Evaluation of Quality of Life and Surgical Outcomes for Treatment of Diverticular Disease

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Abstract

The prevalence of diverticular disease in the Western and industrialized nations has increased over the last century, and our understanding of this disease and its management continues to evolve. In this article, we review the literature regarding the postoperative quality of life (QOL) and functional outcomes following surgical management of diverticulitis, including information regarding bowel function, recurrence of symptoms, and other postoperative sequelae. While objective parameters, such as attacks of diverticulitis, complications, and clinical episodes have been studied, there is a paucity of data on less objective factors, such as overall patient satisfaction after operative management of diverticular disease. The literature shows improvement in QOL following surgical intervention for diverticulitis if preoperative QOL was significantly low, secondary to severe/complicated diverticulitis. However, a subset of patients does continue to have symptoms following surgical intervention for diverticulitis. Often neglected in the literature, there remains a need for prospective data evaluating preoperative function to ascertain the impact of surgery on patients' QOL and postoperative function.

Keywords

- diverticular disease
- quality-of-life measurement
- surgical outcomes
- postoperative sequelae

Diverticular disease is common in the Western culture and poses a significant clinical burden to the United States population. Given its prevalence, the diverticular disease remains one of the most common indications for both elective and emergent colon resections in the United States.^{1,2} The treatment paradigm for management of diverticular disease, however, has shifted away from being strictly based on the number of previous attacks of diverticulitis toward a more case-by-case approach, taking into account a multitude of variables.³ The decision to proceed with elective colon resection in patients after successful recovery from an episode of acute diverticulitis has been intended to prevent future hospitalizations, decrease the risk of needing emergent colon resection, and to achieve long-term cure defined as the absence of abdominal symptoms or recurrent diverticulitis, although the literature has not staunchly supported this premise.^{4,5} Amidst the ongoing debate about whether or not to operate on patients with diverticulitis, significant albeit not often addressed aspects

of diverticular disease include quality of life (QOL) and surgical outcomes for patients treated with prophylactic surgery.

In this article, we will review the available literature pertinent to postoperative QOL and functional outcomes after resection for diverticular disease. Current information with regards to bowel function, recurrence of symptoms, and other postoperative sequelae will be addressed. Unfortunately, little formal weight has traditionally been given to long-term functional outcomes after surgical management of diverticulitis. An understanding of these long-term outcomes is necessary, however, to provide patients optimal counseling regarding the decision of whether or not to undergo elective operative intervention for diverticulitis. Whether or not surgery can restore QOL in patients with symptomatic diverticular disease which causes considerable disruption of lifestyle and general “well-being” may represent the most compelling reason yet to offer surgical treatment as an option.⁶

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Diverticular Disease and Quality of Life

The majority of patients with diverticular disease remain asymptomatic, however, up to 25% of patients with diverticulosis will develop symptoms of diverticulitis in their lifetime, such as abdominal pain, bloating, and disturbances of bowel habits.^{7,8} Of these patients who develop diverticulitis, up to 20% will develop complications from their diverticular disease, defined as diverticulitis associated with abscess, fistula, obstruction, phlegmon, bleeding, or perforation.^{7,8} Although a recent study found that patients with multiple episodes of diverticulitis are not at increased risk for poor outcomes, chronic diverticular disease continues to pose a considerable burden on patients afflicted with this condition.⁹

Health-related QOL (HRQOL) is a concept that attempts to predict daily function and well-being based on subjective attitudes and evaluated from the patient's viewpoint of a specific chronic illness on their functional status.¹⁰ HRQOL thus serves as an important way to assess a variety of chronic gastrointestinal conditions by promoting direct patient involvement, patient-centered measurements of disease impact, and implementation of effective treatments based on patient-focused outcomes. HRQOL reflects the physical, social, and emotional attitudes of an individual as related to their prior and current health status, and can be measured by generic multi-item questionnaires and disease-specific instruments, for example, the Gastrointestinal Quality of Life Index (GIQLI). The GIQLI is a validated quality-of-life questionnaire that addresses core gastrointestinal symptoms and physical, psychological, social, and disease-specific issues. The GIQLI questionnaire has undergone rigorous development to become a reproducible and consistent index that measures QOL.¹¹ Clinicians can utilize HRQOL to tailor treatment based on individual patient needs and examine relationships between disease severity and functional capacity.

To test whether the diverticular disease has an impact on QOL, Bolster et al used a disease-specific questionnaire that has been validated for patients with inflammatory bowel disease, completed by subjects in their patient group and the control group of healthy volunteers.¹² This structured questionnaire examined bowel symptoms, systemic symptoms, emotional symptoms, and social function. Their study suggested that diverticular disease has a negative impact on QOL, as patients with diverticular disease had significantly lower QOL scores compared with controls, a difference that was consistent in all four areas examined: bowel symptoms, systemic symptoms, emotional symptoms, and social function ($p < 0.003$ for all categories).¹³ They submit that taking QOL into account can affect decision-making regarding elective surgery for diverticular disease. Since the current criteria for selection of patients with diverticular disease for surgery remain unclear, formal assessment of QOL via a tool, such as a questionnaire survey, that can accurately measure health status may be helpful in selecting appropriate candidates for elective surgery.

Comparato et al aimed to assess QOL in a group of 58 patients with the uncomplicated symptomatic diverticular disease, using the Short-Form 36-item (SF-36) Health Survey questionnaire and clinical evaluation by means of the global

symptomatic score at baseline and after 6 months of medical treatment.^{14,15} They determined that diverticular disease had a negative impact on QOL compared with the general population, as patients with diverticular disease had substantially impaired QOL score compared with their normative control group.¹⁶ Furthermore, this study showed no differences in QOL between the two sexes and between younger and older patients. These findings supported the results of the previously mentioned study by Bolster et al.

HRQOL is becoming an important issue in the evaluation of any therapeutic intervention, especially in chronic conditions such as diverticulosis, where the aim of therapy is to reduce symptoms, decrease discomfort, and prevent future episodes caused by the disease. To date, there have not been many studies that have investigated QOL in diverticular disease, however, based on Bolster and Comparato's results, the diverticular disease has a negative impact on QOL, and it is important to evaluate the efficacy of therapy for this disease.

Postoperative Quality of Life

The indications for elective sigmoid resections in the treatment of uncomplicated diverticular disease are unclear. The decision to operate is based on future risk estimates of disease recurrence and complications rates, while QOL is rarely calculated into the risk-benefit analysis to warrant the risk of operative intervention.¹⁷ However, several studies have observed a significant improvement in QOL following elective sigmoid colectomy in patients with diverticular disease, comparing the HRQOL before and after surgery.

Pasternak et al performed a retrospective study to assess disease-related QOL after laparoscopic sigmoidectomy in 130 patients undergoing elective operation between 1999 and 2006 at a regional medical center in Switzerland.¹⁸ The authors explicitly stated their interest in examining "subjective" outcomes of health-related QOL in this study which are not typically represented by "objective" data, such as vital signs or laboratory values, with a focus on transforming patient-reported data into a measurable and specific outcome variable.

All patients in this study conducted by Pasternak et al had an endoscopy which confirmed the presence of diverticulosis. One subgroup had confirmation of previous episodes of diverticulitis by triple contrast computed tomography (CT) scan, while a second subgroup was symptomatic with no other etiology for their complaints. Exclusion criteria included patients who required an emergency operation. The same surgeon performed all operations in this study, and treatment protocol was standardized and applied to all patients. Patients filled in the GIQLI measurement tool questionnaire describing their QOL, with mean follow-up being 40 months. The mean GIQLI score was 95 before and 114 after the operation, with only 48% of patients reporting a GIQLI > 100 before the surgery, which improved to 83% after the operation ($p < 0.0001$). The results of this study showed an overall 96% patient satisfaction with the operation, with the majority of patients reporting improved QOL after their surgery. The clearest benefit was observed in patients who had multiple previous episodes of diverticulitis.

Forgione et al performed the first prospective clinical study examining QOL in patients with confirmed diverticulitis, before and after surgical resection.¹⁹ Their objective was to prospectively determine the functional impact of elective laparoscopic sigmoidectomy after prior acute diverticulitis in 46 patients diagnosed with CT scans over an 18 month period. Preoperative measures of HRQOL were assessed by the GIQLI questionnaire at baseline (preoperative) and again subsequently throughout the first postoperative year (3, 6, and 12 months postoperatively) regarding QOL and bowel symptomatology. 46 patients were studied, 45 of whom had their surgery completed laparoscopically. QOL significantly improved in the group overall, with 36 patients having an increase in their GIQLI evident at 3 months and maintained after that. Interestingly, the improvement was most significant in those patients who had the lowest preoperative scoring. The authors concluded that significant improvement in QOL and social functioning resulted from elective sigmoid resection in the majority of patients.

In both of the studies discussed above, success rates concerning a gain in QOL were high. However, a study published in 2008 revealed much worse outcomes. Egger et al designed their study to determine the incidence and pattern of persistent symptoms and their association with preoperative parameters.²⁰ Data were obtained from a database of all patients undergoing colonic resection (laparoscopic and open) within a surgical department in a university hospital setting in Switzerland. Follow-up at a mean of 33 months was conducted through structured interviews (124 patients were available out of total 162). In this study, Egger et al found that despite technically successful surgery for diverticular disease, a significant portion of patients experienced persistent symptoms not resulting from recurrent diverticulitis.

Of patients who underwent elective surgery, 25% continued to experience symptoms such as painful constipation, abdominal distention, cramps, and frequent diarrhea. Not surprisingly, patients with persistent symptoms were also found to have a lower sense of well-being.²⁰ There was no statistically significant correlation between the stage of disease (complicated versus uncomplicated) nor the surgical technique (laparotomy versus laparoscopy) and the recurrence of symptoms. They concluded that a substantial number of patients continued to experience persistent symptoms after bowel resection, a finding that supported a previous study conducted by Janes et al, which reviewed the literature to arrive at a similar conclusion.²¹ Despite improved medication and surgical technique, Janes et al also found that surgery for diverticular disease had a high complication rate, with 25% of patients continuing to experience recurrent symptoms after bowel resection.²¹

Some key differences, however, exist between the studies conducted by Pasternak and Forgione versus Egger's study, which could explain the disparity between the results. Egger's study results may only be partially comparable, as the inclusion and exclusion criteria were quite different. Pasternak and Forgione used very similar inclusion and exclusion criteria, as well as the same outcome tool, the GIQLI questionnaire. Neither Pasternak nor Forgione included patients who were operated on emergently. Pasternak excluded patients who

underwent conventional open surgery and those patients who had stomas. The patient population included in the studies performed by Pasternak and Forgione appeared to be more homogeneous, which could explain the unexpected results which emerged from Egger's study. Also, the latter study did not exclude those patients who had a coexisting irritable bowel syndrome which could have explained persistent symptoms postoperatively.

A recent meta-analysis regarding diverticulitis and QOL undertook a systematic review of QOL after conservative versus surgical treatment of uncomplicated diverticulitis.²² Andeweg et al collected data from 21 studies that included 1858 patients total from 1990 to 2014. Based on the SF-36 scores, patients in this study had higher QOL scores after elective laparoscopic resection when compared with conservative treatment of recurrent diverticulitis (73.4 vs. 58.1, 95% confidence interval [CI]: 65.7–81.1 vs. 47.2–69.1, respectively). They concluded that patients have better QOL after laparoscopic surgery versus conservative treatment of diverticulitis. Admittedly, the studies taken into account for this meta-analysis had a high risk of bias and were underpowered for comparison between the two different treatment modalities. The limitations of this study include heterogeneity among existing studies upon which the conclusions of their meta-analysis were based. They conceded that higher quality trials focused on QOL with well-defined patient populations with diverticular disease were needed.

Nevertheless, preoperative counseling and inclusion of QOL parameters in discussing elective surgery with patients presenting with the diverticular disease is not only helpful but becomes essential when taking into account the wide spectrum of patient-reported outcomes after surgical treatment of diverticulitis.

Bowel Function

Little has been written in the literature regarding bowel function and functional outcomes following surgery for diverticulitis. A recent retrospective study by Levack et al aimed to document the frequency, severity, and predictors of suboptimal bowel function, defined as fecal incontinence, urgency, and/or incomplete emptying, in patients who underwent sigmoid colectomy for diverticulitis at a large academic medical center.²³ Using a series of validated tools, 325 patients between 2001 and 2008 who had either a laparoscopic or open sigmoid colectomy for diverticulitis were surveyed with regard to fecal incontinence, fecal urgency, and difficult evacuation postoperatively. A 70-question survey incorporating the Fecal Incontinence Severity Index, the Fecal Incontinence Quality of Life Scale, and the Memorial Bowel Function Instrument, was utilized. Survey responders with suboptimal bowel function were compared with those patients who had good outcomes by using a logistic regression analysis to determine predictors of poor functional outcome. Levack et al found that approximately 25% of their surveyed patients reported fecal incontinence and 20% had fecal urgency and difficult evacuation. Interestingly, female patients were at greater risk for postoperative impairment in bowel function, being twice as likely as their male

counterparts to experience incontinence and 1.5 times more likely to have issues with urgency and evacuation. The results of this study, with approximately one-fifth of their patients reporting fecal urgency, fecal incontinence, or incomplete emptying after surgery for diverticulitis, were as much surprising as they were concerning, although the study had its limitations and the data were incomplete.

The above results were difficult to interpret, especially given that Levack et al's study did not have a preoperative arm, and thus, without preoperative functional data it would be difficult to discern whether the patients studied had preexisting pelvic floor disorder and/or underlying gastrointestinal dysfunction also or apart from diverticulitis. Furthermore, this study did not use a non-diverticulitis control group. Despite its' limitations, this study did find a rate of bowel dysfunction significantly higher than that of the general population. Further studies with prospective data accounting for preoperative function are needed to elucidate the impact of surgery on patients with diverticulitis.

In contrast, Ambrosetti et al performed a prospective study to analyze functional results following elective laparoscopic sigmoidectomy for patients with diverticulitis objectively diagnosed by CT scan. A questionnaire administered at a mean time of 40 months postoperatively inquired about new abdominal symptoms and whether bowel function was better, worse, or unchanged following surgery.²⁴ Overall, bowel function was reported to be better for 56% of their patients, unchanged for 37%, and worse for 7%. In addition to better bowel function outcomes, the majority of patients surveyed in their study were satisfied with their postoperative general comfort. Interestingly, male gender, the absence of preoperative history compatible with irritable bowel syndrome, longer length of resected sigmoid (mean: 23.3 cm, range: 14–50 cm) and acute residual inflammation on histological examination of surgical specimen were correlated with a higher degree of postoperative satisfaction.²⁴ The authors concluded that surgery for diverticulitis led to good functional results. They postulated that based on the results of their study, diagnostic accuracy of diverticulitis and having well-established secondary indications to proceed with elective surgery for the diverticular disease are most important for reaching the best postoperative results.

There is a paucity of literature regarding the functional changes that patients should consider when faced with the decision regarding elective surgery following previous episodes of diverticulitis, whether complicated or not. The above studies with contradictory findings highlight the need for a prospective study to delineate the relationship between surgery for diverticulitis, preoperative function, and postoperative outcomes.

Recurrence of Symptoms

A review of current literature suggests that the rate of recurrent diverticulitis after resection of the sigmoid colon ranges from 1 to 10%, and of concern is that up to 25% of patients who underwent surgical intervention experienced persistent symptoms postoperatively.²⁰ As mentioned previously, Egger

et al found that 25% of patients undergoing elective surgery for a diverticular disease suffered persistent symptoms. Interestingly, they found that patients who required emergency surgery had a similar rate of persistent symptoms compared with those who underwent elective sigmoid resection for diverticular disease. However, as mentioned previously, their patient population was potentially confounded by preexisting or associated irritable bowel syndrome, which could explain persistent symptoms following sigmoid resection.

Thorn et al reviewed 75 patients with the diverticular disease who were subjected to elective colonic resection in Sweden from 1989 to 1994.²⁵ They sent these patients a questionnaire about abdominal symptoms and functional results postoperatively, and analyzed possible associations between patient characteristics and postoperative complications and functional outcomes. They found that only 8% of their patient population (six people) had a recurrence of symptoms, with the mean length of time from operation to the diagnosis of the recurrent disease being 25 months. Of note, patients with functional bowel symptoms, especially that suggestive of irritable bowel syndrome, before surgery had significantly worse results ($p < 0.05$).

Peppas et al performed a systematic review of 21 studies from 1983 to 2005 in the PubMed database looking at the outcomes after medical versus surgical treatment of diverticulitis.²⁶ The main outcomes of interest were mortality, morbidity, and recurrence of diverticulitis after medical or surgical treatment. Morbidity was defined as the development of postoperative complications, for example, wound infection, abscess, fistula and small bowel obstruction, which led to reoperation. This study showed that the recurrence of symptoms compatible with diverticular disease and readmission rates to the hospital for these complaints were more common for patients treated conservatively (18.6%) compared with those patients treated surgically (6.1%). Unfortunately, the analysis in this study was limited by several issues. The most important limitation was that the studies they compared for the review were not randomized controlled trials. Furthermore, the available data only allowed comparisons between patients with diverticular disease treated medically versus those treated by emergency surgery, not selectively. As such, the patient characteristics between the two groups differed considerably, and precluding any more definitive conclusions to be drawn from this systematic review.

Similarly, Bargellini et al evaluated the long-term results in patients treated for the diverticular disease, focusing on comparison of outcomes between different modalities of treatment: medical treatment, elective surgery, and emergency surgery (35.6, 24.6, and 39.7%, respectively).²⁷ They prospectively examined a group of consecutive patients who were treated for the diverticular disease at a university hospital in Italy between 2003 and 2007. After treatment, the patients responded to the Cleveland Global Quality of Life (CGQL) questionnaire as well as a recurrence of symptoms questionnaire via phone interview. The median follow-up was at 99 months. Surprisingly, the CGQL total scores were found to be similar across the three groups, and diverticular disease affected bowel function in the long-term follow-up regardless

of the type of therapy initially adopted. No significant difference was observed in terms of the rate of recurrent symptoms at follow-up among patients of the three different groups, including abdominal pain, tenderness, bloating, diarrhea and constipation. Bargellini et al concluded that the persistence of symptoms after resection for the diverticular disease should be taken seriously and further examined.

Other Postoperative Sequelae

Equally as important as postoperative bowel function is the consideration of potential iatrogenic sequelae after sigmoid resection for diverticular disease. Despite undergoing the same procedure of sigmoid colectomy as some other diseases commonly requiring colectomy, patients with diverticular disease have significantly worse and costlier outcomes after elective colectomy compared with patients with colon cancer, for example.²⁸

Van Arendonk et al compared outcomes and costs of elective surgery for diverticular disease with other diseases that commonly require colectomy.²⁸ They hypothesized that because diverticulitis is inflammatory, outcomes after elective surgical resection for the diverticular disease may be worse than the same operation performed for a noninflammatory disease process, independent of other variations among patient populations. Outcomes of interest that were examined in this study include in-hospital mortality, ostomy placement, infection, unexpected reoperation, hemorrhage, acute myocardial infarction, thromboembolic events, shock and sepsis, renal failure, and pulmonary compromise.

Using the Nationwide Inpatient Sample from 2003 to 2009, Van Arendonk et al were able to perform a retrospective analysis of data which included a 20% representative sample of hospitals in the United States. Of 74,879 patients, they found that patients with the diverticular disease were more likely than patients with colon cancer to experience in-hospital mortality ($p < 0.001$), develop a postoperative infection ($p < 0.001$), and have an ostomy placed ($p < 0.001$).²⁸ Furthermore, the adjusted total hospital charges for patients with the diverticular disease were considerably higher (\$6,678.78, 95% CI: \$5,722.12–7,635.43, $p < 0.001$) and length of stay was 1 day longer ($p < 0.001$) compared with patients being operated on for colon cancer. They concluded that these relatively poor outcomes should be factored into decision-making when considering routine elective colectomy for diverticular disease.

In addition to examining QOL, as mentioned previously, Forgione et al also looked at iatrogenic dysfunction after operation for diverticular disease. Preoperative measures of urinary and sexual function were assessed by standardized questionnaires administered before surgery and again at regular intervals throughout the first postoperative year. Men were evaluated by means of the international prostate symptom severity and international index of erectile function, while women were evaluated by the urinary dysfunction index and a modified questionnaire for the evaluation of sexual function. Forgione et al did not find any significant deterioration in postoperative urinary or sexual function in either men or women.¹⁹

Constantinides et al investigated more traditional adverse outcomes associated with surgical treatment for the diverticular disease, focusing specifically on complicated diverticulitis.²⁹ The primary outcome in their study was 30-day postoperative mortality, defined as death within 30 days of operation, regardless of cause. Secondary outcomes they examined were postoperative surgical complications as well as medical complications. Surgical complications included intra-peritoneal sepsis or wound infection, anastomotic leak, bowel obstruction, stoma complications, and bleeding. Medical complications included deep venous thrombosis (DVT), pulmonary embolism (PE), myocardial infarction (MI), stroke, and urinary tract infection. In this study, Constantinides and colleagues focused on the choice of operation for complicated diverticular disease, comparing primary resection and anastomosis (PRA) to Hartmann's procedure (HP).²⁹ They found that the rate of all complications for PRA was 37.1% versus 69.5% for HP post-operatively ($p < 0.001$). Major complications of surgery, such as bleeding, occurred at a rate of 19.0% for PRA and 22.2% for HP ($p = 0.456$). Medical complications such as DVT, PE, MI, or stroke, occurred at a rate of 13.7% versus 30.5% for HP ($p < 0.001$). Mortality rates, defined as in-hospital deaths, occurred at a rate of 4.0% for PRA and 23.4% for HP ($p < 0.001$).

Surgical Outcomes: Laparoscopic versus Open Resection

While few studies have compared laparoscopic sigmoid resection (LSR) to open sigmoid resection (OSR) for symptomatic diverticulitis, it is worthwhile to mention differences in outcomes when comparing LSR to OSR, especially since the review of literature undertaken here found that most studies grouped both LSR and OSR together when examining postoperative sequelae, including QOL.

Klarenbeek et al conducted their Sigma Trial, which was a prospective, multicenter, double-blind, parallel-arm, randomized controlled trial to test the hypothesis that LSR is associated with decreased postoperative complication rates and better QOL when compared with OSR.³⁰ From 2002 to 2006, 104 patients were randomized across five centers. LSR patients experienced less postoperative pain, systemic analgesia requirements, returned home earlier, and the SF-36 questionnaire showed significantly better QOL.

Siddiqui et al performed a meta-analysis of published literature comparing open and laparoscopic elective sigmoidectomy for diverticular disease, and found similar results to Klarenbeek, concluding that LSR is safe with fewer postoperative complications when compared with OSR.³¹ This meta-analysis confirms results of the Sigma Trial, and showed that patients undergoing LSR have a statistically significant lower rate of wound infections, postoperative ileus, incisional hernia, and need for blood transfusions when compared with OSR.

Discussion

Whether or not to operate on diverticulitis is an ambiguous, complex issue that continues to challenge both surgeons and patients, despite multiple advances in our knowledge of this

disease process. The advancements in both medical and surgical treatment of diverticular disease have in some ways confused the picture even more, regarding the best course of treatment for patients with diverticulitis, and practice patterns continue to evolve.³² However, particularly in complicated and recurrent cases, not enough studies have shown support for nonoperative management. Lamb et al concluded in their study that the evidence in literature, albeit weak, still suggest that complicated diverticulitis with abscess formation is associated with high probability of resective surgery, whereas conservative management results in chronic or recurrent diverticular symptoms.³³ Central to this complex, difficult debate, is the importance of a complete understanding of QOL and the postoperative outcomes following surgical treatment of diverticular disease.

Our knowledge of the diverticular disease itself, as well as recurring or persistent symptoms and functional outcomes that patients experience after surgery, continues to evolve. Decades ago, Parks et al first described this subject, where they found that 24% of patients surgically treated for diverticular disease continued to experience mild symptoms postoperatively.^{34,35} Over the past 20 years, there has since been a shift toward a decrease in the use of elective colectomy following an episode of diverticulitis, as increasing evidence lends support for nonoperative management of diverticular disease.³⁶

Multiple attempts have been made by individual experts as well as consensus groups to define objective criteria to identify individuals likely to benefit from surgical resection for diverticular disease.³⁷ From the now antiquated practice of recommending surgery for patients after the second episode of diverticulitis, we now understand that the first episode of diverticulitis is likely the most virulent, with recurrent episodes rarely requiring emergency surgery.^{21,38}

However, studies have demonstrated that elective surgery may be associated with improved QOL, as well as reduced abdominal pain and abnormal defecation caused by the diverticular disease.³⁹ Current practice parameters outlined by the Clinical Practice Guideline Task Force of the American Society of Colon and Rectal Surgeons for the treatment of sigmoid diverticulitis recommend individualized management, with the ultimate decision for proceeding with any specific procedure be made by the physician with heavy deference to the unique circumstances presented by each patient.⁴⁰

Unfortunately, analysis of such patient-centered measures of postoperative QOL, bowel function, and recurrence of symptoms is much less well-defined compared with traditional objective evaluation of, for example, mortality and adverse outcomes such as DVT or MI. Given how complex diverticular disease is, and how the personal perception of the severity of the disease varies with each individual, perhaps more weight should be given to patient-reported outcomes when measuring the success or failure of therapy, versus the traditional measures of outcomes mentioned above.

In our investigation and review of the current information available, we did observe an overall improvement in the literature describing QOL and patient satisfaction postoperatively after resection for diverticular disease. Much of the subjective benefits described by patients in questionnaires

were predicated on their preoperative QOL scores, as well as the preoperative functional baseline.^{18,19} Thus, as much as preoperative functional assessment and perception of the severity of their disease may help select those patients who may benefit from surgery, it may just as likely contribute to determine those patients who would be unlikely to derive much benefit from elective surgery for their disease.

In contrast to the consistent overall trend toward improvement in QOL, we discovered conflicting results regarding the subject of bowel function after sigmoid resection for diverticulitis. Although none of the studies we examined in any way proved whether elective surgical resection for diverticular disease either improved or led to a deterioration of bowel function, the presence of postoperative symptoms within the population that included urgency, fecal incontinence, and obstructed defecation are troublesome.²³ These heterogeneous findings highlight the importance of further investigation to delineate relationships between surgery for diverticular disease and preoperative as well as postoperative outcomes, particularly subjective measures that have not been previously explored in detail.

Looking forward to future prospective multicenter studies to compare QOL and functional results before and after elective surgery for diverticular disease, it will be important to survey patients with questionnaires regarding preoperative versus postoperative bowel function, symptomatology, and recurrence of symptoms, at regular intervals after surgery.

Conclusion

One of the most important and frequently debated questions plaguing surgeons is whether or not to operate, a dilemma exemplified in the decision-making process involving treatment of diverticular disease. In Western and industrialized societies like the United States, the colonic diverticular disease is common, the prevalence increasing with age. Thus, much work has been contributed to better understanding the natural history of diverticular disease, and we have moved from routine operation after the second episode of diverticulitis to a case-based approach, taking into account a multitude of variables such as frequency and severity of attacks. It is presumed that elective surgery leads to alleviation of current symptoms and prevention of future diverticulitis attacks, and that the benefits will outweigh the risks of operative intervention. However, this assumption has not been proven in the literature. Furthermore, less objective factors such as QOL, functional outcomes, and overall patient satisfaction after operative management of diverticular disease remain largely glossed over, and more data on these long-term outcomes will be necessary to determine the impact of surgical treatment on patients' lives. An understanding of the long-term functional outcomes and overall patient satisfaction after undergoing sigmoid resection for diverticulitis is crucial to provide a complete counseling to patients who are faced with the decision of whether or not to undergo an operation. There is a need for prospective data that accounts for preoperative function and further delineates the impact of surgery on patients' QOL and overall function postoperatively.

References

- 1 Salem L, Veenstra DL, Sullivan SD, Flum DR. The timing of elective colectomy in diverticulitis: a decision analysis. *J Am Coll Surg* 2004;199(06):904–912
- 2 Juo YY, Hyder O, Haider AH, Camp M, Lidor A, Ahuja N. Is minimally invasive colon resection better than traditional approaches?: First comprehensive national examination with propensity score matching *JAMA Surg* 2014;149(02):177–184
- 3 Etzioni DA, Mack TM, Beart RW Jr, Kaiser AM. Diverticulitis in the United States: 1998–2005: changing patterns of disease and treatment. *Ann Surg* 2009;249(02):210–217
- 4 Stocchi L. Current indications and role of surgery in the management of sigmoid diverticulitis. *World J Gastroenterol* 2010;16(07):804–817
- 5 Simianu VV, Strate LL, Billingham RP, et al. The impact of elective colon resection on rates of emergency surgery for diverticulitis. *Ann Surg* 2016;263(01):123–129
- 6 Koo V, Strange J, Lam CY, Epanomeritakis M. Young patients with diverticular disease: a preliminary quality of life study. *Int J Surg* 2007;5(04):244–249
- 7 Parks TG. Natural history of diverticular disease of the colon. *Clin Gastroenterol* 1975;4(01):53–69
- 8 Farmakis N, Tudor RG, Keighley MR. The 5-year natural history of complicated diverticular disease. *Br J Surg* 1994;81(05):733–735
- 9 Chapman JR, Dozois EJ, Wolff BG, Gullerud RE, Larson DR. Diverticulitis: a progressive disease? Do multiple recurrences predict less favorable outcomes?. *Ann Surg* 2006;243(06):876–830, discussion 880–883
- 10 Bargaonkar MR, Irvine EJ. Quality of life measurement in gastrointestinal and liver disorders. *Gut* 2000;47(03):444–454
- 11 Eypasch E, Williams JL, Wood-Dauphinee S, et al. Gastrointestinal Quality of Life Index: development, validation and application of a new instrument. *Br J Surg* 1995;82(02):216–222
- 12 Guyatt G, Mitchell A, Irvine EJ, et al. A new measure of health status for clinical trials in inflammatory bowel disease. *Gastroenterology* 1989;96(03):804–810
- 13 Bolster LT, Papagrigoriadis S. Diverticular disease has an impact on quality of life – results of a preliminary study. *Colorectal Dis* 2003;5(04):320–323
- 14 McHorney CA, Ware JE Jr, Lu JF, Sherbourne CD. The MOS 36-item Short-Form Health Survey (SF-36): III. Tests of data quality, scaling assumptions, and reliability across diverse patient groups. *Med Care* 1994;32(01):40–66
- 15 McHorney CA, Ware JE Jr, Raczek AE. The MOS 36-Item Short-Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Med Care* 1993;31(03):247–263
- 16 Comparato G, Fanigliulo L, Aragona G, et al. Quality of life in uncomplicated symptomatic diverticular disease: is it another good reason for treatment? *Dig Dis* 2007;25(03):252–259
- 17 Klarenbeek BR, Samuels M, van der Wal MA, van der Peet DL, Meijerink WJ, Cuesta MA. Indications for elective sigmoid resection in diverticular disease. *Ann Surg* 2010;251(04):670–674
- 18 Pasternak I, Wiedemann N, Basilicata G, Melcher GA. Gastrointestinal quality of life after laparoscopic-assisted sigmoidectomy for diverticular disease. *Int J Colorectal Dis* 2012;27(06):781–787
- 19 Forgione A, Leroy J, Cahill RA, et al. Prospective evaluation of functional outcome after laparoscopic sigmoid colectomy. *Ann Surg* 2009;249(02):218–224
- 20 Egger B, Peter MK, Candinas D. Persistent symptoms after elective sigmoid resection for diverticulitis. *Dis Colon Rectum* 2008;51(07):1044–1048
- 21 Janes S, Meagher A, Frizelle FA. Elective surgery after acute diverticulitis. *Br J Surg* 2005;92(02):133–142
- 22 Andeweg CS, Berg R, Staal JB, ten Broek RP, van Goor H. Patient-reported outcomes after conservative or surgical management of recurrent and chronic complaints of diverticulitis: systematic review and meta-analysis. *Clin Gastroenterol Hepatol* 2016;14(02):183–190
- 23 Levack MM, Savitt LR, Berger DL, et al. Sigmoidectomy syndrome? Patients' perspectives on the functional outcomes following surgery for diverticulitis. *Dis Colon Rectum* 2012;55(01):10–17
- 24 Ambrosetti P, Francis K, Weintraub D, Weintraub J. Functional results following elective laparoscopic sigmoidectomy after CT-proven diagnosis of acute diverticulitis evaluation of 43 patients and review of the literature. *J Gastrointest Surg* 2007;11(06):767–772
- 25 Thörn M, Graf W, Stefánsson T, Pahlman L. Clinical and functional results after elective colonic resection in 75 consecutive patients with diverticular disease. *Am J Surg* 2002;183(01):7–11
- 26 Peppas G, Bliziotis IA, Oikonomaki D, Falagas ME. Outcomes after medical and surgical treatment of diverticulitis: a systematic review of the available evidence. *J Gastroenterol Hepatol* 2007;22(09):1360–1368
- 27 Bargellini T, Martellucci J, Tonelli P, Valeri A. Long-term results of treatment of acute diverticulitis: still lessons to be learned? *Updates Surg* 2013;65(02):125–130
- 28 Van Arendonk KJ, Tymitz KM, Gearhart SL, Stem M, Lidor AO. Outcomes and costs of elective surgery for diverticular disease: a comparison with other diseases requiring colectomy. *JAMA Surg* 2013;148(04):316–321
- 29 Constantinides VA, Tekkis PP, Senapati A; Association of Colorectal of Great Britain Ireland. Prospective multicentre evaluation of adverse outcomes following treatment for complicated diverticular disease. *Br J Surg* 2006;93(12):1503–1513
- 30 Klarenbeek BR, Veenhof AA, Bergamaschi R, et al. Laparoscopic sigmoid resection for diverticulitis decreases major morbidity rates: a randomized control trial: short-term results of the Sigma Trial. *Ann Surg* 2009;249(01):39–44
- 31 Siddiqui MRS, Sajid MS, Qureshi S, Cheek E, Baig MK. Elective laparoscopic sigmoid resection for diverticular disease has fewer complications than conventional surgery: a meta-analysis. *Am J Surg* 2010;200(01):144–161
- 32 Li D, Baxter NN, McLeod RS, Moineddin R, Wilton AS, Nathens AB. Evolving practice patterns in the management of acute colonic diverticulitis: a population-based analysis. *Dis Colon Rectum* 2014;57(12):1397–1405
- 33 Lamb MN, Kaiser AM. Elective resection versus observation after nonoperative management of complicated diverticulitis with abscess: a systematic review and meta-analysis. *Dis Colon Rectum* 2014;57(12):1430–1440
- 34 Parks TG. Natural history of diverticular disease of the colon. A review of 521 cases. *BMJ* 1969;4(5684):639–642
- 35 Parks TG, Connell AM. The outcome in 455 patients admitted for treatment of diverticular disease of the colon. *Br J Surg* 1970;57(10):775–778
- 36 Li D, Baxter NN, McLeod RS, Moineddin R, Nathens AB. The decline of elective colectomy following diverticulitis: a population-based analysis. *Dis Colon Rectum* 2016;59(04):332–339
- 37 Simianu VV, Bastawrous AL, Billingham RP, et al. Addressing the appropriateness of elective colon resection for diverticulitis: a report from the SCOAP CERTAIN collaborative. *Ann Surg* 2014;260(03):533–538, discussion 538–539
- 38 Mäkelä JT, Kiviniemi HO, Laitinen ST. Spectrum of disease and outcome among patients with acute diverticulitis. *Dig Surg* 2010;27(03):190–196
- 39 van de Wall BJ, Draaisma WA, van Iersel JJ, Consten EC, Wiezer MJ, Broeders IA. Elective resection for ongoing diverticular disease significantly improves quality of life. *Dig Surg* 2013;30(03):190–197
- 40 Feingold D, Steele SR, Lee S, et al. Practice parameters for the treatment of sigmoid diverticulitis. *Dis Colon Rectum* 2014;57(03):284–294