

Functional Bowel Disorders (FBD): The Expanding Role of Magnetic Resonance Imaging

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Abstract

Aim: To highlight the potential for a new and unexpected role of MR defecography in FBD.

Materials and Methods: The imaging series and clinical findings of 84 consecutive patients [67 (79.7%) women aged 56 ± 8.5 yr, range 18 - 83 yr and 17 (20.2%) men aged 55 ± 3.2 yr, range 30 - 78 yr] referred to our Diagnostic unit for MR defecography during the last 32 months were reviewed with regard to: a) specialization of the referring physician; b) clue for exam and presenting symptoms and; c) diagnostic yield.

Results: The request from the gastroenterologist ranked first with 62 cases (73.8%) followed by that of coloproctologist in 12 (14.2%). The most frequent reason for referral occurring in 47/84 (55.9%) has been a combination of symptoms consistent with FC (abdominal bloating and distention, stool frequency < 3 /week with or without strain at stool and need to provoke evacuation by laxatives). In up to 13/84 (15.4%) this was followed by recurrent episodes of left lower quadrant pain, fecal urgency and change in bowel habit with or without symptom's release after evacuation, as it occurs in irritable bowel syndrome (IBS). Interestingly, the chronic use of antidepressants ranked third in 12/84 cases (14.2%) and was associated with episodes of diarrhea, staining and minor incontinence more frequently than with difficulty at stools (8 vs 4). At imaging, besides presence of well known changes such as rectocele, intussusception and ano-rectal dyssynergia alone or in combination (41%), typical features in FC included rectal inertia (28%) and abnormally enlarged colonic segments with fecal impaction, namely in the cecum and transverse colon and rectum, in the absence of any sensation of fullness or need to evacuate (48%). On the other hand, typical MR feature seen in IBS has been the "concertina-shaped" sigmoid colon, allowing clear differentiation in 35% of cases with that of diverticular disease which was responsible of similar presenting symptoms.

Conclusion: New horizons in image analysis and interpretation of MR defecography can be anticipated under the increasing influence of gastroenterologist's referrals for FBD such as IBS, FC and evacuation disorders other than ODS.

Keywords: Functional Bowel Disorders; Chronic Constipation; Irritable Bowel Syndrome; Functional Constipation; MR-Defecography; Epidemiology of FBD

Introduction

The term functional bowel disorders (FBD) is commonly used [1] to indicate a spectrum of abnormalities affecting the gastrointestinal tract characterized by significant overlap of similar symptoms such as abdominal pain, bloating, distention, constipation, and diarrhea in the absence of obvious anatomic or physiologic abnormalities on routine diagnostic tests. Experts agree on including in the list of FBD the following 5 categories of disorders: irritable bowel syndrome (IBS), functional constipation (FC), functional diarrhea (FD), functional abdominal bloating/distention (FB) and other unspecified bowel disorders.

Regardless of age, sex, race or socioeconomic status, it has recently been estimated [2-5], that over 40% of persons worldwide and more than 1 in every 4 adult are affected by one of them with significant negative impact on health system and quality of life.

While precise detection of the underlying mechanism can lead to potentially curative treatment, diagnosing each disorder on objective basis is notoriously difficult as symptoms are typically not specific enough to allow clear distinction among the various categories of FBD, as well as their differential diagnosis with more demanding organic pathologies such as diverticular disease, ulcerative colitis and Crohn disease. To add a note of complexity to the issue, it should be remarked that, depending on the specialist consulted by the patient, whether gastroenterologist or coloproctologist, the relevance of presenting symptoms is considered differently on the referral, as follows: while the former will place more emphasis on symptoms such as abdominal bloating and distention, pain and change in bowel rhythm, the latter will do the same on obstinate constipation unrelieved by purgatives, a sensation of difficult and unsatisfactory evacuation, burning and fullness, and need to assist evacuation by manual support or digital extraction.

In a recent review of methods and clinical use of diagnostic tools in defecatory disorders by Barrucha, *et al.* [6], anorectal manometry (ARM) in conjunction with rectal balloon expulsion test have been considered useful to identify anorectal sensorimotor dysfunctions and guide patient's management.

As far as imaging is concerned, great importance has traditionally been given to transit time studies with radiopaque markers to distinguish patients with normal transit from those with slow transit, both segmental and whole-gut, although with disparate results [7]. Today, in selected cases evacuation proctography (EP) by either conventional (X-ray) studies or MR imaging [8] is also more and more frequently considered by clinicians as a valid adjunct to identify the cause of outlet obstruction in single cases, whether organic or functional.

Purpose of the Study

The purpose of the current paper is to highlight how magnetic resonance imaging, rather than in selected cases only, can systematically be used in FBD as the first line approach after clinical history, physical examination and a limited number of diagnostic tests, so as to speed up both the diagnostic work-up and therapy planning.

Materials and Methods

All patients of both genders who were referred to our Imaging Diagnostic Center for MR defecography examination during the last 32 months were admitted into the study if they met the following criteria: 1) recurrent or persistent symptoms consistent with FBD lasting no less than 6 months including abdominal pain, bloating, distention, constipation, obstructed defecation, episodes of fecal urgency, staining or minor incontinence and diarrhea; 2) careful description of the physical examination by the referring physician, whether gastroenterologist, coloproctologist, urogynecologist, neurologist or psychiatrist; 3) recent colonoscopy certifying the absence of organic pathology.

Reasons for exclusion were (a) history of prior pelvic surgery for endometriosis, prolapse repair, hemorrhoidectomy, ano perianal fistula disease and tumor removal, the only exception being those cases with surgical reconstruction for congenital gut anomalies in neonatal age; (b) associated or prevalent symptoms related to the uro genital pelvic floor compartments. On the other hand, the presence of limiting factors in patient's motility such as tetra or paraplegia, as well as history of neurologic sequelae for ischemic or degenerative disease, did not constitute reason for exclusion.

Study protocol

The original study protocol described by us in prior reports [9,10] has been modified and tailored to the new perspective as follows: 1) no intestinal cleansing is requested to the patient who is only asked to empty his/her bladder in the toilette just prior to the examination. In this way, the presence of any residue of urine after voiding is easily ruled out on first images, while the natural distribution of small bowel loops and large intestine in the various quadrants of the abdomen is not hindered by bladder distention; 2) during the anatomic phase of image acquisition in the coronal plane, the field of view is extended upwards to include the entire colon. This, in turn is intended to reveal variants of abnormally long or large bowel segments located in unusual abdominal quadrants with potentially misleading effect on symptoms interpretation and/or radiopaque markers counting on transit time studies (Figure 1).

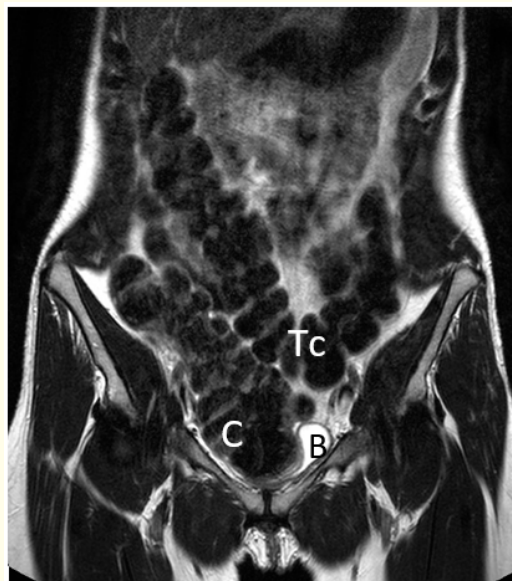


Figure 1: T2 w MR coronal view of the abdomen showing the cecum very deep in the pelvis imprinting the bladder and a ptotic, festoon-shaped transverse colon. C: Cecum; B: Bladder; Tc: Transverse Colon.

The dynamic phase of the examination is maintained essentially the same with the only adjunct of a final series acquisition after completion of contrast evacuation in the toilette located inside the diagnostic room.

Results

From the entire data base series collected during the last 32 months, a selected group of 84 patients who met the criteria for inclusion in the current study have been obtained; of them, 67 (79.7%) were women aged 56 ± 8.5 yr, range 18 - 83 yr and 17 (20.2%) were men

aged 55 ± 3.2 yr, range 30 - 78 yr. With regard to the referring physician, 62 cases (73.8%) were referred by gastroenterologists, 12 (14.2%) by coloproctologists and the remaining 10 (11.9%) by a mix including, urogynecologists, neurologists and psychiatrists.

Overall, the most frequent presenting symptom's combination was consistent with the recent definition of functional constipation (FC); it occurred in 47 (55.9%) (group A), and included abdominal distention and bloating with evacuation difficulty culminating in episodes of acute obstruction due to fecal impaction together with reduced stool frequency, i.e. < 3 movements/week. An additional group of 13 cases (15.4%) followed (group B) who suffered from a combination of left lower quadrant pain, change in bowel habit, fecal urgency, with or without staining episodes in case of loose motion or incontinence to gas material, consistent with the condition of irritable bowel syndrome (IBS). Interestingly, a significant number of patients (group C), including 12 cases (14.2%) reported the chronic use of antidepressants or other neuroleptic drugs associated with change in usual bowel habit, abdominal bloating/distention and other unspecified bowel disorders leading to evacuation disorders characterized by episodes of reduced control of fecal material more frequently than to difficulty in expulsion (8 vs 4 cases).

At imaging, besides the well known changes of rectocele, intussusception and ano-rectal dyssynergia (Figure 2) which accounted for 41% of cases, common features associated with patients of group A included 1) a U-shaped transverse colon reaching down the bladder and pubic bone (See figure 1); 2) fecal impaction occurring most frequently (up to 48% of cases) in the recto sigmoid junction and rectal ampulla in the absence of characteristic filling sensation, or even in an extraordinary enlarged cecum unusually located deep and posteriorly in the pelvis (Figure 3); 3) rectal inertia with total inability to expel contrast after repeated attempts (Figure 4).

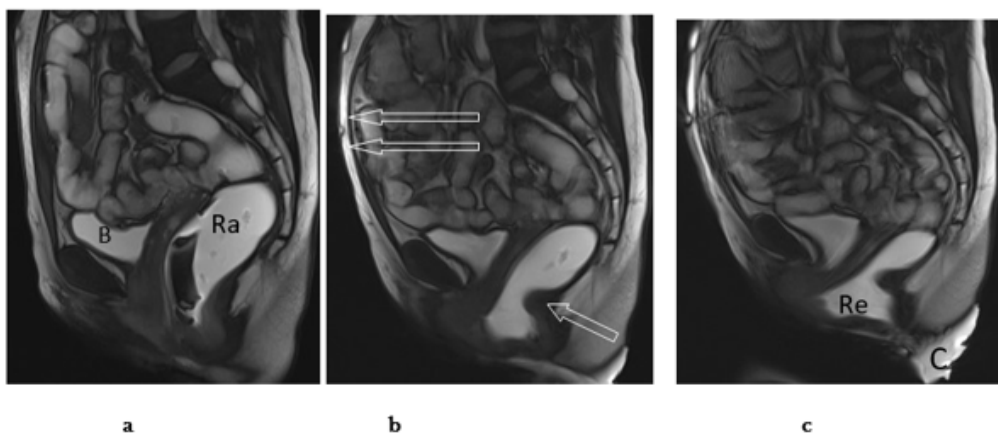


Figure 2: MR defecography in a 49 old woman with abdominal distention, bloating, prolonged staying at stool and feeling of unsatisfactory evacuation, showing typical pattern of recto-anal dyssynergia: shape of the jel filled rectal ampulla before (a); at start (b); and in the middle of evacuation (c). Note the progressive development of puborectalis impression on the posterior aspect of the anorectal junction (arrow) together with anterior rectocele (Re) and the abdominal wall strainful contraction (double arrows) necessary to obtain contrast release. B: Bladder; Ra: Rectal Ampulla; C: Expelled Contrast; Re: Rectocele.

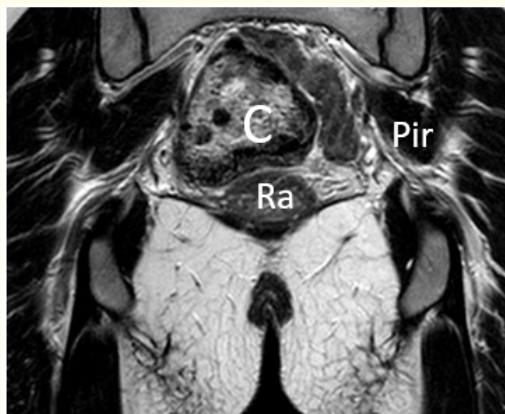


Figure 3: T2 w MR coronal view showing the cecum located in unusual position very deep in the posterior compartment of the pelvis just in front of the sacral spine. C: Cecum; Ra: Rectal Ampulla; Pir: Piriformis Muscle.

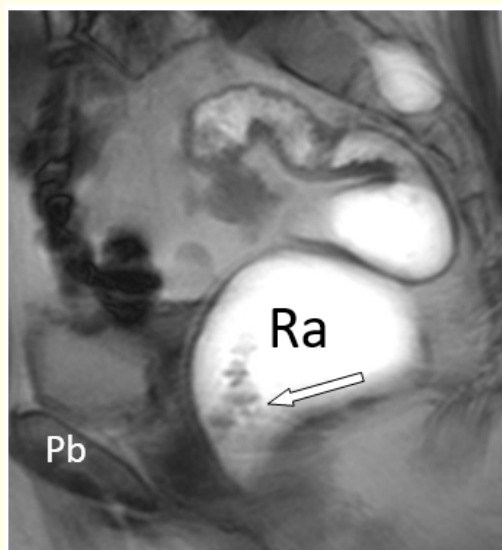


Figure 4: MR defecography. Post-voiding Imaging series obtained after repeated attempts both in the diagnostic room and toilette: note the total retention of contrast in the rectal ampulla and the presence of faecal debris (arrow). Pb: Pubic Bone; Ra: Rectal Ampulla.

Most common features associated with patients of group B included a concertina-shaped sigmoid colon, characterized by increased number of crowded haustra, narrow gut caliber and tortuous course resembling a snake. Despite frequent association with the presence of diverticula in the sigmoid colon, recognition of this pattern allowed clear differentiation from that of overt diverticular disease in 35% of cases (Figure 5).

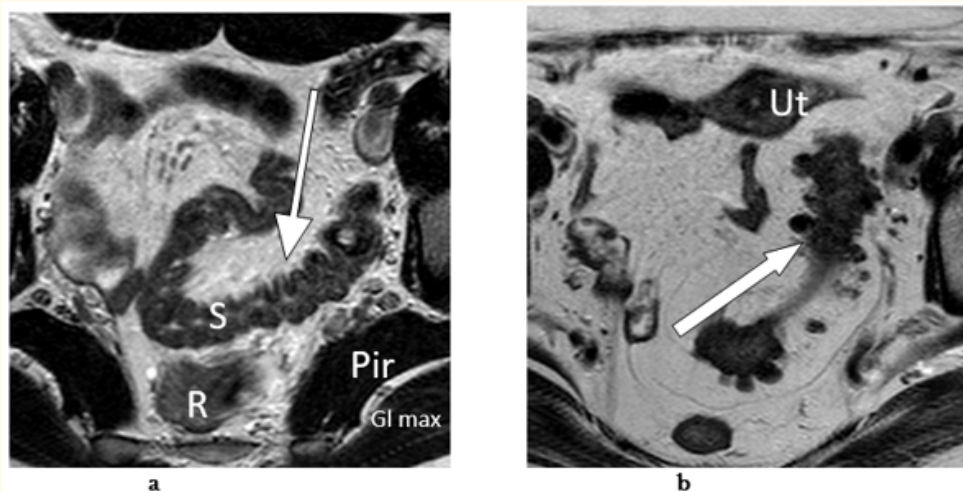


Figure 5: T2 w MR axial view in two different patients with left lower quadrant pain, change in bowel habit, fecal urgency and episodes of diarrhea: note the different feature of the sigmoid colon with increased number of crowded haustra (thin white arrow), also called “concertina-sign”, and the snake-shaped consistent with IBS (a) compared to the typical outpouchings (thick white arrow) of diverticular disease (b). S: Sigmoid Colon; R: Rectum; Pir: Piriformis Muscle; Gl max: Gluteus Maximus Muscle; Ut: Uterus.

Discussion

Over the last few years, the growing interest of the Gastroenterological scientific community in the field of functional imaging seems to have triggered a sort of “reciprocity mechanism” on the side of the Radiological world, namely that dedicated to the diagnostic imaging of pelvic floor dysfunctions and evacuation disorders. Not surprisingly, while the latest published documents on the standardization of the MR examination has had a predominantly surgical connotation, as proven by both the Joint Recommendations of the European ESUR and ESGAR Pelvic Floor Working Group [11] and, more recently, by the Proceedings of the Consensus Meeting of the American Consortium for the Pelvic Floor Disorders [12], a new fervent scientific curiosity is registered to day by the world of Gastroenterology. The current study, even though it only expresses the trend of the last 32 months occurring in a single reference Diagnostic Unit, unequivocally demonstrates the upsurging demand of requests for MR defecography from gastroenterologists compared to other specialists. To tell the truth, this attitude of specific interest in Italy had already begun in 2013, as demonstrated by a Consensus Statement [13] on the diagnosis and treatment of chronic constipation and obstructed defecation developed by a Joint Committee which included gastroenterologists, coloproctologists and radiologists. Undoubtedly, however, the level of attention is higher and prompts the radiologist both to adapt more closely the study protocol and the exam report to the needs of the gastroenterologist. As such, in the new perspective of offering a help to better define the clinical problems faced by the gastroenterologist during the every day practice, the behaviour of the radiologist is no longer limited to take notice of the act of evacuation but rather to extend the image analysis to gut segments located in the sigmoid colon or even in the entire colon. In other words, all of the above has been traduced in moving the aim of the examination from the simple analysis of evacuation phenomenon to that of bowel rhythm and functional bowel disorders. Thanks to the absence of invasiveness, high contrast tissue resolution and panoramic overview capabilities, MRI is ideally suited to offer a global view of the abdominal anatomy including the small and large bowel, together with that of urinary tract, bladder and genital organs, bony landmarks, muscles and fat recesses. Its use in pelvic floor dysfunctions and evacuation disorders received proper standardization in 2017 [11] and more recently in 2022 [12]. The examination, commonly referred to as “MR defecography” has almost completely replaced the conventional (X-ray) study [14,15] all over

the world and is currently considered the method of choice in a number of disorders including obstructed defecation syndromes, pelvic organ prolapse, ano rectal intussusception and rectocele, fecal and urinary incontinence. However, while the impact of the examination on surgeon's decision making during the pre and post operative evaluation seems clarified today, until recently the same cannot be said on the side of gastroenterologist's need, in particular with regard to the appropriateness of the examination and the diagnostic yield in face of the five categories of FBD above-mentioned in the introduction section. The present study demonstrates the potential of an unexpected contribution by MR imaging at least in the categories of FC, IBS and diverticular disease.

More precisely, a brief reminder of the most recent knowledge on the subject may be useful here as follows: first of all FC, which can be defined [1] as a disorder characterized by difficult, infrequent or incomplete evacuation whose onset dates back at least 6 months and symptoms have lasted no less than 3 < months. Common diagnostic criteria for FC include 2 or more of the following: straining at stool, lumpy/ hard stools, sensation of incomplete evacuation/ blockade, manual assistance or digitation in > 25% of defecations, and < than 3 spontaneous movements per week. In adults the mean prevalence rate is 14% (range 1.9% to 40.1%) with a 5:1 female-to-male ratio. At the beginning of the diagnostic evaluation it is necessary to exclude the presence of mechanical obstruction throughout the colon by colonoscopy. Thereafter, transit time studies by radiopaque markers allow distinction between constipated subjects with normal transit from those with delayed transit, with variations regarding where a colonic segment is affected. At MR defecography, besides the depiction of act of evacuation, the imaging features reported by us in the current study can represent a valid adjunct to better define the entire anatomic distribution of fecal impact by colonic segment other than that in the distal gut.

Secondly, IBS which has been defined [1] as a condition in which recurrent episodes of abdominal pain associated with defecation or a change in bowel habit have been present for at least 3 months; at defecation, however, an improvement of pain is referred in some cases as opposed to worsening in others. The reported worldwide prevalence of the disturbance, which is more common in women and people younger than 50 years of age, varies between 9.8 and 12.8%. On history taking, the presence of pain throughout the abdomen or more commonly in the lower abdomen and its temporal association with episode of constipation or diarrhea is mandatory for the diagnosis which is also based on noting any abnormality in stool form and stool frequency (types 1-2 or 6-7 of the Bristol scale and > 3 mov/day or < 3 mov/week, respectively). All the above is useful to classify the single patient as belonging to the IBS category with predominant constipation, diarrhea or mixed subtype. Usually at this point, after ruling out the presence of alarm features such as positive family history for colorectal cancer, rectal bleeding, weight loss and anemia, a careful physical examination is performed including the abdomen, the anorectal region and pelvic floor followed by limited laboratory studies (complete blood count, fecal calprotectin measurement and serologic tests for celiac disease). Given the complex pathophysiology of IBS and the multiple factors potentially involved, including food intolerance, chronic stress, diverticulitis, altered intestinal motility, to name a few, a non invasive diagnostic tool capable to offer an overview of the entire abdomen is highly desirable. With no need for bowel preparation of any kind, MRI sounds perfectly suitable for the purpose. Typically, on plain MR imaging series the sigmoid colon mimics the appearance of a "concertina" characterized by reduced viscus diameter, increased number of crowded haustra and deeply incised external margins or as an alternative, that of a "snake" with multiple angulations, narrow caliber and tortuous course. This pattern is consistently seen in patients with IBS and can be easily differentiated from that of diverticula in the colon which are outpouching of colonic mucosa and submucosa outside the intestinal lumen (See figure 5a and 5b).

As known, the presence of diverticula can occur in any segment of the bowels; however the sigmoid colon is the most affected segment. Diverticulosis remains asymptomatic in most individuals but approximately 25% of people will experience abdominal pain, change in bowel habit and rectal bleeding, a clinical picture which is called diverticular disease and can at times mimic inflammatory bowel disease or bowel malignancy. Taking into account the life-threatening danger of most common sequelae and complications of diverticulitis including perforation, peri-colic abscess/phlegmon, fistula, and bowel strictures, once again the availability of a reliable, non invasive diagnostic test is of utmost importance in clinical practice.

Conclusion

Over the past three decades the progressive replacement of motion picture radiography by non-ionizing techniques, such as ultrasonography and magnetic resonance imaging, in the assessment of pelvic floor dysfunctions has led more and more young people to undergo diagnostic imaging tests with greater ease than in the past. This phenomenon has particularly affected the field of evacuation disorders for which there was a reasonable reluctance to use diagnostic radiography in the young age by both the patient and the referring physicians due to the well known radiation hazard. The advent and expanding use of magnetic resonance imaging, has brought to the fore hidden clinical problems which rarely, if ever, would have been investigated on such as that of FBD. In some of these conditions, namely in FC, IBS and diverticular disease, thanks to its ability to provide both the depiction of pelvic anatomy and the functional aspects in exquisite details, MRI seems ideally suited for giving useful information to the gastroenterologist and no longer just to the coloproctologist.

In the end, however, a question spontaneously arose for the authors, as follows: can the casual finding of fecal impaction in the rectum by the radiologist (Figure 6) be taken as a reliable expression of an unknown FBD deserving further assessment by the gastroenterologist?



Figure 6: 33-old male with no history of prior FBD, referred to MR imaging study for suspected pudendal nerve neuropathy, suffering from lower urinary tract symptoms and genital infection following unprotected sexual intercourse. T2 w midsagittal view showing an overt pattern of fecal impaction (arrow) in the rectal ampulla despite the routine intestinal cleansing required by the examination study protocol. Pb: Pubic Bone; Ra: Rectal Ampulla.

The current article simply presents a pictorial assay of the most relevant features observed during the last 3 years but a prospective study aimed at validating its use on a large scale is currently being planned by us.

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