FUNCTIONAL BLOATING AND DISTENSION

Prof. Dr. Mehmet Bektaş
Abdominal bloating is characterized by symptoms (subjective) of recurrent abdominal fullness, pressure, or a sensation of trapped gas.

Abdominal distention is characterized by measurable (objective) increase in abdominal girth.
Healthy individuals may occasionally get bloated.

- After indulging in large, heavy meals
- An overload of fermentable foodstuffs.
- This type of bloating is usually short lasting, maximum a few hours, and ends when the individual expels stool and/ or gas.

Am J Gastroenterol 2017;112:1221-31
In most episodic bloaters there is a very apparent circadian rhythm.

✓ Wake up in the morning with no or minimal bloating.

✓ After breakfast and early evening the bloating sensation worsens and abdominal distension becomes more apparent.
Bloating and flatulence, defined as evacuation of large volumes of gas per anus, often coexist but are definitely not the same.

✓ Increasing the amount of fermentable substrate in the colon

✓ Poorly absorbable oligosaccharide such as lactulose
  ✓ Excess gas (mostly H2 and CO2) flatulence, and bloating healthy.

✓ Ingestion of low fermentable psyllium fiber
  ✓ May induce a similar bloating sensation without excess intestinal gas production and hence without increased flatulence.

Gastroenterology 2006;130:1480 – 91.
Am J Gastroenterol 2013; 108: 1541
Bloating and abdominal distension may be the manifestations of an organic disease.

- Acute infectious enteritis
  - In the early stages and before the onset of diarrhea.
- Celiac disease and other conditions associated with malabsorption.
- Acute or subacute bowel ischemia
- In the early stages of ascites formation in patients with liver cirrhosis
- Neoplastic conditions
- Mechanical impediment to normal aboral flow of content along the gastrointestinal tract.

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Bloating is usually associated with functional gastrointestinal disorders.

✓ Irritable bowel syndrome (IBS)
  ✓ Bloating is a highly prevalent manifestation in IBS patients
  ✓ IBS bloating is described by patients as “wearing tight clothes”.

✓ In functional dyspepsia
  ✓ Bloating sensation centered in the upper abdomen, often postprandial and sometimes associated with visible upper abdominal distension.

Gastroenterology 2016;150:1393–1407
Am J Gastroenterol 2008 ; 103 : 1241 – 8
Am J Gastroenterol 1999 ; 94 : 1320 – 6
BMJ 1989 ; 299 : 1138
Diagnostic Criteria a for Functional Abdominal Bloating/Distension (Roma IV)

✓ Recurrent bloating and/or distention occurring, on average, at least 1 day per week; abdominal bloating and/or distention predominates over other symptoms.

✓ There are insufficient criteria for a diagnosis of irritable bowel syndrome, functional constipation, functional diarrhea, or postprandial distress syndrome.

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

- Mild pain related to bloating may be present as well as minor bowel movement abnormalities.

Gastroenterology 2016;150:1393–1407
Epidemiology

- The incidence of functional bloating has not been assessed in large prospective studies.

- The prevalence of bloating is better described.

  - In a large survey study in the USA (n: 2510) had reported in 15.9% of the cases
    - In females: 19.2%
    - In males: 10.5%

Clinical Evaluation

- FAB/FAD should be diagnosed based on the following 3 key features:
  - Clinical history
  - Physical examination
  - Diagnostic studies.
History of patients

✓ Includes the onset of symptoms

✓ The relationship to diet (e.g., wheat, dairy, fructose, fiber, nonabsorbable sugars)

✓ The presence of symptoms suggestive of other FGIDs.

✓ Alarm features (such as anemia and unintentional weight loss) should be assessed.

Physical examination

- During the bloating (subjective) and distention (objective) should be differentiated and explained to the patient.

- The abdominal distention is a visible increase in abdominal girth.

- Evidence of a partial bowel obstruction or organomegaly warrants further evaluation.

- A pelvic examination should be performed when appropriate.
Laboratory
- CBC
- Celiac tests
- Intolerances to lactose, fructose, and sorbitol could be evaluated with breath tests.
- Jejunal aspirate

Radiological image
- Abdominal X ray
- CT scan evaluation of bloating and distension is useful in providing a measure of abdominal distension and reshaping.
- Abdominal MRI may be useful for repeat imaging because it does not involve radiation.

The measurement of tolerance and disposal of infused jejunal gas.

Possible underlining mechanism of bloating

- Gas
- Stools
- Liquid
- Fat

- Defective propulsion
- Obstructed evacuation

- Increased luminal contents
- Impaired abdominal emptying

- Altered intra abdominal volume displacement
- Increased perception of intestinal stimuli

- Abdomino phrenic theory
- Sensory dysfunction
- Psychological factors

# The mechanism of functional bloating and distension

| Increased bowel wall tension | - Gastric and intestinal expansion by swallowed air and CO₂.
- Expanded intestinal fluid load by osmotically molecules.
- Colonic accumulation of packed stool (+impaired small bowel outflow?)
- Increased colonic endogenous gas due to:
  - Retention of fermentable substrate
  - Gas producing microbiota
  - Reduced gas consumption microbiota
  - Impaired intestinal gas diffusion |
| Augmented conscious perception of wall tension | - Intestinal wall inflammation
- Neurosensitization: local, spinal, and brain pain circuitry
- Emotional: stress, anxiety, somatization, and hypervigilance
- Other: circadian, fatty meals, intraabdominal adipose tissue, and perimenstrual |
| Distending abdominal reshaping by abnormal viscero-somatic responses | - Aberrant conductual manoeuvres in response to bowel stimuli
  - Thoracic expansion
  - Diaphragmatic descent
  - Abdominal muscle relaxation |

*Am J Gastroenterol 2017;112:1221-31*
Bloating and distension associated with accumulation of luminal gas and/or fluid

- Aerophagia, that is excessive swallowing of air.
  - By rapid ingestion of carbonated drinks
  - It is associated with lag between gas swallowing and spontaneous gas venting.

- Aerophagics tend to be belchers as well and even if they fill up their stomachs with air.

- The air advancing from the stomach into the upper small bowel is promptly cleared.
Bloating / distension associated with increased generation of intestinal gas

- The important gases produced endogenously are CO2, H2, and CH4.
  - CO2 gases are produced by bicarbonate neutralization of gastric acid entering the duodenum.
    - CO2 rapidly diffuses from the small intestinal wall.

- Intraluminal fermentation of dietary and endogenous substrates which takes place mostly in the colon, is the main source of bowel gas.

- In healthy individuals, ~69% of the total gas present in their guts is located in the colon.
  - Elimination routes of gas:
    - 23% of the gas expelled by anus,
    - Transmural disposal
    - Bacterial consumption.
The newly generated colonic gas remains not inside the colon depends on:

- Wall’s physical permeability
  - The permeability of the bowel wall to gas diffusion is modified by blood flow and inflammation
- The type of motor activity
- Exercise
  - It favours antegrade movement and evacuation of intraluminal gas
- Catabolizing bacteria.
  - Bacterial gas consumption by colonic methanogenic, sulfate reducing, and acetogenic bacteria

Am J Gastroenterol 2017;112:1221-31
Clin Nurs Stud 2017; 1: 82 – 92
The increased gas production or decreased gas consumption in patients with bloating and flatulence may occur due to variations in colonic microbiota.
Individual perception and focused attention

✓ Conscious perception of both bowel and abdominal distension play a determinant role in symptomatic bloating.
  ✓ Normal propulsion of intraluminal content which may cause transient bowel distension.
    ✓ Unperceived: minor discomfort
  ✓ Conscious perception of intraluminal content may cause bloating, pain and other symptoms.
    ✓ Perceived: significant pain

✓ Regional tolerance is another important factor.
  ✓ The exogenous gas infused into the colon is better tolerated than gas infused into the small bowel.
  ✓ The gut normally tolerates postprandial load of food, liquid, and gas, with the postprandial accommodation mechanism.
Reflex responses to unperceived stimuli

- Unperceived stimuli may be modulated and upgraded by the central nervous system.
- Abnormal viscero-somatic reflex responses can produce abdominal distension.
- Extraintestinal tissues within the abdominal cavity may also potentially influence the perception of bloating and abdominal distension.
  - Intraabdominal adipose tissue

Reflex responses to unperceived stimuli
(Intraabdominal adipose tissue)

✓ The rapid weight gain aggravates symptomatic bloating, and conversely, weight loss tends to be associated with improvement.

✓ Intraabdominal fat accumulation may constrain bowel expansion during luminal distension by gas or fluid, hence stimulating visceral and peritoneal sensory receptors.

✓ The adipose tissue accumulation in the epiplon or mesentery may have a pro-inflammatory action.
  ✓ The release of inflammatory cytokines can contribute to intestinal hypersensitivity.

Reflex responses to unperceived stimuli (Perimenstrual period)

- Abdominal bloating and discomfort frequently develop during the perimenstrual period.
  - The enhancement of visceral sensitivity is probably a relevant factor.

- Bloating and abdominal distension are also much influenced by meals and evacuation.
  - The bloating sensation increases during the postprandial period.
  - The gas and chyme pooling can enhances gut sensorial stimulation during digestion.
    - The chemical stimulation by specific food components, such as fat, that appears to intervene via CCK-dependent mechanisms.

References:
- Gastroenterol Nurs 2006; 29: 4–11
- Gut 2002; 50: 471–4
- J Gastroenterol Hepatol 2015; 31: 288–93.
Relationship between bloating and flatulence

- The relationship between bloating and flatulence is somewhat ambiguous.

- Bloated patients often could expel “retained” gas per anus and/or mouth.
  - Gas evacuation can reduce bowel distension.

- The location of the retained gas stimulus that induces the bloating sensation.
  - The gas accumulating inside the small bowel is more likely to induce abdominal discomfort than in the colon.

- The patients complaints about flatulence may not feel bloated unless they voluntarily inhibit expelling gas for social or other reasons.
Abdominal Shape
(Viscero-somatic responses)

- Normal individuals react to intestinal gas distension by contracting their anterior abdominal muscles and relaxing the diaphragm.

<table>
<thead>
<tr>
<th></th>
<th>Normaly</th>
<th>Bloating/ distension</th>
</tr>
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<tbody>
<tr>
<td>Torax</td>
<td>Expansiyon</td>
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<tr>
<td>Diaphragm</td>
<td>Relexation</td>
<td>Contraction</td>
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<tr>
<td>Anteriyor abdominal muscule</td>
<td>Contraction</td>
<td>Relation</td>
</tr>
<tr>
<td>Abdominal cavity</td>
<td>Without protruding</td>
<td>Protruding</td>
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</table>

Neurogastroenterol Motil 2013 ; 25 : e389-94
Am J Gastroenterol 2011 ; 106 : 815 – 9
Gastroenterology 2015 ; 148 : 732 – 8
Abdominal shape

**Functional bloating**
- Mild bloating + distension -
- Bloating + distension +

**Intestinal dysmotility.**
- Moderately distended
- Bloating and distension

Basal

Bloating

Basal

Bloating

Neurogastroenterol Motil 2013 ; 25 : e389-94
Am J Gastroenterol 2011 ; 106 : 815 – 9
Gastroenterology 2015 ; 148 : 732 – 8
A structural approach to abdominal bloating/distension with therapeutic options to be considered

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Exclude organic etiologies including enteric dysmotility and chronic intestinal pseudoobstruction</th>
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<tbody>
<tr>
<td>Step 2</td>
<td>Ascertain from anamnesis whether bloating/distension are: Part of the clinical picture of FD/IBS?</td>
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<tr>
<td>Step 3</td>
<td>Are there recognizable pathogenetic factors present?</td>
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<td>Manage pharmacologically</td>
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<td>Correct without fiber overload</td>
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<td>Biofeedback</td>
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<td></td>
<td>Avoid culprits; FODMAP diet</td>
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<td></td>
<td>Advice to restrain or substitute</td>
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<td></td>
<td>Prostaglandin synthesis inhibitors</td>
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<td>Hypocaloric diet</td>
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<td>Behavioural management; psychopharmacology</td>
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<tr>
<td></td>
<td>Psychopharmacology</td>
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<td>Same</td>
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### Step 4

<table>
<thead>
<tr>
<th>Laboratory evaluation of pathogenesis</th>
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<tbody>
<tr>
<td>Breath test for lactose, fructose malabsorption</td>
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<tr>
<td>Gluten intolerances by challenge tests</td>
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<tr>
<td>Test for small bowel bacterial overgrowth</td>
</tr>
<tr>
<td>Microbiome dysbiosis (direct assessment arduous)</td>
</tr>
</tbody>
</table>

### Step 5

If abdominal distension is major clinical feature: asses by CT and MRI electromyography

| Biofeedback |

### Step 6

Protracted, refractory, desperate cases merges with chronic abdominal pain syndrome

| Consider referral to specialized neuro-gastroenterological team |
Simple explanation and reassurance

✓ Mild cases of bloating and distension may be managed with an explanation and reassurance.

✓ The distension tends to point abnormal viscerosomatic responses and reshaping of the abdomen.

✓ The pain associated with distension would point visceral hypersensitivity.

✓ The psychopathological features of distension may need to be specifically addressed as part of the therapeutic plan.
Anamnesis is very important.

- A detailed dietary history (consumes excess fermentable foods or other products).
- Assessment of bowel movement frequency and stool consistency.
Dietary therapy

✓ The dietary therapeutic approach to bloating has two distincts:
  ✓ Avoiding food intolerances
  ✓ Reducing fermentation of food residues.

✓ Excess fermentation may occur because of:
  ✓ High intake of gas producing foods
  ✓ Small bowel malabsorption
  ✓ Variations in the metabolic activity of the microbiota.

✓ A diet low in fermentable components are associated with a major and measurable reduction in flatulence, abdominal distension, and improvement in wellbeing.

Gut 2014; 63: 401 – 8
Neurogastroenterol Motil 2014; 26: 779 – 85
Dietary therapy

✓ FODMAP restricted diet (avoiding lactose, fructose, fructans, polyols, and galactooligosaccharides) is a cornerstone of dietary management of functional bloating, including bloating associated with IBS.

✓ This excludes many common components of a normal western diet.
✓ Compliance and benefits produced by long term adherence to a FODMAP diet.
✓ Restrictive diets may have potential deleterious effects on microbiota.

Gastroenterology 2014; 146: 67 – 75
Clin Gastroenterol Hepatol 2008; 6: 765 – 71
Microbiome modulation

✓ Reducing gas-producing bacterial species

✓ Modifying their metabolic activity.

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Microbiome modulation (Antibiotics)

- Broad spectrum antibiotics (ampicillin, tetracycline, and cephalosporins)
  - fail to substantially reduce net H2 excretion
  - undiscriminate action on the intestinal flora.

- Rifaximin
  - An unabsorbable wide spectrum antibiotic.
  - Some effectiveness in relieving IBS associated bloating has been proved.
  - Favorable effects on bloating by diminishing small bowel bacterial overgrowth or by modifying the fermenting colonic microbiota.

J Clin Invest 1992; 89 : 1304 – 11
Microbiome modulation (Probiotics)

✓ The probiotics are modulate intraluminal fermentation, mucosal inflammation, and visceral sensitivity.

✓ Probiotics would seem an attractive option for the treatment of bloating.

✓ However, clinical efficacy of probiotics remains meager.

Am J Gastroenterol 2006; 101 : 1581 – 90
Aliment Pharmacol Ther 2009; 29 : 104 – 14
Microbiome modulation
(Prebiotics)

✓ Prebiotics are non-absorbable, fermentable substrates

✓ They induce the proliferation of beneficial microorganisms.

✓ Initially, these substrates increase gas production.

✓ After a 1–2 week adaptation period, gas production decreases and abdominal symptoms may improve.

Microbiome modulation

 ✓ There are also significant microbial taxa differences between healthy individuals and IBS with bloating.
 ✓ They can give a variable response to diets, antibiotics, and probiotics.
 ✓ Intestinal motility and colonic propulsive activity also influences microbiota activity.

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Promoting gas evacuation

✓ The bulk and osmotic laxatives increase luminal distension. For this reason, they are avoided from being used.

✓ The clearance of accumulated gases may be accelerated by physical exercise and rapidly acting cholinomimetic agents such as parenteral neostigmine.

✓ The use of oral pyridostigmine is not efficient because of tachyphylaxis.

Neurogastroenterol Mot 2006; 18: 905 – 10
Gastroenterology 2002; 122: 1748 – 55
Prucalopride promotes propulsive peristalsis and reduces bloating in patients with chronic constipation.

Linaclotide has antinociceptive properties that could possibly attenuate visceral hypersensitivity.

If gas retention is associated to functional outlet, then obstruction, anorectal biofeedback may be useful.

Neurogastroenterol Motil 2014 ; 26 : 21 – 7
Dig Dis Sci 2000 ; 45 : 18 – 22
Neurogastroenterol Motil 2010 ; 22 : 312 – 84
OTC and “natural” remedies

✓ Numerous agents use the treatment of functional bloating but the efficiency of these materials are generally weak.

✓ These agents include:
  ✓ Activated charcoal
  ✓ Simethicone
  ✓ kiwi fruit extract
  ✓ STWS (Iberogast),
  ✓ Magnesium salts

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Attenuating visceral perception

✓ The wall tension is the main stimulus for gut discomfort.

✓ The magnitude of the perceived sensations is amplified by visceral hypersensitivity.

✓ Some pharmacologic agents may be utilized to decrease gut perception of wall tension.
  ✓ Antispasmodic drugs
  ✓ Antispasmodic drugs have muscle relaxing properties but the effect of these drugs on bloating is minimal.

Am J Gastroenterol 2017;112:1221-31
Attenuating visceral perception

 ✓ The gut–brain axis seems to be a more suitable therapeutic target to ameliorate the bloating sensation.

 ✓ Linaclotide has antinociceptive effects.

 ✓ Antidepressants have been employed as visceral antinociceptive agents but it remains uncertain whether they specifically improve bloating
   ✓ Improve mood and control anxiety.

 ✓ SSNRI may be more effective to reduce visceral hypersensitivity than specific serotonin-reuptake inhibitors.

Biol Psychiatry 2009 ; 33 : 118 – 27
Cochrane Database Syst Rev 2007.CD005110
Attenuating visceral perception

- The tricyclic antidepressants exhibit antihypersensitivity actions but their use tends to be limited by unwanted side effects.

- Anxiolytic agents such as benzodiazepines may alleviate bloating possibly by acting centrally to reduce the effect of chronic stress.

- Psychological approaches such as hypnotherapy and behavioral modification may be required. However, their efficacy is variable and probably depends on:
  - the expertize of the team
  - selection of the patients

Biol Psychiatry 2009; 33: 118 – 27
Cochrane Database Syst Rev 2007.CD005110
Abdominal biofeedback treatment

✔ Thoraco-abdominal striated muscular activity reshapes the abdomen.
  ✔ Intraabdominal volume remains constant or near constant.

✔ The patient reduces the activity of intercostal muscles and diaphragm increasing the activity of the anterior abdominal muscles.

✔ EMG records that allow the visual control of muscle activity of patients during treatment sessions.
Abdominal biofeedback treatment

- Biofeedback therapy is performed for 1-2 weeks for up to 3 days on separate days.

- Biofeedback may reduce
  - 20% of diaphragmatic and intercostal muscle activity.
  - 40% of subject abdominal distension sensation
  - The abdominal circumference by 2.5 cm
# Therapeutic approaches to functional bloating and distension

<table>
<thead>
<tr>
<th>Action</th>
<th>Predicted efficacy</th>
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<tbody>
<tr>
<td><strong>Simple explanation and reassurance</strong></td>
<td>May benefit in mild, not too concerned patients</td>
</tr>
<tr>
<td><strong>Relief of significant constipation by:</strong></td>
<td></td>
</tr>
<tr>
<td>• Non fermentable, non-bulky laxatives</td>
<td>Effective, deserves trial in constipated bloaters</td>
</tr>
<tr>
<td>• Intestinal prokinetics (prucalopride)</td>
<td></td>
</tr>
<tr>
<td>• Fluid exorption promoters (linaclotide and lubiprostone)</td>
<td></td>
</tr>
<tr>
<td><strong>Diet modification:</strong></td>
<td>Effective, deserves trial</td>
</tr>
<tr>
<td>Restriction of lactose and other untolerated carbohydrates (patient experience helpful, breath tests may not be required)</td>
<td>Challenging long term adherence</td>
</tr>
<tr>
<td><strong>FODMAP diet</strong></td>
<td>Mostly meager effects. Market abundance of scientifically untested products</td>
</tr>
<tr>
<td><strong>Antibiotics</strong></td>
<td>Poor results</td>
</tr>
<tr>
<td>Broad spectrum agents</td>
<td>Variable efficacy but apparently safe, deserves trial</td>
</tr>
<tr>
<td>Rifaximin (up to 6 weeks)</td>
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<tr>
<td><strong>Probiotics</strong></td>
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<tr>
<td>Bifidobacteria, other tested species</td>
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</table>
Conclusion

- Abdominal bloating is a subjective symptom, but distension is characterized by an increase in abdominal cavity.

- Anamnesis should exclude organic causes and other functional diseases.

- The different pathways affect pathogenesis.

- The treatment of functional abdominal bloating and distension may be change of according to the underlying mechanism.
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<table>
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<th>Action</th>
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<tr>
<td><strong>Prebiotics</strong></td>
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<tr>
<td>Non absorbable fermentable substrates</td>
<td>Aggravate bloating first 1–2 weeks but may help later</td>
</tr>
<tr>
<td><strong>Attenuation of conscious visceral perception</strong></td>
<td></td>
</tr>
<tr>
<td>Distraction, self-control of hypervigilance</td>
<td>Depends on symptom severity, individual responsiveness, and tolerance to side effects</td>
</tr>
<tr>
<td><strong>Antispasmodics</strong></td>
<td></td>
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<tr>
<td>Visceral antinociceptives (non-specific, probably indirect effects)</td>
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<tr>
<td>- Trycyclic antidepressants</td>
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<tr>
<td>- SSRI’s; SSNRI’s</td>
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<tr>
<td>- Anxiolytics</td>
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<tr>
<td><strong>Abdominal biofeedback</strong></td>
<td></td>
</tr>
<tr>
<td>Trains to voluntarily decrease intercostal + diaphragmatic muscle activity and contract anterior abdominal muscles</td>
<td>Limited to specialized centers&lt;br&gt;Corrects distension &gt; than bloating sensation</td>
</tr>
</tbody>
</table>