บทความปริทัศน์หรือการทบทวนวรรณกรรม (Review article)

โรคถุงผนังลำไส้: การทบทวนภาพรังสีและการรักษา

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บทคัดย่อ

โรคถุงผนังลำไส้ เดิมเคยเชื่อว่าเป็นโรคของคนแก่ แต่ในปัจจุบันพบได้มากขึ้นในผู้ป่วยที่อายุน้อยลง นอกจากนี้ความชุกของโรคก็เพิ่มมากขึ้นเนื่องจากประชากรมีอายุเฉลี่ยมากขึ้น ภาวะแทรกซ้อนที่พบได้บ่อยในโรคถุงผนังลำไส้คือการอักเสบ ปัจจุบันเครื่องมือทางรังสีวินิจฉัยมีความก้าวหน้ามากขึ้นทำให้การรักษาภาวะแทรกซ้อนของโรคถุงผนังลำไส้มีการเปลี่ยนแปลงใน 2-3 ปีมานี้ จึงนำมาสู่วัตถุประสงค์ของการทบทวนวรรณกรรมเรื่องโรคถุงผนังลำไส้ ข้อบ่งชี้ในแง่ของวิธีการต่างๆ ทางรังสีวินิจฉัย ลักษณะสำคัญที่พบของภาพรังสีและข้อมูลใหม่ๆ ทางการรักษาภาวะแทรกซ้อนของโรคถุงผนังลำไส้

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Intestinal diverticular disease: a review of radiologic findings and management

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Abstract

Intestinal diverticular disease, which once thought to be a disease of the elderly, is now becoming more common in younger age group. The prevalence of this disease is increasing due to the rising of the average age. Most common complication of diverticular disease is acute diverticulitis. Withthe progression and advancement of radiologic investigation, the choices of managements have been changing in the past few years. The objectives of this article are to review indication of each imaging modality, to identify its radiologic findings and to update on choice of management.

Keywords Complication, Diverticular disease, Imaging, intestine, Management

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Abbreviations:

CD = Complicated diverticular disease

DD = Intestinal diverticular disease

AXR = Plain abdominal radiographs

UD = Uncomplicated diverticulitis

CE = Contrast enema

US = Ultrasound

CECT = Contrast enhanced computed tomography

CTC = Computed tomography colonography

MRI = Magnetic resonance imaging

Introduction

Diverticula are small out-pouchings through intestinal wall. Most common diverticula of intestine are acquired type which is caused by herniation of mucosa through intestinal wall. Diverticulosis is called when there are multiple diverticula. Diverticulitis is the term used to name the gross inflammation of diverticulum with advancement into the extra-luminal space. Complications of diverticular disease include hemorrhage, abscess, phlegmon, perforation, fistula, stricture, peritonitis and obstruction.[1] Complicated diverticular disease (CD) can lead to fatal consequences.[2] Chronic diverticulitis is defined when clinical signs or symptoms persisted for more than 2 months.[3] Imaging study has an important role in initiating proper management. This article aims to review the indication and radiological features of each imaging modality of intestinal diverticular disease (DD) with emphasis on colonic diverticulosis, which is the most common, and update on choices of management.

Epidemiology

DD is usually found incidentally on imaging or endoscopy. The incidence increases with age. It occurs mostly at the sixth decades of life[4], which decreasing age in urban population.[2,5] Obesity, low-fiber diet and hereditary diseases have been known as risk factors.[5-8] The commonly affected site is colon with sigmoid colon predominance[4-5], followed by descending colon, ascending colon, cecum and transverse colon.[5] In contrast, right hemicolon is predominant in Asian population.[9] Small bowel diverticulosis is rare and usually asymptomatic.[10-12] Duodenum is the second most common location of DD following colon with a frequency of 5% (Fig.1).[12]

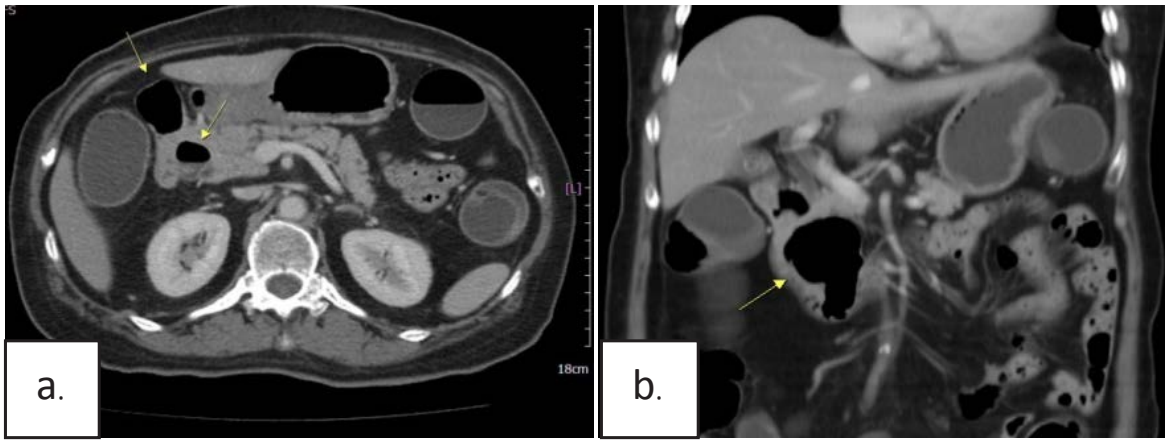

Figure 1 Contrast enhanced CT of the abdomen in a 68 year-old shows incidental finding of two diverticula (arrow in a.), oneat second part of duodenum and the other large one (arrow in b.) at the third part.

The most common sites of duodenal diverticula are located in the second part followed by the fourth part.[10] Jejunum and ileum are the least common sites in small bowel diverticulosis, and jejunum is more common thanileum.[11] The incidence of jejunal diverticulosis varies from 0.2% - 1.3% in autopsy studies.[13]

Clinical manifestations

Minority of people with diverticula are symptomatic.[14] CD is developed in 15%-20% of patients.[15] Symptoms include unspecific abdominal pain, bleeding, unexplained anemia, obstructive symptoms, compressive symptoms, presence of fistula and generalized peritonitis [1]. However the clinical diagnosis of CD is somewhat limited.[9,14]

Pathophysiology

Etiology of DD is still poorly understood but most accepted theory is the alteration in colonic motility together with the loss of tensile strength in certain part of the intestine causing protrusion of the mucosa outward to form a diverticulum. Weak points are often on the mesenteric side where the blood vessels enter.[16]

Diverticulitis starts with the micro-perforation of infection into the para-intestinal fat. Abscess is then gradually formed and walled off in normal host defense mechanism. Higher pressure causes perforation into intra-abdominal cavity causing purulent peritonitis. However, if the perforation originates directly from the bowel without the process of walled-off mechanism, it will cause fecal peritonitis.

Imaging

Plain abdominal radiograph

Plain abdominal radiographs (AXR) have been commonly used in acute abdominal patients. However previous study showed that 76% of AXR ordering at emergency

department werereported as normal.[17] Findings of AXR in uncomplicated diverticulitis (UD) are often non-diagnostic. Thus AXR in the clinical suspicious of UD is not indicated according to the Royal College of Radiologists guidelines.[18] In CD, AXR is not helpful.[19]

Contrast enema

Contrast enema (CE), either barium or water-soluble contrast, was the gold standard for the diagnosis of colonic diverticular disease.[20] In UD, CE demonstrates a flask-like, extra-luminal out-pouchings[20] (Figure 2.). Diverticula, tethering, and stenosis were the most common findings in acute diverticulitis.[21] Findings in CD include segmental spasm and other co-existing complications such as sinus tract (Figure 3.), fistula, and mass effect from extra-luminal abscess formation.[20]

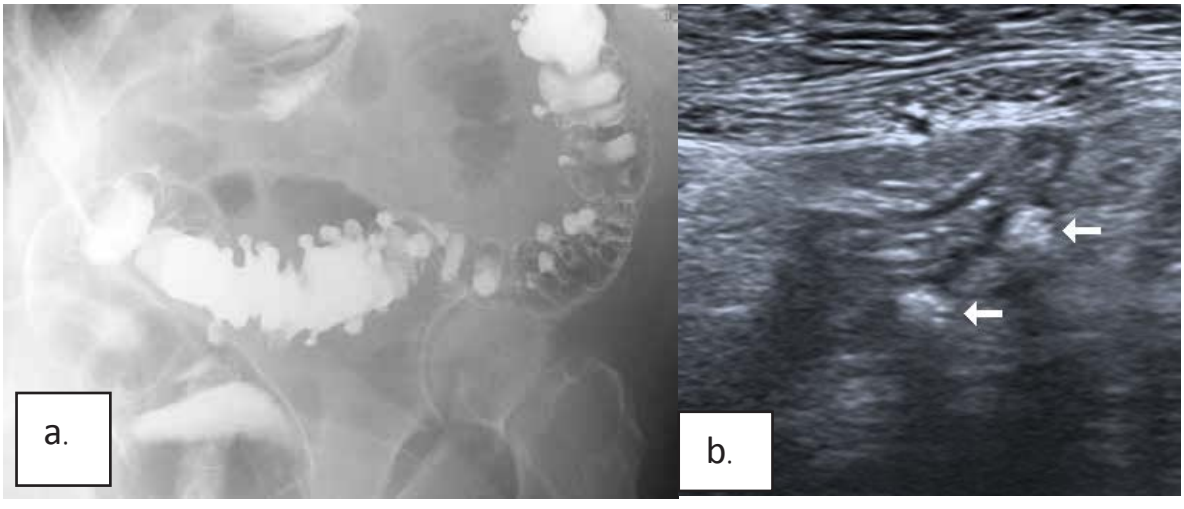

Figure 2 (a.) Contrast enema reveals multiple diverticula at sigmoid colon. (b.) Corresponding US image shows two thin-walled outpouching lesions, contained hyperechoes (arrows), implying non-inflamed diverticula.

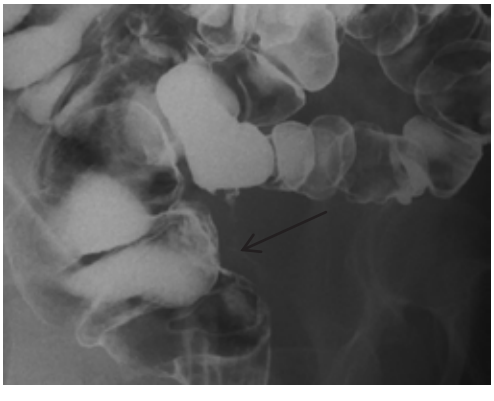

Figure 3 Contrast enema reveals a sinus tract (arrow) from sigmoid colon.

Water-soluble contrast is used when suspicious of perforation.[20] Although contrast enema is good in demonstration of structural changes, it is poor in indicating active inflammation or pericolonic changes.[20] A relatively long segment of circumferential narrowing with tethered or spiculated contour but preserved mucosal folds was commonly presented in chronic diverticulitis.[3] The reported sensitivity and specificity of CE for detecting colonic lesions were 50% and

67%, respectively.[22] However therapeutic option of BE in cases of lower gastrointestinal tract bleeding still showed high efficacy in a literature review by Kenig et al.[23]

Ultrasound

Ultrasound (US) is not an initial imaging modality for the diagnosis of diverticulitis. It is usually diagnosed accidentally during the investigation of suspected acute appendicitis.[24] However US has gained its popular use as first-line imaging modality in some countries.[25] US had a sensitivity of 91.3%, a specificity of 99.8%, and an accuracy of 99.5%, according to the report of Chou et al.[24] The typical US findings of diverticulitis are a round or oval-shaped hypoechoic or nearly anechoic structure protruding out from the segmentally thickened colonic wall, associated with peridiverticular fat thickening[24] (Figure 4.). US can demonstrate muscular hypertrophy as hypoechoic mural thickening[20] (Figure 5.).The presence of air in the surrounding tissue also suggests a wall-offed perforation.[26] Contrast-enhanced US has been reported to demonstrate an actively bleeding in a jejunal diverticulum.[27] However US is very operator dependent and results are variable.

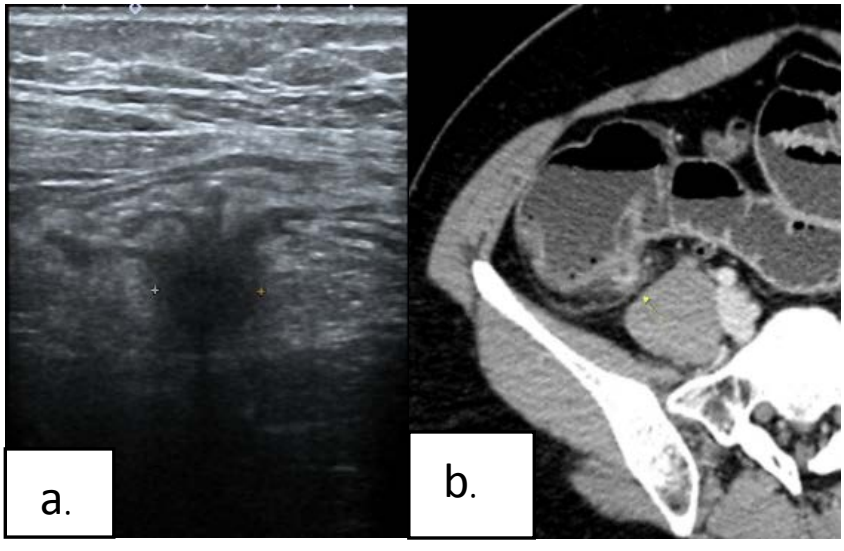

Figure 4 (a.) Ultrasound reveals a round hypoechoic structure (calipers) protruding from cecal wall with peridiverticular fat thickening. (b.) Corresponding contrast enhanced CT image shows thickening and enhancement of diverticular wall (arrow) with adjacent fat stranding, indicating acute diverticulitis.

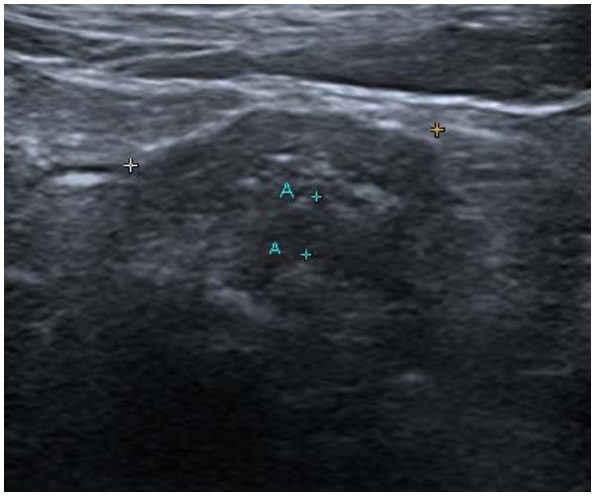

Figure 5 Ultrasound demonstrates muscular hypertrophy of sigmoid colon as a hypoechoic mural thickening (caliper A).

Computed tomography

Contrast-enhanced computed tomography (CECT) has been replaced CE due to its superiority in the demonstration of structural changes, pericolonic inflammation and complications.[28] The reported sensitivity and specificity of CECT was as high as 98% and 99%, respectively.[29] Currently, CECT becomes the imaging modality of choice in patients suspected of having CD.[29-30] Common manifestations in UD are presence of diverticula, moderate wall thickening and pericolonic fat inflammation[31] (Figure 6.), similar to the findings in chronic diverticulitis.[3]The fat stranding is characteristicly disproportional to the relatively mild, focal colonic wall thickening.[32] In chronic diverticulitis, the muscular hypertrophy segment sometimes resembles carcinoma (Figure 7.). Lips et al.[33] suggested using the combination of two signs, including absence of diverticula and presence of shouldering, that favored cancer.

Pre-operative diagnosis of complicated small bowel diverticulitis is quite difficult because of its rarity.[34] (Figure 8.) More common differential diagnoses, such as perforated carcinoma, acute appendicitis, bowel ischemia, and inflammatory bowel disease, must be looked out and excluded. Kubotal et al.[35] suggested that the extra-luminal air in an arrowhead-like shape, surrounded by inflammatory tissue, was a helpful sign to distinguish diverticulitis from other causes of small bowel perforation.

Computed tomography colonography (CTC) has been initially used as a screening tool for colorectal cancer.[36] Recent studies proofed that it was also useful in follow-up patients after an acute episode of diverticulitis.[37-38]

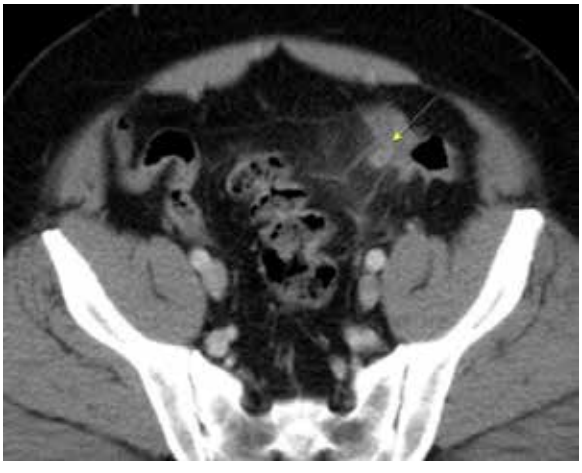

Figure 6 Contrast enhanced CT reveals thickening and enhancement of diverticular wall (arrow) at sigmoid colon with adjacent fat stranding, consistent with Hinchey class I.

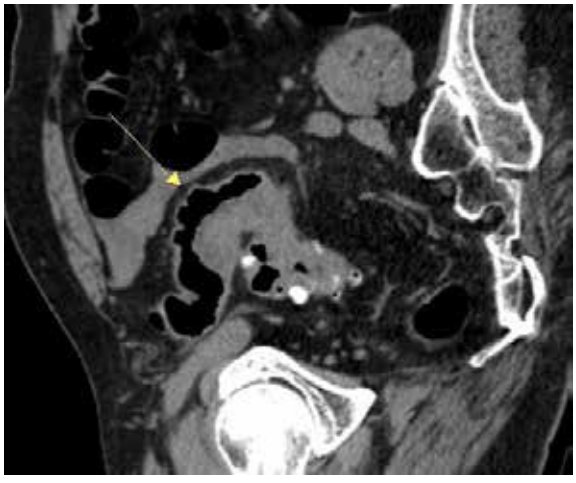

Figure 7 CT colonography shows asymmetrical thickening of sigmoid colonic wall (arrow) in chronic diverticulitis, resembled cancer.

Figure 8 Contrast enhanced CT shows a defect (arrow) in the wall of jejunum, leading to abscess between jejunal loops. Operative findings reveal perforated jejunal diverticulitis.

Magnetic resonance imaging

Magnetic resonance imaging (MRI) techniques for colorectal pathologies have been developing.[30,39-40] In 1997, Luboldt and colleagues[39] used three-dimensional MRI dataset in a single breath hold with gadolinium contrast enema and intravenous gadolinium in three patients. Their study was able to demonstrate various colonic abnormalities including diverticula, carcinomas, and polyps. MRI-based colonography was presented by Schreyer et al.[30] in 2004. They prospectively evaluated MRI colonography compared to CTC in 14 patients, suspicious of diverticulitis, and found the good results.[30] Ajaj et al.[40] used dark-lumen magnetic resonance colonography by using a T1-weighted volumetric interpolate breath-hold examination sequence and combining a rectal water enema with intravenous administration of gadolinium contrast-based agent. Their study showed a sensitivity of 86% and a specificity of 92% for the detection of sigmoid diverticulitis.[40] Therefore, MRI can be used as an alternative imaging modality in sigmoid diverticulitis in children, pregnant women or patients allergic to iodinated contrast material.

Classifications

There has been a variety of classification systems. The popular system used by surgeons, is the Hinchey classification by Hinchey et al.[1], based on clinical and surgical findings, as shown in Table 1. CT based classifications have also been developed. Some were modified from Hinchey classification, others were based on objective observations[1]. In 2012, Klarenbeek et al.[1]proposed a new classification system by

incorporation of clinical presentation, imaging and treatment. Another study proposed a new CT-based classification, which was more defined in stages and suggested possible management in each stage.[29] Severity score has also been developed in CTC by using maximum colonic wall thickness and minimum lumen diameter.[41] The same authors later reported that they found significant correlation (p = 0.022) between CTC severity score and final clinical outcome at follow-up, as well as a significant correlation between this score and the risk of undergoing surgery (p = 0.007).[38]

Table 1 Hinchey classification

Stage 1	Pericolic/mesenteric abscess or phlegmon
Stage 2	Pelvic, intra-abdominal or retroperitoneal abscess
Stage 3	Generalized purulent peritonitis
Stage 4	Generalized fecal peritonitis

Management

Diagnostic imaging plays the important role in both diagnosis and classifcation (the severity and staging) of the disease, which will lead to the decision in non-operative or operative management.

About 75% of patient withacute diverticulitisareuncomplicated, which conservative management is preferred.[42] Study from England showed 85% success in conservative management with 2% recurrent rate per year in patients with UD.[43] A prospective study (median follow-up of 9.5 years) showed that 68% of complication was avoided in patients with non-operative treatment.[44] Bowel resting and antibiotic coverage of gram negative and anaerobe bacteria are considered the standard management.[45-46] To prevent recurrent diverticulitis, a systematic review in 2010 proposed the role of 5-aminosalicylic acid in uncomplicated diverticulitis.[47] High-fiber diet in the treatment of diverticular disease is lacking in high-quality evidence but still recommended.[6]

Surgery is indicated when diverticulitis is complicated.[48] However, surgical management varies in individual practices.[4] About 15% of CD is classified as Hinchey stage I and stage II, and US or CT guided abscess drainage is suggested [4]. Emergency osteotomy which may lead to morbidity and mortality could be avoided in 30% - 40% of Hinchey stage II.[49] Siewart et al.[50] in 2006 showed 22 out of 30 patients (73%) with diverticulitis abscess, which were smaller than 3 cm., could be successfully treated with antibiotic. For the others 8 patients (27%) with larger abscesses, 4 patients were successfully treated with antibiotics but the other 4 patients underwent CT–guided drainage. Among these 8 patients, five later came for elective operation.[50] De Stigter and colleague[51] advised to inject contrast via drainage tube to exclude intestinal fistula. If fistula was noted, it was

associated with unimproved by conservative treatment, and emergency operation was advised.[51]

The management of patients with perforated diverticulitis (Hinchey stage III and IV) is emergency exploratory laparotomy and resection. In a systematic review by Constantinides et al.[52], it showed no significant in mortality rate between resection with primary anastomosis and Hartmann's procedure (14.1% and 14.4%). Laparoscopic inspection and peritoneal lavage with intra-peritoneal drainage in patient with Hinchey III were tried and the results were satisfied with lower than 5 percent of morbidity and mortality.[53-56]

Elective surgery in diverticulitis is indicated in patients with 1). chronic complications such as fistula or stricture 2). persistent symptomatic chronic diverticulitis (smouldering disease).[57] 3). Risk of recurrence, such as steroid or immune-suppressive drug intake and 4). young age.[58] The history of UD attack more than once is no longer the indication forelective surgery.[59] Elective surgerycan be done either by open surgery or laparoscopic surgery. Literature showed that laparoscopic surgery benefited in decreased post-operative pain, fewer post-operative complications, less ileus, and shorter hospital stay compared to open colectomy.[60-62] However, operative time is longer in laparoscopic group.[63-64] Laparoscopic surgery in patient with CD shows high conversion rate[65-66], but doable depending on surgeon experience.[67] Although laparoscopic benefits in postoperative short term outcomes, there is difference in long term results, except for the cosmetic outcome.[68-69] In contrast, a multicenter randomized control trial in Netherland, comparing laparoscopic peritoneal lavage and resection, demonstrated high major morbidity and mortality rate in the lavage group and this trial was terminated.[70] They concluded that the major reason for lavage failure was inabilityto distinguish Hinchey III from Hinchey IV perforated diverticulitis, and underlying colorectal cancer.[70]

Conclusion

Intestinal diverticular disease is a common problem, especially in aging and urban population. With high accuracy of CT, intestinal diverticular disease is increasingly diagnosed. CT becomes the imaging modality of choice when suspicious of complicated diverticular disease. Change in management has followed the ability of CT in accurate assessment of both intra-luminal and extra-luminal components, as well as the extent of disease. US or MRI can be used as an alternative imaging modality to avoid radiation or iodinated contrast medium.

Funding

This article does not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

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