

Anorectal HRM and Anorectal Disease

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استادیار دانشگاه

GI Manometry

GI Manometry is a diagnostic test that measures changes in **intraluminal pressure** and the **coordination of activity in the muscles** of the GI tract

History

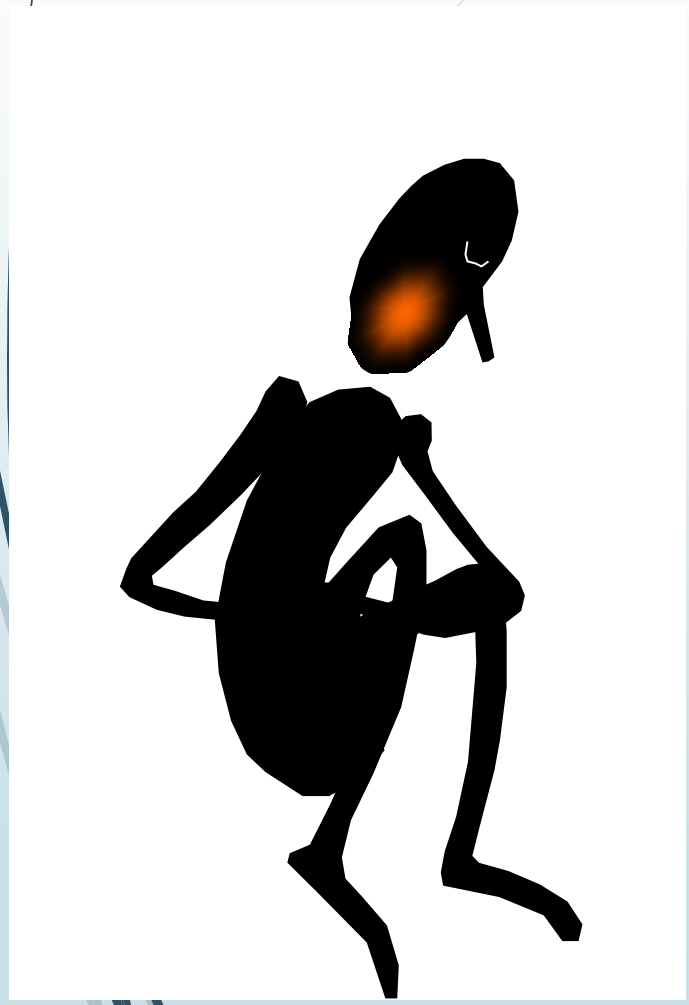
- 1955 Syringe pump 3-4 channels
- 1965 Andorfer perfusion pump 8 channels
- 1975 Sleeve sensor by prof. John Dent
- 1985 Computer systems
- 1995 Clouse Contour Plot
- 2005 HRM, computerized pumps

History





Anorectal Functional Testing



The main function of the rectum is to act as a reservoir of stool for short periods of time.

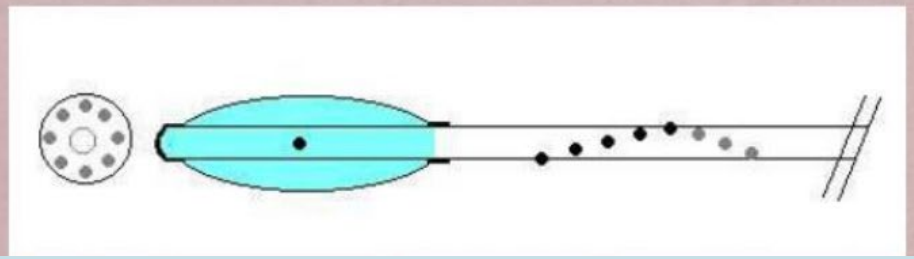
This allows defecation to occur voluntarily at the appropriate time.

The anal canal maintains fecal continence and controls defecation.

Anorectal Manometry provides information on the anorectal muscle tone and the coordination between the rectum and the anal sphincters

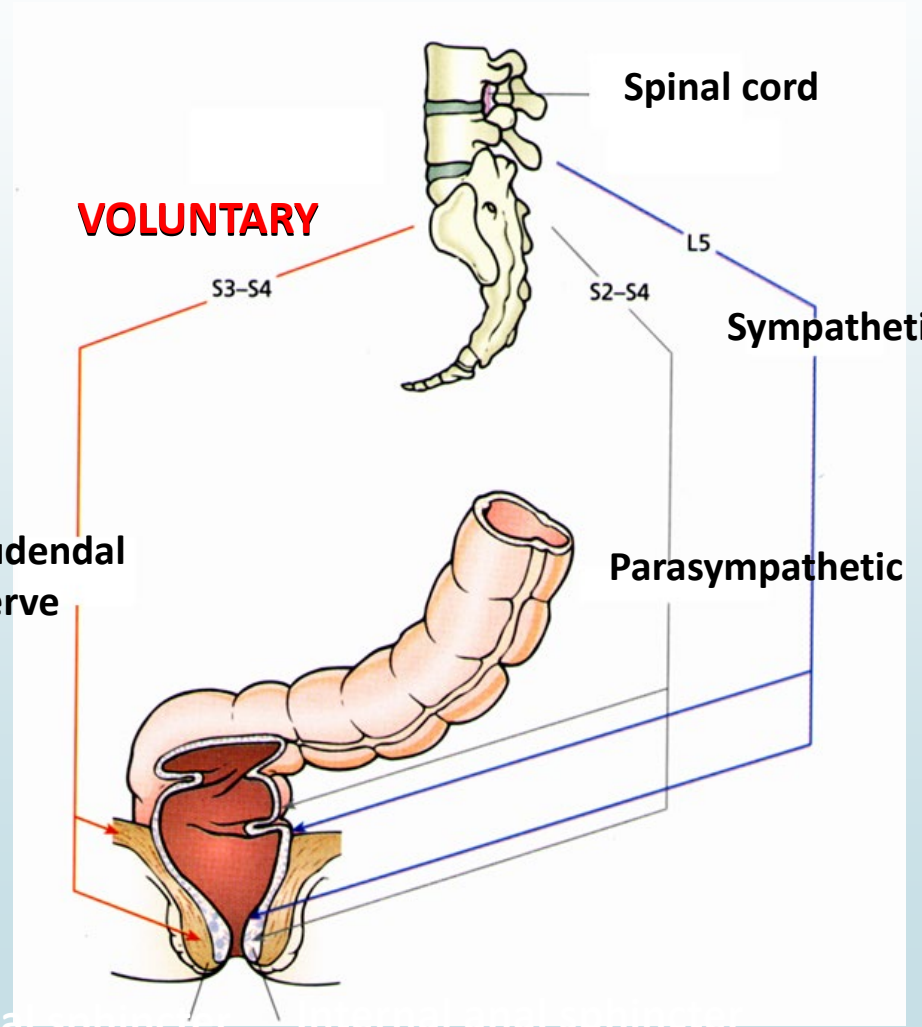
ANORECTAL MANOMETRY

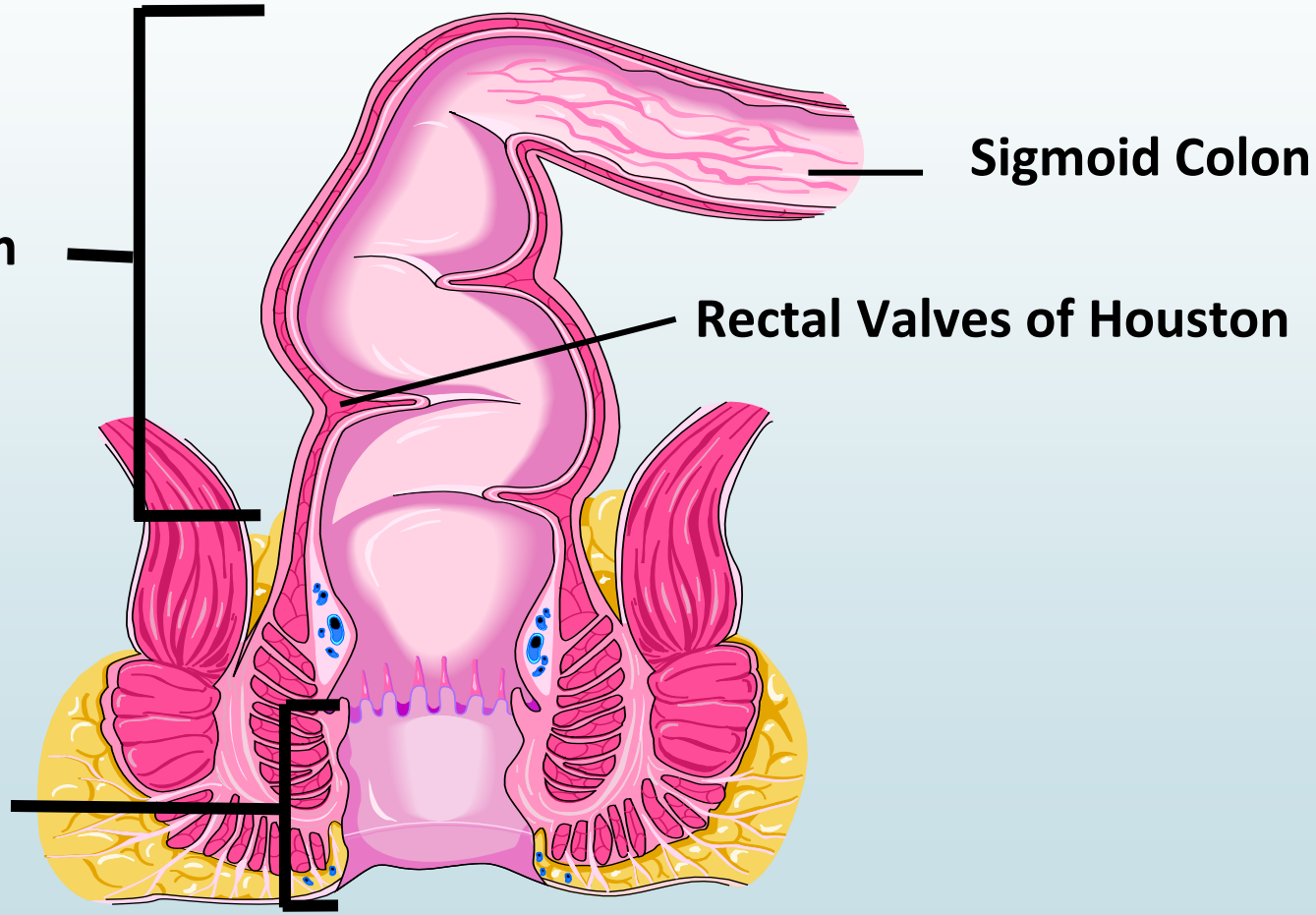
- Equipment
  - Ano-rectal motility probe
    - × 3, 4, 6 or 8 channels
    - × Balloon
    - × Water perfused
    - × Micro-tip (not very common)





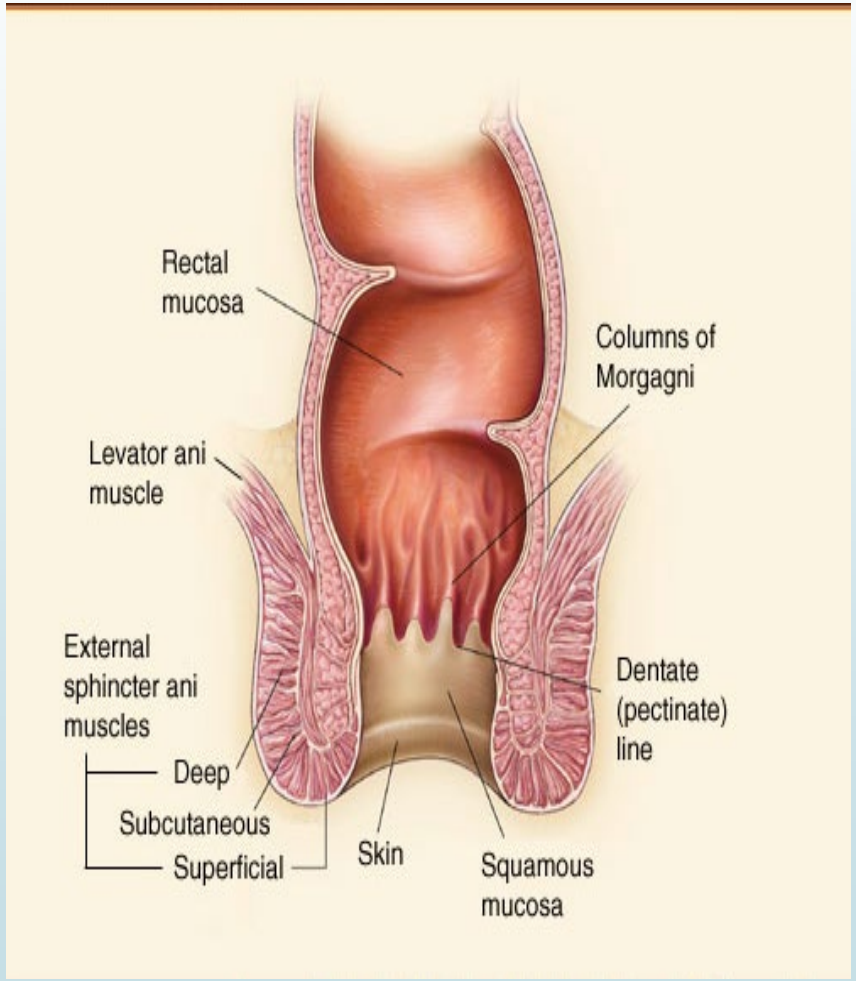
Innervation




Rectum
Sigmoid Colon
Rectal Valves of Houston

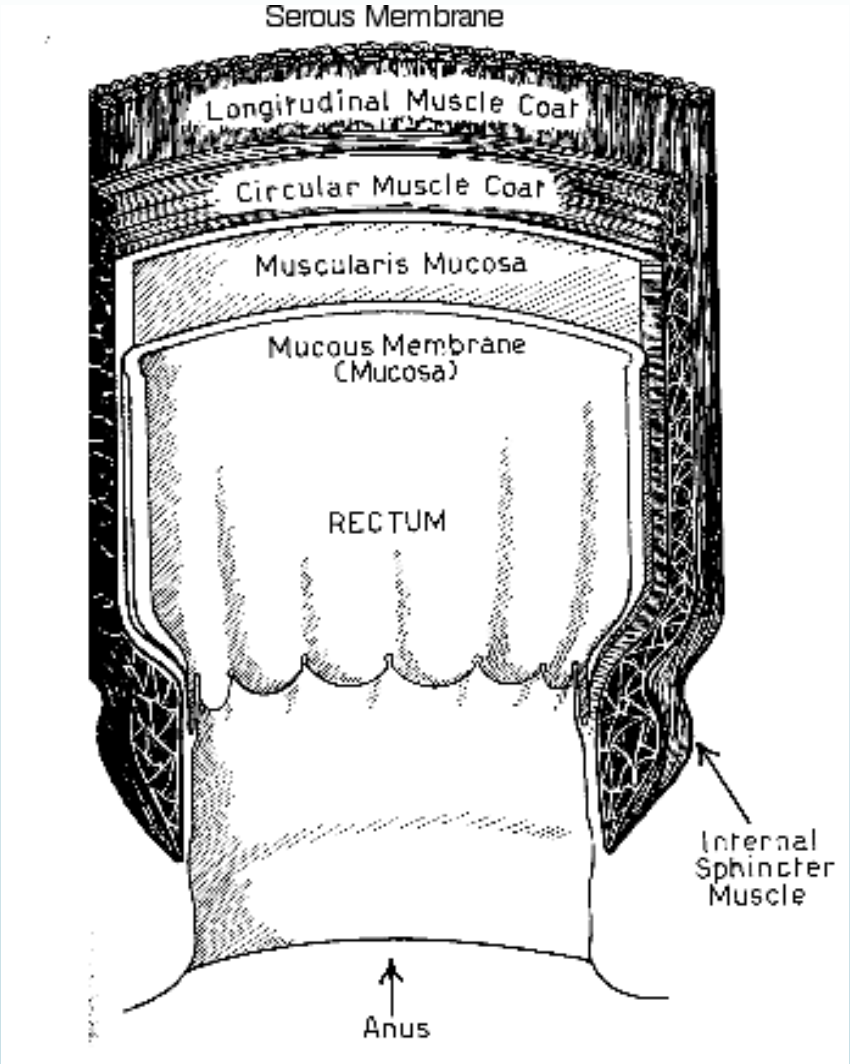
Introduction

- **Length:** 12-15 cm.
- **Diameter:** Upper part → same of sigmoid (4cm) but lower is dilated (rectal ampulla).
- **Beginning:** rectosigmoid junction (sacral promontory).
- **End:** 2.5 cm below and in front of the tip of coccyx.



- The rectum has four well-defined coats

1. **Mucosa**
2. **Submucosa,**
3. **Muscularis (circular and longitudinal)**
4. **Serosa**



Anatomy of Anal Canal

Length: 4 cm

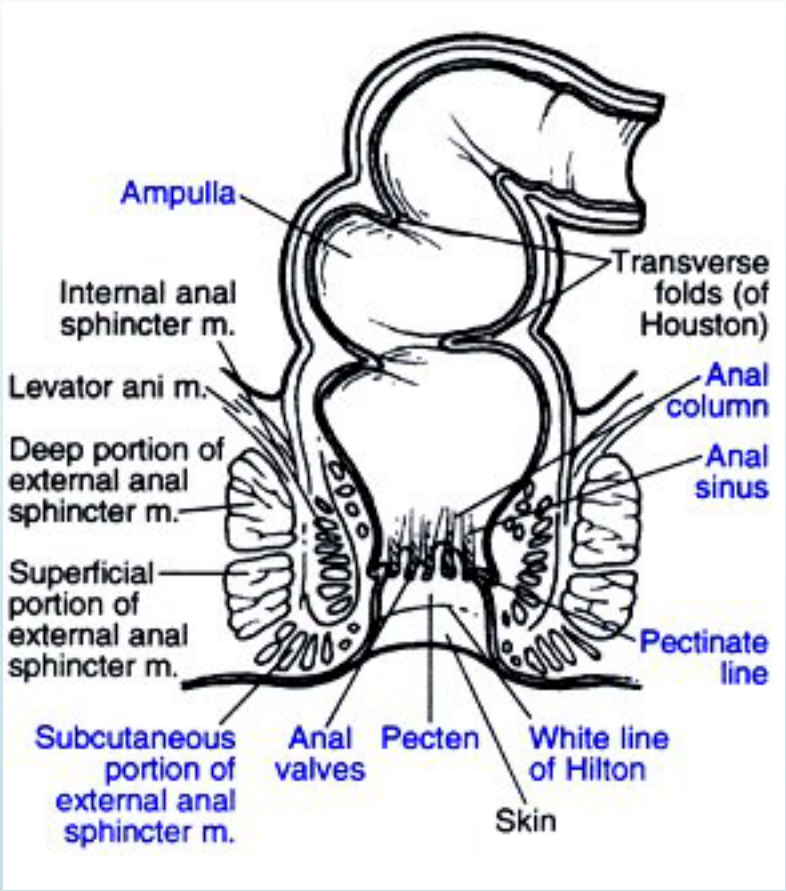
Extent:

from anorectal junction to the anus.

Interior:

Anal column

- Anal valve
- Anal sinus
- Dentate line



Anatomy of Anal Canal

Musculature:

1. External anal sphincter
2. Internal anal sphincter

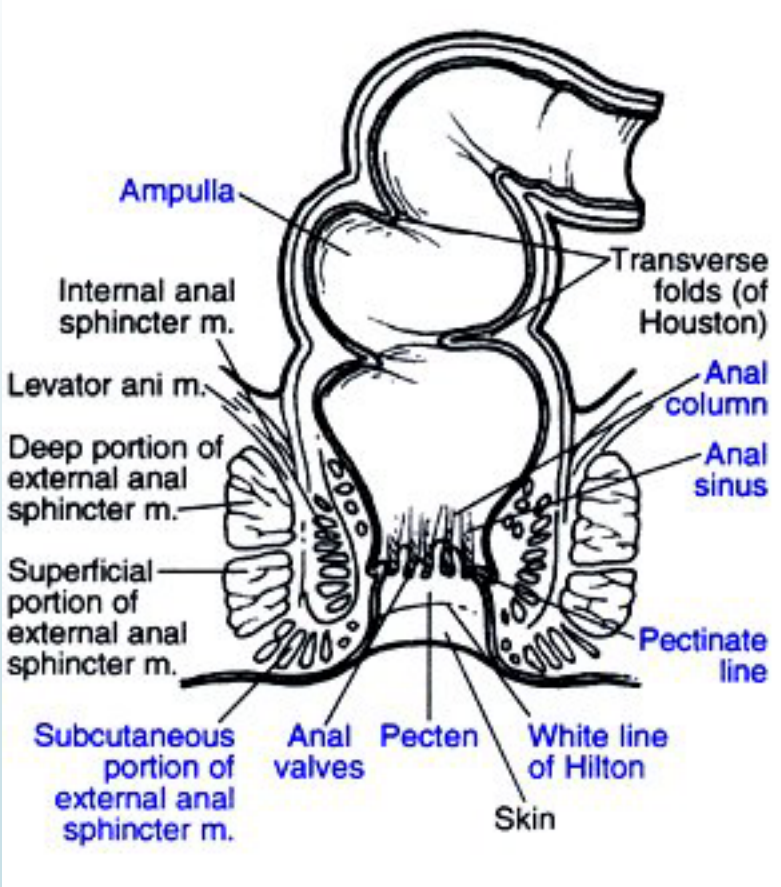
- Arterial supply:

  Inferior rectal arteries.

- Venous Drainage:

  Rectal venous plexus

- Lymphatic Drainage.



The **Anal Sphincter Complex** is made up of the internal and external anal sphincter.

- The ***Internal anal sphincter*** is smooth muscle and a continuation of the circular fibers of the rectal wall. It is innervated by the intestinal myenteric plexus and is therefore not under voluntary control.

- The ***External anal sphincter*** is formed in continuation with the levator ani muscles and is under voluntary control. The pudendal nerve supplies motor innervation to the external anal sphincter.

Mechanism of Defecation

I. **Rectum**
   - 3 semilunar mucosal folds (help maintain capacitance)
   - Can accommodate up to 300 ml without significant increase in intraluminal pressure
   - >300 ml causes increased pressure with feeling of urgency

II. **Internal Anal Sphincter**
   - Smooth muscle layer innervated by the enteric nervous system
   - Tonically contracted and accounts for 80-85% of anal canal resting pressure
   - IAS relaxes transiently in response to rectal distention (anorectal inhibitory reflex)

III. **External anal sphincter and puborectalis muscle**
   - Voluntary component, striated muscle with somatic innervation (pudendal n. & S3-S4)
   - Function as a unit
   - Spinal reflex causes the EAS to contract with sudden increase in intraabdominal pressure (cough, lifting)
   - PRM forms an anatomic barrier against discharge of stool (anorectal angle)

1. Stool enters the rectum → rectal distention

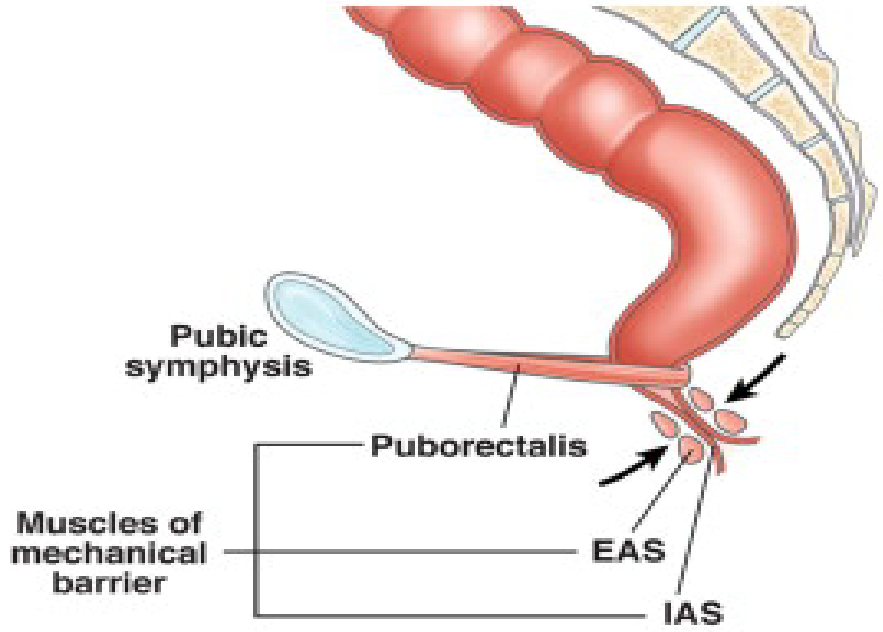
2. Reflex relaxation of the internal anal sphincter

3. Anorectal angle is voluntarily straightened (squatting)
   abdominal pressure is increased (straining)

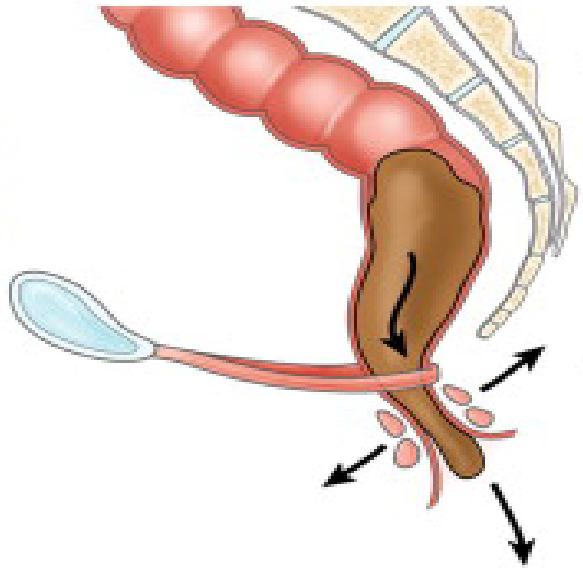
4. Descent of the pelvic floor
   Contraction of the rectum
   Voluntary inhibition of external anal sphincter

5. Evacuation of rectal contents

Resting

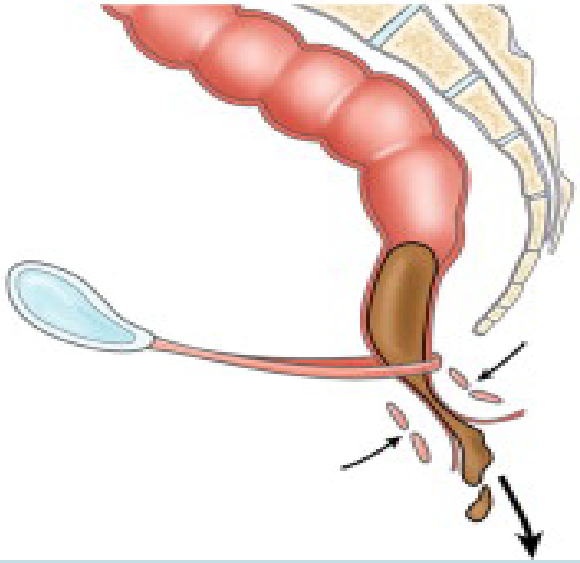


Normal defecation



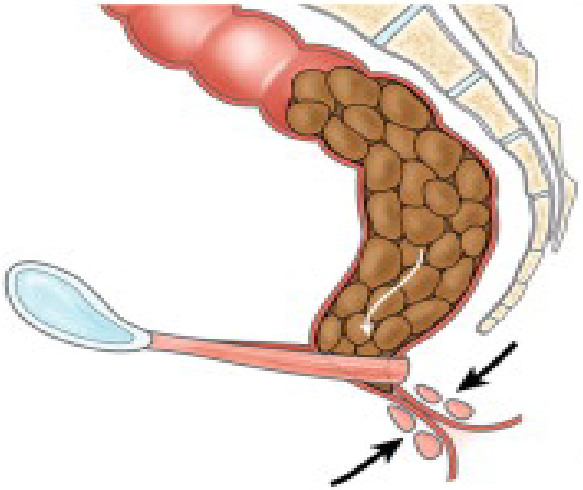
- Sensory perception of stool
- Rectal distension
- Contract diaphragm, abdomen, and rectal muscles
- Relax EAS (decreased sphincter pressure)
- Relax puborectalis muscle

Incontinence



- Low resting and/or low squeeze sphincter pressures (weak IAS and EAS)
- Weakness of puborectalis
- Neuropathy
- Altered rectal or anal sensation
- Diarrheal conditions
- Diminished rectal capacity

Dyssynergic defecation



- Prolonged colonic transit time
- Discoordination of abdominal, rectoanal, and pelvic floor muscles
- Rectal hyposensitivity
- Paradoxical increase in sphincter pressure
- < 20% relaxation of resting anal sphincter pressure
- Inadequate abdomino-rectal propulsive forces

Indication

- Fecal incontinence
- Constipation
- Evaluation before operation
- In assessing objective improvement following treatment .



Technique

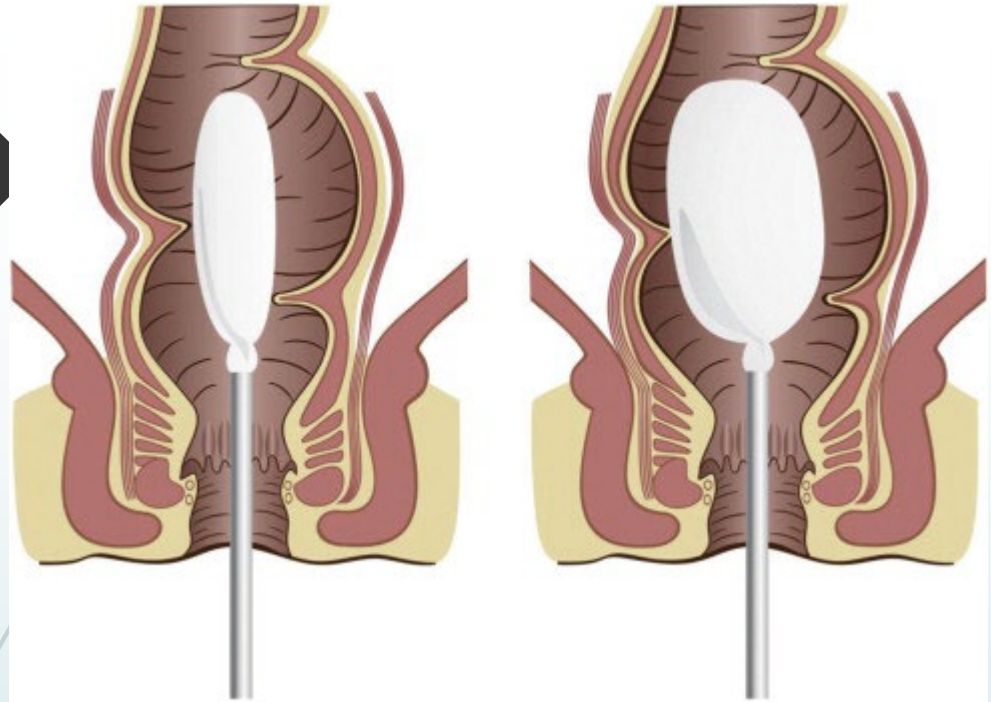
- An oral bowel preparation is usually not required. However, an enema is recommended if stool is detected on a digital rectal examination.
- With the patient in the left lateral position with knees and hips bent at a 90 degree angle, the lubricated probe is gently inserted into the rectum.
- This allows for detailed reading of measurements from the rectum and anal canal with respect to probe orientation. Anal resting pressure is generally measured over 20 seconds. The patient is asked to squeeze the anus for as long as possible, for a maximum of 30 seconds. The patient is asked to bear down as if to defecate in order to assess changes in anal and rectal pressures and cough to measure rectoanal reflex activity.

Analysis and interpretation

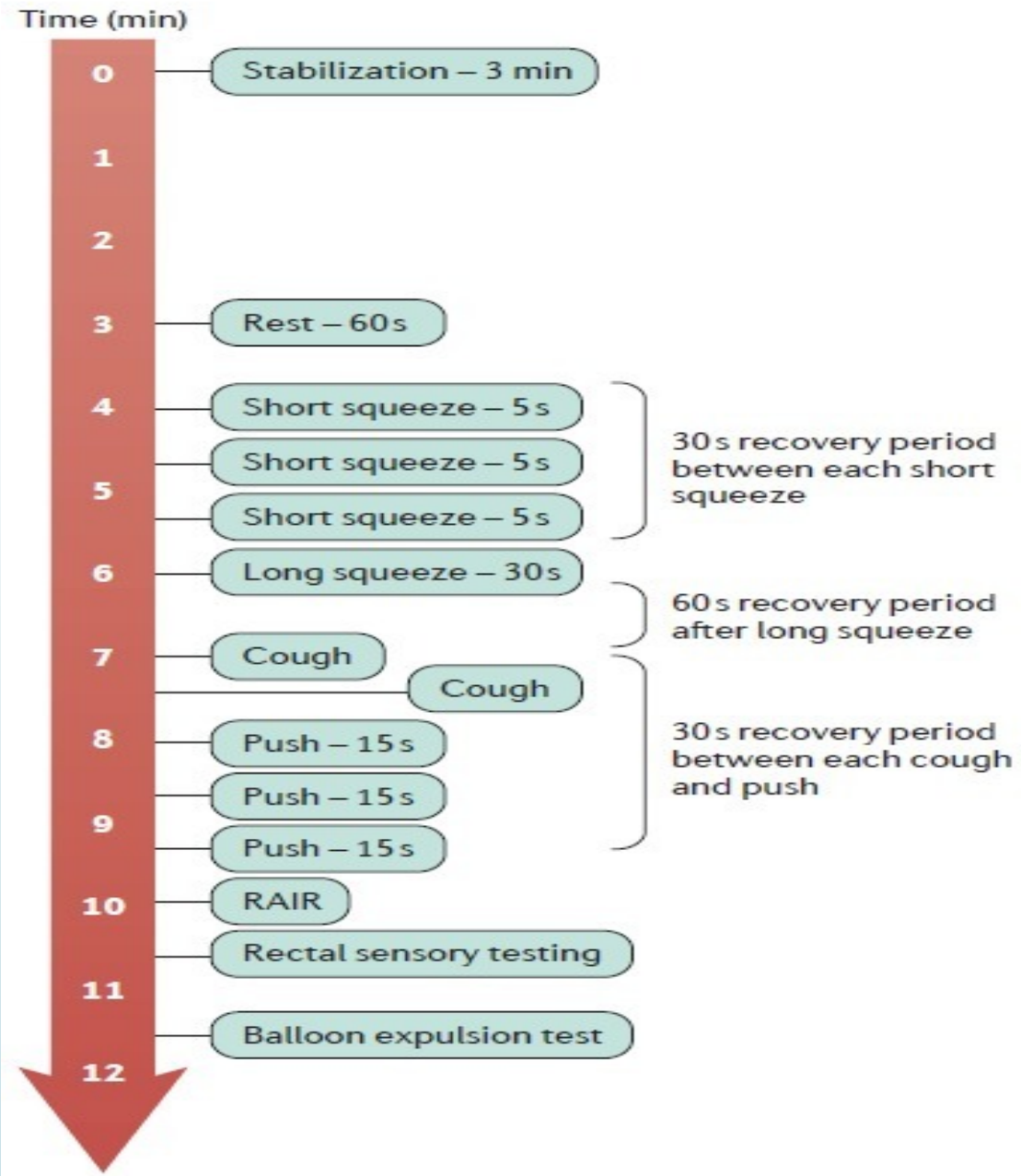
- Anorectal manometry should include an assessment of the following parameters

- **Anal sphincter function**
- **Rectoanal reflex activity**
- **Rectal sensation**
- **Changes in anal and rectal pressures during attempted defecation**

- Resting/Relax pressure
- Squeeze pressure
- Endurance squeeze
- Push/strain pressures
- Cough test
- RAIR (reflex)
- Sensation test
- Balloon expulsion test






Time (min)
0
Stabilization – 3 min
1
2
3
Rest – 60 s
4
Short squeeze – 5 s
5
Short squeeze – 5 s
Short squeeze – 5 s
30 s recovery period between each short squeeze
6
Long squeeze – 30 s
60 s recovery period after long squeeze
7
Cough
Cough
30 s recovery period between each cough and push
8
Push – 15 s
Push – 15 s
9
Push – 15 s
10
RAIR
Rectal sensory testing
11
Balloon expulsion test
12

Anal sphincter function

- Anal sphincter function is assessed by measurement of resting sphincter pressure, squeeze sphincter pressure, and the functional length of the anal canal.
- Maximum resting anal canal tone predominantly reflects internal anal sphincter function, while voluntary anal squeeze pressure reflects external anal sphincter (EAS) function.

FECAL INCONTINENCE

Incidence and Epidemiology

- Fecal incontinence is the involuntary passage of fecal material for at least 1 month in an individual with a developmental age of at least 4 years
- The majority of patients are women and aged >65. A higher incidence of incontinence is seen among parous women.
- One-half of patients with fecal incontinence also suffer from urinary incontinence.
- ***The majority of incontinence is a result of obstetric injury to the pelvic floor***, either while carrying a fetus or during the delivery.
- An anatomic sphincter defect may occur in up to 32% of women following childbirth regardless of visible damage to the perineum. Risk factors at the time of delivery include prolonged labor, the use of forceps, and the need for an episiotomy. Symptoms of incontinence can present after two or more decades following obstetric injury

TABLE 321-5 Medical Conditions That Contribute to Symptoms of Fecal Incontinence

Neurologic Disorders
• Dementia
• Brain tumor
• Stroke
• Multiple sclerosis
• Tabes dorsalis
• Cauda equina lesions
Skeletal Muscle Disorders
• Myasthenia gravis
• Myopathies, muscular dystrophy
Miscellaneous
• Hypothyroidism
• Irritable bowel syndrome
• Diabetes
• Severe diarrhea
• Scleroderma

Presentation and Evaluation

- Patients may suffer with varying degrees of fecal incontinence.

Minor incontinence includes incontinence to flatus and occasional seepage of liquid stool. Major incontinence is frequent inability to control solid waste.

As a result of fecal incontinence, patients suffer from poor perianal hygiene. Beyond the immediate problems associated with fecal incontinence, these patients are often withdrawn and suffer from depression. For this reason, quality-of-life measures are an important component in the evaluation of patients with fecal incontinence.

Loss of continence can result from various abnormalities

- ***Anal sphincter dysfunction***

Anal sphincter dysfunction can occur due to weakness or injury to the sphincter muscles themselves or to the nerves that supply these muscles (eg, pudendal nerve injury or autonomic neuropathy).

- ***Alterations in rectal sensation***

Alterations in sensory perception of the rectum can be due to problems in the peripheral, central or autonomic nervous systems

- ***Decreased rectal compliance***

- ***Altered stool consistency***

Urge versus passive incontinence

- ***Urge incontinence*** is characterized by the desire to defecate, but incontinence occurs despite efforts to retain stool.
- ***Passive incontinence*** is characterized by the lack of awareness of the need to defecate before the incontinent episode.

- Passive incontinence suggests weakness of the internal anal sphincter, whereas urge incontinence may indicate weakness of the external anal sphincter or decreased rectal capacity or rectal hypersensitivity

Anorectal manometry is helpful in the evaluation of fecal incontinence because it can diagnose functional sphincter weakness and detect abnormal rectal sensation, which is an important predictor of response to biofeedback training.

Interpretation

- Common findings on anorectal manometry and their interpretation include:

- ***Decreased squeeze pressure*** suggests isolated external anal sphincter dysfunction

One common cause is episiotomy during childbirth; patients with this finding tend to respond well to biofeedback provided the external anal sphincter is still intact.

- ***Decreased resting anal pressure*** suggests injury to the internal anal sphincter complex or atrophy

Common causes include idiopathic atrophy or trauma (eg, surgical fissure removal) of the internal anal sphincter. Patients with this finding tend not to respond as well to anorectal biofeedback

constipation

constipation began to be defined as less than three bowel movements per week, and this definition continued as the predominant definition

infrequent bowel movements only capture a small percentage of individuals with constipation.

patients consider other symptoms to also represent constipation. 52% believed that constipation meant straining to pass stool, whereas 44% believed that constipation was present if the stools were hard. Other definitions included the inability to defecate when desired (34%) and abdominal discomfort associated with defecation.

There appears to be a divergence between physicians' and patients' perspectives as to what constitutes constipation

classification

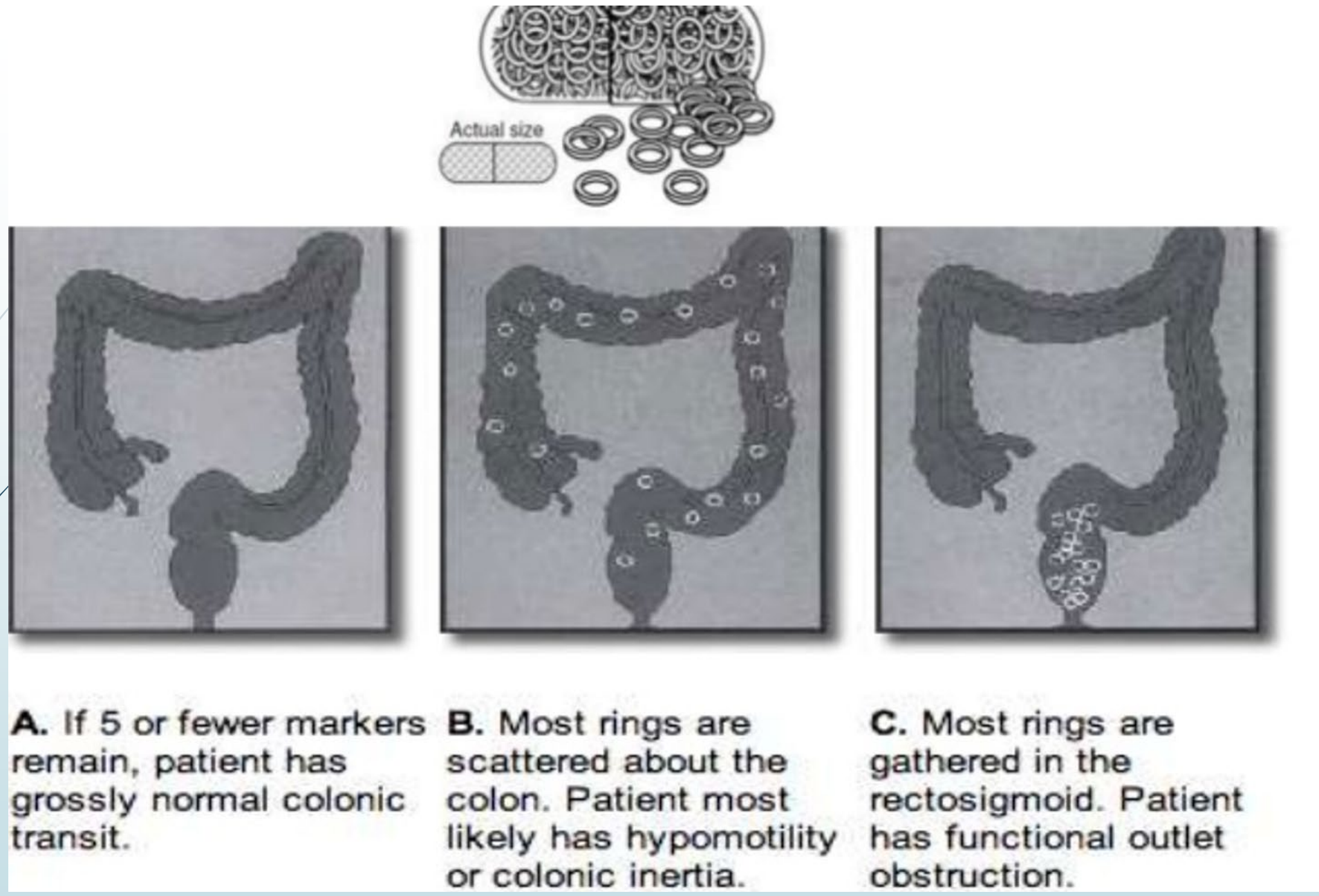
- **Secondary chronic constipation**
- **Chronic idiopathic constipation**

Chronic idiopathic constipation can be due to defecatory dysfunction, slow transit constipation, or normal transit (ie, functional) constipation

Defecatory dysfunction

- Normal defecation requires the coordinated relaxation of the puborectalis and external anal sphincter muscles, together with increased intraabdominal pressure and inhibition of colonic segmenting activity.
- Defecation disorders result from the inability to coordinate the abdominal and pelvic floor muscles to evacuate stool
- Patients with defecatory dysfunction often report excessive straining, prolonged defecation time, feelings of incomplete evacuation, and use of digital maneuvers to defecate
- Digital rectal examination may demonstrate a high anal resting pressure, an impaired push effort, or a paradoxical contraction of the anal sphincter or puborectalis muscles during simulated evacuation [24].

A diagnosis of Dyssynergic defecation requires fulfillment of all the clinical criteria of functional constipation and the presence of consistent findings on anorectal manometry (ARM) and balloon expulsion testing

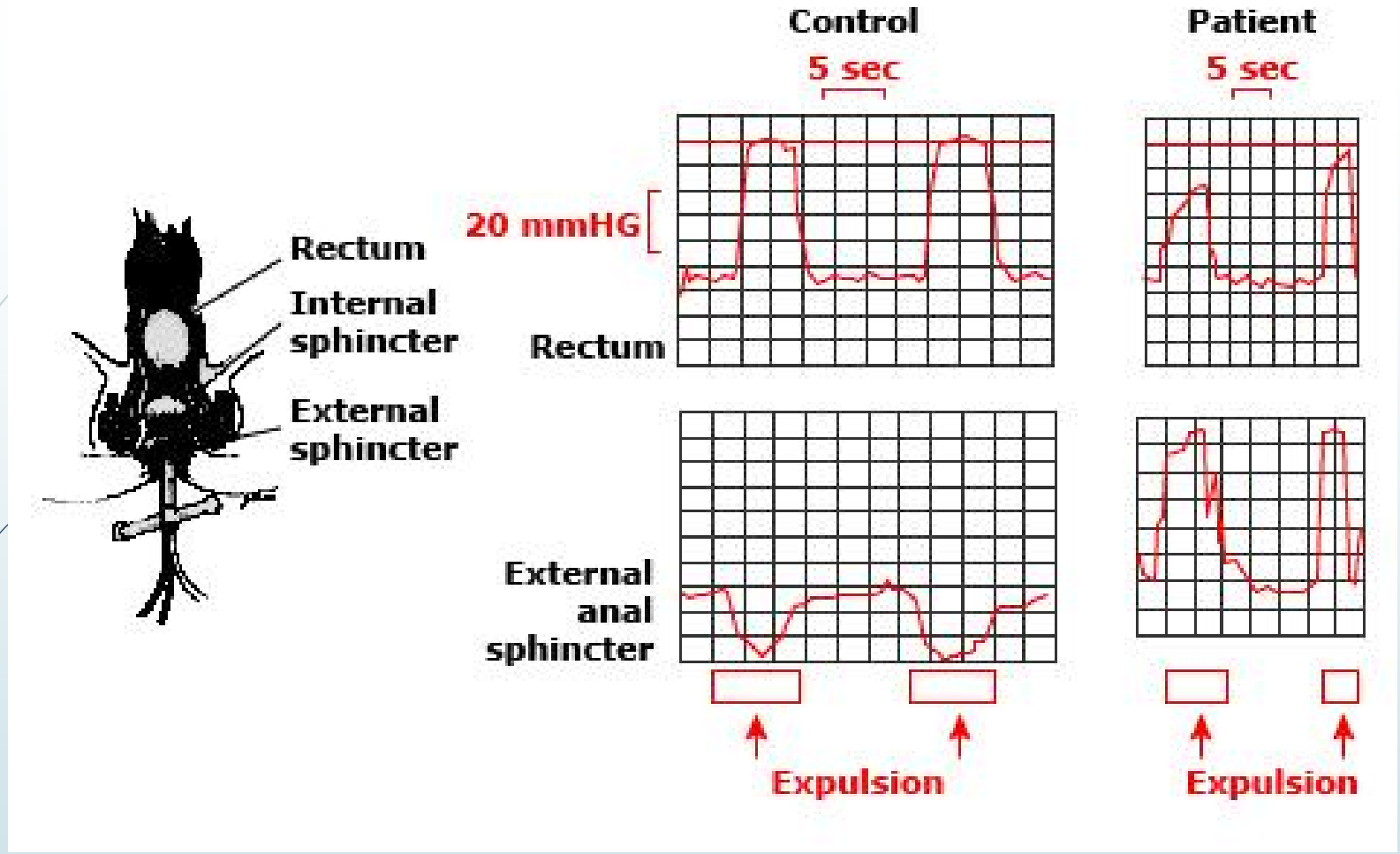


A. If 5 or fewer markers remain, patient has grossly normal colonic transit.

B. Most rings are scattered about the colon. Patient most likely has hypomotility or colonic inertia.

C. Most rings are gathered in the rectosigmoid. Patient has functional outlet obstruction.


a
Right
b
R



Defecation normally involves the coordinated relaxation of the puborectalis and external anal sphincter muscles as pressure is building in the rectum (control panel, left). However, in patients with dyssynergic defecation (patient panel, right), ineffective defecation is associated with a failure to relax, or inappropriate contraction of, the puborectalis and external anal sphincter muscles as pressure increases in the rectum.

- The normal response to attempted defecation consists of an increase in rectal pressure and a relaxation of the EAS.

- Four types of **Dyssynergic defecation** are recognized:

Type 1 – Paradoxical increase in anal sphincter pressure during attempted defecation with normal adequate pushing force

Type 2 – Inadequate pushing force but paradoxical anal contraction

Type 3 – Adequate pushing force, but has absent or incomplete (<20 percent) sphincter relaxation

Type 4 – Inadequate rectal push effort and inadequate anal sphincter relaxation (<20 percent)

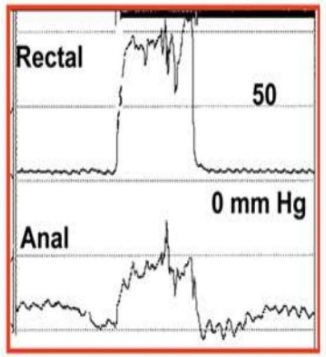
Dyssynergia described by conventional manometry

Rao's classification

Four types of dyssynergia
• **Type I** Adequate push effort (≥40 mmHg) with paradoxical anal contraction • **Type II** Impaired push effort (≤40 mmHg) with paradoxical anal contraction • **Type III** Adequate push effort with impaired anal relaxation (≤ 20% mmHg) • **Type IV** Impaired push effort with impaired anal relaxation (≤ 20% mmHg)

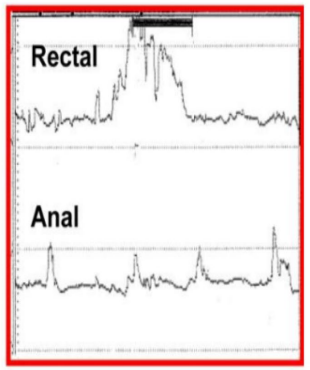
Rao SS. Gastroenterol Clin North Am 2008; 37:569-586.

Dyssenergia type I



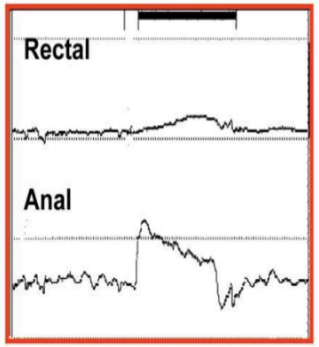
Adequate push effort (≥ 40 mmHg) with paradoxical anal contraction

Dyssenergia type III



Adequate push effort with impaired anal relaxation (≤ 20% mmHg)

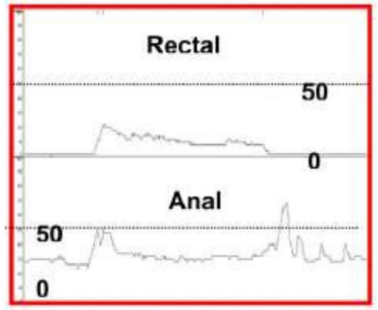
Dyssenergia type II



Impaired push effort (≤ 40 mmHg) with paradoxical anal contraction

Rao SSC. Gastroenterol Clin North Am 2008; 37:569-586.

Dyssenergia type IV



Impaired push effort with impaired anal relaxation (≤ 20% mmHg)

Anorectal manometry

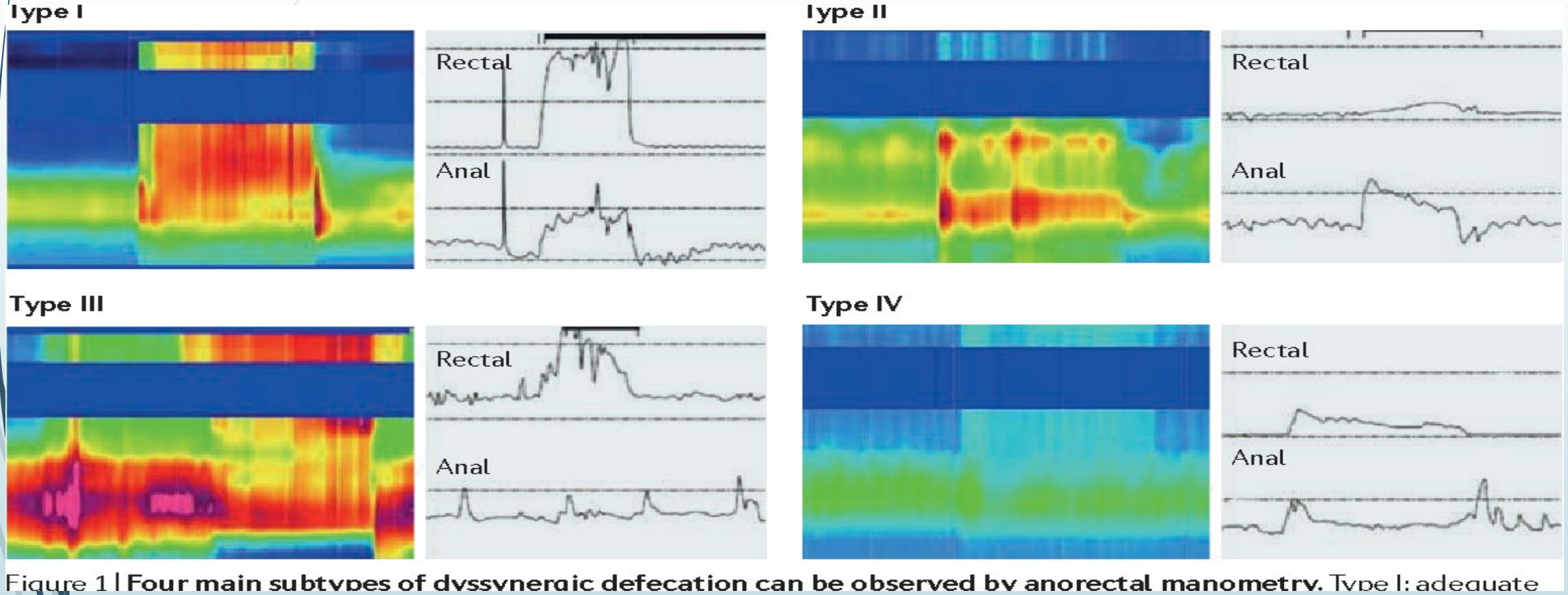


Figure 1 | **Four main subtypes of dyssynergic defecation can be observed by anorectal manometry.** Type I: adequate


Thank You!