

# The use of bowel in gender-affirming vaginoplasty

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## Introduction

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### History

Despite significant modifications in techniques for feminizing genital gender affirmation surgery in recent decades, the fundamental surgical techniques were developed over a half century ago. The techniques for the creation of the vaginal canal first developed for the treatment of congenital vaginal agenesis have since played an important role in the treatment of Cis gender patients with Mayer–Rokitansky–Kuster–Hauser (MRKH) syndrome. For patients with MRKH, nonoperative techniques, such as serial dilation, typically offer inadequate depth results. However, use of the bowel for the neovagina in this cis-gender population has allowed a near normal appearance with excellent depth and a good blood supply [1].

The use of the bowel for vaginoplasties originated earlier than the peritoneal flap and penile inversion techniques (see Table 17.1). The first peritoneal flap in cisgender women was first done in 1912 by Dmitry Oskarovich Ott, though Davydov became the namesake of the present-day procedure [2]. Approximately 40 years later in 1952, Harold Delf Gillies first described the penile inversion vaginoplasty for transgender patients [3]. The bowel vaginoplasty originated earlier in 1892, when the Russian surgeon Sneguireff used the rectum for a neovaginal reconstruction in the treatment of vaginal agenesis [4]. Then, in 1904, Baldwin

TABLE 17.1 History of bowel vaginoplasty.

Date	Surgeon	Type of vaginoplasty	Cis/Transgender women
1892	Sneguireff	Rectum	Cisgender
1904	Baldwin	Ileum (cisgender women)	Cisgender
1911	Wallace	Sigmoid	Cisgender
1912	Oskarovich	Peritoneal flap	Cisgender
1952	Delf Gillies	Penile inversion	Cisgender
1974	Markland and Hastings	Cecum and sigmoid	Transgender

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used an isolated loop of the ileum in the treatment of congenital vaginal absence but also suggested that the sigmoid could be used. It then took only 7 years for Wallace to report the successful use of sigmoid colon in vaginal construction in 1911 [1]. These techniques have now been translated to genital surgery for the transgender population. The first mention of the creation of the neovagina with bowel segment in transwomen is in 1974 by Markland and Hastings who used the cecum and a part of the sigmoid in a neovaginal reconstruction [5]. Recently, the use of bowel segments has become increasingly important for the transgender population.

In addition to the type of bowel used, a variety of approaches have been described to harvest the bowel segment, including open as well as minimally invasive laparoscopic and robotic techniques.

### Potential benefits of bowel in the gender-affirming vaginoplasty

Theoretically, the neovagina should be supple, carry low surgical risk, use easily available tissue, self-lubricate with sexual arousal, maintain adequate depth for sexual intercourse without the need for dilation, and carry minimal long-term risks [6].

No feminizing vaginoplasty fulfills all of these criteria, and patients must decide in consultation with their surgeon what option suits their needs best. Alternatives to bowel vaginoplasty include minimal depth vaginoplasty, or vulvoplasty, penile inversion vaginoplasty with free graft, and peritoneal flap vaginoplasty. There are several drawbacks to a penile inversion: risk of recurrent vaginal infections, lack of lubrication necessitating use of exogenous lubrication with dilations or penetrative vaginal intercourse, development of granulation tissue within the canal, and the need for lifetime maintenance dilations. In patients with genital hypoplasia, tissue may be inadequate for penile inversion vaginoplasty to achieve adequate depth. Although peritoneal flap vaginoplasty may be useful in a subset of these patients, there may still not be adequate tissue for all patients. Intestinal vaginoplasty techniques can result in the greatest depth of the vaginal canal for these patients.

Table 17.2 shows the mean vaginal canal depths for three vaginoplasty techniques. Meta-analysis from Bustos et al. reported the mean vaginal depth for standard penile inversion vaginoplasty as 9.4 cm (7.9–10.9 cm), and all types of intestinal vaginoplasties 15.3 cm

TABLE 17.2 Mean vaginal canal depth for three techniques.

Technique	Mean vaginal depth
Penile inversion vaginoplasty [7]	9.4 cm (7.9–10.9 cm)
Bowel vaginoplasty [7]	15.3 cm (13.8–16.7 cm)
Robotic-assisted peritoneal flap vaginoplasty [8]	13.9 cm (13.6–14.1 cm)

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(13.8–16.7 cm) [7]. Mean depth for robotic-assisted peritoneal flap vaginoplasty in Dy et al. was 13.9 cm (13.6–14.1 cm) [8].

Bowel vaginoplasty offers abundant native tissue allowing for the attainment of adequate depth and width regardless of the amount of scrotal skin and can provide a more natural vagina-like mucosa with enough self-lubrication to preclude the need for exogenous lubricants.

When executed correctly, bowel vaginoplasty maintains its vascularity, theoretically reducing the risk of vaginal stenosis and potentially also permitting larger vaginal depths to be created. Accordingly, in a study of 12 patients undergoing sigmoid vaginoplasty, the average depth of the newly created vagina was approximately  $13.9 \pm 2.0$  cm with 67% having no complications, and all of these patients retained tissue suitable for engaging in sexual activity [9]. Thus, bowel vaginoplasties are suitable when there is not enough skin for a graft to create a vagina with sufficient depth and width, especially if patients have genital hypoplasia from prepubertal androgen suppression [4].

Anecdotally in our practice, we have found that patients undergoing revision or primary sigmoid vaginoplasty can dilate as needed after the first 6–12 months postsurgery, whereas patients undergoing penile inversion vaginoplasty necessitate lifelong dilation.

The common risks in the use of the colon for the vaginal lining include unwanted mucus production, odor, introital stenosis, and diversion neovaginitis [6]. Additionally, chronic inflammation of the neovaginal segment could theoretically pose a long-term risk of cancer; however, there are only isolated case reports on this topic. Thus, long-term follow-up is necessary for risk stratification. Patients should be counseled on these risks when considering intestinal vaginoplasty for secondary operations following primary procedures or as a primary operation. Many believe that sigmoid vaginoplasties come with many gastrointestinal complications, but these complications occur less than previously thought, despite the more invasive nature of the procedure [9]. This could be attributed to the fact that only a 12–15 cm segment of the large intestine is typically harvested.

## Contraindications

Extensive medical history must be obtained prior to surgery. There are several contraindications to intestinal vaginoplasty. Patients with inflammatory bowel diseases, hereditary colon cancer syndromes, extensive history of intraabdominal surgery or trauma, or history of pelvic radiation are not candidates for intestinal vaginoplasty. Patients with short gut

syndrome or a history of small bowel resection should not be offered ileal vaginoplasty as this can exacerbate nutritional and metabolic abnormalities.

### Preoperative preparations

The first preoperative consideration is obtaining medical and psychiatric clearance as per WPATH guidelines.

Then, in the setting of revision surgery, a vaginoscopy is recommended to evaluate the extent of vaginal stenosis and assess for any possible fistulae.

In addition, a colonoscopy is recommended for all bowel vaginoplasty candidates over the age of 50 as part of standard recommended cancer screening guidelines prior to surgery date. Abnormal findings may preclude the use of a bowel segment for vaginoplasty.

Mechanical bowel preparation the day before surgery is encouraged and can vary depending on surgeon preference. The use of mechanical bowel preparation is not mandatory for small bowel diversions; however, it may aid in the dissection of the vaginal canal. At our institution, we instruct patients to obtain an 8.3 oz bottle of polyethylene glycol, to be mixed with a 64 oz sports drink such as Gatorade, and begin drinking 8 oz every 15–30 min, starting 16 h before scheduled surgery time. Oral antibiotics are typically not given as part of the bowel preparation.

### Perioperative considerations

Our preference has been the sigmoid colon harvested robotically for the creation of the neovaginal canal. At the time of induction, patients are given 5000U of subcutaneous heparin as prophylaxis given the high risk nature of a long surgery with the patient in a steep Trendelenburg dorsal lithotomy position.

When performing any type of colorectal surgery, antibiotic prophylaxis should include coverage of enteric gram-negative bacilli, enterococci, anaerobes, and *Staphylococcus aureus* and should be administered 30 min prior to incision. At our institution, we administer IV cefazolin and metronidazole, unless contraindicated.

## Surgical technique

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### Primary versus secondary bowel vaginoplasty

Bowel for creation of the vaginal canal in transgender patients has been used as a revision procedure for vaginal or introital stenosis as well as a primary vaginoplasty surgery. In primary vaginoplasty cases, penile disassembly with penectomy, orchiectomy, urethroplasty, and creation of the vulva is performed in the standard penile inversion vaginoplasty technique prior to proceeding with intestinal harvest and creation of the vaginal canal. The inverted phallic skin flap is sutured to the bowel segment either with robot assistance or, if accessible, externally through the perineal incisions.

In revision cases, external genital incisions are generally not necessary unless the patient is undergoing concomitant aesthetic revisions. When performed as a revision or secondary

surgery, remnants of the scarred and fibrotic neovagina should be excised circumferentially to ensure optimal wound edges are prepared prior to anastomosis of the pedicled intestinal flap.

## ***Ileum***

[10] reported that the average depth of the ileal neovagina was 13 cm (range 12.5–14 cm) at the first postoperative visit [10]. However, the use of the ileum for neovaginal canal creation has not been widely adopted for vaginoplasty in gender-affirming surgery. In addition to an absence of significant data on its use, the small intestine may generate a larger amount of mucus production and carry a higher risk of injury with dilations and intercourse (due to the lack of structural resilience compared with the large bowel), and patients may be susceptible to resorptive or metabolic disorders. Historically, this procedure may have been used if the patient had insufficient genital tissue for the creation of vaginal canal lining from penile and scrotal skin alone. However, its use has been described mostly in the revision vaginoplasty setting after loss of vaginal canal depth. For most patients, better options exist with fewer physiological and metabolic complications than the use of the ileum. These alternative options also still offer adequate tissue for depth, and therefore, we generally do not recommend the use of the ileum for the creation of the vaginal canal.

### ***Ileal vaginoplasty: Surgical technique***

A combined perineal and laparoscopic or robotic approach is recommended for both primary and secondary/revision cases to maximize exposure and minimize perforations [11]. The patient should always be positioned in dorsal lithotomy to allow access for both teams to work concomitantly.

In primary cases, the procedure begins with standard penile inversion vaginoplasty techniques, and the intestinal harvest will occur second. In revision cases, vaginal remnant and scar tissue should be excised by the perineal approach first.

When ileal harvesting is performed as open surgery, a Pfannenstiel or median laparotomy incision can be used. If the procedure is performed laparoscopically or robotically, peritoneal access is obtained by insertion of the umbilical trocar and pneumoperitoneum is applied. Subsequently, a right lateral trocar is inserted at the midclavicular line at the level of the umbilicus. The third trocar is placed in the right lower quadrant, lateral to the epigastric vessels.

Once peritoneal access is obtained, the ileal flap is harvested. 20 cm distal to the ileocecal valve, an ileal segment measuring approximately 15–20 cm is chosen for harvest. Vascular integrity of the ileal loop is maintained by using the standard transillumination technique. The segment is then isolated using a linear bowel stapler. Then, bowel continuity is restored in an end-to-end or side-to-side fashion using an intracorporeal approach, manual suturing, or a linear stapler.

The distal portion of the ileal segment is transferred to the neovaginal cavity. The harvested ileal segment can be kept as a single lumen to line the vaginal cavity, or it can be opened on its antimesenteric border and reconfigured into a “U” or “J” shape, then retubularized, if further maximization of the neovaginal lumen is necessary. Once complete, the ileal segment is brought to the perineum or the phallic skin flap, and the ileocutaneous anastomosis is performed in a tension-free manner [12].

## Use of the colon segments

### **Indications**

Colon segments may be considered when penile inversion vaginoplasty or peritoneal flap vaginoplasty is not an option for transwomen with penoscrotal hypoplasia (penile length <8 cm and insufficient scrotal skin for lining the neovagina), or those who have undergone prior penile inversion vaginoplasty or peritoneal flap vaginoplasty, but failed to achieve adequate neovaginal depth. In addition, it may be considered as a primary technique based on patient preferences after discussing the unique risks of this technique. Techniques using both sigmoid and right colon have been described in the literature, and segments harvested range from 12 to 18 cm, depending on the needed depth. Colovaginoplasty, whether using the right colon or sigmoid colon, offers several advantages compared with other techniques.

1. The texture and appearance of the colon resemble a natural vagina.
2. Bowel lumen and natural lubrication provide copious vaginal depth and moisture, which reduces risk of future vaginal stenosis [5].
3. Lifelong vaginal dilation is not necessary, and introital dilation can be replaced with penetrative intercourse.
4. Penetrative intercourse may be aided without external lubrication by the colon's ability to produce mucus.

### **Right colon**

The right colon technique has only been described in the literature in the setting of revision/salvage vaginoplasty cases once the peritoneal flap has been exhausted or is not technically feasible.

Several advantages have been proposed in favor of right colon over sigmoid by Garcia et al. 2020 and can be summarized as follows:

1. When compared with the sigmoid colon (and its varying blood supply from inferior mesenteric artery and sigmoidal arteries), the vasculature of the right colon is more anatomically consistent, with less known variations [6]. The ileocolic artery is the most inferior branch of the SMA (superior mesenteric artery) and is the primary pedicle for the ascending colon. It is known for being a long artery, and its anatomic variation is mostly limited to traveling either anterior or posterior to the superior mesenteric vein [13]. Because of this limited variation, identification and preservation of the pedicle is facilitated. The generous length of the ileocolic artery also allows for easier tension-free translocation of the harvested segment from the right upper quadrant down to the vaginal introitus.
2. Moreover, the use of the right colon may result in a lower risk of anastomotic leak: ileocolic anastomosis (1%–2% leak rate) versus a colorectal anastomosis (5%–7% leak rate).
3. Finally, the location of the ileocolic anastomosis remains in the right upper quadrant versus the colorectal anastomosis being directly proximal and posterior to the neovagina in the left lower quadrant [13–15].

Garcia et al. 2020 described their laparoscopic right colon vaginoplasty technique for revision vaginoplasty on 22 patients. Of these 22 patients, 20 were revision cases after a failed penile inversion vaginoplasty and 2 had prior minimal depth vaginoplasty. In this technique, they utilize four laparoscopic ports, three 5-mm ports, and one 12-mm assistant port.

The procedure begins in the pelvis, where the vaginal remnant and scar tissue are identified and excised circumferentially entirely to prepare for anastomosis. The pelvic surgeon can help with identification of the vagina by placing a dilator into the vaginal canal.

Then, the ascending colon is mobilized by complete lateral dissection along the white line of Toldt up to the hepatic flexure. Proximal to the middle colic artery, the transverse colon is mobilized off the stomach, duodenum, gallbladder, and liver with sharp and blunt dissection as well as ligature. To minimize bulk, the omentum is dissected off the proximal half of the transverse colon. Inferior to the ileocolic vessels, the mesentery to the terminal ileum is divided cautiously so as to not compromise the ileocolic vascular pedicle to the neovagina (the ileocolic artery is preserved, but the right colic artery and the right branch of the middle colic artery must be divided). An appendectomy is also performed at this time. Next, the mesentery of the transverse colon and the left middle colic artery are ligated proximal to the middle colic arterial trunk. The terminal ileum and proximal transverse colon are divided after confirming the harvested segment reaches vaginal introitus without tension (the length of the colonic segment harvested is not specified in the literature and should be tailored to the patient's anatomy). Then, the terminal ileum and distal transverse colon are anastomosed to one another. After harvesting the right colon segment, it is rotated clockwise 180 degrees and the stapled end of the transverse colon is pulled to the vaginal introitus, where a Babcock passed into the vaginal canal will hold it in place. Per Garcia et al. clockwise rotation of the harvested segment allows less kinking and tension of the pedicle [6]. The colon segment is then gently oriented with tinea at 12 o'clock for proper orientation. During this maneuver, care should be taken to avoid excess traction on the pedicle to prevent an avulsion injury (see Fig. 17.1).

### **Left colon (sigmoid)**

The sigmoid is likely the most commonly used intestinal segment in gender-affirming vaginoplasty today. Harvesting of the sigmoid segment can be performed in an open manner or done laparoscopically or with robotic assistance depending on surgeon experience. The proximity of the sigmoid colon to the perineum minimizes the distance needed for mobilization of the intestinal flap into the vaginal canal. Moreover, the diameter of the sigmoid lumen allows for maximal width of the vagina. Its proximity to the perineum allows for excellent vaginal depth regardless of technique. With the laparoscopic technique, [9] reported an average neovagina depth of 13.9 +/- 2.0 cm in 12 patients [9]. In another study, [11] achieved an average neovaginal depth of 14.5 cm (range 12–20 cm) in 14 patients [16]. Accordingly, there is a decreased need for lifelong dilation and vaginal molding.

Compared with the small intestine and skin grafts, the thickness of the sigmoid colon wall seems to withstand trauma more effectively [17]. This thickness can lead to a decreased risk of bleeding and vaginal injury after sexual intercourse [5].

Overall, laparoscopy procedures in this area have shown excellent visibility, fast recovery, favorable cosmetic results, minimal scarring, and reduced hospitalization duration [17]. In

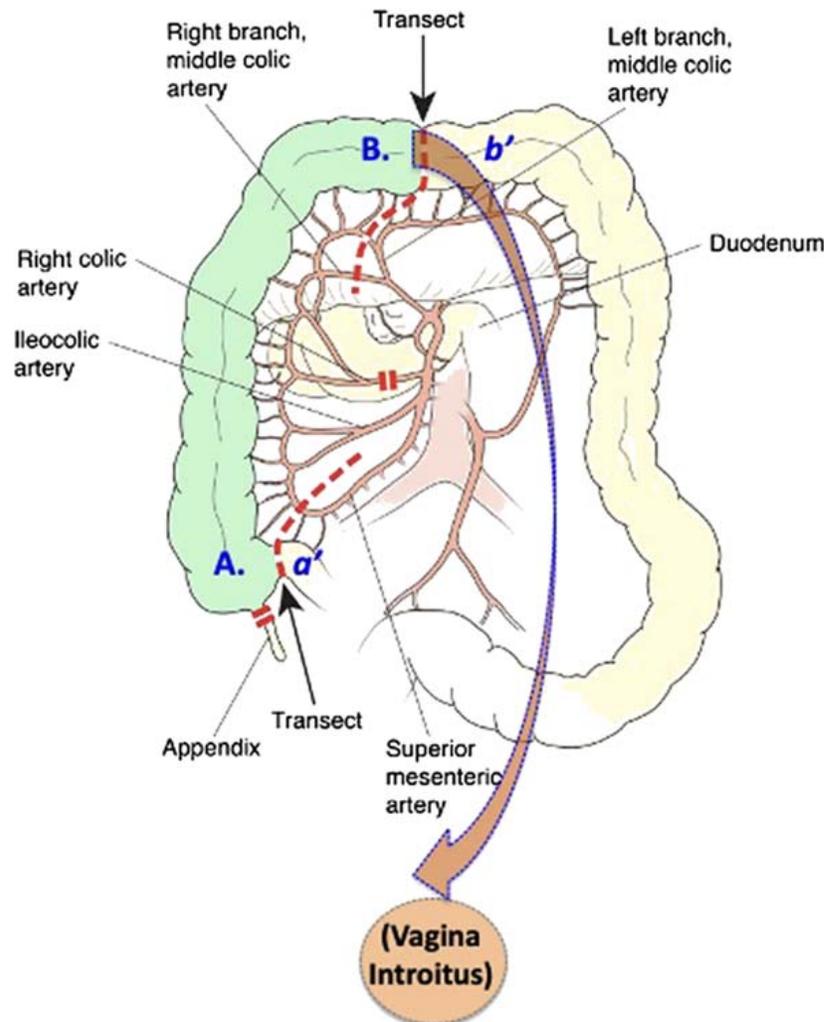


FIGURE 17.1 Vascularity and mobilization of the right colon for vaginoplasty. *Courtesy of Maurice Garcia.*

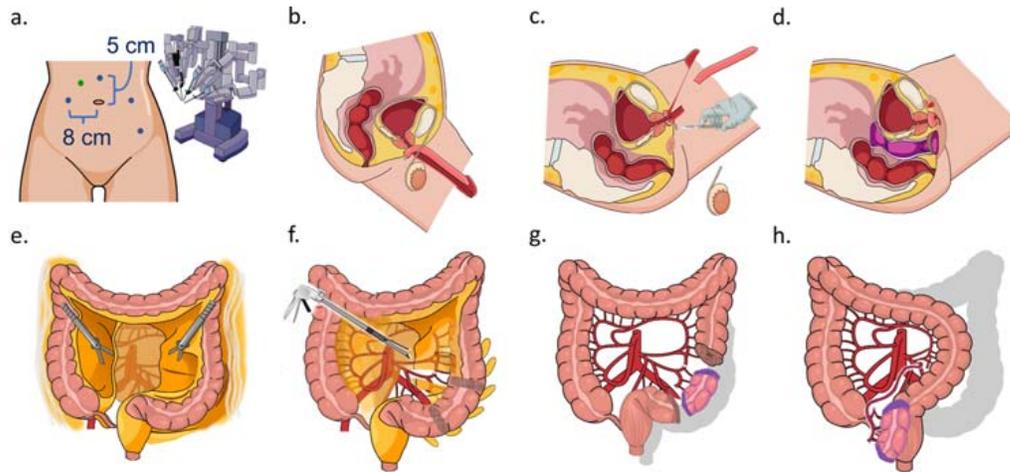
one study, [18] used an open technique using the sigmoid, with which a satisfactory aesthetic result was achieved in 77 out of 86 patients (89%) [18].

Our institution is the first to describe the robotic-assisted sigmoid vaginoplasty (RSV) technique in both primary and in revision cases of vaginoplasty.

### **Robotic Sigmoid Vaginoplasty: Surgical technique**

Fig. 17.2 provides an overview of the steps of the procedure. Patients are positioned in dorsal lithotomy with their arms tucked, which will allow for two teams to work simultaneously, a robotic team and a pelvic reconstructive team.

When performing primary sigmoid vaginoplasty, perineal dissection and penile inversion vaginoplasty are performed by the reconstructive team. After the phallic skin flap has been mobilized, the vaginal canal is dissected, and once Denonvilliers' fascia has been incised



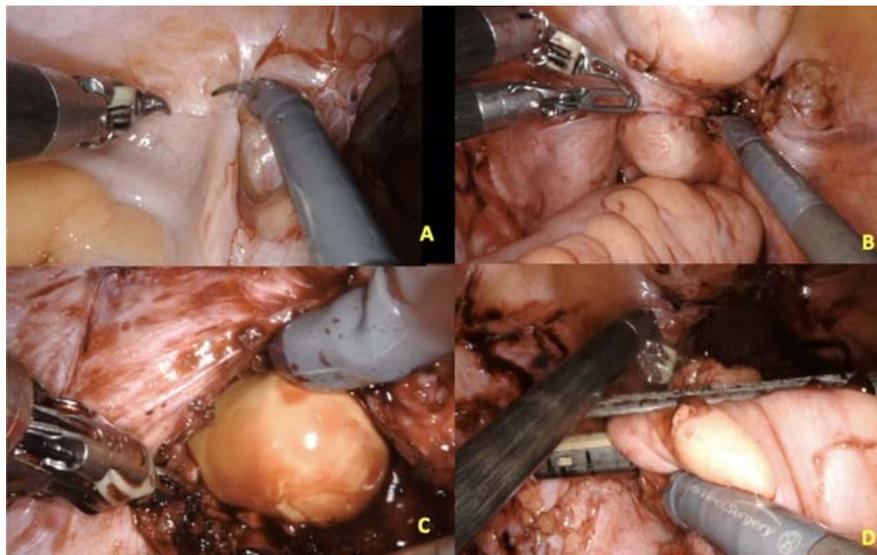
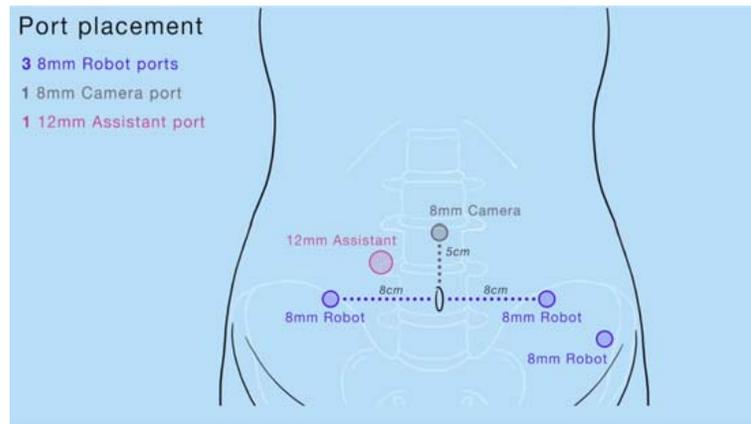
**FIGURE 17.2 Overview of robotic sigmoid vaginoplasty steps.** (a) Trocar placement. Four robotic 8-mm ports (*blue*); the robotic 8-mm camera port is placed 5 cm supraumbilical; 2 8-mm robotic ports should be placed 8 cm lateral to the umbilicus and immediately superior to the anterior superior iliac spine crest. The 12-mm assistant port (*green*) is placed between the camera port and right lateral robotic ports. (b–d) The reconstructive surgeon performs the penile inversion vaginoplasty portion of the procedure with orchiectomy, clitoroplasty, urethroplasty, and vulvoplasty in primary cases; and in revision cases, excises all remnant vaginal scar tissue. (e–h) Robotic sigmoid harvesting is performed by dissecting the mesentery to the root of the IMA, creating a medial pedicle, and bringing the tension-free sigmoid donor segment into the vaginal canal.

from the perineum, then the robotic team begins the bowel harvest. In secondary or revision cases, the reconstructive surgeon begins by excising any scar tissue in the vaginal canal.

The robotic portion of the procedure begins by gaining intraperitoneal access using the Veress needle technique, and an 8-mm robotic camera port is placed 5 cm supraumbilical. The remainder of the ports should be placed under direct camera vision (Fig. 17.3).

Once the robot has been docked, the first step of the procedure is to locate the vaginal remnant or the remnant of the previously dissected canal. This is done by incising the peritoneum in the pouch of Douglas and dissecting distally, just posterior to the seminal vesicles and the prostate until reaching Denonvilliers' fascia. This plane is followed down toward the apex of the prostate. In revision cases, the remnant of the vaginal canal is opened with a vaginal dilator inserted to help with localization of the correct space. The sigmoid is harvested. Dissection begins lateral to medial along the white line of Toldt to mobilize the sigmoid colon all the way to the splenic flexure. The sigmoid must be released from its lateral adhesions and retroperitoneal attachments with careful blunt dissection down to the level of the IMA and medialized. A 60-mm linear bowel stapler is used to transect the distal sigmoid just proximal to the rectum at the area where the mesentery is longest (Fig. 17.4). The mesosigmoid is then opened and transected until it reaches the base of the sigmoid artery. A 15-cm segment of sigmoid for the neovagina is measured, and the proximal segment is stapled with another 60-mm linear bowel stapler. Of note, the sigmoid arteries are more easily identified by a medial approach. Close inspection of the surrounding vasculature is necessary since the sigmoid artery serves as the vascular pedicle for the sigmoid flap. The sigmoid

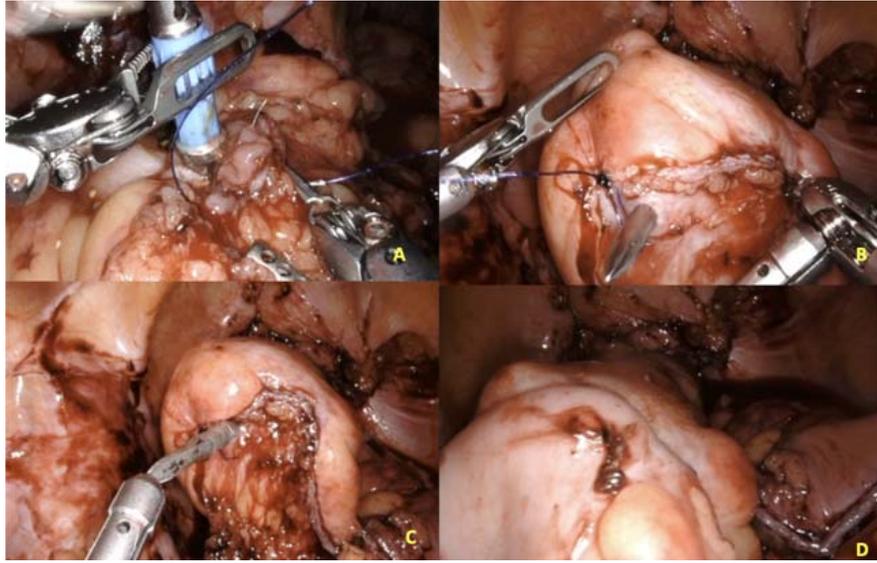
**FIGURE 17.3** Port placement for robotic sigmoid vaginoplasty. Courtesy of Dr. Rajveer Purohit.



**FIGURE 17.4** Robotic sigmoid vaginoplasty. Incision at the line of Toldt (a) to mobilize the colon. Indentation seen between instruments (b) that dilator is pushed through (c). Once vaginal space is created, EndoGIA stapler is used to harvest the sigmoid segment (d).

artery often derives from the IMA, but it can also stem from the left colic artery. Care must be taken not to injure the superior rectal artery.

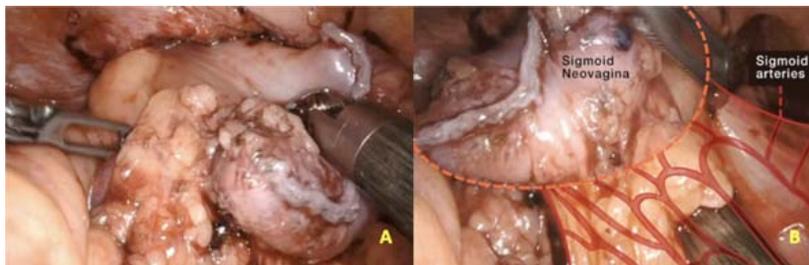
Bowel continuity is then restored using a 28-mm EEA circular stapler brought in from the rectum. Continuity is achieved by first excising the staple line from the proximal sigmoid, and placing the anvil inside to proceed with suturing. We use 4–0 PDS to close the sigmoid around the anvil. The proximal and distal colonic limbs are then easy to bring together and staple. Care must be taken to avoid any crossing of staples with the new staple line from the prior stapling as this can cause faulty anastomosis (Fig. 17.5). After stapling, the presence of



**FIGURE 17.5** Robotic sigmoid vaginoplasty. Bowel continuity is reestablished by suturing the anvil in place proximally (a) and placing EEA trocar through the rectum until trocar fully pierces distal end (b). Anvil and Trocar are connected (c) and bowel continuity is reestablished (d).

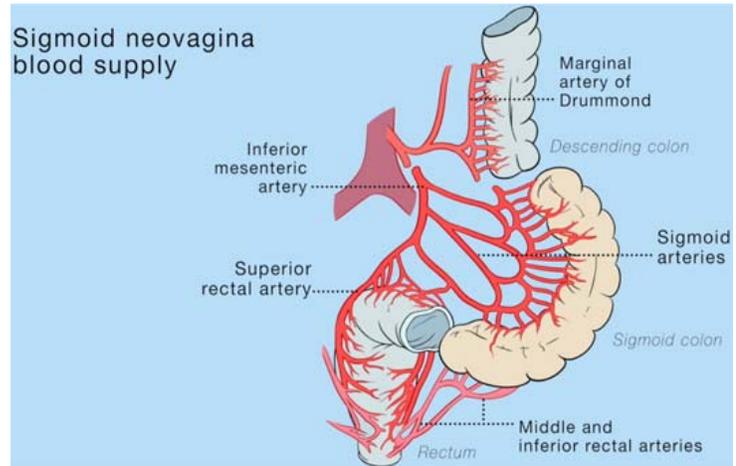
two staple donuts should be confirmed. Once continuity is restored, the harvested sigmoid segment is freed/mobilized and pulled toward the inverted penile skin. If the segment is on tension, the distal sigmoid artery branches can be ligated/sacrificed to allow for more length and mobility of the conduit (Figs. 17.6 and 17.7). Tension-free translocation of the segment into the vaginal canal is crucial, and Indocyanine Green (ICG, firefly mode) can be used to facilitate identification of the preserved vasculature at this time.

Anastomosis between previously dissected fasciocutaneous flaps of penile skin and the harvested sigmoid segment is performed with the robot and done in an interrupted fashion using 4–0 PDS. The neovagina is fixed to the sacrum, preventing postoperative prolapse. The depth and width of the vagina is checked by vaginal dilators. The distal sigmoid staple line is then opened and anastomosed to the vaginal canal remnant or penile skin to create the vaginal canal (Fig. 17.8).

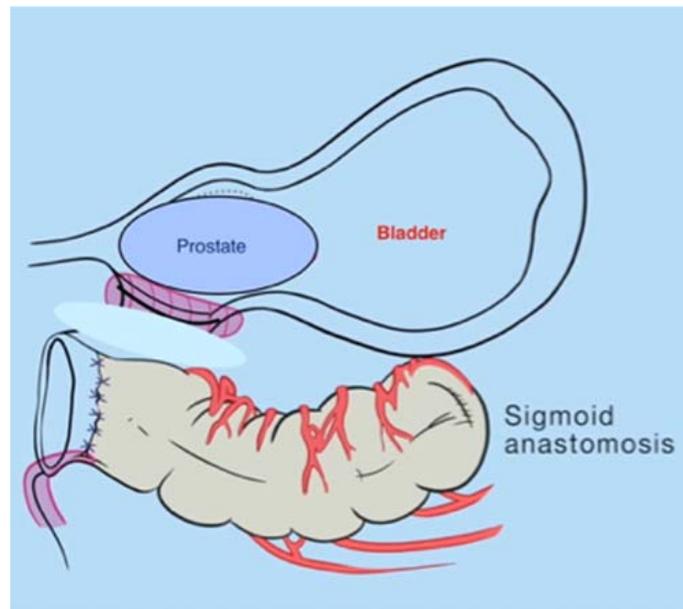


**FIGURE 17.6** Robotic sigmoid vaginoplasty. Sigmoid segment is positioned through the neovaginal space (a) with location of vascularity (b) shown.

**FIGURE 17.7** Vascular supply to the sigmoid segment. *Courtesy of Dr. Rajveer Purohit.*



**FIGURE 17.8** Sigmoid anastomosis. Once sigmoid is harvested, care must be taken to ensure penile skin is then anastomosed to the sigmoid deep to the introitus to maintain optimal cosmesis.



The neovagina can be fixed to the sacral promontory to prevent postoperative neovaginal prolapse if there is concern for this. The integrity of the anastomosis and depth and width of the vagina is confirmed by using vaginal dilators. Once complete, the neovagina is lightly packed with metrogel-soaked vaginal packing just beyond the site of anastomosis to prevent stenosis while healing. For aesthetic reasons, in both revision sigmoid vaginoplasty (Fig. 17.9) and primary sigmoid vaginoplasty (Fig. 17.10) cases, we try to keep the skin anastomosis as deep as possible to minimize the external visibility of colonic mucosa and the appearance of a stoma.



**FIGURE 17.9** Final appearance of revision sigmoid vaginoplasty. *Courtesy of Dr. Rajveer Purohit.*



**FIGURE 17.10** Final external appearance of the primary sigmoid vaginoplasty. *Courtesy of Dr. Rajveer Purohit.*

## Limitations and complications

Surgical procedures involving the intestines and bowel anastomosis carry potential for complications, and intestinal vaginoplasty does have limitations. Complications may include vaginal and introital stenosis, diversion colitis, fistula, excessive mucus production with odor, and rarely cancer affecting the specific portion of the intestine [19].

### Ileum

It was found that the small intestine lacks the necessary width to achieve adequate depth when creating a neovagina (average ileum-derived neovagina depth is 13 cm (range 12.5–14 cm), as mentioned previously—the lower end of the range for intestinal vaginoplasty). Moreover, the process of positioning the small intestine within the pelvic cavity is challenging due to the short length of the mesentery and the considerable distance that needs to be covered. The walls of the small intestine are also relatively fragile, and its delicate mucosal lining is susceptible to damage, which can result in subsequent bleeding [19].

[12] evaluated 32 patients (27 transgender and 5 nontransgender patients) with an ileal vaginoplasty as a primary procedure in 3 patients and a secondary procedure in the remaining 29. In this study, the main complication of ileum-derived vaginoplasty was introital stenosis. Out of the 32 patients, introital stenosis occurred in 4 patients (12.5%) [12]. Additionally, a rectoneovaginal fistula occurred in one patient and required surgical intervention. They reported that revision vaginoplasty procedures may cause increased risks of iatrogenic injuries and subsequent risks of rectoneovaginal fistula formation [12]. An anastomosis leakage or anastomotic stricture are two additional complications that may occur; [12] reported one case of anastomosis leakage and one case of intestinal anastomotic stricture [12].

There is concern around the occurrence of prolapse and diversion colitis when using the ileum [2]. However, no prolapse or diversion colitis was reported by [12]. Additionally, in four studies with a total of 169 patients, both transgender and cisgender patients, [20] reported no prolapse, diversion colitis, or cancer [20].

The vaginal-like mucosa that occurs, however, causes excessive discharge with no malodor Bouman et al. [20]. The ileum's mucosal secretions are more prevalent yet also less lubricating than the sigmoid segment [5]. In a study with 80 transgender and cisgender patients, on average, the patients used about 10–15 sanitary pads every day for the first month Wu et al. [19]. However, this temporary high level of discharge gradually reduced to a manageable level within a period of 2–6 months, without causing significant clinical morbidity [20]. Liguori et al. 2005 closely studied five transgender patients with an ileum-derived neovagina and reported that none reported significant dyspareunia [10].

### Right colon

One study has reported outcomes using the right colon for the vaginal canal in transgender patients. In Garcia et al. 2020, 22 transgender women underwent revision vaginoplasty with the right colon. Two intraoperative complications were reported: one bowel ischemia and one bladder injury [6]. The most common short-term complication (<30 days) was ileus/small

bowel obstruction, which occurred in 3/22 patients (13.6%). No patient experienced an anastomotic leak. 6/22 (27.3%) patients had long-term complications (>30 days): 1 developed Crohn's (not involving neovagina); 1 experienced late small bowel obstruction; 5 had issues with neovagina prolapse (22.7%); 4 developed stenosis (18.2%); 2 faced external obstruction at the recto-vaginal junction; and 3 were diagnosed with diversion neovaginitis (13.6%). [6] A total of 6 of 22 individual patients (27.3%) required postoperative surgery. Diversion neovaginitis was clinically suspected in three patients with mild bleeding/discharge symptoms (mucus production/amount of vaginal discharge was not quantified or assessed) and confirmed on endoscopic biopsy. Diversion neovaginitis was successfully treated with mesal-amine enema in all patients [6].

## Sigmoid

In Bouman et al. [15], 42 transgender patients underwent primary laparoscopic sigmoid vaginoplasty. Only one intraoperative complication occurred, a rectal injury that was primarily repaired [15]. Immediate postoperative complications requiring reoperation occurred in 3/42 patients (6.8%), one of which had an anastomotic leak. Introital stenosis required surgical revision in 6/41 patients (14.6%). One patient had mucosal prolapse [15].

In [11], at the long-term follow-up (median was 23.8 years), after a secondary sigmoid vaginoplasty, one of the most common complications was neovaginal fistula. Three patients developed a neovaginal fistula (13%), requiring secondary surgery [16].

In [20] and [21], the most common complication of sigmoid-derived vaginoplasty was stenosis (8.6% and 8.3%, respectively) [19,21]. Further, in [20], out of 686 sigmoid vaginoplasties in a systematic review of both cisgender and transgender individuals, 27 cases (4.1%) of introital stenosis needed surgical intervention, and dilation solved 30 cases (4.5%) [20]. This stenosis often occurred during the first postoperative year. Prolapse also occurred in 7.7% of sigmoid-derived vaginoplasties, occurring more often than with ileum grafts (7.7% vs. 0%, respectively). Among the cases, 27 instances (6.5%) involved a minor mucosal prolapse, which could be addressed with a straightforward local incision Bouman et al. [20]. In two cases (0.48%), a subsequent neovaginopexy procedure was conducted. In follow-ups ranging from 15.6 months to 12 years, no diversion colitis or cancer was reported [19].

In a study with solely transgender patients, [15] experienced similar long-term postoperative complications requiring surgical correction after  $3.2 \pm 2.1$  years: introital stenosis ( $n = 6$ , 14.6%) and minimal mucosal prolapse ( $n = 1$ , 2.4%) [15].

Neovaginal discharge can be the sole indicator or clinical presentation for various different complications including fistulae, granulation tissue, infections, or malignancy as described in [11,22]. Most individuals' high levels of discharge decreased to an acceptable level within 2–6 months, similarly to the ileum-derived vaginoplasty [20]. However, according to [11], a few patients had excessive neovaginal discharge due to mild diversion neovaginitis ( $n = 2$ , 4.8%)—both were treated with short-chain fatty acid enemas [15].

Kwun Kim et al. [23] reported whether patients experienced any malodor 1 year after their surgery and found that only 3/28 transgender patients (10.7%) complained of malodor [23].

Additionally, [11] examined the long-term risk of diversion neovaginitis. They reported that the most significant endoscopic features were a diminished vascular pattern, edema,

granularity, friability, decreased resilience, and erythema [24]. The endoscopic findings of the neovaginal segment were consistent with inflammatory changes analogous to diversion colitis patients. Excess discharge is vaguely defined in the literature by whether a patient deems it as problematic. Excessive discharge has several possible causes, such as diversion neovaginitis, infection, and fistulas, and so there is a need for a standardized diagnostic and treatment algorithm to best approach analyzing discharge levels [22].

### ***Postoperative care and follow-up***

Vaginal packing and the 16 Fr foley catheter remain in place for 1 week postoperatively until the first follow-up visit. Patients are on bedrest for postoperative day (POD) 0 and then placed on standard ERAS protocol starting POD 1. Our patients are admitted to the hospital for 3–4 days depending on the return of bowel function. In the literature, the average hospital stay for sigmoid vaginoplasty was longer ( $12.5 \pm 9.5$  days) than for an ileum graft (7.1, range 6–12 days) [9,10].

Vaginal packing and urethral foley are removed 1 week postoperatively at first office visit. Dilation education is performed at this first visit. Patients are instructed to begin vaginal dilations three times daily using just the patient's finger to keep the junction between the skin and the intestinal section open. They are provided with a set of vaginal dilators and instructed to begin with the smallest dilator in the set. Patients were discouraged from penetrative sexual activity before the 6 months postoperative time point. Copious water-based lubrication is encouraged on an as-needed basis for easier dilation. Patients with pain on dilation are referred to pelvic floor physical therapy.

Vaginal douche to evacuate the mucus is recommended for a period of 1 month postsurgery if necessary [25].

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## Sexual satisfaction

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### **Ileum**

In terms of sexual activity and sexual satisfaction with **ileum** grafts, patients were able to resume sexual activity 1–2 months after surgery. For ileal vaginoplasty, all patients were sexually active after 6 months Trombetta et al. [26]. Additionally, overall sexual satisfaction is very high in ileum-derived vaginoplasty due to the natural vaginal-like mucosa—100% overall sexual satisfaction was reported by Liguori et al. [10].

### **Right colon**

All (100%) patients reported satisfaction with right colon-derived neovagina function and appearance (mean satisfaction with colon neovagina function was 4.4/5 (SD 0.5), and 4.1/5 (SD 0.87) for appearance of the introitus (5 means very satisfied and 1 means very dissatisfied) [6].

## Sigmoid

Satisfactory sexual activity is a common reason to perform intestinal vaginoplasties, and data suggests sigmoid vaginoplasties offer high sexual satisfaction rates. After a year, [23] reported that 22 transgender patients (78.5%) were sexually active with 19 (86.3%) of those patients experiencing orgasm [23]. The other patients were not having sexual intercourse due to lack of partners. Only one patient experienced pain during intercourse (3.5%), and two patients experienced vaginal bleeding during intercourse (7.1%) [23]. In Wright et al. [21], out of 19 sexually active patients with sigmoid vaginoplasty available for a long-term follow-up, no individuals reported any dyspareunia [21]. However, in a larger systematic review including both transgender and cisgender individuals, dyspareunia affected 24.7% of 271 patients with sigmoid vaginoplasties in a total of seven studies [20] and can often be a result of neovaginal colitis [19].

Overall sexual satisfaction is very high (>80%) in all types of gender-affirming vaginoplasty [25]. Sexual satisfaction assessments varied due to lack of standardized questionnaires in the transgender population, and therefore, FSFI (female sexual functioning index) was often used. However, standardized questionnaires were rarely used, enforcing the need for a standardized approach when evaluating sexual satisfaction.

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## Conclusion

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The use of bowel segments for gender-affirming revision and primary vaginoplasty carry unique advantages and risks. Extensive patient counseling and shared-decision making should help guide treatment decisions regarding use of bowel for gender-affirming vaginoplasty. Average procedure-related complication rates for ileum and sigmoid were 8.3% and 6.6%, respectively [20].

Overall, all types of intestinal vaginoplasty offer abundant native tissue allowing for the attainment of adequate depth and width regardless of amount of scrotal skin and can provide enough lubrication to preclude the need for exogenous lubricants. When executed correctly, bowel vaginoplasty maintains its vascularity, theoretically reducing the risk of vaginal stenosis and potentially also permitting larger vaginal depths to be created.

The final choice of which surgical procedure to use depends on the specific patient and their individual anatomy and the surgeon's expertise and preferences. For a variety of reasons described, we have avoided use of small bowel and prefer the sigmoid for neovaginal wall creation. Sigmoid vaginoplasty has been particularly useful in situations where a patient does not have adequate skin to use for a penile inversion due to a stoppage in puberty.

Overall, level 1 evidence is lacking, but data suggests that the utilization of bowel segments in vaginoplasty is a safe and effective procedure that offers satisfactory outcomes with potential benefits such as a natural and self-lubricating neovagina of sufficient width and depth, eliminating the need for long-term dilation and achieving enhanced cosmesis.

A review of the significant published literature on the use of bowel segments for a vaginoplasty is seen in [Table 17.3](#).

TABLE 17.3 A review of the significant published literature on the use of bowel segments for vaginoplasty.

Reference	Year # of patients	Technique	Mean follow up	Outcomes measured (OR time, LOS, vaginal depth, sexual satisfaction, overall satisfaction, complication rate)	Complications
Bouman et al. [20]	2014 686 sigmoid 169 ileum (both cisgender and transgender patients)	Sigmoid, ileum (open, laparoscopic, and robotic)	Sigmoid: 18 months to 12 years (19.7 months) Ileum: 14 –34.6 months (49.9 months)	DOP: 204 min sigmoid, 269 min ileum LOS: 8.9 days sigmoid, 13.4 days ileum VD: 11.5–13 cm sigmoid, 10.5–18 cm ileum Diameter: 3.7–4 cm sigmoid, 2.5–4.5 ileum SA: 74.2% sigmoid, 56%, 88%, 100% in 3 different studies ileum SS: 85.7% sigmoid, 100% ileum	Sigmoid: Stenosis Discharge Malodor Prolapse Necrotizing fasciitis intraluminal abscess dyspareunia Ileum: Discharge Malodor Stenosis Dyspareunia
Djordjevic et al. [18]	2011 27	Secondary sigmoid (open)	47 months	LOS: 7–9 days VD: 12 cm VW: 3.4 cm FSFI: 11.5–35.7 (mean 28.9) SS: 79% (women asked to define SS)	Mucus discharge Persistent introital stenosis Dyspareunia
Kim et al. [17]	2021 15	Sigmoid (laparoscopic)	24.8 months	DOP: 529 ± 128 min, mean VD: 15.2 ± 1.3 cm LOS: 8.7 ± 1.7 days SS: 50% of de novo surgery	Stenosis Postoperative anastomotic leakage Rectovaginal fistula formation Colon flap necrosis Necrotizing cellulitis Anastomotic leakage
Salgado et al. [9]	2018 12	Sigmoid (laparoscopic)	6 months	VD: 13.9 ± 2.0 cm LOS: 9 ± 2.1 days SA: 42% SS: 100%	Introital stenosis Bladder injury Deep venous thrombosis Death from pulmonary embolism Infection
Meece et al. [27]	2023 2	Sigmoid	19–20 days then 1 year; 1 month		Abscess formation leading to necrosis Stenosis leading to sigmoid conduit Ischemia

Zolper et al. [28]	2020	69	Sigmoid (78.3%); transverse (21.7%)	49.8 months	LOS: 8.5 days VD: 15.3 cm, n = 54 OS: 77.6% SA: 51.2% AO: 84.0%	Introitus stricture
Kwun Kim et al. [23]	2003	28	Sigmoid	1, 2, 6, and 12 months and then once a year until 10 years	LOS: 8–10 days VD: 12 cm VW: 3.9 cm SA: 100% AO: 88.9%	Excessive discharge Malodor Intermittent abdominal pain Pain during intercourse Bleeding during intercourse Vaginal orifice constriction Problem with urination Rectovaginal fistula Excessive rectosigmoid vaginal protrusion
R C Franz [29]	1996	2	Sigmoid	1 year	PI: 0%	Mild stenosis
Zhao et al. [30]	2011	19	Ileum (laparoscopic)	Mean follow-up 34.6 months	DOP: 215 min LOS: 12.5 days VW: 3.2 cm VD: 15 cm TOS: 7.5 months	Rectum and/or bladder injury during operation Acute renal failure Delayed healing of ileocutaneous anastomosis Introital stenosis Intestinal obstruction Neovaginal discharge (8–12 sanitary pads)
Garcia et al. [6]	2021	22	Right colon (laparoscopic)	30 days, 5 months, 9.5 months (median 4 months)	DOP: 210 min for primary RBF: 2.7 days OS: 4.4/5 SD 0.5 SS: 4.1/5 SD 0.87 *1 means very dissatisfied, 5 means very satisfied	Injury of ileocolic pedicle Minor bladder injury Small bowel obstruction Intraabdominal hemorrhage Neovagina prolapse Stenosis Extrinsic obstruction at the rectovaginal junction Diversion neovaginitis

AO, Achieve orgasm; DOP, Duration of procedure; LOS, Length of hospital stay; OS, Overall satisfaction; PI, Pain during intercourse; RBF, Return of bowel function; SA, Sexual activity; SS, Sexual satisfaction; TOS, Mean time between operation and sexual intercourse; VD, Vaginal depth; VW, Vaginal width

From *Icahn School of Medicine at Mount Sinai*.

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