p < 0.001$	24% overall fecal urgency rate (higher in STARR), 1% bleeding
[45], single group prospective, France	30	C	5 years	Improved: Rectocele by defecography	Improved: PAC-QoL:	46% bowel urgency rate at 3 months, 3% bleeding

Table 11 (continued)

Reference, study design, country	Total number of participants	Study quality	Follow-up duration	Anatomical changes after surgery	Symptom changes after surgery	Adverse events
					64 ± 20 ➜ 28 ± 27 @ 1 year ➜ 30 ± 21 @ 5 years ODS score: 14.5 ± 4 preop ➜ 6 ± 4.5 postop, $p < 0.001$	
[53], single group prospective, Germany	30	C	3.4 months	Improved: Rectocele by MRI: 30/30 (100%) ➜ 7/30 (26%), $p < 0.001$	Improved: CCS score: 7.8 ± 1 ➜ no significant change	10% bleeding, 13% urgency (resolved by 6 weeks)
[54], single group prospective (only surgical arm included in otherwise randomized controlled trial), France/Italy/UK	59 surgical patients Single-arm STARR included in this analysis	A	12 months	Improved: Rectocele by defecography: 49/53 (92%) ➜ 19/46 (41%)	Improved: ODS score: 16.2 ± 4 ➜ 4.7 ± 5, $p < 0.0001$ 81.5% success rate based on change in ODS score Total PAC-QOL score: 63.9 ± 18.5 ➜ 27.9 ± 25.1, $p < 0.0001$	1% bleeding requiring reoperation
[46], single group retrospective, Germany	51	C	12 months	Improved: Rectocele by defecography: Mean depth 27.1 ± 7.4 mm ➜ 16.5 ± 9.7 mm, $p = 0.00001$	Improved: CCS score: 16.5 ± 4.1 ➜ 7.3 ± 3.7, $p < 0.0001$	11% fecal urgency, 1.9% minor bleeding
[52], single group prospective, Spain	37	B	24 months	Improved: Rectocele by clinical exam and MRI: 34/37 (92%) ➜2/37 (5%)	Improved: Total CSS constipation scale: 12.77 ➜ 4.12, $p < 0.01$	5% recurrence; 24% fecal urgency (all resolved by 6 months); 1 patient reoperated on for bleeding
[55], single group prospective, Italy	33	B	18 months	Improved: Rectocele by defecography: 29/29 (100%) ➜ 9/29 (31%), $p = 0.0012$	Improved: CSS score: 16.24 ± 0.18 ➜ 4.48 ± 0.06, $p < 0.0001$ VAS satisfaction score (median): 4 ➜ 8, $p < 0.0001$	2 patients with fecal urgency, improved in 4–6 months
[51], randomized controlled trial, Italy	50 STAPL vs STARR	B	20 months	Improved: Rectocele by defecography: 25/25 (100%) ➜ 7/25 (28%) STAPL had small residual rectocele	Improved: Constipation	Less postop pain with STARR; 16% fecal urgency in STARR; 1 STARR patient returned to operating room for bleeding; 5% dyspareunia in STAPL
[57], single group retrospective, China	43	C	12 months	Improved: Rectocele by defecography: 43/43 (100%) ➜ 28/43 (65%)	Improved: Wexner constipation scale: 13.56 ± 3.13 ➜ 5.07 ± 3.37, $p < 0.05$	9% fecal urgency, resolved by 3 months; 7% persistent postop pain lasting up to 6 months
[47], single group prospective, China	61	C	15.1 months	Improved: Rectocele by defecography: Depth ≥ 3 cm in 61/61 (100%) ➜ 0/61 (0%)	Improved: ODS score: 18.31 ± 0.91 ➜ 3.10 ± 0.89, $p < 0.01$	21% urinary retention, 3% rectal stenosis

Table 11 (continued)

Reference, study design, country	Total number of participants	Study quality	Follow-up duration	Anatomical changes after surgery	Symptom changes after surgery	Adverse events
[59] single group retrospective, China	30	C	12 months	Improved: Rectocele by defecography: 34.1 ± 0.4 mm ➔ 3.1 ± 0.3, $p = 0.00$	Improved: ODS scale: 32.85 ± 3.62 ➔ 13.05 ± 7.49 @ 1 month postop, $p = 0.00$; no significant differences between 1/3/6/12 months	26.7% fecal urgency, all resolved by 3 months; 16.7% urinary retention; 20% persistent postop pain, timeframe not given

PAC-QOL Patient Assessment of Constipation Quality of Life, *CCS* Constipation Scoring System, *FI* fecal incontinence, *STAPL* stapled transanal prolapsectomy associated with perineal levatorplasty

References

1. Grimes CL, Overholser RH, Xu R, Tan-Kim J, Nager CW, Dyer KY, et al. Measuring the impact of a posterior compartment procedure on symptoms of obstructed defecation and posterior vaginal compartment anatomy. Int Urogynecol J. 2016;27(12):1817–23. https://doi.org/10.1007/s00192-016-3046-0.
2. Ellis CN, Essani R. Treatment of obstructed defecation. Clin Colon Rectal Surg. 2012;25(1):24–33. https://doi.org/10.1055/s-0032-1301756.
3. Bump RC, Mattiasson A, Bø K, et al. The standardization of terminology of female pelvic organ prolapse and pelvic floor dysfunction. Am J Obstet Gynecol. 1996;175:10.
4. Baden WF, Walker TA, Lindsey JH. The vaginal profile. Tex Med. 1968;64:56.
5. Altomare DF, Spazzafumo L, Rinaldi M, Dodi G, Ghiselli R, Piloni V. Set-up and statistical validation of a new scoring system for obstructed defaecation syndrome. Colorectal Dis. 2008;10:84–8. https://doi.org/10.1111/j.1463-1318.2007.01262.x.
6. Barber MD, Walters M, Bump RC. Short forms of two condition-specific quality-of-life questionnaires for women with pelvic floor disorders (PFDI-20 and PFIQ-7). Am J Obstet Gynecol. 2005;193(1):103–13.
7. Wallace BC, Small K, Brodley CE, Lau J, Trikalinos TA. Deploying an interactive machine learning system in an evidence-based practice center: abstrackr. In: Proceedings of the ACM International Health Informatics Symposium (IHI). New York: Association for Computing Machinery; 2012. p. 819–24.
8. Higgins JPT, Altman DG. Assessing risk of bias in included studies. In: Higgins JPT, Green S, editors. Cochrane handbook for systematic reviews of interventions. Hoboken: Wiley; 2008.
9. Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Ottawa Hospital Research Institute. www.ohri.ca/programs/clinical_epidemiology/oxford.asp. Accessed 3 May 2016.
10. Schimpf MO, Rahn DD, Wheeler TL, Patel M, White AB, Orejuela FJ, et al. Sling surgery for stress urinary incontinence in women: a systematic review and metaanalysis. Am J Obstet Gynecol. 2014;211(1):71 e71–27. https://doi.org/10.1016/j.ajog.2014.01.030.
11. Atkins D, Best D, Briss PA, Eccles M, Falck-Ytter Y, Flottorp S, et al. Grading quality of evidence and strength of recommendations. Br Med J. 2004;328:1490–4.
12. Ramanah R, Ballester M, Chereau E, Bui C, Rouzier R, Darai E. Anorectal symptoms before and after laparoscopic sacrocolpoperineopexy for pelvic organ prolapse. Int Urogynecol J. 2012;23(6):779–83. https://doi.org/10.1007/s00192-011-1657-z.
13. Barber MD, Kuchibhatla M, Pieper CF, Bump RC. Psychometric evaluation of 2 comprehensive condition-specific quality of life instruments for women with pelvic floor disorders. Am J Obstet Gynecol. 2001;185:1388–95.
14. Sung VW, Rardin CR, Raker CA, Lasala CA, Myers DL. Porcine subintestinal submucosal graft augmentation for rectocele repair: a randomized controlled trial. Obstet Gynecol. 2012;119(1):125–33. https://doi.org/10.1097/AOG.0b013e31823d407e.
15. Ellis CN. Outcomes after the repair of rectoceles with transperineal insertion of a bioprosthetic graft. Dis Colon Rectum. 2010;53(2):213–8. https://doi.org/10.1007/DCR.0b013e3181c8e549.
16. Grimes CL, Tan-Kim J, Whitcomb EL, Lukacz ES, Menefee SA. Long-term outcomes after native tissue vs. biological graft-augmented repair in the posterior compartment. Int Urogynecol J. 2012;23(5):597–604. https://doi.org/10.1007/s00192-011-1607-9.
17. Biehl RC, Moore R, Miklos JR, Kohli N, Anand IS, Mattox TF. Site-specific rectocele repair with dermal graft augmentation:

comparison of porcine dermal xenograft (Pelvicol) and human dermal allograft. Surg Technol Int. 2008;XVII:174–80.
18. Leventoglu S, Mentes BB, Akin M, Karen M, Karamercan A, Oguz M. Transperineal rectocele repair with polyglycolic acid mesh: a case series. Dis Colon Rectum. 2007;50(12):2085–92. https://doi.org/10.1007/s10350-007-9067-5. discussion 2092-2085.
19. Altman D, Zetterstrom J, Lopez A, Anzen B, Falconer C, Hjern F, et al. Functional and anatomic outcome after transvaginal rectocele repair using collagen mesh: a prospective study. Dis Colon Rectum. 2005;48(6):1233–41. https://doi.org/10.1007/s10350-005-0023-y. discussion 1241-1232; author reply 1242.
20. Milani R, Salvatore S, Soligo M, Pifarotti P, Meschia M, Cortese M. Functional and anatomical outcome of anterior and posterior vaginal prolapse repair with prolene mesh. BJOG. 2005;112:107–11.
21. Lim YN, Rane A, Muller R. An ambispective observational study in the safety and efficacy of posterior colporrhaphy with composite Vicryl-Prolene mesh. Int Urogynecol J Pelvic Floor Dysfunct. 2005;16(2):126–31. https://doi.org/10.1007/s00192-004-1236-7. discussion 131.
22. Kobashi KC, Leach GE, Frederick R, Kuznetsov DD, Hsiao KC. Initial experience with rectocele repair using nonfrozen cadaveric fascia lata interposition. Urology. 2005;66(6):1203–7. https://doi.org/10.1016/j.urology.2005.06.130. discussion 1207-1208.
23. Guzman Rojas R, Kamisan Atan I, Shek KL, Dietz HP. Defect-specific rectocele repair: medium-term anatomical, functional and subjective outcomes. Aust N Z J Obstet Gynaecol. 2015;55(5):487–92. https://doi.org/10.1111/ajo.12347.
24. Porter WE, Steele A, Walsh P, Kohli N, Karram MM. The anatomic and functional outcomes of defect-specific rectocele repairs. Am J Obstet Gynecol. 1999;181:1353–9.
25. Kenton K, Sholt S, Brubaker L. Outcome after rectovaginal fascia reattachment for rectocele repair. Am J Obstet Gynecol. 1999;181:1360–4.
26. Sardeli C, Axelsen SM, Kjaer D, Bek KM. Outcome of site-specific fascia repair for rectocele. Acta Obstet Gynecol Scand. 2007;86(8):973–7. https://doi.org/10.1080/00016340701444905.
27. Singh K, Cortes E, Reid WMM. Evaluation of the fascial technique for surgical repair of isolated posterior vaginal wall prolapse. Obstet Gynecol. 2003;101(2):320–4.
28. Abramov Y, Gandhi S, Goldberg RP, Botros SM, Kwon C, Sand PK. Site-specific rectocele repair compared with standard posterior colporrhaphy. Obstet Gynecol. 2005;105(2):314–8. https://doi.org/10.1097/01.AOG.0000151990.08019.30.
29. Cundiff GW, Weidner A, Visco AG, Addison WL, Bump RC. An anatomic and functional assessment of the discrete defect rectocele repair. Am J Obstet Gynecol. 1998;179:1451–7.
30. Nieminen K, Hiltunen K-M, Laitinen J, Oksala J, Heinonen PK. Transanal or vaginal approach to rectocele repair: a prospective, randomized pilot study. Dis Colon Rectum. 2004;47(10):1636–42. https://doi.org/10.1007/s10350-004-0656-2.
31. Farid M, Madbouly KM, Hussein A, Mahdy T, Moneim HA, Omar W. Randomized controlled trial between perineal and anal repairs of rectocele in obstructed defecation. World J Surg. 2010;34(4):822–9. https://doi.org/10.1007/s00268-010-0390-y.
32. Yamana T, Takahashi T, Iwadare J. Clinical and physiologic outcomes after transvaginal rectocele repair. Dis Colon Rectum. 2006;49(5):661–7. https://doi.org/10.1007/s10350-006-0502-9.
33. Kuhn A, Gelman W, O'Sullivan S, Monga A. The feasibility, efficacy and functional outcome of local anaesthetic repair of anterior and posterior vaginal wall prolapse. Eur J Obstet Gynecol Reprod Biol. 2006;124(1):88–92. https://doi.org/10.1016/j.ejogrb.2005.06.009.
34. Maher CF, Qatawneh AM, Baessler K, Schluter PJ. Midline rectovaginal fascial plication for repair of rectocele and obstructed defecation. Obstet Gynecol. 2004;104(4):685–9. https://doi.org/10.1097/01.AOG.0000139833.48063.03.
35. Milani AL, Withagen MI, Schweitzer KJ, Janszen EW, Vierhout ME. Midline fascial plication under continuous digital transrectal control: which factors determine anatomic outcome? Int Urogynecol J. 2010;21(6):623–30. https://doi.org/10.1007/s00192-010-1097-1.
36. Schmidlin-Enderli K, Schuessler B. A new rectovaginal fascial plication technique for treatment of rectocele with obstructed defecation: a proof of concept study. Int Urogynecol J. 2013;24(4):613–9. https://doi.org/10.1007/s00192-012-1911-z.
37. Henn EW, Cronje HS. Rectocele plication: description of a novel surgical technique and review of clinical results. Int Urogynecol J. 2018;29(11):1655–60. https://doi.org/10.1007/s00192-018-3623-5.
38. Robinson D, Wadsworth S, Cardozo L, Bidmead J, Balmforth J. Fascial posterior colpoperineorrhaphy. J Pelvic Med Surg. 2003;9(6):279–83. https://doi.org/10.1097/01.spv.0000103950.44439.be.
39. Heriot AG, Skull A, Kumar D. Functional and physiological outcome following transanal repair of rectocele. Br J Surg. 2004;91(10):1340–4. https://doi.org/10.1002/bjs.4543.
40. Boccasanta P, Venturi M, Cioffi U, De Simone M, Strinna M, Salamina G, et al. Selection criteria and long-term results of surgery in symptomatic rectocele. Minerva Chir. 2002;57:157–63.
41. Hasan HM, Hasan HM. Stapled transanal rectal resection for the surgical treatment of obstructed defecation syndrome associated with rectocele and rectal intussusception. ISRN Surg. 2012;2012:652345. https://doi.org/10.5402/2012/652345.
42. Ding JH, Zhang B, Bi LX, Yin SH, Zhao K. Functional and morphologic outcome after stapled transanal rectal resection for obstructed defecation syndrome. Dis Colon Rectum. 2011;54(4):418–24. https://doi.org/10.1007/DCR.0b013e3182061c81.
43. Boccasanta P, Venturi M, Roviaro G. What is the benefit of a new stapler device in the surgical treatment of obstructed defecation? Three-year outcomes from a randomized controlled trial. Dis Colon Rectum. 2011;54(1):77–84. https://doi.org/10.1007/DCR.0b013e3181e8aa73.
44. Renzi A, Izzo D, Di Sarno G, Izzo G, Di Martino N. Stapled transanal rectal resection to treat obstructed defecation caused by rectal intussusception and rectocele. Int J Colorectal Dis. 2006;21(7):661–7. https://doi.org/10.1007/s00384-005-0066-5.
45. Meurette G, Wong M, Frampas E, Regenet N, Lehur PA. Anatomical and functional results after stapled transanal rectal resection (STARR) for obstructed defaecation syndrome. Colorectal Dis. 2011;13(1):e6–11. https://doi.org/10.1111/j.1463-1318.2010.02415.x.
46. Boenicke L, Jayne DG, Kim M, Reibetanz J, Bolte R, Kenn W, et al. What happens in stapled transanal rectum resection? Dis Colon Rectum. 2011;54(5):593–600. https://doi.org/10.1007/DCR.0b013e318207ecad.
47. Zhang ZG, Yang G, Pan D, Liang CH. Efficacy of endoscopic stapled transanal rectal resection of the treatment of rectocele. Eur Rev Med Pharmacol Sci. 2014;18:3921–6.
48. Boccasanta P, Venturi M, Stuto A, Bottini C, Caviglia A, Carriero A, et al. Stapled transanal rectal resection for outlet obstruction: a prospective, multicenter trial. Dis Colon Rectum. 2004;47(8):1285–97. https://doi.org/10.1007/s10350-004-0582-3.
49. Shafik AA, El Sibai O, Shafik IA. Rectocele repair with stapled transvaginal rectal resection. Tech Coloproctol. 2016;20(4):207–14. https://doi.org/10.1007/s10151-015-1410-6.
50. Gagliardi G, Pescatori M, Altomare DF, Binda GA, Bottini C, Dodi G, et al. Results, outcome predictors, and complications after stapled transanal rectal resection for obstructed defecation. Dis Colon Rectum. 2008;51(2):186–95. https://doi.org/10.1007/s10350-007-9096-0.
51. Boccasanta P, Venturi M, Salamina G, Cesana BM, Bernasconi F, Roviaro G. New trends in the surgical treatment of outlet obstruction: clinical and functional results of two novel transanal stapled

techniques from a randomised controlled trial. Int J Colorectal Dis. 2004;19(4):359–69. https://doi.org/10.1007/s00384-003-0572-2.
52. Arroyo A, Perez-Vicente F, Serrano P, Sanchez A, Miranda E, Navarro JM, et al. Evaluation of the stapled transanal rectal resection technique with two staplers in the treatment of obstructive defecation syndrome. J Am Coll Surg. 2007;204(1):56–63. https://doi.org/10.1016/j.jamcollsurg.2006.09.017.
53. Schwandner T, Hecker A, Hirschburger M, Hecker M, Kierer W, Padberg W. Does the STARR procedure change the pelvic floor: a preoperative and postoperative study with dynamic pelvic floor MRI. Dis Colon Rectum. 2011;54(4):412–7. https://doi.org/10.1007/DCR.0b013e318205ddda.
54. Lehur PA, Stuto A, Fantoli M, Villani RD, Queralto M, Lazorthes F, et al. Outcomes of stapled transanal rectal resection vs. biofeedback for the treatment of outlet obstruction associated with rectal intussusception and rectocele: a multicenter, randomized, controlled trial. Dis Colon Rectum. 2008;51(11):1611–8. https://doi.org/10.1007/s10350-008-9378-1.
55. Reboa G, Gipponi M, Ligorio M, Marino P, Lantieri F. The impact of stapled transanal rectal resection on anorectal function in patients with obstructed defecation syndrome. Dis Colon Rectum. 2009;52(9):1598–604. https://doi.org/10.1007/DCR.0b013e3181a74111.
56. Leal VM, Regadas FS, Regadas SM, Veras LR. Clinical and functional evaluation of patients with rectocele and mucosal prolapse treated with transanal repair of rectocele and rectal mucosectomy with a single circular stapler (TRREMS). Tech Coloproctol. 2010;14(4):329–35. https://doi.org/10.1007/s10151-010-0649-1.
57. Jiang C, Ding Z, Wang M, Yang G, Situ G, Wu Y, et al. A transanal procedure using an endoscopic linear stapler for obstructed defecation syndrome: the first Chinese experience. Tech Coloproctol. 2012;16(1):21–7. https://doi.org/10.1007/s10151-011-0789-y.
58. Slim K, Mezoughi S, Launay-Savary MV, Tuech JJ, Michot F, Sielezneff I, et al. Traitement de la rectocèle par résection rectale transanale à la pince mécanique: résultats à moyen terme d'une étude multicentrique en France. J Chir. 2008;145:27–31.
59. Chen L, Meng F, Zhang T, Liu Y, Sha S. Modified stapled transanal rectal resection combined with perioperative pelvic floor biofeedback therapy in the treatment of obstructed defecation syndrome. Chin J Gastrointes Surg. 2017;20(5):514-518.
60. Sung VW, Rogers R, Schaffer JI, Balk EM, Uhlig K, Lau J, et al. Graft use in transvaginal pelvic organ prolapse repair: a systematic review. Obstet Gynecol. 2008;112(5):1131–42.
61. Murphy M; Society of Gynecologic Surgeons Systematic Review Group. Clinical practice guidelines on vaginal graft use from the Society of Gynecologic Surgeons. Obstet Gynecol. 2008;112(5):1123–30.
62. Abed H, Rahn D, Lowenstein L, Balk EM, Clemons JL, Rogers RG, et al. Incidence and management of graft erosion, wound granulation, and dyspareunia following vaginal prolapse repair with graft materials: a systematic review. Int Urogynecol J. 2011;22(7):789–98.
63. Guttadauro A, Chiarelli M, Maternini M, Baini M, Pecora N, Gabrielli F. Value and limits of stapled transanal rectal repair for obstructed defecation syndrome: 10 years experience with 450 cases. Asian J Surg. 2017;41:573–7.