Review Article
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Role of high-resolution anal manometry in evaluation of chronic constipation. A Review

Abstract

Chronic constipation is a common and heterogeneous disorder in gastroenterology which requires detailed history and multiple investigations to reach an appropriate diagnosis. Patients are often referred to gastroenterologists when conventional treatment modalities fail. In a country like India, where there are multiple, parallel systems of medicine including the traditional system of medicines, patients are usually on a cocktail of medications by the time they are referred for advanced testing. With this review, we aim to bring in a scientific and a structured format for understanding primary constipation and associated testing for the same.

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Introduction

Constipation is defined in multiple ways by patients like reduced frequency of bowel habits, hard stools, excessive straining, or a sense of incomplete evacuation. Patients often present with varying combinations of symptoms. Constipation may be primary or secondary due to an underlying disorder. It can also be understood as arising from organic/structural disorder, a motility disorder (like Slow transit or dyssynergia) or a functional disorder (functional constipation and IBS C).

Secondary causes include conditions like hypothyroidism, colonic mechanical obstruction, malignancies, extrinsic compressions etc which are usually obvious on testing (Table 1). Usually, it is the primary constipation that is difficult to treat and hence referred for advanced testing. For this review, we would limit the discussion to evaluation of primary constipation.

Table 1 Causes of Secondary Constipation[1]

Drugs	Anabolic steroids, analgesics, opioids (codeine), NSAIDs, anticholinergics, anticonvulsants, antidepressants, antihistamines, antihypertensives (verapamil e clonidine), anti-Parkinsonian, diuretics, antacids containing calcium or aluminium, cholestyramine, calcium channel blockers, Iron supplements.
Neuropathic and myopathic disorders	Amyloidosis, Aganglionosis (Hirschsprung's disease, Chagas disease), connective tissue disorders, CNS lesions, autonomic diabetic neuropathy, multiple sclerosis, Cerebrovascular disease
Idiopathic	Paraneoplastic syndromes, Parkinson's disease, dementia, scleroderma, post-viral colon-paresis, intestinal pseudo-obstruction, spinal or ganglion tumour, ischemia.
Electrolytic balance alterations	Hypokalaemia, hypercalcemia
Organic intestinal diseases	Obstruction/stenosis: adenoma, cancer, diverticulitis, rectocele, hernia, foreign bodies, faecal impaction, IBD and complications. Anorectal abnormalities: anal stenosis or fissures, proctitis, rectocele, haemorrhoids.
Endocrine-metabolic causes	Hypothyroidism, diabetes mellitus, pregnancy and childbirth, hyperglycaemia
Systemic	Amyloidosis, Scleroderma, Polymyositis
Lifestyle	Inadequate fibre, Inadequate fluid intake
Psychological	Depression, Eating Disorders

Multiple societies like American gastroenterological association and others usually classify primary constipation into the following types. This classification is a functional and mechanistic classification. It is not an airtight compartment with various types occurring in isolation. In clinical practice, it is much more common to have significant overlap in various types, particularly slow transit usually ends up with patients developing dyssynergia over the years as secondary adaptation. For the purpose of understanding, primary constipation can be divided into following.[1-4]

a) Normal transit constipation (NTC)

b) Slow transit constipation (STC)

c)Pelvic floor dysfunction or defecatory disorders (DD)

Normal and slow transit constipation

Transit is defined as the time during which faecal matter passes through the colon or GI Tract. Colon transit time can be tested in isolation using Sitzmark markers or as part of the Whole Gut transit study using radiolabelled markers. Various protocols and methods have been described in text for testing for colon transit. The usual method used in India is the one described by Ghosal et al (Table 2).[5]

Table 2 Colon Transit Study Protocol[5]

Pre procedure Instructions: • Patients are asked to consume a normal diet, continue with normal routine activities. • Avoid any drug which can alter the gut motility 7 days before and during the study period. Laxatives and enemas are also to be avoided during the study period.
Procedure: Patients are asked to ingest 4 capsules (containing 5 markers in each capsule) at 0 hours. These are circular in shape.
Ingest another 4 capsules at 12 hours which are rectangular in shape.
Ingest another 4 capsules at 24 hours which are triangular in shape.
Abdominal X ray (erect) at 36 hours
Abdominal X ray(erect) at 60 hours

On the basis of Sitzmark study, Colon transit can be divided into Normal or slow transit. Clinically, in an outpatient setting, Bristol Stool chart is an important guide towards transit times. Bristol type 1 and 2 is usually associated with slow transit across colon whereas Type 3 and 4 is associated with normal transit.[6,7]

Slow colonic transit in the absence of a defecatory disorder is called Isolated slow transit constipation. There are multiple factors contributing to its development, for example, deficient calories in diet, neuromuscular dysregulation of the intrinsic plexuses and cells of Cajal. It has been described in multiple conditions, some of which are genetic and associated with various syndromes. Another entity called colonic inertia also presents as slow transit constipation. Upon conducting a colonic manometry in such patients, the colonic peristalsis is absent or markedly reduced to a meal/pharmacological stimulus. Such patients, sometimes end up with colectomy. It is therefore mandatory to conduct a colonic manometry before subjecting patients for surgery as there is a lot of significant overlap of functional disorders with visceral myopathies. They are also associated with visceral myopathies and neuropathies as a part of generalised dysmotility disorder.[2]

Gut microbiome is also known to play a significant role in both NTC and STC.

In a study, when germ free mice were colonised with the faecal microbiome from patients with constipation, the mice developed STC. STC is inversely related to colonic serotonin content, altered faecal content of short chain fatty acids and bile acids.[8-10] Some studies have reported methane gas accumulation in the colon as a cause for constipation although its significance is not well established. Methane production has been found to be more common in patients of STC.[8-10]

It is also important to rule out any opioid addictions, overt or occult as it can mimic slow colon transit. Lot of traditional systems of medicine and complementary medicines contain various kinds of opioids. It is hence pertinent to do the testing after stopping all such medications which can interfere with the peristalsis of the colon.

Defecatory disorders

Defecatory disorders (DD) are much more common than slow transit constipation and require anorectal manometry for diagnosis. DD has a pooled prevalence in the community of 14% and has significant cost and healthcare utilisation. It is common in patients with medically refractory constipation.

Functional Defecatory disorders (FDD) are diagnosed when more than two symptoms of chronic constipation or irritable bowel syndrome (IBS) and more than two parameters of impaired evacuation, i.e. dyssynergic manometry patterns, impaired evacuation on imaging, or failed balloon expulsion test (BET), are present. These disorders significantly impact the quality of life as screening is difficult and patients are reluctant to address the symptoms due to the perceived social stigma.[20]

There is also a lack of awareness about evacuation or defecatory disorders amongst general physicians as well as gastroenterologists. Symptoms are often downplayed for years before patients are subjected to further testing. These patients are on laxatives for years together which are not significantly helpful in this subgroup. It is crucial to know this as this subgroup does well with non-medical therapies like biofeedback therapy, sacral stimulation amongst others. These therapies are now available at various centres in India, particularly referral centres. In our experience, the majority of patients with chronic constipation, both adult and paediatric, have dyssynergic defecation. It is also common for patients with dyssynergia to have a history of rectal prolapse, haemorrhoids which have required repeated interventions, finger evacuation, history of documented solitary rectal ulcer syndrome, bleeding in stools.

The pelvic floor muscles add a mechanical component in the development of defecatory disorders. Uncoordinated contraction of the puborectalis reduces the anorectal angle which causes a mechanical obstruction to the passage of stools. Several behavioural conditions like anxiety, OCD, depression increase muscle tension and therefor influence the development of dyssynergic defecation.[7,11,12]

In a prospective investigation evaluating the aetiology of dyssynergic defecation in a group of 100 patients, Rao et al. found that symptoms began during childhood in 31% of the patients and occurred following a mechanical cause (such as pregnancy or trauma) in 29%; however, in 40% of the patients, no cause was identified. Additionally, a history of sexual abuse was found in 22% of the women.[11,12,19]

There are various tests available to investigate these disorders however anorectal manometry (ARM) remains the most performed, accepted and best-established investigation. It assesses the pressure in the anal canal at rest and during voluntary effort (squeeze) as well as during attempted evacuation (simulated defecation). The pressures in the anal canal and rectum are either presented as line traces (conventional manometry) or as colour-contour plots (high-resolution manometry (HRM)). Both water-perfused and solid-state catheters are used in clinical practice.

On the basis of Anorectal manometry findings, Dyssynergia has been divided into various types. The classification has limited clinical applicability in practice but is very important while planning for biofeedback therapy where the mechanism of dyssynergia becomes important. In the recent London classification, this concept has been utilised for dividing patients into various major and minor disorders (Table 3).

Table 3 Types of Dyssynergia (Rao's Type)[40]

Rao's Type	Description
Type I	The patient can generate an adequate pushing force (rise in intraabdominal pressure) along with a paradoxical increase in anal sphincter pressure.
Type II	The patient is unable to generate an adequate pushing force (no increase in intrarectal pressure) but exhibit a paradoxical anal sphincter contraction.
Type III	The patient can generate an adequate pushing force (increase in intrarectal pressure) but, either has absent or incomplete (< 20%) anal sphincter relaxation (i.e., no decrease in anal sphincter pressure)
Type IV	The patient is unable to generate an adequate pushing force and demonstrates an absent or incomplete anal sphincter relaxation

Functional disorders (FC/IBS-C)

After assessing for slow colon transit and dyssynergia, the other major diagnostic complex usually comes from functional causes like Functional Constipation and Irritable Bowel Syndrome-Constipation predominant (IBS-C). These groups of disorders are diagnosed using Rome 4 criteria and usually after slow transit and dyssynergia constipation have been ruled out. As stressed earlier, there is a significant overlap between these conditions and patients with functional constipation (FC) and IBS-C may have associated dyssynergia or failed balloon expulsion test. These patients usually require a multifaceted approach towards their treatment with both DD and functional constipation being managed simultaneously. We briefly mention the existing criteria for its diagnosis.

ii) **Rome IV criteria**- This incorporates symptoms and anorectal assessment of rectal evaluation.

Criteria for Functional constipation (FC): -

*Diagnostic criteria**

1. Must include two or more of the following: **
2. Straining during more than ¼ (25%) of defecations
3. Lumpy or hard stools (Bristol Stool Form Scale 1-2) more than ¼ (25%) of defecations
4. Sensation of incomplete evacuation more than ¼ (25%) of defecations
5. Sensation of anorectal obstruction/blockage more than ¼ (25%) of defecations
6. Manual manoeuvres to facilitate more than ¼ (25%) of defecations (e.g., digital evacuation, support of the pelvic floor)
7. Fewer than three SBM per week
8. Loose stools are rarely present without the use of laxatives
9. Insufficient criteria for irritable bowel syndrome

*Criteria fulfilled for the last 3 months with symptom onset at least 6 months prior to diagnosis

**For research studies, patients meeting criteria for opioid-induced constipation (OIC) should not be given a diagnosis of FC because it is difficult to distinguish between opioid side effects and other causes of constipation.

There is often an overlap between functional constipation (FC) and constipation predominant irritable bowel syndrome (IBS-C). Some patients satisfy the criteria for FC and IBS-C and vice versa.

Rome criteria for IBS-C (constipation predominant Irritable bowel syndrome):

Irritable bowel syndrome

Recurrent abdominal pain on average at least 1 day/week in the last 3 months, associated with two or more of the following criteria:

1. Related to defecation
2. Associated with a change in frequency of stool
3. Associated with a change in form (appearance) of stool

* Criteria fulfilled for the last 3 months with symptom onset at least 6 months prior to diagnosis

Methods to assess Chronic constipation

Digital Rectal Examination (DRE)

Bedside tests like DRE are considered the most important standard for dyssynergia defecation. The resting and squeeze pressures lie within a certain range. Healthy individuals when instructed to push and bear down as if to defecate during DRE, the examiner can appreciate the relaxation of external anal sphincter and/or puborectalis muscle, together with perineal descent and tightening of abdominal muscles A well and thoroughly performed per rectum examination can identify abnormalities like anal spasm, anal stricture, impacted stools, mass per rectum, inadequate push during defecation, paradoxical contraction of the pelvic muscles.

In a diagnostic study by Jie Liv et al, it was established that there exists a moderate agreement between the findings of DRE and ARM (k coefficient:0.474). It estimated the overall sensitivity of DRE to be 71.3% and sensitivity to be 76.1%.[14]

In another study, 87% had dyssynergia defecation, based on standard criteria; 73% of these were identified to have features of dyssynergia, based on DREs. The sensitivity and specificity of DRE for identifying dyssynergia in patients with chronic constipation were 75% and 87%, respectively; the positive predictive value was 97%. DRE was able to identify normal resting and normal squeeze pressure in 86% and 82% of dyssynergia patients, respectively.[15]

The multiple investigations required to establish the diagnosis of DD are not readily available and, in such situations, Digital rectal examination becomes an important clinical skill and an indispensable tool. However, there is a lack of emphasis on the use of DRE in routine clinical examination. In a study by Lawrentschuk et al. 'only 11% of medical students had palpated constipated patients, and up to 17% did not perform it during medical school.' Consequently, this study confirmed the lack of awareness around DRE.[16]

To summarise, DRE has moderate correlation with anorectal physiological tests and is an indispensable tool if performed accurately and thoroughly.

Anorectal Manometry

Anorectal manometry (ARM) and rectal balloon expulsion tests have become the first line tests for diagnosing defecatory disorders in constipated patients. It is also useful in identifying reduced anal pressures at rest and during squeeze in faecal incontinence. It is also indicated when patients are diagnosed with SRUS or Solitary rectal ulcer syndrome. Solitary rectal Ulcer syndrome (SRUS) is a chronic disorder with varied clinical manifestations and poorly understood pathophysiology. Dyssynergia defecation plays an important role in the development of SRUS. ARM helps diagnose SRUS when abnormal pressure gradients, paradoxical contractions are seen on the manometry.[19]

There exist two systems of conducting manometry i.e. conventional or non-high resolution and high resolution. Prior to the advent of HRM, a conventional system of manometry was used. In conventional, the equipment records pressure from a single point in the anal canal. High resolution anorectal manometry (HR-ARM) can record and display pressures from multiple points in the anorectum. It consists of a probe with circumferentially placed sensors, each 1.5-2 cm apart. HR-ARM records the pressures of the lumen and the data is presented in the form of colour coded graphs, 3D ARM records pressures both longitudinally and radially and displays the information in both 2D and 3D.[20] 3D reconstruction of high-resolution anorectal manometry is also used by some manufactures but few studies have shown limited applicability over 2D high resolution images. It may be a useful adjunctive tool during biofeedback therapy[21]

Although ARM is not absolutely accurate due to paucity of normative data, along with other confirmatory investigations it helps diagnose the disorders of constipation and incontinence accurately.

Before proceeding with ARM, a Digital Rectal Examination (DRE) should always be conducted to have an overview of the anorectum and pelvic floor physiology, to rule out an anal fissure, fistula, haemorrhoids and also the anal tone. While performing a per rectal exam, the patient can be introduced to commands like 'push' and 'squeeze'. This manoeuvre will help patients comprehend the same commands during manometry.

Test procedure

The IAPWG (The International Anorectal Physiology Working Group) outlines the protocol to be followed for conducting the tests related to anorectal function.

The procedure must include an assessment of recto anal pressure and anal canal length at rest, recto-anal pressures during squeeze, simulated evacuation, and coughing, and, rectal sensation. A rectal balloon expulsion test (BET), which is an effective screening test to identify defecatory disorders, should be performed at the same visit as the anorectal manometry.

The duration of the study can last between 15 to 20 mins but variations are present between different institutions.

The protocol can be summarised as below:

Patient preparation and position

Patients are asked not to take any medication that affects intestinal motility at least 3 days before the test. Bowel preparation is not routinely used. An enema is given if stool is detected on a digital rectal examination. At least 30 minutes to 2 hours should elapse from enema insertion to probe placement. The patient is placed in the left lateral position with knees and hips bent at a 90° angle.

Probe placement

The lubricated probe is gently inserted into the rectum. The probe is oriented with its dorsal aspect corresponding to that of the patient. Once positioned, the probe assembly remains stationary for the duration of the study.

Rest

This manoeuvre measures the resting anal pressure which is defined as Mean maximum pressure measured from the whole anal canal over a 60-second recording period. All efforts must be made to avoid a movement artefact by instructing the patient to remain still.

Squeeze test

This manoeuvre records the pressure in anal canal during voluntary effort to contract the anal canal/pelvic floor. It measures two types of pressures,

a) **Anal squeeze pressure**- Maximum incremental pressure observed during the 5-s short squeeze.

These are measured over a period of 5 seconds with a 30 second interval recovery period in between. Best of three recordings is taken as the final value.

b) **Long squeeze pressure-** The duration of time the subject under study can voluntarily sustain an increase in anal pressure > 50% of maximum incremental squeeze pressure during the 30-second long squeeze.

It measures the anal pressure during a 30s sustained voluntary contractile period. It aims to describe the fatigability of the pelvic floor muscles as opposed to the contractile ability described by short squeeze.

This is followed by a 60s recovery interval.

Cough reflex test

It measures the reflex increase in anal pressure during cough and records the maximum pressure in the anorectum during the cough manoeuvre.

This manoeuvre demonstrates the integrity of spinal reflex, especially in patients of incontinence.

The patient is asked to cough twice with a 30s recovery interval in between.

Simulated defecation

The patient is asked to simulate the act of defecation i.e. bear down as if to defecate, it measures the maximum rectal and anal pressures. Three pushes are performed, each lasting for a duration of 15s and separated by a 30s recovery interval in between.

The test is conducted with and without the distension of a 50 ml rectal balloon. It is essential to instruct the patient to try not to withhold the probe. Such coaching can change the manometric diagnosis from 'pathologic' to 'normal'.

Graded balloon distension

This manoeuvre consists of intermittent balloon distension to assess rectal sensation and Recto anal Inhibitory Reflex (RAIR).

The recto anal inhibitory reflex (RAIR) (also known as the anal sampling mechanism, anal sampling reflex, recto sphincteric reflex, anorectal sampling reflex, or the fart reflex) is a reflex characterized by a transient involuntary relaxation of the internal anal sphincter in response to distention of the rectum. The RAIR provides the upper anal canal with the ability to discriminate between flatus and faecal material. RAIR is performed with a starting volume of at least 30mls.

If the reflex is not recorded, the following manoeuvres can help:

(1) ask the patient not to contract the external anal sphincter during rectal distension

(2) make sure there is no faecal impaction, and

(3) raise the rectal distension volume.

Rectal sensation can be assessed by rectal barostat studies or by syringe-driven balloon distension with the balloon either mounted on the manometry catheter or attached to a Foley catheter placed at least 3-5 cm above the upper border of the anal canal. The balloon volume is recorded for three sensory thresholds:

a) First constant sensation volume (FCSV)- The minimum balloon insufflation volume required to elicit a sensory response.

b) Desire to defecate volume (DDV)-The balloon insufflation volume required to elicit a sustained desire to defecate.

c) Maximum tolerated volume (MTV)- The balloon insufflation volume that causes an intolerable desire to defecate.

Analysis and Interpretation of ARM

Several studies have shown that variations in hardware and the protocol can produce varying results, thereby affecting diagnosis and treatment.[17] Therefore, it is important to follow standard protocol and guidelines for appropriate diagnosis and interpretation of tests.

We will discuss the interpretation of the ARM findings according to two classifications.

a) London classification of anorectal disorders- This classification has been developed taking into account the result of HR-ARM, BET and RST.

The findings have been categorised into the following categories (based on Chicago Classification of oesophageal motility disorders)-

I) Major finding- A pattern not seen in control subjects and likely to demonstrate a pathological result.

ii) Minor finding- A pattern seen in patients with anorectal complaints, however can also be present in control/asymptomatic subjects.

iii) Inconclusive finding- A pattern seen in both patients and healthy subjects however their relevance is yet to be fully determined.

According to London classification, anorectal dysfunction has been divided into 4 parts.

PART 1: Disorder of recto anal Inhibitory reflex

These results may indicate the need for further investigation to exclude aganglionosis especially in paediatric populations and adult patients with co-existent megarectum/megacolon. This pattern can also be found in asymptomatic patients following rectal resection / ileal pouch anal anastomosis, anal hypotonia, faecal loading or megarectum

PART 2: Disorders of Anal tone and contractility

This part includes disorders such as Chronic Anal fissure, Levator ani syndrome, Proctalgia Fugax (Under the anal Hypertension sub category).

In disorders of anal hypotension, an abnormal cough reflex indicates a severe abnormality.

LLN: Lower limit of normal

ULN: Upper limit of normal

PART 3: Disorders of recto anal coordination:

These disorders require the use of both balloon expulsion test and anorectal manometry for the diagnosis.

PART 4: Disorders of rectal sensation:

The parameters used to diagnose these disorders are (I) First constant Sensation Volume, (ii)Desire to Defecate Volume, (iii) Maximum Tolerated Volume

Functional defecation disorders are characterised by paradoxical contraction or inadequate relaxation of the pelvic floor muscles during attempted defecation (dyssynergic defecation) or inadequate propulsive forces during simulated defecation (inadequate defecatory propulsion).

Type 1: Increased intrarectal pressure (>=40mmHg) with paradoxical increase in intra anal pressure.

Type 2: Inadequate intrarectal pressure (<40mmHg) with paradoxical anal contraction.

Type 3: Adequate intra rectal pressure/ adequate propulsive forces (>=40mmHg) with incomplete or absent relaxation (<=20%) of resting pressures of anal sphincters.

Type 4: Inadequate propulsive force(<40mmHg) with incomplete or absent relaxation of anal sphincter.

Clinical and diagnostic utility of ARM

ARM is an upcoming investigation for the diagnosis of anorectal diseases. It is also useful in evaluating structural pathologies of the anorectum. However, the analysis of individual sphincter function is difficult since the muscle anatomy is complex and manometry is unable to differentiate between the contributions of each sphincter.

Many studies have reported that the findings of dyssynergic defecation have been observed in healthy volunteers and a standardised reporting system is required across all institutions performing the tests.[21] Test results are variable with different test equipment, age, gender and parity (in case of women).[17,18] Another reason that the findings are variable could be the awkward position of the patient during investigation i.e. left lateral position instead of the conventional squatting position during defecation.[20]

The reliability of ARM to diagnose functional constipation, dyssynergic defecation has been questioned but its ability to sub classify DD into Rao's subtypes is exemplary.[18,20]

The prevalence of dyssynergic defecation was 45.3% in pooled global studies of chronically constipated patients. Based on the observed likelihood ratios, an abnormal manometry predicts a 58% (57%–60%) chance of having dyssynergic defecation for which a trial of biofeedback therapy is warranted, while a normal manometry reduces the likelihood of having a biofeedback responsive defecatory disorder to 19% (17%–22%) in pooled global cohort studies.[23]

Anorectal manometry likely remains clinically relevant for several reasons.

(a) It provides additional physiological data, for example, rectal sensation and tone to assess a broader range of possible anorectal physiology disorders (rectal areflexia, anal hypotension, or rectal hyper/hyposensitivity).

(b) the standard recommended course of biofeedback therapy provided by physical therapists involves a treat-to-target approach to (1) improve a patient's ability to expel a balloon from the rectum, (2) improve anal sphincter relaxation during simulated defecation, and (3) normalize rectal hyper or hyposensitivity when present. Anorectal manometry is necessary to assess the latter two treatment targets, and simplified anorectal pressure sensors are used by physical therapists during treatment when the protocol is strictly followed.[22]

(c) anorectal manometry may represent an opportunity as a biomarker to assess treatment response.

A substantial number of healthy volunteers have been observed to have dyssynergia or abnormal manometric patterns. However, dyssynergia on manometry and failed balloon expulsion test (failure to expel the balloon within 5 minutes) can identify patients who benefit from biofeedback therapy.[11,26]

Tests of evacuation

MR defecography

MR defecography has recently emerged as the modality of choice for evaluation of pelvic floor pathologies due to the multiplanar imaging ability and it enables the physicians to directly visualise the defect, anal sphincter and pelvic floor muscles. It is usually employed when ARM and BET are equivocal/inconclusive.

MR defecography can also identify other pelvic pathologies like rectal intussusception, and abnormal content of the peritoneal cul-de-sac, which can be missed on conventional defecography.[26,27]

The parameters assessed in MR defecography are[26]

1. Anorectal angle (at rest and during straining)

2. Anal diameter

3. Degree of rectal emptying

4. Pelvic floor descent.

All the above mentioned are useful in assessing for various morphological and surgical disorders like rectocele, intussusception, descending perineum syndrome, paradoxical contractions (by measuring the ano-rectal angle), incomplete relaxation of anal sphincter.

Defecography may play a crucial role in the evaluation of FDD, especially when a balloon expulsion test (BET) and/or anorectal manometry (ARM) are equivocal or demonstrate contradictory results.[26]

Balloon expulsion test

Balloon expulsion test is a simple test to assess the presence of defecatory disorders in patients. It involves assessment of the subject's ability to evacuate a simulated stool. This test can be conducted as a standalone test or as a part of the manometric evaluation. Manometric Evaluation alone poorly predicts the prolonged expulsion time of the balloon. The ideal method is that both ARM and balloon expulsion tests are performed in the same sitting of the test. The subject is placed in left lateral decubitus with both knees and hip flexed. A lubricated latex balloon attached to a catheter with a water filled syringe is placed in the rectum and is inflated with a fixed volume, usually up to 50 ml of water is used. However, some studies have reported that this volume is insufficient to stimulate the urge to defecate but higher volumes of water could indicate the presence of DD.[28]

The presence of abnormal BET favours the presence of constipation between 23-67%. One study reported the sensitivity of 87.5% and positive predictive value of 64% for diagnosing PFD by BET.[29] In another study by Lalwani et al. a Negative predictive value of 97% was reported for BET. Ortengren et al. observed that performing three sequential simulated defecation attempts (rather than only one or two attempts) optimized diagnostic accuracy to detect dyssynergic defecation.

Therefore, BET test can be used as a bedside test for the screening of prevalence of DD but it is not gold standard and must be used in conjunction with other tests to diagnose DD.

ARM versus MR Defecography

MR/barium defecography evaluates rectal wall morphology, pelvic floor motion and evacuation, persistent contraction of the puborectalis results in muscle hypertrophy and a prominent impression on the anorectal junction, with a paradoxical narrowing in the anorectal angle (ARA) during defecation.[30] Indication for this investigation is to rule out functional obstruction (such as rectocele, obstructing intussusception, megarectum, descending perineum syndrome) and/or pelvic organ prolapse in patients with constipation.[33]

Advocates for it suggest that it provides a precise evaluation of pelvic organs and associated structures which can be over looked in other investigations.[25,26]

There are several limitations to defecography; in case of barium studies, radiation exposure limits the age group in which the investigation can be applied successfully. Social stigma and inhibition in the patient can influence the findings.

Manometry and defecography together help segregate patients in two broad categories, (a) Non-evacuators, characterized by limited abdominal expansion, a spastic pelvic floor, and inadequate rectal pressure during evacuation; (b) Evacuators, characterized by preserved abdominal expansion, rectal pressure, and anal opening. Most patients with DD do not have isolated rectal or anal dysfunctions but rather a combination of impaired abdominal expansion, rectal propulsion, anal opening, and perineal descent during evacuation.[32,34]

Diagnostic agreement between anorectal HR-ARM and MR defecography is high and pressure measurements accurately identify recto-anal dyssynergia and intra-anal outlet obstruction by structural pathology as causes of obstructive defecation.[34]

The diagnosis of dyssynergia defecation is complicated, and no single test can be attributed as a gold standard test that can accurately diagnose this disorder.[35] In clinically suspected cases of

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DD, MR defecography should be considered when ARM and BET are inconclusive. An abnormal defecography can be diagnostic in such a scenario and help make an accurate diagnosis.[26]

Currently, the investigations for anorectal function are best suited to be used in conjugation with each other in order to provide a comprehensive overview of the diagnosis and pathologies of the anorectum.

HRAM and HDAM versus conventional Anorectal Manometry

Table for comparison between HRAM, HDAM and conventional Manometry

High resolution (HRAM) and 3-D high definition (HDAM) manometry	Conventional manometry
More sensors at close intervals (continuum in space and time), e-sleeve for high pressure zone	Fewer sensors at wider intervals, Dent sleeve for high pressure zone
Stationary examination, less discomfort	Pull-through, can be uncomfortable
Colour topographic display, better resolution allowing easier interpretation with less time	Lines display, poor anatomical resolution, less easy to interpret, and time consuming
High-definition allows radial besides circular pressure measurement	Only circular pressure measurement
More fragile, shorter life-span, greater maintenance needed	Less susceptible to wear and tear, little maintenance and seldom malfunctions

While patients with normal defecatory function or obstructive defecation because of either poor anal sphincter relaxation or poor defecatory effort can be accurately identified with either technique, patients with obstructive defecation because of poor relaxation or paradoxical contraction of the puborectalis muscle are not reliably identified with water perfused manometry because it provides less physiologic and anatomic resolution.[36,37] When compared with standard manometry, there is high correlation for diagnosis although HRAM pressures tend to be higher and therefore the normative values for HRAM need to be investigated and published.[38]

Biofeedback therapy

Biofeedback therapy is used for multiple disorders and relies on visual and verbal feedback techniques. It is based on the model of operant conditioning and positive reinforcement. Operant conditioning relies on rewards for positive behaviour, it leads to development of an association between a particular behaviour and consequence. This therapy is useful for evacuation disorders and incontinence. It can be done both by visual/audio feedback or EMG based. In various studies when compared to standard interventions, biofeedback therapy has been found to be useful for patients with dyssynergia as well as incontinence.[38-40] There is no standard protocol for doing biofeedback therapy. Various authors have described the steps. Primarily, with advent of London classification, it is important to identify the underlying mechanism for evacuation disorder and work on that during feedback for example, weak abdominal push or inadequate anal relaxation.[41,42]

Biofeedback therapy for the management of dyssynergic constipation is considered a superior therapy as compared to pharmacological management alone. SRU patients with DD are typically unresponsive medical treatments. Ameliorating anorectal dyssynergia should be the priority of treatment in these patients. BFT is an effective treatment for DD. BFT enhances the healing of ulcers in patients with SRU by restoring coordination of the pelvic floor.[48] The recommended patients for biofeedback therapy are the ones fulfilling the criteria for dyssynergic defecation.

The goal of the therapy is to correct dyssynergia/ incoordination of muscles, simulated defecation training to facilitate normal evacuation and to improve rectal sensory function.

There are certain contraindications for the therapy[44]

a) Severe neurological disorders

b) Inability to sit on a commode

c) Developmental disability and visual impairment.

The duration and frequency of training sessions is highly individualised. A typical session is conducted twice weekly with each session lasting on an average for 1 hour. Periodic reinforcements are necessary to maintain the progress of the patient. The training is discontinued when the patients coordinated anorectal movement for defecation, improved stool habits. Biofeedback therapy has proved superior to laxatives and other conventional treatment modalities and the results are sustained long after stopping the treatment.

Home biofeedback therapy is a new and emerging concept. It is proving to be a cost-effective method for the management of chronic dyssynergic constipation since office-based therapy is available only in a select few tertiary centres.[43-45]

It consists of educating the patient about the hand-held device which is inserted into the rectum and the patient is asked to perform push manoeuvres whilst observing the changes in the rectal and anal pressure.

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