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Advances in management of patients with acute diverticulitis

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ABSTRACT

Objective: To analyse the development of the medical and surgical treatment of acute diverticulitis to develop an appropriate decision-making algorithm.

Methods: We analysed the demographic characteristics, radiological images, disease severity, treatments and surgical outcomes of all of the patients with a diagnosis of acute diverticulitis admitted to the Department of General and Emergency Surgery between 1 January 2009 and 30 June 2014.

Results: During the 66-month study period, 219 patients with acute diverticulitis attended our department; 69% had simple diverticulitis (93% were treated conservatively and 7% surgically) and 31% had complicated diverticulitis (76% were treated surgically and 24% conservatively). Of the patients who were treated surgically, 62.5% underwent primary resection with anastomosis, 31.94% Hartmann's procedure, and 5.56% laparoscopic lavage and drainage.

Conclusions: Our cases and a careful review of the literature allowed us to develop a decision-making algorithm for patients with acute diverticulitis.

1. Introduction

Diverticulitis is the most frequent surgically treated disease after cancer in modern Western societies, and its incidence is increasing with the older average age of the population. It affects 10% of the people living in industrialised countries: 5% aged <40 years, 30% aged >60 years and 65% aged >80 years[1]. Only 16% of patients experience a first episode at an age <45 years while the average age of hospitalization for the first episode of acute diverticulitis is 63 years[2,3].

Diverticulitis is a heterogeneous disease that 75% of cases occur in uncomplicated form while 25% of cases can be complicated by abscess, fistula, peritonitis, obstruction and haemorrhage[4].

Disease severity is classified using Hinchey's staging system[5], as modified by Wasvary *et al.* in 1999: Stage 0 mild clinical diverticulitis; Stage IA confined pericolic inflammation or phlegmon; Stage IB pericolic or mesocolic abscess; Stage II pelvic, distant intra-abdominal or retroperitoneal abscess; Stage III generalised purulent peritonitis; and Stage IV generalised faecal peritonitis (Table 1)[6]. Treatment mainly depends on disease severity and recent surgical strategies have concentrated on reducing the duration of surgery and postoperative complications[7].

The first surgical technique, known as the "three-stage procedure", was developed by Mayo *et al.* in 1907: a colostomy at the level of the transverse colon and the positioning of drainage; the resection of the diseased colon after a period of 3–6 months; and stoma closure after a further 3–6 months[8]. The morbidity rate was acceptable, but it was burdened by a high rate of mortality (30%–60%) because the diseased colon remained *in situ* for a long time and was a significant source of infection[9].

The second method, the "two-stage" or Hartmann's procedure (HP), was used for the first time by Henry Hartmann in 1921 in order to perform sigmoid resection for the treatment of neoplastic disease[10]. It consists of a segmental resection of the diseased colon without a primary anastomosis but with an end colostomy[11]; intestinal continuity can be restored during a second operation, but this is not possible in 20%–50% of cases[12]. Widely used since the 1950s, HP became the standard of care in the 1980s, but has a significant complication rate and mortality rates range from 5% to 14%[13].

A "one-stage" procedure [primary resection with anastomosis (PRA)] has been proposed since 1990. The most feared

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Table 1
Hinchey staging system as modified by Wasvary and CT findings according to Ambrosetti's criteria.

Hinchey classification modified by Wasvary		CT findings (Ambrosetti's criteria)
Stage 0	Mild clinical diverticulitis	Diverticula with or without colonic wall thickening
Stage IA	Confined pericolic inflammation or phlegmon	Colonic wall thickening and inflammatory reaction of pericolic fatty tissue
Stage IB	Pericolic or mesocolic abscess	Colonic wall thickening, inflammatory reaction of pericolic fatty tissue and pericolic or mesocolic abscess
Stage II	Pelvic, distant intra-abdominal or retroperitoneal abscess	Colonic wall thickening, inflammatory reaction of pericolic fatty tissue and pelvic/distant intra-abdominal/retroperitoneal abscess
Stage III	Generalised purulent peritonitis	Extraluminal air/extraluminal contrast
Stage IV	Generalised faecal peritonitis	Extraluminal air/extraluminal contrast

complication of this technique is anastomotic leakage, which occurs in 6% of cases, particularly when there is considerable peritoneal contamination; however, the risk of anastomotic dehiscence can be reduced by performing a proximal loop ileostomy to be closed during a second procedure[14].

In a bid to reduce the mortality and morbidity associated with emergency surgery, a new approach that consists of administering intravenous antibiotics and performing a percutaneous drainage (PCD) of major abscesses or using laparoscopic lavage of the abdominal cavity with the positioning of drainages [laparoscopic lavage and drainage (LLD)] has recently been adopted.

It has been noted that mortality is very low in patients treated in this manner, who are discharged earlier than those undergoing HP[15]. PCD can be performed under ultrasound (US) or computed tomography (CT) guidance, and drainage is usually done through the anterior or lateral abdominal wall in order to avoid damaging the inferior epigastric artery and deep circumflex iliac vessels, although transgluteal, transperineal, transvaginal and transanal approaches can also be used[16]. Complications, such as bleeding, visceral perforation, solid organ injury and fistulation only occur in 5% of cases, and the failure rate ranges from 15% to 30%[17].

LLD is a minimally invasive operation that consists of aspirating free purulent fluid from the peritoneal cavity, mobilising inflammatory abdominal wall attachments from the inflamed colon, opening purulent cavities and copious (>4 L) washings with a warmed iodine and saline solution, followed by the placement of drainages. This operation is supported by the administration of intravenous antibiotics. The use of LLD to manage severe diverticulitis with generalised peritonitis is associated with mortality and morbidity rates less than 5%, and so it is useful in patients with Hinchey stage III or IV diverticulitis[18].

Finally, Damage Control Surgery (DCS) is an approach that can be used for patients with peritonitis caused by acute perforated diverticulitis who are rapidly developing septic shock. The technique was created in 1983 by Stone *et al.* as a means of treating trauma patients presenting with the bloody viscous cycle: acidosis, hypothermia, coagulopathy[19], but can also be used for patients with intra-abdominal sepsis that may rapidly evolve in septic shock as they are too unstable to undergo immediate surgery and have an high postoperative risk of acute kidney injury and multiple organ failure[20]. In the case of acute diverticulitis with perforation and severe septic shock, DCS consists of a limited resection of the inflamed perforated colon using staplers without making a colostomy, after which the abdominal wall is temporarily closed using the vacuum-assisted closure (VAC) technique. The patients are then transferred to an ICU for ongoing resuscitation and, once their physiological status has been optimised, returned to the operating room to undergo peritoneal lavage and colostomy or primary anastomosis depending on the condition of the bowel (oedema and hypoperfusion of the wall), their comorbidities and the surgeon's experience[21].

Given the frequency and severity of the disease, and the rapidly evolving therapeutic scenario, the aim of this study was to analyse the development of the medical and surgical treatment of acute diverticulitis on the basis of a literature review and our own clinical experience in order to develop an appropriate decision-making algorithm.

2. Materials and methods

We considered all of the patients admitted to the Department of General and Emergency Surgery, IRCCS Ca' Granda – Maggiore Policlinico Hospital Foundation (Milan, Italy) between 1 January 2009 and 30 June 2014 with a diagnosis of acute diverticulitis. Diverticulitis was diagnosed by evaluating the patients' history, clinical features (left lower abdominal pain, tenderness, palpable resistance, fever, diarrhoea, constipation, vomiting, and urinary disorders), laboratory findings (leukocytes, C-reactive protein, s-amylase, s-lipase, s-aminotransferase, s-alkaline phosphatase, s-bilirubin, s-electrolytes), abdominal radiography and CT scan in order to confirm the suspected diagnosis by excluding other causes of abdominal pain and allow disease staging. We also analysed their demographic characteristics, disease severity and treatments, and finally examined their surgical outcomes on the basis of operating times, the number of days of analgesia, the resumption of peristalsis and canalisation, the day of nasogastric tube (NGT) removal, the resumption of eating, the duration of hospitalisation, the incidence of major and minor complications, reoperations, and intra- or postoperative mortality.

3. Results

During the 66-month study period, 219 patients with acute diverticulitis [47% males and 53% females; mean age 61.9 years (range 25–94); median age 63 years] attended the Department of General and Emergency Surgery; 10% aged <40 years, 33% aged 40–60 years, 42% aged 60–80 years, and 15% aged >80 years (fully in line with the age distribution described in the literature)[22]. The age- and gender-related disease prevalence rates was also the same as those previously published[23]: the disease was more prevalent among males than females aged <50 years (74% *vs.* 26%; M:F = 2.9:1); similarly prevalent among those aged 50–70 years (52% *vs.* 48%; M:F = 1.1:1);