ACR Appropriateness Criteria Pelvic Floor Dysfunction

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Abstract

Pelvic floor dysfunction is a common and potentially complex condition. Imaging can complement physical examination by revealing clinically occult abnormalities and clarifying the nature of the pelvic floor defects present. Imaging can add value in preoperative management for patients with a complex clinical presentation, and in postoperative management of patients suspected to have recurrent pelvic floor dysfunction or a surgical complication. Imaging findings are only clinically relevant if the patient is symptomatic. Several imaging modalities have a potential role in evaluating patients; the choice of modality depends on the patient’s symptoms, the clinical information desired, and the usefulness of the test.

The ACR Appropriateness Criteria are evidence-based guidelines for specific clinical conditions; they are reviewed every 3 years by a multidisciplinary expert panel. The guideline development and review include an extensive analysis of current medical literature from peer-reviewed journals, and the application of a well-established consensus methodology (modified Delphi) to rate the appropriateness of imaging and treatment procedures by the panel. In instances in which evidence is lacking or not definitive, expert opinion may be used to recommend imaging or treatment.

Key Words: Appropriateness criteria, pelvic floor dysfunction, fluoroscopy, ultrasound, MRI

SUMMARY OF LITERATURE REVIEW

Introduction/Background

Pelvic floor dysfunction is common and is an umbrella term for conditions such as urinary incontinence, pelvic organ prolapse (POP), anal incontinence, and defecatory dysfunction. History and physical examination are the key elements of patient evaluation. In addition, radiologic tests such as fluoroscopy, MRI, and ultrasound provide information about the pelvic floor. The availability and incorporation of these tests in clinical practice is not universal. Added value of radiologic imaging is in areas in which clinical evaluation is limited, such as severe or recurrent prolapse, enteroceles, and defecatory dysfunction. Although patients may have a predominant presenting symptom, pelvic floor abnormalities often involve multiple sites\textsuperscript{[1,2]}. Assessment of all the pelvic compartments allows repair of all defects in a single surgical procedure\textsuperscript{[3-5]}. 

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Overview of Radiologic Imaging Modalities

Mobility of the pelvic viscera is captured in real time by fluoroscopy and ultrasound. Organ opacification is required for fluoroscopy. Patients are imaged seated on a commode to maximize stress on the pelvic floor, replicate conditions causing symptoms, and assess the effectiveness of patient maneuvers to alleviate discomfort. For these reasons, fluoroscopic cystocolpoproctography (CCP), with opacification of the bladder, small bowel, vagina, and rectum, is the traditional imaging method for evaluating pelvic floor dysfunction.

Ultrasound is an important emerging technique in urogynecology for preoperative and postoperative imaging [6]. Transabdominal and transvaginal probes can be used for transperineal or transvaginal scanning of the bladder, urethra, and vagina during rest and strain. The anal sphincter is demonstrated with endoanal ultrasound. The patient is typically imaged without rectal contrast, which is not optimal for evaluating defecation disorders. In the postoperative patient, ultrasound has an important role in showing surgical implants and structural abnormalities. Ultrasound is readily available, but is operator dependent and requires appropriate skills, especially for anal sphincter and 3-dimensional imaging.

MRI has inherent soft-tissue contrast and lacks ionizing radiation. Dynamic MRI during patient straining or defecation demonstrates mobility of the pelvic organs and changes in the genital hiatus. Static MRI displays the morphology of the anal sphincter and pelvic floor musculature. Patients are typically imaged in the supine position, which can limit assessment of defecatory dysfunction. Acute, typically postoperative, conditions affecting patients are evaluated with CT.

Pelvic Organ Prolapse

POP is abnormal descent of the vagina, involving the anterior wall, posterior wall, and/or apex [6]. This is usually secondary to protrusion of adjacent pelvic viscera and can be symptomatic. Abnormal descent can be due to cystocele, uterine procidentia, enterocele, or rectocele [7].

The limitations of physical examination create a role for imaging in patients with POP. Prolapsing pelvic viscera are assessed only indirectly by palpation, which hinders correct identification. In addition, support defects are underdiagnosed on physical examination, compared with surgical assessment [8]. Clinical examination tends to work better in patients with anterior and middle-compartment prolapse, higher stages of prolapse, and those with multiple defects. However, in severe prolapse, the contribution of specific viscera can be difficult to delineate with this method [8,9].

Imaging identifies the specific pelvic viscera that are causing a bulge in the vagina. In patients with severe prolapse, this delineation of the involved viscera can alter the approach to surgical repair [10]. In addition, imaging confirms whether clinically diagnosed POP is present, and can reveal POP in clinically unsuspected compartments, both of which can alter diagnosis and affect operative management [10,11]. Of all the prolapsing pelvic viscera, enterocele in particular is diagnosed more often on imaging compared with physical examination [12,13]. Approximately 50%-80% of enteroceles seen on fluoroscopic CCP are missed on physical examination [10,13]. More enteroceles have been reported on MRI, compared with physical examination, as well [9]. In addition, most sigmoidoceles seen on imaging are clinically occult [13].

Therefore, radiologic imaging can complement the clinical evaluation of POP by revealing clinically occult abnormalities and evaluating patients with complex presentation. Global assessment is necessary, as prolapse is often seen in multiple compartments, even though one is predominantly symptomatic [1,2,7,14,15]. Overdistended viscera can impede prolapse of other organs and should be avoided during imaging. Fluoroscopic CCP, because it is performed with the patient in the seated position and with increased abdominal pressure during defecation, is the main radiologic test to evaluate patients with POP [7,16]. Dynamic MRI of the pelvis is a feasible alternative in situations in which defecatory dysfunction is not the primary concern; visualization of the soft tissues of the pelvic floor is desired; radiation is a concern; fluoroscopic equipment is unavailable; or expertise in performing fluoroscopic studies is limited. Although MR defecography with the patient in the seated position on a commode, similar to fluoroscopic CCP, would be ideal, the lack of availability of such MRI scanners in general practice is a limitation [17].

As with fluoroscopic CCP, POP can be depicted in all compartments with MRI [15]. The detection rate of POP has been reported to be lower on supine MRI compared with fluoroscopy and upright MRI, in particular for enteroceles and MRI scans without rectal contrast [17,18]. Rectal contrast, repeated Valsalva maneuvers, and defecation can help reduce false-negative results for POP [14,15,18-21]. Incomplete evacuation of rectal contrast due to a supine patient position on MRI can result in underestimation of the severity of POP [16-18].

Transperineal ultrasound, like fluoroscopic CCP and MRI, demonstrates bladder, urethral, and cervical hypermobility [22]. Other than showing anal sphincter defects, the role of ultrasound in the posterior compartment is less clear [12,22-25]. The patient is typically imaged without rectal contrast on ultrasound, which can limit the full extent of straining and is not optimal for evaluating defecation disorders [26]. Factors influencing ultrasound results include operator expertise, probes used, pressure applied by the operator, and patient position and Valsalva effort [27].
Although POP is easy to recognize on imaging, no consensus has been reached on the method for quantifying prolapse. The pubococcygeal line and midpubic line are the most commonly used reference lines on MRI and fluoroscopic CCP. An additional method on MRI is the hiatus/muscle/organ classification. On ultrasound, prolapse is measured relative to the symphysis pubis. Prolapse is described qualitatively on physical examination or quantitatively using the POP-quantification criteria. Regardless of the reference line used on imaging, studies have shown a poor correlation between clinical and imaging measurements of prolapse, possibly owing partly to differences in measurement landmarks, patient position, patient straining, and interobserver variability. Despite these limitations in correlating imaging with clinical assessment, the added value of radiologic imaging is to show abnormalities, such as enteroceles and the etiology of defecatory dysfunction, that are difficult to elucidate clinically and can alter surgical management. Abnormalities seen on imaging are only clinically relevant if the patient is symptomatic. (See Variants 1-4.)

**Urinary Dysfunction**

Urinary incontinence is typically due to bladder-neck hypermobility, abnormal urethral closure pressure, or detrusor instability. Noninvasive evaluations include voiding

<table>
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<tr>
<th>Variants 1-4, Pelvic Floor Dysfunction</th>
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<tr>
<td><strong>Radiologic Procedures</strong></td>
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<tr>
<td>X-ray fluoroscopic cystocolpoproctography</td>
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<tr>
<td>MR defecography with rectal contrast</td>
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<tr>
<td>US pelvis transperineal</td>
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<tr>
<td>MRI pelvis dynamic with rectal contrast</td>
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<tr>
<td>X-ray fluoroscopic defecography</td>
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<tr>
<td>US pelvis transvaginal</td>
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<tr>
<td>US pelvis endorectal</td>
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<td>US pelvis transabdominal</td>
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<tr>
<td>MRI pelvis with endorectal coil</td>
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<tr>
<td>CT pelvis without IV contrast</td>
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<tr>
<td>CT pelvis with IV contrast</td>
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<tr>
<td>CT pelvis without and with IV contrast</td>
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</tbody>
</table>

**Rating Scale:** 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

<sup>a</sup>Oral contrast can be administered to opacify the small bowel and detect enteroceles.

<sup>b</sup>Imaging patient in the seated position is preferred, if possible.

<sup>c</sup>Dynamic refers to imaging the patient during rest and strain maneuvers. Encourage adequate Valsalva effort by patient. Avoid overdistended bladder. Vaginal contrast may also be given.

<sup>d</sup>Lack of rectal contrast may result in suboptimal study.

<sup>e</sup>Lack of intraluminal contrast in the bladder, bowel, and vagina limits assessment of entire pelvic floor.

<sup>f</sup>Consider this procedure to assess for generalized pelvic floor abnormality.

<sup>g</sup>Lack of bladder contrast limits assessment.

<sup>h</sup>Consider this procedure to assess urethral/vaginal mass.

<sup>i</sup>Indication for this procedure is to assess bladder post void residual.

<sup>j</sup>MRI defecography is equivalent to x-ray fluoroscopic defecography if patient is imaged in the seated position in a vertically configured MR scanner. Rectal evacuation is suboptimally assessed when patient is supine.

<sup>k</sup>This procedure is most appropriate for mesh complications.

<sup>l</sup>This procedure may be appropriate if a failed anal sphincter repair is suspected.
defects is usually lower with these [53]. Three-dimensional these probes, although the level of detection of sphincter endoanal ultrasound, owing to the greater availability of Transvaginal and transperineal ultrasound are alternatives to sphincter tears [24].

The role of radiologic imaging in urinary dysfunction is to identify the position of the bladder neck and urethra and to measure postvoid bladder volume. Imaging can distinguish between a cystocele with urethral hypermobility and a cystocele without urethral rotation [40]. Rotation and descent of both the urethrovaginal junction and bladder are associated with stress incontinence [22]. Conversely, descent of the bladder alone, with intact position of the urethrovaginal junction, results in kinking of the urethra and urinary retention [22]. Increased mobility of the bladder and descent below the pubic symphysis are seen on ultrasound and MRI in patients with a cystocele. Rotation of the urethra and widening of the retrovesical angle are seen in patients with urethral hypermobility. Intact orientation of the urethra and the retrovesical angle are seen in patients with cystocele and kinking of the urethrovaginal junction. Postvoid residual urine in the bladder can be measured with ultrasound or by catheterization. Imaging of the entire pelvic floor with MRI can give a global overview of additional abnormalities that can affect the anterior compartment. Significant POP can hinder urethral hypermobility and mask signs of stress incontinence that may become apparent only after the prolapse has been corrected. In addition, an elevated postvoid residual can be seen in patients with significant POP [41].

Imaging can assess for urethral diverticulum, vaginal wall cyst, or mass [42]. The size and complexity of a urethral diverticulum and its relationship to surrounding anatomy on MRI can affect surgical management [43-45]. The distinction between a urethral diverticulum and a Skene gland cyst or a vaginal wall cyst alters the surgical approach, and risk of complication, and can be made in most cases with MRI [46-48]. (See Variants 1-4.)

**Anal Incontinence**

Endoanal ultrasound is the primary imaging method for evaluating the internal and external anal sphincters, and it adds value to clinical examination and manometry in patients with fecal incontinence [6,49,50]. It has a high correlation with surgical and histologic findings [51,52]. Transvaginal and transperineal ultrasound are alternatives to endoanal ultrasound, owing to the greater availability of these probes, although the level of detection of sphincter defects is usually lower with these [53]. Three-dimensional ultrasound shows the levator ani muscle, and the length of sphincter tears [24].

Endoanal MRI has a high correlation with surgical findings of sphincter defects [54]. In experienced hands, endoanal ultrasound and endoanal MRI are equivalent for evaluating internal and external anal sphincter tears [55,56]. Advantages of ultrasound include greater availability, whereas advantages of MRI include better evaluation of external anal sphincter atrophy and pelvic floor musculature [57,58]. The outer boundary of the external anal sphincter is better delineated on MRI than on ultrasound for measuring muscle thickness and detecting replacement of the muscle by fat when the sphincter atrophies [54,55,59]. Atrophy of the external anal sphincter can result in decreased anal squeeze pressure and symptoms of fecal urgency in patients. Determining the presence of atrophy can help predict the success of sphincter defect repair in patients being considered for surgery [60]. Concurrent abnormalities of the levator ani muscle complex are also demonstrated on MRI [61,62].

As an alternative to endoanal MRI, experienced readers with attention to image quality can perform MRI with an external phased array coil for visualizing the anal sphincter complex [52,63,64]. MR defecography in patients with fecal incontinence can reveal excessive perineal descent, rectoceles, and rectal intussusceptions, which can alter surgical management [65]. (See Variant 5.)

**Defecatory Dysfunction**

Obstructed defecation is suspected in patients with chronic constipation who have difficulty defecating and may require

<table>
<thead>
<tr>
<th>Radiologic Procedures</th>
<th>Variant 5: Pelvic Floor Dysfunction</th>
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<tbody>
<tr>
<td>US pelvis endorectal (anal sphincter) 9°</td>
<td>Involuntary leakage of stool/liquid/gas.</td>
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<tr>
<td>MRI pelvis (anal sphincter) 9°</td>
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<td>MR defecography with rectal contrast 6°</td>
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<tr>
<td>X-ray fluoroscopic cystocolpoproctography 6°</td>
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<td>X-ray fluoroscopic defecography 6</td>
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<td>MRI pelvis dynamic with rectal contrast 5°</td>
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<td>US pelvis transperineal 5°</td>
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<td>US pelvis transvaginal 5°</td>
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<td>US pelvis transabdominal 1</td>
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<td>CT pelvis without IV contrast 1</td>
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<td>CT pelvis with IV contrast 1</td>
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<td>CT pelvis without and with IV contrast 1</td>
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**Rating Scale:** 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

- 9° Endorectal probe should be used for anal sphincter imaging.
- 9° An endorectal coil may be used.
- 4° Imaging patient in the seated position is preferred, if possible.
- 5° Consider this procedure to assess associated pelvic floor abnormality.
- 6° Consider this procedure to assess associated pelvic floor abnormality and pelvic floor musculature.
- 7° In this procedure, attention is focused on anatomy of anal sphincter.
excessive straining or manual digitation for evacuation. Patients are clinically assessed by digital rectal examination. To diagnose a functional defecation disorder according to Rome III diagnostic criteria, the patient must have impaired rectal evacuation, suboptimal propulsion, or paradoxical contraction of the pelvic floor muscles [66,67]. A rectal balloon expulsion test provides information on rectal sensation for initiating defecation and the ability to evacuate. Anal manometry identifies anismus by revealing an elevated anal resting pressure. In addition to these tests, the Rome III criteria include imaging for evaluating functional defecation disorders [66]. Failed or prolonged evacuation of contrast on fluoroscopic defecography is sensitive and specific for diagnosing anismus [68]. Defecography can be utilized in patients with discordant findings on manometry and the balloon expulsion test [67,69]. Unlike these 2 techniques, defecography directly images the process of rectal evacuation and identifies associated structural abnormalities in the pelvic floor.

Interpretation of fluoroscopic defecography relies primarily on assessment of rectal emptying, which can be supplemented by measuring rectocele size, craniocaudal movement of the anorectal junction, and in some cases, the anorectal angle [70-72]. Imaging findings are interpreted in the context of patient symptoms, physical examination, and results of other clinical workup. Overlap in findings between those who are asymptomatic versus symptomatic includes small intrarectal mucosal intussusceptions, small anterior rectoceles, and anorectal angle [72]. Imaging in the coronal plane can reduce false-positive diagnoses of intussusceptions owing to changes in rectal contour with evacuation. Treatment addresses patient symptoms rather than imaging results, particularly in the case of small, isolated imaging findings [70,73]. Patient maneuvers during defecography, such as manual digitation to facilitate rectal emptying, are important for demonstrating the clinical significance of imaging abnormalities and explaining patient symptoms. Intussusception in a patient with the sensation of incomplete evacuation or presence of a rectal ulcer can influence management [7].

Fluoroscopic defecography adds additional value to the clinical examination by revealing clinically occult sigmoidoceles and enteroceles, which can be present in isolation or in combination with other abnormalities [10,70]. The detection of these diagnoses on defecography has been shown to alter or clarify the initial clinical assessment in a significant percentage of patients with constipation [74]. In addition, the presence and severity of anorectal disorders are objectively documented by imaging in the preoperative setting [75].

MR defecography lacks ionizing radiation, and the patient can be easily imaged in multiple planes. Gel is used for rectal contrast in most cases, but it is not as viscous as potato starch, thick barium paste, or stool. In addition, the supine position is not physiologically ideal for rectal evacuation. In patients being assessed specifically for obstructed defecation, imaging on an upright MRI scanner is preferable, as it is similar to the position used in fluoroscopic defecography [7,65]. Although anorectal abnormalities are seen on both supine and upright MRI, more abnormalities, particularly intussusceptions, are seen in the upright position [17]. Rectal evacuation is often incomplete in the supine position, which can limit the specificity for diagnosing dyssynergic defecation [18,76]. Obstructed defecation is suboptimally evaluated in the absence of rectal contrast on MRI. Dynamic MR defecography can add clinical value in patients with rectal disorders by revealing additional abnormalities such as enteroceles that alter patient management [77]. (See Variants 1-4).

### Variant 6, Pelvic Floor Dysfunction

<table>
<thead>
<tr>
<th>Radiologic Procedures</th>
<th>CT pelvis with IV contrast</th>
<th>MRI pelvis without and with IV contrast</th>
<th>CT pelvis without and with IV contrast</th>
<th>MRI pelvis without IV contrast</th>
<th>US pelvis transvaginal</th>
<th>CT pelvis without IV contrast</th>
<th>US pelvis transabdominal</th>
<th>US pelvis transperineal</th>
<th>US pelvis endorectal</th>
<th>MRI pelvis with endorectal coil</th>
<th>MRI pelvis dynamic with rectal contrast</th>
<th>MR defecography with rectal contrast</th>
<th>X-ray fluoroscopic defecography</th>
<th>X-ray fluoroscopic cystocolpoproctography</th>
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<td>Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</td>
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<td>a This procedure is most useful for suspected osteomyelitis or myositis.</td>
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<td>b Noncontrast CT may be helpful for suspected hematoma without infectious clinical signs and symptoms. Consider contrast-enhanced CT for suspected abscess.</td>
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<td>c Vaginal probe insertion may be inadvisable in the immediate postoperative period due to discomfort and/or injury to the surgical bed.</td>
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<td>d This procedure may be helpful for suspected hematoma without infectious clinical signs and symptoms.</td>
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<td>e Consider this procedure to assess for retropubic hematoma or postvoid residual.</td>
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<td>f Consider this procedure to assess for retropubic hematoma.</td>
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</table>
Pelvic Floor Integrity

Muscle tone and defects are palpated on physical examination. On MRI, images are assessed for significant asymmetry, in the morphology of the right and left sides of the muscle in an individual patient, and excessive ballooning [78]. Larger genital hiatus and a greater fixed and dynamic perineal descent are seen in patients with abnormal levator muscle [79,80]. In addition, major muscle loss can be seen in combination with external anal sphincter injury on MRI in postpartum patients [61]. In patients with recurrent POP after surgery, major levator muscle defects may be a contributing factor [81-84].

The use of 3-dimensional ultrasound to assess the configuration of the genital hiatus and continuity of the levator muscle has been described [22,24,84]. In addition to the pelvic floor muscle, detailed images of the urethra and vagina are technically feasible with MRI, to assess for morphologic alterations in their associated support structures [85-91].

Imaging the Complications of Surgery

Complications of POP surgery include infection, hemorrhage, and adjacent organ or ureteral injury [92]. Complications of midurethral slings include hematoma, particularly with the retropubic approach, and bladder perforation, myositis, or abscess with the transobturator approach [92]. Functional complications of pelvic floor surgery include voiding dysfunction, persistent pain, and dyspareunia [92,93]. Pelvic hemorrhage, bladder leak, and abscess are typically imaged with CT, whereas myositis is well imaged with MRI. Urinary retention and retropubic hematomas can be assessed with ultrasound.

Surgical repair of pelvic floor disorders may be performed using native tissue, or with implants, tapes, or mesh-reinforcing native tissues [94,95]. Potential complications of using mesh include contraction, exposure, and extrusion [95-98], meaning shrinkage of the mesh, exposure through a defect in the mucosa, and extrusion out of the body cavity [98]. Imaging can complement physical examination for complications [99]. Ultrasound is the key modality for demonstrating the location and configuration of suburethral slings, as well as their distortion resulting from contraction [24,100]. A paucity of literature exists on the appearance of suburethral slings on MRI [101,102]. Dynamic ultrasound and MRI both show postoperative urethral mobility after sling placement [103,104]. Sacrococcygeal mesh can be seen on MRI and CT, and whether thickening and enhancement is present with coexisting inflammation [99,105]. Abscess and fistula formation, as well as the axis of the vagina, are evident on cross-sectional imaging. For the urethral and anal sphincters, both ultrasound and MRI show the location and volume of injected bulking agents, and the postoperative configuration of surgical sphincter repair [60,106-108]. (See Variant 6.)

Recurrent Prolapse

In addition to mesh complications, a significant percentage of patients may have recurrent prolapse after pelvic floor surgery. A wide range of failure rates have been reported in the literature according to specific surgical sites and techniques [2-4]. In patients with symptoms after surgery, imaging objectively documents improvement or recurrence of POP in the corrected compartment(s) [2]. Emergence of prolapse in an uncorrected compartment is also evident. The location and orientation of visible surgical material, postoperative mobility, as well as angulation of the pelvic viscera, and integrity and angulation of the pelvic floor muscles are demonstrated on imaging. (See Variants 1-4.)

SUMMARY

- Several imaging modalities have a potential role in the evaluation of patients with pelvic floor dysfunction. The choice of modality depends on patients’ specific chief complaint, the clinical information desired, the imaging equipment available, and physician expertise.
- Fluoroscopic CCP provides both functional and 2-dimensional anatomic information for patients with pelvic floor dysfunction. The proctography component is the imaging test of choice for patients with defecatory dysfunction.
- Imaging patients with pelvic floor dysfunction with MRI has the advantage of superior contrast resolution and 3-dimensional volumetric data. Adequate patient strain effort is necessary for a diagnostic functional study and is aided by including a defecation sequence as well as imaging the patient in an upright magnet.
- Transperineal ultrasound is an emerging technique that provides real-time functional and 2- or 3-dimensional anatomic information for evaluating patients with pelvic floor dysfunction, particularly POP; urinary dysfunction; and for postoperative assessment. Three-dimensional volumetric data are especially useful for postoperative assessment of mesh complications.
- Anal sphincter imaging can be performed with endoanal ultrasound or MRI.

This article is a revised version of ACR Appropriateness Criteria® Pelvic Floor Dysfunction. Practitioners are encouraged to refer to the complete version, available at www.acr.org/ac.

REFERENCES


