



Rectal diverticulum: a rare surgical dilemma that manifest in different ways and manageable with new treatment options

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A recent article on the treatment of symptomatic rectal diverticulum by robotic surgery is fascinating. The importance lies in defining the associations of the rectal diverticulum, which can be treated potentially with curative intent. The associations can be benign, like rectal diverticulitis, prolapse, or can be a cancer. The author, Bustamante-Lopez *et al.* (1), has treated this rare entity presenting with symptoms of obstructive defecation using robotic ventral mesh rectopexy. This article has opened up another dimension in the treatment options and provides insight to clinicians facing this rare challenge.

Background

A diverticulum is an abnormal protrusion or outpouching of the mucosa with or without the submucosa. This protrusion occurs at weak areas in the muscular layers of the wall. A true diverticulum is when all the layers of the wall are involved, whilst a pseudodiverticulum involves only the mucosal and submucosal layers. Diverticulum can be congenital, or acquired later in life, and are found in the gastrointestinal (GI) tract, urinary bladder, gall bladder, ectoderm in the brain (Rathke's pouch), etc.

Diverticulosis is a condition where asymptomatic diverticula are present, and can be seen anywhere in the

GI tract. Congenital diverticulum is uncommon but are usually seen in the proximal GI tract, for example Zenker's, duodenal, Meckel's or jejunal diverticulum. Acquired types of diverticula are more common than congenital, develop with ageing, and are often found in the distal colon. The incidence of diverticulosis is increasing in western countries, affecting 50% of individuals over the age of 60 years old (2). Diverticulosis in the sigmoid colon accounts for approximately 65% of the total cases in western populations. In contrast, right-sided colonic diverticulosis is less common and seen predominantly in Asian populations (3).

Rectal diverticulum is interesting because of their rarity, with an estimated incidence of less than 0.1% (4,5). Rectal diverticulum is distinct from those found in the sigmoid colon in that they have a wider mouth, are true diverticulum involving all layers of the bowel wall, they are also larger measuring 2 to 3 cm, and less numerous numbering between 1 and 3 (6). Sigmoid diverticula on the other hand are pseudodiverticula with a narrower mouth, are smaller measuring between 0.5 and 1 cm, and more numerous. Rectal diverticulosis is often an incidental diagnosis accompanying sigmoid diverticulosis, but solitary cases have also been described in the literature. Whilst the majority are asymptomatic, a few can harbour significant pathology like cancers or cause symptoms necessitating further diagnostic

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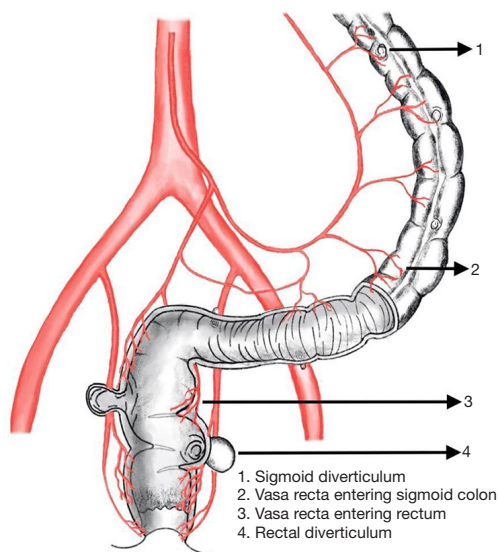


Figure 1 Blood supply course and orientation of sigmoid colon and rectum. Sigmoid diverticulum [1] and perpendicular entry of vasa recta vessels [2] into sigmoid colon, on the contrary to a longitudinal course and an oblique insertion of vasa recta vessels [3] into the rectum, one explanation of the rarity of rectal diverticulum [4].

investigations and treatment.

Since their first description in 1911 (7), a thorough search of EMBASE, CINHAI, MEDLINE and PubMed electronic medical databases reveals less than 50 articles published on rectal diverticulum within the literature. This reflects the rarity of this condition and the insufficient knowledge of the topic among clinicians.

Aetiology

Rectal diverticulum is uncommon and little is known about their aetiology, but they have often been noted to accompany sigmoid diverticulosis. Colonic diverticulosis is more prevalent in western countries, where the incidence is increasing and presenting in younger age groups (2). Lack of dietary fibre in the western diet has been considered as a cause but could not be proved in epidemiological studies (8).

The theory of Laplace's law has been linked to the development of colonic diverticulosis in the literature. In this, the pressure inside the colonic lumen is proportional to the bowel wall tension and inversely related to the radius of the lumen. Changes in the intra-luminal pressure are attributed to the act of expulsion and peristaltic movement of the colon for moving the content forward. Blood vessels supplying the colon, the vasa recta, enter perpendicularly

to the bowel wall at the sides of taenia coli, producing an area of weakness. This, combined with increased pressure, leads to the formation of diverticula. This pseudodiverticula formation in dynamic pressure zones is also called pulsion diverticulum. Taenia coli create a tough longitudinal muscular layer over the colon where the diverticulum is not seen. Instead, diverticulum is seen in the areas between these taenias where the vasa recta enter the bowel wall. Most cases of diverticulosis confined to the sigmoid colon are attributed to the fact that it has the highest intra-luminal pressure.

The taenia libera and taenia omentalis spread and merge anteriorly, fortifying strength in the rectum, whilst the taenia coli mesocolica spreads and covers the posterior part of the rectum (9). There is potential for developing a weakness on the lateral aspects of the rectum where taenia coli from the anterior and posterior parts meet. This theory explains the commonly found lateral position of the rectal diverticulum, followed by the posterior part, where weak areas are also present. Other predisposing factors mentioned in the literature are iatrogenic post-surgery development of weakness, congenital muscular atrophy, lack of structural support around the rectum like weak pelvic floor musculature, weak circumferential muscles around rectum, relaxed rectovaginal septum, recurring stool impaction, constipation, absence of the coccyx, bacterial infection causing weakening of the rectal wall, etc. (9-11).

Anterior protrusion of the rectum, a rectocele, is the most common and familiar form. It has been thoroughly researched and one can easily find the guidelines for treatment, but lateral and posterior protrusions pose a clinical dilemma and have been inadequately researched due to their rarity.

An interesting Portuguese angiomorphological study on 80 human cadavers produced a hypothesis for the rectal diverticulum's low incidence based on the vasa recta's course. Longitudinal orientation, oblique insertion into the wall, traversing through both muscular layers, and the long course of the vasa recta vessel in the rectal wall does not impair the wall's strength. Whereas the perpendicular insertion, short course and traversing through only the circular muscle layer in the colon lead to weakness and diverticulum formation (12). *Figure 1* shows the insertion of vasa recta and diverticulum in the sigmoid colon and rectum. The strong outer longitudinal muscular layer, lying within a confined compartment, reduced peristalsis and the inability of the rectum to dilate excessively compared to the sigmoid colon are the other factors which help to explain the low incidence of the rectal diverticulum.

Pathogenesis and clinical features

Often the rectal diverticula are asymptomatic, but faecal impaction is an issue, similar to the colonic diverticula. There are reports of rectal diverticular inflammation (diverticulitis), abscess formation and perforation necessitating treatment. A rectal diverticulum can also present with symptoms of obstructive defecation due to impacted stools, or prolapse due to the inversion of the diverticulum. Most worrying is the presence of cancer within the diverticulum, which has been reported in most of the articles on rectal diverticulum published in the literature.

A patient with rectal diverticulum can present with symptoms of abdominal pain, bleeding per rectum, tenesmus, perianal pain, purulent discharge, change in bowel habit and other red flags of cancer. Some articles have also reported symptoms due to compression and inflammatory consequences of a big abscess caused by a complicated rectal diverticulum causing obstructive uropathy and neuropraxia (13). Other complications associated with rectal diverticulum are rectal stenosis, recto-vesicle fistula, recto-vaginal fistula, and misdiagnosis of rectal mass or cancer.

Investigations

Cancer associated with rectal diverticula is of significant concern, but a treatable condition that warrants rectal diverticulum to be investigated and resected (14). These are best examined with computed tomography (CT) scans with rectal contrast, and an magnetic resonance imaging (MRI) of the rectum. Other investigations which can aid in diagnosis are barium enema, defecating proctograms, transrectal ultrasound and colonoscopies. Digital rectal examinations in outpatient settings and examination of the rectum under anaesthesia are other vital techniques that can aid in diagnosis. There are reports of missing the identification of the rectal diverticular opening while performing a colonoscopy (14). Therefore, it is imperative to proceed with the radiological investigation and examine the rectum in the clinical setting or under anaesthesia in a surgical theatre, particularly in symptomatic patients.

Often the investigations help to obtain a diagnosis and to formulate a plan of action for symptomatic patients. Non-specific presentations are not uncommon and can lead to misdiagnosis. Some differentials might change the course of treatment, like rectal duplication cyst, congenital

epidermoid or inclusion cyst, teratoma, chondroma, inflammatory mass, neurogenic lesion, rectal prolapse, rectocele, solitary rectal ulcer, etc. (15). Therefore, these diagnoses should be considered while investigating patients.

Management

Treatment of rectal diverticulum is individualised, factoring in the patient's fitness status and quality of life. Asymptomatic cases with benign-looking uncomplicated diverticulum need no intervention. Whereas symptomatic and malignant features mandate surgical treatment. Cancer harbouring rectal diverticulum should be resected on oncological principles with total mesorectal excision (TME) by anterior or abdominoperineal resection. TME can be performed by open, laparoscopic, robotic, trans-anal or hybrid approaches, depending on the surgeon's experience.

Acute cases presenting with rectal diverticulitis, abscess or perforation can be treated conservatively with antibiotics, and localised collections can be drained radiologically. Emergency intervention in the form of abscess drainage, rectal resection, Hartmann's procedure or defunctioning colostomy is considered in the event of profound clinical insult and the failure of conservative management in acute presentations.

Cases of rectal diverticulum with obstructive defecation can be treated with resection or mesh rectopexy from an abdominal approach, as described in the article by Bustamante-Lopez *et al.* (1) and Chen *et al.* (11). Surgeons should carefully choose the type of mesh, and its fixation, as the rectal wall is already weak. Biodegradable mesh is preferred as synthetic meshes may erode the weak rectal walls. Ventral mesh rectopexy not only repairs the rectal diverticulum but also would support the weakened area and avoiding resection would have the advantage of less complications. Perianal or transanal resectional procedures can also be an excellent alternative, particularly in a patient who is not an ideal candidate for a repair from the abdominal approach. Transanal or endoscopic diverticulectomy can be considered in the expert's hands if the patient is unsuitable for surgery, even via a perianal procedure.

The transanal approach for resection of the diverticulum is preferred in the event of diagnostic uncertainty. However, colonoscopy carries the disadvantage of potentially causing an iatrogenic perforation in the rectal diverticulum. This risk increases further during difficult rectal retroflexion. But colonoscopy can aid in diagnosing and treating the

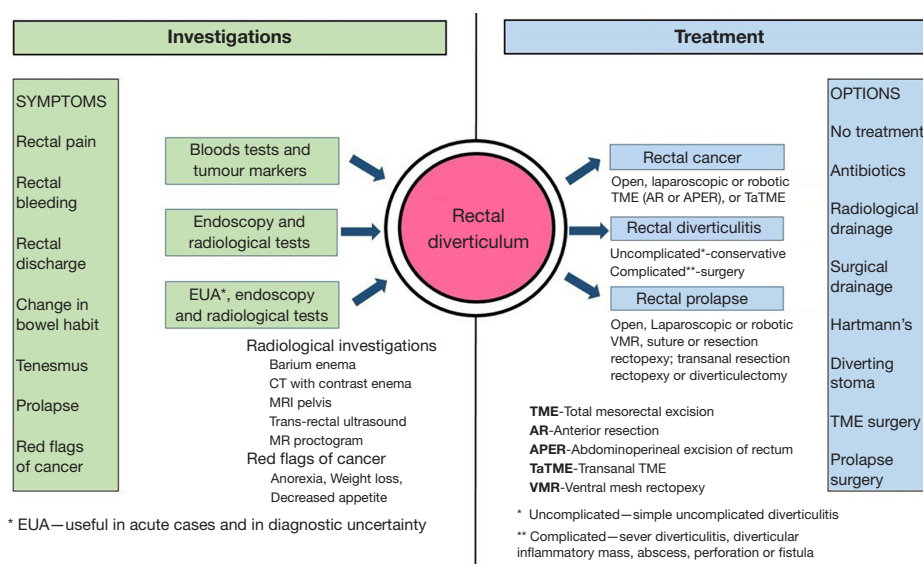


Figure 2 On the left-hand side of the table shows a summary of presenting symptoms and required potential investigations of rectal diverticulum, and on the right-hand side of the table a summary of treatment options that are available and specific depending on the diagnosis of uncomplicated or complicated rectal diverticulum. EUA, examination under anaesthesia; CT, computed tomography.

perforated diverticulum using through-the-scope or over-the-scope clips with or without endoloops (16). *Figure 2* shows a summary of the potential investigations and treatment required in case of rectal diverticulum.

Conclusions

Bustamante-Lopez *et al.* (1) has added another tool to the basket of options for treating rectal diverticulum. The rectal diverticulum is a rare condition with significant associations. It is vital to be aware of the entity and consider the differentials of a rectal diverticulum in all patients with perianal symptoms for further appropriate investigations. The author has also contributed valuably to the rare literature and concisely provided a solution with robotic ventral mesh rectopexy for a symptomatic benign rectal diverticulum causing the obstructive defecation.

All clinicians are encouraged to report such incidents to increase and strengthen the relevant medical literature. This will further improve surgeon's awareness and confidence with innovations in managing the rectal diverticulum.

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