

Considerations at Colonoscopy in Diverticular Disease

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INTRODUCTION

Diverticular disease of the colon is a common condition becoming ever more prevalent. While it is considered a disease of an elder population in the western world, it is becoming more prevalent in populations not typically associated with the presence of the disease. In the past century the prevalence of the disease has been seen to rise, which is believed by many to be due to aging population, low fiber diets and the obesity epidemic of the modern western world. Given the rise witnessed in the past number of years, which can only be expected to continue, and the advancements made in technology and medical care pertaining to this disease, it is of importance to gastrointestinal surgeons and physicians alike. The frequent presence of this condition at endoscopy and in clinical practice is guaranteed for all parties whose scope of practice pertains to the lower gastrointestinal tract. The scope of this chapter is to update and inform those relevant medical professionals on updates and ongoing developments in the field of diverticular disease.

TERMINOLOGY

Diverticulae (diverticulum singular) are saccular out pouchings of the alimentary tract formed at a point of structural weakness within the wall of the tract. In instances where an increase in intra luminal pressure is the mechanism whereby the wall integrity is compromised, the diverticulum is termed a pulsion diverticulum. This is thought to be the case in colonic diverticulae which are most frequently found in the distal colon and associated with increasing age. The term diverticulosis refers to the presence of multiple diverticulae in a segment of intestine without any evidence of inflammation and being asymptomatic. If colonic diverticulae result in patients experiencing symptoms, most commonly abdominal pain and changes in bowel habit, the term; diverticular disease is applied. Diverticulitis most commonly occurs in colonic diverticulae and involves inflammation of the diverticulum secondary to infection, leading to abdominal pain, constipation, diarrhoea and in more severe cases abscess formation. The distinction between the presentation of diverticulitis and diverticular disease is that the pain experienced by the patient is due to inflammation and infection in the former and symptomatic colonic spasms in the latter [1].

ANATOMY

Diverticulosis is commonly identified in the sigmoid colon, the anatomy of which, not only bears significance in the development of the disease but also the reported complications and their extent. The sigmoid colon begins at the termination of the ascending colon proximally, at the level of the pelvic inlet. It terminates with commencement of the rectum approximately at the vertebral level S3, after completing its, somewhat tortuous, course through the pelvis from which it gets its name. The “S” shape of the sigmoid colon, in the setting of diverticulosis is an important consideration for endoscopists as it may lead to difficulty progressing the investigation to completion [2] and one must be aware of the dangers of intubating a diverticulum in error, in place of the potentially difficult lumen.

As with the rest of the colon, the longitudinal muscle layer of the sigmoid is concentrated into three taenia coli. As a result of this the sigmoid wall has sections unsupported by a continuous longitudinal muscle layer as seen in other parts of the gastrointestinal tract. The sigmoid colon is the narrowest part of the colon inevitably predisposing it to higher intra luminal pressures, which coupled with other factors is thought to contribute significantly to the pathophysiology of diverticulosis.

The sigmoid and transverse segments of the colon are intraperitoneal structures, allowing for expansion of faeculent collections in complicated diverticular disease.

The blood supply of the sigmoid colon originates from the inferior mesenteric branch of the aorta and divides into a number of sigmoid branches which form arcades from which the vasa recta pass distally to the bowel wall.

The close relationship of the sigmoid colon to other pelvic structures such as the left ureter and the bladder contribute to the development of complications in diverticular disease such as obstructing inflammatory masses and colo-vesical fistulisation respectively [3-4].

PATHOPHYSIOLOGY

Despite descriptions of diverticulosis in humans that date back to near antiquity, the prevalence of diverticular disease has been on the increase in modern times and is generally regarded as a disease of modernity. A definite explanation for the pathophysiology of diverticulosis and its various symptomatic complications has eluded investigators for many years [5].

At the beginning of the last century Drummond published his findings on the topic following post-mortem examinations of patients harbouring colonic diverticulae. He described in his report “pathological sacculations” (which we now know as diverticulae) of the large intestine and found that their locations bore a relationship to the point at which the vasculature of the bowel wall, by way of the vasa recta, perforated the muscularis mucosa [6]. The conclusion drawn by Drummond, that the development of diverticulosis, was in part, related to the structural compromise of muscularis by vasculature, has been built upon in the subsequent years and is generally accepted as a causal factor. The close relationship between colonic diverticulae and the vasa recta has also been investigated as the cause of the typically large, painless, haematochezia in resected sigmoid specimens. The specimens, removed as an emergency measure for life threatening bleed, were injected with a gelatin and barium based mixture which identified the perforating arteries juxtapose to the diverticulae as the source of bleeding [7].

Aside from the contribution of perforating vessels, the intra luminal forces applied to the wall of the sigmoid colon have also been shown to result in pulsion diverticulae. From a physiological and anatomical stand point the sigmoid colon is primed for the development of diverticulae due to its narrow lumen, particularly muscular wall and propensity to spasm [8]. These physiological and anatomical distinctions of the sigmoid contribute to diverticulosis in line with the law of LaPlace which explains how the intra luminal pressure within the sigmoid will be influenced by both the narrow radius of the sigmoid and the colonic wall tension brought about by spasm.

The biomechanical make up of the colonic wall has also been shown in laboratory studies to undergo change that undermines its integrity and contributes to the development and progression of diverticulosis. Investigators found that colonic specimens containing diverticulae had significantly greater collagen content in the mucosal and submucosal layers when compared to colonic specimens free of diverticulosis. The extent of collagen infiltration was also seen to bear a proportional relationship with the extent of the diverticulosis. The collagen infiltration was also linked to age related changes within the tissue and was also accompanied by thickening of the muscularis propria [9].

The natural history of diverticulitis has been compared in reports to that of the inflammatory and infective processes of the vermiform appendix. It stands to reason that despite the fact that pulsion diverticulae are acquired both they and the appendix would be subject to similar pathological processes. Obstruction of the neck of the diverticulum is commonly by way of a faecolith, leading to failure of the mucosa within the obstructed viscus to dispel its secretions. Accumulation of colonic secretions leads to oedema of the viscus, compromise of its local vasculature and eventually necrosis and rupture. The resemblance between the two pathological processes is further marked by the initial presentation of inflammation in apices of both viscera [10].

CURRENT GUIDANCE ON DIVERTICULAR DISEASE

The management of diverticulitis is typically undertaken by gastro intestinal or general surgeons and guidance on the workup and management is provided by The American Society of Colon and Rectal Surgeons. It's most recent guidance was published in 2014[11] and replaces the previous guidance document of 2006[12].

Recommendations for the initial work up of suspected diverticulitis is a focused clinical examination and history. Accurate clinical features include left lower quadrant pain without evidence of other peritoneal signs, pyrexia and leukocytosis on complete blood count. Further to complete blood count, the initial work up should include urinalysis and radiograph of the abdomen to exclude potential mimics of diverticulitis (Low quality evidence - 1C).

Further diagnostic workup should include computed tomography imaging of the abdomen and pelvis, enhanced by intra luminal and intra venous radio contrast, to grade the severity of diverticulitis and guide appropriate treatment. Contrast Enhanced Computed Tomography (CECT) can also further exclude diverticulitis mimics (Moderate quality evidence -1B).

Mild to moderate diverticulitis can be managed non operatively with anti microbial therapy and diet modification (Low quality evidence - 1C) and image guided percutaneous drainage is recommended for diverticular abscesses, thereby avoiding surgical management in a considerable cohort (Moderate quality evidence -1B).

Emergency surgical management is advised for all cases of peritonitis or failure of the more conservative, medical approach (Moderate quality evidence - 1B). Elective surgery is recommended in cases of complicated disease (Moderate quality evidence - 1B) and should be performed laparoscopically where the expertise is available and according to patient suitability (High quality evidence - 1A).

Following recovery from acute diverticulitis and in the absence of a recent colonoscopy it is recommended that all diverticulitis patients, for whom this is their first episode, undergo endoscopic evaluation of the colon. The logic of this recommendation is to exclude other potential diagnoses that may go undetected following the diagnosis of diverticulitis. Potential underlying

diagnoses may include, ischaemia, inflammatory bowel disease and neoplastic processes (Low grade evidence -1C) [11].

Aside from the diagnostic applications of endoscopy in diverticular disease, as recommended following acute diverticulitis, diverticular disease presenting as bleeding can be successfully managed with therapeutic applications as recommended by the American Society of Gastrointestinal Endoscopy.

In diverticular bleeding the use of thermal contact coagulation in tandem with epinephrine or in isolation is recommended. In instances where an adherent clot is identified this can be snared and the underlying vessel dealt with by coagulation. Perforation is a risk due to transmural injury if repeated attempts are made or higher settings are used. Endoscopic clips are also recommended as a viable alternative for clipping the vessel or neck of diverticulum. Tattooing adjacent to the offending diverticulum is also recommended [13].

OPPOSITION TO CURRENT GUIDANCE

The basis of ASCRS guidance surrounding the topic of interval colonoscopy is founded upon the logic that features of diverticulitis and symptomatic diverticular disease can also be found in other pathologies of the large intestine. The most concerning of these alternative diagnoses being an occult malignancy [11] for which the expected rates in an asymptomatic population are between 0.8% and 1% [14-15].

The practice however has been called into question by a number of authors in recent years and the once theorised causal relationship between diverticular disease and colorectal cancer has become a controversial topic [16].

Aside from clinical features such as abdominal pain, bleeding per rectum and change in bowel habit being shared by diverticular disease and other colonic pathologies, there are also shared radiological findings. It is not uncommon that following particularly severe or repeated attacks of inflammatory diverticulitis, that fibrotic strictures will form within the colon. On imaging the presence of a narrowed lumen will present an obvious concern for radiologists and primary physicians alike, even if the clinical picture presents diverticular disease as the most plausible diagnosis. Other radiological findings should, in this technologically advanced era, provide greater certainty. Such findings that have been proven to direct radiological diagnoses with high specificity and sensitivity include; mass lesions, contrast enhancement, thickness of bowel wall >6mm and the presence of localised lymphadenopathy [17]. These findings on CECT are significantly indicative of a diagnosis of colorectal cancer over diverticulitis leading to concluding recommendations that the cohort of patients with these findings should be selectively evaluated with early colonoscopies. That same study found the overall rate of malignancy to be low and not in support of the blanket recommendation of the ASCRS; that all patients with diverticulitis need to undergo interval colonoscopy.

Other studies have highlighted that the clinical course of a patient's index admission with suspected diverticulitis may guide the definitive diagnosis. In a prospective study of patients admitted to hospital with uncomplicated diverticulitis that underwent the recommended interval colonoscopy the rate of CRC discovery was in line with that expected of an asymptomatic cohort of similar age. The authors of that study found that the patients who subsequently received a diagnosis of CRC had not responded to appropriate therapy for the initial diagnosis of diverticulitis [18]. In combination with clinical and radiological distinctions, the monitoring of response to treatment may also be purported as an indicator of true diagnosis and aid stratification of clinical need for colonoscopy.

Evidence also exists regarding the diagnostic importance of relevant negative findings that support an uncomplicated course of diverticulitis over that of CRC. In a large study that amalgamated endoscopic, radiologic and clinical predictors of CRC in diverticulitis patients it was found that the absence of "alarm" symptoms in patients with diverticulitis was reasonable grounds to forgo the recommended interval colonoscopy. Their data show that 99.5% of this cohort could expect to be free of any occult malignancy, having been spared the expense and morbidity of the, arguably, unnecessary investigation [19].

Patients' age may also guide clinicians in their decision on which diverticulitis patients warrant endoscopy. While diverticulitis is reportedly more common in the older population, within that cohort, the older demographic demonstrate a higher risk of malignancy. A study of over 500 patients with diverticulitis found that the average age for acute diverticulitis was just over 65 years and that the diagnosis of CRC trended towards those of advancing age with the mean age for malignancy being 76 years. This trend is further evidence that patients can be categorised based on need for further follow up colonoscopy after diverticulitis resolution [20].

A culmination of published evidence that contravenes the ASCRS guidance can be found in a systematic review published by Sai et al [21]. Those authors concluded that the groundswell in evidence indicates that colonoscopy can be safely and accurately utilized by better selection of diverticulitis patients who would benefit most. Further to this finding the authors also propose that the basis of the current guidance is on outdated evidence that has been surpassed by advancements in the technology and delivery of gastrointestinal imaging. This proposal may relate to the routine use of barium studies prior to the availability of CECT imaging that is part of modern clinical practice. Reports on diverticulitis at that time show a rate of between 2.4 and 17% for occult colorectal malignancies in patients with initial diagnoses of diverticulitis [22-23].

Based on such reports, the ASCRS guidance would indeed be prudent and warranted however the modernisation of diagnostic radiology and improved availability are incongruent with the recommendation that has persisted despite these advancements. Prior to routine use of CT imaging, barium enema studies were commonplace for the investigation of diverticulosis and other colonic pathologies, including malignancy. When the findings of barium enema and

endoscopy were compared in patients with symptomatic diverticular disease the imaging was found to be inaccurate 35% of the time with generally poor specificity and sensitivity for detection of polypoid or malignant disease in diverticular patients [24].

Patients found to benefit most from the use of interval colonoscopy after acute diverticulitis is those patients whose initial course is particularly severe. Patients who are found to have paracolic or pelvic abscesses appear to have an increased risk of diagnosis of malignancy within a year of their diverticulitis presentation [25]. It should be noted that the finding of CRC so soon after a diverticulitis diagnosis, is expected to be due to concealment of the true pathology by the abscess rather than some causal relationship [20]. A recent meta analysis also demonstrated that this cohort of patient is at higher risk of CRC diagnosis and simultaneously reported that patients with acute uncomplicated diverticulitis did not represent the same risk [26].

ENDOSCOPIC COMPLICATIONS IN DIVERTICULAR DISEASE

Diverticulosis is a common disease and its prevalence can only be expected to rise as our population ages. It is expected that approximately 60% of all adults over the age of 60 years have asymptomatic diverticulae based on incidental findings at endoscopy. Among that 60%, between 10 and 25% of patients will develop a symptomatic diverticulitis [27-28]. In line with current guidance, it can be expected that endoscopists will continue to encounter diverticulae frequently and increasingly so, with the expected growth in prevalence.

Colonoscopy, while a common investigation is not without its risks which are equally present in diverticular disease if not increasingly so. During colonoscopy it is not uncommon for patients to experience discomfort or pain, in the vast majority however this can be expected to resolve expectantly. In more troubling cases, patients can go on to develop colonic perforation or haemorrhage. In diverticulosis there is also an additional possibility of colonoscopy inducing an acute inflammatory diverticulitis [29].

Perforations in diverticular disease are a source of particular concern in light of the compromise to bowel wall integrity (discussed previously) and it has been shown that both instrumentation, for example direct contact or scope looping, and insufflation of air place patients with diverticulae at high risk of rupture [30]. Reported incidences of perforation at colonoscopy are less than 1 case per 1000 and the single biggest contributor towards this figure is therapeutic endoscopy. While therapeutic endoscopy is not often undertaken as part of routine work up for diverticular disease, perforations are also seen more frequently in the elderly, those with a history of co morbidities and in the presence of diverticulosis [31].

The rates of serious complications, even in the presence of diverticulae, are relatively low but more commonly diverticulae may present technical challenges to endoscopists. Studies examining completion rates of colonoscopy, as defined by arrival at the cecum, were repeatedly influenced by the presence of diverticulae. As with complication rates, presence of diverticulae

and advanced age were both associated with higher rates of failed completion and longer times to completion [32-33]. As discussed previously, the presence of diverticulae in the colon bears a causal relationship to advancing age which can be explained by age related collagen deposition in bowel wall. Both contributors to the technical difficulty of colonoscopy can be expected to present themselves simultaneously, adding to the challenge in this patient cohort.

BLEEDING PER RECTUM AND DIVERTICULAE AT COLONOSCOPY

The classical presentation of a diverticular bleed is a painless and profuse episode of haematochezia. This comes about as an offending diverticulum results in the erosion of the perforating artery to which it bears a close relationship. The consequence of the erosion is an arterial bleed that may be pooled for a time in the rectum prior to expulsion. The management of such a presentation will involve supportive measures and urgent investigation of the colonic lumen.

Evidence from colonoscopies in the acute instance report that diverticulae are very often incidental the bleed and not often the cause, although diverticulae are the most common source of haematochezia in the elderly [34-35]. That same study also advocated the use of therapeutic measures in true diverticular bleeds as it brought about immediate resolution of the bleeding source, resulted in patients' avoiding surgical intervention and had low rates of recurrent bleeding. When the cohort of patients that underwent endoscopic treatment of their bleeding, were compared to those who underwent surgery, it was also found they had a shorter and less complicated hospital admission [36].

A large population based study, evaluating haematochezia and the role of colonoscopy found that diverticulae were present in just under 40% of patients and that haemorrhoids were the most likely culprit of their presentation. Bleeding colonic polyps were the cause almost as frequently as diverticulae, highlighting the importance of thorough examination of the colon regardless of an early finding of diverticulosis. In a recurring theme it found that the diagnoses of diverticulae, polyps and carcinoma were more prevalent in the elderly who were also highest risk for failure of a complete exam [37].

CONCLUSION

In conclusion, colonic diverticulae are an ever present feature at colonoscopy. The prevalence of diverticulosis and in turn diverticular disease has been increasing in the past number of decades and this trend is expected to continue as our population ages. The distinct anatomy of the sigmoid colon lends itself to disease development in this, anecdotally, challenging segment of colon to traverse at colonoscopy. Endoscopists must be conscious of the implications of diverticulae, as they contribute to increased difficulty in exam completion and higher risk of severe complications such as perforation. Current guidance pertaining to colonoscopy in this disease process recommends both therapeutic and diagnostic applications. In the case of diverticular haemorrhage, haemostatic

techniques are approved and the evidence shows that patients can benefit from their employment. Regarding routine interval colonoscopy recommendations following acute diverticulitis, there are a milieu of publications in conflict with the practice guidelines and within the evidence there is a move towards a more selective approach to colonoscopy use.

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