Diverticular Disease

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Abstract

Diverticular disease is an umbrella term encompassing symptomatic diverticulosis, uncomplicated and complicated diverticulitis. The presence of diverticula increases with age, affecting up 70% of the population by 80 years of age. It is associated with a significant economic burden in terms of health-care costs, hospitalisation, and resource utilisation. Although mortality from non-complicated diverticulosis is extremely rare, morbidity and mortality risk increase ten-fold with complications such as perforation or fistula. This article will examine diverticular disease, its pathogenesis, symptoms, and complications. Additionally, the surgical and non-surgical treatment options will be discussed including the role of antibiotics.

Diverticular Disease

Diverticular disease is an umbrella term encompassing symptomatic diverticulosis, uncomplicated and complicated diverticulitis (Black and Hyde 2005). Diverticular disease is significantly increasing in prevalence in western countries by 0.56 to 1.20 per 1000 population per year (Jeyarajah et al. 2009). The presence of diverticula increases with age, 50% of the population aged over 50 years are affected, rising to 70% by 80 years of age (Royal College of Surgeons (RCS) 2014a). It is associated with a significant economic burden in terms of health-care costs, hospitalisation, and resource utilisation (Imaeda and Hibi 2018). Mortality from non-complicated diverticulosis is extremely rare, that said, morbidity and mortality risk increase ten-fold with some of the potential complications such as perforation or fistula, paired with a pre-morbid aging population (Humes and West 2012, Sartelli et al. 2020).

The presence of diverticula in the absence of any associated symptoms is known as diverticulosis (Kumar and Clark 2017). Diverticula are sac-like protrusions which form when colonic mucosa and submucosa herniate through defects in the muscle layer of

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the colon wall, typically occurring in parallel rows between the taenia coli (Black and Hyde 2005). Diverticula are most commonly left sided found in the descending and sigmoid colon (Imaeda and Hibi 2018, Thaha and Carrington 2020); however, multiple studies have shown the anatomic distribution of diverticula varies. Right sided diverticulosis appears more common in certain ethnic groups. Golder et al. (2011) found black Africans were 3.51 times more likely than Caucasian to have right-sided diverticular disease and Hong et al. (2016) study of east Oriental subjects concluded right sided diverticula in 85.3% of the subjects compared to only 10.9% left-sided disease. Although not entirely understood these differences appear to be contributed to factors including industrialisation, diet and genetic dispositions (Strate and Morris 2019, Sartelli et al. 2020); hence clinicians should have awareness of potential ethnic attributes to tailor investigation and treatment.

Pathogenesis

Pathogenesis of the disorder is in part understood and likely involves a number of complex mechanisms including structural abnormalities of the colonic wall, disordered intestinal motility, and deficiencies of dietary fibre (Black and Hyde 2005). Diverticula formation is multifactorial but the 21st century lifestyle of unbalanced, low fibre diet and rise in obesity are proven risks (Thaha and Carrington 2020). Ma et al. (2020) found those who gained ≥20 kg in adult life had a 73% increased risk of diverticulitis. This study was solely female subjects, however, is supported by large prospective study on solely males who concluded that Body Mass Index (BMI), waist circumference and waist-to-hip ratio significantly increased the risks of diverticulitis (Strate et al. 2009). Other risk factors include genetics, advancing age and smoking (National Institute for Health and Care Excellence (NICE) 2019). Smoking has not only been shown to increase risk of incidence by 1.36 for current smokers and 1.17 for former smokers but has further been linked to an increased risk of developing complicated disease (Anue et al. 2017). A meta-analysis by Wijarnpreecha et al. (2018) hypothesised that nicotine can reduce tone and activity of smooth muscle in sigmoid colon, resulting in reduction of the colonic contraction. Furthermore, that cigarette smoking is often associated with other poor health habits which are predisposing factors for diverticulosis.

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As diverticulosis is asymptomatic, specific treatment is not recommended (NICE 2019, Thaha and Carrington 2020). Given the known risk factors, lifestyle advice encouraging a healthy balanced diet, adequate fluid intake and weight-management should be offered. Health promotion is a fundamental aspect in nursing practice; Registered Nurses (RN) can use their interactions to provide individuals with meaningful public health advice, guidance, and support (Brooker and Waugh 2013, Royal College of Nursing (RCN) 2016). Individuals' engagement can widely vary, hence, clinicians should make every moment count. The National Health Service (NHS) making every contact count campaign (NHS 2014) recommended for the best outcomes the information provided to be selective focusing on one area at a time, work in partnership with the individuals, be positive, encouraging and supportive and consider potential barriers and how to overcome them.

Traditionally there was a notion that individuals with diverticula should avoid nuts, seeds and corn; this theory is no longer recommended following a large prospective study who found no significant association between consumption of these items and incidence of diverticulitis (Strate et al. 2008). A high fibre diet still remains recommended (NICE 2019, RCS 2014a). Aune et al. (2020) found a high fibre intake, categorised as consuming 30g daily, had a 41% risk reduction in the risk of diverticular disease. Increased fibre intake has further been displayed to improve abdominal symptoms potentially due to increased stool weight and volume in turn increasing transit time, lowering intracolonic pressures and contributing to more frequent bowel movements (Carabotti and Annibale 2018). Clinicians should not solely recommend a low fibre diet but rather tailor fit to each individual patient. However, if fibre is thought to cause symptoms then clinicians should signpost for provide dietary advice,e.g.The Association of UK Dietitians has useful Food Fact Sheets. In more complex cases, benefit may be gained from a formal dietician referral for individualised guidance (NICE 2019, The Association of UK Dietitians 2022).

Symptoms

Approximately 25% will develop symptoms of a broad spectrum from mild to severe and potentially catastrophic (RCS 2014a). Symptomatic uncomplicated diverticular disease (SUDD) encompasses abdominal symptoms including pain, bloating and

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changes in bowel habit in the absence of inflammation (Tham, Collins and Soetikno 2016). Frequency and extent of symptoms is variable but has been shown to negatively impact an individuals' quality of life attributing to a wide range of physical, psychological and social restrictions (Spiegel et al. 2015). High quality holistic care of these individuals is paramount, RNs are optimally placed to build relationships and support not only the physical aspects but provided emotional support to protect physiological wellbeing (NMC 2018).

Given the nature of abdominal symptoms Carabotti and Annibale (2018) explain it is extremely challenging to differentiate between SUDD, functional gastrointestinal disorders and visceral hypersensitivity, re-enforcing differential diagnoses should be considered, and investigated to enable exclusion. Advanced Clinical Practitioners (ACPs) are well placed caring and assessing these individuals given their highly developed clinical assessment skills paired with sound clinical reasoning abilities (Health Education England (HEE) 2017). The main goal in the management of SUDD is the relief of abdominal symptoms; guidance advises simple analgesia, antispasmodics and consideration of bulk-form laxatives. In the presence of functional symptoms alongside SUDD, antibiotic treatment is not recommended of benefit in this cohort of patients (NICE 2019, Sartelli et al. 2020).

Diverticulitis

Diverticula in the presence of infection is known as diverticulitis (Kumar and Clark 2017). It is believed diverticulitis results from impacted faeces within a diverticulum, leading to an obstruction of the lumen, raising interdiverticular pressure by continuing mucus formation and ultimately causing ulceration within the diverticular mucosa (Tham, Collins and Soetikno 2016). Subsequently allowing for proliferation of bacteria, microperforation, ischemia and inflammatory infiltrates composed of lymphocytes, neutrophils, and activated macrophages (Black and Hyde 2005). Changes in colonic microbial environment, with higher levels of Bacteroides and lower levels of Bifidobacterium have been linked to diverticulitis along with increased expression of histamine and metalloproteases, which are associated with intestinal inflammation (Strate and Morris 2019).

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In patients with suspected acute diverticulitis complete assessment of the patient using clinical history, examination signs, laboratorial inflammation markers, and radiological finding is recommended (RCS 2014a, Sartelli et al. 2020). Common clinical manifestation of diverticulitis is constant abdominal pain, usually severe and localising in the left lower quadrant, fever, fulness or abdominal distention and new change in bowel habit and or rectal bleeding (NICE 2019, Thaha and Carrington 2020). As with any acute abdominal presentation, symptoms are often varied and non-specific, it is essential differential diagnoses are considered and any red flag, malignancy symptoms forefront when establishing a comprehensive history (RCS 2014b).

Blood tests

White Cell Count (WCC) and C-Reactive Protein (CRP) are the inflammatory markers shown to be of considerable benefit in the diagnosis and severity prediction of diverticulitis. Tan et al. (2016) found association between an elevated WBC count and disease severity; however, this was not able to predict a requirement for surgical versus medical treatment or difference in mortality. Considering the studies reviewed were not within the UK, there may be a potential limitation in transferability. CRP was evaluated in a systematic review which found a significant association between raised CRP and the risk of complicated diverticulitis. The overall mean CRP among patients with uncomplicated diverticulitis 68 mg/L compared to 186 mg/L among patients with complicated diverticulitis (Bolkenstein et al. 2017). That said, Sartelli et al. (2020) highlight great caution should be taken using CRP to exclude diverticulitis given its non-specific nature and there is a delay of 6-8 hours from disease onset and CRP does not peak until 48 hours. When monitoring WCC and CRP in the acute phase it is sensible to monitor the trend view of serial samples to ensure adequate response to treatment (Black and Hyde 2005).

Imaging

Computerised Tomography (CT) is the gold standard imaging modality for acute diverticulitis (RCS 2014a, NICE 2019) with exceptional sensitivity and specificity 97% and 98% respectively (Kandagatla and Stefanou 2018). Furthermore, it can include and exclude other differential diagnoses, evaluate the extent severity of disease, and guide treatment planning of complications such as abscess (Sartelli et al. 2020).

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There are risks involved including exposure to ionising radiation and administration of contrast with potential for allergic reaction and contrast induced nephropathy (DeStigter and Keating 2009). In certain groups given the risks CT may not be an option, Ultra-sound scan (USS) is a viable alternative, is able to measure bowel wall thickness, demonstrate pericolonic inflammation and identify abscess with a sensitivity of 77 to 98% and a specificity of 80 to 99% (DeStigter and Keating 2009).

Classification systems

There are numerous classification systems for diverticulitis, in international guidelines by Sartelli et al. (2020) none were concluded proven to be superior in predicting patient outcomes. Locally the Modified Hinchey classification is most utilised to guide management, with 6 categories of disease extent. 0-1a broadly speaking are uncomplicated disease, 1a-4 are varying degrees of complicated disease from localised small abscess to generalised faecal peritonitis (Fozard et al. 2011). ACPs frequently utilise local and National policy to ensure contemporary evidence-based rationale underpins clinical decision making (HEE 2017).

Uncomplicated diverticulitis is defined as localised, contained diverticular inflammation (Kumar and Clark 2017). The recommended treatment is conservative management with simple analgesia and consideration of antibiotics (NICE 2019). ACPs independent prescribing abilities allows them to autonomously provide holistic care. Independent prescribers take accountability for clinical assessment, establishing a diagnosis, management and effective, safe prescribing (Royal Pharmaceutical Society 2016); hence should have awareness of cautions and contraindications before any medication is prescribed. Opioids and Non-steroidal anti-inflammatories are cautioned with diverticular disease, both being linked with increased risk of complications (Kvasnovsky, Papagrigoriadis and Bjarnason 2014). Opioids are known for their anti-cholinergic effects, they act on gut motility by decreasing the autonomic activity of the central nervous system reducing normal peristalsis; in turn increasing intraluminal pressures which may contribute to the production of new diverticula or an already diseased segment, to diverticula perforation (Gravante and Yahia 2013).

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The role of antibiotics

Prescribing antibiotics in acute uncomplicated diverticulitis is widely debated. A Cochrane review by Shabanzadeh and Wille-Jorgensen (2012) concluded a non-inferiority between antibiotics versus no antibiotics in the treatment of uncomplicated diverticulitis. This was more recently supported by multicentric observational study who concluded observational treatment without antibiotics did not prolong recovery, with significantly lower hospital stay and can be considered appropriate in patients with uncomplicated diverticulitis (Daniels et al. 2017). However, on examining this studies data it became apparent although potentially not statistically significant there were clear differences with some end points including readmission which was 17.6% compared with 12% when treated with antibiotics and mortality rates which were 1.1% and 0.4% respectively.

An emerging consensus is that uncomplicated acute diverticulitis may be more inflammatory in nature and a self-limiting condition in which local host defences can manage (Sartelli et al. 2020) paired with increased concern over antimicrobial resistance and the potential for adverse reaction NICE (2019) recommends a no antibiotic prescribing strategy in the clinically stable patient. This patient group potentially can be managed in an ambulatory manner reducing a substantial expensive and potentially avoidable, inpatient burden (RCS 2014b). Appropriate selection of individual suitability is paramount; with a low threshold for prescribing antibiotics in immunosuppressed, co-morbid individuals (NICE 2019). It is vital if antibiotics are withheld there is a high index of clinical suspicion for re-assessment and clear safety netting advice is provided given the potentially devastating effects of sepsis (Sartelli et al. 2020).

In the haemodynamically unstable patient or where there is suspicion of complicated pathology a broad-spectrum antibiotic should be administered (NICE 2019). The most common organisms involved in intra-abdominal infections are gram negatives, such as Escherichia coli and Bacteroides fragilis; adequate coverage of gram-negative rods and anaerobic bacteria is advised (NICE 2016). The initial care should mirror that of any acutely unwell patient, a comprehensive A-E assessment, appropriate fluid

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resuscitation, timely antibiotics administration and source control (Tham, Collins and Soetikno 2016).

Complicated diverticulitis

Complicated diverticulitis includes, but is not limited to abscess, fistula and perforation which occurs in approximately 12% of individuals with diverticulitis (Strate and Morris 2019). Complications are associated with a substantial risk increase. Humes and West (2012) reinforces this, concluding perforation or abscess had a 4.5-fold increase in 1-year mortality, whereas those with a fistula or stricture had a 2.5-fold increase in mortality. Complicated disease is no longer contained and isolated within the organ, subsequently resulting in peritoneal or extraperitoneal bacterial contamination, causing intra-abdominal sepsis and peritonitis (Browse et al. 2010).

Intra-abdominal sepsis occurs when common gut flora enters the usually sterile peritoneal cavity, endotoxins produced by gram-negative bacteria lead to the release of cytokines that induce cellular and humoral cascades, manifesting in acceleration and exaggeration of macrophage-derived cytokines release and effect (Daniels and Nutbeam 2010). Activating neutrophils, releases nitric oxide, a potent vasodilator that leads to septic shock. Tissue necrotic factor (TNFa), Interleukin 1 and 6 orchestrates production of toxic mediators that damage the endothelial lining, leading to increased capillary leakage (Sartelli et al. 2017). This complex amplified pro-inflammatory and anti-inflammatory response induces widespread dysregulation of innate systems and ultimately multi organ failure.

The most common complication is diverticular abscess; persistent infection can lead to localised ischaemia, enabling translocation of mucosal bacteria and eventual micro-perforation contained within pericolic fat, causing small pericolic or intra-mesenteric abscesses (Strate and Morris 2019). Treatment recommendations is dependent upon the size of the abscess; conservative antimicrobial therapy is suggestive for abscesses less then 5cm, with a 73% success rate (Bugiantella et al. 2014). In larger abscesses there is an increased failure rate for conservative treatment as such percutaneous drainage is a viable option (NICE 2019, Sartelli et al. 2020). Percutaneous drainage has been challenged by Mali et al. (2019) who concluded successful drainage remained at 13–18% regardless of the abscess size, paired with the inevitable

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potential complications as with any invasive procedure; intervention does not seem to be superior to the treatment with only antibiotics.

Fistula Formation and Perforation

Diverticular abscess can rupture or extend into adjacent organs forming a fistula, the formation of an abnormal pathway between two organs (Black and Hyde 2005). In diverticulitis, the most common fistulas are between the colon and bladder, known as colovisicular, or colon and vagina known as colovaginal; there should be a high clinical suspicion of fistula formation in patients presenting with symptoms of pneumaturia, dysuria and faecaluria (Browse et al. 2010). The primary management for these fistulas is resection of the affected colonic segment. However, in select instances for example in frail comorbid patients who are operatively high-risk non-operative management may be indicated (Tham, Collins and Soetikno 2016).

Perforation is a relatively common but potentially catastrophic complication with a UK population-based study discovering mortality at 1 year was 20% in patients with perforated diverticulitis (Humes and West 2012). Perforation is most common in the sigmoid colon, raised intraluminal pressure and pressure changes are an important aetiological factor (Black and Hyde 2005). There are wide degrees of perforation from localised contained micro-perforations, to distant, diffuse causing faeculent and purulent peritonitis (Tham, Collins and Soetikno 2016).

Non-surgical and surgical interventions

Non-operative management can be considered in highly selected patient cohorts, more so in the instance of localised sealed perforations, or individuals deemed too high-risk for operative intervention (NICE 2019, Sartelli et al. 2020). That said a high percentage require surgery, displayed by Sallinen et al. (2014) who found a conservative management failure rate of approximately 60%. Patient requiring emergency laparotomy are likely to have varying degrees of haemodynamic instability, it is paramount effective care pathways are in place to prevent delay to intervention alongside pre-operative optimisation of patient condition (National Emergency Laparotomy Audit (NELA) 2021).

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Hartmann's procedure is the most commonly performed emergency bowel resection procedure. Hartmann's is the surgical resection of the sigmoid colon; the affected area of bowel is removed and an end colostomy is formed (Black and Hyde 2005). RNs are central to the post-operative care following stoma formation; providing stoma care to ensure skin integrity is not compromised, stoma education and ongoing support (Brooker and Waugh 2013). Despite it being the procedure of choice, it remains associated with high levels of morbidity and mortality potentially due to the instability of patients pre-operatively potentially as it is the chosen technique in aged, frail, co-morbid populations (Sartelli et al. 2020, NELA 2021).

An ongoing debate remains regarding Hartmann's in comparison to primary anastomosis. Primary anastomosis is where the two ends of the bowel are re-attached preserving intestinal continuity (Black and Hyde 2005). Following Hartmann's procedure restoration of bowel continuity is always a dilemma with significant morbidity, of up to 25% and increased resource utilisation meaning a high proportion do not undergo reversal (Fleming and Gillen 2009). A permanent stoma can have devastating physical, social and physiological effects greatly impacting on an individual's quality of life (Vonk-Klaassen et al. 2016). In stable patients with minimal co-morbidities primary anastomosis with or without a diverting stoma has shown to be equivocal in terms of morbidity and mortality with stoma reversal rates significantly higher with primary anastomosis (Sartelli et al. 2020). The recent LADIES multicentre, randomised, superiority trial mirrored the safety of primary anastomosis, going further suggesting 12-month stoma-free survival was significantly better for patients undergoing primary anastomosis compared with Hartmann's procedure, 94·6% versus 71·7% (Lambrichts et al. 2019). Although the ultimate decision of operative technique lies with the consultant, nurses can collate and present the pertinent information required to comprehensively assess the associated risks and benefits of procedure choice.

Conclusion

The complexity of diverticular disease, the varying pathological changes and the need for adaptive management strategies is more than apparent. It has highlighted the need for a systematic approach and sound clinical reasoning. Given the increased

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prevalence, timely diagnosis, investigation and appropriate treatment could have a substantial impact in the future, for example hospital admission rates and antimicrobial stewardship. The role of the nurse or advanced practitioner within surgery, places them in an optimal position in the assessment and management of this patient group. Due to their high level of critical thinking, they can practice efficiently and deliver high quality holistic patient-centred; whilst practicing contemporary evidence-based care and adherence to local policy, encompassing the four pillars of advanced practice (HEE 2017).

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