Perforated colonic diverticulum in old age: surgical or medical management?

Perforation of a colonic diverticulum is a common surgical emergency particularly in older people. Surgical treatments result in the best outcomes for patients with good functional and physiological status, but for frailer patients there are minimally invasive and medical alternatives. This article considers the evidence for the different options.

The term diverticulosis refers to the presence of diverticulae or outpouchings of the colonic mucosa and sub-mucosa. These pockets of mucosa prolapse through weaknesses in the muscle layers in the wall of the colon at the points where blood vessels penetrate the colonic smooth muscle. Diverticulosis is uncommon before the age of 40 years and increases in incidence after that age (Comparato et al, 2007). Diverticulae are more often found in the sigmoid colon, probably as a consequence of the higher intraluminal pressure there. Epidemiological studies have identified dietary factors as potential explanations for the large geographical variations in the disease. A high intake of fibre, fruits and vegetables and wholemeal bread is associated with a 40–50% lower prevalence (Manousos et al, 1985; Aldoori et al, 1994).

Up to one-third people over the age of 45 years and two thirds of the population over the age of 85 years were affected by diverticulosis in the mid-1990s (Roberts et al, 1995). There is evidence that the incidence of complications of diverticular disease has risen in parallel with the overall prevalence. For example, in Finland the annual incidence of a perforated sigmoid diverticulum has increased from 2.4 per 100 000 in 1986 to 3.8 per 100 000 in 2000 (Makela et al, 2002).

Although most patients with diverticulosis are asymptomatic, around 20% will develop symptoms attributable to the condition and it is then usually called diverticular disease. Diverticulitis is the most common complication, which is thought to occur when faeces block diverticulae which then become inflamed. This in turn can lead to a number of acute and long-term sequelae including bleeding, fibrosis with stricture formation and, most seriously of all, colonic perforation. Perforation can result in localized purulent collections or, with larger perforations, generalized faecal peritonitis. In one large analysis of perforated diverticulitis there was a mortality rate of 6% for purulent peritonitis and 35% for faecal peritonitis (Eggenberger, 1999).

For many years most patients with a perforated colonic diverticulum have been treated operatively. However, surgery for the condition is associated with a significant mortality risk (Wayne et al, 2000; Kulah et al, 2003), and there has been debate about the best surgical technique to use in order to minimize the postoperative mortality. For most patients with non-perforated, non-obstructed acute diverticulitis there is a broad consensus that a non-surgical approach offers the best treatment at all ages (Eggenberger, 1999; Broderick-Villa et al, 2005; Comparato et al, 2007). In cases of perforation and generalized peritonitis surgery is the best option for the majority of patients (Smirniotis et al, 1992; Rohr et al, 1994; Faltyn and Jungwirth, 1996; Isbister, 1997; Funariu et al, 2006; Pavlidis et al, 2006; Richter et al, 2006).

However, some patients are too frail to undergo major surgery and require a conservative approach to therapy. There is a contention among some clinicians that very frail patients have better outcomes if colonic perforation caused by diverticulitis is managed medically, or with minimally invasive interventions. This article summarizes the evidence for such a conservative approach and outlines the best clinical practice for elderly patients with diverticulitis and colonic perforation with peritonitis.

Review methods

Searches were conducted of Medline/PubMed, the Cochrane library and Excerpta Medica databases from 1970–2008. Search phrases and key words used in the search were: 'conservative versus surgical treatment in the elderly', 'conservative treatment of colonic perforations', 'diverticulitis', 'perforated diverticulitis in the elderly', and 'management of complicated diverticular disease'. The total number of publications identified was 838. An initial screen of abstracts was conducted to select papers that specifically dealt with perforation of colonic diverticulitis. The final selection of papers was based on the size and quality of studies, the comprehensiveness of reviews, and recent publications taking account of modern surgical, imaging and medical technologies. Some papers included were selected from the

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citations of high level reviews, and some best practice recommendations from relevant specialist medical organizations were also included.

Making the diagnosis: clinical findings, laboratory measurements and imaging

Conducting a good quality initial assessment by obtaining a clear history and performing a careful physical examination is vital for all patients presenting with an acute abdomen. It must also be remembered that some frail older patients will not complain spontaneously of abdominal pain, and can present with less well-defined symptoms such as delirium. Tenderness, usually with guarding, in the left iliac fossa (localized inflammation) or throughout the abdomen (more generalized peritonitis) is a common finding, and most, but not all, patients will have a neutrophil leukocytosis and raised temperature. A raised heart rate is usual. Some patients have signs of systemic sepsis, such as hypotension and a metabolic acidosis.

Once a diagnosis of peritonitis by perforation has been considered then specific investigation to confirm the diagnosis is essential. The American College of Gastroenterology (Stollman and Raskin, 1999) and the Society for Surgery of the Alimentary Tract (2007) advocate that all patients should have a plain radiograph of the erect chest to look for pneumoperitoneum, indicated by gas under the diaphragm, as part of the cardiopulmonary assessment in elderly patients. The European Association of Endoscopic Surgeons (1999) state that the gold standard investigation for complicated diverticular disease is computed tomography, and this is superior to ultrasonography and contrast enema radiography in the diagnosis of acute diverticulitis (Eggesbo et al, 1998). Computed tomography also helps to determine the prognosis, as the diagnosis of diverticular abscess or perforation would indicate a poor response to non-operative management (Kaiser et al, 2005).

Initial management and the use of antibiotics

All patients need immediate assessment and investigations together with simultaneous basic supportive treatment with intravenous fluid replacement, pain control and fasting (in case early surgical treatment is chosen), with urgent assessment by a surgeon.

Table 1. Hinchey classification of intra-peritoneal sepsis

Based on the clinical presentation and results of computed tomography	
Stage I	Pericolic abscess
Stage II	Pelvic, retroperitoneal or distant peritoneal abscess
Stage III	Generalized purulent peritonitis
Stage IV	Generalized faeculent peritonitis

From Hinchey et al (1978)

Broad spectrum intravenous antibiotics should be given (American Society of Colon and Rectal Surgeons, 2001; Society for Surgery of the Alimentary Tract, 2007). The choice of antibiotic regimen will depend on local policies and resistance patterns. Intra-abdominal infections are usually caused by Gram-negative bacilli and anaerobes. The current antibiotics most commonly used are metronidazole and a cephalosporin in combination, although trials have shown single agents to be as effective as combination therapy (Mosdell et al, 1991; Kellum et al, 1992). Conversely, inadequate antibiotic therapy results in poorer outcomes (Mosdell et al, 1991).

Next steps in acute management

No trials provide categorical evidence as to which patients should be treated surgically or medically. The main considerations are the severity of the intraperitoneal sepsis, as classified by Hinchey et al (1978) (*Table 1*), and the patient's functional and physiological state, which takes into account cardiopulmonary and renal function, and the extent of co-morbidities (Komatsu et al, 2005; Makela et al, 2005) (*Tables 2* and *3*). However, there is no comprehensively agreed approach to this and the decision depends on the judgement of the clinicians involved.

An approach to management of colonic diverticular perforation in frail old age

When an elderly patient presents with an acute abdomen caused by diverticular perforation many factors need to be taken into account to decide the optimal treatment for that patient. In particular, the extent of the intraperitoneal sepsis (*Table 1*) and clinical-physiological state (*Table 2*) of the patient must be assessed. In conjunction, the admitting clinicians need to decide what the ceiling of treatment would be for the patient based on their knowledge of the risks and potential benefit of any intervention undertaken.

Broadly, older patients who present with an acute abdomen secondary to colonic diverticular perforation can be split up into three main groups:

1. Those who although elderly are deemed fit enough for all procedures. For such patients the full range of options can be considered, including laparotomy and resection
2. Those who are deemed not fit enough for major surgery as a result of frailty or co-morbidities but are not terminally ill and stand to benefit from treatment. These patients can be considered for all other forms of active treatment, with a judgement needed as to which will receive medical treatments only and which might benefit from minimally invasive procedures, such as drain placement
3. Those who are very frail as a result of advanced co-morbidities, or known to have end-stage pathology, who are not likely to survive the peritoneal sepsis whatever treatment is given. These patients need the best available palliative care.

Surgery

If the clinical picture and investigations point towards generalized faecal peritonitis (Hinchey stage IV) and the patient is deemed fit enough for surgery, then surgical resection of the perforated bowel is the best option (Faltyn and Jungwirth, 1996; Isbister, 1997; Funariu et al, 2006; Pavlidis et al, 2006; Richter et al, 2006). There has been a marked improvement in outcomes of surgery since the 1970s as the preferred procedure has shifted from diversionary colostomy and drainage to bowel resection with or without primary anastomosis (Rohr et al, 1994). Perioperative optimization of the patient's physiological state with intravenous fluid infusion and intravenous antibiotics is essential.

The most frequently performed operation is the Hartmann procedure in which the perforated segment of sigmoid colon is resected and an end colostomy and rectal stump are fashioned. The colostomy is reversed several months later. However, there is growing evidence that primary anastomosis has better morbidity and mortality rates in Hinchey I and II, and comparable rates in Hinchey III and IV, when compared to the two-stage Hartmann's procedure (Nespoli et al, 1993; Constantinides et al, 2006; Richter et al, 2006), although that is still controversial.

If primary resection is not appropriate because of the high risk of perioperative mortality, diversionary loop colostomy, which may be performed laparoscopically, can be a life-saving alternative (Funariu et al, 2006; Pavlidis et al, 2006). The main factors associated with a high risk of postoperative mortality from colonic perforation treated by resection are late diagnosis, concomitant comorbities, particularly renal failure and cardiorespiratory disease, and the severity of the peritonitis (Shinkawa et al, 2003; Richter et al, 2006). The incidence of postoperative infections is also higher in patients with colonic perforation of non-malignant aetiology (Bielecki et al, 2002). Owing to the high morbidity and mortality rates in patients undergoing an emergency laparotomy with severe peritonitis, management on a high dependency unit with joint care with the intensive care physicians is advised. The mortality rate can also be reduced by ensuring better medical management of perioperative sepsis (Chandra et al, 2004).

Non-surgical management

Advanced age alone is not a contraindication to surgery although outcomes are poorer in extreme old age (Pavlidis et al, 2006). However, when an elderly patient with peritonitis is considered to be unsuitable for surgery a decision needs to be made as to whether he/she is likely to benefit from a non-operative but interventional approach to drain an abscess or free peritoneal fluid. This includes laparoscopic procedures (washout and drain insertion) and imaging-guided (computed tomography or ultrasound) drain placement (*Figures 1* and *2*). A study by Brandt et al (2006) concluded that percutaneous drainage can be safely performed as a definitive treatment for diverticular abscess in high surgical risk patients as well as being a bridge to a surgical procedure. Singh et al (2008) found that percutaneous drainage reduced the need for surgery and stoma formation. Further, they presented evidence that for the patient with a paracolic abscess there is no benefit from urgent colonic surgery over percutaneous drainage even if the patient is fit for immediate surgery.

Patients who should be considered for purely conservative management include those who are very frail with septic shock, diffuse peritonitis and very severe co-morbidities including end-stage renal failure requiring haemodialysis (although otherwise well patients on established dialysis might be suitable), severe cardiorespiratory disease, low preoperative platelet count and those who have very poor exercise tolerance before the acute abdominal presentation (Shinkawa et al, 2003) (*Table 3*).

If the patient is not fit enough for surgery or percutaneous drainage, but is thought not to be ready for purely palliative measures, then medical therapies need to be given, although patients with a diverticular

Table 2. Functional and physiological indices associated with a poorer outcome from surgical treatment but which are not absolute contraindications

Physical, radiological or echocardiographic evidence of heart failure
Chronic respiratory disease leading to a walking exercise tolerance of less than 50 metres
Chronic renal failure with an estimated glomerular filtration rate of less than 30 ml/min and/or serum creatinine above 200 µg/litre
Severe sepsis with a systolic blood pressure below 90 mmHg despite adequate fluid replacement and other measures
Co-morbidities in multiple physiological systems

Table 3. Clinical and physiological abnormalities that usually preclude surgery, although some patients might be suitable for percutaneous drain placement

Severe heart failure (New York class 4, or left ventricular ejection fraction below 25%)
Type 2 respiratory failure or type 1 respiratory failure not responding to oxygen supplementation
Cardiac and/or respiratory disease limiting walking to less than 20 metres
Estimated glomerular filtration rate below 10 ml/min and/or serum creatinine above 300 µg/litre
Hepatic failure
Platelet count below 50 x 10^9/litre
Severe co-morbid conditions such as advanced dementia or disseminated malignancy

Note: There is no trial-based evidence for these thresholds. This is not a comprehensive list and in an individual patient these, and other factors, would be part of the overall assessment made by an experienced clinician

abscess are not likely to survive without drainage. These involve optimizing fluid and electrolyte status with intravenous fluid, intravenous antibiotics and keeping the patient in the fasting ('nil by mouth') state for a few days in case he/she becomes fit enough for an intervention at a later stage. Longer periods of nil by mouth require parenteral nutritional support. The patient should be assessed regularly by the surgical, medical and critical care teams so that a comprehensive plan of the management can be made along with a decision on the ceiling of treatment tailored to each patient. For some very frail patients a period of intravenous antibiotics and bowel rest may be the only reasonable option, and there is some descriptive evidence that such an approach delivers outcomes that are no worse, and possibly better, than surgery or other interventions. However, there are no formal trials, or even case series, to establish evidence for that approach.

Predictors of mortality

Predictive scoring systems have been developed to help to determine the prognosis. Several studies have shown the Manheim Peritonitis Index (Linder et al, 1987) to be a sensitive scoring system for predicting mortality from colonic perforation, especially in the elderly (Kriwanek et al, 1994; Pisanu et al, 2004; Makela et al, 2005). The American Society of Anesthesiologists score has also been shown to be an independent prognostic factor associated with mortality in left-sided colonic peritonitis (Biondo et al, 2000). However, Komatsu et al (2005) concluded that while no one system was best at identifying the high-risk patients, they all had their place in clinical practice.

Figure 1. Computed tomography pelvic scan showing a large abscess (A) arising from a perforated sigmoid diverticulum. The patient was elderly, frail and had cardiac and renal co-morbidities.

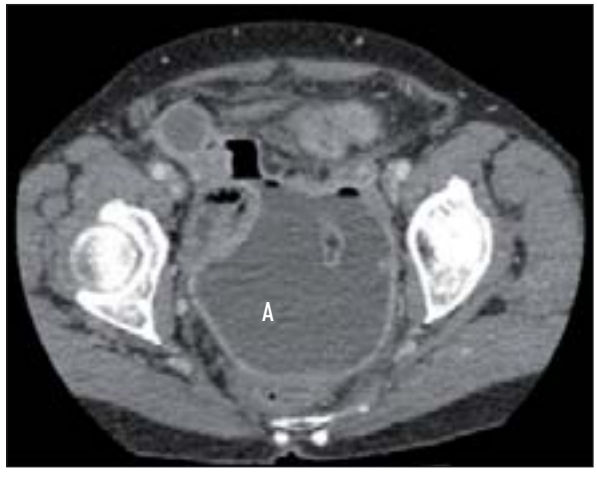
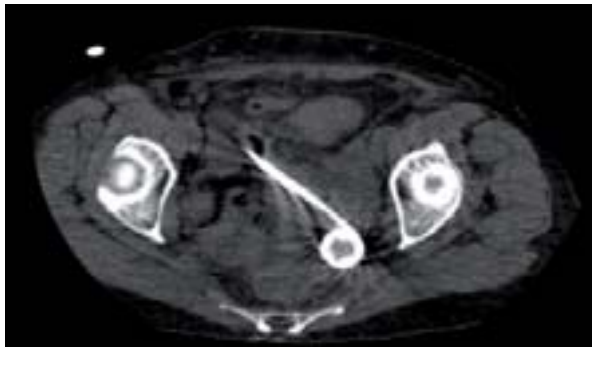


Figure 2. The same patient as* Figure 1 *with a drain inserted under computed tomography guidance.



Palliation and pain control

Some patients who cannot undergo surgery will have such severe peritonitis and sepsis that they do not respond to the conservative measures described above. Other patients have such severe comorbities or poor premorbid functional status, or are known to be in the late stage of a fatal illness so that attempting curative treatment is inappropriate. In such instances a decision to give palliative treatment is usually the right option. It is important to involve physicians and nurses with experience in palliation so that all the patient's palliative needs are addressed.

The Liverpool integrated care pathway (Ellershaw et al, 1997) is commonly used in end of life care in both primary and secondary care. It has been structured to encourage a multi-professional approach to the delivery of care that focuses on the physical, psychological and spiritual comfort of patients and their relatives (Ellershaw and Ward, 2003). Before a decision has been made on the approach to the treatment of the perforation it is important to provide adequate pain relief. Although there are concerns that effective analgesia, namely opiates, may mask important clinical findings in abdominal pain, and thus impede diagnostic accuracy and management plans, there is evidence that this does not happen (Thomas et al, 2003). Therefore early provision of effective analgesia in undifferentiated abdominal pain is a vital part of patient care.

Conclusions

Diverticular disease is common in old age. One severe complication of this disease is colonic perforation leading to peritonitis. In cases of faecal peritonitis, surgical resection remains the management of choice in all patients fit enough for an operation, but continued research into the best surgical options is needed as modern techniques become more refined and are used more often. Emergency surgery in colonic perforation comes with a high morbidity and mortality, and minimally invasive and medical therapies can also be lifesaving for patients who cannot undergo surgery. Improved outcomes are associated with coordinated and timely medical management and physiological optimization of the patient perioperatively.

There is a paucity of high quality evidence that can be used to categorize frail elderly patients into the operative or non-operative treatment options, so this remains a grey area of clinical practice. There is therefore a need for

research, probably in the form of randomized controlled trials, to compare the conservative and surgical management options in frail and elderly patients. In particular clinicians need better means of identifying the sub-group of patients who might do better with medical rather than surgical management. **BJHM**

Conflict of interest: none.

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KEY POINTS

- Diverticular disease is common in old age.
- Perforated colonic diverticulum is a medical emergency.
- Diverticular abscess almost always requires drainage.
- Faecal peritonitis carries a high mortality in frail old age.
- Frail elderly people should receive best surgical treatments if their physiological condition allows.
- Hartmann's procedure is the most commonly used open surgical treatment for colonic perforation.
- Imaging-guided drain insertion is a suitable option for more frail patients.
- Medical management is a suitable option for very frail patients who are not fit for any surgical procedure.