Interpretation of Defecating Proctograms: Getting to the bottom of it!

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Learning objectives

• Be able to describe the appearances of a normal resting anorectal anatomy as seen on fluoroscopic defecating proctogram study.
• Be able to describe the normal change in anatomy and the physiological process of defecation.
• Be able to recognize the common abnormalities seen on a defecating proctograms, in particular enterocele, rectocele, rectal mucosal prolapse and paradoxical puborectalis.
• Develop an understanding of what important positive and negative findings should be reported back to the referring clinician.

Background

Defecating proctography is a well-established minimally invasive fluoroscopic technique for assessing the process of voluntary defecation. As well as studies showing high observer accuracy it is a cost effective investigation compared to other imaging methods (1). The patients usually referred by clinicians, complain of obstipation, incomplete rectal emptying and defecation distress (2).

Preparation for the investigation involves patients drinking liquid barium over a 60-minute period prior to starting, this opacifies the small bowel. The patient is then invited to the fluoroscopic suite where barium paste with consistency similar to stool is passed via a rectal catheter into the rectum. The patient then evacuates the paste in the sitting position to subject the patient to normal gravitational forces exerted in normal daily life (fig. 1). Simultaneously fluoroscopic images are acquired of the anorectal anatomy in the lateral projection for interpretation. Images are usually acquired at 1 frame per second. For patients struggling to pass the paste intermittent series of images are acquired to reduce unnecessary radiation dose to the patient.

The study provides important information on anorectal anatomy as well as physiology (3). It provides the referring clinician with vital information which can then be used to treat patients in the most effective way, which may be surgically, medically or through biofeedback therapy which involves retraining the patient on how to improve the physiological process of defecation.

Images for this section:
**Fig. 1:** Patient position during investigation. Images are acquired in the lateral projection.
Findings and procedure details

Normal anorectal anatomy and physiology on fluoroscopy

The resting fluoroscopic appearances of the anorectal anatomy are shown in figure 2 along with important anatomical lines and angles one should be aware of when analyzing the study.

The anal canal has a slightly oblique orientation in the anterio-posterior direction (fig. 2). The rectum lies perpendicular to the orientation of the anal canal. The angle formed by the two is called the anorectal angle. This is formed by the puborectalis muscle, which is part of the urogenital diaphragm. It forms a sling around the anorectal junction and attaches anteriorly to the inferior aspect of the pubic symphysis. It has a key role in maintaining continence. A normal resting anorectal angle measures 90 degree +/- 20 degree.

At the point at which the lines A and C bisect (fig. 2) is called the anorectal junction. This junction along with a line passing from the inferior aspect of the coccyx to pubic symphysis (Pubo-coccygeal line) are used to assess the anatomical position of the anorectal junction, which should be less than 8cm. Perineal descent is the difference in the position of the anorectal junction at rest to the position in the evacuation phase and this should be less than 3.5cm.

A number of anatomical changes are seen during the evacuation phase. Figure 3 outlines the changes that should be expected in a normal study. The puborectalis muscle relaxes resulting in loss of the muscular impression on the posterior wall of the superior anal canal, allowing the anorectal angle to increase. This along with the pelvic floor decent allows the rectal axis to become more vertical. The normal anorectal angle during evacuation is between 100 to 140 degree.

The anorectal junction also descends (normal is less then 3.5cm) and the anal canal is open by at least 0.5cm. In a normal study the rectum is expected to empty most of the injected paste in less then 30 seconds with only little remaining residual volume (1).

In the recovery phase the puborectalis muscle regains its tone recovering the resting anorectal angle and the anal canal closes. The anorectal junction ascends back to its resting position (fig. 4).

Common abnormalities seen on defecating proctography
**Anterior rectocele**

An anterior rectocele is an abnormal bulge of the anterior distal rectal wall (fig. 5). It is usually seen in patients with poor relaxation of the puborectalis muscle and commonly seen after child birth. This results from the upstream upper rectum contents pushing down and anteriorly, eventually resulting in an anterior rectocele. Patients usually complain of incomplete emptying and often having to digitally apply pressure to the vagina or perineum to aid evacuation of the trapped rectal content in the rectocele (4).

The anterior rectocele is measured from the anterior anal wall to the anterior wall of the rectocele (Figure 5B red arrow). Rectocele less than 2 cm are considered small and clinically insignificant, more than 3.5 cm are taken to be large rectocele (1).

The anterior rectocele can be surgically treated. However, in most cases the anterior rectocele develops secondary to an obstructive cause; for example, poor relaxation of the puborectalis muscle and or pelvic floor dyssynergy. In these cases biofeedback therapy may be of benefit.

**Posterior rectocele**

Posterior rectocele is not as common as the anterior rectocele and usually not as large in size. The aetiology is similar to the development of an anterior rectocele and is usually secondary to obstructive defecation (fig. 6). The treatment again would consist of surgery and if secondary to pelvic floor dyssynergy then biofeedback therapy is required in addition.

**Enterocoele**

An enterocoele is where small bowel descends in to the lower pelvis and may exert external compression on the ventral surface of the rectum causing luminal narrowing. In more severe cases, it may prolapse through the anal canal along with the rectum (4). Figure 7 shows examples of enterocoele. The enterocoele can result in partial or complete obstruction; preventing the emptying of up stream bowel content. Patients who have had previous pelvic floor surgery are at a higher risk of developing an enterocoele. Chronically increased intra-abdominal pressure is also a contributing factor.

**Paradoxical puborectalis muscle**
This is the poor relaxation or paradoxical contraction of the puborectalis muscle during the evacuation phase resulting in defecation outlet obstruction. The patient has to force the rectal contents around the anorectal angle (fig. 8). This can result in the development of secondary abnormalities such anterior rectocele and posterior rectocele (fig. 9). The first line treatment for paradoxical puborectalis is biofeedback.

Mucosal and full bowel wall thickness prolapse

Mucosal prolapse is the invagination of the mucosal layer only into the distal rectal lumen. In severe cases full thickness bowel intussusception may be seen, which can be intra rectal, intra-anal or extend to an extra rectal prolapse (1). Defecating proctography is a highly sensitive method for detecting this pathology (5). Prolapse is usually a result of chronic straining and can result in obstruction and poor emptying of upstream rectal content (fig. 10, 11 and 12).

Pelvic floor dyssynergy and anal canal dysfunction.

This is poor relaxation or paradoxical contraction of the pelvic floor muscles and or external anal sphincter (3). On imaging this is observed as very little or no pelvic floor decent or anal canal opening. Patients complain of straining and tenesmus. Psychological stress and anxiety have been linked to pelvic floor dyssynergy and is more common in females who have been subjected to sexual abuse (1).

Figure 13 shows a patient with poor perineal decent and puborectalis relaxation along with poor anal canal opening (also seen in fig. 14). This patient may benefit from biofeedback (6).

Descending perineum syndrome.

This is excessive decent of the pelvic floor and is defined as decent of the anorectal junction by more than 3.5cm from the position in the rest phase to evacuation phase (fig. 15). Or alternatively can be diagnosed if the anorectal junction lies 8cm or more from the pubo-coccygeal line at rest (fig. 2 and 3).

This syndrome is thought to be linked to chronic straining. The low lying pelvic floor at rest may represent muscle weakness. The pelvic floor is seen to lie lower as patients get older and a greater degree of normal descent is seen in younger patients (1).

Biofeedback
This is the process of gaining important pathophysiological information and then retraining the individual to control these physiological properties or to react to these changes at a conscious level to help regain control of normal defecation process. Literature review show the therapy has a positive impact on more than 70% of patients with pelvic floor dyssynergy.

This therapy involves multiple sessions and uses sensory training, electromyography and manometry (3).

Images for this section:
**Fig. 2:** Anorectal anatomy at the resting position. (A) Anal canal position, (B) Pubo-coccygeal line, (C) Posterior distal rectal wall axis, (D) Anorectal Junction, (E) Anorectal angle

**Fig. 3:** Anorectal anatomy during the evacuation phase. Anorectal anatomy at the resting position. (A) Anal canal position, (B) Pubo-coccygeal line, (C) Anorectal angle, Single arrow head: Perineal decent, Double arrow head: Anal canal opening.
**Fig. 4:** This spot view shows recovery of the normal resting anatomy after evacuation.
Fig. 5: Anterior rectocele. The patient presented with symptoms of incomplete emptying and having to digitate. (A) Anterior rectocele develops during the evacuation phase and also note that the rectum does not orientate vertically due to poor relaxation of the puborectalis muscle. (B) The anterior rectocele remains and shows residual paste after the evacuation phase. The red arrow shows the measurement of the rectocele.

Fig. 6: Two examples of posterior rectoceles (Red arrows).
Fig. 7: Enterocele. (A) rest phase. (B and C) evacuation phases. This patient has a large enterocele (white arrow) which is seen descending onto the anorectal junction resulting in the formation of an anterior rectocele (red arrow) and obstruction to the passage of the upstream rectal content. In addition intra-rectal mucosal prolapse is seen (yellow arrow).

Fig. 8: The above images show the initial (A) relaxed phase, (B) evacuation phase and (C) recovery phase. The puborectalis muscle does not relax resulting in poor
verticalization of the rectum and a fixed anorectal angle of around 90 degree (red arrow). The recovery phase also shows a small anterior rectocele (yellow arrow) and poor emptying of the up stream rectal paste (white arrow).

Fig. 9: Poor relaxation of the puborectalis muscle depicted by the posterior anal wall impression (yellow arrow) and development of a posterior rectocele (red arrow).
Fig. 10: Shows intra-rectal mucosal prolapse (red arrows). Image B also shows the development of an anterior rectocele (Yellow arrow) which is unable to emptying due to the obstruction at the neck of the rectocele by the mucosal prolapse.
Fig. 11: Shows full thickness circumferential intra-rectal prolapse (A) and intra anal prolapse (B). There is also paradoxical mid-rectum contraction in Image B (yellow arrow).
Fig. 12: This study shows the initial rest image (A) and then further 2 images (B and C) of the evacuation phase demonstrating the development of full thickness rectal wall intra-anal intussusception (red arrow). In addition there is development of an anterior rectocele (yellow arrow) which contains residual material due to the obstructive effects of the prolapse.

Fig. 13: (A) relaxed phase shows normal rectal volume and anorectal angle. (B) in the evacuation phase there is no relaxation of the puborectalis muscle, therefore maintaining a prominent impression on the posterior anal wall and maintaining the anorectal angle. Very little pelvic floor decent is seen comparing the position of the anorectal junction at rest and evacuation. Very poor opening of the anal canal (yellow arrow) less than 0.5cm.
Fig. 14: Spot view shows paradoxical contraction of the anal sphincter (red arrow).
Fig. 15: The spot views are of a rest phase (A) and evacuation phase (B). The study shows significant decent of the anorectal junction (yellow arrow) of more than 3.5cm suggesting excessive pelvic floor decent. In addition there is also a development of an anterior rectocele.
Conclusion

Defecating proctography is currently the gold standard for assessing pelvic floor and anorectal function. It is widely available and is well tolerated by patients, and provides important diagnostic information on anatomical and physiological abnormalities such as rectocele, prolapse and pelvic dyssynergy. These can be easily identified by a trained radiologist. This information allows the clinicians to manage patients with better therapeutic outcomes.

Treatment options range from surgical, medical or to re-training the patient through biofeedback. In many cases patients present with complex physiologically interconnected abnormalities, requiring both surgical and non-invasive therapies.

Personal information

References


