Overlooked Long-Term Complications of Colorectal Surgery

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Abstract

While colorectal surgery has been documented to have some of the highest complication rates in the surgical field, some of the more common, functional complications are often overlooked in the literature and in discussion with patients. Urinary, sexual, and defecatory dysfunction are common after colorectal surgery, especially after pelvic dissections, and may severely impact the postoperative quality of life for patients. These complications include urinary retention, erectile dysfunction, retrograde ejaculation, dyspareunia, infertility, and low anterior resection syndrome. The majority is rooted in autonomic nerve damage, both sympathetic and parasympathetic, that occurs during mobilization and resection of the sigmoid colon and rectum. While not all of these postoperative complications are preventable, treatment strategies have been developed to ameliorate the impact on quality of life. Given the high incidence and direct effect on patients, clinicians should be familiar with the etiology, prevention, and treatment strategies of these complications to provide the highest quality of care.

Keywords

- postoperative complication
- bladder dysfunction
- sexual dysfunction
- low anterior resection syndrome

Postoperative complications in colorectal surgery are well documented with rates approaching 30%[1] and accounting for nearly 25% of all complications in general surgery.[2] While much attention has been focused on identifying and preventing acute postoperative complications, such as anastomotic leaks, wound infections, and medical complications, much less energy has been invested in highlighting some of the common but overlooked long-term changes that occur following colorectal surgery.

In particular, surgery on the rectum may result in significant functional changes that can affect quality of life. Changes in bladder, sexual, and defecatory function can occur after pelvic surgery. These complications are often multifactorial in nature, difficult to treat, and remain as lasting side effects. This article will review the most common functional complications that present following rectal surgery and discuss the anatomy and physiology that account for these complications. In addition, options for treatment or improvement in outcomes will be discussed.

Etiology of Functional Complications

The gastrointestinal, urinary, and sexual systems are closely intertwined within the pelvis. Each system is derived from a dual innervation of sympathetic and parasympathetic nerves that course through the pelvis. There are four locations that are believed to be at highest risk for nerve injury during pelvic surgery (►**Table 1**). The sympathetic preaortic nerves can be injured during high ligation of the inferior mesenteric artery. At the level of the sacral promontory, the superior hypogastric plexus and hypogastric nerves may be injured. The nervi erigentes can be injured during dissection at the posterior lateral aspect of the pelvis near the middle hemorrhoidal artery. Dissection near the seminal vesicles and prostate may result in injury to the periprostatic plexus. Not only can nerves be directly damaged during surgery, thermal injuries, stretching, inflammation, and ischemia may also indirectly damage nerves during pelvic dissection. All of these can have significant and long-term effects on urinary, sexual, and defecatory function.

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Table 1 Most likely anatomic locations of nerve injuries and subsequent complications

Area of injury	Nerves impacted	Complications from nerve injury
High ligation of inferior mesenteric artery	Hypogastric nerve (sympathetic branches), superior hypogastric plexus, inferior mesenteric plexus, preaortic plexus	Retrograde ejaculation
Sacral promontory	Hypogastric nerves (sympathetic and parasympathetic branches)	Retrograde ejaculation, erectile dysfunction, bladder dysfunction/urinary retention, low anterior resection syndrome
Posterolateral rectal dissection	Hypogastric nerves (sympathetic and parasympathetic branches), nervi erigentes	Erectile dysfunction, bladder dysfunction/urinary retention, low anterior resection syndrome
Anterolateral rectal dissection	Hypogastric nerves, inferior hypogastric plexus, pelvic plexus, periprostatic plexus	Erectile dysfunction, bladder dysfunction/urinary retention, low anterior resection syndrome

In addition, many patients who undergo pelvic surgery have preexisting comorbidities that affect urinary, sexual, and defecatory function. Cancer patients may have dysfunction from tumor invasion, as well neoadjuvant or adjuvant radiation. Patients with inflammatory bowel disease and diverticular disease may have inflammation, fistulas, or infection which may affect function preoperatively. Medical comorbidities, including diabetes, prostatic hypertrophy, and endometriosis, may change preoperative baselines. Sexual function, in particular, may also be affected by the emotional stresses around surgical intervention. Each of these factors must be included in the evaluation and work-up of postoperative functional disorders.

When evaluating long-term overlooked complications of colorectal surgery, the constellation of symptoms can be easily grouped into three distinct organ-based systems: urinary/bladder, sexual/genital, and defecatory.

Urinary/Bladder Dysfunction

Anatomy, Physiology, and Etiology

Bladder dysfunction can cause significant functional deficits, including both urinary incontinence and urinary retention. Patients with bladder dysfunction may require short- or long-term catheterization, either indwelling or intermittent. In addition, urinary dysfunction can lead to further deleterious sequelae, such as urinary tract infections, hydronephrosis, urinary reflux, pyelonephritis, and impaired renal function.[3] Abdominoperineal resection (APR) and low anterior resection (LAR) have reported postoperative bladder dysfunction rates approaching 50 and 25%, respectively.[4]

Postoperative bladder dysfunction after colorectal surgery is usually associated with deep pelvic operations affecting the autonomic pelvic plexus. Urogenital bundles run just above the lateral ligaments at the point of insertion on the endopelvic fascia. Injury to these autonomic nerves results in parasympathetic detrusor denervation, resulting in impaired bladder contractility. Rather than creating a productive contraction, the detrusor muscle spasms, resulting in inadequate pressure to overcome the urethral resistance. Patients with underlying bladder dysfunction, including benign prostatic hypertrophy, urinary retention, or urinary incontinence may develop exacerbation of their preexisting conditions.

Bouchet-Doumenq et al found a 38% postoperative urinary dysfunction rate among men undergoing rectal resections, with dysfunction defined as catheterization past postoperative day 6 and/or acute urinary retention after catheter removal. The study showed diabetes, a previous urologic history and a total mesorectal excision (TME) being independent risk factors for urinary dysfunction.[5]

When evaluating tumor location as a determinant of postoperative urinary dysfunction, Changchien et al found that patients undergoing surgery for rectal cancer were over five times more likely to develop postoperative urinary retention than those undergoing colon cancer resections. Risk factors for development of postoperative urinary dysfunction included with a tumor located in the rectum were increased age, lung disease, longer operations, and an additional pelvic procedure at the time of index operation.[6] Importantly, male gender, American Society of Anesthesiologists class 2 or 3, rectal tumor, presence of a surgical drain, and a pelvic infection were identified as risk factors for those patients who had prolonged urinary dysfunction more than 1 month compared with transient urinary dysfunction.[6]

Bregendahl et al studied females who underwent APR and LAR for rectal cancer and found that 77 and 63% of females suffered from urinary urgency and urinary incontinence postoperatively. They also found that preoperative radiotherapy was independently associated with voiding difficulties postoperatively. Those undergoing LAR who developed bowel dysfunction postoperatively were also independently at risk for bladder storage difficulties and urinary incontinence.[7]

The vast majority of patients suffering from this postoperative bladder dysfunction regain the ability to empty the bladder; however, this may take up to 1 year[8] and require either clean intermittent catheterization or chronic-indwelling catheterization until function returns. George et al

studied men who underwent laparoscopic proctectomy with complete TME with internationally validated scoring systems to assess bladder dysfunction. They found 20% of males had moderate to severe bladder dysfunction at 3 months postoperatively with a reduction to 3% at 9 months. There was an increase in bladder dysfunction among those patients with low rectal tumors compared with mid-rectal tumors.[8]

There has long been a debate and varying practice patterns regarding urinary catheter removal after deep pelvic surgery, especially with increased focus on enhanced recovery pathways. Kwaan et al found that early removal of a urinary catheter in patients after pelvic surgery increases rates of urinary retention.[9] This leads to increased catheter reinsertion, which then increases the rate of postoperative urinary tract infections.[10] However, Coyle et al conducted a randomized controlled trial of early catheter removal in patients with epidurals and found no difference in postoperative urinary retention in those patients who had the catheter removed on postoperative day 2 compared with those waiting to be removed after the epidural was removed.[11] Similarly, Benoist et al showed that the vast majority of patients undergoing upper and middle rectal resections can be safely managed with only a 1-day transurethral catheter drainage with a lower rate of urinary tract infections and a slightly higher incidence of acute urinary retention compared with those patients with a 5-day catheter drainage.[12] This same study did find that low rectal cancer, defined as within 5 cm of the dentate line, and lymph node metastasis were independent risk factors for acute urinary retention in patients undergoing proctectomy.[12]

Treatment of Urinary Dysfunction

In the immediate setting, patients with inability to void, or inability to void completely, are treated with replacement of urinary catheter. This prevents excessive dilation of the urinary bladder. Patients with more than 200 mL of residual urine on postvoid ultrasound should be considered for recatheterization. A urinalysis may demonstrate urinary tract infection, which may exacerbate urinary symptoms and require antibiotic treatment. Addition of adrenoceptor antagonist may be helpful for treatment acute postoperative urinary dysfunction.[13] Alternatively, patients can be considered for treatment with intermittent catheterization. Patients who fail multiple attempts at voiding trials should be considered for discharge with urinary catheterization.

A comprehensive evaluation will help determine the etiology and options for treatment for patients with postoperative urinary dysfunction. This will generally be conducted in the outpatient setting, when patients have recovered from the immediate postoperative complications and difficulties. Evaluation should include urodynamics if patients remain unable to void, generally 2 to 3 months postoperatively.[3] This helps differentiate the type of urinary dysfunction into those with failure of compliance and failure of voiding. If patients are noted to have compliance abnormalities, they can be treated with anticholinergic medications. Neuromodulation may also be used with good success to improve bladder function and reduce rates of urinary retention.[14]

Conclusion

Postoperative bladder dysfunction is a common postoperative complication of any pelvic surgery, which is especially true in colorectal pelvic operations. Although the incidence is higher than some other complications, the dysfunction is very treatable and is usually transient.

Sexual/Genital Dysfunction

Sexual dysfunction can occur after colorectal operations, most commonly when dealing with the sigmoid colon and rectum since the nerves that control sexual function in both males and females arise and course from the lumbar and sacral nerve roots. While the nerves arising are similar in both, the postoperative dysfunction is quite different between the two sexes.

Male Dysfunction

Anatomy, Physiology, and Etiology

Male sexual function is controlled by a combination of sympathetic and parasympathetic innervations from both lumbar and sacral roots. Injury or disruption of any of these innervations along the pathway can result in sexual dysfunction in the form of erectile dysfunction, retrograde ejaculation, and impotence. As with urinary dysfunction, preexisting dysfunction and medical comorbidities, including prior radiation and tumor presence, can affect baseline sexual function.

Trauma to the nerves can occur at several points during surgery of the rectum (►**Table 1**). Trauma to the autonomic nerves may occur during high ligation of the inferior mesenteric artery. The superior hypogastric nerves may also be injured along the sacral promontory or in the presacral region. Sympathetic denervation can result in retrograde ejaculation. The nervi erigentes are located in the posterolateral aspect of the pelvis, close to the lateral stalks and middle hemorrhoidal artery. These can be injured during dissection or by excessive traction on the rectum. Injuries at this location to the sympathetic nerves may affect ability to ejaculate, whereas injuries to the parasympathetic nerves can result in erectile dysfunction. Damage may also occur near the seminal vesicles and prostate, where mixed fibers of parasympathetic and sympathetic nerves may result in erectile impotence.

In surgery for benign disease, consideration of "nerve-sparing surgeries" using a mid-mesenteric dissection, close to the bowel wall, can be considered. However, this may not completely eradicate risks for these patients. Hicks et al studied the impact of an intramesorectal excision during proctectomy for ulcerative colitis (UC) compared with complete TME and the effect on sexual function postoperatively. They found no difference in postoperative sexual function with an intramesorectal excision compared with a TME.[15]

George et al studied men who underwent laparoscopic proctectomy with complete TME and evaluated patients using internationally validated scoring systems to assess sexual dysfunction postoperatively. They found that 75% of

men had some degree of sexual dysfunction at 3 months postoperative follow-up. At 9 months, the rates of sexual dysfunction decreased to 55%.[8]

Attaallah et al studied patients undergoing proctectomy for rectal cancer and the impact on postoperative sexual dysfunction. They found that sexual dysfunction increased by 39% postoperatively in men and was associated with an open approach and postoperative chemo- or radiotherapy.[16] In contrast, two previous studies showed that a laparoscopic approach, compared with open approach, does not affect the outcome of postoperative sexual dysfunction.[17,18]

Adam et al studied male sexual function for those undergoing proctectomy for rectal cancer and found a decrease in sexual function from preoperative to postoperative in erectile function (71 vs. 24%), ejaculatory function (78 vs. 32%), and sexual activity (82 vs. 57%). They also found T3–T4 tumors and low rectal tumors were independently associated with worse sexual function postoperatively.[19] Bauer et al also studied the effects of proctectomy on sexual dysfunction in men and found that 4 out of 135 males (3%) suffered permanent sexual dysfunction postoperatively. Two males could maintain an erection but had retrograde ejaculation and the other two remained impotent after a year and a half.[20]

In contrast to the other studies mentioned, a study out of UCSF found that male patients undergoing proctectomy or proctocolectomy for UC or Crohn's disease actually had an improvement in sexual function and desire postoperatively. This may indicate that chronic pelvic inflammation, once removed, may improve functional outcomes in selected inflammatory bowel disease (IBD) patients.[21]

Treatment Options

For erectile dysfunction, the first-line treatment begins with medical therapy in the form of phosphodiesterase-5 inhibitors, such as sildenafil and tadalafil. If these are unsuccessful, other treatment options include penile vacuum devices, as well as a surgically implanted penile prosthesis. For retrograde ejaculation, no good proven therapy exists to reverse this complication. Males interested in preserving reproductive options may also consider sperm banking prior to undergoing elective pelvic operations or delaying operation until after completing reproductive plans.

Female Sexual Dysfunction and Infertility

As with males, female sexual function is controlled by a combination of sympathetic and parasympathetic innervations from both lumbar and sacral roots. Injury or disruption of any of these innervations along the pathway can result in sexual dysfunction. Females can develop alterations in sexual desire, arousal, and satisfaction, while also suffering from dyspareunia.[22]

In addition, women can develop infertility issues, which may have more to do with mechanical function affecting the ovaries and fallopian tubes. Sexual dysfunction in females is probably often unrecognized after pelvic surgery and frequently, the only "hard evidence" of dysfunction is infertility.

Sexual Dysfunction

Bregendahl et al found that in females who underwent either an APR or LAR for rectal cancer, 72% suffered from vaginal dryness, 53% with dyspareunia, 29% with reduced vaginal dimensions, and 69% had little to no sexual desire postoperatively.[7] Patients who received preoperative radiotherapy were independently associated with reduced vaginal dimensions, dyspareunia, lack of sexual desire, and had lower sexual activity postoperatively.[7] Women with iatrogenic injuries to the sympathetic nerves of the pelvis have been found to have decreased vaginal lubrication.[23]

Attaallah et al also studied females, in their previously mentioned study, on the impact of sexual dysfunction in those undergoing proctectomy for rectal cancer, which found a 24% increase in sexual dysfunction postoperatively compared with preoperatively. Worsening sexual function was associated with an open approach and postoperative chemo- or radiotherapy.[16] Adam et al's study of the same cohort found that sexual activity in females declined from 59% preoperative to 36% at the 12-month postoperative period.[19]

In their review of the published literature, Izanec and Nagle found conflicting data on postoperative dyspareunia.[23] They found four studies showing only small improvements in sexual function or decreases in dyspareunia postoperatively, but five others showed much larger increases in sexual dysfunction, up to 33%.[23] Bauer et al found that out of 152 female patients who were sexually active after proctectomy, only 2 (1.3%) had any postoperative sexual dysfunction in the form of dyspareunia, both resolved within 1 year of the operation.[20] Wang et al found that proctectomy or proctocolectomy in female IBD patients actually improved postoperative sexual desire but did not affect sexual function.[21]

A study out of Toronto evaluated quality of life impact after proctectomy in women. They found that 20% of females acquired postoperative sexual dysfunction and 28% endorsed that surgery made their sexual lives worse.[24] Most surprising in this study was the fact that only 9% of females endorsed discuss the possible sexual side effects with their surgeon prior to their operation.[24]

Infertility

Differences in female postoperative are hypothesized to be due to adhesive disease and scarring of the fallopian tubes and other reproductive structures from pelvic dissection.[22] Intrapelvic adhesions are hypothesized to complicate normal passage of a fertilized ovum from the ovary through the fallopian tubes.[25] In addition, a high rate of damage to the fimbria hydrosalpinx or tubal injury may occur after pelvic surgery.[26]

A meta-analysis found a postoperative female infertility rate of 48% compared with 15% preoperatively for patients undergoing a restorative proctocolectomy for UC.[27] A separate systematic literature review was done for female patients with UC showing infertility rates increasing to 26% after surgery compared with 12% preoperatively when undergoing restorative proctocolectomy.[28] Ørding Olsen et al examined fertility rates in UC patients who underwent

ileal pouch anal anastomoses (IPAA) and found that UC patients preoperatively had a similar cumulative incidence of pregnancy in 24 months preoperatively to the general population of the same age; however, this incidence fell from 85 to 27% in 24 months postoperatively.[29]

Another study evaluated preoperative versus postoperative rates of infertility in UC patients after IPAA, which was defined as lack of conception following 1 year of unprotected sexual intercourse. This study found that the infertility rate increased from 38% preoperatively to 56% postoperatively.[30] Given that the general population infertility rate in women is between 7 and 8.5%,[31] UC patients appear to start preoperatively at reduced fertility rate compared with the general population, possibly related to medical complications of their disease and this is only exacerbated after pelvic surgery. In benign disease, consideration of delayed proctectomy may be reasonable until after patients have completed reproductive desires.

While many cancer patients may be diagnosed after completing reproductive years, the incidence of rectal cancers in young patients is increasing. In addition, patients with polyposis syndromes may require proctectomy at a younger age. Stupart et al studied survivors of colorectal cancer (CRC) with Lynch's syndrome and the effects on fertility rates. They found that the overall fertility rate of women decreased by 40% after a diagnosis of CRC compared with those Lynch's patients who were not diagnosed with CRC. However, only females with CRC aged 20 to 24 years developed lower age-specific fertility declines compared with their counterparts who did not develop CRC. The fertility decline did not extend to women older than the age of 24 years.[32]

In contrast to IBD patients, patients with endometriosis-associated infertility and colorectal involvement may benefit from a surgical approach when evaluating treatment for infertility. Bendifallah et al showed that for females with colorectal endometriosis-associated infertility, the cumulative live birth rate with colorectal surgery as the first-line treatment was significantly higher than those treated with assisted reproductive technology, such as in vitro fertilization.[33]

Treatment Options

Several new treatment strategies for sexual dysfunction have become available with increasing evidence to identify the problem. Topical therapy to ameliorate low estrogen levels is an easily identifiable remedy for those with symptoms of vaginal dryness, dyspareunia, bleeding, or malodorous discharge. Behavioral therapy is also an option for both individuals and couples, to address unique physical concerns after surgery. Mechanical female tumescence devices, which can enhance clitoral blood flow and congestion, are also an option to improve desire and sexual activity.[23] For those female patients suffering from infertility postoperatively, laparoscopic adhesiolysis may be an option if scarring is thought to be the primary cause. Alternatively, assisted reproductive technology, such as in vitro fertilization, may be an option.

Preventative strategies have been advocated as ways to preserve fertility in those females undergoing pelvic surgery. These include oophoropexy, adhesion barriers, and laparoscopic approach; however, there is limited data demonstrating the efficacy of these approaches. A study by Indar et al demonstrated that women undergoing laparoscopic IPAA had low rates of adnexal adhesions.[34] This was further validated in a study by Hull et al, which demonstrated lower adhesions in the abdomen and adnexal following laparoscopic surgery.[35] As in males, women seeking to preserve sexual function and fertility may choose to delay surgery in elective cases.

Conclusion

Sexual dysfunction in males and females arises from injury to similar nerves, with different effects on each sex. While preservation of these nerves is advocated, a review of sexual dysfunction following rectal cancer surgery did not find consistent evidence of any improvement in function or nerve preservation using minimally invasive techniques including laparoscopic and robotic surgery.[36] Some of the sexual side effects are reversible and treatable, but others are not, which makes preoperative discussion with patients of utmost importance.

Defecatory Dysfunction

Defecatory function is a complex combination of preoperative function, including underlying continence, number of bowel movements, and rectal compliance. Postoperatively, neurologic changes, as well as mechanical changes to the rectum, and stretching of the sphincters may affect defecation. When defecatory dysfunction occurs following proctectomy, it can be described as LAR syndrome.

Anatomy, Physiology, and Etiology

LAR syndrome includes a variety of symptoms, including fecal incontinence, urgency, increased frequency of bowel movements, and clustering of bowel movements.[37] Fecal continence is controlled by various muscles and the nerves that innervate them. The muscular components include the levator ani, the internal anal sphincter (IAS) and the external anal sphincter (EAS), which are all innervated by branches of the sacral nerves and pudendal nerve. The main hollow organs involved in the final stages of fecal continence are the rectum and anus.

At baseline, the rectum has two important functions: capacitance and defecation. Capacitance is the capability of the rectum to continue to hold and store stool until one is ready to evacuate. To perform this function, the rectum works in close association with the anus. The rectum itself lacks the appropriate proprioceptors for this function and must rely on the upper anal canal epithelial innervation. The upper anal canal contains a high density of sensory nerve endings, including Meisner's corpuscles (touch), Krause's bulbs (cold), Golgi–Mazzoni's bodies (pressure), and genital corpuscles (friction).[38–40] These nerve endings allow the upper anal canal to sample contents of the distal rectum to determine the quality and consistency, and to discern gas from liquid and from solid. In addition, they provide a

feedback mechanism to the rectum to continue to hold waste until the individual is ready to evacuate. This rectoanal inhibitory reflex was first described by Gowers in 1877.[41] Replacement of the rectum with neorectum, either colonic or ileal in nature, disrupts the feedback mechanism that helps control capacitance.

The IAS, EAS, and levator ani muscles are the major components of normal human fecal continence. In general, the IAS is generally thought of as controlling involuntary continence. The IAS is the distal continuation of the rectal circular smooth muscle and is controlled by involuntary autonomic nerves, specifically L5 sympathetic fibers and S2, S3, and S4 parasympathetic fibers bilaterally. The EAS is the striated muscle that forms around the IAS and the conjoined longitudinal muscle from the anal verge to the levator ani muscles and is controlled voluntarily bilaterally by the inferior rectal branch of the pudendal nerve (S2 and S3), as well as the perineal branch of S4.[42] Although the EAS is responsible for much of voluntary control, there is significant crossover innervation around the anus as complete disruption of either pudendal nerve alone does not always result in asymmetric sphincter atrophy or fecal incontinence. However, with the pudendal nerve providing motor innervation to the EAS and sensory information from the perineum, injury to one or both of these nerves can result in fecal incontinence. Rectal surgery may include injury to the nerves controlling the IAS and EAS, but alternatively may include resection, such as in an intersphincteric resection for cancer. This may have significant effect on continence.

If any of these muscles, nerves, or organs are damaged or altered with surgical intervention, LAR syndrome can result. Patients with LAR syndrome may have difficulty discriminating liquid and gas, which affects fecal continence.[43] In 2012, Emmertsen and Laurberg published the LAR syndrome score, which established a validated objective tool for evaluation of bowel function following LAR, with scores based on the impact of LAR syndrome symptoms on the quality of life of patients[44] (►**Table 2**). This may help standardize evaluation of LAR syndrome in the future and lead to better preventative and treatment research to improve patient outcomes.

A recent study found 72% of patients undergoing a LAR reported some degree of fecal incontinence postoperatively.[45] Juul et al evaluated 796 patients who underwent proctectomy for rectal cancer and showed that postoperative quality of life is closely related to the presence and severity of LAR syndrome symptoms.[37] While the etiology of the symptoms comprising LAR syndrome has not been elucidated, the severity of symptoms does appear to correlate with tumor height more than 5 cm, a TME and treatment with radiotherapy.[44]

Marijnen et al found that patients receiving neoadjuvant radiotherapy had slower recovery from defecation problems.[46] A separate randomized controlled trial found that preoperative radiotherapy increased overall levels of fecal incontinence.[47] A recent study from Spain found that 75.8% of postoperative patients after a LAR syndrome suffered from some degree of LAR syndrome, with 56.2% suffering from major LAR syndrome. Postoperative major LAR syndrome was found to be independently associated with a complete TME, preoperative radiotherapy, and postoperative radiotherapy.[48]

Table 2 Table of low anterior resection syndrome score

Category	Score
Incontinence for flatus	
Never	0
< Once per week	4
≥ Once per week	7
Incontinence for liquid stool	
Never	0
< Once per week	3
≥ Once per week	3
Frequency of bowel movements	
> 7 times per day	4
4–7 times per day	2
1–3 times per day	0
< Once per day	5
Clustering of stools	
Never	0
< Once per week	9
≥ Once per week	11
Urgency	
Never	0
< Once per week	11
≥ Once per week	16
Total score	0–42
Interpretation	
No low anterior resection syndrome	0–20
Minor low anterior resection syndrome	21–29
Major low anterior resection syndrome	30–42

Treatment of Low Anterior Resection Syndrome

Treatments aimed at LAR syndrome have mostly comprised efforts to remedy the associated symptoms and improve quality of life, not alter the course of the underlying cause, as this has not been definitively established. These treatments include dietary adequacy, fiber ingestion, antidiarrheals such as loperamide, anorectal biofeedback, pelvic floor rehabilitation, sacral nerve stimulation (SNS), and permanent stoma construction.[49] Recently, rectal irrigation has also been proposed as an effective tool to treat LAR syndrome.

McCutchan et al evaluated postoperative patients with LAR syndrome and treated each with rectal irrigation primarily. They found that those patients with more severe symptoms were more likely to opt for rectal irrigation as a

treatment and found that those who completed rectal irrigation treatments had improve quality of life, mainly in the ability to control the timing of defecation.[50]

Recently, Eftaiha et al studied the effects of SNS as a possible treatment option for LAR syndrome. Although only 10 patients were included in the final group who proceeded to permanent implantation, all patients showed significant improvement in incontinence, as well as the LAR syndrome score.[51] Similarly, D'Hondt et al studied a similar patient group with LAR syndrome and treatment with SNS by looking at Wexner and LAR syndrome scores. In their study, 11 patients had permanent implantation, with Wexner scores improving from 17.7 to 4.6 and LAR syndrome scores improving from 36.9 to 11.4.[52] Given these limited but encouraging studies, SNS is a possible additional treatment option that can be considered and deserves more research at improving LAR syndrome.

Conclusion

With a constellation of symptoms affecting quality of life, LAR syndrome is a common but modifiable complication after pelvic surgery. While quality of life can be negatively impacted by the initial changes to defecatory function, there are promising treatments to this syndrome, such as SNS. With the advent of the LAR syndrome score, future research should only improve the postoperative life of patients negatively affected by this syndrome.

Conclusion

Postoperative functional complications are common following pelvic surgery. Long-term complications such as bladder dysfunction, sexual dysfunction, and low anterior rectal syndrome are common, but often overlooked when discussing postoperative complications in the literature and often neglected to discuss with patients in the preoperative setting. While not all complications are preventable, a detailed understanding of the rates of these complications, as well as the treatment and prevention of them, is paramount to achieving desirable outcomes. Since not all complications have an established anatomic and physiologic etiology, further research is needed in these three areas to better understand why, when, and how these complications arise. These complications directly affect the patient's postoperative quality of life; therefore, maximum efforts should be made to treat them when they occur and prevent them when possible.

Conflict of Interest
None declared.

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