Key Concepts

- There are three constipation subtypes which can be differentiated by symptoms and diagnostic testing, although there can be overlap between subtypes.
- Initial treatment of constipation includes behavioral modification and medication.
- Surgical management of constipation is reserved for severe slow transit constipation that is not responsive to medications.

Prevalence

Constipation is an extremely common complaint and in North America alone it is estimated that 63 million people suffer from constipation. The prevalence has been estimated between 2 and 27% and accounts for 2.5 million physician visits annually [1, 2]. Women report a two- to three-fold higher incidence of constipation than their male counterparts. In a survey study of 600 healthy women from Spain, almost a third had functional constipation symptoms [3]. In another study of patients presenting to European tertiary care centers for idiopathic constipation, 92% were women, and furthermore, women were more likely to have a diagnosis of slow transit constipation [4]. There is a higher incidence of constipation in non-Caucasians as well as individuals with less education and lower income. Additionally, multiple studies have found older patients have a higher prevalence of constipation, particularly over the age of 65 [5–8].

Etiology of Constipation

Defecation is a complex process that results from stool formation, gastrointestinal motility, and pelvic floor function. Constipation may result from dysfunction of any portion of the defecatory process. Contributing factors may include diet, medications, neurologic or endocrine disorders, psychosocial issues, colonic disease, or pelvic floor abnormalities (Table 58-1). Often patients may have constipation with no identifiable cause.

Rome Criteria and Constipation Subtypes

In an effort to standardize the definitions associated with constipation, a symptom-based classification was established by consensus approach. The most recent iteration was created by the Rome Committee in 2006 and is termed the Rome III Criteria [9]. For functional constipation, criteria (Table 58-2) must be met for the last 3 months, with symptom onset at least 6 months prior to diagnosis [10].

Constipation can be further categorized into the following subtypes: slow transit constipation, normal transit constipation, or pelvic constipation. Slow transit constipation or abdominal constipation is a motility disorder and stool moves through the colon at a slow rate. In some patients, only the colon is affected, while in others, there may be involvement of other portions of the gastrointestinal tract. Patients with slow transit constipation may not have bowel movements for days to weeks at a time, despite using laxatives and enemas. Normal transit constipation, also termed constipation predominant-irritable bowel syndrome, is a functional disorder characterized by normal transit through the gastrointestinal tract, however, stools are hard and defecation may be difficult. Additionally, patients may complain of abdominal pain and bloating that is relieved by defecation. Pelvic constipation includes lack of coordination of the pelvic floor during defecation, rectal hyposensitivity, or constipation from impingement, such as rectoceles, enteroceles, and sigmoidoceles. There may also be associated full thickness rectal prolapse, internal intussusception, and solitary rectal ulcer syndrome. Pelvic constipation results in
Table 58-1. Factors associated with constipation lifestyle, medications, medical illness, psychological, colonic structure/function, pelvic floor abnormality

<table>
<thead>
<tr>
<th>Lifestyle</th>
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<tbody>
<tr>
<td>Inadequate fluid intake</td>
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<td>Inadequate fiber intake</td>
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<tr>
<td>Inactivity</td>
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<td>Laxative abuse</td>
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<tr>
<th>Medications</th>
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<tr>
<td>Opiates</td>
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<td>Anticholinergics</td>
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<td>Iron</td>
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<th>Medical illness</th>
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<tr>
<td>Neurologic</td>
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<td>Spinal cord dysfunction/damage</td>
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<tr>
<td>Parkinson’s disease</td>
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<tr>
<td>Multiple sclerosis</td>
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<tr>
<td>Endocrine/metabolic dysfunction</td>
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<tr>
<td>Diabetes mellitus</td>
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<tr>
<td>Hypothyroidism</td>
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<tr>
<td>Hyperparathyroidism</td>
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<td>Electrolyte abnormalities</td>
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<td>Uremia</td>
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<td>Hypercalcemia</td>
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<td>Porphyria</td>
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<th>Psychological</th>
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<td>Depression</td>
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<td>Anorexia</td>
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<td>Psychiatric illness</td>
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<td>Sexual abuse</td>
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<tr>
<th>Colonic structure/function</th>
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<tbody>
<tr>
<td>Cancer</td>
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<td>Crohn’s disease</td>
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<td>Irradiation</td>
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<td>Endometriosis</td>
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<tr>
<td>Hirschsprung’s disease</td>
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<td>Chagas disease</td>
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<th>Pelvic floor abnormality</th>
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<tr>
<td>Nonrelaxing puborectalis</td>
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<tr>
<td>Anal stenosis</td>
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<tr>
<td>Rectocele/enterocele/sigmoidocele</td>
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Table 58-2. Rome III criteria for functional constipation

1. Must include 2 or more of the following:
   a. Straining during at least 25 % of defecations
   b. Lumpy or hard stools in at least 25 % of defecations
   c. Sensation of incomplete evacuation for at least 25 % of defecations
   d. Sensation of anorectal obstruction/blockage for at least 25 % of defecations
   e. Manual maneuvers to facilitate at least 25 % of defecations
   f. Fewer than 3 defecations per week

2. There are insufficient criteria for irritable bowel syndrome

3. Loose stools are rarely present without the use of laxatives

4. There are insufficient criteria for irritable bowel syndrome

*Criteria fulfilled for the last 3 months with symptom onset at least 6 months prior to diagnosis
excessive straining, need for digital manipulation, and incomplete evacuation. Each of these constipation subtypes may occur either in isolation or in various combinations, which may create treatment challenges. The focus of this chapter is to discuss the evaluation and management of slow transit constipation; irritable bowel syndrome and obstructed defecation will be discussed in detail elsewhere.

History and Physical Examination

Evaluation of constipation should always begin with a thorough history (Table 58-3) and physical examination. Information collected should include details regarding stool consistency, caliber, and frequency as well as onset and duration of symptoms. Stool consistency can be described using the Bristol Stool Form Scale (Figure 58-1). A stool diary kept by the patient which details stool form and frequency may provide valuable data for providers. The patient should be questioned regarding dietary intake, fluid consumption, and exercise habits. Patients may note bloating, pain with defecation, and need for significant straining or digital maneuvers to evacuate, which may aid physicians in differentiating between constipation subtypes. Finally, a detailed medical history, including psychiatric illness, and surgical history should be obtained. Patients complaining of constipation have a 20–30% incidence of physical and sexual abuse and therefore this must also be specifically queried [11]. Medication history, including over-the-counter medications, fibers, laxatives, and enemas, should be noted. Scoring systems and constipation-specific quality of life indices may be helpful in determining severity and effect of constipation (see Chap. 57 for details).

Table 58-3. History for patients with constipation

<table>
<thead>
<tr>
<th>Bowel habit frequency</th>
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<tr>
<td>Stool consistencya</td>
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<tr>
<td>Onset and duration of symptoms</td>
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<tr>
<td>Straining during defecation and need for manual maneuvers</td>
</tr>
<tr>
<td>Dietary history</td>
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<tr>
<td>Exercise habits</td>
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<tr>
<td>Laxative use</td>
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<tr>
<td>Medication history</td>
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<tr>
<td>Medical history</td>
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<tr>
<td>Physical and sexual abuse history</td>
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</table>

aAs depicted in the Bristol Stool Scale, see Figure 58-1

Physical examination, while important, is often unremarkable in patients with constipation. The abdominal examination may be notable for distention. Examination of the pelvic floor should include digital rectal examination and the patient should be asked to contract and relax the sphincter muscles to assess for dyssynergia. The presence of a rectocele should be noted. Anoscopy is used to evaluate the anorectal mucosa for abnormalities. Valsalva should be performed on the commode and the perineum should be studied for perineal descent and prolapse of the rectum, bladder, or uterus.

Diagnostic Testing

Initial laboratory testing for slow transit constipation should include a complete blood count, chemistry panel, calcium level, and thyroid function tests to exclude metabolic abnormalities such as diabetes, hyperparathyroidism, or hypothyroidism. Colonoscopy is appropriate to rule out a mechanical obstruction from malignancy or strictures related to diverticular disease or inflammatory bowel disease. Additional radiologic or functional testing may be beneficial for patients who are not responsive to medical therapy (Figure 58-2). These tests may help to distinguish between constipation subtypes and most commonly include transit studies, anorectal testing, and defecography.

Colonic transit studies provide an estimate of gastrointestinal motility. There are three general ways of assessing transit time: radiopaque markers, scintigraphy, and capsule studies. The most commonly performed transit studies involve radiopaque markers. There are several procedural variations of these studies [12, 13], however, most often they include ingestion of radiopaque markers by the patient and abdominal radiographs taken after 5 days. During the study period, patients are advised not to take laxatives. In normal subjects, at least 80% of the markers should pass within 5 days; if more than 20% of the markers are retained in the colon, the transit study is considered abnormal (Figure 58-3). If the markers are distributed throughout the colon, slow transit constipation is suggested. Traditionally, markers distributed mostly in the rectosigmoid colon suggest obstructed defecation, however, this has been challenged by Cowlam et al. who examined 108 patients with functional constipation [14]. Their findings demonstrated that patients with obstructed defecation had no difference in marker distribution as compared to other functional constipation patients, and therefore they could not be diagnosed alone based on markers. Other studies have also questioned the accuracy of interpreting this type of transit study [15].

Colonic scintigraphy involves ingestion of an isotope (indium 111 or technetium 99) in a coated capsule or with a test meal. Gamma camera images are subsequently obtained.
and transit times are generated by following the passage of the isotope through the intestinal tract. Eising et al. studied 32 patients with constipation and were able to distinguish between slow transit constipation and obstructed defecation [16]. Scintigraphy studies have been demonstrated to be reliable [17], however, cost and availability limit use.

The wireless motility capsule is a newer technology which allows for measurement of gastric, small bowel, and colonic transit times using pH change and temperature. The capsule has been demonstrated to have good sensitivity and specificity for evaluating colonic transit [18] and when compared to radiopaque markers, an 87% agreement was demonstrated in differentiating slow versus normal colonic transit [19].

There are several examinations which may be performed to determine anorectal and pelvic floor function. Anal manometry evaluates resting and squeeze pressures in the anorectum and provides information regarding rectal sensation. Anal manometry can diagnose pelvic floor dysfunction, and if the rectal anal inhibitory reflex (RAIR) is present, a diagnosis of Hirschsprung’s disease can be excluded [20]. Rectal electromyography may demonstrate non-relaxation of the pelvic floor. Additionally, rectal balloon expulsion provides a simple assessment of ability to evacuate. Failure to evacuate the balloon suggests dyssynergia.

Defecography allows for dynamic study of the rectum and pelvic floor. Contrast is inserted into the rectum and vagina, and fluoroscopy is performed during defecation. It may identify paradoxical contraction of the pelvic floor, internal intussusception, full thickness rectal prolapse, rectocele, or enterocele, which can contribute to obstructed defecation. Dynamic MRI similarly gives an impression of the pelvic floor during defecation of contrast, but is not available in all centers.

**Slow Transit Constipation**

In slow transit constipation or colonic inertia, there is diminished colonic propulsion resulting in markedly reduced stool frequency. The clinical presentation may be somewhat varied and patients may suffer from abdominal pain, bloating, nausea, and incomplete defecation. A diagnosis of slow transit constipation must be confirmed by transit studies. Once the diagnosis is made, the first step in management is medical treatment.

**Medical Management of Slow Transit Constipation**

The management of constipation should always begin with appropriate counselling, which includes listening to and validating the patient’s complaints. It is important for patients to understand that daily bowel movements are not necessary and that there is a large variation in bowel habits across the normal population. The majority of patients have between 3 and 20 bowel movements per week [21], and men have increased stool frequency compared to women [22]. Minimizing patient anxiety can often go a long way.

Behavioral modifications are usually touted as the first step towards treating constipation and this includes increasing hydration and exercise, as well as dietary and medication changes. Some studies report that constipation is more prevalent in patients with sedentary lifestyles and that physical activity may increase stool transit time [23, 24]. Other studies have reported no such association between constipation and activity levels [25]. Despite this conflicting data, increased physical activity is often recommended for constipated patients; however, there is no direct evidence that exercise improves constipation. Fluid intake is also often encouraged in patients with constipation and is thought to soften stool and make it easier to pass. However, there is minimal evidence to support that increasing oral fluid intake improves constipation, except in dehydrated patients [26].

There are extensive lists of medications which contribute to the development of constipation. These medications should be reviewed and minimized, and alternatives should be considered when appropriate.

There are many medical treatments available for chronic constipation (Table 58-4). These include bulking agents, osmotic laxatives, colonic irritants, softening laxatives, and medications.

Lack of dietary fiber intake may contribute to the development of constipation. Fibers are bulking laxatives considered to be first-line therapy for the treatment of constipation. There have been studies which have demonstrated their benefit [27, 28]. Fiber is found in grains, fruits, vegetables, nuts, seeds, and beans and can be categorized as either soluble or insoluble. Examples of fiber include psyllium (Metamucil®,
Konsyl®, methylcellulose (Citrucel®), and calcium polycarbophili (Fibercon®). They soften and increase the size of the stool bolus by absorbing and retaining fluid with the stool. Therefore, fiber must be ingested with sufficient amounts of fluid to reach efficacy. Recommended daily fiber intake is between 25 and 35 grams. Side effects of fiber consumption include abdominal bloating and flatulence.

Osmotic laxatives promote accumulation of large volumes of fluid in the colon lumen by osmosis. The osmotically active particles can be derived from sugars or salts such as sucrose-based sorbitol and lactulose. Lactulose is degraded in the colon yielding the production of fatty acids, hydrogen, and carbon dioxide. MiraLAX® (polyethylene glycol 3350) is an over-the-counter osmotic laxative that increases the frequency of bowel moments and softens the stool. It is one of the most commonly recommended laxatives, found to be safe and effective for everyday use. Osmotic laxatives can also be based on nonabsorbable ions, commonly derived from magnesium or phosphate. Examples are magnesium hydroxide (Milk of Magnesia®) or sodium phosphate (Fleets® Phosphosoda). Caution must be exercised in patients with renal insufficiency as hypermagnesemia and renal failure can result. Polyethylene glycol-based products such as NuLYTELY or GoLYTELY are used in many bowel cleansing regimens but can also be used for constipation. However, chronic use can lead to electrolyte disturbances and dehydration.

Colonic irritants stimulate colonic motility, thereby diminishing constipation. Examples are anthracone derivatives, which include senna and cascara and are found in Senekot® and Pericolace®. Bisacodyl is another irritant and can be found in the agent Dulcolax®. Long-term use can generate a characteristic brown discoloration of the mucosa called melanosis coli. Additionally, sustained use of anthracene irritants may lead to poor colon function and therefore, such use is discouraged.

Softening laxatives change the stool composition, creating softer stools and they include mineral oil and docusate (Colace®). Mineral oil coats the stool, creating an emulsion. Docusate is a detergent which allows increased absorption of fluid into the stool bolus and there is conflicting data regarding its efficacy [29].

Enemas and suppositories are used to stimulate bowel movements. Strategies include promotion of defecation through rectal distension (saline enema), rectal irritation (soapsuds, bisacodyl), or physical softening of the stool (glycerine). Enema therapy can be habituating and therefore providers should be mindful of this potential dependency.

There are several medications which have been used to treat slow transit constipation. Lubiprostone (Amitiza®) is a bicyclic functional fatty acid which activates chloride channels to increase intestinal chloride secretion. This facilitates stool transit and has been demonstrated to be beneficial in the treatment of constipation [30, 31]. Common side effects include nausea, headaches, and diarrhea. Linaclootide (Linzess®) is a peptide agonist of guanylate cyclase which increases colonic smooth muscle cell contraction and promotes bowel movements. Studies have shown improvement in constipation over placebo [32, 33]. Both lubiprostone and linaclootide are approved for the treatment of slow transit constipation and constipation predominant-irritable bowel syndrome in the USA.

In patients taking opioid medications, methylnaltrexone and alvimopan can increase motility [34–37]. However this benefit does not seem to extend to patients with idiopathic constipation. Tegaserod, a 5-HT4 receptor agonist, was initially introduced for the treatment of irritable bowel syndrome and subsequently extended for the treatment of slow transit constipation. It was later removed from the market because of findings that the drug was associated with increased risk of cardiovascular disease. To avoid these deleterious effects, a more selective 5-HT4 agonist, prucalopride, has been developed. While prucalopride has been shown to increase number of bowel movements, it is not currently approved for use in the USA [38, 39].

**Surgical Therapy of Slow Transit Constipation**

Surgical therapy for constipation should only be considered after nonsurgical therapy has been completely exhausted. A thorough diagnostic workup, including transit studies confirming slow transit constipation, is important in order to select the appropriate operative treatment and to aid in pre-operative counselling regarding outcome. In patients diagnosed with generalized intestinal dysmotility including both upper and lower gastrointestinal tracts, the incidence of recurrent constipation has been shown to be much higher than in patients with colonic inertia alone [40]. Given that constipation is a functional disorder, it is extremely impor-
tant to set patient expectations regarding outcomes and possible postoperative issues.

**Abdominal Colectomy**

In patients with constipation for whom surgical management is indicated, abdominal colectomy is usually the treatment of choice. Lane first reported this idea in 1908 when he published his series describing resolution of constipation symptoms in two-thirds of patients. The surgical procedure remains essentially unchanged since its initial description, although minimally invasive techniques have been successfully applied to this procedure [41, 42] and are commonly performed.

Webster et al. reported results in 50 patients who underwent total abdominal colectomy [43]. In the immediate postoperative period, 42% of patients experienced complications, most commonly ileus. Anastomotic leak occurred in 4%. Five patients had persistent constipation. At 12-month follow-up, patients averaged 3 stools per day and the most common complaint was abdominal pain in 19% of patients. The majority of patients rated their results as “good” or “excellent.” Regarding long-term follow-up, Pikarsky et al. reported results in 50 patients who underwent total abdominal colectomy at a median follow up of 106 months (range 61–122 months) [44]. Data was gathered via telephone interviews and the average frequency of bowel movements was 2.5 (range 1–6). Two patients required enemas/laxatives and two patients required antidiarrheal medications. Six patients had small bowel obstructions postoperatively, three of whom required laparotomy. Overall, patients were satisfied with their bowel function and had sustained benefit.

Variations of the procedure include subtotal colectomy with ileosigmoid anastomosis and subtotal colectomy with Cecorectal anastomosis. These variations have been developed to reduce unwanted side effects of diarrhea and electrolyte abnormalities following total abdominal colectomy. Cecorectal anastomosis was suggested by Sarli et al. in an effort to leave a physiologic reservoir for colonic bacteria and thereby maintain normal postoperative stool consistency [45]. They reported their results in 19 patients at a median follow up of 64 months. Thirteen patients reported solid stool consistency, one reported constipation, and five reported diarrhea with the need to take antidiarrheals. In a follow up study of the same cohort of patients, 88.2% reported that they would undergo surgery again given the same preoperative conditions [46]. In an effort to compare functional outcomes between ileosigmoid and cecorectal anastomoses, Feng et al. compared 79 patients who underwent ileosigmoid or cecorectal anastomosis at a mean follow up of 2 years [47]. Defecation frequency increased and abdominal pain and bloating diminished in both groups. However, more patients in the cecorectal group complained of persistent constipation, and overall ileosigmoid anastomosis led to higher patient satisfaction.

In 1999, Knowles et al. reviewed 32 series, which included ten or more patients treated for constipation with colectomy. There was a great deal of variation between the publications regarding data collection, preoperative workup, and surgical technique [48]. However, the overall success rate ranged from 39 to 100%, with median reported to be 86%. The median number of daily bowel movements was 2.9 (range 1.3–5) and the median frequency of incontinence was 14% (range 0–52%). The frequency of recurrent constipation was 9% (range 0–33%). Persistent abdominal pain was present in 41% of patients. Additionally, because of poor functional outcomes, 5% (range 0–28%) of patients eventually underwent permanent ileostomy creation.

Given that constipation is a functional disorder, quality of life studies are extremely important in understanding patient outcomes. Hassan et al. evaluated 110 patients who underwent total abdominal colectomy with ileorectal anastomosis at a median follow up of 11 years. Prospectively collected annual functional surveys were available for 85 patients and demonstrated that 98% of patients had improvement in constipation and 85% were satisfied with their outcome. Additional quality of life questionnaires were completed by 59 respondents demonstrating that all reported their constipation improved, 83% did not require any antidiarrheal agents and 85% were satisfied with their bowel function.

FitzHarris et al. similarly sent quality of life questionnaires to 112 patients who previously underwent total abdominal colectomy with ileorectal anastomosis for constipation and had a 67% response rate [49]. Of those, 81% of patients were pleased with their frequency of stools. However, 41% reported abdominal pain, 21% reported fecal incontinence, and 46% had some diarrhea, and these symptoms negatively impacted quality of life scores. In a smaller study, Thaler et al. surveyed patients using the SF-36 Health Survey and found that while all patients had relief of constipation, patients had significantly lower quality of life scores compared with the general population [50]. More recently, Zutshi et al. surveyed 69 patients who underwent colectomy with ileorectal anastomosis at a median follow up of 10.8 years. Of the 35 respondents, 77% reported that surgery was beneficial, but results of the SF-36 demonstrated low mental and social functioning scores [51]. These data must be considered when counselling patients and setting appropriate postoperative expectations.

There are special circumstances which should be noted. In some patients, concomitant pelvic floor dysfunction may be present. This may be diagnosed with defecography, electromyography, and anorectal manometry. Bernini et al. studied 16 patients with slow transit constipation and pelvic floor dysfunction who underwent a colectomy by distributing questionnaires [52]. Preoperatively, all patients underwent biofeedback, which resulted in pelvic floor relaxation confirmed by electromyography. Postoperatively 43% of patients had complete resolution of constipation symptoms, six patients complained of incomplete evacuation, and three patients complained of diarrhea and incontinence. Only nine
patients were satisfied with the surgical outcome. More recently, Reshef et al. compared 144 patients who underwent colectomy for slow transit constipation with and without obstructed defecation [53]. At a median follow up of 43 months, 88 patients were available for phone interview. Short- and long-term outcomes were found to be equivalent between groups as was patient satisfaction. They concluded that total abdominal colectomy can be offered to patients with slow transit constipation with concomitant obstructed defecation.

Another group of patients that deserves mention are patients with associated small bowel and gastric dysmotility, or global dysmotility. Zmora et al. reviewed patients who underwent total abdominal colectomy and had preoperative small bowel transit studies [54]. There was no difference in postoperative function between patients that have normal and abnormal transit studies. Mollen et al. found similar results in a study of 21 patients [55]. However, Glia et al. studied 17 patients and found a trend towards better long-term results following colectomy in patients with normal preoperative antroduodenal manometry [56]. While these results are not definitive, preoperative functional evaluation for global dysmotility is still recommended. If concomitant delayed gastric or small bowel motility is determined, colectomy is not absolutely contraindicated; however, patients should be warned that they may have persistent postoperative abdominal symptoms.

Finally, patients with a history of sexual trauma have been shown to require more medical care for abdominal complaints following colectomy for constipation [57]. For this subset of patients, preoperative preparation should include evaluation and treatment of psychosocial/psychiatric issues as well as pelvic floor dysfunction and a discussion of possible postoperative abdominal symptoms.

Segmental Colectomy

In an effort to reduce the diarrhea associated with abdominal colectomy, some surgeons have advocated the use of segmental colectomy for the treatment of slow transit constipation. In some published reports, segmental colectomy has resulted in improvement of constipation [58, 59]. You et al. reported a group of 28 patients who underwent segmental colectomy based on the distribution of markers in the colon, of which three patients experienced recurrent constipation [60]. Similarly, Lundin et al. performed segmental resections on 28 patients studied preoperatively with radiopaque markers and scintigraphy and found to have impaired transit in one segment [61]. After a median follow up of 50 months, 23 patients were satisfied with the outcome, whereas five patients required additional surgery for constipation. Rectal sensation, based on preoperative manovolumetry, was diminished in patients who experienced treatment failure. Similar findings were demonstrated more recently by Ripetti et al., in 15 patients with slow transit constipation, seven underwent left-sided colectomy while the rest underwent total colectomy [62]. All but one patient in the segmental colectomy group had symptom improvement. In each of these studies, patients underwent careful and extensive evaluation prior to surgery and it must be reemphasized that evaluation by radiopaque markers may not be exact.

Proctocolectomy with Ileal Pouch Anal Anastomosis

Proctocolectomy with ileoanal pouch (IPAA) reconstruction has been described for slow transit constipation. Keighley et al. performed IPAA in patients who previously underwent total colectomy with ileorectal anastomosis and had recurrent difficulty with defecation [63]. Four of these patients subsequently underwent excision of their pouches because of dissatisfaction with functional results. The authors no longer recommend IPAA for slow transit constipation. Another group performed proctocolectomy with IPAA for 15 patients having less than one bowel movement per week with slow transit constipation and rectal inertia [64]. Preoperative workup in these patients demonstrated abnormal transit studies and abnormal defecography, specifically megarectum or rectal dysmotility. Two patients subsequently underwent pouch excision for intractable pelvic pain. At follow up, patients had a mean stool frequency of 5 per day and reported significant improvement in quality of life scores following surgery. Overall, this is a small and well-selected group of patients and proctocolectomy should be chosen carefully if being considered for slow transit constipation. Additionally, before considering pouch creation for constipation, pelvic floor relaxation should be studied and confirmed otherwise patients may have continued difficulty with defecation.

Ileostomy Creation

Fecal diversion for the treatment of slow transit constipation tends to be reserved for those patients who fail other surgical management. In a review of patients who underwent surgical intervention for constipation, 2–25 % of patients who underwent other surgical management went on to have end ileostomies [65]. Additionally, for those who may not tolerate colon resection, who have concomitant fecal incontinence or in whom it is uncertain as to whether the patient will benefit from colon resection, creation of a loop ileostomy may be an appropriate alternative. Loop ileostomy is relatively simple to reverse should the patient not derive the anticipated benefit. Scarpa et al. retrospectively reviewed outcomes in 24 patients with ileostomies created for constipation: 9 end ileostomies and 16 loop ileostomies [66]. One patient had persistent constipation after stoma creation with bloating and
infrequent output. Four patients underwent ileostomy closure, two of whom had recurrent constipation. Patients undergoing ileostomy creation should be warned that they may have persistent symptoms, especially if global intestinal motility is suspected. While it may seem to be an extreme measure, ileostomy creation is beneficial in some patients.

**Antegrade Colonic Enema**

The concept of the antegrade colonic enema (ACE) is to washout the colon via enemas delivered to the cecum. The concept was first described by Malone et al. for the treatment of fecal incontinence in children, and later the indications were extended to include intractable constipation. In the original technique, the appendix is reversed and a non-refluxing, catheterizable appendicostomy is created, through which the enemas are delivered [67]. There have since been many modifications to this procedure, including utilizing the appendix in situ, stoma creation using the ileum and/or cecum, permanent catheter implantation, and left colon placement [68–70].

While originally described in children, this procedure is increasingly used in the adult patients although the reported success rates are inferior [71–73]. This procedure is less invasive than colectomy and there is avoidance of an ileostomy or colostomy. Lees et al. reported that in 32 patients who underwent the ACE procedure for constipation, satisfactory function was achieved in 47 % at a mean follow up of 36 months [74]. Similarly, Worsoe et al. reported results in 69 patients who underwent ACE for constipation. Patients were surveyed regarding continued use of ACE and symptom resolution and 42 % reported success at a median follow up of 75 months [75]. Revisions of the stoma are common, and most often required for stenosis or leakage. Using an indwelling catheter reduces stenosis, but wound infection and long-term catheter dislodgement are common [70].

**Sacral Nerve Stimulation**

Sacral nerve stimulation is most widely utilized for the treatment of urinary and fecal incontinence. This therapy involves electrical stimulation of the sacral nerve roots. Patients undergo a test phase to determine if there is a therapeutic benefit and if so, the permanent device is implanted. Sacral nerve stimulation has been shown to increase bowel frequency, improve defecation, and reduce laxative use [76, 77]. While the exact mechanism which improves constipation is unknown, sacral nerve stimulation has been shown to increase colonic propagating sequences [78]. The largest series reported by Govaert et al. included 117 patients with constipation, of which 75 had slow transit constipation diagnosed by a transit study. All underwent percutaneous nerve evaluation (PNE), of which 52 % responded to therapy during the initial test period [79]. The success rate of PNE was lower in patients with slow transit constipation versus patients with normal transit constipation. A prospective European study was conducted in 62 patients with constipation. Transit studies were available for 27 patients prior to implantation and 20 patients had prolonged transit. At 6 months following sacral nerve stimulation, only nine patients had prolonged transit (p=0.014). In subjects with normalized transit times, defecation frequency increased from a median weekly stool frequency of 2.7–6.5 at 6 months [80]. Studies by Ortiz et al. [81] and Graf et al. [82] reported much lower success rated for sacral nerve stimulation in constipated patients. Further long-term studies and detailed evaluation of patient selection are indicated. At present, sacral nerve stimulation is not approved in the USA for use in patients with constipation.

**Conclusion**

Constipation can range in presentation from minor annoyance to a significant disruption of daily life. Initial management should include behavioral modification, fiber supplementation, or laxatives. In patients requiring additional therapy, differentiating between constipation subtypes is necessary and can be accomplished by a good history, transit studies, and pelvic floor testing. For patients with slow transit constipation who do not respond to medical management, surgical intervention may be appropriate. Care of the constipated patient requires patience, compassion, and the ability to tailor treatments to the individual.

**References**

Evaluation of Constipation and Treatment of Abdominal Constipation


