



Anorectal Manometry Overview Quick Reference Guide

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Alterations of anorectal function cause anorectal disorders that affect 20% of the population. Anorectal manometry (ARM) is the most commonly performed test of anorectal function. It provides comprehensive information about anal sphincter function; mechanisms of continence and defecation, rectal sensation, rectal compliance, and anorectal reflexes¹; and facilitates optimal management.

Equipment

The ARM system consists of 4 main components: a pressure-sensing device (probe), an amplifier/recorder that converts signals for digital display and storage, a monitor for displaying recordings, and software for data analysis.

Patient Preparation

Usually, no bowel preparation is required prior to ARM¹⁷. There are no diet restrictions and routine medication can be continued. The patient is asked to empty his/her bowel prior to the test. Some centers give a Fleet enema 2 hours before performing the test.

Patient Position

The patient is placed in the left lateral position with the hips and knees flexed at 90 degrees throughout the procedure.

Steps in Anorectal Manometry

ARM is not a single test but consist of several maneuvers that provide several measurements. Optional additional tests may include saline continence test, pudental terminal motor latency, and balloon expulsion tests.

Probe Placement

With the patient in left lateral position, a lubricated probe is inserted into the rectum. The most distal sensor should be oriented and located posteriorly from the anal verge. Accurate probe position and calibration are essential for accurate interpretation.

Assessment of Resting Anal Sphincter Pressure

Purpose

The purpose is to assess baseline sphincter pressure, which predominantly reflects internal anal sphincter (IAS) function.

Technique

After probe insertion, a run-in time of 5 minutes is allowed to enable the sphincter to return to basal levels. Ultraslow wave activity may be seen as phasic pressure activity at 1 to 1.5 cycles/min with an amplitude >40 mm Hg. This is associated with either normal or hypertonic anal sphincter.^{1,12}

The method that the mcompass uses for assessing resting anal sphincter pressure:

- **Stationary Technique:** This is the preferred technique of measuring the resting anal sphincter pressure. After probe placement, the highest pressure at any level in the anal canal is taken as the maximum resting sphincter pressure.

Analyses/Interpretation

Maximum resting sphincter pressure: The difference between the baseline pressure (atmospheric pressure) and the maximum anal sphincter pressure at rest is defined as resting sphincter pressure. The maximum sphincter pressure at any level in the anal canal is measured and taken as the maximal resting sphincter pressure.

Clinical Significance

The IAS provides 80% of the resting anal sphincter pressure. The maximum resting pressure is usually 50 to 80 mm Hg in normal subjects²². A decrease in resting anal sphincter pressure indicates weakness or disruption of the IAS. Nulliparous women have significantly higher resting pressure than multiparous women.²³ Currently; there are conflicting data about the correlation between age and anal resting pressure. Some authors found no significant correlation²³ with others²⁴ found higher resting pressure in younger compared to older subjects.

Assessment of Squeeze Anal Sphincter Pressure

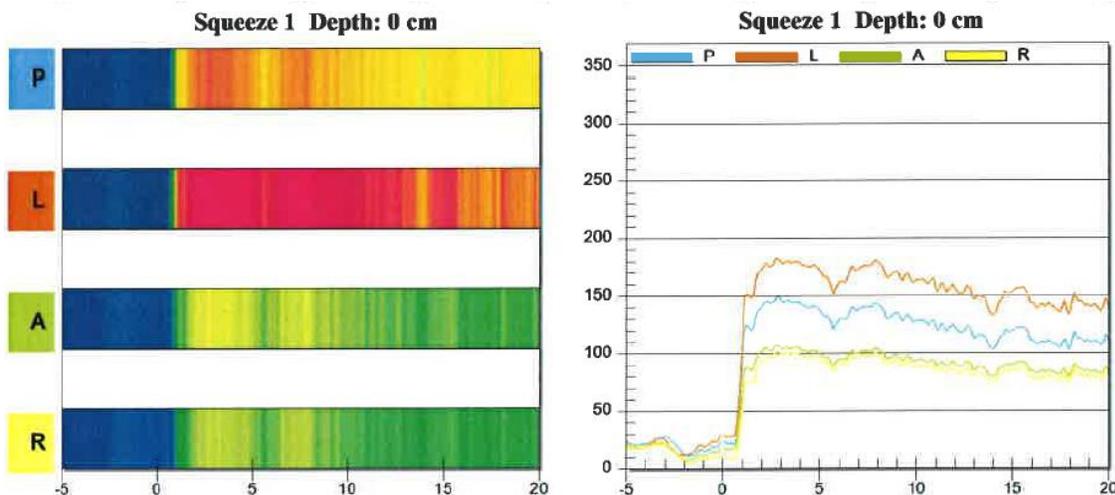
Purpose

To assess the strength of the EAS during voluntary squeeze.

Technique

The patient is instructed to squeeze the anus for as long as possible and at least 20 seconds. The maximum anal squeeze pressure is the highest sphincter pressure recorded at any level in the anal canal. The contraction of the EAS is usually associated with contraction of the puborectalis but manometrically, it is difficult to separate the 2 muscles. EAS contraction elevates the pressure throughout the anal canal, but the pressure rise occurs maximally in the lower canal.

The squeeze pressure profile is biphasic with an initial sharp rise (maximum sphincter pressure) followed by a drop and a sustained pressure. The latter is important to maintaining continence.



Analysis/Interpretation

- Maximum squeeze pressure: the difference between the atmospheric baseline and the highest pressure recorded at any level within the anal canal during squeeze is measured as the maximum squeeze pressure. In order to correctly interpret this parameter, it should be ensured that the intra-abdominal pressure is not simultaneously increased and the patient fully understands the maneuver.
- Sustained squeeze pressure: this is the difference between the baseline anal sphincter pressure and the highest anal sphincter pressure value that is sustained for more than 15 seconds at any site in the anal canal.
- Duration of squeeze: This is the time interval in seconds during which the patient can maintain a squeeze pressure at or above 50% of the maximum squeeze pressure. In a patient who cannot generate a good squeeze, the time interval between the onset of the squeeze response and its return to baseline pressure is measured. The mean duration of the squeeze ranges from 25 to 31 seconds¹⁹ although healthy subjects can maintain squeeze for up to 50 seconds.

Clinical Significance

A weak squeeze response may be due to myogenic causes.²⁵ Men have significantly higher maximal squeeze pressures than women.^{19,23} Nulliparous women have nonsignificant higher squeeze pressures than multiparous women.²³ The maximum squeeze pressure is significantly lower in older individuals when compared to younger individuals.^{19,24}

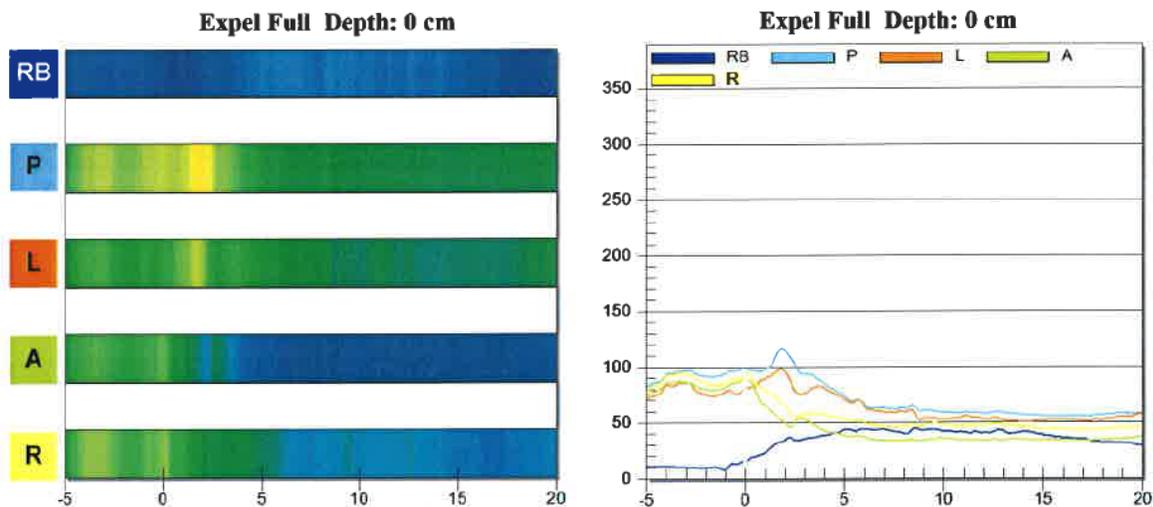
Expel Empty/Full

Purpose

To assess the rectal and anal sphincter pressure changes during an attempted defecation and their coordination with abdominal muscle contraction.

Technique

Here, the patient is asked to strain and to bear down as if to defecate. First, with the rectum acting as empty for 20 seconds, the maneuver is repeated again but with 50cc of air in the rectal balloon to act as though the rectum is full.



Analysis/Interpretation

The anal residual pressure is defined as the lowest pressure within the anal canal during attempted defecation. Percent anal relaxation is calculated by using the formula: percent anal relaxation = anal relaxation pressure/ anal resting pressure x 100. The overall index of the changes in the rectal and anal pressure is calculated by defecation index: defecation index = maximum rectal pressure during bearing down/minimal anal residual pressure during bearing down.

Clinical Significance

Normally, there is an increase in rectal pressure and a decrease in anal sphincter pressure. The inability to perform this coordinated maneuver leads to functional obstruction to the passage of stool and is termed *dyssynergic defecation*. There are at least 4 manometric types of dyssynergic defecation.

Rectoanal Inhibitory Reflex

Purpose

To assess the presence of this local enteric reflex.

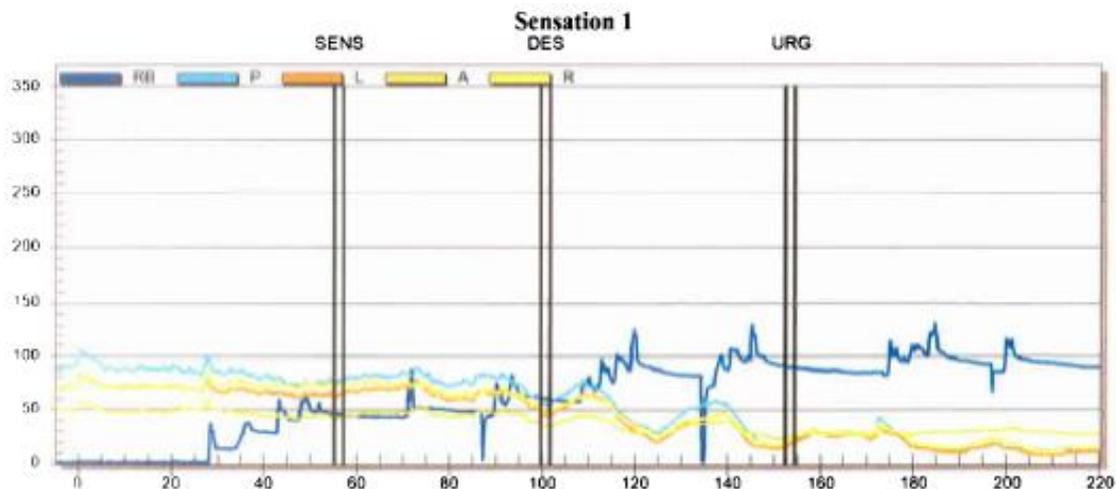
Technique

To elicit this reflex, the intrarectal balloon is inflated, up to 50 mL of air. The lowest balloon volume that induces anal sphincter relaxation and which causes sustained relaxation is recorded.

Analysis/Interpretation

Distension of the rectal wall induces relaxation of the IAS. This phenomenon was first observed by Denny-Brown and Robertson in 1935 and was described as rectoanal inhibitory reflex (RAIR) subsequently.¹¹ This reflex is mediated through the myenteric plexus.

A normal RAIR is shown in the figure below. Additionally a rectoanal contractile reflex can be demonstrated.²⁶ this is a reflex contraction of the EAS in response to a transient distension of rectum. This reflex is associated with an increase in the electrical activity of the EAS.¹³ A higher volume of rectal distention will abolish the EAS activity. There is no difference in the minimum volume required to cause anal relaxation in young versus old age groups.



Clinical Significance

The absence of RAIR is a typical finding in Hirschprung's disease with a high sensitivity, specificity, positive predictive value and negative predictive value. However, this diagnosis is rare in adults. Any condition that disturbs this neural arc can alter this reflex.

Sensorimotor Response

Rectal distension also produces motor response from the anal sphincter/puborectalis region termed sensorimotor response and this is usually evoked in response to rectal perception, often with a desire to defecate.²⁵⁻²⁷ This reflex response is impaired in patients with rectal hyposensitivity.

Rectal Sensory Testing

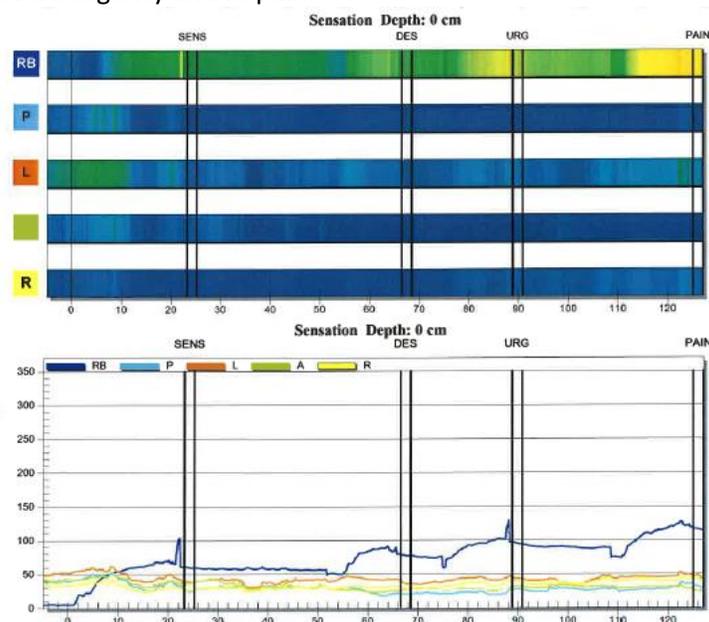
Purpose

To assess sensory thresholds in response to rectal balloon distension.

Technique

The rectal balloon is intermittently inflated in increments of 10 cc until the subject reports first sensation, and then continue with 10 cc up to a maximum of 180 cc or until the maximum tolerable volume is reached.¹² After each inflation, the distention is maintained for 30 seconds before complete deflation, and after a 30-second test interval, the balloon is reinflated to the next volume. The rate of inflations is standardized at 10 cc/sec. The following sensations are evoked:

- *Sensation*: a transient sensation of fullness, bloating or gas; a vague sensation that disappears completely
- *Desire*: A desire to have a bowel movement that lasts > 15 seconds
- *Urgency*: an urgent desire to have a bowel movement that would force the individual to stop doing anything else and rush to the bathroom
- *Pain*: The maximum volume of distension that is tolerable, often associated with severe urgency and or pain





Analysis/Interpretation

The interpretation of the rectal sensory data should be performed along with an assessment of the rectal compliance data. The sensory thresholds vary among laboratories and may differ according to the type, shape, length, and elasticity of the balloon as well as the distance of the balloon from the anal verge, the technique of inflation (phasic versus continuous) and the speed of inflation.³ Thus, the technique should be standardized and normative data should be obtained for each laboratory. There was no difference between the rectal volumes for first sensation between young and older individuals.²⁴ Rectal hyposensitivity is defined as diminished perception of rectal distension for at least 2 modalities such as sensation and urgency. A higher threshold for first perception is found in patients with diabetes and fecal incontinence and for urgency in patients with constipation.²⁵ In contrast, rectal hypersensitivity or lower thresholds for sensory perception can be found in patients with urge incontinence, proctitis, irritable bowel syndrome and lower abdominal/ pelvic pain.²⁵

Clinical Significance

Abnormal rectal sensation can play a role in the pathophysiology of many colorectal problems, and some of these can be reversed as exemplified by successful biofeedback training.

Assessment of Rectal Compliance

Purpose

To assess distensibility of the rectum and pressure responses the distending volume.

Technique

During intermittent inflation of the balloon, the intrarectal pressure is recorded. The steady state rectal pressure for each distending volume is calculated by subtracting the intra balloon pressure obtained during balloon inflation in the ambient air from the intrarectal pressure during balloon distention.

Interpretation

Inflation of the balloon causes an initial increase in intrarectal pressure, which is followed by a slow decline in pressure to a steady state as the rectum accommodates to the increased volume. Rectal compliance is calculated from the slope of the graph describing the relationship between the change in the intraballoon volume and the change in the intrarectal pressure at steady state. A single number reflects the average slope of the pressure-volume curve. However the curve is nonlinear, thus a graph/table showing all of the volumes test may be more useful.

Clinical Significance

The rectal compliance provides a measure of the accommodation of the rectal wall and it depends on the viscoelastic properties of the rectal wall and the mobility of the adjacent pelvic viscera.²⁵ Rectal compliance is decreased in older subjects and patients with inflammatory bowel disease, chronic ischemia, or pelvic irradiation. In contracts, a higher rectal compliance is seen in megarectum and fecal impaction.

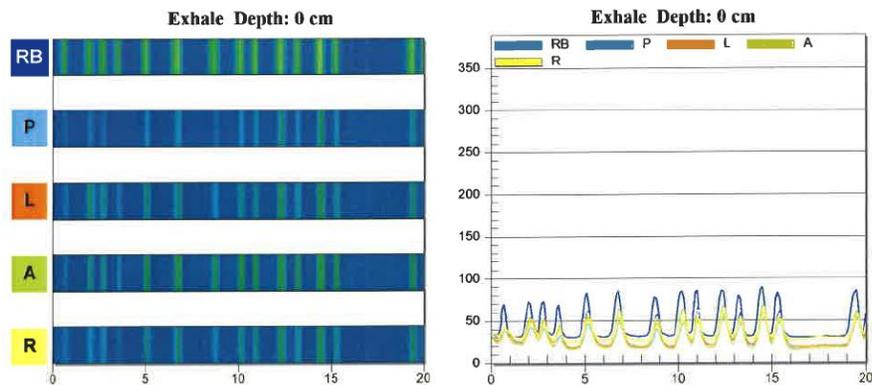
Abdomino-Pelvic Reflex (Cough Reflex Test)

Purpose

To determine the integrity of the local reflex arc responsible for maintain continence during an abrupt increase of intra-abdominal pressure.

Technique

Here the patient is either asked to cough or to blow up a party balloon a few times during the 20 second test.



Analysis/Interpretation

This maneuver induces an abrupt increase in intra-abdominal pressure together with a reflex increase in anal sphincter pressure. This is mediated by a local spinal reflex. It is intact in patients with upper motor neuron lesions, but it is absent or impaired in patients with cauda equine lesions.¹⁷ The difference between the baseline pressure and the highest intrarectal and highest anal pressure are measured as rectal and anal pressures.

Clinical Significance

The findings of this reflex should be interpreted along with squeeze pressure.²⁵ An absent reflex together with an absent voluntary squeeze indicates a lower motor neuron lesion. (eg, cauda equine syndrome or sacral plexus injury). Whereas in patients with supraconal lesions, this reflex is present but the voluntary squeeze response may be absent.

Standard Report of Anorectal Manometry

The ARM report includes the following information:

- General information
- Patient demographics
- Procedure details: Indications for test, orientation, number and location of sensors, balloon location and length, documentation of calibration
- Anal sphincter pressures: resting sphincter pressure, squeeze sphincter, pressure (mm Hg), duration of sustained squeeze, cough reflex and anal pressure, attempted defecation, rectoanal inhibitory reflex
- Rectal sensation: Threshold for sensation, desire, urgency and pain
- Comments/interpretation/summary: the findings are summarized



- Diagnosis
- Identifier/signature

Complications of Anorectal Manometry

There are rare reports of serious complications such as colon perforation.^{35,36} Although rare, steps should be taken to prevent problems; the probe should be inserted and removed gently, the intraluminal pressure should be monitored during balloon distention, and the balloon deflated promptly if the patients reports pain.

Clinical Utility of Anorectal Manometry

ARM together with adjunctive tests can not only confirm a clinical diagnosis but also provide new information that may not be detected clinically^{4,13} and can influence the outcome of patients with defecation disorders.⁴ Selective tests should be performed based on potential indication to evaluate each condition. In a prospective study⁴ ARM was felt to be useful in 88% of patients. In 12% of patients, studies were normal. A follow-up manometry after treatment or after surgical correction of anorectal malformation or sacral nerve stimulation can provide objective assessment of improvement.

Recommended List of Tests/Maneuvers to be Performed Based on Potential Indications

Test/Maneuver	Incontinence	Constipation	Pre-op
Resting Pressure	Yes	Yes	Yes
Squeeze Pressure	Yes	Optional	Yes
Expel Empty/Full Rectoanal Inhibitory Reflex	No	Yes	Optional
Rectal Sensation	No	Yes	Yes
Cough Reflex	Yes	Yes	Yes
	Yes	No	Optional

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