Surgery for constipation in patients with prior spinal cord injury: The Department of Veterans Affairs experience

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Objective: Patients with spinal cord injury (SCI) typically have difficulty with constipation. Some undergo surgery for bowel management. We predicted that SCI patients would have higher mortality and/or morbidity rates following such surgery than neurally intact patients receiving the same procedures. We sought to evaluate this using a large population-based data set.

Methods: Patients receiving care at Department of Veterans Affairs Medical Centers (DVAMCs) with computer codes for SCI and constipation who later underwent colectomy, colostomy, or ileostomy during fiscal years 1993–2002 were identified. Charts were requested from the VAMCs where the surgery had been performed and a retrospective chart review of these charts was done. We collected data on patient demographics, six specific pre-operative co-morbidities, surgical complications, and post-operative mortality. Comparisons were made to current literature evaluating a population receiving total abdominal colectomy and ileorectal anastomosis for constipation but not selected for SCI.

Results: Of 299 patients identified by computer search, 43 (14%) had codes for SCI and 10 of 43 (24%) met our inclusion criteria. All were symptomatic and had received appropriate medical management. Co-morbid conditions were present in 9 of 10 patients (90%). There were no deaths within 30 days. The complication rate was zero. The mean post-operative length of stay was 17 days.

Conclusions: Patients with SCI comprise about 14% of the population who receive surgery for severe constipation in the Department of Veterans Affairs system. The mortality and morbidity rates in these patients are similar to those reported in other constipated patients who have surgery for intractable constipation. Our data suggest that stoma formation ± bowel resection in patients with SCI is a safe and effective treatment for chronic constipation.

Keywords: Neurogenic bowel, Bowel management, Constipation, Outcomes, Surgery, Colectomy, Colostomy, Ileostomy, Spinal cord injuries

Introduction

There are approximately 250 000 people with spinal cord injury (SCI) in the United States at present.¹ Each year it is estimated that 10 000 more will incur an SCI.² In a study utilizing data from the US National Disease and Therapeutic Index, Sonnenberg and Koch estimated that about 1.2% of physician visits are for constipation. However, only about 0.04%

of patients with constipation severe enough to result in a doctor's visit eventually receive surgical treatment.³ Korsten *et al.*⁴ documented that severe constipation is a much more common problem in patients with SCI. They described how difficult it is to manage and its effects on the life of SCI patients. In a comprehensive review, Knowles *et al.*⁵ identified the need for data concerning outcomes of surgery for constipation in patients with prior SCI. Numerous reports have provided evidence that patients with SCI have poorer outcomes than neurally intact patients following surgical

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treatment for other conditions such as abdominal aortic aneurysm, prostate cancer, colorectal cancer, and appendicitis.^{6–9}

Previous studies of patients with SCI receiving colostomies have reported high complication rates.^{10–13} Patients with SCI often have important co-morbid conditions such as chronic sepsis from urinary infection, decreased respiratory function, and chronic brain syndrome secondary to the original injury. These are risk factors for adverse outcomes of surgery. We predicted that such factors would be associated with a higher rate of death and complications in patients with complete SCI and constipation severe enough to warrant surgical treatment compared with those receiving surgery for constipation in the general population, for whom such procedures have been well studied. We expected that these data would help fill the gap in evidence pointed out by Knowles *et al.*⁵ and should improve the selection process for patients being considered for colectomy or colostomy for constipation.

Materials and methods

The Department of Veterans Affairs (DVA) Patient Treatment File (PTF) is a centralized administrative database of all patients discharged from Department of Veterans Affairs Medical Centers. After institutional review board approval for this study had been obtained, PTF was accessed to obtain data on all patients much more frequently receiving care at all DVA facilities who suffered from severe constipation and were treated by colectomy, colostomy, or ileostomy during fiscal years 1993–2002. The DVA Beneficiary Identification and Records Location System file was used to identify deaths occurring after hospital discharge.

The International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)¹⁴ codes for patients with SCI are 344–344.99. The codes that identify patients with the diagnosis of constipation are 564–564.09. All patients were required to have both a diagnosis of SCI and a subsequent diagnosis of constipation to qualify for inclusion in the study. In addition, each subject was required to have a code for colectomy, colostomy, or ileostomy (ICD-9-CM codes 45.74–45.79, 45.8, 45.92, 46.10, 46.13, 46.14, 46.20–46.24).

As the PTF was not specifically designed for research purposes, many important data elements are not collected. Therefore, medical records departments at the DVA medical centers where the patients received clinical care were contacted directly and asked to supply either the full medical record or copies of the discharge summaries, operative reports, pathology reports, and rehabilitation notes. Medical record data were helpful in filling

in occasional missing values on demographic variables such as age, race, and sex, as well as providing data on diagnostic test results, details of the surgery, and details of the patient's SCI. Chart review was conducted by two authors (Hand and West) and included determination of SCI level, surgery type, history and physical findings at the time of admission, and co-morbid conditions. Only patients with complete SCI of traumatic etiology who subsequently underwent colostomy, colectomy, or ileostomy for constipation were selected for further analysis; these were our inclusion criteria. All included patients were categorized as having met American Spinal Injury Association (ASIA) Type A criteria.¹⁵ This category designates complete sensory and motor loss below the site of the lesion. Exclusion criteria included incomplete injury (ASIA B through E), complete injury that was not due to trauma (for example, radiation-induced transverse myelitis, multiple sclerosis, monoplegia), the presence of metastatic carcinoma, non-existent medical records, and insufficient data to permit analysis. We selected six specific co-morbid conditions known to affect outcomes of surgery as a measure of the general condition of the study patients: urinary tract infection, hypertension, atherosclerosis, diabetes mellitus, heterotopic ossification, and previous myocardial infarction. Co-morbid disorders not noted in any of the above reports were assumed absent. If they were noted as being present in the medical record, we assumed that they were present without requiring further documentation. Medical record data were also helpful in assessing the accuracy of ICD-9-CM coding for SCI. Similarly, we sought data on post-operative in-hospital mortality and five specific post-operative complications (gastrointestinal hemorrhage, small bowel obstruction, anastomotic leak, sepsis, and need for reoperation) as an index of the post-operative course.

Data were compiled and analyzed using the Statistical Package for the Social Sciences (SPSS). As this was primarily a descriptive study, the statistical analysis was quite simplistic. Univariate statistics were calculated for demographic data, medical history, SCI level, pre-operative test and clinical examination results, and 30-day morbidity and mortality. The results were then compared to a well-studied series of neurally intact patients undergoing total abdominal colectomy and ileorectal anastomosis for constipation but not selected for SCI.¹⁶ Our null hypothesis was that there would be no difference in complication rate or mortality rate between our series and the control series.¹⁶ The unpaired *t*-test was used to compare means in this study vs. population means. Chi-square tests were used to analyze

categorical variables and the Fisher exact test was used for two-by-two comparisons. $P < 0.05$ was accepted as a criterion for statistical significance.

Results

There were 299 patients with codes for colectomy, colostomy, or ileostomy performed for constipation over the 10-year period 1993–2002. Of these, 43 (14%) had pre-existing diagnostic codes for SCI. These 43 patients were surgically treated for constipation at 32 of the 159 hospitals in the DVA system. Medical records were requested for all 43 patients, and 41 (95%) were received. Two could not be located. There were 14 subjects excluded because their SCI was incomplete, 10 because the SCI was due to non-traumatic etiology, and 2 because the indication for surgery was colon cancer. Seven patients were excluded because their records were either incomplete or internally contradictory (multiple entries in the patient file described conflicting patient conditions). The excluded patients did not differ significantly from the included patients regarding age, sex, type of surgery, mortality, or other reported variables.

Of the 43 patients, 32 (75%) had sufficient data to permit determination of the SCI level, 7 (16%) had inadequate data to determine the level and/or completeness of SCI, and 4 (9%) were erroneously coded as

paraplegic when they were actually quadriplegic. The most common presenting symptom was constipation (100%). The prevalence of the co-morbid conditions is summarized in Table 1. Our patients had a mean of 1.2 of the co-morbid conditions we sought.

Ultimately, 10 subjects met all inclusion criteria and were considered evaluable. Their mean age was 55 years. All were male. The population was primarily Caucasian (80%). The cord injuries occurred at levels C5 through T11, and the mean age at the time of injury was 30. Constipation was noted as a clinical concern months to years after SCI in the patients whose records mentioned this point. Serial transit-time study data were not documented in any patient files, but in three patients there was reference to previous transit-time studies that were diagnostic of slow-transit constipation. Documented bowel care regimens consisted of time-consuming and uncomfortable combinations of manual stimulation and evacuation methods. In the five cases in which it was documented, constipation negatively affected the quality of life (QOL). In all cases the constipation had not improved with medical management, constituting an indication for surgery. The mean pre-operative length of stay was 7 days. Chart review data indicated that this was due to the additional care and workup these patients required for other problems. Five patients underwent sigmoid colostomy, four underwent sigmoid or left colectomy with colostomy formation, and one underwent right transverse colectomy with colostomy formation. Blood loss was only documented in five patients (50–150 ml). In all other surgical reports blood loss was not mentioned and we assumed it was inconsequential.

There were no post-operative deaths at 30 days. No reoperations for persistent constipation were needed, but one patient required reoperation for stoma prolapse, which occurred 3 months after stoma formation. Neither PTF nor patient charts documented any post-operative complications at 30 days. Our null hypothesis was thus not rejected. Prolonged ileus and erythema of wounds (but no infections) were reported in two and one patients, respectively. These were not considered surgical complications in this study. In one patient, surgery for constipation was associated with the resolution of chronic hypertension. Another measure of the burden of surgery is post-operative length of stay. The mean post-operative length of stay in our patients was 17 days (range 3–59 days). All patients achieved regular bowel movements after surgery and there was no mention of further operations for the management of constipation.

Table 1 Clinical features of 10 patients with complete SCI of traumatic etiology who later required surgical treatment for constipation

		N	%
Race	Caucasian	8	80
	Other	2	20
Spinal cord injury level	C1–C8	4	40
	T1–T10	6	60
	T11 and below	0	0
Types of paralysis	Quadriplegia	4	40
	Paraplegia	6	60
Co-morbid conditions*	Urinary tract infection	9	90
	Hypertension	3	30
	Atherosclerosis	0	0
	Diabetes mellitus	0	0
	Heterotopic ossification	0	0
	Previous MI	0	0
Number of co-morbid conditions	None	1	10
	One condition	5	50
	Two or more conditions	3	30
Surgery performed	Colostomy	5	50
	Colectomy	0	0
	Colectomy and colostomy	5	50

*If the finding was not specifically mentioned in the available computer-based or chart-based records, it was assumed to be absent. The total number of co-morbid conditions exceeds 10 because some patients had >1 condition.
MI, myocardial infarction.

Discussion

The life expectancy for patients with SCI is gradually approaching that of the general population as treatment of SCI improves.¹ Their causes of death are now similar to those of neurally intact patients, but their lives are much more frequently complicated by infections, poor blood pressure control, nutritional inadequacy, and a myriad of other concerns. In many cases, medical problems tend to be more serious in patients with SCI because they are often identified later, have more serious physiological causes, or cannot be treated with standard procedures. Constipation continues to be highly prevalent among patients with SCI. This is not surprising because SCI causes loss of nervous control of abdominal organs, depending on the level of injury, and this causes colonic inertia. Glickman and Kamm¹⁷ reported that only 5% of patients had constipation before their injury while 30% reported post-injury constipation. Ninety-five percent of the 115 SCI patients in their report required at least one therapeutic method to initiate defecation and, before colostomy, bowel care took an average of 99 minutes per day.

Determining the cause of constipation is important in designing treatment strategies.¹⁸ The patients in our study all clearly had constipation due to colonic inertia. Normal physiology causes stool passage three or more times per week; however, individuals with colonic inertia often pass stool only once per 7–10 days.⁴ All our patients had time-consuming and uncomfortable bowel habits similar to this.

Prevalence rates of constipation among the general population increase markedly with age.¹⁹ The prevalence of constipation is about 1% in the USA at ages 0–45, rising to about 8% by age >75. The calculated weighted mean age of patients from the general population requiring colectomy for constipation is 41.¹⁶ The mean age at the time of SCI is 33 years and patients with SCI typically develop clinically significant constipation shortly (1–3 years) after injury. In spite of the fact that constipation presents at an early age in patients with SCI, the patients in this study did not require surgical treatment for constipation until a mean age of 55 years.

The data of Piccirillo *et al.*¹⁶ provide a suitable comparison to the current study data. Their report had a sufficient sample size and investigated many of the variables we followed. Piccirillo *et al.* analyzed 54 neurally intact patients presenting with chronic constipation and related abdominal pain and distension without selecting for SCI. Their mean age was 49 (range 17–78) years. There were no pre-operative co-morbidities listed, but certain etiologies (e.g. vagotomy or

myenteric plexus dysfunction) were ruled out. All patients underwent total abdominal colectomy and ileorectal anastomosis with no major post-operative morbidity. Mean total length of stay was 7 days (range 5–9). Five developed small bowel obstruction and two required reoperation (4%). The patients in our study were all male, older, and had a much longer pre-operative inpatient preparation for surgery and also a longer mean post-operative length of stay than those in the study of Piccirillo *et al.*¹⁶ other demographics were similar. There were no statistically significant differences in co-morbidity status, death rate, or complication rate between our patients and those of Piccirillo *et al.* However, the small sample size (10 patients) in our series suggests that a Type I error (accepting the null hypothesis when there are actually more adverse events in SCI patients than in patients without SCI) may be present. One possible reason is that total abdominal colectomy is a larger operation than any other in our series. In addition, all patients in the control group had an intra-abdominal bowel anastomosis, which is a common source of surgical complications; none of the patients in our series had an anastomosis. Evaluating surgical outcomes requires evaluation of objective and subjective information. Small bowel obstruction was the most common post-operative complication following colectomy for constipation in the Piccirillo *et al.*¹⁶ series. We found no mention of complications of colostomy in our series. Only one patient in our series required reoperation for late stoma prolapse and no other patients experienced notable surgical complications. Both parastomal erythema and pruritus were noted, but infection was not. Discharge summaries described standard recoveries and discharges for many of the patients, so the lack of reported complications is not likely due to incomplete data, but rather to successful therapy. There were no data regarding post-operative colonic transit time studies to quantify functional improvement.

The nerves that control the smooth muscles of the colon are divided regionally: the ascending and transverse colon are innervated by the superior mesenteric plexus, the descending and sigmoid colon are innervated by the superior hypogastric plexus (sympathetic) and the pelvic splanchnic nerves (parasympathetic). Sympathetic nerves originate between T10 through L2; the parasympathetic fibers travel via the vagus nerve and S2 through S4 (pelvic splanchnic nerves). These nerves eventually constitute the enteric plexus, which coordinates gastrointestinal function. Therefore, complete injuries at or above T10 frequently result in

colonic inertia. De Looze *et al.*¹⁹ found that 74% of patients with complete SCI and tetraplegia had clinically important constipation and that those with lower injury levels had significantly fewer problems with evacuation. Han *et al.*,²⁰ in another carefully conducted study, however, found no variation of bowel dysfunction based on the level of injury. Additional risk factors for constipation in some patients with SCI include limited mobility, consumption of a diet insufficient in fiber, and use of constipating prescription medicines such as anticholinergics, narcotics, and antacids.²¹

The ideal patient for colectomy, colostomy, or ileostomy as treatment of constipation would be an otherwise healthy man or woman who has chronic constipation that is not controlled by medical therapy. Absence of psychological problems is important because depression and anxiety have been shown to be predictors of poor outcome. Patients with SCI often do not meet all criteria used to select candidates for surgery among the non-SCI patients. Criteria for colectomy among patients without SCI include generalized colorectal inertia with normal upper intestinal motility, normal defecation, and normal rectal sensation.⁵ However, most, if not all, of the gastrointestinal tract in patients with SCI is dysfunctional due to the total loss of nervous control below the injury level. These patients usually present with functional rectosigmoid delay, decreased or absent anorectal sensation, and upper gastrointestinal dysmotility (depending on the level of injury). Clearly, conditions that contraindicate surgery in constipated neurally intact subjects are rarely of concern in constipated SCI subjects. Determining contraindications for surgical therapy of constipation in SCI patient's merits further investigation as carefully selected patients with SCI can have dramatically improved QOL following colectomy, colostomy, or ileostomy.

Stoma formation in patients with SCI has been employed for the management of chronic gastrointestinal symptoms, gastrointestinal malignancy,²² pressure ulcers,¹⁰ and bowel obstruction.²³ In this series, we selected for patients with complete SCI of traumatic origin in whom chronic constipation was the specified indication for surgery. Despite previous reports that SCI patients receiving colostomies have high complication rates, we found no complications in our series. Branagan *et al.*¹¹ reported that of 32 patients with SCI selected for stoma formation, 9 required reoperation. The total complication rate was 43%, with most occurring late. Most of the patients in this study had SCI of traumatic origin and constipation as the major indication for surgery. In a review of 20 patients with SCI

selected for colostomy, Stone *et al.*¹⁰ reported that the rate of both early and late complications was 15%.

Although all patients in this series achieved regular bowel movements with a normal diet after surgery, our study was not designed to assess patient satisfaction or perceived QOL. Although Branagan *et al.*¹¹ reported a high complication rate, 25 of 32 patients in that study mentioned that they wished for the option of stoma formation had been offered earlier. Safadi *et al.*²⁴ reviewed the medical records of 33 patients with SCI who received a colostomy and used a questionnaire designed to assess the QOL after a mean time of 5.5 years after stoma formation. They found that 31 of the 33 patients were satisfied with the result of the colostomy and that most wished that the option of stoma formation had been offered earlier. However, Randell *et al.*²³ sent a questionnaire to 26 patients with SCI who had colostomy and 26 patients with SCI without colostomy and found no difference in the QOL. Luther *et al.*²⁵ also reported no significant differences in the scores for bowel-related QOL items between a large group of veterans with SCI and colostomy and a matched group of veterans with SCI without colostomy, both receiving a standard bowel care regimen. Nevertheless, it is well documented that stoma formation in patients with SCI dramatically reduces the daily time spent on bowel-related care^{10,24,25} and hospital admissions for chronic bowel dysfunction.²⁶

This study is a retrospective review of a large national data set and is subject to the expected limitations and sources of error such as selection bias. The design of our study undoubtedly resulted in a conservative estimate of the number and severity of co-morbid conditions and represents a limitation of the study. It is important also to note that the sample included no women. This limits the generalizability of the data considerably since constipation is three times more common in women than in men.¹⁹ While our patients are not representative of all patients with SCI in the USA who suffer from constipation, they are representative of the nationwide VA population. In addition, 81% of all persons in the National Spinal Cord Injury Statistical Center Database (the most extensive collection of SCI patients nationwide) are men.¹ Although the results are not directly generalizable to women with SCI, results from the VA databases provide a reasonable proxy. The Consortium for Spinal Cord Medicine, which is composed of 21 professional, payer, and consumer organizations and uses an interdisciplinary methodology to develop evidence-based guidelines, has recognized the lack of evidence concerning

management of constipation in patients with SCI on which to base guidelines.^{27,28} Further research focusing on large nationwide samples, particularly those with a larger female population, is needed in order to expand the evidence base.

Conclusions

Patients with SCI are at particular risk of developing chronic constipation and frequently undergo colostomy or colectomy to alleviate the debilitating stresses of their bowel dysfunction. Data from this study indicate that outcomes in patients with SCI are comparable to those in neurally intact patients in spite of the evidence that they present with more co-morbid illnesses, in general. Our original prediction that patients with SCI would experience worse outcomes, such as higher complication rates, was not confirmed. Despite previous reports of high complication rates after stoma formation in patients with SCI, the complication rate among subjects selected for undergoing surgery for constipation in this series was zero. Based on the data we report here, SCI should not be considered a contraindication for colectomy or colostomy for chronic constipation.

The post-operative length of stay is typically quite long for patients with SCI; it seems likely that patients were not discharged until their wounds healed more completely than patients without SCI. The pre-operative length of stay was also prolonged in several of the cases in our report. In these cases, extensive pre-operative therapy was undertaken to prevent post-operative complications.

These data were collected from DVA medical centers, a non-referral-based national medical system. We hope that our results stimulate others to search other large databases for data on this topic. Such efforts should help refine the evidence base upon which modern medical care increasingly rests. The National Surgical Quality Improvement Program of the DVA has recently accepted SCI as a putative risk factor for all operations it studies. This will allow investigators to use much higher-quality data in the future to evaluate this subset of patients.

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