Rectal area as surrogate measure of rectal emptying during MR defecography

Patients with chronic constipation frequently report symptoms of difficult defecation such as excessive straining, feeling of incomplete evacuation, and digital facilitation of bowel movements. Current functional investigations have not yet found specific alterations that explain these symptoms, perhaps in relation to the multi-dimensional pathophysiology of chronic constipation and to the strong influence that the voluntary control of the external anal sphincter might have on colorectal function. In the balloon expulsion test (BET), rectal expulsion is evaluated by asking patients to expel balloons filled with water or air from the rectum. The normal time required to expel the balloon depends on the method used and lasts up to 1-3 minutes. A prolonged expulsion time has been found to predict the response to biofeedback treatment, but a normal test does not exclude a defecation disorder. Anorectal manometry includes measurement of anal sphincter pressures at rest and during voluntary contractions, anal sphincter relaxation and rectal sensitivity in response to rectal distension and measurement of anal pressures during attempted defecation. Studies with high-resolution anorectal manometry have recently demonstrated that the “abnormal” pressure changes during attempted defecation, believed to underlie a difficult defecation, are unspecific as often found in healthy subjects. Evacuation pressures at rest and during voluntary contractions, anal sphincter pressures during rectal distension and measurement of anal pressures during attempted defecation. The technique is not standardized across different centers, and both structural and functional abnormalities found at defecography are often found also in healthy subjects, indicating that the role of defecography in the evidence-based management of patients with difficult defecation remains unclear.

The technical note from Puthanmadhom Narayanan et al published in the journal presents a software-based analysis of MR defecography that provides a more objective assessment of rectal area and volume after rectal administration of ultrasound gel and after evacuation in healthy subjects and constipated patients. The results are compared with those of BET. Indeed, even if a semi-automated program for quantifying rectal emptying is available, barium defecography is generally performed by visually estimating the change in rectal area in the lateral view before and after evacuation, assuming that rectal area represents a surrogate measure of rectal volume during evacuation.

Previous studies with barium defecography reported an 82% reduction in rectal area after defecation in healthy subjects with a wide range of variation. The present data show that the percentage reduction in rectal volume after evacuation was significantly lower in participants with abnormal than normal BET (69% vs 83%; P < 0.01), suggesting that the behavioral or visceral factors determining the abnormal BET impair the efficiency of evacuation. Whether the patients with abnormal BET and inefficient evacuation at MR defecography represent a specific subset of constipated patients amenable of specific treatment remains to be elucidated. Meanwhile, the not negligible percentage (12%) of healthy subjects with an abnormal BET reminds that these alterations are not specific and that both BET and the MR assessment of the efficiency of evacuation are strongly influenced by the attitude/embarrassment to accomplish the act of defecation in the laboratory and in response to an artificial stimulation.

"Obstructed defecation" is one of the diagnoses often used to identify constipated patients with difficult defecation. The definition of obstruction in gastroenterology usually requires the dilation of the segment of the gut cranial to the obstruction. The present data show that the rectal volume after administering the ultrasound gel in participants with abnormal BET was even smaller than the rectum of participants with normal BET indicating that the mechanisms underlying an abnormal BET do not cause a significant mechanical obstruction. Thus, the term of "obstructed defecation" should be abandoned to identify constipated patients with difficult defecation.

The changes in rectal area were strongly correlated to the changes in rectal volume and equivalent for distinguishing between normal or abnormal BET. The Authors concluded that changes in rectal area represent a reasonably accurate surrogate measure of rectal emptying during MR defecography. However, the differences between the two measures were greater when rectal evacuation was lower and the proportion of patients with a rectocele >2 cm was greater; these results suggest that at least in certain anatomical conditions the assessment of rectal area might not be representative of rectal volume. As defecography is often analyzed with qualitative methods, the present study prompts the application of software-based techniques to allow a quick automatic calculation of...
rectal area and hopefully rectal volume in order to provide a precise definition of investigated variables. New research should also consider that dedicated software might automatically draw the region of interest used to calculate the areas of each sagittal image, further minimizing the qualitative part of the analytical process.

The results of the study by Puthanmadhom Narayanan et al are not limited to the interpretation of MR defecography, but they may also give some clues on rectal physiology and on the interpretation of previous studies assessing rectal motor and sensory responses to distension. Anatomical textbook reports that the rectum is about 15 cm long and 4 cm large; assuming a cylindrical shape, the calculated volume should be 188 mL. The results of the present study show that the capacity of the rectum after retrograde load of 180 mL ultrasound gel was 65% of the administered volume (118 mL), suggesting that this volume might represent the “normal” maximal volume of the rectum after retrograde load. Conflicting results were previously reported on rectal motor response to distension in terms of rectal tone and compliance in healthy subjects and patients with irritable bowel syndrome (IBS). Some Authors suggested that these characteristics should have been investigated within “physiological” distension ranges in order to maximize the effects related to the active contractile properties of the rectal muscle and not at greater painful levels of distensions, when not compliant passive tissue components were more involved. These “physiological” distension ranges remained poorly defined, but in fact a significant difference in rectal motor response to distension was found when the volumes of rectal distension (within a 8 cm barostat bag inflated at the minimal distending pressure) were lower (99 mL in healthy subjects and 84 mL in IBS) than the normal maximal volume of the present study. In line with these results, the rectum of patients with IBS turned out to be hyperreactive and poorly compliant in response to relatively low volumes of distension.

After evacuation, the volume of the rectum become very small (13 mL) in subjects with normal BET but it was significantly greater in subjects with abnormal BET (25 mL) suggesting an abnormal retention after evacuation in the latter group. However, even this volume was smaller than the volume of 44 mL measured with MR imaging in resting conditions and without retrograde load in healthy subjects, suggesting that the volume of an “empty” rectum might vary according to different experimental conditions and that the retained volume found in subjects with abnormal BET might not be for itself pathological.

In conclusion, the study by Puthanmadhom Narayanan et al should be greatly appreciated as it expands our understanding on rectal physiology, it provides some interesting clues on the interpretation of physiological tests performed in patients with functional bowel disorders, and it finally prompts both radiologist and gastroenterologist to adopt software-based systems of quantitative analysis of rectal volumes in order to explore with more robust data this complicated area of gastrointestinal function. In this prospective, it is highly advocated that radiologists, gastroenterologists, and MRI experts parallel the clinical success of cine cardiac MRI and work together to improve and standardize MR defecography. This will allow multicenter high-quality studies to evaluate the role of anatomical and functional rectal alterations in constipated patients with difficult defecation.

**CONFLICT OF INTEREST**

No competing interests declared.

Guido Basilisco1
Maura Corsetti2,3

1Gastroenterology and Endoscopy Unit, Fondazione IRCCS Cà Granda Ospedale Maggiore Policlinico, Milano, Italy
2NIHR Nottingham Biomedical Research Centre (BRC), Nottingham University Hospitals NHS Trust and the University of Nottingham, Nottingham, UK
3Nottingham Digestive Diseases Centre, School of Medicine, University of Nottingham, Nottingham, UK

**Correspondence**

Guido Basilisco, Padiglione Bergamasco, Fondazione IRCCS Cà Granda, Ospedale Maggiore Policlinico, Via della Commenda 19, 20122 Milano, Italy.
Email: guido.basilisco@policlinico.mi.it

**ORCID**

Guido Basilisco https://orcid.org/0000-0002-5043-9666
Maura Corsetti https://orcid.org/0000-0003-2957-4684

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