MR Defecography in Patients with Fecal Incontinence: Imaging Findings and Their Effect on Surgical Management[1]

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Purpose: To retrospectively evaluate magnetic resonance (MR) defecography findings in patients with fecal incontinence who were evaluated for surgical treatment and to assess the influence of MR defecography on surgical therapy.

Materials and Methods: Institutional review board approval was obtained. Informed consent was waived; however, written informed consent for imaging was obtained. Fifty patients (44 women, six men; mean age, 61 years) with fecal incontinence were placed in a sitting position and underwent MR defecography performed with an open-configuration MR system. Midsagittal T1-weighted MR images were obtained at rest, at maximal contraction of the sphincter, and at defecation. Images were prospectively and retrospectively reviewed by two independent observers for a variety of findings. Interobserver agreement was analyzed by calculating κ statistics. Prospective interpretation of MR defecography findings was used to influence surgical therapy, and retrospective interpretation was used for concomitant pelvic floor disorders.

Results: MR defecography revealed rectal descent of more than 6 cm (relative to the pubococcygeal line) in 47 (94%) of 50 patients. A bladder descent of more than 3 cm was present in 20 (40%) of 50 patients, and a vaginal vault descent of more than 3 cm was present in 19 (43%) of 44 women. Moreover, 17 (34%) anterior proctoceles, 16 (32%) enteroceles, and 10 (20%) rectal prolapses were noted. Interobserver agreement was good to excellent ($\kappa = 0.6–0.91$) for image analysis results. MR defecography findings led to changes in the surgical approach in 22 (67%) of 33 patients who underwent surgery.

Conclusion: MR defecography may demonstrate a variety of abnormal findings in patients who are considered candidates for surgical therapy for fecal incontinence, and the findings may influence the surgical treatment that is subsequently chosen.

Supplemental material: *http://radiology.rsnajnls.org/cgi/content/full/2402050648/DC1*

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Fecal incontinence is defined as the involuntary loss of fecal material at an inappropriate time or place (1,2). The true prevalence of this abnormality is unknown; however, it is known to increase with age. The prevalence of fetal incontinence increases from approximately 4% in patients older than 40 years to 11% in patients aged 80 years or older (3).

A detailed medical history and thorough physical examination still are the cornerstones of clinical evaluation in patients with fecal incontinence. However, in light of the many possible treatments for fecal incontinence (including conservative treatment strategies, surgery, and sacral nerve stimulation [4]), various additional diagnostic tests are performed in clinical practice to tailor the treatment strategy to the individual patient. Anorectal physiologic testing (including sphincter manometry, anorectal sensitivity, and measurement of pudendal nerve motor latency), endoanal ultrasonography (US), or endorectal coil magnetic resonance (MR) imaging is recommended for use in diagnostic evaluation and treatment planning in patients with fecal incontinence, depending on the local situation and availability (1).

The role of conventional evacuation proctography in the assessment of pelvic floor motion in patients with fecal incontinence is unclear. Few study investigators have assessed the usefulness of evacuation proctography in patients with fecal incontinence (5–7). Evacuation proctography may reveal various abnormal findings in patients with fecal incontinence (5–7); however, Rex and Lappas (6) found that this modality did not add any information about sphincter strength beyond that already obtained with anal manometry. Similarly, experience with MR defecography, which has been shown to be a valuable alternative to evacuation proctography (8,9), is limited in patients with fecal incontinence. To our knowledge, only one report (8) has described MR defecography findings in patients with fecal incontinence.

Despite the sparse data regarding the use of evacuation proctography and MR defecography in patients with fecal incontinence, several authorities consider evacuation proctography and MR defecography to be helpful in the evaluation of patients with fecal incontinence, particularly before surgical intervention (1,8,10,11).

The purpose of our study was to retrospectively evaluate MR defecography findings in patients with fecal incontinence who were evaluated for surgical treatment and to assess the influence of MR defecography on surgical therapy in these patients.

Advances in Knowledge

- MR defecography reveals various pelvic floor abnormalities, including rectal descent, cystocele, vaginal vault descent, enterocele, anterior proctocele, and internal rectal prolapse.
- MR defecography findings changed the surgical therapy in 68% of patients in whom some form of surgery was performed as therapy for fecal incontinence.

Materials and Methods

Patients

This study was approved by the institutional review board, and the informed consent requirement was waived. However, every patient provided written informed consent for imaging.

All patients with fecal incontinence who were referred for MR defecography by physicians in the section of proctology of the department of surgery between October 2001 and January 2004 ($n = 55$) were included. Our hospital is a tertiary center for physiologic assessment and treatment of patients with fecal incontinence. MR defecography has been performed routinely as part of the clinical work-up of patients with fecal incontinence since 2001, particularly when surgery or sacral nerve stimulation was considered a therapeutic option for treatment. In our institution, surgical therapy for fecal incontinence is considered to be refractory to medical care and biofeedback.

Patients with functional disorders (inflammatory bowel disease, external rectal prolapse, or malabsorption) or contraindications to MR imaging (ferromagnetic implants, cardial pacemakers, neurostimulators, or severe claustrophobia) were excluded.

The final study group consisted of 50 patients (44 women, six men; mean age, 61 years; age range, 23–86 years). Before patients were referred for MR defecography, each patient was assessed to exclude any organic disease. Fecal incontinence was diagnosed in accordance with the Rome II diagnostic criteria for functional anal disorders (12). Symptoms of fecal incontinence were classified with a previously described system (13,14): 19 patients (38%) reported having only passive fecal incontinence (ie, incontinence occurred without the patient's knowledge), four patients (8%) reported having only urge fecal incontinence (ie, incontinence occurred with the patient's knowledge but against his or her will because of lack of voluntary control), and one patient (2%) reported having only postdefecation leakage (ie, passive incontinence temporally related to defecation) (Table 1). In 26 patients (52%), more than one symptom was present (Table 1).

Of the 44 women, 37 (84%) had a history of childbirth and 23 (52%) reported at least one vaginal delivery with complications. Thirty-one (70%)

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Abbreviations:
ARA = anorectal angle
PCL = pubococcygeal line

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women had undergone pelvic surgery. Hysterectomy had been performed in 29 patients (66%) and was the most commonly performed procedure. Eight women had undergone anal or pelvic surgery (hemorrhoidectomy, $n = 3$; sigmoid colon resection, $n = 3$; colporrhaphy, $n = 1$; anorectal fistula resection, $n = 1$). Among the six men with fecal incontinence, one had a history of hemorrhoidectomy.

A thorough medical history was obtained from all patients; thereafter, all patients underwent a full anorectal physiologic assessment that included endoanal US, measurement of anorectal pressure with anal manometry, and evaluation of rectal and anocutaneous sensitivity with previously described techniques (15,16).

MR Defecography

MR defecography was performed with a superconducting open-configuration MR imaging system (Signa SP; GE Medical Systems, Milwaukee, Wis). Examinations were performed with the patient in a sitting position and with a technique similar to that described by Schoenenberger et al (9). Before MR imaging, the patient's rectum was filled with 300 mL of synthetic stool (mashed potato starch) mixed with 1.5 mL of gadopentate dimeglumine (377 mg/mL) (Magnevist; Schering, Berlin, Germany), which yielded a gadolinium concentration of 2.5 mmol/L. After the rectum was filled, the patient was placed upright on a wooden chair that fit into the magnet rings. A flexible transmit-receive radiofrequency coil was wrapped around the pelvis.

After localizing images were acquired, a multiphase fast T1-weighted spoiled gradient-recalled-echo sequence was performed in the midsagittal plane of the anal canal, with an image update provided every 2 seconds. The imaging parameters were as follows: repetition time msec/echo time msec, 22.2–22.4/10.6–10.7; flip angle, 90°; section thickness, 1.5 cm with no intersection gap; bandwidth, 12.5 kHz; field of view, 29–32 cm; image matrix, 256 × 160; and one signal acquired. This sequence was used to obtain images of the pelvis with the patient at rest, at maximal voluntary contraction of the sphincter and pelvic floor muscles (hereafter, squeezing), at straining, and at defecation. If patients were suspected of having internal rectal prolapse or lateral proctocele on the basis of midsagittal imaging findings, additional images were acquired with the same parameters used to acquire images in the transaxial plane. To obtain images of the pelvic positions at rest, at squeezing, at straining, and at defecation, patients were coached by the technician performing the examination; a microphone and headset enabled communication. All images acquired at different pelvic positions were formatted into a cine loop presentation to enable assessment of the dynamics of both rectal emptying and pelvic floor movement. The overall imaging time for MR defecography, including patient preparation, was between 20 and 25 minutes.

Data Analysis

Analysis of MR images.—All MR images were analyzed with both a prospective and a retrospective interpretation. One radiologist (D.W., with 6 years of experience in interpretation of MR defecography images) performed the prospective interpretation. The delay between acquisition and prospective analysis of MR data was limited to 24 hours. The radiologist was not blinded to patients' clinical data or clinical information. The radiologist noted his findings on a standardized report for interpretation of MR defecography images. The findings contained in this report, which corresponded to the original findings communicated to the referring clinicians, were used to evaluate the effect of MR defecography on surgical treatment.

Two experienced radiologists (D.W. and C.T., with 6 years and 1 year, respectively, of experience in interpretation of MR defecography images) retrospectively and independently analyzed all MR defecography images. The order of examinations was randomized. A consensus was reached in cases of disagreement. The radiologists who performed this retrospective analysis and

Figure 1

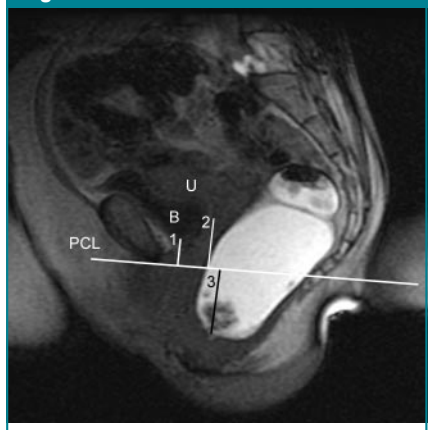


Figure 1: Midsagittal contrast material–enhanced T1-weighted spoiled gradient-recalled-echo MR image (22.4/10.6) in a 60-year-old woman with fecal incontinence, obtained at rest in the sitting position. The distance between the bladder *(B)* base (*1,* anterior pelvic compartment), vaginal vault (*2,* middle pelvic compartment), and anorectal junction (*3,* posterior pelvic compartment) was measured with regard to the PCL at a separate workstation. *U* = uterus.

Table 1

Clinical Characteristics

Type of Incontinence	Total ($n = 50$)	Women ($n = 44$)	Men ($n = 6$)
Passive	19 (38)	15 (34)	4 (66)
Urge	4 (8)	4 (9)	· · ·
PDL	1 (2)	1 (2)	· · ·
Passive and PDL	4 (8)	4 (9)	· · ·
Urge and passive	16 (32)	16 (36)	· · ·
Urge and PDL	1 (2)	· · ·	1 (17)
Urge, passive, and PDL	5 (10)	4 (9)	1 (17)

Note.—Data are numbers of patients, and data in parentheses are percentages. PDL = postdefecation leakage.

interpretation were blinded to all clinical data. Prospective and retrospective analyses were performed at a separate workstation (Advantage Windowing Workstation; GE Medical Systems Europe, Buc, France). MR defecography image interpretations were based on all source image and cine loop findings obtained at different pelvic positions.

MR images and cine loops were analyzed with regard to pelvic floor structural abnormalities, including anterior proctoceles, enteroceles, rectal prolapses, rectal descents (descent of the posterior compartment), cystoceles (descent of the anterior compartment), and vaginal vault descents (descent of the middle compartment) or descent of any part of the remaining cervix in cases of hysterectomy. Observers in the prospective and retrospective image analyses recorded standard measurements with an electronic caliper that was included as part of the standard software delivered with the workstation. As in previous studies, a pubococcygeal line (PCL) (defined as the line that joined the inferior border of the symphysis pubis to the last coccygeal joint on a midline sagittal image [17,18]) was drawn on the midline sagittal MR image. The positions of the bladder base, vaginal vault (or any part of the remaining cervix in case of hysterectomy), and anorectal junction (defined as the junction of the rectal ampulla and anal canal) were measured at a 90° angle to the PCL, which was used as the reference line to determine the extent of cystocele, enterocele, rectal descent, or vaginal vault descent. The anorectal angle (ARA) (defined as the angle between the longitudinal axis of the anal canal and the posterior rectal wall) was measured (17). All ARA measurements were obtained at rest (ARA_R), at sphincter contraction (ARA_{SC}), and at the end of defecation (ARA_D); the change in ARA between measurements was expressed as a percentage and calculated with the following equation: $\{[ARA_R - (ARA_{SC}/ARA_D)]/ARA_R\} \cdot 100$. Published data show the ARA change in healthy volunteers between rest and squeezing and between rest and defecation is usually 15%–20% (5,19–21). Thus, we classified an ARA change of 10% or less between the pelvic positions as abnormal.

The position of any of the three compartments of the pelvic floor relative to the PCL was measured (22,23) in all four pelvic positions. The largest measured distance (usually at the end of defecation) was used for further analysis (Fig 1). Cystocele represented an anterior pelvic floor compartment abnormality and was defined as descent of the bladder base below the PCL. Vaginal vault descent represented a middle pelvic floor compartment abnormality and was defined as descent of the vaginal vault (or any part of the remaining cervix in cases of hysterectomy) below the PCL. Similarly, rectal descent represented a posterior pelvic floor compartment abnormality and was defined as descent of the anorectal junction below the PCL (22). Enterocele was defined as descent of either the peritoneum-containing small bowel or the sigmoid colon below the PCL (22). The terms *sigmoidoceles* and *peritoneoceles* were not used because we did not distinguish between the different contents (peritoneal fat, small intestine, or sigmoid colon) within the herniated peritoneal sac. The extent of any cystocele, enterocele, anterior proctocele, or vaginal vault or rectal descent was measured at a 90° angle to the PCL and graded with a three-grade scoring system as small, moderate, or large, as shown in Table 2 (22,23).

A proctocele was defined as a protrusion of the rectal wall anterior to a line extending upward through the anal canal. The size (depth) of anterior proctoceles was expressed as the depth of wall protrusion beyond the expected margin of the normal rectal wall and classified as small (<2 cm), moderate

Table 2

Grading System for MR Defecography Findings

Abnormality	Small	Moderate	Large
Cystocele	<3 cm	3–6 cm	>6 cm
Vaginal vault descent	<3 cm	3–6 cm	>6 cm
Enterocele	<3 cm	3–6 cm	>6 cm
Rectal descent	<3 cm	3–6 cm	>6 cm
Anterior proctocele	<2 cm	2–4 cm	>4 cm

Source.—Reference 23.

Table 3

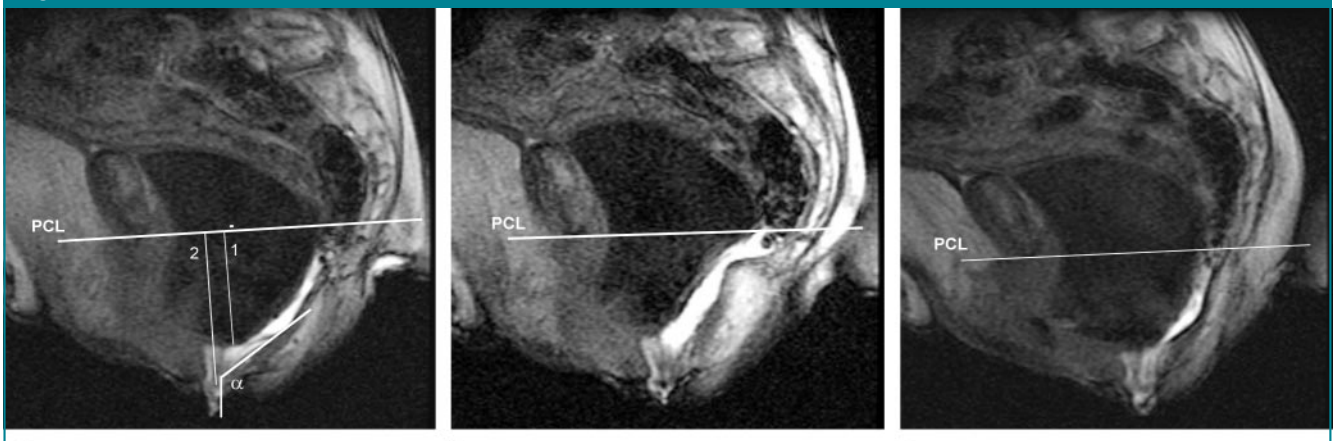
Change of Surgical Therapy in Specific Patients

Intended Surgical Treatment Before MR Defecography	MR Defecographic Finding	Final Treatment
Sphincter repair	Proctocele*	Sphincteroplasty and anterior levatorplasty
Sphincter repair	Enterocele	Sphincteroplasty and anterior levatorplasty
Sphincter repair	Internal rectum prolapse	Laparoscopic proctopexy
Sphincter repair	Moderate or severe pelvic descent	Sacral nerve stimulation
Sacral nerve stimulation	No contraindications†	Sacral nerve stimulation

* Proctocele with sagittal diameter of less than 2 cm or incomplete evacuation of any proctocele.

† No anterior proctocele with sagittal diameter of 2 cm or more, no enterocele with sagittal diameter of 3 cm or more, and no internal rectal prolapse.

Figure 2



a. b. c.

Figure 2: Midsagittal spoiled gradient-recalled-echo MR images (22.4/10.7) in an 83-year-old woman with passive fecal incontinence and a history of two vaginal deliveries and hysterectomy, obtained at **(a)** rest, **(b)** squeezing, and **(c)** defecation. The patient was unable to hold the entire enema because of passive fecal incontinence. In **a**, a moderate cystocele (*1;* anterior compartment measurement, 5.9 cm) and a large rectal descent (*2;* posterior compartment measurement, 8.1 cm) are visible. The ARA at rest (α) is 136°. In **b**, there is nearly no change in the size of the cystocele (5.6 cm), the extent of rectal descent (8.2 cm), or the ARA (139°). In **c**, there is nearly no change in the size of the cystocele (5.7 cm) or the extent of rectal descent (8.1 cm). The ARA at rest and at defecation (135°) differ by less than 10° (Movie 1, *http://radiology.rsnajnls.org/cgi/content/full/2402050648/DC1).*

(2–4 cm), or large (>4 cm) (22,23). In addition, proctoceles were classified as those with complete defecation and those with incomplete defecation on the basis of whether the evacuation of the contrast material was complete or incomplete at the end of defecation.

The observers performed all quantitative measurements at each pelvic position separately three times, and the mean values for each observer were calculated. For the compilation of data, the mean values for the measurements of the observers were used.

The presence of rectal prolapse was noted. Different grades of severity can be distinguished for rectal prolapse (24). These grades include intrarectal intussusception (full-thickness intussusception of the rectal wall into the rectal lumen during rectal defecation), intraanal rectal intussusception (apex of the rectal intussusception passes into the anal canal and remains there during straining), and external rectal prolapse (intussusception passes through the anal canal). In our study, intrarectal and intraanal intussusceptions were classified as internal prolapse.

Analysis of clinical data.—A radiologist (G.A.) and a surgeon (F.H.H.) reviewed all clinical charts. Special attention was drawn to assess the effect of MR defecography findings on the choice of the surgical approach if surgery was to be performed to treat fecal incontinence (Table 3). In cases of small sphincter defects where MR defecography revealed a pelvic descent, sacral nerve stimulation was performed instead of sphincteroplasty. MR defecography was performed in these patients to rule out an anterior proctocele with a sagittal diameter of more than 2 cm, an enterocele with a sagittal diameter of more than 2 cm, or an internal rectal prolapse.

Statistical Analysis

We determined the interobserver agreement between the prospective and retrospective interpretations by calculating κ values and 95% confidence intervals (poor agreement, $\kappa = 0.00$; slight agreement, $\kappa = 0.01–0.20$; fair agreement, $\kappa = 0.21–0.40$; moderate agreement, $\kappa = 0.41–0.60$; good agreement, $\kappa = 0.61–0.80$; and excellent agreement, $\kappa = 0.81–1.00$) (25). The κ values were tested for a significant difference from zero. A *P* value of .05 or less was considered to indicate a statistically significant difference. SPSS software (SPSS, Chicago, Ill) was used to perform all statistical analyses.

Results

Clinical Findings

Twenty-four (48%) of the 50 patients exhibited a structural defect of the anal sphincter at endosonography: 12 patients (24%) had external and internal sphincter defects, 11 (22%) had isolated external sphincter defects, and one (2%) had an isolated internal sphincter defect. Thirty patients (60%) had a substantial reduction in pressure at rest or at squeezing, as measured with manometry and compared with the pressure achieved by healthy volunteers reported in the literature (15). Isolated reduced squeezing pressure was found in eight patients (16%), and isolated reduced resting pressure was found in four (8%). Insufflation of the balloon probe revealed rectal hypersensibility in 36 patients (72%) and rectal hyposensibility in five (10%).

MR Defecography

Eighteen (36%) of the 50 patients were unable to hold the 300-mL enema until the MR examination. We observed some anorectal leakage of the enema in four patients; however, the amount of material leaked was considered too

Table 4

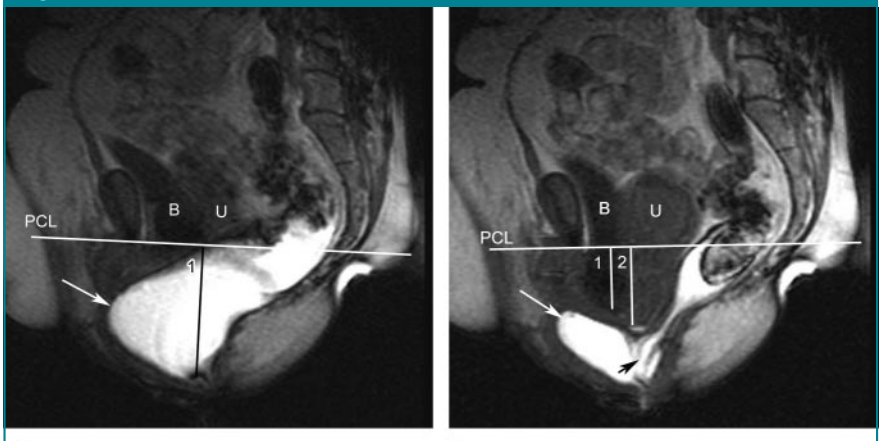
Frequency of MR Defecography Findings

Abnormality	No. of Patients*	Size (cm)†
Cystocele		
Small	19 (38)	2.4 ± 0.6
Moderate	20 (40)	4.5 ± 0.8
Vaginal vault descent		
Moderate	14 (33)	5.2 ± 0.9
Large	5 (12)	7.5 ± 1.7
Enterocele		
Small	3 (6)	2.1 ± 0.4
Moderate	5 (10)	4.6 ± 0.9
Large	11 (22)	8.8 ± 1.9
Rectal descent		
Moderate	4 (8)	4.4 ± 0.5%
Large	43 (86)	8.8 ± 2.0
Anterior proctocele		
Small	18 (36)	1.4 ± 0.4
Moderate	11 (22)	2.8 ± 0.4
Large	6 (12)	4.9 ± 0.6
Internal rectal prolapse	6 (12)	. . .

* Data in parentheses are percentages.

† Data are mean ± standard deviation.

Figure 3



a. **b.**

Figure 3: Midsagittal spoiled gradient-recalled-echo MR images (22.2/10.6) in a 55-year-old woman with postdefecation leakage and a history of two vaginal deliveries, obtained in the sitting position at **(a)** rest and **(b)** the end of defecation. *B* = bladder, *U* = uterus. In **a**, a moderate anterior proctocele (sagittal diameter, 2.6 cm; arrow) and a large rectal descent (*1,* measurement for the posterior compartment) are visible. In **b**, a large anterior proctocele (sagittal diameter, 4.8 cm; white arrow) is present, with incomplete evacuation of the contrast material. In addition, an internal prolapse (black arrow) is visible. The bladder base *(1)* is located 3.0 cm below the PCL, and the vaginal vault *(2)* is located 3.6 cm below the PCL; these findings are consistent with a moderate cystocele and moderate vaginal vault descent (Movie 2, *http://radiology.rsnajnls.org/cgi/content/full/2402050648/DC1).*

small to be pertinent to our investigation. The mean ARA in all patients was 108° ± 13 (standard deviation) at rest (110° ± 12 in women, 104° ± 15 in men), 92° ± 13 at squeezing (93° ± 11 in women, 86° ± 18 in men), and 121° at defecation (121° ± 12 in women, 120° ± 20 in men). In 20 patients (40%), ARA changes between rest and squeezing or between rest and defecation were less than 10° (Fig 2). Moderate or large rectal descent was found in 47 patients (94%), making this the most common finding at defecography (Table 4, Fig 2). Only three men (6%) had no evidence of rectal descent, regardless of the pelvic floor position. A moderate cystocele was noted in 20 patients (40%), and a moderate or large vaginal vault descent was present in 19 (43%) of 44 women.

Pelvic floor descent involved all three compartments of the pelvic floor in 31 patients (62%). Pelvic floor descent involved two compartments in nine patients (18%) and one compartment in seven patients (14%). Anterior proctoceles were found in 35 patients (70%); these proctoceles were classified as moderate or large in 17 patients. Of these 17 patients, 12 (70%) retained contrast material at the end of defecation and consequently had incomplete defecation of the enema (trapping) (Fig 3). Moderate or large enteroceles were present in 19 patients (38%) (Fig 4). MR defecography showed internal rectal prolapse in 10 patients (20%) (Figs 3, 5). In five of these 10 patients, internal prolapse was associated with an anterior proctocele (Fig 3).

Agreement between the prospective and retrospective image analysis results was classified as good or excellent regarding all evaluated abnormalities (κ = 0.6–0.91) (Table 5). For the retrospective image analysis, consensus reading was necessary for 32 of the 800 possible decisions (4%). All κ values were significantly different from 0 (P = .008–.016).

Influence on Surgical Therapy

During the follow-up period, 33 patients (66%) underwent surgery. Sacral nerve stimulation was performed in 11 (33%) of these patients, sphincter repair with

anterior levatorplasty was performed in 12 (36%), and laparoscopic rectopexia was performed in five (15%). Two patients (6%) underwent isolated anterior levatorplasty, two (6%) underwent isolated sphincter repair, and one (3%) underwent dynamic graciloplasty. In 22 (67%) of these 33 patients, the outcome of MR defecography directly influenced the type of surgical intervention that was used.

Discussion

The use of dynamic imaging in the assessment of fecal incontinence, particularly the influence of dynamic imaging findings on the choice of therapy, is not well established in the literature. Before the advent of MR defecography, evacuation proctography was the preferred imaging modality used to assess anorectal configuration and dynamic aspects of the pelvic floor (26). Over time, dynamic examination of the pelvic floor with MR imaging has gained increasing interest for use in the assessment of functional and morphologic abnormalities of the anorectal region (8,20, 23,27).

Bartolo et al (7) used evacuation proctography to examine 37 patients with either fecal incontinence or constipation. Several diagnostic tests, including evacuation proctography, were performed in all 37 patients. The findings were compared with findings in patients with constipation and with findings in asymptomatic subjects. Bartolo et al (7) found that the ARA as measured with MR defecography was substantially more obtuse in patients with fecal incontinence than in patients with constipation or in control subjects.

We measured the ARA in our study; however, when we compared the mean ARA values at the different pelvic positions in asymptomatic volunteers (at rest, 108°–127°; at straining or defecation, 122°–132°) (5,19–21), there seemed to be no difference with regard to any of the previously published values. The lack of a significant difference in ARA between incontinent and constipated patients and asymptomatic volunteers has been substantiated by Goei (5), who found no difference in the ARA at rest, at squeezing, or at straining between asymptomatic volunteers and patients with fecal incontinence or constipation. Although there seems to be no difference in the absolute values of the ARA between patients with incontinence and healthy volunteers, the relatively high number of patients with a change in ARA below 10% between rest and squeezing or between rest and defecation is striking. However, our results are in agreement with the findings of Rex and Lappas (6), who noticed the ARA did not decrease between rest and defecation in 50% of the examined patients with fecal incontinence. In our study, the ARA change between rest and squeezing and between rest and defecation was less than 10% in 20 (40%) of the 50 patients; this finding indicates a dysfunction of the puborectalis sling mechanism.

In our study, moderate or severe descent of the rectum was noted in 94% of patients with fecal incontinence. Increased perineal descent of the posterior pelvic floor compartment was also reported by Goei (5). In addition, our results show that abnormal descent of the posterior pelvic floor compartment is often combined with abnormal descent of the middle or anterior pelvic floor compartment. These findings support the concept that pelvic floor weakness is often generalized and involves more than one compartment, even in patients with manifestations that can be attributed to one pelvic floor compartment (28). The descending perineal syndrome is a manifestation of pelvic floor weakness, which may result from a combination of obstetric trauma, chronic straining, and pudendal neuropathy (29). This syndrome is characterized initially by predominant symptoms of constipation that are subsequently followed by fecal incontinence. The prevalence of pelvic floor descent in patients with fecal incontinence is most likely a consequence of pudendal nerve impairment (7).

Figure 4

Figure 4: Midsagittal MR image (22.4/10.7) in a 65-year-old woman with postdefecation leakage, urge incontinence, and a history of one vaginal delivery and hysterectomy, obtained at defecation shows a moderate enterocele (*) containing portions of the small and large bowels and leading to outlet obstruction. A large anterior proctocele is visible, with incomplete evacuation of the contrast agent (arrow). A large rectal descent (anorectal junction, 6.7 cm below the PCL) and a small cystocele (bladder *[B]* base, 1.1 cm below the PCL) are also visible (Movie 3, *http://radiology.rsnajnls.org/cgi/content/full/2402050648/DC1).*

Figure 5

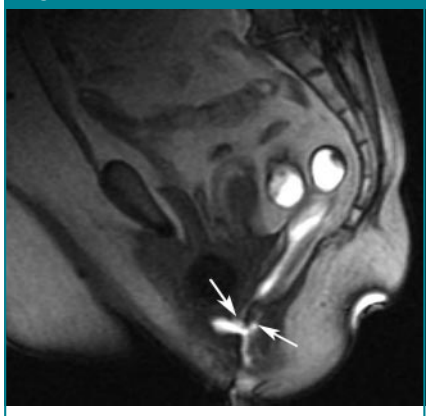


Figure 5: Midsagittal spoiled gradient-recalled-echo MR image (22.2/10.6) in a 60-year-old woman with passive fecal incontinence and a history of two vaginal deliveries, obtained at the end of defecation shows an internal prolapse (arrows) with a moderate anterior proctocele (sagittal diameter, 2.2 cm). Additional findings include a moderate cystocele (bladder base, 4.2 cm below the PCL), a moderate vaginal descent (vaginal vault, 4 cm below the PCL), and a large rectal descent (anorectal junction, 8 cm below the PCL) (Movie 4, *http://radiology.rsnajnls.org/cgi/content/full/2402050648/DC1).*

Similar to the findings of Rex and Lappas (6), we found a high prevalence of proctoceles in our patients. In our study, 34% of patients had a clinically substantial anterior proctocele (ie, >2 cm in depth); of these patients, 61% retained some contrast material. Proctoceles of rectums that retain contrast material have been identified as a possible cause of fecal incontinence in other studies (1,10).

In our study, the frequency with which internal rectal prolapse was detected with MR defecography was remarkable. We also noted an internal rectal prolapse associated with anterior proctocele in five of the 10 patients with internal prolapse. The association of anterior proctocele and internal rectal prolapse has been described by Marti et al (30). Diagnosis of internal rectal prolapse is important because internal rectal prolapse may be a cause of fecal incontinence. Surgical repair of internal rectal prolapse by means of rectopexia relieves incontinence in up to 75% of patients (31).

We agree that conventional evacuation proctography and MR defecography have limited value in establishing a diagnosis of fecal incontinence. Anal US, manometry, and electrophysiologic examinations are better techniques for this purpose (32). However, as we have shown, MR defecography is useful in patients who are considered candidates for surgical treatment of incontinence. In these patients, MR defecography is used to detect previously unknown findings in the anterior, middle, or posterior pelvic compartments, and the findings lead to changes in the surgical approach.

Some clinicians may argue that all the findings detected with MR defecography may also be detected with a clinical examination. However, there is general agreement that at least some of the findings, such as the extent of evacuation of an anterior proctocele or the presence or absence of an internal rectal prolapse, are difficult to diagnose on clinical grounds alone. Moreover, quantification of some of the findings, such as anterior proctoceles, is considered important when choosing an adequate treatment.

In our study, MR defecography findings led us to change the surgical therapy in 67% of the patients in whom some form of surgery was performed to treat fecal incontinence. Thus, at our institution, MR defecography is part of the work-up of patients with fecal incontinence who are considered surgical candidates.

Our study had several limitations. First, this was a retrospective study. However, at our institution, MR defecography is performed in a standardized manner, and the treatment of patients with fecal incontinence—particularly the criteria for surgical therapy based on findings at MR defecography—is largely standardized. Second, the fact that patients were selected from a tertiary referral center might have resulted in selection bias. Third, one of the radiologists who performed the retrospective image interpretation (without any knowledge of clinical information) was also involved in the prospective image interpretation (with knowledge of clinical information); therefore, the interobserver agreement data might have been biased. Fourth, caution has been recommended in the interpretation of both conventional evacuation proctography findings and MR defecography findings because proctoceles, pelvic descents, enteroceles, and other abnormalities are frequently found in asymptomatic volunteers, thus resulting in an overlap between the findings in symptomatic patients and asymptomatic subjects (18,27,33).

In conclusion, our study has shown that MR defecography in patients who are considered candidates for surgical therapy may demonstrate a broad variety of abnormal findings, which may directly affect prospective surgical therapy.

Table 5

Comparison between Prospective and Retrospective Evaluation of MR Images

Abnormality	Prospective*	Retrospective*	κ Value†	*P* Value
Cystocele				
Total	34	39	0.64 (0.36, 0.94)	<.001
Small	13	19		
Moderate	21	20		
Vaginal vault descent				
Total	25	19	0.74 (0.55, 0.93)	<.001
Small	5	. . .		
Moderate	15	14		
Large	5	5		
Enterocele				
Total	19	16	0.87 (0.74, 1.0)	<.001
Small	2	. . .		
Moderate	6	5		
Large	11	11		
Rectal descent				
Total	47	47	1.0 (1, 1)	<.001
Moderate	4	4		
Large	43	43		
Anterior proctocele				
Total	28	35	0.72 (0.53, 0.91)	<.001
Small	12	18		
Moderate	11	11		
Large	5	6		
Internal rectal prolapse	8	10	0.91 (0.82, 0.96)	<.001

Note.—Prospective and retrospective data differ because readout was performed at different times.

* Data are number of patients.

† Data in parentheses are 95% confidence intervals.

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