CONSENSUS STATEMENT

Consensus Definitions and Interpretation Templates for Fluoroscopic Imaging of Defecatory Pelvic Floor Disorders

Proceedings of the Consensus Meeting of the Pelvic Floor Consortium of the American Society of Colon and Rectal Surgeons, the Society of Abdominal Radiology, the International Continence Society, the American Urogynecologic Society, the International Urogynecological Association, and the Society of Gynecologic Surgeons

Ian Paquette, M.D.[1] • David Rosman, M.D.[2] • Rania El Sayed, M.D.[3] • Tracy Hull, M.D.[4]
Ervin Kocjancic, M.D.[5] • Lieschen Quiroz, M.D.[6] • Susan Palmer, M.D.[7]
Abbas Shobeiri, M.D., M.B.A.[8] • Milena Weinstein, M.D.[9] • Gaurav Khatri, M.D.[10]
Liliana Bordeianou, M.D., M.P.H.[11]• Members of the Expert Workgroup on Fluoroscopic Imaging of Pelvic Floor Disorders

1 Department Colorectal Surgery, University of Cincinnati, Cincinnati, Ohio
2 Department of Radiology, Pelvic Floor Disorders Center at the Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts
3 Department of Radiology, Cairo University Pelvic Floor Centre of Excellency and Research Lab at Cairo University Faculty of Medicine and Teaching Hospitals, Cairo, Egypt
4 Department of Colorectal Surgery, Cleveland Clinic Hospitals, Cleveland, Ohio
5 Department of Urology, University of Illinois, Chicago, Illinois
6 Department of Obstetrics & Gynecology, University of Oklahoma, Oklahoma City, Oklahoma
7 Department of Radiology, Keck Medical Center of USC, Los Angeles, California
8 Department of Obstetrics & Gynecology, University of Virginia, INOVA Women's Hospital, Falls Church, Virginia
9 Department of Obstetrics & Gynecology, Massachusetts General Hospital Pelvic Floor Disorders Center, Harvard Medical School, Boston, Massachusetts
10 Department of Radiology, UT Southwestern Medical Center, Dallas, Texas
11 Section of Colorectal Surgery, Massachusetts General Hospital Pelvic Floor Disorders Center, Harvard Medical School, Boston, Massachusetts

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Correspondence: Liliana Bordeianou, M.D., Massachusetts General Hospital, Division of General and Gastrointestinal Surgery, 15 Parkman St, WACC 460, Boston, MA 02114. E-mail: lbordeianou@mgh.harvard.edu

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The Pelvic Floor Disorders Consortium (PFDC) is a multidisciplinary organization of colorectal surgeons, urogynecologists, urologists, gynecologists, gastroenterologists, radiologists, physiotherapists, and other advanced care practitioners. Because all these specialists are dedicated to the care of patients with pelvic floor disorders, but sometimes approach evaluation and treatment of patients with pelvic floor complaints with differing perspectives, the PFDC was formed to arrange collaboration between these specialties. The PFDC's goal is to collaborate to develop and evaluate educational programs, create clinical guidelines and algorithms, and promote overall quality of care in this unique population. The following recommendations arising from this effort represent the work product of the *PFDC Working Group on Fluoroscopic Imaging of Pelvic Floor Disorders.* The objective was to generate inclusive, rather than prescriptive, guidance for all practitioners, irrespective of discipline, in the care and treatment of patients with pelvic floor disorders. This process was intended to clarify which domains of fluoroscopic defecography have consensus among mul-

tidisciplinary experts, and which areas deserve further dedicated research.

STATEMENT OF THE PROBLEM

Fluoroscopic defecography (FD) is a critical tool long used in the evaluation of defecatory disorders. Like most imaging studies, such examinations are ordered by multiple different specialties each with their own needs from the examination and different means of interpretation. Fluoroscopic defecography provides functional evaluation during defecation and demonstrates the interplay of small bowel, distal colon, rectum and the pelvic organs during evacuation. There are many excellent articles written on FD from radiological,[1] colorectal,[2] or urogynecologic perspectives.[3] However, different definitions of pathology, different protocols, and contradicting interpretations of these tests are often described. This lack of consensus leads to a significant variation in performance, use, and applicability to clinical practice among health care providers and institutions and even within institutions.[4] As a result, research efforts or publications that use radiological images to quantify or define studied pathology cannot be pulled together into meaningful meta-analyses, and data cannot be easily compared from study to study. Furthermore, imaging may need to be repeated when the studies are performed at outside institutions due to variations in technique or interpretation. Discordant findings on such studies may contribute to patient and physician confusion, particularly because patients often develop perceptions regarding the severity of their pathology based on radiological reports.[5,6]

Thus, this effort was undertaken to address some of these inconsistencies by initiating a consensus process that included representatives from colon and rectal surgery, female pelvic medicine and reconstructive surgery, female urology, gastroenterology, physiotherapy, radiology, urology, and their respective advanced practice practitioners, thus allowing for all voices to be heard in discussion to reach unity, which, via an a priory decision by the group, was defined as a 70% consensus. Participants agreed, a priori, that a decision reaching a 70% consensus would be adopted unanimously by the group for the sake of promoting multidisciplinary collaboration and cohesiveness as the minimum suggested baseline. With this understanding, the group convened to review the relevant literature, discuss the current radiological protocols used to perform FD, and provide each other with input on the clinical significance of the various possible radiological observations and measurements. The goal was to create a template for FD technique that is clinically relevant, radiologically feasible, and ultimately useful in efforts to standardize the care of patients with pelvic floor conditions.

Of note, this is not meant to be an exhaustive description or pictorial essay of all disease processes found on FD. Rather, this is an effort to identify areas of consensus across disciplines so that a common language can be utilized to achieve the shared goal of caring for patients with defecatory pelvic floor disorders. Areas where consensus cannot be achieved will become topics for further research to help further standardize best practices in the future.

METHODOLOGY

This document was created at the initiative of the *Pelvic Floor Disorders Consortium (PFDC) Working Group on Fluoroscopic Imaging*. The PFDC is composed of clinicians with demonstrated expertise in the care and treatment of pelvic floor conditions. The Working Group was created by enlisting a subset of Pelvic Floor Consortium members by invitation (Table 1). Invitation criteria included leadership in the field of pelvic floor disorders with academic scholarship and history of cross-disciplinary collaboration. Members of the working group participated in at least 2 group preliminary phone calls and researched an assigned topic. Each topic had at least 2 members assigned, always from different specialties. Each group identified the literature on a relevant topic or controversy and performed a careful review of the literature using a specified format to address these points systematically by using a standardized literature review format.

These reviews involved an organized search of MEDLINE, PubMed, EMBASE, and the Cochrane Database of Collected Reviews performed with an end date of April 1, 2019. Retrieved publications were limited to the English language, but no limits on year of publication were applied. The search terms included "fecal incontinence, urinary incontinence, constipation, lower urinary tract symptoms in men and women, and pelvic floor disorders in men and women." The search strategies used "defecography," "proctography," "defecogram," fluorodefecography," "fluoroscopic," "dynamic," "enterocoele," "omentocele," "rectocele," "intussusception," "contrast," "pubococcygeal line," "constipation," "pelvic floor," "rectal prolapse," "perineal descent," "radiological definition," and "radiological management" as primary search terms. Directed searches of the embedded references from the primary articles were also performed. Criteria for inclusion of the references included articles that described technical components of radiological measurements discussed during the meeting, or clinically relevant literature describing use of radiological imaging in clinical practice. The working groups then presented their preliminary research to the consortium at large for further discussion.

Pelvic Floor Consortium Expert Meeting

The PFDC Expert Meeting convened on June 2, 2019 in Cleveland, Ohio. It included 126 in-person or online par-

TABLE 1. Members of the Expert Panel, in alphabetical order

Author	*Institution*
Bordeianou, Liliana	Massachusetts General Hospital
Paquette, Ian M	University of Cincinnati College of Medicine
Rosman, David	Mass General Massachusetts General Hospital
Atkinson, Sarah J	University of Washington
Ayscue, Jennifer	Medstar Washington Hospital
Basilio, Pedro	Clinica de Saúde Intestinal -Rio de Janeiro, Brazil
	Colorectal Surgeon Institute D'Or de Oncologia - Clinica São Vicente
Bhullar, Jasneet	UPMC Williamsport
El Sayad, Rania Farouk	Cairo University Hospitals
Huang, Emily	Ohio State University
Hull, Tracy	Cleveland Clinic
Khatri, Guarav	UT Southwestern
Krishnamurty, Devi Mukkai	Creighton University
Mimura, Toshiki	Jichi Medical University
Ogilve, James W Jr	Michigan State University
Palmer, Suzanne L	Keck School of Medicine, University of Southern California
Parlade, Albert J	Cleveland Clinic Florida
Ratto, Carlo	Catholic University, Foundation University Hospital
Schizas, Alexis	Guy's and St. Thomas Hospital, London
Snyder, Michael	McGovern School of Medicine
Speranza, Jenny	University of Rochester
Tyler, Kelly	University of Massachusetts Baystate
Wexner, Steven D	Cleveland Clinic Florida
Yamana, Tetsuo	Tokyo Yamate Medical Center
Zutshi, Massarat	Cleveland Clinic

ticipants from the United States, Europe, Asia, England, and Canada. These experts belonged to several subspecialties (colorectal surgery, gastroenterology, urogynecology, urology, physiotherapy, and radiology). There were also members of numerous professional societies involved in the diagnosing and treating of pelvic floor disorders. The event was also audited by formal representatives from the American Society of Colon & Rectal Surgeons (ASCRS), the Society of Abdominal Radiology (SAR), the International Continence Society, the American Urogynecologic Society, the International Urodynamics Association, and the Society Gynecologic Surgeons. The meeting was funded by the ASCRS, who graciously helped host the PFDC Expert meeting the day before the ASCRS annual meeting.

The participants at the expert consensus meeting analyzed all of the proposed radiological definitions measuring or identifying each of the conditions reviewed in this statement, ultimately recommending a synoptic reporting template that included the recommended steps for a thorough and clinically relevant examination, as well as the clinically relevant radiological definitions for common defecatory pelvic floor disorders seen on FD. They labeled this final template as the **"Fluoro**scopic Interpretation Template for the **I**nitial **M**easurement of **Pa**tient Reported Defecatory Pelvic Floor **C**omplain**t**s" or Fluoro-IMPACT (Table 2). For a recommendation to make it into the Fluoro-IMPACT template, an expert consensus was required. Consensus was defined as at least 70% agreement or more from the in-person or remote voting participants at the PFDC Meeting. When consensus was not reached, the workgroups performed additional research and literature reviews to clarify additional questions raised. A subsequent committee meeting was held to conduct final voting on the recommendations and definitions listed in the Fluoro-IMPACT document, while keeping the directives of the expert consensus panel discussions in mind.

Final Review

Once the document was finalized, the proposed recommendations were reviewed by the ASCRS Pelvic Floor Disorders Steering Committee. This steering committee develops clinical practice recommendations for colorectal pelvic floor disorders based on best available evidence. The ASCRS Steering Committee edited the document and sent it to the ASCRS Executive Committee for final approval for publication. Similar reviews and endorsements were also given by the American Urogynecologic Society Publication Committee, the SAR Board of Directors, the SAR Disease Focus Panel on Pelvic Floor Dysfunction, the International Continence Society Board of Directors, and supported by the Board of Directors of the Society of Gynecologic Surgeons. In accordance with their policy, the International Urogynecological Association Board of Directors distributed the document for review by its entire membership and subsequently endorsed the document as well.

RECOMMENDATIONS

General Considerations

1. Findings on fluoroscopic defecography report are highly dependent on patient effort, and the quality of defecatory effort should be reported as "good," "moderate," or "poor" to provide clinical context (Degree of consensus: 100%).

Fluoroscopic defecography is performed following careful patient counseling to assure their understanding of the goal of the study, its benefits, and its limitations. The study generates significant patient anxiety, and care must be taken to assure that the radiology team is caring, professional, and understanding of the challenges faced by patients when asked to evacuate in public.[7] The patient should be carefully coached to empty fully and push/bear down completely during the test to assure maximum visualization of pathology, without having to worry about spillage of contrast or "accidents." Radiologists should be aware that many of patients experiencing evacuatory

TABLE 2. The clinically relevant interpretation synoptic template based on these consensus recommendations

TEMPLATE

The participants at the expert consensus meeting analyzed all of the proposed radiological definitions measuring or identifying each of the conditions reviewed in this statement, ultimately recommending a synoptic reporting template that included the recommended steps for a thorough and clinically relevant examination, as well as the clinically relevant radiological definitions for common defecatory pelvic floor disorders seen on fluoroscopic defecography. They labeled this final template as the Fluoroscopic Interpretation Template for the Initial Measurement of Patient Reported Pelvic Floor Complaints (Fluoro-IMPACT)

TECHNIQUE

The patient was informed of the nature of the procedure. An external radiopaque marker [was/was not] placed on the perineum. Fluoroscopy and spot images were obtained in the lateral projection with patient in sitting position while at rest and during defecation.
Scout anteroposterior radiograph of lower abdomen and pelvis [discuss findings].
Digital rectal examination: [not performed/ mention presence or absence of masses, sphincter tone, etc]
Contrast used:
Rectal: […] cc of barium paste inserted into rectum
Vaginal: [None/ if yes, give type and amount]
Small bowel: [None/ if yes, give type and amount]
Bladder: [None/ if yes, give type and amount]

FINDINGS

Evacuation: Patient made [good/moderate/poor efforts to evacuate/had fecal incontinence and could not be evaluated during evacuation during the test].
Perineal descent: Excessive descent [present/absent] (assess location of anorectal junction at maximal defecation relative to rest or measure relative to PCL).
Anterior compartment: There [is/is no significant] mass effect on the anterior vaginal wall due to bladder descent. Findings [are/are not] consistent with cystocele.
Middle compartment: There [is/is no significant prolapse] of the vaginal apex.
Cul-de-sac hernia (if visible): [None/sigmoidocele, enterocele, peritoneocele (describe and if quantifying measure relative to PCL and vagina)] [extending into the rectovaginal septum to the level of the upper one-third of the vaginal wall/middle two-thirds of the vaginal wall/all the way to the pelvic floor] and extending […] cm below the PCL.
Posterior compartment: There was [complete/incomplete] emptying of the rectum with [no rectal contrast evacuated/one-third of the baseline rectal contrast evacuated/two-thirds of the rectal contrast evacuated/ all rectal contrast still evacuated] at the end of the examination. [Contrast was retained in the entire rectum] [Contrast was retained in the rectocele only].
Anorectal angle:
There is [expected widening/paradoxical narrowing] of the anorectal angle during defecation or attempted evacuation.
Anorectal angle at rest:
Anorectal angle at defecation/attempted evacuation:
The findings [are/are not] consistent with pelvic floor dyssynergia.
Rectocele: [Present/absent] (report size/retention of contrast)
Patient manipulation for defecation: The patient [did use/did not use manipulation to assist emptying [of rectum] [of rectocele] [of both the rectum and rectocele].
Type and effectiveness of manipulation: [Describe/N/A]
Intussusception/prolapse: [Present/absent (report intrarectal, intra-anal, external)]
Other findings: [Both imaging and clinical observation (ie, does the patient have persistent symptoms despite an empty rectum?)]
Radiation exposure:
Fluoroscopy time: XX min; Dose: XX mGy; Dose Area Product: XX Gy×cm^2; Number of Spot films: XX

IMPRESSION

[…]

N/A = not applicable; PCL = pubococcygeal line.

dysfunction may have had a history of prior sexual abuse, and utmost care and kindness is needed to coax patients through this experience.[8]

It is also important to stress that these fluoroscopic images must be obtained in the sitting position on a radiolucent commode (or at the edge of the fluoroscopy table), so as to best mimic physiologic position. When this is not possible, consortium experts agreed (degree of consensus: 81%) that a supine imaging examination (such as MRI) could be acquired, but that the interpretation of pathology in these cases may be difficult, especially if the test is "normal" and its findings do not match clinical impression.

Coaching and support should continue throughout the process of image acquisition to assure patients push hard and try to expel the contrast despite their embarrassment. "Good effort" to empty the contrast should be defined as either complete rectal emptying during the examination, or at least 3 attempts to evacuate. Each attempt should last a minimum of 30 seconds (if unable to fully empty the rectum). If patients do not defecate after 3 tries, they should be asked to expel in the privacy of a bathroom and then have repeat radiographs to see if they were able to evacuate the contrast in the bathroom. In the cases when patients are successful in evacuating in the bathroom but not during the test, their defecatory ef-

fort should be labeled as either "poor" or "moderate," depending on the level of rectal emptying achieved during the test. The emphasis on effort is demonstrated by these images that demonstrate additional pathology as effort is increased (Fig. 1).

2. A radiopaque marker should be placed on the perineal body as a point of anatomic reference (Degree of consensus: 92%).

A perineal marker should be used, because, without a visible landmark, it is difficult to identify the surface of the perineal skin on FD. A perineal marker may be used as a landmark for localization and measurement purposes, and several marking techniques have been presented in the literature. For example, as the rectal syringe or catheter is removed after barium paste instillation, a small amount of barium paste may be injected in the anal canal and at the anal verge to localize the level of the perineum. Although the placed barium paste would localize the perineum, it does not serve as a surrogate for a ruler or an indicator of size. Measurements made on the fluoroscopic images may be calibrated against a radiopaque marker of predetermined size. Palmer et al[9] proposed an example of "a penny (19 mm)" as a marker to be taped to the perineum. Gonçalves et al[10] reported a specially designed marker to visualize the pubococcygeal line (PCL) and perineum for defecography. A barium tablet (13 mm) would also serve the purpose (Fig. 2).

3. The examination should be done under fluoroscopic evaluation, rather than only with static single-exposure radiographs (Degree of consensus: 94%).

Because defecation is a dynamic act that involves a complex interplay of anorectal and pelvic floor muscles and anal sphincters, abnormalities during defecation are best evaluated with real-time imaging. In comparison with spot images alone, real-time FD allows for direct visualization of all phases of evacuation, providing qualitative and quantitative information on the defecatory process. Fluoroscopic defecography remains one of the most appropriate imaging studies to evaluate patients with symptoms of obstructed defecation where commonly encountered pathologies include, but are not limited to, rectoceles, intussusception, cul-de-sac hernias, and anismus.

The technique for performing FD has not changed over the years, but technological advances have allowed for improved image capture techniques. Videotape, CD, and DVD image capture are still being used; however, direct digital capture of real-time fluoroscopy, archived directly to Picture Archiving and Communications Systems, is becoming the most common method for image acquisition.[9,11,12] With Picture Archiving and Communications Systems archiving of cine defecography, FD studies become portable, allowing the referring physician access to the complete examination for easier review and integration into patient care planning.

During the consortium meeting, some concerns were raised regarding the level of radiation exposure to patients during FD. Goi et al[13] demonstrated a mean effective dose equivalent of 4.9 mSV for women undergoing FD, which is approximatively half the amount of a CT of the abdomen and pelvis. To minimize radiation exposure, FD should be obtained only when truly indicated based on clinical findings, particularly in women of childbearing age. Furthermore, radiologists must apply the ALARA (as low as reasonably achievable) principle to minimize radiation exposure to patients and used pulsed fluoroscopic acquisition whenever possible. In patients with contraindications to radiation exposure, alternate studies such as pelvic floor MRI defecography or dynamic pelvic floor ultrasound should be considered. Additional recommendations on

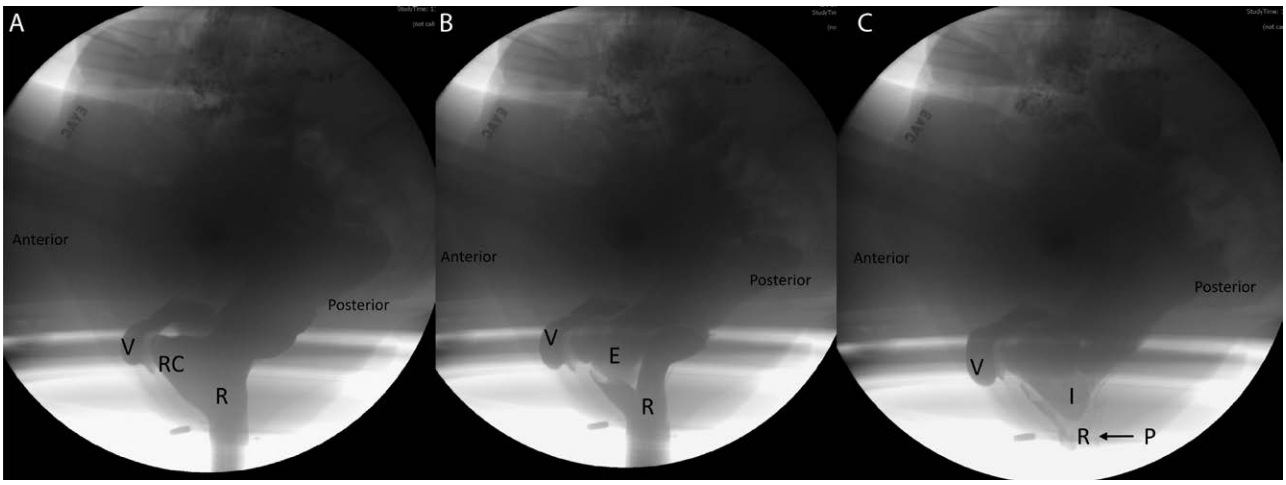

FIGURE 1. The importance of sufficient effort during defecography. The vagina (V) is anteriorly displaced by the rectocele (RC) pushing forward from the rectum (R). There is increasing effort from A to C that demonstrates enterocele (E), prolapse (P), and intussusception of the enterocele (I). A, Initial attempt to defecate failed. B, After the third attempt with good effort, an enterocele (E) is demonstrated with, C, Subsequent demonstration of prolapse (P) and intussusception of the enterocele (I).

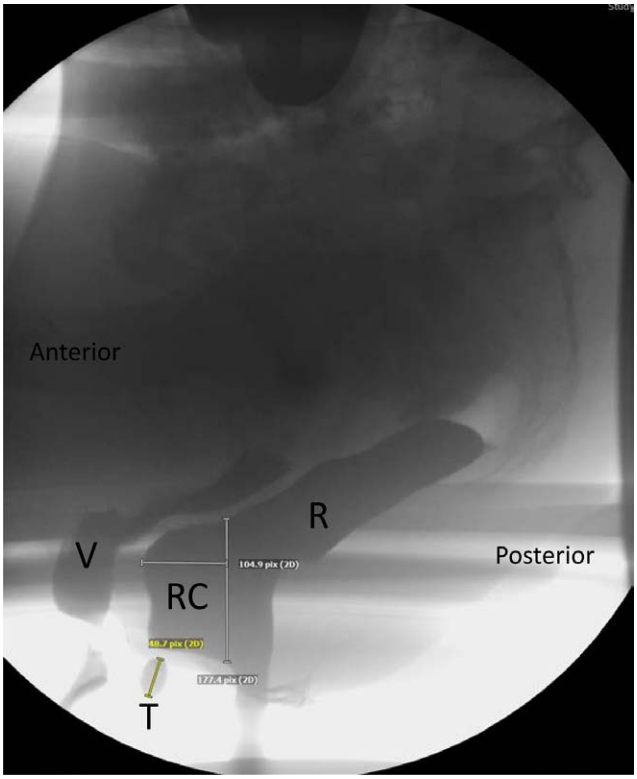

FIGURE 2. How to measure a rectocele. Vertical line indicates the expected location of the anterior wall of the rectum (R). The horizontal line measures the rectocele (RC) protruding into the vagina (V). Size of the rectocele can be estimated by utilizing the 1.3-cm barium tablet as a ruler (indicated by T).

the language and procedures to perform MRI and pelvic floor ultrasound are forthcoming, together with recommended MRI-IMPACT and ULTRASOUND-IMPACT interpretation templates.

Contrast Considerations

1. Vaginal contrast should be used to provide relevant clinical information at defecography (Degree of consensus: 87%).

The literature regarding the instillation of contrast within each pelvic organ for a FD is limited and techniques vary significantly between studies.[14–17] The use of vaginal, bladder, and small-bowel contrast for FD was debated within the consortium, and a consensus was reached that vaginal contrast was beneficial, because the vagina is an important landmark against which all other structures are described to better understand the interplay of small bowel, colon, and rectum during defecation. Adding vaginal contrast is thought to increase ease of identifying abnormal pelvic organ descent including rectocele, enterocele, peritoneocele, and cystocele. To assure full opacification of contrast, we recommend instillation of contrast via either a Foley or a bulb syringe. We do not recommend soaking a tampon and placing it into the vagina because the tampon may function as a pessary, splinting the vaginal wall and confounding interpretation of findings.

2. Bladder contrast need not be used routinely for defecography studies in patients with evacuatory dysfunction (Degree of consensus: 77%).

Instillation of bladder contrast does not contribute to the investigation of evacuatory dysfunction and need not be used routinely in these patients, thus saving time and patient discomfort associated with bladder catheterization. Bladder contrast is, of course, beneficial when performing a cystogram or cystodefecography for patients with predominant anterior compartment or urinary complaints. Although this consensus effort was focused primarily on patients with defecatory dysfunction, the expert panel did feel that referring clinicians would be interested in knowing whether the patient has anterior vaginal vault prolapse in association with a cul-de-sac hernia. This observation can be made, however, with vaginal contrast alone, while minimizing the overall level of patient discomfort. In cases when further details about the bladder anatomy may be needed, other imaging modalities such as MRI would be more beneficial than adding bladder contrast to fluoroscopy.[18]

3. Small-bowel contrast can assist in the identification of enterocele, but there was no consensus on whether it should be routinely used (Degree of consensus: 68%, threshold not reached). Therefore, small-bowel contrast is not recommended as a minimum requirement for routine evaluation of pelvic organ prolapse.

The expert panel debated on the routine use of small-bowel contrast for FD. The proponents for the routine use of small-bowel contrast argued that opacification of small bowel allows for identification of any small-bowel herniation. Small-bowel contrast can add to the anatomical information fluoroscopy can provide and can be considered if the clinical scenario warrants it. The small bowel can enter the rectovaginal space (enterocele), or the rectum and the vagina (prolapse). All of these are substantially easier to identify when the small bowel is visible (Fig. 3). Additionally, cephalad displacement of the opacified small bowel can be seen in the setting of pelvic masses. In some instances, abnormalities such as enterocele can be suggested based on the scout images when small-bowel contrast is utilized (Fig. 4). However, members of the consortium against routine use of small-bowel contrast argued that the content of a cul-de-sac hernia was not relevant to surgical or clinical decision making. It was felt that, regardless of its content (small bowel, sigmoid colon, or omentum), the patient with any type of cul-de-sac hernia would undergo the same treatment. A cul-de-sac hernia can be identified without small-bowel contrast by observing the presence of a wide separation between the vagina and the rectum (Fig. 5). Experts argued that the addition of contrast ex-

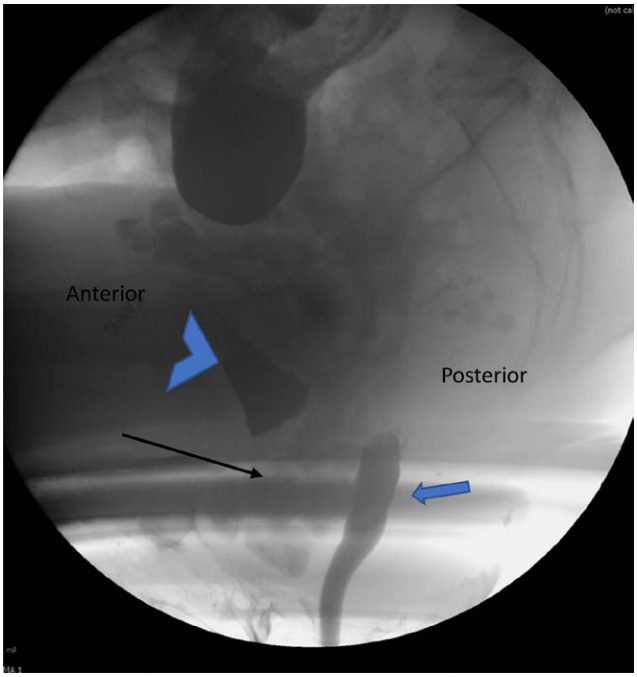

FIGURE 3. Challenges from insufficient small-bowel contrast. The suboptimal opacification of the small bowel makes this enterocele harder to see. Small bowel (long arrow), rectum (short arrow), and vagina (arrowhead).

FIGURE 4. Enterocele on scout image. As can be seen on this scout image before administration of rectal and vaginal contrast, there is extension of the small bowel into the pelvis and deep into the rectovaginal space (arrow).

tended the length and the discomfort of the study, especially given the possible difficulties in expelling barium from the GI tract in patients with added slow-transit constipation. Weighing these pros and cons, the consortium experts voted against routine use of small-bowel opacification, but with a very narrow margin, and with the caveat that bowel contrast could certainly be added to standard radiological protocols per local practice patterns or at the request of referring providers when this additional anatomical information is useful clinically.

Imaging Technique

1. Static images at rest should be captured to obtain a clinical baseline. However, there is no clinical benefit in obtaining initial "strain" images to assess for fecal incontinence and this sequence can be omitted from routine protocols (Degree of consensus:79%).

Contrast leakage during defecography is multifactorial and is related to viscosity of the contrast medium, sphincter strength, rectal compliance, and the anorectal angle. There is a dearth of studies evaluating contrast leakage on defecography as it relates to disease severity or response to therapy. There were 3 studies that evaluated contrast leakage during defecography and correlated it with findings on anorectal manometry. In a study of 50 patients with fecal incontinence, Rex et al[19] concluded that leakage of contrast at rest was a specific but not sensitive predictor of impaired sphincter strength as measured by manometry. In another study evaluating incontinence on defecography, Bielefeldt et al[20] noted leakage of contrast spontaneously in 13 patients, and a majority of these patients (12/13) demonstrated incomplete closure of the anal canal at rest. In a prospective study evaluating 160 consecutive patients referred for both anorectal manometry and defecography, Kruyt et al[21] described using a contrast medium of standard viscosity and scored leakage of contrast during rest, squeeze, Valsalva, and coughing. The patients were classified in 3 groups: fully continent (no leakage in the 3 phases), intermediate (leakage in 1 or 2 phases), and fully incontinent (leakage in all 3 phases). In this study, the degree of leakage correlated with an obtuse anorectal angle; decreased resting pressures and decreased squeeze pressures. However, it was noted that some patients in each group had normal values for anorectal angles, resting pressures, and squeeze pressures.

Although these radiological observations are interesting, most of the clinicians at the consortium meeting felt that the diagnosis of fecal incontinence is ultimately a clinical one. Furthermore, the addition of this sequence could lead to patient confusion and loss of contrast before the clinically relevant evacuation images that would follow. Given the lack of proven clinical relevance, the panel concluded that these images can be omitted.

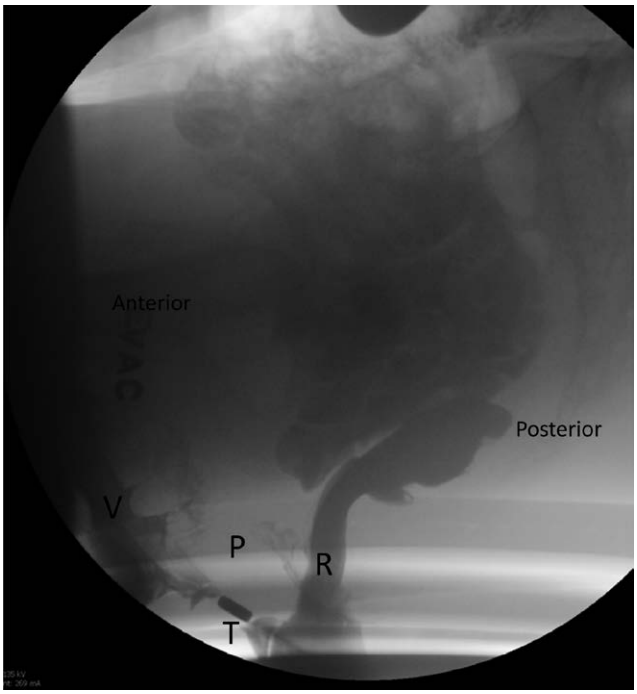

FIGURE 5. Peritoneocele/cul-de-sac hernia. Observe the empty space between the vagina (V) and the rectum (R). This is filled with fat or fluid, and it represents a peritoneocele (P). The rectum (R) can be seen posteriorly, and the vagina (V) is displaced anteriorly by this peritoneocele (P). Its size can be estimated by the presence of the 1.3-cm barium tablet (T).

2. Evacuation images should be obtained, preferably in the sitting position (Degree of consensus: 100%).

Functional evaluation during rectal evacuation is the hallmark of fluorodefecography. One of the advantages of this examination over supine MRI or other imaging examinations is that it can closely simulate the physiologic act of natural defecation when images are obtained in a seated position. Although the literature has shown variable results comparing upright and supine examinations, the upright, seated position is generally preferred when possible. This can be obtained using a raised table and a bedpan or, more conveniently, a fluoroscopic toilet (Fig. 6). Although MR defecography can be performed in the upright position as well, open magnets to facilitate imaging in this position are not available at most centers.

3. Following evacuation of contrast, postdefecation image acquisition should be performed to assure complete evacuation (Degree of consensus: 100%).

Achieving complete emptying is ideal for identification of all pelvic floor defects. Often, additional pathology not seen in the presence of rectal contrast (enterocele, vaginal prolapse) can be visualized after emptying of the rectum. Thus, images should be acquired during maximum strain, ideally after real-time rectal emptying, but also can be obtained after the patient completes emptying in the bathroom if unable to do so under fluoroscopic observation.

FIGURE 6. Fluoroscopic defecography chair/toilet.

Interpretation and Reporting

1. The degree of perineal descent should be described routinely as either "present" or "absent" (Degree of consensus: 95%) if the anorectal junction drops by more than 2 cm (Degree of consensus: 71%). Perineal descent should then be further quantified in centimeters, by measuring the movement of the anorectal junction from its position at rest toward the point of maximum descent with defecation of contrast (Degree of consensus: 82%).

Descending perineum syndrome is defined as an excessive ballooning of the perineum due to pelvic floor laxity that is associated with various symptoms including evacuation difficulty, fecal incontinence, and rectoanal discomfort/pain.[22] Although the measurement of the perineal descent has been reported by many studies, there is still poor consensus on its definition and pathophysiological implications.[23–25] More-

over, anatomical reference points vary among studies in measuring the perineal descent, including PCL, ischial tuberosities, anorectal junction, and perineal skin.[26,27]

Perineal descent (PD) is thought to be an indicator of poor prognosis due to complete pelvic floor decompensation, and it should be reported while describing other forms of prolapse. Following discussion of various modes of quantification of PD experts agreed that it is best measured or identified using the anorectal junction (point of angulation of the anorectal angle). It was thought that this landmark is most consistent both at rest and at the point of its lowest descent during evacuation.

Expert discussions on grading of PD noted that, whereas descent of the perineum can be easily measured or identified during FD, the literature is mixed in terms of what defines abnormal descent and its overall clinical significance in terms of pelvic organ prolapse and obstructed defecation. A recent systematic review on a large series of patients who had obstructed defecation and prolapse found PD in 44.4% (36.2%–52.7%) of patients.[27] Measurement of the descent of the perineum as the distance of the anorectal junction below the PCL has been performed both at rest and during straining; however, most studies focus on measuring descent during straining from a seated position.[28] Descent seen in healthy volunteers averages 2 cm,[26] and various authors have defined excessive descent ranging as greater than 2 to 3.5 cm.[23,29–32] Excessive descent of the perineum or PD is correlated with advanced age, delayed pudendal nerve terminal motor latency, symptoms of incontinence, and a higher number of vaginal deliveries.[33] Radiographically, PD is associated with increasing size of rectocele, sigmoidocele, and rectal intussusception (Video 1 http://links.lww.com/DCR/B385). Clinically, however, multiple studies have reported no correlation of PD with severity of symptoms, success of biofeedback therapy, or quality of life.[25,33–36] Although the degree of PD can be lessened after ventral rectopexy,[36] only 1 retrospective series identified an association between improved PD and symptomatic improvement after sacrocolpoexy.[37]

Ultimately, the experts concluded that pending further understanding of the relevance of PD on overall patient prognosis, it is probably best to report PD as measured in centimeters, without assignment of grades that have not been validated clinically. They agreed that further studies would be needed to assess whether the finding of PD on FD is associated with a decrease in the success of surgical repairs and whether its presence or absence could potentially be used for patient counseling and setting of expectations.

2. The presence or absence of anorectal angle relaxation should be described and quantified by measuring the anorectal angle (Degree of consenus: 80%).

Pelvic floor dyssynergia, which is defined as abnormal constriction of either the puborectalis (paradoxical contraction of puborectalis) or the anus (anismus) during the defecatory effort is a very common cause of defecatory dysfunction.[38] This diagnosis is frequently missed on other forms of testing, including manometry or electromyography, yet it is very important clinically because it is very treatable with biofeedback. Furthermore, the presence or absence of dyssynergia in the setting of other anatomical abnormalities can exacerbate symptoms, prompt premature surgery, and lead to poor long-term outcomes when untreated and unrecognized.[39] Given these clinical considerations, radiological recognition of dyssynergia is essential and it can be done by a careful evaluation of the changes to the anorectal angle.

The anorectal angle is the angle between a line parallel to the posterior wall of the ampullary portion of the rectum and a line drawn along the anal canal (Fig. 7, Video 2 http://links.lww.com/DCR/B386). This angle is observed during Kegel and at peak straining during defecography and compared to the angle at rest. The angle should become more acute during Kegel. In healthy individuals, the resting angle is approximately 85 to 96 degrees, which decreases by 10 to 15 degrees during Kegel and becomes more obtuse during straining in comparison to the angle at rest[40,41] (Fig. 8). However, due to poor reproducibility, many radiologists do not measure the actual degree of change in the anorectal angle, and instead comment on whether the angle widens, narrows, or stays the same.[42]

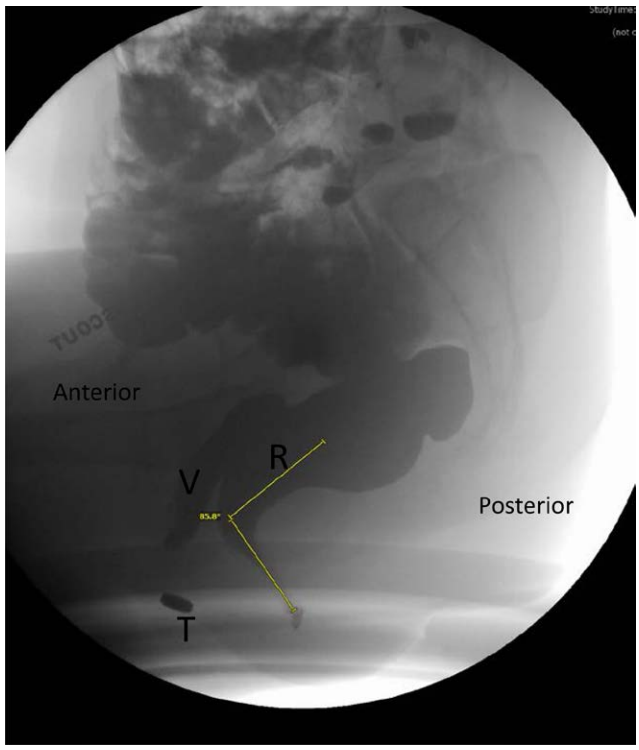

FIGURE 7. Approximation of the anorectal angle. The anorectal angle is measured by drawing a line along the rectal ampulla (R) and a second line along the axis of the anal canal. Additional landmarks: vagina (V), radiopaque barium tablet (T).

The consortium discussed the options of measuring the degree of changes in the anorectal angle versus only commenting on the direction of the angle change, but ultimately felt that a quantitative measurement of the angle would be most meaningful in clinical practice, acknowledging that the precise value of the angle may at times be difficult to obtain and reliably reproduce. A recommendation was also made to add further detail to the description by adding information on whether the anus opened or stayed closed during attempted evacuation.

3. The pubococcygeal line should be the reference point from which to quantify prolapse of abdominal organs (Degree of consensus: 95%).

Radiological evaluation of pelvic organ prolapse is highly relevant in clinical management of patients with defecatory disorders. It is felt that the lack of recognition and treatment of all pelvic organ compartments simultaneously leads to frequent recurrences of prolapse in the untreated compartments, consecutive procedures, and poor functional outcomes.[43]

It was noted that in FD no fixed landmark was ideal because the starting and finishing positions of the organs are variable, and what is most important is their absolute movement and movement relative to each other rather than to a fixed landmark. However, because some desire a reference landmark, the PCL was chosen as the best of the options to be concordant with MRI. The PCL is drawn from the inferior border of the symphysis pubis to the coccygeal extremity

However, because of decompensation of the pelvic floor, the PCL, while serving as a reference, can lack both sensitivity and specificity. During fluorodefecography, one can visualize rectal or vaginal prolapse above this line and can also see the defecatory organs extend below without prolapsing, thus allowing the observer to bypass fixed landmarks in exchange for the direct visualization of the organs during prolapse.

4. All middle compartment structures and hernias into the rectovaginal septum, such as enteroceles, sigmoidoceles, or peritoneoceles, should be described by observing their movement in relationship to the PCL in centimeters. Additional details should include size and location in relationship to the vagina by specifying the lowest extent of the hernia as being to the "top of vagina," "middle of vagina," or "on pelvic floor" (Degree of consensus: 79%). Additional grading of pathology as low/high grade or grade 1 to 4 is not clinically relevant and is not encouraged (Degree of consensus: 70%).

The presence of cul-de-sac hernias is clinically important when it comes to our expectations in regard to the success of medical therapy or biofeedback when it comes to managing patients with symptoms of obstructed defecation syndrome, as well as patients with symptoms of posterior vaginal wall prolapse. Furthermore, the presence or absence of this pathology may change surgical management based on the location of the small bowel, which can enter the rectovaginal space (enterocele), the rectum (enterocele with intussusception), or the vagina (enterocele with vault prolapse). For example, a patient being treated for rectal prolapse and vault prolapse may be advised regarding a concomitant colposuspension.[44] Conversely, a patient with vaginal vault prolapse and concomitant rectal intussusception may require additional rectopexy with ventral mesh for a complete repair of their pelvic floor pathology.

It is important to note that a normal cul-de-sac may extend 4 to 5 cm below the level of the vaginal apex along the posterior vaginal wall, and that the small bowel or sigmoid colon in the posterior cul-de-sac is commonly found in healthy, asymptomatic women. This should not be considered pathologic unless the rectovaginal space is separated and these structures begin to approach the pelvic floor and cause mass effect on neighboring organs.[3,8]

The clinicians felt that "grades" assigned during FD did not provide added clinical benefit and that the reporting system should be simplified. A recommendation was made to measure the inferior extent of cul-de-sac hernias

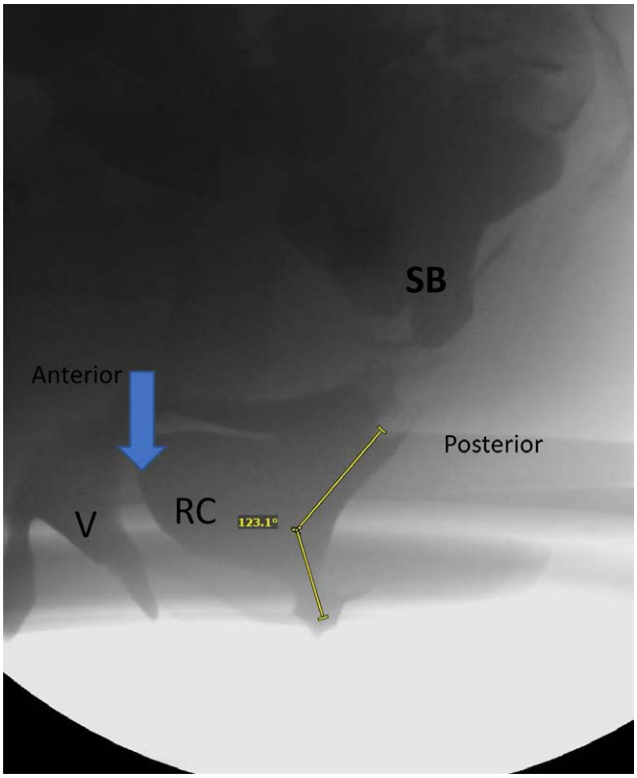

FIGURE 8. Anorectal angle during evacuation. During evacuation, there is a large rectocele (RC) pushing the vagina (V) anteriorly. There is an obtuse anorectal angle. There is no evidence of widening of the pelvic cul-de-sac (arrow). Small bowel (SB) does not drop into the cul-de-sac.

in centimeters relative to the PCL by using a perpendicular line from the PCL to the lowest margin of herniated content during maximum defecatory effort.[45] The consortium members noted, however, that ultimately the descent is only relevant while understanding the relationship of these organs to the vagina and rectum, which presumably are also dropping at the same time. Experts agreed that a good radiological report would also describe the relationship of the cul-de-sac hernia in relationship to the rectovaginal septum. They suggested that most of these herniations are only clinically relevant when they begin to enter the rectovaginal septum (and not when they drop below the PCL because of perineal descent). Consensus was reached that the herniation into the rectovaginal septum should be carefully described, especially if this occurs while the vagina or rectum begin to prolapse at the same time (Video 2 http://links.lww.com/DCR/B386). Finally, clinicians agreed cul-de-sac hernias can also be an incidental finding, even in its most dramatic radiological form. They urged interpreting clinicians to avoid verbiage connoting grades of severity (eg, "high grade" or "stage 4") to allow ultimate assessment with physical examination and symptom severity.

5. Rectoceles should be quantified in centimeters, by measuring the maximal displacement of the anterior rectal wall from the expected resting position during defecation (Degree consensus: 96%). Further characterization should include information regarding rectocele emptying, rectal emptying, need for digitation or pressure to achieve complete emptying, and degree of concomitant displacement of the posterior vaginal wall, if any. Additional grading of pathology as low/high grade or small/large is not clinically relevant and is not encouraged (Degree of consensus: 70%).

Rectoceles (Fig. 9) are thought to be a common cause of obstructed defecation syndrome, and may be associated with symptoms of straining, splinting, and pain with defecation. When small, rectoceles are best visualized on imaging. Over time, rectoceles may be associated with intussusception and rectal prolapse.

Radiographically, rectoceles are best seen during the evacuation phase with maximum strain. Much has been written about whether an anterior rectocele measuring less than 2 cm is clinically significant when compared to larger rectoceles. Although rectoceles may be classified based on size, the members of the consortium felt that the classification of rectocele requires significant clinical correlation and that radiographic assignment of severity is not helpful.[15,46–48] The consortium agreed, however, that he appropriate measurement of anterior rectocele must be performed to allow future research and to avoid interobserver variation. Measurement is considered to be similar in plain radiographic and MR modalities.[49]

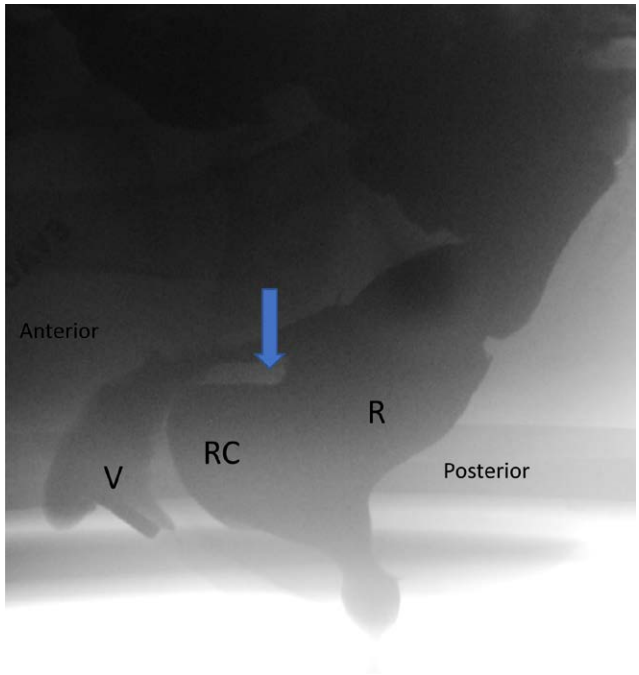

FIGURE 9. Rectocele. This anterior rectocele (RC) is pushing the wall of the vagina (V), but the anterior rectal wall intussusception (arrow) does not block the emptying of the rectum (R).

Appropriate measuring technique has been described previously and should be standardized (Fig. 2, Video 2 http://links.lww.com/DCR/B386).[31,50,51] In addition to size quantification, the radiological report should include a comment on whether the patient was able to fully empty the rectocele at defecation, or if there was retained contrast, and whether the patient used digital manipulation to empty the rectocele. The finding of digital manipulation suggests that the symptoms caused by the rectocele are not likely to improve with biofeedback alone.[52]

6. At minimum, internal intussusception should be quantified as either "intrarectal," "intra-anal," or "external" (Degree of consensus: 75%). Additional scoring to quantify the mobility of the anterior rectal wall versus the posterior rectal wall circumferentially (Oxford Scale) was much debated, but experts voted against mandating its routine use in clinical practice as the bare minimum reportable threshold (Votes for the Oxford Scale: 67%, consensus not reached).

A relatively recent body of literature suggests the possibility that the radiological identification of rectorectal or rectoanal invagination of the rectal wall during straining known as "internal intussusception" may be of clinical relevance. Some experts argue, in particular in the colorectal literature, that this leads to symptoms consistent with obstructed defecation syndrome, with the telescoping of the intussusception leading to a mechanical outlet obstruction.[31] However, there are sceptics who point out that internal intussusception has also been identified in 20% to 50% of asymptomatic volunteers on defecography and

that the radiographic findings of intussusception alone have not been shown to correlate with rectal emptying or an increase in constipation severity.[53]

Nonetheless, all consortium experts agreed that internal intussusception should be commented on as present or absent on defecography. The intussusception usually can be seen originating 6 to 8 cm above the anal canal at the level of the main rectal fold and can be either anterior, circumferential, or posterior in location.[31,54] This is best visualized after a forced evacuation. Identification of the upper point of the invagination and where it descends into the anorectum can be measured and graded as intrarectal, intra-anal, or external (extra-anal).[36,55–59] It should be recognized that external (extra-anal) intussusception is also called rectal prolapse, and these terms are interchangeable.

The consortium debated the minimum grading requirement when describing radiographic intussusception. It was noted that most of the relevant colorectal literature suggests that the Oxford grading score is one of the most utilized scales when documenting rectal intussusception.[59,60] Its advocates argued that the scale provided the most descriptive classification system, thus allowing for better future research on the topic. However, others felt that the gradation was too complex for routine clinical care and that the simpler reporting option that is also used in the literature, and in which authors simply separate intussusception based on its degree of invagination, intrarectal intussusception, intra-anal intussusception (Video 1 http://links.lww.com/DCR/B385), and external (extra-anal) intussusception (Video 3 http://links.lww.com/DCR/B387), or rectal prolapse maybe more clinically relevant when it comes to making the decision for surgery.[61,62]

7. After maximal evacuation or after maximal patient effort, the degree of rectal emptying should be quantified relative to initial rectal contrast volume ("1/3 volume evacuated," "2/3 volume evacuated," and "complete evacuation") (Degree of consensus: 94%).

Understanding the degree of rectal emptying is clinically relevant for referring physicians, and allows for an assessment of the completeness of the examination. An examination with only one-third rectal emptying would be potentially less sensitive for pelvic floor pathology than one in which the rectum empties completely. The experts agreed that the degree of rectal emptying should be assessed subjectively by comparing the visualized resting rectal volume at the beginning and the end of the examination. The amount evacuated should be reported relative to the initial volume in fraction of thirds.

CONCLUSION

Consensus was reached by the PFDC on many relevant technical and reporting considerations of FD. A clinically relevant interpretation synoptic template was suggested based on these consensus recommendations (Table 2). These recommendations and the associated interpretation template are advocated as the minimum requirements when performing FD in patients with evacuation disorders of the pelvic floor, but can be augmented with additional radiological maneuvers and report elements that may be unique to other indications or practice patterns at specific institutions.

ACKNOWLEDGMENTS

A complete list of the members of the Expert Workgroup on Fluoroscopic Imaging of Pelvic Floor Disorders is provided in Table 1.

KEY WORDS: Defecography; Dynamic defecogram; Fluorodefecography; Pelvic floor proctogram.

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