A three-step approach to patients with suspected acute diverticulitis in the emergency department: An interdisciplinary algorithm proposal

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Abstract

Patients with acute abdominal pain due to acute colonic diverticulitis are a frequent cause of hospital admission. Diverticulitis is a considerable challenge, since numerous other acute abdominal conditions mimic its clinical characteristics. Another problem is the atypical presentation in older patients. A high index of suspicion in the setting of a compatible history and physical examination serves as the cornerstone of early diagnosis. The purpose of this review is to underline the importance of an intimately integrate multidisciplinary approach between emergency physicians, radiologists and surgeons.

Introduction

Diverticular disease in the emergency department

Acute abdominal pain is the most common cause for visits to the emergency department (ED), accounting for an estimated 5-10% of all admissions. The underlying causes of abdominal pain range from life-threatening conditions that require fairly immediate decision and urgent surgical intervention to self-limiting conditions from common to unusual diseases. Abdominal pain is a common occurrence in elderly patients. With the increasing mean age of the population, the prevalence of age-correlated diseases has concomitantly increased.2 A typical example is acute diverticulitis (AD). In Western populations, aging and lifestyle changes place the elderly at high risk for diverticulosis. Diverticula are sac-like outpouchings of the colon that occur through weakened areas of the muscularis of the colon wall. The pathophysiology is not well understood but diets low in fiber are epidemiologically related to the underlying process of outpouching of colonic mucosa.3 Estimated at 5% of general population, diverticular disease is diagnosed in 50% individuals over 70 years and 80% over 85 years of age.2 A population-based cohort study on the Danish population from 2000 to 2012 evidenced that overall admission rates for complicated diverticulitis increased significantly.4 The most frequent complications from diverticula include bleeding and diverticulitis. Bleeding occurs in 15% of patients with diverticulosis. It is the most common cause of lower gastrointestinal bleeding in the elderly. The bleeding is usually mild, but occasionally it is massive. Several studies have reported that approximately 30% of patients with diverticular disease develop diverticulitis or its complications.1 Diverticulitis is caused by obstruction or abrasion by a fecalith, leading to inflammation, and eventually infection from the proliferation of colonic bacteria and build-up of bowel secretions within the diverticula. According to an earlier Swedish study, about 47 patients per 100,000 population/year are admitted in the ED for AD.5 It occurs most frequently in the descending and sigmoid regions of the colon but can occur throughout the colon.

The clinical problem

The most common symptom of diverticulitis is abdominal pain. The pain usually evolves over 1 to 2 days from dull, diffuse abdominal discomfort to more intense, localized left lower quadrant pain. Classic signs of left lower quadrant abdominal pain associated with cramping, fever, nausea with occasional vomiting, mild abdominal distention, decreased appetite and leukocytosis are usually present. Many may report a known history of diverticular disease. Diarrhoea and constipation have both been reported as alterations in bowel habits. Diverticulitis might be complicated by the formation of an abscess or fistula, bowel obstruction, free perforation, or the development of sepsis.

The identification of patients with AD is a considerable chal-
lenge, since numerous other acute abdominal conditions can mimic its clinical characteristics. The left lower quadrant is more frequently involved in AD, such as urolithiasis, acute appendicitis, stercoral perforation, ischemic or infectious colitis, aortic abdominal aneurysm, spontaneous retroperitoneal hemorrhage or gynecological disease (Table 1). In 2010, Lameris et al. monitored 126 patients with suspected diverticulitis and showed different final diagnoses in 37% of cases (aspecific abdominal pain and acute appendicitis at first). In contrast to appendicitis, diagnostic value of specific elements has not been extensively studied for AD. A comprehensive study by the group of Andeweg characterized patients with abdominal pain at high risk of AD based on the following criteria: age greater than 50 years, one or more similar previous episodes, localization of symptoms in the lower left abdomen, aggravation of pain on movement, absence of vomiting, localization of tenderness in the lower left abdomen, and CRP of 50 mg/L or higher. The discriminatory power of the different variables alone was very low but improved upon combining the independent risk factors. The sensitivity of clinical evaluation was not satisfactory, with accuracy in only 43% of patients from the Andeweg cohort. Other comparable studies have demonstrated similar low sensitivity.

In elderly patients many factors make diagnosis of AD even more difficult. Perception of pain is often suppressed due to decreased immune responses and changes in the neurological system. Additionally, muscular defense and rebound signs in abdominal examination may not be evident despite the presence of serious intra-abdominal diseases because of a thinner abdominal wall, degeneration of the inflammatory process, and abolition of peripheral nerve functions. Thirty percent of elderly with AD don’t have abdominal tenderness on exam. Immunosenescence is associated with aging. Older adults experience a reduced febrile response caused by altered thermoregulation and decrease in mean body temperature. Laboratory studies have significant limitations, particularly in elders. The group of Laurell (2006) reported that laboratory parameters cannot be effectively used to distinguish patients affected by AD from those with aspecific abdominal pain. Overall, 24 patients (16%) with a final diagnosis of diverticulitis showed a CRP level below the upper limit of the 95% confidence interval relative to CRP of patients with a final diagnosis of aspecific abdominal pain. Same limitations were evident for leukocyte count. A recent study by the group of Lameris showed that the strongest clinical features used for diagnosis of AD (tenderness in the left lower quadrant, absence of vomiting and CRP level>50 mg/L) were only present in about a quarter of patients. Almost half of older patients suffering AD have a normal white blood cell count.

Diagnosis of AD involves a strategy encompassing age, history, clinical, differential diagnosis and laboratory tests but often it’s not enough. It’s necessary increase in accuracy after clinical evaluation following an imaging strategy.

### An imaging strategy

In the setting of suspected AD, the clinical questions are essentially the following: i) to exclude other potential diseases that can mimic diverticulitis; ii) to confirm the diagnosis of diverticulitis and iii) to stage the entity of the disease.

Abdominal radiography is of limited value, and cannot be utilised to achieve either of the above objectives. Furthermore, plain radiography may be applied in case of suspicion of diverticulitis complicated by occlusion or perforation but it’s 100% sensitive only for a large pneumoperitoneum. Ultrasound (US) is a useful imaging modality for evaluating the abdomen, being noninvasive, portable, widely available, and relatively inexpensive. US findings in patients with AD include a thickened loop of bowel with a target-like appearance. Small air bubbles can be visualised as a sign for micropерforation. Sonography is also useful for assessing large abscesses. In emergency setting the most common US technique used to examine patients with suspected AD is a transabdominal compression, first introduced in 1990. The clinician performs an abdominal US to assess for diverticulitis using a low-frequency curvilinear transducer by gently squeezing through loops of the bowel in the area of localised abdominal pain. The presence of echogenic non-compressible fat surrounding one or more diverticula is suggestive for the presence of inflammation.

The sensitivity of US in diagnosing AD has been reported to be as high as 84-100%. But two complete and comprehensive literature researches conducted by the groups of Liljegren in 2006 and Lameris in 2008 to compare the diagnostic accuracy of graded compression of US vs CT in diagnosis AD revealed a very limited number of high-quality studies. A complete search of the Medline, Embase and Cinahl databases resulted in a collection of 1689 studies, among which only 12 were relevant. Numerous bias

### Table 1. Differential diagnosis of left lower quadrant pain.

| Vascular | Gastrointestinal | Genitourinary |
|----------|------------------|--------------|
| Iliac aneurysm | Acute left colon diverticulitis | Ureterolithiasis |
| Gynecologic | | |
| Ectopic pregnancy | Colorectal malignancy | Urinary infection |
| Malignancy | Intestinal ischemia | Urinary malignancy |
| Ovarian torsion | Incarcerated hernia | | |
| Ruptured corpus luteum | Constipation | Abdominal wall hematoma |
| Ruptured ovarian cyst | Diverticulosis | Retroperitoneal hemorrhage |
| | Acute appendicitis | Psoas abscess |
| | Intestinal obstruction | Aspecific abdominal pain |
| | Sigmoid volvulus | | |
| | Mesenteric lymphadenitis | | |
| | Intestinal perforation | | |
The management

In the last years the management of AD is profoundly changed. Until a few years ago hospitalization, bowel rest, intravenous fluids and antibiotic therapy were universally accepted as the first choice treatment for mild uncomplicated diverticulitis. This practice was based on the belief that diverticulitis was due to obstruction of a diverticulum leading to mucosal abrasions, microperforation and bacterial translocation. However, this concept has been changed with newer hypotheses highlighting that AD may be an inflammatory rather than an infectious condition. Indeed, prospective randomized, case-control and retrospective cohort study shown no benefit for the use of antibiotics in the treatment of uncomplicated AD, suggesting that its use should be reserved for the treatment of complicated disease. An increasingly conservative approach changed also the surgery. The old simple rule of two attacks, then operate was gone, the patients with pericolic air or small fluid collection should be managed by antibiotic therapy, abscesses having a diameter of more than 4 cm are best treated by percutaneous drainage. Surgical resection is confined to patients with severe sepsis or septic shock, or if non-invasive treatments fail. The cornerstone is to create a puzzle that takes into account the clinical conditions and the extension of the disease. More extensive is the infection, more aggressive is the treatment. Fortunately, the majority of AD episodes are uncomplicated, with about only 15% presenting complications (abscess, perforation, obstruction, fistula); even if a recurrence of AD has been reported in 15-30% of patients, generally the first episode is the most severe. The development of CT has radically changed the treatment approach for patients with acute diverticulitis. CT can be effectively employed not only to diagnose colonic acute diverticulitis but also verify the severity and extent of disease. Staging of acute diverticulitis is an essential tool that could aid in clinical decision making, such as determining the need for percutaneous drainage or surgical intervention, assessing the length of hospitalization and antibiotic administration or the opportunity for early return home directly from the ED. The original classification proposed by Hinchey in 1978 was used as an intraoperative system, and did not meet these needs. The modified Hinchey classification proposed in 1999 was essentially a surgical assessment that described the stages of perforated diverticular disease. Both classifications have some bias, they don’t take clinical symptoms into account, and are built for advanced-stage disease. In 2015, Sartelli et al. proposed a more complete classification taking in account the severity of the disease and the clinical condition (Table 2). Fortunately, patients with uncomplicated diverticulitis are more frequently admitted to the ED. Usually the patient complains of moderate pain and is able to tolerate oral intake, with good response to first treatment measures in the ED. A corroborative CT is performed in these cases, which highlights that the infection only involves the colon and does not extend to the peritoneum, leading to safe discharge of patients directly from the ED. Furthermore, evidence of involvement of <5 cm of the colon is associated with a low probability of recurrence. The severity of diverticulitis on CT is statistically predictive of the risk of medical treatment failure during the acute phase and chance of poor secondary outcome after successful medical treatment of the first episode. Staging is also a guide for antibiotic therapy. The AVOD study was the first prospective random-

| Table 2. A proposal for a computed-tomography guided classification of acute diverticulitis. Adapted from Sartelli et al. |
|-----------------------------------------------|-------------------------------------------------|
| Stage 0 | Diverticula, thickening of the colonic wall or increased density of the pericolic fat |
| Stage 1a | Pericolic air bubbles or little pericolic fluid without abscess (within 5 cm from inflamed bowel segment) |
| Grade Ib | Abscess ≤ 4 cm |
| Grade Ia | Abscess > 4 cm |
| Grade Ibb | Distant air (>5 cm from inflamed bowel segment) |
ized controlled trial to show no benefit of antibiotic treatment in patients with uncomplicated diverticulitis. Small abscesses may be solely treated with antibiotics while large abscesses need to be interventionaly drained in addition to antibiotic treatment.

The three-step approach

Several guidelines and reviews on diverticular disease have been published in lasts years with discrepancies regarding important issues, such as the role of clinical examinations, the imaging approach, the antibiotic prescriptions for uncomplicated diverticulitis, treatment of abscesses, and indications for colon resection in case of peritonitis. The diversified approach is attributed to the lack of high-quality evidence. Another limitation of these guidelines is that they were originally developed by experts in various fields, including gastroenterologists and surgeons. In the clinical, the course of suspected AD can involves emergency physicians at first, followed if necessary by radiologists and surgeons. Aim of this review authored by a small group of emergency physicians, radiologists and surgeons with expertise in acute abdominal pain is focused on a multimodal and collaborative approach for treatment of patients suspected of AD. This approach involves three steps, each of them is essential for the success of the course.

Step one: the suspicion

i) Age greater than 50 years, one or more similar previous episodes, localization of symptoms in the lower left abdomen, aggravation of pain on movement, absence of vomiting, tenderness in the lower left abdomen, and CRP of 50 mg/L or higher characterize patients with high suspect of AD; ii) It’s reasonable a prudent approach, the antibiotic prescriptions for uncomplicated diverticulitis takes into account the extension of the disease, the clinical condition and the compliance of the patients permits to plan a tailored treatment.

Step two: the confirmation

i) US may aid in excluding the most frequent diseases that mimic of AD, (abdominal aortic aneurysm or hydrenephrosis, for example); ii) US appears also to present a logical and safe technique of choice in younger skinny patients or if there’s the suspect of a non-complicated recurrent colonic diverticulitis; iii) CT is the imaging technique of choice for evaluation of patients with suspected AD. CT is also helpful in identifying alternative diagnoses with similar presentations.

Step three: the staging

i) Assessing the site and the severity of the disease is the key; ii) Staging of diverticulitis on CT is the guide for the treatment planning according to its severity; iii) Effective communication and condivision of strategies among emergency physicians, radiologists and surgeons must be necessary for a positive impact on the quality of care provided to patients with suspect of AD.

Conclusions

Over the last 10 years, the number of patients suffering of AD is increasing in all over the world. It is now classified as the third most common gastrointestinal discharge diagnosis. Most of the time signs and symptoms associated with AD are aspecific and commons to other intra-abdominal pathologic conditions. In recent years, integrated imaging has revolutionized the classical approach to acute abdominal pain and close cooperation is essential among emergency physicians, radiologists and surgeons for improving treatment outcomes. A high index of suspicion in the setting of a compatible history and physical examination is the cornerstone of early diagnosis. Inclusion of an appropriate diagnostic modality is crucial to validate initial suspicion of the disease, to exclude other potential diseases that mimic diverticulitis, and to evaluate the severity and extent of disease. Only a collaborative strategy that takes into account the extension of the disease, the clinical condition and the compliance of the patients permits to plan a tailored treatment.

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