

# Evaluation of Constipation

Amer M. Alame, M.D.<sup>1</sup> Heidi Bahna, M.D.<sup>1</sup>

<sup>1</sup>Department of Colorectal Surgery, University of Miami School of Medicine, Miami, Florida.

**Address for correspondence and reprint requests** Amer M. Alame, M.D., 1120 NW 14th St., 4th Fl., Miami, FL 33136 (e-mail: amer@doctoralame.com).

Clin Colon Rectal Surg 2012;25:5–11.

## Abstract

The evaluation of the chronically constipated patient is multifaceted and challenging. Many clinicians define constipation according to the latest Rome III diagnostic criteria for functional gastrointestinal disorders. Female sex, older age, low fiber diet, a sedentary life style, malnutrition, polypharmacy, and a lower socioeconomic status have all been identified as risk factors for functional constipation. In elderly patients, it is important to rule out a colonic malignancy as the cause of constipation. The initial evaluation of the constipated patient includes a detailed history to elicit symptoms distinguishing slow transit constipation from obstructive defecation. Slow transit and obstructive defecation are the two major subtypes of functional constipation. In addition, the clinician should identify any secondary causes of constipation. The office examination of the constipated patient includes an abdominal, perineal, and a rectal exam. Many patients improve with lifestyle modification. When dietary interventions and lifestyle modifications fail, many diagnostic studies are available to further evaluate the constipated patient. Sitzmark transit study, nuclear scintigraphic defecography, electromyography, anorectal manometry, balloon expulsion test, paradoxical puborectalis contraction, cinedefecography, and dynamic magnetic resonance imaging defecography have all been used to diagnose the underlying causes of functional constipation.

## Keywords

- ▶ evaluation of constipation
- ▶ causes of constipation
- ▶ radiopaque marker study
- ▶ anorectal manometry
- ▶ defecography

**Objectives:** On completion of this article, the reader should understand the causes and diagnostic studies used in the evaluation of the constipated patient.

Constipation is a condition beleaguered by subjectivity.<sup>1,2</sup> Constipation-related complaints of patients presenting to colorectal surgeons have ranged from infrequent bowel movements, excessive straining, hard stools, sensation of incomplete evacuation, and a sense of anorectal obstruction. A population-based study in North America estimated the prevalence of constipation to be as high as 27%<sup>3</sup> and a systematic review listed constipation as the second most common diagnosis in the ambulatory care setting.<sup>4</sup> Epidemiologically, women are afflicted 5- to 10-fold more than men<sup>3,5,6</sup> and have significantly higher medical care utilization and costs.<sup>7</sup>

## Definition

Clinicians define constipation according to the latest Rome III Criteria (▶**Table 1**). It is important to remember that a

diagnosis of functional constipation cannot be reached in a patient who meets irritable bowel syndrome (IBS) criteria<sup>8</sup> (▶**Table 2**).

## Initial Evaluation

When evaluating the constipated patient, it is necessary to be cognizant of the multifaceted nature of the problem.<sup>9–13</sup> Female sex, older age, low fiber diet, a sedentary life style, malnutrition, polypharmacy, and a lower socioeconomic status have all been identified as risk factors for constipation.<sup>9,11,14–21</sup> Given the subjective nature of patients' perceptions of what defines constipation, the first task is to clarify specific symptoms and severity of constipation. To establish that, the clinician should ask specific questions rather than rely on the patient to volunteer the information related to their particular symptoms. It is imperative to obtain a full and exhaustive medical history to rule out secondary causes of constipation resulting from medication<sup>22</sup>

**Issue Theme** Functional Bowel Disease; Guest Editor, David E. Beck, M.D.

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DOI <http://dx.doi.org/10.1055/s-0032-1301753>. ISSN 1531-0043.

**Table 1** Rome III Criteria for Constipation<sup>8</sup>

The latest Rome consensus from 2006 requires the following criteria fulfilled for the last 3 months with symptom onset at least 6 months prior to diagnosis.
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 (e.g., digital evacuation, support of the pelvic floor)
f. Fewer than 3 defecations per week
2. Loose stools are rarely present without the use of laxatives.
3. There are insufficient criteria for irritable bowel syndrome (►Table 2).

(►Table 3) or other etiologies as outlined in ►Table 4. Complaints of prolonged or incomplete defecation, excessive straining, the need for pelvic support, or digital manipulation are suggestive of pelvic floor dysfunction. Conversely, feelings of pain, bloating, or colicky pains that are relieved with defecation suggest a diagnosis of IBS (►Table 2). It is useful to adopt a scoring system to simplify and objectively gauge the extent of complaints. The Wexner constipation score incorporates frequency of bowel movements, difficulty or pain on evacuation, feelings of incomplete evacuation, abdominal pain, time spent in the lavatory, the use of laxatives or digital assistance, failed evacuation attempts per 24 hours, and the duration of constipation symptoms. The Wexner score (minimum score, 0; maximum score, 30) correlates well with objective physiologic findings found on further testing and provides a baseline in the evaluation of the constipated patient.<sup>23</sup>

## Physical Exam

The office examination should include an abdominal exam, a perineal exam, and a rectal exam. Due to the sensitive nature of the examinations involved, it is important to go from least invasive (abdominal exam) to most (rectal exam) to build patient rapport and prevent anxiety, fear, or muscle guarding, which might affect the evaluation.<sup>24</sup> The abdominal exam

**Table 2** Rome III Diagnostic Criteria for Irritable Bowel Syndrome<sup>8</sup>

Recurrent abdominal pain or discomfort at least 3 days/month associated with 2 or more of the following:
1. Improvement with defecation
2. Onset associated with a change in frequency of stool
3. Onset associated with a change in form (appearance) of stool

The above criteria must be fulfilled for the last 3 months with onset of symptoms at least 6 months prior to diagnosis.

should rule out any palpable masses, hepatomegaly, or other reasons that can be the cause of the patient's presenting symptoms. While the patient is still supine, both inguinal regions are examined to rule out any hernias before instructing the patient to assume the left lateral position or prone for the remaining part of the examination. The perineum is evaluated thoroughly for evidence of external hemorrhoids, skin tags, anal warts, fissures, or abnormal descent upon pushing (more than 3 cm). A digital examination is done to evaluate sphincter tone (resting and squeeze) and to rule out any palpable rectal masses or obvious rectocele. A side-viewing anoscope is then inserted to rule out any enlarged internal hemorrhoids or any other anal pathology. After obtaining a full history and completing the physical examination a differential diagnosis can be established and further testing is tailored on a case by case basis. In patients older than 30 years old who present to our practice complaining of constipation, routine blood work to evaluate electrolyte abnormalities and a colonoscopy are recommended.

## Types of Functional Constipation

Slow transit and obstructive defecation comprise the two subtypes of functional constipation. The former being due to diminished motility causes longer transit time through the colon, whereas obstructive defecation is the inability to

**Table 3** Medications Associated with Constipation<sup>6</sup>

Antacids (more common when containing aluminum or calcium)
Iron and calcium supplements
Opioids and other narcotics
Anticholinergic agents
Calcium channel blockers
Diuretics
Nonsteroidal anti-inflammatory drugs
Sympathomimetics
Tricyclic antidepressants

**Table 4** Etiology of Chronic Constipation<sup>22</sup>

Mechanical	Metabolic	Neuropathies	Myopathies
Cancer	Diabetes mellitus	Hirschsprung disease	Scleroderma
Stricture	Hypothyroidism	Parkinson disease	Amyloidosis
Rectocele	Hyperparathyroidism	Injury to nervi erigentes	
Sigmoidocele	Hypercalcemia	Paraplegia	
Enterocoele	Hypokalemia	Multiple sclerosis	
Abnormal perineal descent	Hypomagnesemia		
Intussusception	Uremia		
Rectal prolapse	Depression		
Paradoxical puborectalis contraction			
Megacolon			
Colonic inertia			
Anal fissure			

propagate the stool out of the rectum. In all patients complaining of constipation, 11% have slow transit constipation, 13% have obstructive defecation, and the vast majority has constipation due to IBS.

### Slow Transit Constipation

Slow transit constipation, or colonic inertia, is defined as long transit time through the colon. Meals, stress, medical conditions, spinal cord lesions, sleep-wake cycle, endocrine and renal conditions have all been cited in the medical literature as causes of slow transit constipation.<sup>9,25</sup> Symptoms of slow transit constipation reported by patients are vague and include infrequent urges to defecate, bloating, and abdominal discomfort. In addition, attempts by the clinician to ameliorate this type of constipation with fiber supplements are usually not successful.<sup>26</sup> The most common test used to diagnose slow transit constipation is the Sitzmark transit study. Scintigraphic defecography, which measures colonic motility via radionuclide scanning, is much less commonly performed.

### Sitzmark Study

First described in the 1969 by Hinton et al, the Sitzmark test is still widely used today for the workup of functional constipation.<sup>27</sup> Prior to performing a Sitzmark test, the patient is first instructed to abstain from using laxatives, enemas, or suppositories for 5 days. The patient is then instructed on day 0 to ingest one gelatin capsule containing 24 precut radiopaque polyvinyl chloride markers (each of which is 4.5 mm × 1 mm). On day 5, a flat plate of the abdomen is obtained. Patients who have normal colonic motility will expel over 80% of the markers. Patients who retain five or more radiopaque markers have a positive study. If the retained markers are scattered about the colon, the patient most likely has colonic inertia. However, an accumulation of markers in the rectosigmoid most likely points to an etiology

of functional outlet obstruction. Metcalf et al developed a protocol for the Sitzmark test that uses three different types of radiopaque markers (O markers, Double-D markers on day 1, and Tri-Chamber markers on day 2). A flat plate is taken on day 4 and again on day 7 if necessary. Metcalf's protocol with different radiopaque markers on different days is more complicated to interpret, however, it is more useful in diagnosing segmental areas of colonic inertia.

A number of variations of the test have been described. One method involves the patient ingesting the capsule on Sunday night and obtaining abdominal x-rays on Monday, Wednesday, and Friday morning (days 1, 3, 5). The presence of markers in the colon on the initial Monday morning x-ray excludes a gastric or small bowel motility problem. The subsequent two films provide a general pattern of marker movement.

### Nuclear Scintigraphic Defecography

Radionuclide scintigraphy is a noninvasive nuclear medicine test that provides regional as well as overall colonic transit motility information. The radionuclide 111-diethylenetriamine pentaacetic acid (<sup>111</sup>In-DTPA) is used in this colonic transit study. When it was first introduced, scintigraphic defecography required introduction of <sup>111</sup>In-DTPA to the cecum antegrade by placing a tube orally to intubate the cecum or retrograde via a tube placed during colonoscopy. The invasive nature of both of those studies has led researchers at the Mayo Clinic to develop a resin-coated capsule that releases its contents in the distal ileum's pH of 7.4. The patient is placed under a gamma probe and colonic motility is analyzed by scintigraphic scans of the patient again at 24 hours and 48 hours. A quoted benefit of scintigraphy is the ability to also combine technetium-99 (Tc<sup>99</sup>) with <sup>111</sup>In-DTPA to obtain motility studies of the stomach and small bowel in addition to the colon (whole gut transit scintigraphy). This comprehensive study helps rule out diffuse gastrointestinal

dysmotility as a cause of the patient's slow transit constipation. Moreover, one has to be aware of the low percentage (20%) of slow transit cases that are also associated with obstructive defecation.

### Obstructive Defecation

Causes of obstructive defecation syndrome (ODS) can be multifactorial ranging from mechanical, physiologic, to congenital. ODS largely affects the female population, and is characterized by difficulty evacuating requiring use of mechanical aids, digitation, excessive straining, incomplete evacuation, and excessive time needed to evacuate. ODS has been linked to anatomic abnormalities of rectocele, rectoanal or rectorectal intussusception, paradoxical puborectalis contraction, pelvic organ prolapse, descending perineum syndrome, solitary rectal ulcer syndrome, sigmoidoceles, and enteroceles.<sup>27</sup> However, abnormal findings on anorectal studies such as rectoceles may be seen in asymptomatic subjects. Functional abnormalities such as pelvic floor dyssynergia, decreased rectal compliance, and decreased rectal sensation have also been shown to contribute to symptoms of ODS. Although the symptomatology has been well defined in the literature, the pathophysiology and etiology of this syndrome are still poorly understood.<sup>28</sup>

Anorectal physiologic studies to evaluate the patient with obstructive defecation include electromyography, anorectal manometry, rectal anal inhibitory reflex (RAIR), balloon expulsion test, and paradoxical puborectalis contraction. Radiologic studies include triple contrast defecography under fluoroscopy and dynamic magnetic resonance imaging (MRI) defecography, which are used to evaluate anatomic and functional causes of ODS.

### Electromyography

Pelvic floor electromyography (EMG) analyzes the motor unit action potentials (MUAP) of the pelvic floor musculature.<sup>29</sup> EMG tracings outline the duration, amplitude, and recruitment during voluntary squeeze and push maneuvers providing helpful information to complement other anorectal tests performed. EMG can be performed using skin electrodes (surface noninvasive EMG), an anal plug, or a concentric needle (invasive EMG). The surface EMG method has been shown to be equivalent to the concentric needle technique<sup>30</sup> and carries a good negative predictive value (91%) to rule out paradoxical puborectalis contraction (PPC). Owing to its simplicity and dependability, surface EMG is the test of choice in our practice. PPC can be diagnosed on EMG when MUAP recordings from the puborectalis fail to decrease during attempted evacuation. However the positive predictive value is low with EMG (31%) and an EMG test suggestive of PPC should trigger further definitive testing with cinedefecography.<sup>31</sup> EMG-equipped anal plugs are commonly used during biofeedback sessions for pelvic floor muscle retraining in patients with functional outlet obstruction (i.e., paradoxical puborectalis contraction).<sup>29</sup>

### Anorectal Manometry

Manometry remains the most widely used anorectal physiology investigative tool. Several different anorectal physiolo-

gy recording systems are available. Catheters and pressure transducers used in manometry are thin and flexible. Anorectal manometry catheters range from solid-state probes to water perfused or air charged. Anorectal manometry can evaluate sphincter pressure while the patient is resting, squeezing, and attempting to defecate. With the patient in the left lateral decubitus position or lithotomy, the manometry catheter is introduced into the rectum and pulled back through the anal canal with measurements taken at intervals to determine the rest, squeeze, and push pressures of the anal sphincter. Normal ranges differ by age and gender and patients should be compared to matched normal individuals.<sup>32,33</sup> As a general rule, all manometric amplitudes decrease with age.<sup>34</sup>

In addition to direct sphincter pressure measurements, the presence or absence of rectoanal reflexes and rectal sensory function can be assessed easily. Distention of the rectum by feces can be simulated by inflating a rectal balloon with air while monitoring anal sphincter pressures.<sup>35</sup> In normal individuals, with sudden distention of the rectum—as with the arrival of a bolus of feces—the internal anal sphincter relaxes. The amount of inhibition of the anal sphincter and the duration of relaxation both seem to be proportional to the amount of rectal distension.<sup>36</sup> If a clinician is unable to illicit a RAIR with the initial attempt, a larger volume of air should be used to distend the rectum before registering the RAIR as missing. RAIR is present even in patients with high spinal cord lesions.<sup>37</sup>

### Balloon Expulsion Test

First described by Barnes,<sup>38</sup> the balloon expulsion test is another tool available to assess rectoanal coordination during defecation. Many variations have been described when performing this test.<sup>39</sup> Some recent studies support individualizing the amount of volume instilled into the balloon depending on tested sensation thresholds obtained prior to performing the expulsion test. Normal subjects can increase their intraabdominal pressure above 80 mmHg and successfully expel the balloon in a median of 50 seconds.<sup>40</sup> The inability of a subject to expel the balloon is suggestive of an outlet obstruction and should trigger further anorectal testing (i.e., cinedefecography).<sup>41,42</sup>

### Paradoxical Puborectalis Contraction

During normal defecation, the pelvic floor relaxes to increase the anorectal angle. As the anorectal angle becomes more obtuse, the evacuation of stool is facilitated through the relaxed anal sphincter. Failure of the puborectalis muscle to relax or paradoxical contraction results in obstructed defecation.<sup>43</sup> In patients reporting excessive straining, prolonged periods of defecation, feelings of incomplete evacuation, and a need for digitations, PPC may be the cause of pelvic floor dysfunction.<sup>44</sup> Patients suffering from PPC may have an underlying psychological component and may benefit from biofeedback sessions aimed at training them to relax their pelvic floor during defecation. In the long term, biofeedback often loses efficacy and may need to be repeated.

### Cine-Defecography

Cine-defecography is a radiologic evaluation that provides insight into anorectal structure and function. Initial fluoroscopic studies of defecation date back to 1952 when Lennart Wallden investigated causes of obstructed defecation.<sup>44</sup> Defecography studies are indicated in patients when an outlet anatomic or functional disorder is suspected as the cause of constipation.<sup>45–47</sup>

Triple-contrast defecography requires oral, vaginal, and rectal opacification. The patient is instructed to consume a barium meal 1.5 hours before the examination. In women, vaginal opacification is recommended to enhance the contrast imagery. Thirty minutes prior to performing cinedefecography, the patient's rectum is cleared with a sodium phosphate enema (Fleet™; C.B. Fleet Co., Lynchburg, VA). The test should be explained in detail to patients to obtain their full cooperation. First, the patient is placed in the left lateral decubitus (Sims) position and a 50-mL barium enema followed by air insufflation is administered to delineate the rectal mucosa. Second, the rectum is opacified with a barium paste product (Anatrast®; E-Z-EM, Westbury, NY) that resembles stool in weight and consistency. A caulking gun injector is used to fill the rectum with 250 cc (500 g)—less if the patient reports fullness—of thick barium paste. As the caulking gun is withdrawn from the rectum, barium paste is also injected into the anal canal. The patient is then seated on a water-filled radiolucent commode (Sunburst, Ladson, SC). Lateral films are first taken to localize the bony landmarks and to check the quality of the various contrast agents given. Fluoroscopic images are obtained at rest, during squeezing, and while the patient is defecating. Maintaining patient privacy during defecation is very important. This can be achieved by keeping the radiology suite as quiet as possible, and by positioning the patient out of the view of the technologists during defecation.

Despite many improvements to standardize this study,<sup>48–51</sup> differences still exist in the way measurements are taken by individual examiners.<sup>52,53</sup> The anorectal angle (ARA) is the angle between the axis of the anal canal and the distal half of the posterior wall of the rectum. When a patient squeezes, the anorectal angle becomes more acute preventing defecation. Relaxing the puborectalis muscle causes the anorectal angle to increase and become more obtuse and elevating the intraabdominal pressure allows defecation to occur. Pathologic findings on defecography are abnormal perineal descent, non-emptying rectocele, rectal prolapse, PPC, enterocele, and sigmoidocele.

Fluoroscopic x-ray defecography subjects the patient to a mean radiation dose of 4.9 mSv, most of which is concentrated in the pelvis making it contraindicated in pregnancy.<sup>54–56</sup>

### Dynamic MRI Defecography

MRI defecography made its debut with the advent of open-configuration MRI, which made it possible to image patients in the vertical position.<sup>57</sup> MRI defecography overcomes the projectional limitations of fluoroscopic defecography and can be safely used in patients when pelvic radiation is contra-

indicated (i.e., pregnancy). In addition, MRI defecography depicts perirectal soft tissue and can detect more clearly pelvic floor descent, rectoceles, and intussusceptions.<sup>58</sup> A wide variety of techniques is present in the literature on the best method to perform this test. For example, patients may be positioned in the supine or sitting position; ultrasound gel or mashed potatoes loaded with gadopentetate dimeglumine may be used for rectal contrast.<sup>59</sup> Proponents of MRI prefer its better interobserver consistency and quality images that delineate bony structures from surrounding soft tissue.<sup>60</sup> However, the lower temporal resolution and higher cost of an MRI contrasted exam have hindered MRI defecography from widespread use; a lot of valuable information may be obtained via the cheaper and simpler fluoroscopic defecography.

### Anatomic Abnormalities

Rectoceles, sigmoidoceles, enteroceles, rectoanal intussusception, and rectal prolapse are all anatomic abnormalities that can be detected on fluoroscopic or MRI defecography. The most common finding on defecography is a rectocele. A rectocele is a protrusion of the anterior rectal wall beyond its normal anatomic position (usually towards the vagina) and can be present in up to 80% of normal subjects.<sup>61</sup> Rectoceles over 2 cm are significant and usually alter the direction of the propulsive forces into the rectocele itself rather than towards the anus, thus obstructing defecation.<sup>59</sup> In a recent study, 39% of women over 50 had a significant rectocele diagnosed on defecography and 75% of women over 50 with a prior vaginal delivery have evidence of concomitant intussusception and rectocele.<sup>62</sup> Obstetric trauma during vaginal delivery and pelvic relaxation have both been cited as causative agents leading to the development of abnormalities on defecography studies done in women. Standard terminology classifies rectoceles in women as low, midvaginal, or high.<sup>63</sup> Hysterectomy, postmenopausal status, anismus, dyssynergic defecation, and chronic constipation have all been associated with rectocele.<sup>64</sup> Most of the physiologic findings are unchanged in patients with an isolated finding of a rectocele. Sigmoidoceles, enteroceles, and rectoanal intussusception are all anatomic variants found in normal patients, extremes of which can lead to obstructive defecation and mandate surgical intervention for repair.

### Conclusions

Evaluation of the chronically constipated patient remains a challenging problem even for a subspecialist. Many of the patients improve with lifestyle modification consisting of a high fiber diet, exercise, and increased fluid intake. It is important to rule out a colonic malignancy as the cause of constipation, especially in an elderly patient with a dramatic change in bowel habits. When dietary interventions and lifestyle modifications fail, further testing is warranted. Transit studies, defecography, and anorectal physiology testing are tools available for the clinician to further evaluate the constipated patient.

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