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Magnetic Resonance Defecography: Technique, Indications, and Interpretation

Redouane Roukhsi[1*], Ben Elhend Salah[1], Abdelilah Mouhcine[1], El Mehdi Atmane[1], El Fikri Abdelghani[1]

[1]Radiology Department, Military Hospital Avicenne, Marrakech, Morocco

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***Corresponding author:** Redouane Roukhsi
Radiology Department, Military Hospital Avicenne, Marrakech, Morocco

Abstract **Review Article**

Magnetic resonance defecography (MR defecography) is a dynamic imaging technique used to assess pelvic floor disorders and defecation abnormalities. This state-of-the-art review, intended for specialist radiologists, details the technical aspects, acquisition sequences, clinical indications, and interpretation methodology.

Keywords: MR defecography, Pelvic floor disorders, Dynamic imaging, Pelvic organ prolapse.

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1. INTRODUCTION

MR defecography is playing an increasingly important role in the evaluation of complex pelvic floor disorders. Unlike conventional radiographic defecography, it provides a multiparametric analysis without the use of ionizing radiation, while offering exceptional soft-tissue characterization [1, 2]. Indeed, MRI enables precise visualization of soft tissues, ligamentous structures, and the various pelvic compartments (anterior, middle, and posterior) in a single acquisition [3].

Pelvic floor disorders represent a significant public health issue, affecting nearly 50% of multiparous women and causing substantial functional impairment [4]. MR defecography meets the need for a comprehensive, dynamic assessment of these often multicompartmental disorders [5, 6].

2. TECHNIQUES AND ACQUISITION SEQUENCES

2.1. Patient Preparation:

A rigorous preparation protocol is essential for examination quality [7]:

- **Colon:** Rectal emptying using an enema two hours prior to the examination.
- **Bladder:** Voiding one hour before the examination, with semi-filled bladder at the time of the procedure.
- **Marking:** Ultrasound gel administered intravaginally (anterior compartment) and intrarectally (posterior compartment) using a 60 mL syringe.
- **Positioning:** Supine position with knees flexed (gynecological position).

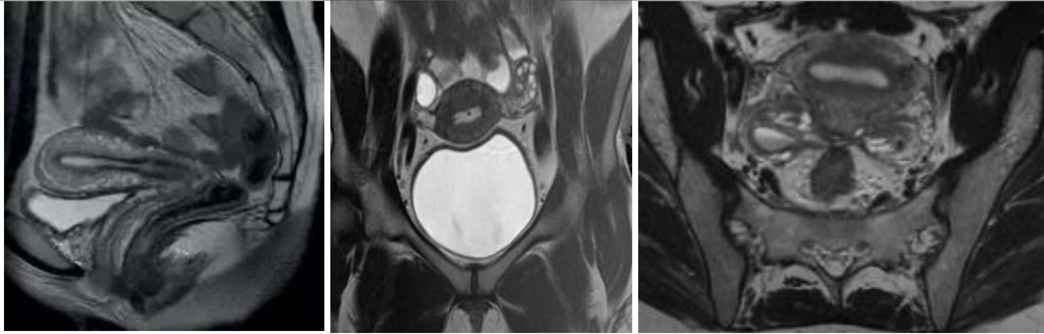
2.2. Equipment and Parameters:

- **Magnetic field:** 1.5 Tesla or 3 Tesla recommended [8].
- **Coil:** Multichannel pelvic phased-array coil (16 to 32 channels).
- **Position:** Patient supine, arms along the body.

2.3. Static Morphological Sequences:

Sequence	Plane	Parameters	Objective
T2 FSE	Sagittal	TR/TE 4000/100, slice thickness 3-4 mm	Anatomical reference, analysis of pelvic organs
T2 FSE	Axial	Perpendicular to vaginal axis	Analysis of levator ani muscles and lateral rectal spaces
T2 FSE	Coronal	TR/TE 4000/100	Analysis of the pelvic floor
T1 without and with fat saturation	Axial/sagittal	TR/TE 500/10	Detection of collections, hematomas, fatty infiltration

These static sequences are essential for morphological analysis prior to dynamic evaluation [3, 9].



MRI in T2 FSE sequence on the three planes

2.4. Dynamic Sequences:

The reference sequence is a dynamic sagittal sequence using ultrafast T2-weighted imaging (True-FISP, bSSFP, or HASTE) [10]:

- Continuous acquisition for 60 to 90 seconds.
- One image every 1 to 2 seconds.
- Three phases :
- **Rest:** Initial acquisition.
- **Maximum contraction:** Assessment of levator ani muscle tone.
- **Maximum strain:** Simulation of defecation (Valsalva maneuver).
- **Evacuation:** Following intrarectal gel administration (optional).

The use of dynamic sequences with high temporal resolution is essential for visualizing the movement of pelvic organs in real time [5, 11].

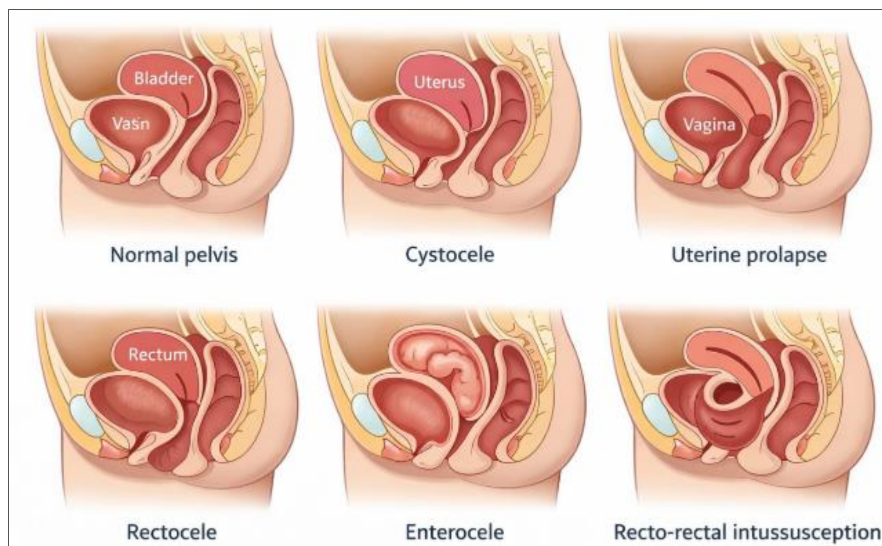
2.5. Post-Dynamic Sequence:

- Delayed contrast-enhanced imaging following gadolinium injection (if fistula or endometriosis is suspected) [12].
- Analysis of positional changes after stress.

3. INDICATIONS :

3.1. Pelvic Floor Disorders :

- **Cystocele:** Herniation of the posterior bladder wall [4].
- **Hysteroceles / Vaginal vault prolapses:** Uterine or vaginal prolapse [13].
- **Rectocele:** Anterior herniation of the rectum (> 2 cm symptomatic) [14].
- **Enterocele:** Herniation of the pouch of Douglas [6].
- **Recto-rectal intussusception:** Mucosal or full-thickness intussusception [15].



Diagrams illustrating aspects of cystocele, hysterocele, rectocele, enterocele, and recto-rectal intussusception

3.2. Defecation Disorders:

- Chronic constipation with a sensation of blockage [16].
- Fecal incontinence (sphincters assessable on axial T2-weighted images) [17].
- Descending perineum syndrome (> 3 cm at rest or during strain) [5].
- Abdominopelvic dyssynergia: failure of levator relaxation [18].

3.3. Complex Pathologies :

- Deep pelvic endometriosis: involvement of the uterosacral ligaments, rectum, or bladder [12].
- Fistulas: rectovaginal, vesicovaginal [19].

- Post-surgical recurrence: evaluation after mesh placement or sacrocolpopexy [20].

3.4. Pre-Therapeutic Assessment:

- Lesional assessment prior to surgical repair [6, 21].
- Guidance towards a surgical approach (vaginal, laparoscopic, or open) versus medical treatment or pelvic floor rehabilitation [22].

4. INTERPRETATION METHODS:

4.1. Anatomical Landmarks:

The reference plane is the median sagittal plane passing through the axis of the anal canal and vagina [23].

Reference Lines [24]:

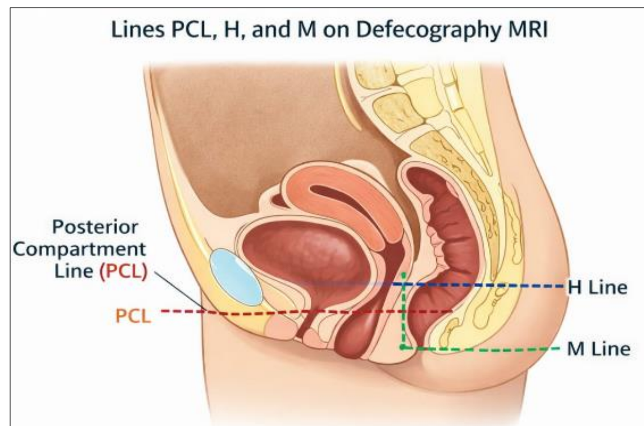
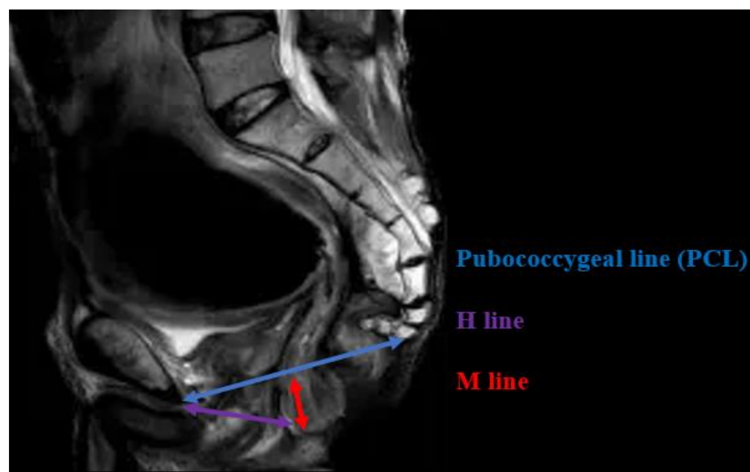


Diagram showing the reference lines

- **PCL (pubococcygeal line):** Connecting the inferior border of the pubic symphysis to the last coccygeal joint.
- **Line H:** Width of the urogenital hiatus (distance between the symphysis and the anterior wall of the rectum at the level of the anorectal junction).
- **Line M:** Descent of the pelvic floor (perpendicular to the PCL).



Sagittal T2 MRI showing the reference lines in the mid-sagittal plane

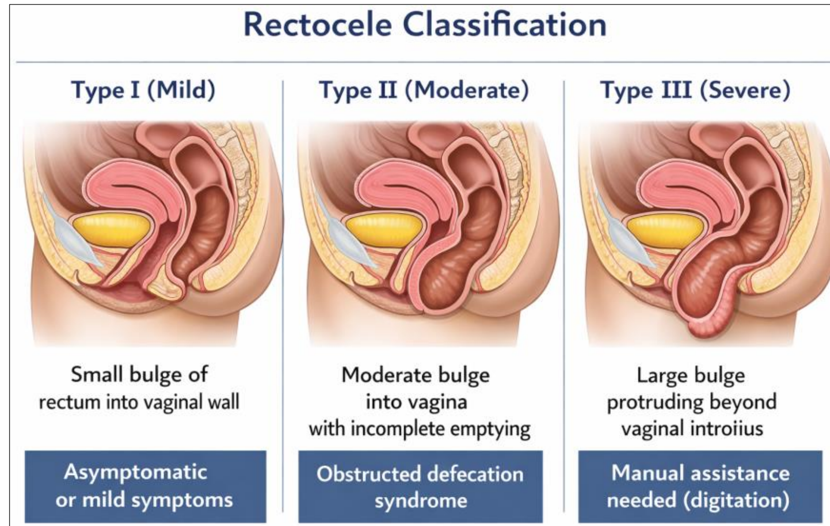
4.2. Quantitative Analysis:

Parameter	Normal Value	Pathological Threshold
Pelvic floor descent	< 2 cm	> 3 cm (descending perineum)
Cystocele	< 2 cm below PCL	> 2 cm
Hysteroceles	< 2 cm	> 2 cm
Rectocele	< 2 cm	> 2 cm (symptomatic)
Intussusception	0	Mucosal (< 3 mm) or full-thickness
Enterocele	Absent	Presence of small bowel between rectum and vagina

These thresholds are derived from international consensus and enable standardized reporting [5, 25].

4.3. Qualitative Analysis: Classification of Rectoceles (according to affected wall) [14]:

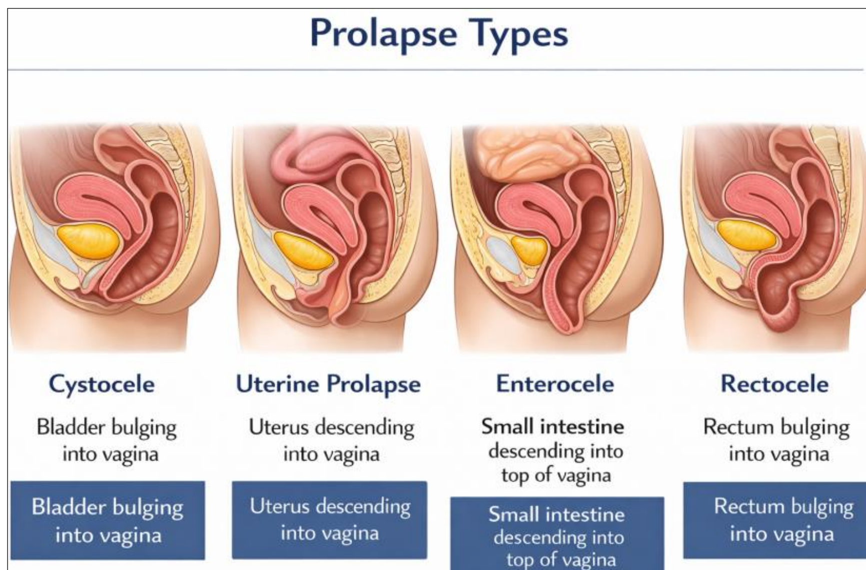
- **Type I:** Anterior (anterior rectal wall).
- **Type II :** Lateral.
- **Type III :** Posterior (rare).



Diagrams illustrating the classification of rectoceles

Prolapse Staging [4, 26]:

- **Grade I:** Descent < 2 cm.
- **Grade II:** Descent between 2 and 4 cm.
- **Grade III:** Descent > 4 cm.
- **Grade IV:** Complete externalization.



Diagrams illustrating the types of prolapse

4.4. Diagnostic Pitfalls and Errors to Avoid:

- **Non-functional rectocele:** If the gel does not evacuate during strain, likely related to a relaxation disorder [14].
- **False intussusception :** Related to paradoxical sphincter contraction [15].
- **Motion artifacts:** Necessitate rapid sequences [10].
- **Distinguishing enterocele from sigmoidocele:** Requires identification of content (small bowel versus sigmoid colon) [27].

4.5. Standardized Report :

Recommended structure for the report [28]:

a) **Examination quality:** Cooperation, artifacts.
b) **Static anatomy:** Organ positions at rest.
c) **Dynamic analysis:**

a. Contraction : Levator tone, organ ascent.
b. Strain : Descent, hernias, rectocele, intussusception.

d) **Compartments:**
a. Anterior : Cystocele, urethrocele.
b. Middle : Hysteroceles, enterocele.
c. Posterior: Rectocele, intussusception.

Conclusion: Summary of abnormalities and clinical correlation.

5. PERSPECTIVES AND INNOVATIONS:

Functional MRI and real-time cine-MRI are paving the way for more physiological analysis of pelvic floor disorders [29]. Artificial intelligence applied to automatic organ segmentation and descent measurement could standardize interpretation and improve interobserver reproducibility [30].

6. CONCLUSION

MR defecography has become the reference examination for the comprehensive evaluation of pelvic floor disorders [5, 6]. Its ability to simultaneously analyze all three pelvic compartments, both statically and dynamically, makes it an indispensable tool for radiologists specializing in pelvic floor pathology. Standardization of acquisition and interpretation protocols, combined with a thorough understanding of anatomical landmarks and classifications [4, 25], allows for optimization of surgical management in these often multimorbid patients.

Conflict of Interest: The authors declare that they have no conflict of interest.

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