ORIGINAL ARTICLE

Differentiation between stercoral perforation and colorectal cancer perforation

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SUMMARY

OBJECTIVE: *To determine the computed tomography (CT) signs associated with stercoral perforation and colorectal cancer perforation.*

MATERIALS AND METHODS: *From May 2003 to Feb. 2015, all surgically and pathologically confirmed patients with stercoral perforation (n=8, mean age 68.3 years) or colon cancer perforation (n=11, mean age 66.3 years) were retrospectively reviewed by two board-certified radiologists blinded to the proven diagnosis. The following CT findings were evaluated and recorded for each patient: wall thickness of the distal colon adjacent to perforation site, pattern of the colon wall thickening and enhancement, length of the thickened bowel wall, presence of fecaloma, degree of proximal colon dilatation, and pericolonic inflammation or presence of pericolonic abscess, and number of enlarged pericolonic lymph nodes. These findings were correlated with the pathologic diagnosis.*

RESULTS: *The mean thickness of the distal colonic wall adjacent to the perforation site was 13.6 mm in patients with colorectal cancer perforation and 5.1 mm with stercoral perforation, which was statistically different. There was a significant correlation between colorectal cancer perforation and eccentric wall thickening ($p<0.01$). CT findings of layered enhancing wall thickening ($p<0.01$) and the presence of fecaloma in the proximal colon ($p<0.01$) were significant findings for stercoral perforation. Patients with colorectal cancer displayed more pericolonic lymph nodes (mean 2.27, $p<0.05$).*

CONCLUSION: *Fecaloma in the proximal colon and layered enhancing wall thickening adjacent to perforation site are likely due to stercoral perforation. Eccentric bowel wall thickening at the distal portion of the perforation site with many enlarged pericolonic lymph nodes is most likely due to colorectal cancer perforation.*

KEYWORDS: *Fecal Impaction. Colorectal Neoplasms. Colitis, Ischemic. Intestinal Perforation.*

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INTRODUCTION

Stercoral colitis is caused by pressure necrosis from a fecal mass [1,2] and it can produce stercoral perforation if not promptly treated. It is a very rare cause of colon perforation but can be life-threatening with mortality rates of 23-57% [3]. In stercoral perforation, the diameter of the perforation site can be large, and the degree of contamination by feces can be severe.

Colorectal cancer, the most common cause of colonic perforation [4], can also lead to fecal impaction by progressive luminal obstruction [5]. Imaging findings can be similar to those of stercoral perforation [5-7]. However, treatments for these two conditions are entirely different. The resection of the diseased segment of the colon and its exteriorization is sufficient for stercoral perforation [2], while extensive bowel resection with lymph node dissection and adjuvant chemotherapy is required for the treatment of colorectal cancer perforation [5]. Thus, distinguishing these two conditions with an accurate preoperative diagnosis can facilitate early therapeutic management and improve survival [4,8,9].

Useful imaging features for the differentiation between stercoral perforation and colorectal perforation from statistical evidence is unclearly reported. The purpose of this study was to evaluate the useful preoperative computed tomography (CT) findings to differentiate stercoral perforation and colorectal cancer perforation.

MATERIALS AND METHODS

The study was approved by the institutional review board. Patient consent was not required for the retrospective review of records and images because patient anonymity was preserved.

Patients

One radiologist retrospectively searched electronic medical records and the radiology information system of our hospital for individuals with stercoral perforation identified from May 2003 until February 2015. First, all enhanced abdomen CT studies for which the reports included the words “stercoral colitis” or “stercoral perforation” were selected. Four patients were included in the stercoral perforation group, with both enhanced CT images and histologic results available. We also included another four patients from two same hospital branches identified by the same method during the same period. Finally, eight patients were included in the stercoral perforation group.

Next, the radiologist searched for reports including the word “bowel perforation” with histologic results, using electronic medical records during the designated period. A total of 95 patients were identified. Patients with small bowel perforation (n=33), ischemic colitis (n=5), diverticulitis or appendicitis (n=7), Crohn’s disease (n=3), other malignant tumor except adenocarcinoma (n=6), iatrogenic cause (n=4), and sclerosing peritonitis (n=1) were excluded. The 17 patients who had not undergone enhanced abdomen CT at our hospital were also excluded. Moreover, patients with ascending colon cancer (n=3) or hepatic metastasis (n=1) were excluded. Because of the large diameter of the ascending colon and a relatively large amount of water in the feces of the ascending colon, stercoral perforation rarely does not occur in the ascending colon. Furthermore, the presence of hepatic metastasis is more suggestive of colon cancer than stercoral perforation.

Finally, 11 patients with perforated colon cancer at the rectum, sigmoid colon or descending colon who showed no evidence of other solid organ metastasis were included in the colorectal cancer perforation group.

CT Examinations

CT examinations in our hospital were performed using a 4-, or 16-detector row CT scanner (Sensation 4 or 64; Siemens Medical Systems, Erlangen, Germany). Scanning parameters were reconstruction thickness, 3 mm; reconstruction interval, 1.5 mm; beam pitch, 1.5; tube voltage, 120 kVp; and tube current, 84 mAs.

For the patients in the second hospital branch, a 16-detector row CT scanner (Sensation 16; Siemens Medical Systems) and a 64-detector row CT scanner (Lightspeed VCT XTe; GE Medical Systems, Milwaukee, WI, USA) were used with the administration of 140 mL of same intravenous (IV) contrast medium. Scanning parameters were reconstruction thickness, 5 mm; reconstruction interval, 5 mm; beam pitch, 1.5; tube voltage, 120 kVp; and tube current, 100 mAs.

In third hospital branch, a Lightspeed VCT XTe 16-detector row CT scanner was also used with the same scanning parameters. About 140-150 mL of ionic or nonionic iodinated IV contrast medium (Omnipaque; Nycomed, Princeton, NJ and Optiray 320,

Mallinckrodt, Dublin, Ireland) was routinely injected in all patients following departmental protocols. In all cases, axial and coronal images at the portal phase were analyzed.

Imaging Analysis

Two abdominal radiologists (10 and 1 years of abdominal imaging experience, respectively) retrospectively reviewed the CT images of the patients. The reviewers were blinded to the pathologic results. Any discrepancy during the review was resolved by consensus.

CT findings that were analyzed for each patient included the following. The colon was divided into proximal and distal portions based on suspected perforation site. The thickness (mm) of the distal colon wall was measured by drawing a right angle to the lumen on the utilized PACS system and grouped into eccentric and concentric wall thickening. Wall thickening was considered to be eccentric when there was asymmetry in the thickening of the two walls of the colon. Patients were also divided into three groups according to the length of the thickened wall (<5 cm, 5~10 cm, >10 cm). The pattern of wall enhancement at the suspected perforation site was recorded as a layered or homogenous enhancement. The presence of the fecaloma in the proximal colon and the degree of proximal colonic dilatation (<3 cm, 3~5 cm, 5~7 cm, >7 cm) were also investigated. Fecaloma was considered to be present when hyperdense mass-like feces filled the entire colonic lumen and caused luminal dilatation. The degree of pericolic fat infiltration (mild, moderate, severe) or presence of abscess, and the number of pericolic lymph nodes were recorded. Lymph nodes were defined as measuring greater than 1 cm in the short-axis diameter.

Statistical Analysis

The CT findings were correlated with the pathologic diagnosis of stercoral perforation and colorectal cancer perforation. All statistical analyses were conducted using SPSS 14.0 for Windows (SPSS, Chicago, Illinois, USA). P<.05 indicated statistical significance. The thickness of the colon wall and the mean number of lymph nodes of each group were compared using the Mann-Whitney U test. Statistical differences for other categorical data (i.e., length of the thickened wall) were analyzed using the Fisher exact test.

RESULTS

The results of analyses of the preoperative CT imaging findings in the stercoral perforation and colorectal cancer perforation groups are shown in Ta-

TABLE 1: PREVALENCE OF CT FINDINGS IN STERCORAL PERFORATION AND COLORECTAL CANCER PERFORATION

Morphologic Criteria	Patient Group		P-value
	Stercoral perforation (n=8)	Colorectal cancer perforation (n=11)	
Wall thickness (mm)	5.1	13.6	.001
Eccentric wall thickening	0 (0%)	11 (100%)	.000
Length of bowel wall thickening			
< 5 cm	3	6	.254
5-10 cm	3	5	
> 10 cm	2		
Homogeneous enhancement	1 (12.5%)	11 (100%)	.000
Fecaloma in proximal bowel	7 (87.5%)	2 (18.2%)	.005
Dilatation of proximal bowel			
< 3 cm	0	3	.177
3-5 cm	3	4	
5-7 cm	4	3	
> 7 cm	1	1	
Pericolonic inflammation			
Mild	2	5	.790
Moderate	4	0	
Severe	2	6	
Pericolonic abscess	1 (12.5%)	3 (37.5%)	.603
Number of pericolonic LNs	0.25	2.27	.011

ble 1. The patients in the stercoral perforation group had a significantly higher prevalence of the following findings (P<.05): thinner thick distal colonic wall adjacent to perforation site, concentric wall thickening, layered enhancement of the colonic wall, and the presence of fecaloma in the proximal colon.

The wall thickness of the just distal bowel on suspected perforation sites was about 5.1 mm in the stercoral perforation group and 13.6 mm in the colorectal cancer perforation group. The difference was statistically significant (p=0.001). All patients in the colon cancer perforation group showed eccentric wall thickening at the distal portion, and no patients in the stercoral perforation group showed eccentric wall thickening (p=0.000). The length of the thickened wall displayed a tendency of a longer length in the stercoral perforation group. However, no statistically significant correlation was seen between the two groups (p=0.254).

Significant differences in the pattern of wall enhancement around the suspected perforation site (p=0.000) and the presence of fecaloma in the proximal colon (p=0.005) were noted between the two groups. All patients with stercoral perforation showed a layered enhancement of the colonic wall at the suspected perforation site, and the other patients with colon cancer perforation showed a homogenous enhancement of the colonic wall. In patients with stercoral perforation, 7 of 8 patients (87.5 %) showed fecaloma in the proximal colon (Fig. 1), whereas in patients with colorectal cancer perforation, 2 of 11 patients (18.2 %) showed fecaloma (Fig. 2).

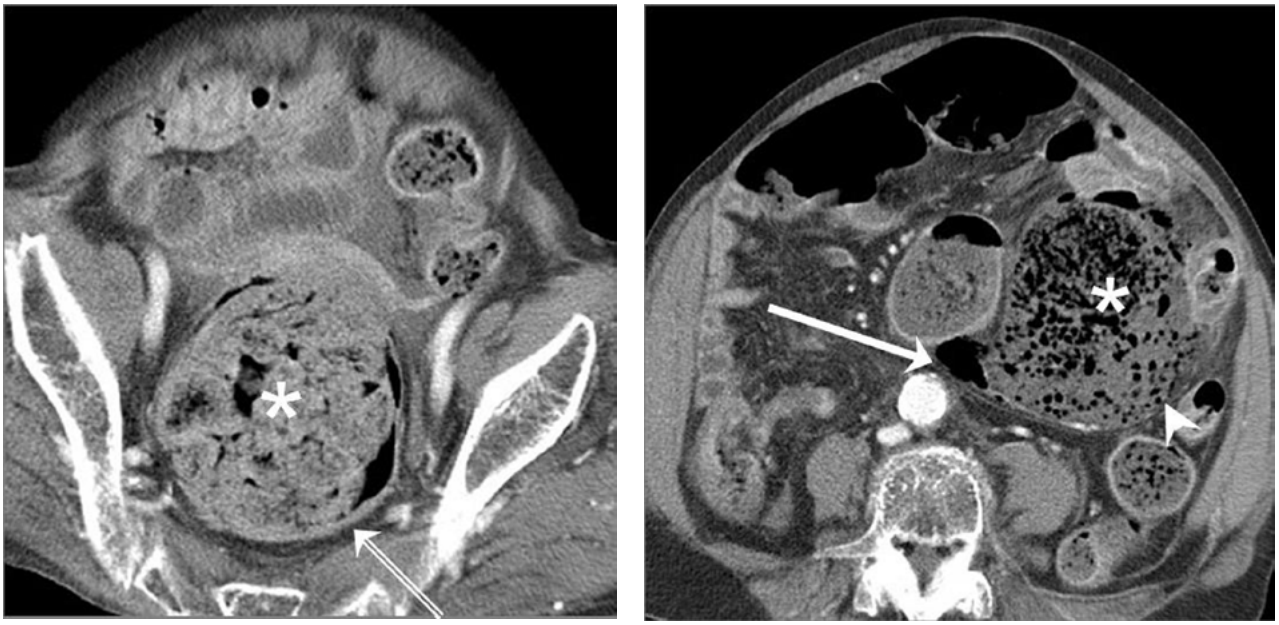
The degree of proximal colonic dilatation was classified into four groups. There was no significant difference (p=0.177). There were also no evident significant differences between the groups in the degree of pericolic fat infiltration (p=0.790) and the presence of pericolic abscess (p=0.603).

The mean number of pericolic lymph nodes was 0.25 for stercoral perforation and 2.27 for colorectal cancer perforation. Significant differences in the number of pericolonic lymph nodes (p=0.011) were noted between the two groups.

DISCUSSION

Recently, increasing numbers of patients with chronic constipation have been documented because of a global aging trend with long-term hospitalization of the elderly, as well as radiation therapy for gastrointestinal tract cancer, steroid use in organ transplant patients [1], frequent use of antidepressants and painkillers, and a low fiber diet in younger people. Chronic constipation increases the incidence of stercoral colitis and stercoral perforation. Thus the interest on these diseases is increasingly growing. In these patients, differentiation between stercoral perforation and colorectal cancer perforation is critical

FIGURE 1: A 78-YEAR-OLD WOMAN WITH ABDOMINAL PAIN AND DIAGNOSED WITH STERCORAL PERFORATION.



A and B. Axial contrast-enhanced CT scans show a focal wall defect (arrowhead) in the sigmoid colon with extra luminal feces, free air (arrow), and fecaloma (*) with luminal dilatation and posterior wall thickening (double arrow) in the rectum, which is suggestive of stercoral colitis.

FIGURE 2: A 77-YEAR-OLD WOMAN WITH CONSTIPATION AND DIAGNOSED WITH RECTAL CANCER PERFORATION.

Axial contrast-enhanced CT scan shows fecaloma (*) with luminal dilatation in the rectum, extraluminal free air (arrow) in the pelvic cavity and abrupt luminal narrowing with homogenously enhancing wall thickening (arrowheads) in the distal rectum. Hartmann's operation was performed, and adenocarcinoma was confirmed by the pathologic examination.

in determining the appropriate treatment plan and predicting the prognosis of patients. Therefore, clear differentiation criteria on imaging will be beneficial in clinical medicine.

Fecaloma that can cause stercoral perforation occurs because of the accumulation of feces over the years after absorption of water contents by the colon, with calcification rarely occurring [10]. These fecaloma gradually expand the lumen of the large bowel and increase the intraluminal pressure, which results with a reduction of blood supply to the bowel wall. If it is not treated appropriately and continued, ulceration or perforation of the bowel wall can occur due to ischemia [2]. However, the fecaloma may also occur by partial obstruction due to colon cancer. Thus, when stercoral colitis or perforation is suspected, the possibility of combined colon cancer causing distal bowel obstruction should be considered.

CT is the most useful examination to detect extraluminal gas. The presence of air in the colon wall, mesocolon, or pneumoperitoneum limited to the pelvic cavity will help to predict colon perforation as the cause of pneumoperitoneum [11]. If fecaloma with luminal dilatation of the colon accompanies extraluminal air, the possibility of stercoral perforation should be considered.

In the present study, the sigmoid colon was the most common site of stercoral perforation, which is consistent with the previous report that sigmoid or rectosigmoid colon is the most frequent site of stercoral perforation [1]. Feces in the more distal colon get harder due to water resorption, so it can increase the chance of colon perforation in the distal colon which has a narrowing lumen [2,8]. On the other hand, the cecum, the largest lumen of the colon, is the most common site for colon cancer perforation [12,13]. In our

study, in the stercoral perforation group, the suspected perforation area was the rectosigmoid colon in 6 patients and the transverse colon in 2 patients. Because we excluded patients with ascending colon cancer perforation, meaningful statistical comparisons between both groups were difficult.

In cases of obstructive colitis associated with colon cancer, normal mucosa without inflammation or ulcer can be found in just the proximal or distal portion of the cancer [5]. In this study, while the stercoral perforation group displayed circumferential-enhancing wall thickening at the site of contact with the fecaloma, the colon cancer perforation group feature eccentric-enhancing wall thickening at the adjacent distal bowel, even with the presence of fecaloma. A thicker distal bowel wall and the presence of several enlarged pericolonic lymph nodes around the perforation site are important findings for the differential diagnosis of colon cancer perforation.

In our study, more severe luminal dilatation of the proximal bowel favored stercoral perforation but did not present statistical significance. Stercoral perforation results from luminal expansion by the fecaloma and secondary pressure necrosis of the bowel wall, so most patients show moderate to severe luminal dilatation. However, colon cancer perforation can occur due to tumor necrosis itself [4], as well as secondary perforation due to luminal distension of the proximal colon due to distal bowel obstruction, so it may not show proximal bowel distension. In this study, we might have subdivided the degree of luminal dilatation too excessively, accounting for the lack of statistical significance, or colon perforation may have occurred before the CT scanning and luminal expansion could have been improved by decreased intraluminal pressure. This result is consistent with the prior description that the degree of luminal expansion is not associated with the prognosis of patients[14].

Layered-enhancing wall thickening was more frequently seen in the stercoral perforation group than the colon cancer perforation group. This finding is also evident in ischemic colitis, which shows circumferential-enhancing wall thickening and hyperattenuating mucosa by mucosal bleeding [3]. However, it can be discriminative because ischemic colitis rarely shows fecaloma [11] and involves a longer segment than stercoral perforation with a narrow lumen.

If bowel perforation occurs gradually, it forms a localized pericolonic abscess at the perforation site rather than spreading rapidly into the abdominal cavity due to the viscosity of feces [2]. There were no statistically significant differences between the two groups in the presence of pericolonic abscess formation or the degree of inflammation. These findings are just secondary findings of colon perforation, not specific CT signs for determining the cause of perforation.

Stercoral perforation shows transmural necrosis, and a well-defined ulcer on the histopathologic exam, the shape of ulcer is irregular according to the shape of contacting fecaloma, and the size is often larger than 1 cm [10]. Chronic inflammatory change and atrophy of the colon wall can be seen around the perforation site. Also, stercoral colitis can occur in several places simultaneously, because the fecaloma could have been located anywhere on the colon [15]. This type of perforation more often occurs in the anti-mesenteric border of the bowel, because the blood perfusion at this portion is low and intraluminal pressure exceeds the capillary perfusion pressure at first [10].

The treatment of choice for stercoral perforation is surgery, and Hartman's operation is usually performed to resect the whole involved bowel segment and make the colostomy [10]. To prevent intraabdominal infection, intraabdominal washing with a large amount of saline and extensive antibiotic use are needed. To prevent the stercoral perforation, active treatment for constipation and rapid removal of the fecaloma are required [15].

The limitation of this study is the small number of patients. Because of the low incidence of the disease, reportedly 0.04%-2.3% [14] and the difficulty in histopathologic assessment with nonspecific pressure necrosis and ischemia, it is hard to recruit many patients. Most of the patients with stercoral colitis receive conservative treatment and are only treated surgically in cases of suspected bowel perforation. Further prospective studies with a larger population are likely necessary to prove our results in those populations. Second, we did not evaluate the reproducibility of CT features of stercoral perforation with various observers as we had resolved any discrepancies between the observers by consensus. Third, we retrospectively searched for individuals with stercoral perforation identified at CT, using electronic medical records and the radiology information system of our hospital. Thus, there is the possibility that we missed some patients with this search method. Fourth, our patients were se-

lected from three different hospitals, so they used different scanners and different parameters. However, it could not help because stercoral perforation has a very low incidence.

CONCLUSION

In conclusion, stercoral perforation is a very rare disease, but the conditions that cause chronic constipation or fecalomas are widespread. If perforation occurs, the prognosis is critical. So, accurate preoperative diagnosis of stercoral perforation on CT examination has important clinical implications. In summary, patients with stercoral perforation exhibited fecaloma in the proximal bowel and layered-enhancing wall thickening around the perforation site. In contrast, patients with colon cancer perforation showed thicker eccentric wall thickening in the distal bowel and more frequently presented with enlarged pericolonic lymph nodes.

RESUMO

OBJETIVO: *Determinar os sinais de CT associados à perfuração estercoral e perfuração do câncer colorretal.*

MÉTODOS: *De maio de 2003 a fevereiro de 2015, todos os pacientes cirurgicamente e patologicamente confirmados com perfuração estercoral (n = 8, idade média de 68,3 anos) ou perfuração de câncer de cólon (n = 11, idade média de 66,3 anos) foram revisados retrospectivamente por dois radiologistas certificados por placa cegados ao diagnóstico comprovado. Os seguintes achados CT foram avaliados e gravados para cada paciente: espessura da parede do cólon distal adjacente ao local da perfuração, padrão de espessamento e realce da parede do cólon, comprimento da parede intestinal espessada, presença de fecaloma, grau de dilatação do cólon proximal e inflamação pericolônica ou presença de abscesso pericolônico e número de linfonodos pericolônicos aumentados. Esses achados foram correlacionados com o diagnóstico patológico.*

RESULTADOS: *A espessura média da parede colônica distal adjacente ao local de perfuração foi de 13,6 mm em pacientes com perfuração de câncer colorretal e 5,1 mm com perfuração estercoral, que foi estatisticamente diferente. Houve uma correlação significativa entre a perfuração do câncer colorretal e o espessamento da parede excêntrica ($p < 0,01$). Os achados de CT de espessamento de parede aprimorada em camadas ($p < 0,01$) e presença de fecaloma no cólon proximal ($p < 0,01$) foram achados significativos para perfuração estercoral. Os pacientes com câncer colorretal apresentaram mais linfonodos pericolônicos (média 2,27, $p < 0,05$).*

CONCLUSÃO: *O fecaloma no cólon proximal e o espessamento da parede que aumenta a camada adjacente ao local da perfuração são provavelmente devidos à perfuração estereocálica. O espessamento da parede intestinal excêntrica na porção distal do local da perfuração com muitos gânglios linfáticos pericolônicos aumentados é provavelmente a perfuração do câncer colorretal.*

PALAVRAS-CHAVE: *Impacção fecal. Neoplasias colorretais. Colite isquêmica. Perfuração intestinal.*

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