Anorectal Physiology and Testing

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KEYWORDS

• Anorectal physiology • Endoanal ultrasound • Manometry • Defecography
• Electromyography

KEY POINTS

- Anorectal physiology involves muscle and nervous coordination to ensure controlled and timely bowel movements.
- The understanding of anorectal physiology is essential so that the physician may order appropriate testing to elicit the most useful information to guide the diagnosis and treatment of anorectal disorders, such as fecal incontinence, constipation, and pain.
- Digital rectal examination should be performed to gain information about a patient's anorectal physiology and to guide investigations.
- Anal manometry, endoanal ultrasound, defecography, balloon expulsion test, magnetic resonance imaging, colonic transit studies, pudendal nerve terminal motor latency studies, and electromyography are commonly used in testing anorectal physiology and are ordered as appropriate based on the patients' symptoms.

INTRODUCTION

The processes of defecation and maintenance of fecal continence are complex, involving both voluntary and involuntary muscular activity. The pudendal and sacral nerves provide important sensory and motor information. The rectum functions as a distensible reservoir to permit time control over the evacuation of stool. All of these activities and anatomic units must act in concert for effective defecation. When there is dysfunction, various disorders may result. These disorders include fecal incontinence, constipation, obstructed defecation, pelvic pain, and the symptoms of ineffective defecation, such as incomplete evacuation or clustered frequent bowel movements.

These disorders have major impacts on the daily life of patients. Patients may, for example, be unable to work because of pain or avoid social activities because of fecal

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incontinence. The morbidities of these conditions are wide reaching, and the proper treatment may have just as powerful of an effect on patients' lives. Anorectal testing is used to discern the most effective potential treatments for an individual patient. The anorectal investigations described in this article are not all available in every institution. Specialized equipment is needed for nearly all of the tests, as are educated health care professionals to both perform the tests and interpret the results. For a fully comprehensive anorectal physiology program, expertise may be used from colorectal surgery, gastroenterology, radiology, and neurology. Although much of the anorectal physiology testing may be office based, an equipped radiology department is needed for tests, such as defecography and magnetic resonance imaging (MRI).

Anorectal testing can be divided into anatomic and functional tests, with some overlap. The anatomic tests include endoanal ultrasound, defecography, and MRI. Functional tests include anal manometry, balloon expulsion test, defecography, dynamic MRI, colonic transit studies, pudendal nerve terminal motor latency study, and electromyography. Each test is described later.

ANORECTAL PHYSIOLOGY

Anorectal physiology is complex. It involves the pelvic floor muscles, motor and sensory neural pathways and is intimately related to the colon physiology. Maintenance of continence depends largely on the pelvic floor musculature, which reacts to signals related to stool consistency and overall bowel motility.[1]

Sensory Physiology

The anal canal receives sensory input from the S2, S3, and S4 nerve roots; composing the pudendal nerve. Although the rectum is only sensitive to stretch, the anus is sensitive to temperature, touch, and pain. These sensations may help a person to assess when it is inconvenient to evacuate stool from an environmental perspective. This area of sensation represents the anal canal, which is kept closed at rest mainly by the internal sphincter muscle.

When the rectum senses stool or flatus, the sensory mechanism allows the rectum to be compliant and stretch to accommodate stool. This sensation should not be a painful sensory response and, in fact, will alleviate the discomfort of the sensation of urgency. Once rectal distension has reached a threshold of compliance, anal canal sensory reflexes result in relaxation and evacuation of stool. The relationship between rectal sensation and anal canal sensation exists but is not essential to maintain continence. For example, most patients with colonic or ileal pouches are able to maintain continence despite not having a rectum to signal to the anal canal.[2,3]

Motor Physiology

The main muscles to consider in anal physiology, namely, the maintenance of continence and effective defecation, are the internal sphincter, external sphincter, and puborectalis muscles. The sphincters are not paired to each other and have distinct functions. The internal anal sphincter is an involuntary muscle. It is innervated by the hypogastric and pelvic plexi and contributes to more than 50% of the resting anal tone. It plays a vital role in continence.[4] At rest, a basal tone of the internal sphincter is maintained by slow, constant waves of contraction.[1] During defecation, the internal sphincter involuntarily relaxes to allow for the evacuation of stool.

The external anal sphincter contributes 30% of the resting tone, with hemorrhoidal tissue contributing the remaining 15%. It contains mainly striated type I fibers muscle, which allows the maintenance of a baseline tone at rest. It is innervated by the

pudendal nerve. A baseline level of tone is maintained at rest. Voluntary contraction may be performed to increase tone and hold in flatus or stool and can last up to 1 minute before the muscle fatigues. During evacuation, voluntary relaxation of the external anal sphincter occurs to permit the passage of stool and flatus.

The puborectalis is a striated muscle that inserts into the pubis and acts as a sling for the rectum. This sling effect creates the anorectal angle at rest, which helps to limit the volume of stool passing into the distal rectum and anal canal. During defecation, the puborectalis relaxes and lengthens, allowing the rectum to straighten and stool to move into the distal rectum and anal canal for evacuation. If paradoxic contraction or nonrelaxation occurs, patients may experience pain, constipation, and incomplete evacuation. Along with the internal and external anal sphincters, the puborectalis is an identifiable anatomic landmark when performing endoanal ultrasound.

There are numerous anorectal reflexes. These reflexes are summarized in **Table 1**.

ANORECTAL TESTING

The tools used to investigate anorectal disorders include both anatomic and functional testing. Not every test is necessary for each patient or each disorder. Investigations should be ordered based on the following:

- Complete history and physical examination
- Digital rectal examination

Table 1
Anorectal reflexes

Name	Reflex	Notes
Rectoanal inhibitory reflex	Internal anal sphincter muscle relaxation caused by rectal distension	• Internal anal sphincter muscle relaxation caused by rectal distension • Provides contact of the anal canal with flatus and stool, allowing the person to discriminate and pass flatus selectively without soiling of stool • Absent in Hirschsprung disease • May be transiently or permanently lost after proctectomy[5]
Cutaneous anal sphincter reflex	Contraction of the distal external sphincter muscle with touch or pain stimulus of anal skin	• Fatigues within seconds • Absent in cauda equina spinal injuries
Bulbocavernosus reflex	Contraction of external anal sphincter muscle with squeezing the glans penis or clitoris or pulling on urethral catheter	• Absent in S2 to S4 injuries • Early reflex to recover following spinal shock
Cough-anal reflex	Contraction of the external anal sphincter muscle in response to coughing or sniffing	• Provides continence during sudden increase in abdominal pressure, such as with coughing, sneezing, or laughing • Absent in sacral nerve or cauda equina injuries

- Review of previous investigations and consultations
- Stool diary when appropriate

General indications for each of the anorectal tests discussed in this article are summarized in **Table 2**.

Digital Rectal Examination

Although not an anorectal physiology *test* or *investigation*, special mention must be given to the utility of a digital rectal examination. It is an essential portion of the physical examination for an anorectal problem. The components of a digital rectal examination are listed in **Box 1**. Digital rectal examination should be performed in a systematic fashion to gather the most useful information. Patients should be placed ideally in a prone kneeling position on an examination table that may be raised and tilted to permit the best view of the anorectum. If this is not available, patients should be positioned in the lateral decubitus position.

Table 2
Anorectal physiology tests and their indications

Test	Potential Indications
Anal manometry	Fecal incontinence Constipation Hirschsprung Anal fissure Anal pain
Endoanal ultrasound	Fecal incontinence Constipation Sphincter defect Anal Fistula Anal pain
Defecography	Constipation Fecal incontinence Obstructed defecation Pelvic descent Suspected prolapse Suspected rectocele Anal pain
MRI	Constipation Fecal incontinence Obstructed defecation Pelvic descent, multiple compartments Sphincter defect Suspected rectocele Anal pain
Balloon expulsion test	Obstructed defecation Constipation
Pudendal nerve terminal motor latency	Fecal incontinence Constipation Suspected nerve injury
Electromyography	Fecal incontinence Suspected nerve injury Constipation
Colonic transit study	Constipation Obstructed defecation

Box 1
Components of a digital rectal examination

- Inspection
- Digital examination
- Anoscopy

The digital rectal examination should begin with inspection of the perianal skin for rashes, skin changes, scars, external skin tags, fissure, and evidence of active infection, such as induration or drainage. While inspecting, patients should be instructed to squeeze the sphincter muscles. A perianal wink should be visualized. Perianal sensation can be tested using a pinprick method when indicated. Patients should be instructed that a lubricated finger will be inserted into the anus. Initial contact with the perianal skin should produce a visible involuntary reflex. Digital examination should be performed to the full length of the finger if tolerated by the patients. The clinician should feel for bulky internal hemorrhoids, prostate, ulceration, and mass. With the finger inserted, resting and squeeze tone should be tested by asking patients to squeeze and relax the anal sphincters. Paradoxic contraction may be assessed by having patients valsalva while the finger is inserted and noting the presence of abnormal sphincter contraction around the finger. Anoscopy may be performed if indicated. This examination allows for the visualization of the anal canal and hemorrhoid columns. Occult blood testing may be performed if there is a concern for rectal bleeding by using fecal material from the gloved finger.

The digital rectal examination may help diagnose anorectal disorders and guide other anorectal testing. In women with constipation and incomplete evacuation, clinical examination with digital rectal examination revealed hypertonic sphincters or rectoceles in 40% of cases.[6] Digital rectal examination, when compared with physiology tests, is accurate in the assessment of sphincter function but should not be used to solely diagnose sphincter defects.[7] The overall sensitivity and specificity of digital rectal examination in evaluating normal resting and squeeze tone has been shown to be more than 75% and is accurate in detecting rectoceles.[8,9] It should always be the starting point for the assessment of anorectal physiology and function.

Anal Manometry

Manometry is a functional test that assesses the tone and function of the anal sphincter muscles. It is performed in the office or physiology laboratory with awake patients. Manometry is useful in the assessment of both fecal incontinence and constipation because it provides a measure of the effectiveness of the anorectal musculature, the rectoanal inhibitory reflex, sensation, and compliance of the rectum. Variations in technique are used to assess these functions, namely, the pull-through or stationary techniques. Newer variations using 3-dimensional measurements and high-resolution technologies are being developed to improve the utility of manometric results.[10,11] The authors' preference is the pull-through technique.

When using anal manometry in one's practice, it is important to note that normal values vary between patient groups. Women have lower resting and squeeze pressures when compared with men.[12–14] Younger women have resting and squeeze pressure that approach those of men, especially nulliparous young women.[12,13] Accurate and useful results depend on having a trained operator for the equipment and consideration of patient age and gender.

To perform an anal manometry, patients are positioned in the left decubitus position. Digital rectal examination is performed to ensure there is no obstruction before inserting the catheter. A manometry probe with a deflated latex balloon at the tip is calibrated to the machine at the level of the anus. The probe is inserted to a distance of 6 to 10 cm and held at that level using a mechanical arm and left in place for 30 seconds before attaining any measurements. Resting and squeeze pressures are measured 3 times each, and mean pressures are calculated. Each squeeze pressure is measured for a sustained squeeze period of 30 seconds. A small volume of water is instilled into the balloon for the measurement of first sensation, typically between 20 and 60 mL of water. Compliance is measured by instilling further water into the balloon until not tolerated by patients, with normal compliance being between 100 and 200 mL of water. The water is then removed. A small volume of air, about 20 mL, is instilled into the balloon over 1 to 2 seconds to elicit a rectoanal inhibitory reflex by a characteristic manometric curve seen on the screen. If the reflex is absent, the process is repeated using 10 mL of more air each time up to the volume of first sensation to see if the reflex is present. **Fig. 1** shows the pressure curve of a normal rectoanal inhibitory reflex.

The results of anal manometry may be used to guide further testing or treatment. Some examples are the following:

- Isolated absence of rectoanal inhibitory reflex may suggest the need for surgical biopsy if Hirschsprung disease is suspected.
- Low resting tone may suggest the need for endoanal ultrasound if the history suggests possible sphincter damage or defect.
- Low resting and squeeze tone may guide patients toward biofeedback strengthening in patients who are incontinent.
- Resting and squeeze tone may be assessed before colostomy reversal in patients with prior rectal trauma.
- High compliance may suggest outlet obstruction in patients who are constipated.

Endoanal Ultrasound

Endoanal ultrasound is an anatomic test used to visualize the anal canal and surrounding structures. Along with endorectal ultrasound, ultrasonographic techniques are now widely used to evaluate rectal lesions, including large polyps and rectal cancer, for depth of invasion and also for complex anal fistulas to document internal communication.[15,16] From a physiology perspective, ultrasound is used to visualize the internal and external anal sphincters. Ideally, a 10-MHz probe is used to provide the best picture, and 3-dimensional imaging allows for various cross sections of the anal canal to be examined.[17] If not available, a 2-dimensional system will still allow for axial imaging of the anal canal and anal sphincters.

Only properly trained clinicians should perform endoanal ultrasound to ensure accurate results, which are user dependent. Patients are first positioned in the lateral decubitus position with the anus positioned at the very edge of the bed to allow for movement of the probe by the operator. Digital rectal examination is performed to rule out a distal obstruction. The lubricated probe is inserted blindly through the anus to the level of the distal rectum. Of note, a rigid proctoscope is not used for endoanal ultrasound, although it is used as part of endorectal ultrasound. With the probe centered, the layers of the anal canal are examined (**Fig. 2**).[17] In the upper anal canal, the puborectalis muscle can be seen posteriorly and laterally as a slinglike stricture. Images should be taken in the upper, middle, and lower anal canal. Sphincter defects are characterized as a segmental defect in the circular ring of a sphincter muscle, and the degree and location of the defect should be measured and recorded.

Fig. 1. Normal rectoanal inhibitory reflex during anal manometry. After the balloon is inflated (*bottom line*), there is a sharp increase in pressure followed by lowering of the anal pressure, signaling sphincter relaxation (*upper line*). (*From* Vrees MD, Weiss EG. The evaluation of constipation. Clin Colon Rectal Surg 2005;18(2):69; with permission.)

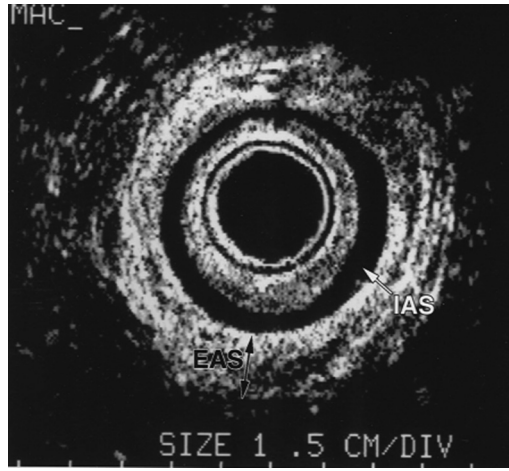

Fig. 2. Ultrasound image of the anal canal showing the internal anal sphincter (IAS) and external anal sphincter (EAS). (*Courtesy of* Tracy Hull, MD, Cleveland Clinic, Cleveland, OH.)

Results of endoanal ultrasound can be used to plan the surgical approach to fecal incontinence. If the surgeon has not personally performed the ultrasound, essentials to look for in the report include thinning of sphincter muscles, documented sphincter defect, location of defect, degree of defect, and bulk of perineal body. Ultrasound may detect sphincter defects not found on clinical examination alone.[18] Early work confirmed the utility of endoanal ultrasound in surgical planning, finding good correlation between ultrasonographic and histologic findings.[19,20] Newer developments have used dynamic endoanal or transperineal ultrasound for functional assessment of the anorectum, similar to defecography.[21]

Defecography

Defecography uses still radiographs and fluoroscopy to assess both anorectal anatomy and function. It is performed in a radiology suite and requires patients to administer enemas before the procedure to ensure the rectum is empty. Following the instillation of contrast into the rectum, the images can be attained in the lateral decubitus or sitting position, though the authors prefer the sitting position on a radiolucent commode because it more approximates the usual position of defecation. Indications for defecography are listed in **Table 2**.

The authors' method of performing defecography is as follows: patients are positioned in the lateral decubitus position on a radiographic table. For women, 25 mL of meglumine diatrizoate (Gastrografin) is injected into the vagina to outline this structure during defecation. A lubricated catheter is inserted into the rectum. Fifty to 100 mL of liquid barium is injected through the catheter, and a still radiograph is taken to confirm filling of the rectum. Air may then be injected to provide mucosal contrast. Thickened barium paste is then injected until contrast refluxes into the sigmoid or until patients do not tolerate further paste. The authors mix the barium paste with water and dry infant cereal mix to create the consistency of loose stool before it is injected. While holding in the paste contrast, patients then stand and the radiographic table is repositioned to the vertical position. A radiolucent commode is placed in front of the radiographic table, and patients sit in the usual position. Lateral radiographs are then taken, 3 while squeezing and 3 while relaxing. Patients then evacuate using their normal defecation maneuvers under fluoroscopy.

Interpretation of the defecography images and fluoroscopy video requires measurement of various anatomic lines and angles. The components of a defecography report are listed in **Box 2**.[22] **Table 3** outlines the normal parameters of defecography, and **Fig. 3** shows lateral views attained during defecography. Clearly, many anatomic and functional diagnoses can be made using defecography. Results may guide treatment, whether biofeedback or surgical intervention. As summarized previously, defecography can be performed in about 10 minutes, with basic radiologic equipment and contrast media, making it a desirable investigation for many anorectal disorders.[23] Reproducibility of results and interobserver agreement can be variable, though, for certain parameters, such as rectal emptying.[24] More recently, MRI defecography has replaced cinedefecography in many centers. MRI is discussed in a later section of this article.

Balloon Expulsion Test

The balloon expulsion test may be performed as part of anal manometry or as an isolated investigation. Its main use is in patients with constipation to attempt to differentiate between obstructed defecation or outlet-type constipation and functional constipation. Manometry or defecography will not be diagnostic in all patients, and the balloon expulsion test may help clarify results.[25] However, it is rarely the sole diagnostic test used and should be used in conjunction with other anorectal physiology studies in patients who are constipated.[26]

The balloon expulsion test may be performed during manometry or in the sitting position. During manometry, patients are kept in the lateral decubitus position; at the end of the manometry procedure, the balloon at the end of the probe is inserted into the rectum and between 50 and 150 mL of water is instilled. Patients are asked to strain and evacuate the balloon. Varying volumes of water may be instilled if patients cannot initially evacuate the balloon. For the sitting technique, patients are initially placed in the lateral decubitus position and a detachable balloon is inserted into the rectum, inflated with 50 to 150 mL of water, and detached from the catheter. Patients are then permitted to sit on a commode in a private bathroom and are asked to strain and evacuate the balloon.[27]

The result of the balloon expulsion test is binary and, thus, easy to interpret. However, the volume of water instilled into the balloon, the position of patients during the attempted evacuation, and time allowed for patients to evacuate are not standardized between studies and physiology laboratories.[26] Aside from the investigation of possible obstructed defecation in patients who are constipated, it need not be used in standard anorectal physiology testing.

Box 2
Components of defecography

- Puborectalis length at rest and straining anorectal angle at rest and straining
- Perineal descent with straining
- Rectocele
- Sigmoidocele
- Intussusception or prolapse
- Degree of opening of anal canal with evacuation
- Degree of emptying of rectocele with evacuation
- Complete or incomplete rectal emptying with evacuation

Table 3
Normal findings of defecography

Finding	Normal Range
Puborectalis length	Rest: 14–16 cm Squeeze: 12–15 cm Push: 15–18 cm
Anorectal angle	Rest: 70°–140° Squeeze: 75°–90° Push: 100°–180°
Perineal descent	Rest: less than 3 cm Push: less than 3 cm change from rest
Puborectalis notch	Push: blunted notch
Rectocele	Less than 2 cm Complete emptying with push
Prolapse	Absent
Anal canal	Push: complete opening
Rectal emptying	10–12 seconds Complete

Data from Sands DR, Wexner SD. Setting up a colorectal physiology lab. In: Corman ML, editor. Corman's colon and rectal surgery. 6th edition. Philadelphia: Lippincott Williams and Wilkins; 2013. p. 150–77.

MRI

The use of MRI in the setting of anorectal physiology and testing was initially as an anatomic test. MRI is able to show the anatomy of the pelvic floor musculature, including the puborectalis and external and internal sphincters, which are often of interest in anorectal disorders. Both endoanal coil and phased array external coils have been used, with the external coil becoming more common because of the improved patient comfort during the investigation. MRI may be performed in a standard fashion for anatomic purposes or combined with dynamic images or MRI defecography. The indications for MRI in anorectal testing are outlined in **Table 2**.

MRI may provide advantages over other anorectal testing for the investigation of particular situations. MRI may be better than endoanal ultrasound at detecting external sphincter defects.[28] MRI allows for investigation of all pelvic compartments at one time and in relation to each other and so is better able to assess the interactions between multiple compartments.[29] Dynamic MRI is a single test that combines clear anatomic views of the anorectum with defecography functional results, which may be appealing to patients requiring multiple anorectal tests for diagnosis.[30,31] The disadvantages of MRI are the expense of the procedure, prolonged time, and decreased detection of rectal intussusceptions compared with standard defecography (which are rarely clinically significant). In addition, it requires a dedicated radiologist with experience in reading dynamic MRI.

Pudendal Nerve Terminal Motor Latency

The pudendal nerves innervate the external anal sphincter bilaterally. Patients with various anorectal disorders may have abnormal conduction of the pudendal nerves. Bilateral nerve conduction abnormalities are required to produce clinical significance.[32] Pudendal nerve terminal motor latency (PNTML) is the time required from the stimulation of the pudendal nerve to the contraction of the sphincter.

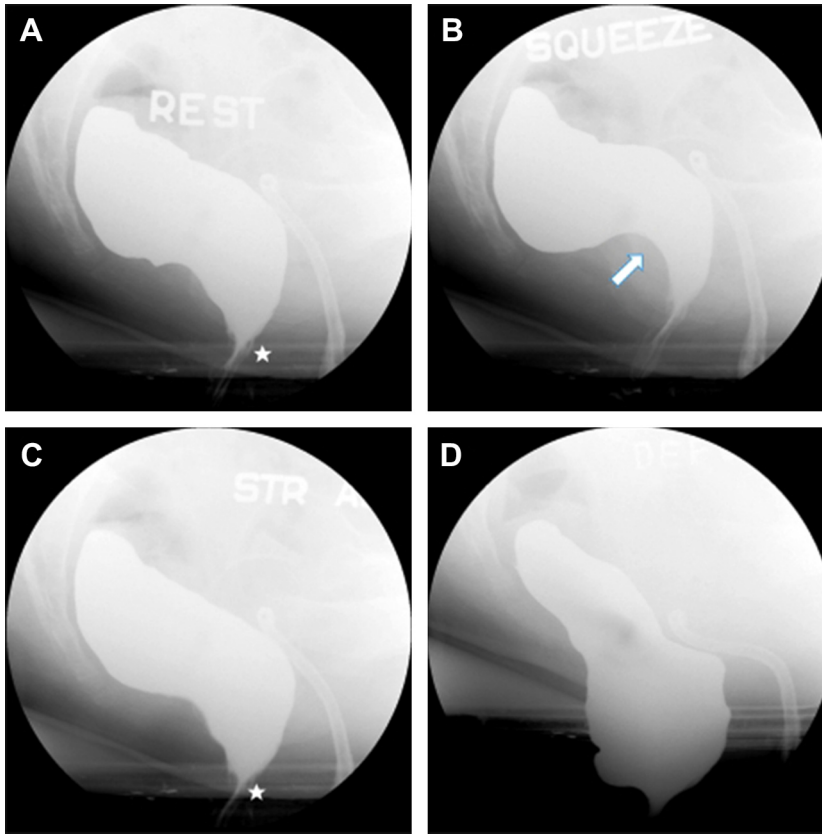

Fig. 3. Defecography images at rest (*A*) and during squeeze (*B*), strain (*C*), and evacuation (*D*), with the notch formed by the puborectalis (*arrow*) and the anorectal junction (*asterisk*) marked. (*From* Kim AY. How to interpret a functional or motility test–defecography. J Neurogastroenterol Motil © 2011;17:418; with permission.)

The process of performing a PNTML study is quick and requires a fingerstall device with implanted electrodes that are worn on the gloved index finger of the examiner. A rectal enema is administered before the test to reduce resistance. Patients are placed in the lateral decubitus position. An electrode gel is placed on the fingerstall device on the examiner's finger. The finger is inserted, and the coccyx is palpated. At the level of the coccyx, the finger is rotated laterally to one side. As short impulses are delivered through the electrodes, the finger is rotated until the site of maximal response is found on that side. A response is seen as contraction of the external anal sphincter around the examiner's finger. PNTML is measured at the site of maximal response 3 times and averaged. The finger is rotated to the other side, and the process is repeated.

Normal values of PNTML are about 2 milliseconds. Latency may be increased in the setting of incontinence or chronic rectal prolapse.[33] Typical PNTML tracings are shown in **Fig. 4**. Prolonged PNTML may help guide decision making regarding the potential treatments and their effectiveness for patients with fecal incontinence. The test is limited, however, by relatively low sensitivity, specificity, and operator dependence;

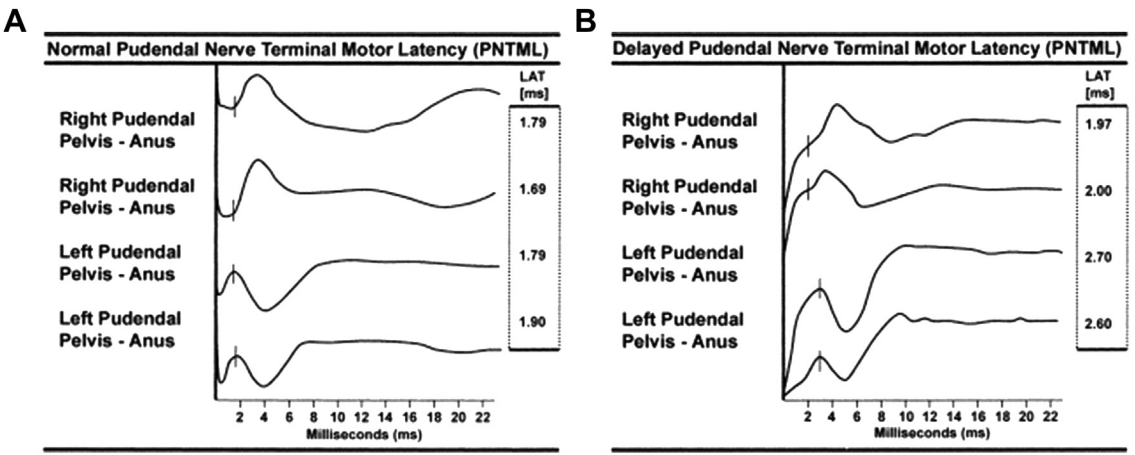

Fig. 4. Normal (*A*) and prolonged (*B*) PNTML tracings. (*From* Papaconstantinou HT. Evaluation of anal incontinence: minimal approach, maximal effectiveness. Clin Colon Rectal Surg 2005;18:9–16; with permission.)

results should be used only as part of the information used to guide treatment decisions.[34,35]

Electromyography

Similar to PNTML studies, electromyography (EMG) is used to assess the contraction of the external anal sphincter. EMG measures depolarization strength (not latency time), and the activity of both the external anal sphincter and puborectalis is captured. The main indication for EMG is fecal incontinence, although it is performed less commonly in this setting with the increased use of endoanal ultrasound.[22] EMG is also commonly used as part of ongoing muscle retraining during biofeedback therapy.[36] The response to treatment is assessed, and EMG may be used during the therapy sessions themselves. EMG can also be applied to the assessment of constipation.

There are various ways of performing EMG, including needle, surface, and anal plug. The choice of technique depends on indication and clinical preference. Needle EMG may be painful for some, although it is most often tolerated very well. Patients are usually placed in the lateral decubitus position. Surface electrodes are placed about the anus if indicated. Needle electrodes may consist of single-fiber electrode or concentric needle electrodes and are placed if indicated. An anal plug electrode is placed if indicated. Depending on the modality chosen, EMG activity may be recorded at rest and with squeeze and push efforts.

Normal findings on EMG are as follows:

- Amplitude of motor unit contraction is up to 2 mV
- Voluntary contraction potential lasts 5.0 to 7.5 milliseconds
- During defecation, EMG activity should be almost zero

Amplitude will be decreased in patients with nerve injury or stretch. EMG activity may be high during defecation in patients with paradoxic puborectalis contraction and difficult evacuation. Thus, EMG may provide some very practical answers in anorectal problems to help guide treatment planning.

Colonic Transit Studies

Within the realm of anorectal physiology testing, a colonic transit study is indicated for the workup of constipation when one wishes to distinguish between slow transit constipation and outlet-type constipation or obstructed defecation. Gastric emptying studies and small bowel transit studies may also be indicated in certain patients when global dysmotility is a considered diagnosis, but these are considered on a case-specific basis. Patients must be willing to stop all laxatives for 5 days during the procedure. Other than stopping laxatives, the test is very well tolerated with little interruption of daily activities. No enemas or bowel preparation is needed. Patients swallow a capsule containing radiopaque markers, commonly 24 markers per capsule. A health care professional should witness patients swallowing the capsule. A flat plate abdominal radiograph is taken to document the location and passage of the markers at various times, depending on center-specific protocols.[37] Common protocols include radiographs on day 5 only, days 1 and 5, or on days 1, 3, and 5.

A normal colonic transit study equates to the passage of at least 80% of the markers, or 19 of the 24 markers, at 5 days. Ninety-five percent of normal patients will pass 80% of the markers within 120 hours.[38,39] Five or fewer markers present after 5 days indicates normal colonic transit. More than 5 markers scattered throughout the

colon suggests colonic inertia or hypomotility. More than 5 markers clustered in the rectum suggest outlet-type obstructed constipation.

SUMMARY

Anorectal physiology functions to maintain continence and allow for effective evacuation in a socially acceptable time and place. Disorders of anorectal physiology can have a profound effect on a person's life. The disruption of normal motor, sensory, or reflexive activities of the anal canal can result in complex problems, which pose challenges to the clinician. Various anatomic and functional tests are available to make an accurate diagnosis and discern between various medical and surgical treatment options. Not all anorectal physiology tests are needed in each situation. The clinician must be thoughtful and prudent when considering the numerous investigations. When used effectively, along with a complete history and physical examination, anorectal physiology tests can provide valuable information on the motor, sensory, and neurologic status of the anorectum and guide treatment decisions accordingly.

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