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Review Article

Significance of Peritoneal Reflection as a Key Indicator in Rectal Endoscopic Procedures

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Abstract

Introduction: The science of GI endoscopy is a science of millimeters that has marvelously evolved over the past 30 years. Rectal lesions are commonly encountered clinical problems, and their appropriate and successful management requires detailed knowledge of the pelvic anatomy. There must be a clear understanding of the anal verge, rectal valves, and most importantly the peritoneal reflection to safely perform advanced endoscopic procedures such as EMR and ESD.
Aim: To educate gastroenterologists and colorectal surgeons regarding the definition of the rectum and its various anatomical markers.
Materials and methods: An online search of published literature was made on PubMed, Ovid Medline, Science Direct and Springer.
Results: This paper presents the current definition of the rectum and the level of peritoneal reflection, which critically defines intraperitoneal perforation as compared to an extraperitoneal perforation during complex EMR ESD procedures.

Introduction:

Colorectal cancer (CRC) ranks among the most prevalent malignancies in Western societies. The genesis of rectal cancer is typically preceded by the emergence of a benign rectal adenoma. Timely identification and removal of rectal adenomas play a pivotal role in preventing the progression to rectal cancer, representing the most reliable strategy for curing this disease.

The management of large rectal adenomas through endoscopic interventions has advanced significantly. While simpler endoscopic therapies suffice for smaller adenomas, larger lesions may necessitate more sophisticated approaches, such as endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD). These methods have emerged as the new standard of care due to their perceived safety and comparable efficacy in relation to transanal endoscopic microsurgery (TEM).

Among the complications associated with colonoscopy and advanced resection techniques, colonic perforation is the most dreaded. Though the overall risk of perforation is relatively low, it is primarily contingent on factors such as lesion size and the specific endoscopic technique employed. In cases of perforation, close monitoring is imperative to promptly identify signs of peritonitis or clinical deterioration. A comprehensive understanding of rectal anatomy is of paramount importance, particularly when encountering unexpected and severe complications like perforation during advanced resection procedures.

Discussion:

The rectum, situated between the sigmoid colon and the anal canal, serves as an important role in stool storage and the mechanisms of continence and defecation. The National Cancer Institute Rectal Cancer Focus Group defines the rectum as extending up to 12 cm from the anal verge and may extend to approximately 15-16 cm. [1].

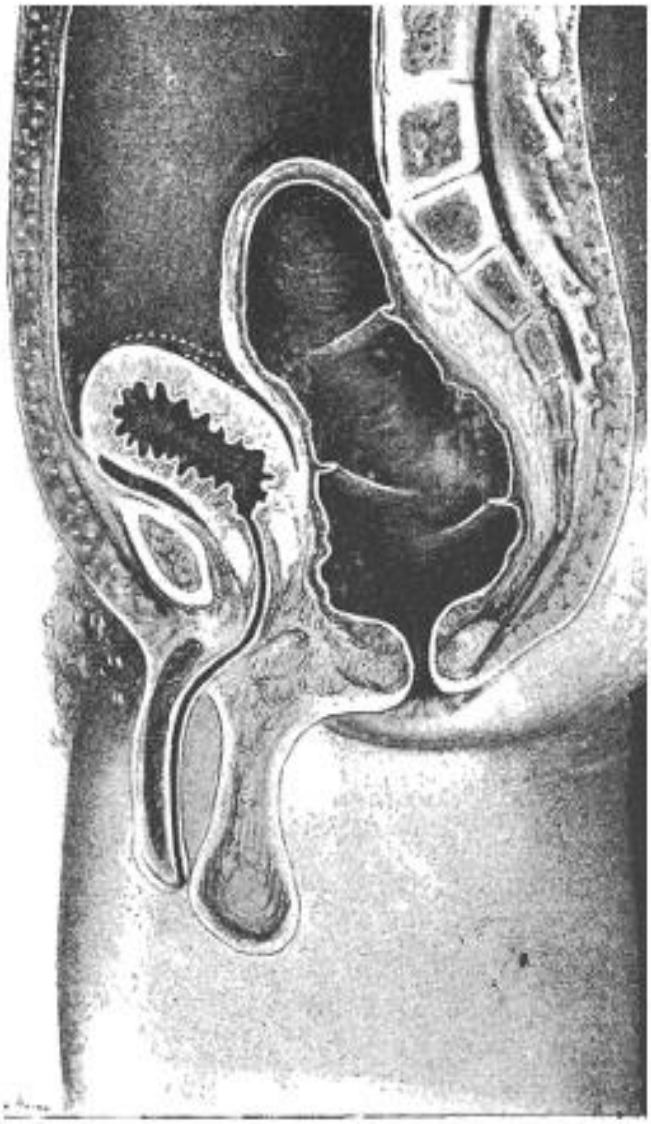


Fig. 2. Sagittal cross section of male pelvis showing Houston's valves. [From Gorsch RV, Proctologic Anatomy, 1955, p 157–163, Baltimore: Williams & Wilkins Co., reproduced by permission. Courtesy of Wolters Kluwer.]

Historically, the rectum's valves were described by Dr. John Houston, an Irish anatomist and surgeon, in 1830. [2] He introduced the concept of "rectal valves of Houston," characterized by their oblique orientation, upward position, and successive placement on opposing sides of the rectum, creating what he termed "a spiral tract down its cavity."

Modern anatomical references typically identify three rectal folds, with two commonly found on the left and one on the right. However, a study by Abramson in 1978, utilizing sigmoidoscopy in 400 adults, revealed considerable variation in the number of valves, ranging from none to seven, with the majority of individuals having two to three valves. [3]

Eponymic confusion arose when Dr. Otto Kohlrausch, a German physician-scientist, designated the mid rectal valve, located behind the bladder or uterus, as the "Kohlrausch valve" or fold. [2] Notably, the term "Kohlrausch valve" is more commonly cited in German literature. The middle valve, or "Kohlrausch valve," is typically the largest and most consistently positioned at around 9-11 cm from the anus, aligning with the level of peritoneal reflection. [2] Given the variation in the number and location of these valves, terms like "upper, middle, and lower" or "spiral rectal valves" are often used to denote their location.

The rectal valves have been postulated to play a role in supporting the weight of fecal matter and facilitating its passage through the rectum. Early descriptions of rectal valves and their potential involvement in constipation led to surgical procedures aimed at their removal, with unfortunate cases, such as rectal perforation and peritonitis, being reported. [4]

Thus, a thorough understanding of rectal anatomy is indispensable, particularly when treating lesions, as the severity of bowel injury increases when it occurs above the peritoneal reflection. The peritoneal reflection demarcates the intraperitoneal and extraperitoneal portions of the rectum, encompassing its anterior, lateral, and posterior aspects in an oblique configuration. Notably, the location and length of the peritoneal reflection can vary significantly.

In standard anatomical references, the second rectal valve serves as a reference point for the anterior peritoneal reflection, typically located at approximately 8 cm and 6 cm from the anal verge in men and women, respectively. It's essential to note that these measurements were conducted in cadavers, and therefore, live human rectal lengths may exhibit variations.

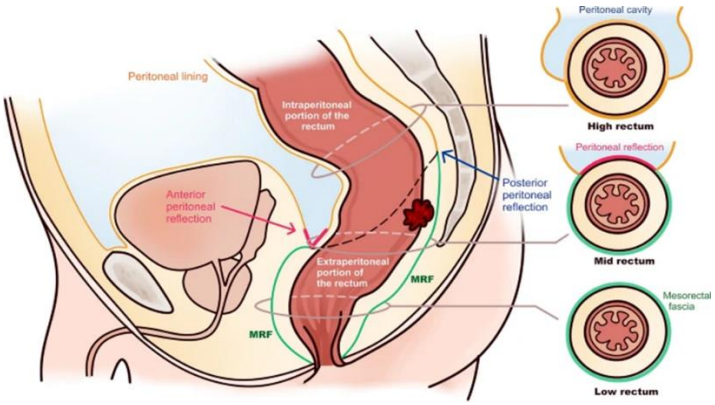
Several studies have attempted to clarify the position and dimensions of peritoneal reflection. Buess et al., in their description of the transanal endoscopic microsurgery (TEM) technique, provided details regarding peritoneal reflections without specifying the measurement methodology, as presented in Table 1.[5] Meanwhile, Najarian et al. established the position of the peritoneal reflection in 50 patients undergoing laparotomy, using simultaneous intraoperative proctoscopy and intra-abdominal visualization of the peritoneal reflection. [6] Table 1 displays the mean distance to the peritoneal reflection, including the range of measurements, with data showing that the average length of the peritoneal reflection exceeded traditional beliefs and exhibited no significant gender-based differences.

Yun et al. conducted a detailed examination of pelvic anatomy during surgery for 23 males and 23 females, presenting the mean length of peritoneal reflections, detailed in Table 1.[7] Their findings indicated no statistically significant differences between

males and females, with height being the only parameter correlated with the length of the sacral promontory, subsequently impacting the lengths of the anterior and posterior peritoneal reflection.

In the context of diagnosing rectal tumors, transrectal ultrasound demonstrated the ability to visualize peritoneal reflections effectively in all 14 patients.[8] However, specific measurements were not provided.

Magnetic resonance imaging (MRI) serves as a valuable tool for assessing rectal masses or tumors. While it accurately depicts the anterior peritoneal reflection, the posterior peritoneal reflection is often concealed in MRI images. In general, measurements related to the mesorectal fascia (MRF) distance are typically reported for extraperitoneal tumors due to the limited visibility of the posterior peritoneal reflection on MRI (as depicted in the figure).[9]



In summary, studies examining the peritoneal reflection points reveal that the actual length is often greater than indicated in textbooks, a disparity likely attributed to cadaveric measurements. Furthermore, there is an incremental increase in the length of the peritoneal reflection as one moves from the anterior to the lateral to the posterior aspects, with differences of 2-3 cm at each level.

Study (year)	No. of patients	Distance of peritoneal reflection (cm)		
		Anterior	Lateral	Posterior
Buess (1992)		12	15	20
Najarian (2004)	50	M 9.7 (7-16) F 9 (5.5-13.5)	M 12.8 (9-19) F 12.2 (8.5-17)	M 15.5 (12-20) F 14.8 (11-19)
Yun (2008)	46	M 8.8 +/- 2.2 F 8.1 +/- 1.7	M 10.8 +/- 2.7 F 11.4 +/- 1.9	M13.8 +/- 2.5 F 14.0 +/- 1.9

Conclusion:

Given the rising prevalence of colorectal cancer, the imperative for timely detection and resection of lesions during colonoscopy examinations has never been more critical. Advanced techniques, specifically Endoscopic Mucosal Resection (EMR) and Endoscopic Submucosal Dissection (ESD), have emerged as safe and cost-effective alternatives to surgical interventions. However, the specter of complications, notably perforations, looms as a formidable concern. An in-depth comprehension of rectal anatomy and the precise location of the peritoneal reflection holds substantial relevance in guiding intra-procedural decision-making and conferring valuable prognostic insights should an endoscopic perforation occur. Leveraging endoscopic ultrasound for the determination of the peritoneal reflection point is a useful strategy, particularly in the context of pre-planned resection of large rectal polyps.

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