

Application of the pediatric Rome criteria permits a rapid, positive diagnosis, enabling the patient and family to understand and cope with abdominal pain.

Every child complains about a bellyache now and then. It is not always easy for a clinician to determine what is wrong or if it is dangerous. Children younger than ages 5 or 6 are unable to describe the sensations accurately. Toddlers do not separate emotional from physical distress. The young child's bellyache may represent hunger, fatigue, or a need to use the bathroom. School-age children may wake with bellyaches on school days. Are they sick, or just anxious about an important test or threats by a bully? What about when the bellyache comes at a birthday party? Some bellyaches seem to arise from too much excitement or worry. When should we be concerned?

Educational Objectives

1. Describe how the application of the Rome II criteria permits a rapid, positive diagnosis in the setting of a child with recurrent abdominal pain.
 2. Review the diagnostic criteria for some of the most common pediatric functional disorders associated with abdominal pain.
 3. Discuss the principles of treatment in pediatric gastrointestinal disorders.
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In 1999, an international working team of pediatric gastroenterologists arrived at a consensus for the symptom-based diagnosis of 13 pediatric functional gastrointestinal (GI) disorders. These diagnostic criteria became known as the Rome criteria, because the working team met in Rome. A functional disorder is characterized by symptoms that are caused by an alteration in the way the body functions rather than by a disease (an anatomic abnormality or serious tissue damage). Like a runner's leg cramp or shivering from the cold, functional symptoms fall within the expected range of behavior for a healthy person.

For most pediatric functional GI disorders, no medical tests are necessary or desirable, because there is no test that confirms them. The diagnosis for each pediatric functional GI disorder depends on symptom-based criteria in the absence of warning signs for disease. Children old enough to give accurate pain histories may have the same functional abdominal pain disorders as adults. In both children and adults, functional GI disorders are more common than disease.



Using the Rome symptom-based criteria, clinicians are able to make a positive diagnosis for a majority of school-age children with bellyaches simply by taking a history and completing a physical examination that reveals no signs of disease. Families are grateful when clinicians are able to provide prompt answers to their concerns. They are satisfied when they hear effective reassurance, including a diagnosis with an explanation for the symptoms, a prognosis, a plan for treatment, and a promise of continued availability for reassessment if the symptoms change.

The traditional approach to childhood bellyaches for the past 50 years had been to rule out disease with a series of screening tests before labeling the condition just another "recurrent abdominal pain of childhood." Reassurance may be provided that the symptoms will resolve, or the family may be referred to a

mental health clinician, but no clear treatment plan is offered. Often, both clinician and family find this disposition unsatisfying. The clinician may be annoyed that the search for disease has wasted time and resources. The family may be frustrated because they understand that the clinician did not find anything wrong and there is no explanation for the symptoms. Each negative test may reinforce the belief that something is being missed. The more anxious the family becomes that something is being missed, the more tests are ordered. In some cases, a cycle of pain, anxiety, and medical testing may accelerate, and the child and family may become disabled.

In contrast to the traditional approach, application of the pediatric Rome criteria permits a rapid, positive diagnosis, enabling the patient and family to understand and cope with the symptoms. There are no tests for functional GI disorders. Some symptoms and signs that suggest a higher pretest probability of organic disease may justify diagnostic testing (see "Sidebar 1" below). In contrast, many factors do not help to discriminate between functional disorders and organic disease (see "Sidebar 2").

The majority of this article focuses on functional dyspepsia, irritable bowel syndrome, and functional abdominal pain syndrome, the most common abdominal problems. Diagnostic criteria are given for other conditions, however. In a validation study for the pediatric Rome criteria, 72% of pediatric patients presenting with recurrent abdominal pain had symptom profiles

Sidebar 1.

Factors that suggest a higher probability or prevalence of organic disease, and justify diagnostic testing.

- *Involuntary weight loss*
- *Deceleration of linear growth*
- *Gastrointestinal blood loss*
- *Frequent vomiting*
- *Chronic severe diarrhea*
- *Consistent right upper quadrant pain*
- *Consistent right lower quadrant pain*
- *Persistent fevers*
- *Family history of inflammatory bowel disease*
- *Abnormal physical examination*

consistent with the functional GI disorders.¹ Chronic or recurrent bellyaches are common, affecting more than 10% of school-aged children and more than 10% of teens and adults.³ Most chronic or recurrent bellyaches are functional, meaning that the pain is real, but not due to any organic disease.



Diagnostic Criteria

Functional Dyspepsia

A diagnosis of functional dyspepsia can be made in children mature enough to provide an accurate pain history of at least 12 weeks, which need not be consecutive, within the preceding 12 months of persistent or recurrent pain or discomfort centered in the upper abdomen; no evidence, including upper endoscopy, that disease is likely to explain the symptoms; and no evidence that the dyspepsia is relieved by defecation or associated with constipation or diarrhea.

Irritable Bowel Syndrome

Children mature enough to provide an accurate pain history must experience at least 12 weeks, which need not be consecutive, within the preceding 12 months of symptoms to be diagnosed with irritable bowel syndrome. Abdominal discomfort or pain must be present and must include two of three features: relieved with defecation; onset associated with a change in frequency of stool, ie, constipation or diarrhea; or onset associated with a change in appearance of stool (ie, constipation or diarrhea). For the diagnosis of irritable bowel syndrome to be made, there must be no structural or metabolic abnormalities to explain the symptoms.

Other features that support the diagnosis of irritable bowel syndrome include lumpy, hard or loose, watery stools, passage of mucus in the stools, and bloating or a feeling of abdominal distention. Straining, urgency, or a feeling of incomplete evacuation of stool is also a feature, as is the passing of more than three bowel movements per day, or fewer than three bowel movements per week.

Functional Abdominal Pain Syndrome

Functional abdominal pain syndrome can be diagnosed when at least 12 weeks of continuous or nearly continuous abdominal pain in a schoolaged child or teen is present. Other factors include: no or only occasional relation of pain with physiological events such as eating, menses, or defecation; some loss of daily functioning; assurance that the pain is not feigned; and insufficient symptoms for any other functional GI disorder to explain the pain.

Abdominal Migraine

Children with three or more sudden spasms, or paroxysmal episodes, of intense abdominal pain lasting 2 hours to several days, with intervening symptom-free intervals lasting weeks to months, may have abdominal migraine. For diagnosis, there must be no evidence of metabolic, GI, or central nervous system structural or biochemical disease. Abdominal migraine must also have two or more of these

features: headache during episodes; sensitivity of the eyes to light during the episodes; family history of migraine: headache on one side only and an aura or warning period consisting of blurred or impaired vision, inability to speak, or paralysis.

Sidebar 2:

Factors that fail to discriminate between functional abdominal pain and organic disease in the absence of alarm symptoms (see sidebar 1).

- *Pain frequency, severity, location, and effects on lifestyle*
- *Pain-associated sleep disturbance*
- *Anorexia*
- *Nausea*
- *Episodic vomiting*
- *Constipation*
- *Diarrhea*
- *Headache*
- *Pallor*
- *Joint pain*
- *Anxiety*
- *Depression*
- *Behavior problems*
- *Recent negative life events*
- *Lab screening tests (CBC, Comprehensive Metabolic Panel, urinalysis, stool parasite analysis)*
- *Abdominal ultrasound*
- *Endoscopy*
- *Esophageal pH monitoring*

Aerophagia

Children must have at least two of the following symptoms for at least 12 weeks, which need not be consecutive, in the preceding 12 months to be diagnosed with aerophagia. Symptoms include air swallowing, abdominal distention, and repetitive belching or increased flatus. Typically, the child's abdomen swells progressively throughout the day, there is passage of flatus throughout the night as the child sleeps, and the abdomen is flat in the morning. The swollen abdomen is either asymptomatic or associated with a bellyache and reduced appetite. Children with chronic pain may adapt to their discomfort, and verbal reports may be a more accurate measure of pain intensity than direct observation.

Functional Fecal Retention

Children from infancy to 16 years old with a history of at least 12 weeks of passage of large-diameter stools less than twice a week who avoiding defecation

by purposefully contracting the pelvic floor and gluteal muscles and squeezing the buttocks together, or through retentive posturing, have functional fecal retention. Accompanying symptoms may include fecal soiling, irritability, abdominal cramps, and decreased appetite, all of which disappear immediately following the passage of a large stool.

Clues to the Importance of the Problem

Acute pain causes changes in behavior, posture, and facial expression. If a child is smiling and standing comfortably reporting a bellyache, the pain is mild. If the child is grimacing and frowning, and has stopped normal activities, the pain is moderate. If the child is lying down, legs flexed and crying, the pain is severe. If pain episodes last less than 5 minutes, the bellyache is unlikely to be anything to be concerned about, even if it recurs over many days. The closer the pain is to the umbilicus, the more likely it is to be functional.

Night waking does not help discriminate functional pain from disease. The anxiety associated with pain, and the tendency for pain to become a focus of attention at night, when children may cease distracting activities, may cause an inability to fall asleep or midnight awakenings.

Pathophysiology of Childhood Bellyaches

The publication of the Rome criteria sparked basic and clinical research in the functional GI disorders. Although these conditions are not dangerous, and there are not simple medical tests for them, we have learned a great deal about the subtleties in physiology that may accompany them.

Functional dyspepsia may be associated with one or more of three distinctive abnormalities: impaired gastric relaxation, poor gastric motility, or gastric hyperalgesia. The term hyperalgesia refers to pain sensations from stimuli that are not expected to cause pain, such as normal gastric contractions or normal increases in gastric pressures. Irritable bowel syndrome may begin following an enteric infection, as inflammation in the mucosa is slow to resolve, and inflammatory mediators alter motor nerve function and induce gastric or colonic hyperalgesia. Intestinal gas transit is impaired in patients with irritable bowel syndrome.

Pain refrains arise mainly from the brain. Chronic hyperalgesia in visceral afferent nerves alters pain pathways in the spinal cord and brain. Brain-imaging studies have shown that adults with irritable bowel syndrome process pain sensations differently from control subjects. Moreover, a patient's pain experience is composed of and altered by not only nociceptive stimuli but also cognitive and emotional factors. For example, negative emotions such as depression and anxiety have been correlated with increased pain intensity and disability. Increased negative emotions can induce increased muscle tension and pain; likewise, increased pain experiences can trigger more anxiety or depression. For the purpose of functional bellyaches, the brain and gut should be considered inexorably linked.

Educating Patients and Families

The decision to seek medical care for a bellyache arises from a parent or caretaker's concern for the child. The parent's threshold for concern varies with his or her own experiences and expectations, coping style, and perception of the child's illness. For this reason, the office visit is not only about the child's bellyache but also about the family's conscious and unconscious fears. The clinician must not only make a diagnosis but also recognize the family's emotional tone and ability to function. An effective treatment plan, therefore, must attend to the child and the family and depends upon securing a therapeutic alliance with both.

Effective communication between the clinician and the family ensures that the child's problems are understood and treated properly. Every parent wants the answer to four questions: What is wrong with my child? Is it dangerous? Will it go away? What can we do about it? The clinician answers each of these questions at the first visit in the appropriate order. An example answer is, "Today your child's symptoms met the criteria for a diagnosis of irritable bowel syndrome. It is not dangerous. It comes and goes, and may even change over time to a different kind of bellyache. However, there are many effective choices for treatment, and we will discuss your options to find the ones that best meet your preferences."

The Influence of Stress on Bellyache

When a child has functional symptoms, the child and parents often hear that stress is a part of the problem. Because the term is used broadly and frequently, the word "stress" has an ambiguous meaning to most people. When used in relation to their child's bellyaches, parents tend to interpret the word as meaning it is a psychological issue. An explanation of stress based on its biology facilitates understanding of the mind/body connection. Parents need to understand that the experience of stress includes physiologic as well as cognitive, emotional, and behavioral factors.

Stress is disruption of homeostasis, the way that the body regulates itself. This disruption can occur due to environmental factors, such as exposure to cold temperature, or in response to an event that is arousing, exciting, or threatening. For children, examples of stress-associated situations might include a birthday party, airplane ride, increased academic demands, changes in peer relationships, or a death in the family. Indeed, the bellyaches themselves are significant sources of stress for the child and family as well and should be described as such.

One key to helping families understand stress is describing the autonomic, physical response that occurs - the increase in heart rate and blood pressure, the slowing of the digestive system. Because the body responds to arousal with a

slowing of digestive functions, the connection between stress and bellyaches is easier to understand.

A recent study of schoolchildren evaluated for bellyache found most children believed the bellyache was related to stress and feared the clinician might find a disease. In contrast, parents worried that the clinician might not find a physical cause, and feared their child's problem would be labeled psychological. The parents may be defensive about a psychological cause for their child's belly ache, because they fear the clinician will blame them for faulty child rearing. There may also be a cultural foundation for familial bias against psychological disorders. Clinicians not formally trained in psychology may also feel uneasy about making a diagnosis that would force them to refer the patient for additional services.

Factors Influencing Pediatric Gastrointestinal Disorders

No functional disorder is totally medical or totally psychological. The GI tract is connected to the brain by millions of nerves, and each system influences the other. Functional bellyaches are a result of three interacting physiologic factors: motility, sensory perception, and arousal. Motility is defined by GI tract wall movements and the transit of its contents. Sensory perception includes feelings of pain, discomfort, or nausea. Arousal is influenced by internal factors such as pain, beliefs, interpretations, and emotions, and by external factors such as physical threats or the pleasure of seeing an old friend.

An explanation for the pain is often required for effective reassurance and for understanding why drug treatment and cognitive behavioral therapy work. An example would be a bellyache that starts with a viral gastroenteritis with symptoms such as vomiting and diarrhea, which are symptoms of disordered motility. The stretching of the bowel and the inflammation within the bowel wall stimulate pain nerves that travel from the GI tract to the spinal cord. In the spinal cord, the intestinal pain nerves transfer their messages to nerves that travel up to the brain. Pain or the sensation of nausea is thus delivered to the brain. Based on the child's interpretation of these symptoms (influenced by the caregiver's past and current response to the symptoms), the child changes his or her behavior. The child stops playing and lies down.

It is easy to understand how abnormal motility causes pain and changes behavior, but pain and emotions also change motility. If one has pain for any reason, such as putting a hand into ice water (a validated research test for pain responses), gastric emptying slows. When a person is aroused by emotion, motility changes. When a person is sad, pains grow worse; emotional discomfort accompanies physical discomfort. Thus, all three factors influence each other, and bellyaches are not all psychological.

Treatment of Pediatric Gastrointestinal Disorders

Perceptions of Illness

There is often little relationship between pain severity and the degree of danger a condition poses. Thoughts, emotions, attention, and expectations influence pain." For example, an athlete injured in a competition may not notice pain because her attention is completely focused on the event. When distractions are reduced afterward, however, the pain sensations may become more intense.

We are accustomed to requiring a swift response to symptoms to reduce the danger and discomfort to the child. When a child is diagnosed with a functional disorder, however, the condition is not dangerous to the child, and the acute medical response is no longer appropriate. Rather, the goal is helping the child learn how to manage the symptoms and to behave again as a healthy child, attending school and participating in age-appropriate activities. This requires changing the perception that this is a sick child.

First, parents must be reassured that organic disease is unlikely in the absence of alarm symptoms such as persistent fever, weight loss, growth failure, bleeding, persistent vomiting, and severe diarrhea. When it fits the medical history, the Rule of Ones helps provide effective reassurance. The Rule of Ones states that if a patient has a bellyache only, it is probably functional. If there is a bellyache and a second sign or symptom, then a careful evaluation is in order. If, in addition to the bellyache, there is weight loss, fever, daily or nightly vomiting, blood in the stool, difficulty swallowing, or pain with urination, then medical tests are necessary.

The Rule of Ones does not help explain irritable bowel syndrome, functional fecal retention, or abdominal migraine, because there is more than one symptom for each of these functional GI disorders. The Rule of Ones is most helpful for explaining bellyaches in children who do not meet diagnostic criteria because of a short duration of symptoms. The Rule of Ones must always be used in combination with the promise of continuing availability of the clinician, which helps cement the therapeutic alliance between family and clinician. Handing a business card with your e-mail address to the child reinforces the collaborative nature of the patient-clinician relationship (not to mention that children often have computer skills lacking in their parents).

Parents and patients have a choice when it comes to treatment of functional dyspepsia and irritable bowel syndrome. Everyone receives the educational component. For many, a rational explanation for symptoms is all that is necessary. Others may prefer medication, cognitivebehavior therapy, or both.

Drugs

The placebo response rate in functional GI disorders is about 40%. This high response rate to placebo may reflect the importance of the education component, the clinician-patient-family therapeutic alliance, and the patient's expectation for improvement.

Upper GI endoscopy is often recommended in adults with dyspepsia. Endoscopy serves to screen adults for gastric cancer and peptic ulcer disease. In otherwise healthy children with bellyaches, gastric cancer is unheard of and peptic ulcer disease is rare, so the risk of masking disease with drug treatment is small. In communities where pediatric endoscopy is not readily available, a diagnostic and therapeutic drug trial is justified.

A trial using a proton pump inhibitor seems appropriate for dyspepsia, due to the device's recorded safety and efficacy. Proton pump inhibitors inhibit gastric acid secretion, so if acid is involved in the production of pain, proton pump inhibitors should be effective. When they do not reduce pain in a child or adolescent who meets symptom-based criteria supporting a functional GI disorder diagnosis, then the problem is likely to be gastric hyperalgesia.

Low-dose tricyclic antidepressant treatment for adults with abdominal pain caused by a functional GI disorder is safe and effective. Tricyclics have been used for decades in children to treat reflex sympathetic dystrophy, bedwetting, and attention-deficit disorder, but there are no published pediatric studies with tricyclics for functional GI disorders. In the authors' experience, imipramine or amitriptyline administered at a dose of 0.2 mg/kg at bedtime, increased weekly by 0.2 mg/kg to a maximum of 1 mg/kg or 50 mg, may reduce pain by increasing the pain threshold of sensory afferent nerves. Amitriptyline has strong anticholinergic effects and may be ideal not only for reducing pain but also for improving restful sleep and eliminating loose stools in diarrhea-predominant irritable bowel syndrome. For constipation-predominant irritable bowel syndrome, imipramine is preferable, because it is less constipating than amitriptyline.

In the authors' experience, tricyclics are helpful in reducing the frequency and intensity of abdominal pain in about four of five children and adolescents with functional dyspepsia, irritable bowel syndrome, and functional abdominal pain syndrome. About one in 20 patients complains of hyperactivity, restlessness, insomnia, and irritability with a tricyclic, necessitating discontinuation of the drug. In the authors' experience, gabapentin reduces pain in about half the patients who do not respond to tricyclics. Antispasmodics also have also been used for irritable bowel syndrome, but well designed studies demonstrating efficacy are lacking.

During the past decade, new drugs specifically targeting the serotonin receptors in the GI tract that mediate pain and motility have served as treatment advances. Alosetron at a dose of 1 mg once or twice a day reduced pain and diarrhea in diarrhea-predominant irritable bowel syndrome. Tegaserod at a dose of 2 or 6 mg twice a day reduced pain and increased the frequency of stools in constipation-predominant irritable bowel syndrome.

Cognitive-behavior Therapy

Cognitive-behavior therapy (CBT) consists of providing patients with active behavioral strategies such as relaxation and helping patients use the thinking part of their brain to change the way they think about and cope with pain and stress. Relaxation techniques help reduce autonomic arousal and muscle tension and have been proven to be effective treatment for children with bellyaches.

The cognitive part of therapy involves challenging patients' passive approach to pain and empowering them to become more active in their recovery. Family sessions may also be necessary to help the family support the child in getting well by changing the way they behave around the patient. Learning these cognitive behavioral strategies can be achieved in about 6 or 8 hours of therapy.

When combined with education and relaxation, CBT is effective for irritable bowel syndrome. Disadvantages of CBT are its lack of availability in many areas, as well as reluctance by medical insurers to cover this expense. The psychologist or mental health clinician must also understand functional disorders and work closely with the physician. Families may feel abandoned if they are referred to a mental health clinician without follow-up from the physician to monitor medications and any new symptoms. Continued reassurance from the physician empowers patients to become more active in their treatment and recovery.

Diet and Dietary Fiber

Diet is important, but every child is different. It is important to eat a well-balanced diet. If it is possible to identify foods that trigger symptoms, those foods can be reduced or eliminated from the diet. In large, population-based studies, dietary fiber seems to have some long-term health advantages. In the short term, increasing fiber in a child's diet may not be worth the effort. Getting toddlers to eat anything every day becomes a struggle, because it is developmentally appropriate for them to be testing their ability to control their environment. The same is true for adolescents. In addition, fiber is associated with increased intestinal gas production and may increase abdominal bloating, cramps, and flatulence. Flatulence is especially embarrassing to the schoolage child. Soft stools and painless defecation are achieved with daily oral polyethylene glycol or mineral oil.

Complementary and Alternative Medicine

In one randomized, double-blind, placebo-controlled, 2-week trial, peppermint oil reduced pain in 75% of those treated.

The Future

In years to come, the acquisition of high-quality evidence will clarify many of the unknown factors about bellyaches. There will be modification and validation of the Rome criteria for pediatric functional GI disorders. The next working teams will meet in December 2004 to develop the Rome III criteria. Suggestions for the criteria may be sent to Dr. Hyman.

Pain-Associated Disability Syndrome

Visceral pain-associated disability syndrome (PADS) is defined by at least 2 months of continuous or recurrent abdominal or chest pain (or other discomfort such as nausea) sufficient to disrupt activities of daily life. Also present are impairment in normal functioning that the patient attributes to the pain, failure of previous pain-management strategies that would be expected to improve pain and enhance functioning for similar patients, and lack of an organic explanation after a thorough medical symptom assessment.

Patients with PADS experience pain that is not feigned or induced by the patient or caretakers. PADS is a term that enables clinicians to describe a subset of chronically ill patients with severe restriction in daily functioning (cannot eat, or cannot attend school), and in whom acute pain management strategies fail. Bellyaches severe enough to curtail normal activities may affect up to 20% of school-aged children but rarely cause prolonged school absence or weight loss requiring special nutritional support.

Visceral PADS most often is associated with an unrecognized functional GI disorder and a comorbid psychological stressor, such as an unrecognized learning disability, social anxiety disorder, or a family problem such as substance abuse or separation anxiety. Low perceived social or academic competence is linked to the higher levels of disability associated with functional bellyaches.

In addition, the practice of punitive medicine - ordering more invasive tests with each negative battery of studies - increases pain experiences in the patient and parental anxiety concerning whether something is being missed. The pain and arousal caused by each negative test increases the visceral hyperalgesia and promotes disability. Thus, zealous clinicians may contribute to the problem.

Treatment for PADS begins with defining the problem and providing an explanation for functional disorders and the interaction among motility, pain, and arousal that satisfies the patient and family. It is important to avoid separating

psychological from physical factors; the two are so closely linked, there is no reason to dichotomize.

Treatment requires a collaboration that includes a medical clinician, mental health professional, the patient, and the family. Medical interventions, such as the use of narcotics, parenteral nutrition, and tube feedings, are systematically withdrawn, and all medical testing stops. Medication is prescribed to regulate the sleep cycle, because it is nearly always disrupted in patients with PADS. CBT and relaxation techniques improve patient coping. Family therapy is often required to reduce arousal in the family and the patient. Neuropathic pain medications such as the tricyclics, gabapentin, and clonidine are often helpful. Daily exercise that does not cause discomfort and activities that promote a sense of well-being, such as listening to music or getting a massage, are recommended. Comorbid mental health issues should be identified and treated when present. Patients and their families return weekly until the patient feels capable of coping with his or her functional disorder.

Summary

Symptom-based diagnoses for most childhood bellyaches may be applied at the first visit, reducing family anxiety and healthcare spending. Primary care clinicians are able to diagnose and treat these disorders effectively. The promise of continuing availability is essential and assures that no disease will be missed.

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