The Value of Urgent Barium Enema and Computed Tomography in Acute Malignant Colonic Obstruction: Is Urgent Barium Enema Still Necessary?

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ABSTRACT

The aim of this study was to evaluate the necessity of urgent barium enema in suspected cases of acute malignant colonic obstruction.

We reviewed the medical records and images for 20 patients with suspected acute colonic obstruction. Nine patients were excluded. Computed tomography (CT) and urgent barium enema images for the remaining 11 cases were reviewed and the results were compared with the surgical findings. The rate of correct diagnosis of obstruction level was compared between CT and barium enema. The diameters of different colonic segments were analyzed on CT, and several different parameters were compared with the obstruction severity on barium enema.

Both CT and barium enema correctly predicted the obstruction level in 100% of the cases. The extent of colonic dilatation was not significantly different between total obstruction and partial obstruction (P > 0.05). The sensitivity and specificity of the continuity sign on CT to predict partial obstruction were 33.33% and 100%, respectively. The possibility of total obstruction for an obstructive lesion distal to the splenic flexure was not statistically different from that for an obstructive lesion proximal to the splenic flexure (P > 0.05).

Urgent barium enema is not necessary in suspected cases of acute malignant colonic obstruction, predominantly due to the advancement in both CT and surgical management of such cases.

Acute colonic obstruction is a surgical emergency, and approximately 85% of cases are caused by colorectal tumors [1]. In all patients with colorectal cancer, 15–20% of cases initially present with acute colonic obstruction [2]. For a patient with suspected colonic obstruction, a supine abdominal plain film and an erect chest plain film are traditionally the first examinations performed to evaluate the condition of the abdomen and to rule out bowel perforation. Abdominal CT and barium enema may be performed to detect a possible obstructive lesion. However, since the advancement of the CT modality, some scholars suggest limiting the use of barium enema in the evaluation of such cases [3]. Moreover, emergency surgery for colorectal cancer is currently not favored due to the associated high mortality and morbidity rates, and barium enema is not routinely performed in many hospitals. In contrast, elective surgery with transitional colonic stenting shows more benefit for patients [4, 5]. However, colonic stenting is not...
always available in hospitals; in such cases, such as in our hospital, the decision between emergent and elective surgery will be based on whether the colon is totally obstructed [6]. The hypothesis of this concept is that total obstruction may result in more severe dilatation of the colon and consequently a higher colonic perforation rate. Therefore, early surgical intervention for total obstruction is indicated. If the severity of dilatation is not different between total and partial obstruction, the need for urgent contrast enema will be lessened. This study aims to evaluate the necessity of urgent barium enema in suspected cases of acute malignant colonic obstruction.

MATERIAL AND METHODS

Patients

In this retrospective study, we collected and reviewed the medical records and imaging studies of 20 patients who presented to the emergency department of our hospital between October 2007 and November 2011 and were clinically suspected of having acute colonic obstruction. All 20 patients underwent both urgent barium enema and abdominal CT. We excluded 9 patients: 2 patients underwent barium enema before CT; another 2 patients showed obvious ileocolonic intussusception on CT; and the remaining 5 patients were eventually diagnosed with ischemic bowel disease, paralytic ileus, adhesive ileus, diverticulitis, and unknown disease, respectively. The patient with unknown disease was highly suspected of having descending colon cancer on CT and barium enema, but the patient died before she was able to undergo surgical resection of the problematic colon lesion. The 11 cases in this study included 3 women and 8 men (age range: 47–86 years; mean: 64.4 years). Of the 11 cases, 10 patients were eventually diagnosed with colon cancer (ascending colon: 2; transverse colon: 3; descending colon: 2; sigmoid colon: 2; and rectum: 1), and the remaining patient had sigmoid colonic metastasis from endometrial cancer.

Imaging techniques

CT: All CT scans were performed without (slice thickness: 5 mm) and with (slice thickness: 2 mm) intravenous contrast injection using one of two 64-channel multidetector CT scanners. Coronal reconstruction (slice thickness: 3 mm) was performed from the enhanced series. For each patient, 80 mL non-ionic or ionic iodinated contrast media was administered intravenously. Neither oral contrast nor rectal contrast was administered.

Barium enema: All barium enema studies were performed by radiologists. The procedure was terminated when the colon was fully distended or when an obstructive lesion was identified. If there was an obstructive lesion, barium was continuously infused until the distal segment of the colon was fully distended for at least 10 seconds to evaluate whether barium could pass through the obstruction. No intravenous medication was administered for this study.

Definitions

The obstruction level, the diameters of the segments proximal and distal to the obstruction, and the continuity of the lumen through the obstructive lesion were recorded based on CT images. The obstruction level was divided into 5 groups including ascending colon, transverse colon, descending colon, sigmoid colon, and rectum. The diameters of the proximal (Pro-diameter) and distal (Dis-diameter) segments were defined as the maximum diameters of the adjacent segments proximal and distal to the obstructive lesion, respectively. The ratio (P-D ratio) between Pro-diameter and Dis-diameter was then calculated. In addition, whenever the intraluminal air or fluid could be continuously traced through the obstructive lesion, the continuity was considered positive (Fig. 1).

Based on barium enema, the obstruction level was also divided into the same 5 groups as those based on CT images. When contrast could pass through the obstructive lesion during barium enema, partial obstruction was considered (Fig. 1). In other cases, total obstruction was favored (Fig. 2).

The definite obstruction level of each case was determined according to the intraoperative findings, and the final diagnosis was based on the pathology report.

Statistical analysis

The sensitivities and specificities of CT and barium enema in localizing the definite obstruction level were compared. The Pro-diameter, Dis-diameter, and P-D ratio were separated into the partial obstruction group and the total obstruction group to elucidate any significant differences between the 2 groups. The value of the continuity sign to predict partial or total obstruction was also analyzed. The possibility of total obstruction was compared between 2 distinct obstruction levels (proximal or distal to the splenic flexure). These calculations were performed using the software SPSS for Windows (Version 17), and a P value of less than 0.05 was considered statistically significant (Student’s t-test).

RESULTS

All of the 11 patients included in this study had single colonic lesions, and the preoperative prediction of the obstruction level was correct in 100% cases by either CT or barium enema. No perforation was noted after barium enema in any of the cases. Of the 11 cases, 5 patients had total obstructions and 6 patients had partial obstructions. The averages of the Pro-diameter, Dis-diameter, and P-D ratio in the total obstruction group were 5.98 cm, 2.34 cm, and 3.24, respectively. Those in the partial obstruction

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group were 6.1 cm, 2.97 cm, and 2.23, respectively. Statistically, the differences of these 3 parameters between the 2 groups were not significant ($P = 0.90$, 0.39, and 0.22) (Fig. 3). All 5 cases in the total obstruction group had negative continuity, whereas 2 of the 6 cases in the partial obstruction group had positive continuity. The sensitivity and specificity of the continuity sign on CT were 33.33% and 100%, respectively, to predict partial obstruction and 100% and 33.33%, respectively, to predict total obstruction (Table 1). Five patients had obstructive lesions proximal to the splenic flexure, and only 1 of the 5 patients (20%) showed total obstruction. In the remaining 6 patients with obstructive lesions distal to the splenic flexure, 4 patients (66.67%) showed total obstruction. However, the possibility of total obstruction for an obstructive lesion distal to the splenic flexure was not statistically different from that for an obstructive lesion proximal to the splenic flexure ($P = 0.15$) (Table 2).

**Figure 1.**

- **a.** Positive continuity sign: fluid and air communication between the 2 colonic segments proximal and distal to the tumor (arrow).
- **b.** Passage of contrast media through the narrowing segment of the tumor (arrow), confirming partial obstruction.

**Figure 2.**

- **a.** Negative continuity sign: no fluid or air communication between the 2 colonic segments proximal and distal to the tumor (arrow).
- **b.** Abrupt cutoff of contrast media at the tumor site (arrow), confirming total obstruction.
Table 1. The relation between obstruction severity and continuity

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<table>
<thead>
<tr>
<th>Continuity * obstruction severity cross tabulation</th>
<th>Obstruction severity</th>
<th>Partial obstruction</th>
<th>Total obstruction</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuity</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td></td>
<td>4</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Positive</td>
<td></td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>6</td>
<td>5</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 2. Patient details of the partial and total obstruction groups

<table>
<thead>
<tr>
<th>Patient details</th>
<th>Partial obstruction (n = 6)</th>
<th>Total obstruction (n = 5)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years, median (range)</td>
<td>69 (56-86)</td>
<td>59 (47-73)</td>
<td>0.215</td>
</tr>
<tr>
<td>Gender (male:female)</td>
<td>3:3</td>
<td>5:0</td>
<td>0.074</td>
</tr>
<tr>
<td>Obstruction level, n (%)</td>
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<td></td>
<td>0.148</td>
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<tr>
<td>Proximal to the splenic flexure</td>
<td>4 (66.7)</td>
<td>1 (20)</td>
<td></td>
</tr>
<tr>
<td>Ascending colon</td>
<td>2 (33.3)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Transverse colon</td>
<td>2 (33.3)</td>
<td>1 (20)</td>
<td></td>
</tr>
<tr>
<td>Distal to the splenic flexure</td>
<td>2 (33.3)</td>
<td>4 (60)</td>
<td></td>
</tr>
<tr>
<td>Descending colon</td>
<td>1 (16.7)</td>
<td>1 (20)</td>
<td></td>
</tr>
<tr>
<td>Sigmoid colon</td>
<td>1 (16.7)</td>
<td>2 (40)</td>
<td></td>
</tr>
<tr>
<td>Rectum</td>
<td>0 (0)</td>
<td>1 (20)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. The averages of Pro-diameter, Dis-diameter, and P-D ratio in the partial obstruction group and in the total obstruction group are 6.10 cm, 2.97 cm, and 2.23 cm, and 5.98 cm, 2.34 cm, and 3.24 cm, respectively. The differences of these 3 parameters between the 2 groups are not significant (P > 0.05).
DISCUSSION

In the past, barium enema was usually performed in cases of suspected colonic obstruction. However, since the improvement of CT machines, namely the advent of the multidetector CT, barium enema has been performed less often in such conditions. Instead, barium enema is reserved for confirming the obstruction site prior to colonic stent insertion or detecting a possible synchronous colonic obstructive lesion in patients with small bowel obstruction [3]. In our study, CT displayed an equal detection rate to barium enema in localizing the obstruction level, and both of their detection rates were 100% compared to the final surgical diagnoses.

Although barium enema is able to detect a second lesion in the segment proximal to the obstruction level that may not be obvious on CT [7], we do not believe that it is necessary to perform urgent barium enema in such a condition. The pathogenesis of colonic perforation due to chronic colonic obstruction, such as fecal impaction, is related to pressure necrosis [8]. Although perforation in colorectal cancer most commonly results due to invasion of the cancer, perforation proximal to the cancer is also possible [9]. In a case with acute malignant colonic obstruction, if there is no initial perforation, delayed perforation might be related more to pressure necrosis at the dilated proximal bowel loops and the weakened obstructive site. As a result, it is not necessary to perform urgent barium enema to detect a possible second lesion in the collapsed distal segment. This collapsed segment has a lower perforation rate compared to the dilated segment and the weakened obstructive site, which are the truly problematic regions necessitating timely management. Instead, elective barium enema after decompression with a nasogastric tube, an anal tube, or other decompression procedures is safer than urgent barium enema if evaluation of the collapsed segment is indicated clinically.

In addition, based on the data analysis in our study, there is no difference of Pro-diameter, Dis-diameter, and P-D ratio between the total obstruction group and the partial obstruction group. Although we cannot identify a suitable parameter by measuring diameters of different colonic segments to predict the severity of obstruction, it is interesting that the extent of colonic dilatation in total obstruction is not more severe than that in partial obstruction. The physical rules indicate that under the same condition, the diameter of the same hollow organ, like a balloon, should be positively correlated with intraluminal pressure. Thus, regardless of partial or total obstruction, we may consider that the perforation rate due to the pressure effect is similar considering that both conditions display a similar extent of colonic dilatation. Therefore, confirming the severity of obstruction by barium enema is not helpful in predicting the perforation rate in the management of acute malignant colonic obstruction. In our study, the only useful sign for confirming partial obstruction on CT is the continuity of traceable air or fluid through the obstructive lesion, but thus occurs in only one-third of partial obstruction cases.

The rate of colonic perforation during barium enema is low (0.02–0.04%), but when it occurs, the mortality rate is as high as 50%. Other reported complications related to barium enema include inspissation of barium with resultant mechanical colonic obstruction and appendicitis, venous embolization of barium, cardiac arrhythmias from colonic manipulation, and barium granuloma of the rectum [10]. Although barium enema is generally a safe procedure, it is not necessary to frequently perform this procedure when considering the devastating outcome after perforation, which is more likely to occur in a diseased colon. Water-soluble contrast agents might be an alternative if contrast enema is clinically necessary. However, water-soluble contrast agents with high osmolality, such as Gastrografin, may cause overdistention of an obstructed colon and thereby increase the perforation rate [11]. Thus, we believe that urgent contrast enema with barium or water-soluble agents is best reserved for patients who will undergo subsequent colonic stent insertion. Although not absolutely necessary in this condition, urgent contrast enema can be helpful in localizing and clearly visualizing the obstructive lesion. Furthermore, if colonic stenting is not available, contrast enema is not indicated. However, if clinicians intend to survey a possible synchronous distal lesion or need to evaluate the morphology of the obstructive lesion, contrast enema can be considered electively after decompression. Water-soluble contrast enema is safer than barium enema, although it is more expensive, and the opacification of colon by water-soluble contrast is less marked than by barium enema.

The major limitation of our study is the small number of cases, which may decrease the statistical significance of data analysis. We hope that a larger study in the future will provide a definite answer to the question: can we omit urgent contrast enema in a patient with suspected acute malignant colonic obstruction?

CONCLUSION

The rate of detecting colonic obstruction level is the same between CT and barium enema, and both methods in our study were correct in 100% of cases. The extent of colonic dilatation is not related to the severity of colonic obstruction. Therefore, the perforation rates of partial and total obstruction due to the pressure effect can reasonably be considered similar. Thus, definitively confirming partial or total colonic obstruction should not be an indication to perform urgent barium enema. Based on our study and a review of the literature, urgent barium enema in a case of acute malignant colonic obstruction currently is of low value due to the advancement of CT.
REFERENCES