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Influence of rectal gel volume on defecation during dynamic pelvic floor magnetic resonance imaging☆,☆☆

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ABSTRACT

Purpose: To evaluate effects of altering rectal contrast volume on defecatory effort during magnetic resonance defecography (MRD).
Methods: We assessed defecation qualitatively and quantitatively as a function of rectal distention (group A: 180 cc, $n=31$; group B: 120 cc, $n=31$). Quantitative evaluation comprised measuring rectal area on midline sagittal images pre- and post-defecation.
Results: Resting rectal area was significantly higher for group A than for group B (35.2 vs. 28.3 cm^2, $P<.0001$). Post-defecation rectal area and change in area (pre- to post-defecation) were not significantly different. Subjective evaluation showed no significant difference.
Conclusion: Decreasing rectal gel volume from 180 to 120 cc did not compromise defecation performance during MRD.

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1. Introduction

Pelvic organ prolapse (POP) is a prevalent and widespread condition that affects nearly one out of four women in the United States [1]. It is a complex and multifactorial disease frequently involving multiple compartments of the pelvic floor [2]. Although physical examination and clinical history have traditionally been used as means of diagnosis and decision making, the true extent of prolapse and the multicompartment involvement may not always be readily apparent [3]. Furthermore, since newer surgical options such as vaginal mesh placement and robotic approaches, as well as nonsurgical treatment options exist, imaging evaluation of these patients has become increasingly useful in deciding management.

Traditional pelvic floor imaging techniques including fluoroscopic defecography (FD) and voiding cystourethrography suffer from relatively narrow evaluation of the pelvic floor, may require opacification of multiple organs, and expose patients to radiation. More recently, magnetic resonance imaging (MRI) techniques such as dynamic MRI with straining and/or defecation have shown promise due to their superior soft-tissue contrast resolution, multiplanar capabilities, and lack of exposure to ionizing radiation [4]. Dynamic MRI of the pelvic floor facilitates assessment of the entire pelvic floor in unison and has been shown to alter surgical management in up to 67% of cases [5]. Dynamic pelvic floor MRI with defecation — magnetic resonance defecography (MRD) — provides better assessment of the degree of POP than MRI with straining alone in sitting [6] or supine positions (Kumar et al., presented at the 2014 annual meeting of the American Roentgen Ray society). Defecation is also imperative when evaluating POP with fluoroscopic cystocolpoproctography [7], and similar detection rates of prolapse have been shown between supine MRD and fluoroscopic cystocolpoproctography [8]. MRD with intrarectal gel has been shown to perform better than dynamic MRI during Valsalva maneuvers without intrarectal contrast when using FD as a reference standard for evaluation of all types of prolapse except enteroceles [9]. However, the composition and volume of contrast utilized to distend the rectum vary widely in the literature [4,10–13].

☆ Conflicts of interest: None.
☆☆ Disclosures: None.

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Table 1
MRD indications for patients in study, separated by study group

MRD reason for referral	Number of patients group A (180 cc)	Number of patients group B (120 cc)	*P*
Pelvic mesh and/or pelvic pain	12	17	.5448[a]
POP	18	13	
Constipation/Difficulty evacuating bowel	1	1	

[a] Overall *P* value for comparison of referral pattern between groups using Fisher's Exact Test.

At the authors' institution, the anatomic and all dynamic 'cine' acquisitions (during Kegel, Valsalva, and defecation maneuvers) are obtained with ultrasound gel in the rectum. Traditionally, 180 cc of gel was instilled in the rectum as the first step of the examination after positioning the patient on the table. During the course of practice, the authors anecdotally noted rectal overdistention precluding visualization of sigmoidoceles. Given that overfilling of the bladder has been reported as a cause for false negative reporting of enteroceles on MRD [8], the authors considered the possibility that rectal overdistention and incomplete evacuation may contribute to the previously shown poor performance of MRD with rectal gel for detection of enteroceles [9]. As a result, the amount of gel used to distend the rectum was reduced from 180 to 120 cc. Knowing that the defecation phase is imperative for evaluation of POP [6,7], the authors sought to evaluate whether this change in rectal gel volume affects the ability to defecate. To the authors' knowledge, there have been no systematic studies in the radiology literature evaluating the appropriate volume of gel to be used for MRD. Therefore, the goal of this retrospective study was to compare the amount and rate of successful defecation in patients with 180 cc of rectal gel to those with 120 cc of rectal gel.

2. Materials and methods

2.1. Patient identification

This was a Health Insurance Portability and Accountability Act-compliant retrospective study. Following institutional review board approval, the authors reviewed the department database for MRD cases in patients with pelvic floor dysfunction performed between 07/2011 and 01/2013. All cases performed until 04/2012 had received 180 cc of gel in the rectum. Patients studied between 04/2012 and 07/2012 received either 180 or 120 cc of rectal gel randomly during the testing phase of the protocol change. Since 07/2012, all cases have been performed with 120 cc of gel in the rectum. Thirty-one consecutive cases referred for MRD by urology predominantly for anterior or middle vaginal compartment symptoms (Table 1) received 180 cc intrarectal gel volume and were identified as group A; 31 consecutive cases referred from the same physician group for similar clinical indications that received 120 cc intrarectal gel were identified as group B.

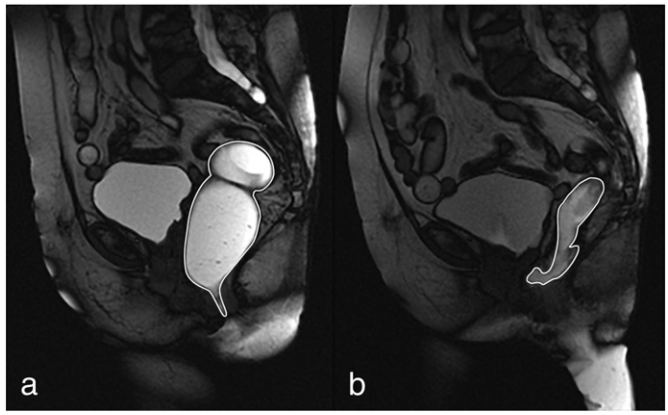

Fig. 1. A 79-year-old female with recurrent vaginal prolapse and suspected enterocele. Sagittal midline TrueFISP images in a patient who received 180 cc of gel in the rectum for MR defecography. Quantitative analysis was performed by measuring area of the gel distention using the free hand ROI tool to outline the rectum at maximal distention (outline in pre-defecation image a) and minimal distention (outline in post-defecation image b).

2.2. Imaging technique

All MRD examinations were performed on a single 1.5-T magnet (Siemens Magnetom® Avanto, Erlangen, Germany) using a six-channel phased-array surface coil. Patients were placed supine within an inflatable enema ring on the MRI table with knees slightly flexed and supported by a cushion for comfort. Ultrasound gel (180 or 120 cc) was instilled in the rectum according to standardized protocol with a catheter tip syringe. After multiplanar T2-weighted turbo spin echo anatomic imaging, cine true fast imaging with steady-state precession (TrueFISP) images was obtained through a midline slice in the sagittal plane during Kegel, Valsalva, defecation, and post-defecation Valsalva maneuvers. When patients were unable to defecate during the examination, they were asked to defecate in the restroom prior to the post-defecation Valsalva cine acquisition. Imaging protocol and parameters are listed in Table 2.

2.3. Image analysis

All studies were reviewed by a single fellowship-trained radiologist (AAB) in MRD who was blinded to the instilled gel volume and not involved in the clinical patient evaluation. Images were viewed on the departmental picture archiving and communication system. Quantitative analysis was performed using a free-hand region of interest (ROI) tool to obtain the area (in cm^2) of gel-distended rectal lumen on midline sagittal images during rest and at the end of defecation to assess change in rectal distention (Fig. 1). Comparisons were made between the two groups (i.e., group A: 180 cc vs. group B: 120 cc). Cine TrueFISP acquisitions obtained during defecation were utilized for all analyses.

For qualitative analysis, the ability of the patient to defecate any volume of gel during the defecation phase acquisition was recorded

Table 2
Institutional MRD protocol and parameters

Sequence	Imaging plane	Maneuver	TR (ms)	TE (ms)	FOV (cm)	Matrix	Slice thickness (mm)
T2 TSE	Axial	Rest	3920	91	26	320×256	5
T2 TSE	Sagittal	Rest	4070	91	26	320×256	5
T2 TSE	Coronal	Rest	4960	105	26	256×243	5
T1 SE	Axial	Rest	625	10	26	256×192	5
Cine TrueFISP	Sagittal	Kegel	734.4	1.8	34	256×256	8
Cine TrueFISP	Sagittal	Valsalva	734.4	1.8	34	256×204	8
Cine TrueFISP	Sagittal	Defecation	734.4	1.8	34	256×204	8
Cine TrueFISP	Sagittal	Post-defecation Valsalva	734.4	1.8	34	256×204	8
T2 TSE	Axial	Rest	3920	91	26	320×256	5

TR, repetition time; TE, echo time; FOV, field of view; TSE, turbo spin echo; SE, spin echo; TrueFISP, true fast imaging with steady-state precession.

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