Operative Management of Complications Following Intestinal Vaginoplasty: A Case Series and Systematic Review

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OBJECTIVE To describe the authors' experience with surgical management of complications following intestinal vaginoplasty and review the literature on incidence of complications following gender-affirming intestinal vaginoplasty.

METHODS Retrospective chart review identified patients presenting with complications following prior intestinal vaginoplasty requiring operative management. Charts were analyzed for medical history, preoperative exam and imaging, intraoperative technique, and long-term outcomes. Systematic literature review was performed to identify primary research on complications following gender-affirming intestinal vaginoplasty.

RESULTS Four patients presented to the senior authors' clinic requiring operative intervention for complications following intestinal vaginoplasty, all of whom underwent surgical revision. Complications included vaginal stenosis (2 patients, 50%), vaginal false passage (1 patient, 25%), and diversion colitis (1 patient, 25%). Postoperatively all patients were able to dilate successfully to a depth of at least 15 cm.

Systematic review identified 10 studies meeting inclusion criteria. There were 215 complications reported across 654 vaginoplasties (33% overall complication rate). Average return to operating room rate was 18%. The most common complications were stenosis (11%), mucorrhea (7%), vaginal prolapse (6%), and malodor (5%). Six intestinal vaginoplasty segments developed vascular compromise leading to flap loss. There were 2 reported mortalities.

CONCLUSION Intestinal vaginoplasty is associated with a range of complications including vaginal stenosis, mucorrhea, and vaginal prolapse. Intra-abdominal complications, including diversion colitis, anastomotic bowel leak, and intra-abdominal abscess can occur many years after surgery, be life-threatening and require prompt diagnosis and management. UROLOGY 180: 105–112, 2023.

With increased insurance coverage, standardization of care, and emergence of improved surgical techniques, the demand for gender-affirming surgery continues to increase.[1,2] Gender-affirming surgery offers a range of psychological, sexual, and functional benefits.[3-5] Several techniques for creation of a vulva and lining of the vaginal canal exist.[3,6] The most commonly performed gender-affirming vaginal reconstruction procedure in the United States is penile inversion vaginoplasty (PIV), a technique that utilizes the penile and scrotal skin to line the vaginal canal.[7-18] While a recent systematic review demonstrated high success rates following primary PIV with relatively low complications,[9] there are limitations to the technique. Alternative techniques may be needed in patients with severe penoscrotal hypoplasia and those seeking revision for either loss of canal depth or rectovaginal fistula.

In patients who are not candidates for PIV, the intestinal vaginoplasty may be considered for vaginal reconstruction.[11] Initially performed in the setting of congenital or acquired vaginal absence due to cancer or trauma, this technique involves harvesting a vascularized segment of the small intestine or colon for use as the neovaginal canal with anastomosis of the remaining bowel.[19] Benefits of the colonic vaginoplasty include greater vaginal depth, concealed and hairless donor site, and lubrication from the colonic mucosa. However, harvesting a segment of the colon and performing a bowel anastomosis increases the risk of intra-abdominal complications including bowel leak, bowel obstruction, and intra-abdominal infection. In addition, long-term

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complications include mucorrhea, diversion colitis, perineal infection, vaginal prolapse, and vaginal stenosis. Importantly, these complications can present many years after the index procedure. There is little data reported on the operative management of severe complications many years after the index operation. In addition, the overall incidence of long-term complications following colonic vaginoplasty is unclear, with current reports limited to single-center retrospective series with limited follow-up duration. The purpose of this study was therefore to (1) describe the authors' experience treating complications following colonic vaginoplasty performed elsewhere, and (2) to review the literature on gender-affirming colonic vaginoplasty with the goal of determining complication incidence and timing.

METHODS

Systematic Review

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed to perform a systematic review analyzing complications following primary and revisional intestinal vaginoplasty. A broad search was performed using OVID (MEDLINE and EMBASE), Wiley Online Library, and PubMed for relevant published studies with identical search terms involving the following keywords: colon OR colonic OR intestine OR intestinal AND vaginoplasty. Specific searches of specialty-related journals including the Journal of Plastic and Reconstructive Surgery, Plastic and Reconstructive Surgery Global Open, and Journal of Urology were conducted using the same search terms. Additionally, reference lists of relevant articles were manually searched. Paper titles and abstracts were independently examined for inclusion or exclusion by two authors (CC and IR). Exclusion criteria included articles for which the full text was not available, non-English language articles, review articles, lack of complications reporting, and those in which data for gender-affirming reconstruction was not isolated.

After exclusion, articles were assessed for eligibility based on inclusion criteria: studies reporting only intestinal vaginoplasty outcomes, those involving exclusively or isolated transgender patient data, primary or revisional surgeries performed, and the presentation of original research. After any discrepancy or disagreement of relevance was discussed between the two reviewers, the remaining papers were included in the integrative review synthesis. Data obtained upon review included publication data, patient demographics and medical history, surgical details, outcomes, complications, and follow-up data. All included studies exhibited an American Society of Plastic Surgeons (ASPS) level of evidence of IV.

Case Series

Following institutional review board approval, retrospective chart review was performed to identify all patients presenting to the senior authors (RBL and LCZ) with complaints following primary or revisionary intestinal vaginoplasty between April 2017 and February 2022. Patients were included who required operative revision to treat issues related to the intestinal vaginoplasty. Patients who were managed nonoperatively were not included in this study.

Patient preoperative demographics, clinical exam, preoperative imaging, intraoperative details, and postoperative outcomes were assessed. Demographic data included age, sex, body mass index (BMI), medical history, surgical history, smoking status, and hormonal therapy. Postoperative outcomes data included postoperative complications as well as functional, sexual, and psychological outcomes. Descriptive statistics were used to analyze the data. Categorical variables are presented as numbers with corresponding percentages.

RESULTS

Systematic Review

The comprehensive literature search yielded 603 studies and after duplicate removal, a total of 285 studies remained for screening. With exclusion criteria defined, 247 additional studies were removed, and 39 articles remained for full-text analysis. Ultimately, a total of 10 studies met inclusion criteria (Supplementary Fig. 1). [6,20-29]

Patient demographics, medical history, and operative details for the included studies is summarized in Supplementary Table 1. Number of patients enrolled in included studies ranged from 12 to 386. Some papers reported primary vaginoplasty data only, some reported secondary vaginoplasty data, and some reported mixed primary and secondary data. The range of ages of subjects studied was 19-50 years with a BMI range of 21-24 kg/m^2. Three studies reported having active smokers included in data and alluded to this comorbidity as a correlative cause for complications. Follow-up duration average was 59.7 months and ranged from 6 to 285 months (0.5-23 years). Six studies included a measure of vaginal depth (mean 14.7 cm) following reconstruction and time of measurement was poorly described.

Aggregated complication rates are presented in Table 1. Due to heterogeneity in data reporting, complication rates are reported using the total number of patients across the studies

Table 1. Systematic literature review aggregated complication rates.

Complication	Total* (%)
Vaginal stenosis	68/621 (11.0)
Mucorrhea	39/555 (7.0)
Vaginal protrusion	35/564 (6.2)
Malodor	6/123 (4.9)
Diversion colitis	3/71 (4.2)
Dyspareunia	21/528 (4.0)
Vaginal prolapse	14/565(2.5)
Urinary obstruction	11/539 (2.0)
Infection	11/562 (2.0)
Ileus/SBO	9/496 (1.8)
Fistula	8/548 (1.5)
Vesicovaginal fistula	1/39 (2.6)
Rectovaginal fistula	4/548 (0.7)
Urethrovaginal fistula	3/508 (0.6)
Intestinal flap necrosis	5/464 (1.1)
Anastomotic bowel leak	2/461 (0.4)
Death	2/69 (2.9)
Return to the OR	108/608 (17.8)
Bowel diversion	3/608 (0.5)
Total complications	215/654 (32.9)

OR, operating room; SBO, small bowel obstruction.
* Denominator denotes sum of total patients in studies reporting the complication in question.

reporting that complication as the denominator. In total 215 complications were reported across 654 patients, yielding an overall complication rate of 33%. One hundred and eight patients out of 608 required return to the operating room (18%). The most common complications were vaginal stenosis (68 reports across 621 patients for 11% rate), mucorrhea (39 of 555 patients, 7%), vaginal prolapse (35/564 patients, 6.2%), malodor (6/123 patients, 5%) and diversion colitis (5/113 patients, 4%). There were 5 cases of intestinal flap necrosis leading to flap loss (1.1%). Three patients required bowel diversion and ostomy creation due to surgical complications. There were 2 cases of anastomotic bowel leak. There were 2 reported mortalities, 1 from necrotizing fasciitis of the surgical site and 1 from a suspected pulmonary embolus.

The time to complication presentation was heterogeneously reported. Five papers reported timing of vaginal stenosis occurrence and no papers reported timing of diversion colitis occurrence. Vaginal stenosis presentation ranged from 5 weeks to 9 years postoperatively. Four papers reported cases of vaginal stenosis presenting greater than 1 year postoperatively (range 1-8 years). The mean follow-up duration of these studies was 6 years (range 0.5-23 years).

Case Series

Chart review identified four patients who presented to the senior authors with complaints related to prior intestinal vaginoplasty that required operative management between April 2017 and February 2022. Mean follow-up duration was 681 days (range 91-1334 days). Patient demographics, medical co-morbidities, surgical history, intraoperative details, and postoperative outcomes is shown in Table 2. Age at presentation ranged from 42 to 67 years. BMI ranged from 23.5 to 35.3 kg/m^2. An average of 14 years (range 2-22 years) had passed between the index vaginoplasty and patient presentation to our clinic. Co-morbidities of the studied group included hypertension, diabetes mellitus, hepatitis C, migraines, diverticulitis, HIV infection, and depression. Two patients underwent colonic vaginoplasty as index procedures, while the other two patients had intestinal vaginoplasty performed as a revision to an initial PIV. Two patients presented with vaginal stenosis, 1 patient presented with diversion colitis, and 1 patient presented with a false vaginal passage. Data on follow-up duration as well as functional and sexual outcomes is shown in Table 2. Further discussion of the individual cases is provided below.

Case 1. Patient 1 is a healthy 51-year-old transgender female who underwent primary PIV at an outside hospital in 2005 which was complicated by vaginal stenosis requiring vaginal canal revision first with skin grafting and ultimately revision with colonic vaginoplasty in 2010. She presented to the authors in 2016 reporting vaginal stenosis with an inability to dilate the vagina as well as recurrent perineal infections and pain with anal penetration. Preoperative exam was notable for severe vaginal stenosis. Magnetic resonance imaging (MRI) of the pelvis with intravenous contrast demonstrated stenosis at the anastomotic site between the skin graft and the colon (Supplementary Fig. 2A).

She underwent robot-assisted diagnostic laparoscopy, adhesiolysis, and neovaginal revision. The colonic segment of the neovagina was identified. Only a forcep could pass between the skin-lined introitus into the deeper colonic segment of the vaginal canal. The stenosis was incised and the canal was dissected to accommodate the orange soul source dilator. The remaining defect between the colonic segment and skin-lined introitus was covered with full-thickness grafts from the lateral flanks. The distal colonic neovaginal segment and proximal vaginal canal skin were anastomosed to reconstruct a continuous vaginal canal (Supplementary Fig. 2B). Colpopexy was performed to position the neovagina between the bladder and rectum. There were no intraoperative complications.

Postoperative course was uneventful, packing was removed on postoperative day (POD) 5 and the patient began vaginal dilation. The patient subsequently underwent revision vulvoplasty to treat esthetic complaints related to labial asymmetry. She was evaluated in the office on POD 931 and was found to be successfully dilating the vaginal canal beyond the fifth dot of the orange Soul Source (North Hollywood, CA) dilator (15.2 cm of vaginal depth with a 3.8 cm diameter dilator), which is the greatest depth and width dilator used by the authors.

Case 2. Patient 2 is a 67-year-old transgender female with a history of hypertension and hepatitis C infection who underwent primary colonic vaginoplasty in 2015 at another center and presented to the authors' clinic in 2017 reporting difficulty with vaginal dilation as well as dissatisfaction with the vulvar esthetic results. Her physical exam was notable for an eccentric vaginal introitus with significant residual bulbar urethral tissue. Pelvic MRI demonstrated focal outpouching of the neovaginal canal with proximal compression between residual bulbar urethral tissue and the inferior pubic ramus (Supplementary Fig. 3).

The patient was brought to the operating room for revision of both the vulva and the vaginal canal. Excess bulbar spongiosum was identified causing pronounced vaginal protrusion which was excised and labiaplasty was performed. The vaginal introitus was deviated to the right. The central tendon under the prostate was dissected and released. The allowed the canal to be repositioned in the midline of the pelvis inferior to the urethra.

Postoperative course was uneventful, packing was removed on POD 5 and the patient began vaginal dilation. She was evaluated in the office on POD 1206 and was found to be successfully dilating to the fifth dot of the green dilator.

Case 3. Patient 3 is a 42-year-old transgender female with a history of diverticulitis who underwent primary PIV in 2000 followed by revision colonic vaginoplasty in the same year. She presented to the authors in 2020 reporting new onset dyspareunia and intermittently bloody green vaginal discharge. Preoperative exam demonstrated a patent vaginal canal with green exudate expressible from the vaginal apex. Pelvic MRI showed no evidence of colovaginal fistula. Pelvic exam under anesthesia, including flexible cystoscopy, vaginoscopy, and vaginogram demonstrated multiple fluid-filled diverticula within the colonic segment of the neovagina, as well as a tortuous, redundant, narrow-necked portion of the neovagina containing copious mucous which was suctioned. The neovagina was noted to be 20 cm from the introitus to the vaginal apex.

Table 2. Patient demographic, preoperative exam, intraoperative details, and postoperative outcomes.

Patient	Age*	BMI (kg/m^2)	Medical History	Surgical History	Chief Complaint and Physical Exam	Diagnostic Imaging	Intraoperative Details	f/u**	Additional Pelvic Surgery	Vaginal Dilation	Vaginal Intercourse
1	51	27.4	• No PMH • Former smoker • Consistent hormone tx	• 2005: Primary PIV • Late 2000s: Vaginal canal revision • 2010: Revision colonic vaginoplasty	• Vaginal stenosis	• MRI: neovaginal stenosis at anastomosis between skin graft and colon	• Vaginal canal stricture release • Revision anastomosis between skin graft and colonic portions of neovagina • Vaginal introitus augmentation with FTSG	931	• POD744 revision vulvoplasty for labial asymmetry	15.2 cm deep with 3.8 cm dilator	No
2	67	23.5	• HTN, hepatitis C, migraines • Never smoker • Consistent hormone tx	• 2015: Primary colonic vaginoplasty • Appendectomy • Splenectomy • Hernia repair	• False vaginal passage • Eccentric vaginal introitus • Significant residual bulbar urethra	• MRI: focal neovaginal canal outpouching with apparent obstruction by proximal residual corporal tissue	• Resection of residual bulbar spongiosum • Centralization of vaginal introitus inferior to the urethra	1206	None	15.2 cm deep with 3.5 cm dilator	No
3	42	25.6	• Diverticulitis • Active smoker • Inconsistent hormone tx	• 2000: Primary PIV • 2000: Revision colonic vaginoplasty • Appendectomy	• Diversion colitis • Vaginal discharge	• MRI: no colovaginal fistula • EUA: multiple mucous-filled diverticula within colonic neovagina, tortuous narrow-necked neovaginal segment	• Resection of redundant colonic neovagina	114	• POD4 diagnostic laparoscopy for small bowel obstruction • POD92 pelvic EUA and vaginoscopy for malodorous vaginal discharge	15.2 cm deep with 3.8 cm dilator	Yes
4	44	35.3	• Diabetes mellitus, HIV, depression • Former smoker • Consistent hormone tx	• 1999: Primary colonic vaginoplasty • 2000s: Vaginal canal revision • 2000s: Vaginal canal revision	• Vaginal stenosis • Vaginal discharge	• CT: focal neovaginal stenosis with proximal dilation	• Resection of stenotic vaginal mucosal ring • Revision anastomosis between colonic neovaginal and introitus	371	None	15.2 cm deep with 3.8 cm dilator	Yes

Table 2 (*Continued*)

Patient	Age*	BMI (kg/m^2)	Medical History	Surgical History	Chief Complaint and Physical Exam	Diagnostic Imaging	Intraoperative Details	f/u**	Additional Pelvic Surgery	Vaginal Dilation	Vaginal Intercourse
				• 2000s: Vaginal canal revision • 2013: Vaginal canal revision							

CT, computed tomography; EUA, exam under anesthesia; f/u, follow-up; FTSG, full-thickness skin graft; HIV, human immunodeficiency virus; HTN, hypertension; MRI, magnetic resonance imaging; PIV, penile inversion vaginoplasty; PMH, past medical history; tx, treatment.

* Age reported in years.

** Follow-up reported in days.

Based the exam under anesthesia findings the patient underwent robot-assisted resection of the redundant neovagina. Cystoscopy was used to identify the functional apex of the vagina and delineate the redundant, narrowed portion of the colonic vaginal segment. The redundant segment was dissected off the surrounding mesentery and excised and the remaining new apex of the vagina was oversewn in two layers. The excised portion of the neovagina was sent for histopathology which demonstrated segments of colonic diverticulosis with chronic diverticulitis and reactive epithelial changes consistent with diversion colitis. The neovaginal closure was confirmed to be watertight prior to completion of the case. Vaginal dilators were inserted to confirm adequate neovaginal width and depth. The patient was discharged on POD1 with her pain well controlled, tolerating regular diet, and demonstrating normal bowel function. She was instructed to hold her dilation regimen until being seen in the office.

On POD3 the patient represented with abdominal pain and inability to tolerate oral intake. Computed tomographic scan of the abdomen and pelvis demonstrated a small bowel obstruction which was initially managed conservatively with nasogastric decompression and nil per os status. The patient's symptoms persisted over the next 24 hours and she was taken back to the operating room for diagnostic laparoscopy. Intraoperatively there were noted to be adhesions between the small bowel and the neovagina. Adhesiolysis was performed. There were no intraoperative complications and the patient's symptoms improved following surgery, with return of normal bowel function and ability to tolerance oral intake.

The patient has subsequently developed intermittent abdominal pain, dyspareunia, and thick, green vaginal discharge consistent with diversion colitis of the neovagina for which she has been treated with antibiotics, hydrocortisone vaginal irrigation, and repeat vaginoscopy with drainage of retained vaginal mucous. These symptoms have continued through her most recent follow-up, POD 114 from her revision vaginoplasty.

Case 4. Patient 4 is a 44-year-old transgender female with a history of type II diabetes and human immunodeficiency virus infection who underwent primary colonic vaginoplasty in 1999 which was complicated by both introital and canal stenosis for which she had undergone four prior revision surgeries at outside hospitals. She presented to the authors in 2020 reporting inability to dilate or have vaginal intercourse. In addition, she noted intermittent malodorous vaginal discharge and abdominal pain. On exam her vaginal canal was noted to be completely closed. Computed tomographic of the abdomen and pelvis with oral and intravenous contrast demonstrated marked vaginal canal stenosis with dilation of the colonic segment of the neovagina proximal to the stenosis (Fig. 1A).

The patient was taken to the operating room and underwent pelvic exam under anesthesia followed by robot-assisted laparoscopic revision colonic vaginoplasty. Diagnostic vaginoscopy demonstrated a stenotic ring of colonic mucosa just proximal to the vaginal introitus (Fig. 1B). Diagnostic laparoscopy demonstrated extensive intra-abdominal and pelvic adhesions with the colonic neovagina densely adherent to the posterior bladder and seminal vesicles. Using sharp dissection the neovagina was carefully mobilized free from the bladder with subsequent bladder irrigation showing no evidence of

Figure 1. **(A)** Patient 4 computed tomography of the abdomen and pelvis demonstrating neovaginal stenosis with distention of the proximal neovagina. **(B)** Patient 4 intraoperative clinical image demonstrating neovagina with stenotic ring preventing dilation. **(C)** Patient 4 intraoperative clinical image demonstrating reconstructed vaginal canal. (Color version available online.)

injury. Once the entire neovagina was mobilized, the stenotic ring of colonic mucosa was sharply excised and the remaining proximal colonic segment of the neovagina was anastomosed to the incised edges of the peri-introital skin (Fig. 1C).

Postoperative course was uneventful, packing was removed on POD 5 and the patient began vaginal dilation. The patient was evaluated in the office on POD371 and was successfully dilating to the fifth dot of the orange soul source dilator and engaging in penetrative vaginal intercourse. Her intermittent abdominal pain and malodorous vaginal discharge have resolved.

DISCUSSION

Intestinal vaginoplasty has been lauded by some authors for its ability to create an expansile, hairless, self-lubricating vaginal canal.[30,31] Supporters often suggest that the incidence of stricture is lower than in PIV and that rates of complications such as mucorrhea, malodor, and diversion colitis are rare. Our experience treating operative complications following intestinal vaginoplasty performed at outside institutions prompted this study, which aimed to (1) report our techniques for treating long-term complications following intestinal vaginoplasty and to (2) perform a systematic review of the literature on intestinal vaginoplasty to quantify rates and time of complication.

Our review identified 10 papers reporting surgical outcomes following gender-affirming intestinal vaginoplasty, with a return to the OR rate of 18% and overall complication rate of 33%. The diagnosis and management of common complications is presented in Figure 2. The most common complication reported was neovaginal stenosis, which is consistent with our experience. Three of the four patients who presented to us for revision were found to have stricture at the intestinal-cutaneous junction requiring operative intervention for stricture release. Importantly, neovaginal stenosis can occur rapidly if a patient ceases dilation protocols. This highlights a key misconception regarding intestinal vaginoplasty, which is that patients do not need to dilate postoperatively to maintain vaginal patency. In our experience, and as highlighted by the 11% vaginal stenosis rate found in this review, failure to continue vaginal dilation can lead to severe stenosis and mucous buildup which can progress to intra-abdominal abscess.

The bowel manipulation required in intestinal vaginoplasty, including isolating the intestinal conduit while maintaining its vascular supply and anastomosing the remaining bowel, creates risk for several complications that are not encountered following PIV. Diversion colitis was reported in 4.4% of patients captured by our literature review and can be difficult to treat. Medical interventions include topical short-chain fatty acids, 5-aminosalicylic acid derivatives, and glucocorticoids, although the success of topical treatments is limited. Ultimately the only curative treatment option is removal of the diverted neovagina. Intestinal flap necrosis and anastomotic bowel leak were reported in 1.1% and 0.4% of patients in this review, respectively. Both complications can be life-threatening and require prompt operative management, potentially requiring bowel resection and/or diversion.

Regarding timing of complications, it is important to note that vaginal stenosis, diversion colitis, and other complications following intestinal vaginoplasty can present many years following the index procedure. Delayed presentation may contribute to an underreporting of complications. The average follow-up duration of the

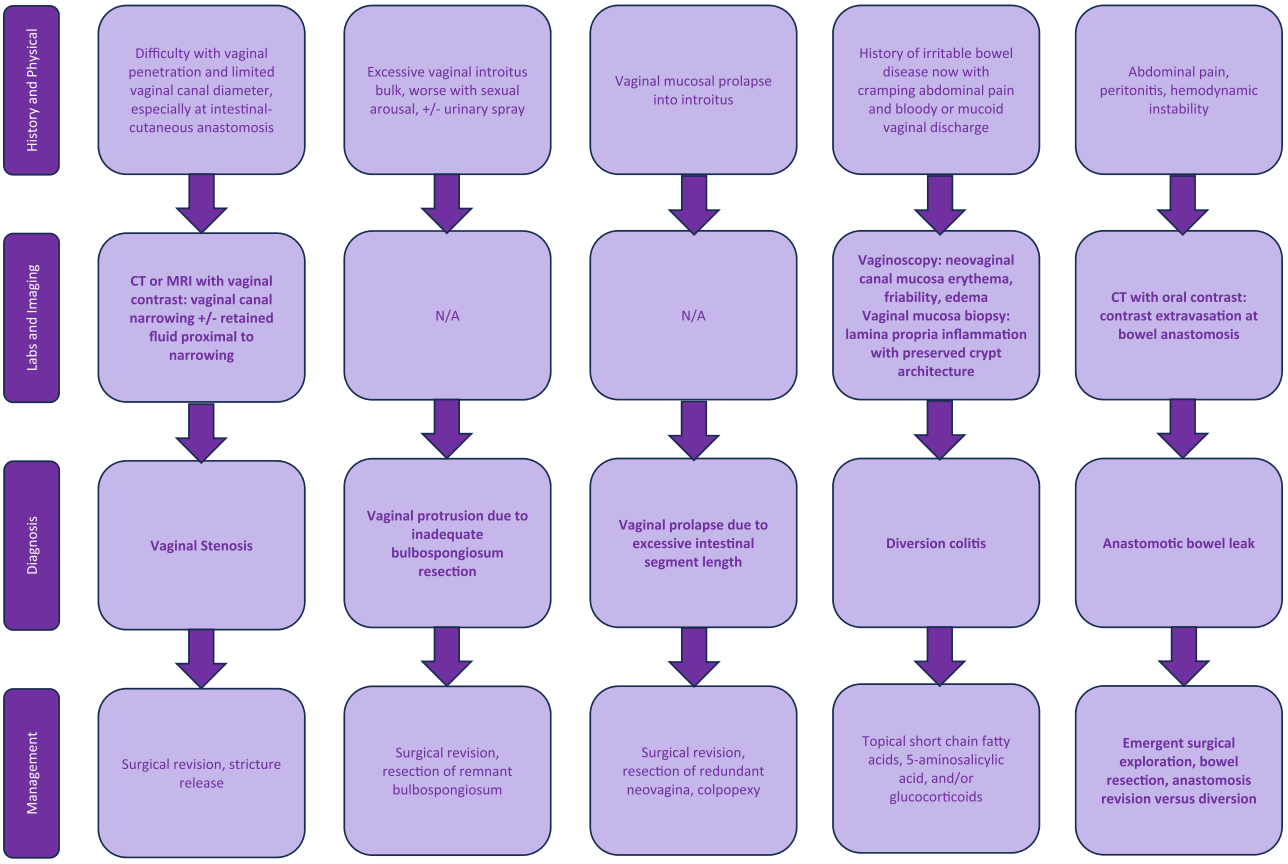

Figure 2. Diagnosis and management of common complications following intestinal vaginoplasty. (Color version available online.)

papers captured in this review was approximately 5 years, while vaginal stenosis was found to present up to 9 years postoperatively in one paper included in this review and more than 20 years following index vaginoplasty in the series of patients treated at our center. Similarly, one patient presented to us with diversion colitis 20 years following her intestinal vaginoplasty. Intestinal vaginoplasty may be associated with long-term complications that is not captured in the majority of literature due to limited duration of follow-up.

This review is limited by the relatively small sample sizes and short follow-up of many of the included studies, which may underestimate the incidence of late-presenting complications. In addition, there is marked heterogeneity in outcomes reporting across studies of intestinal vaginoplasty, thereby limiting the degree of quantitative analysis that can be performed. Furthermore, all included studies report retrospective data. Future studies should aim to collect prospective, blinded data from larger sample sizes.

CONCLUSION

Intestinal vaginoplasty remains an option for lining of the vaginal canal in select patients undergoing gender-affirming vaginoplasty. Patients and surgeons should be aware of the potential complications such as vaginal stenosis and diversion colitis which can occur many years after surgery.

Declaration of Competing Interest

The authors have no conflict of interest to declare.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.urology.2023.07.005.

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