Value of CT in the Diagnosis of Intestinal Ischemia in Small Bowel Obstruction.

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Aims and objectives

The objective of this study is to determine the contribution of CT in the diagnosis of intestinal ischemia in patients with small bowel obstruction (SBO) and to evaluate its impact on the therapeutic management of patients.

Methods and materials

This is a retrospective study that included 50 patients with acute small bowel obstruction, explored in Imaging department of MT Maamouri Nabeul Hospital and Mongi Slim La Marsa Hospital, over a period of 4 year from January 2009 to December 2012. All patients were investigated by abdominopelvic CT. Results were confronted with surgical findings and evolution in medical treatment.

Results

19 patients (38% of patients) has shown CT signs of severity:
- 1 patient whose imaging showed a parietal thinning giving the appearance of a virtual wall (Fig.1).
- 4 patients (8%) whose imaging showed wall thickening of more than 3 mm (Fig. 2, Fig. 3), one was a false positive.
- 1 patient with a lack of enhancement was observed.
- 1 patient had a pneumoperitoneum.
- Ascite was observed in 16 patients (32% of cases).

THERAPEUTIC APPROACHES

Surgical treatment has dominated the therapeutic approach with 38 patients operated (76 % of cases).

23 patients underwent emergency surgery (61% of operated patients and 46% of all patients).

12 patients underwent medical treatment (24 % of cases).
The vitality of the bowel has been reported in all patients.

In 10 patients (26% of operated patients), the vitality of the bowel was considered compromised. Etiologies in these 10 cases were: adhesions in 3 patients, small bowel volvulus in 4 patients, internal hernias in 2 patients and mesenteric venous infarction in 1 patient. The time interval separating the surgical act and admission was 24 hours for 2 patients, 48 hours for 4 patients and 72 hours for 1 patient. Surgery was performed immediately for 4 patients who showed clinical signs of severity.

**RADIOSURGICAL CORRELATIONS**

Signs of severity were overestimated on CT. They were found after surgery in 10 patients versus 19 on CT scan.

The sensitivity and specificity of CT to detect ischemia in our series were respectively 60% and 68% as indicated in Table 1.

<table>
<thead>
<tr>
<th>Severity+ (n=10)</th>
<th>Severity- (n=40)</th>
<th>Se</th>
<th>Sp</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT signs of severity</td>
<td></td>
<td>60%</td>
<td>68%</td>
<td>32%</td>
<td>87%</td>
</tr>
</tbody>
</table>

Table 1- Sensitivity and specificity of CT in determining ischemia.

The sensitivity and specificity were calculated for each sign of CT severity and are detailed in Table 2.

<table>
<thead>
<tr>
<th>CT signs of severity</th>
<th>Se</th>
<th>Sp</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parietal thickening</td>
<td>30%</td>
<td>98%</td>
<td>75%</td>
<td>85%</td>
</tr>
<tr>
<td>Wall thinning</td>
<td>10%</td>
<td>100%</td>
<td>100%</td>
<td>82%</td>
</tr>
<tr>
<td>Lack of enhancement</td>
<td>10%</td>
<td>100%</td>
<td>100%</td>
<td>82%</td>
</tr>
<tr>
<td>Ascites</td>
<td>70%</td>
<td>78%</td>
<td>44%</td>
<td>91%</td>
</tr>
<tr>
<td>Pneumoperitoneum</td>
<td>10%</td>
<td>100%</td>
<td>100%</td>
<td>82%</td>
</tr>
</tbody>
</table>
Parietal pneumatosis - - - - -
Mesenteric venous gas - - - - -
Portal venous gas - - - - -

Table 2- Sensitivity and specificity of CT in the diagnosis of signs of severity.

A multivariate analysis showed that the combination of several signs of severity greatly increase the sensitivity and therefore the value of CT for the detection of complicated small bowel obstruction as shown in Table 3.

<table>
<thead>
<tr>
<th>Combination of CT signs of severity</th>
<th>Se</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall thinning + Ascites</td>
<td>14%</td>
</tr>
<tr>
<td>Lack of enhancement + Ascites</td>
<td>14%</td>
</tr>
<tr>
<td>Parietal thickening + Ascites</td>
<td>43%</td>
</tr>
</tbody>
</table>

Table 3- Value of the combination of signs of severity for detecting ischemia.

By definition, a parietal ischemia of the small intestine during an occlusion is a strangulation. It is estimated about 10% of all cases of SBO. [1] The clinical diagnosis is very difficult and unspecific. The mortality rate is high around 30% to 40% [1] versus 5% to 8% for uncomplicated SBO [2].

The first point revealed by our study is the scarcity of some signs. The parietal pneumatosis the mesenteric venous and portal venous gas were not found in our series. This is probably related to the early management of patients before the onset of ischemia. In fact, 46% of cases in our series were operated in emergency.

The sensitivity and specificity of CT in the detection of ischemia in our series were respectively 60% and 68%. These results are consistent with the findings of the literature databases. Makanjuola [3] reported a sensitivity and specificity of 67% and 100%, respectively; while Kim [4] concluded that the respective values were 71% and 83%. These differences can be explained by the fact that some studies have not analyzed all the CT signs of severity described, the interpretation of signs remains subjective and the time interval between CT and the surgery is different depending on the study.
The most specific signs found in our series were: the parietal thinning, lack of enhancement and pneumoperitoneum.

The results of specificity of lack of enhancement of the wall (excellent specificity in our study: 100%) consistent with the results obtained by Zalcman [5] and Catel [6]. The sensitivity of this sign is low and lower than that reported by Zalcman and Catel. This difference is explained by the fact that the appraiciation of this sign is not based on objective measurement and therefore subject to errors.

The thinning of the bowel wall is described when the wall is less than 1mm. Its specificity is excellent both in our study than Catel [6] but has a low sensitivity measured at 10% versus 36% reported by Catel. This difference is explained by the subjective nature of the apppeciation of the sign.

The wall thickening sign, in our series, has a specificity of 98% and a sensitivity of 30% for a threshold value of 3mm. Our results are similar to those observed in the study of Catel [6] who reported a specificity and sensitivity of 100% and 36%, respectively. But there are differences with the study of Zalcman [5], the sign had a specificity of 78% and a sensitivity of 38%. These differences are explained by the fact that the threshold varies with the studies. Zalcman used a pathological threshold value of 2mm whereas in our series and in the study of Catel, we opted for a threshold value of 3mm.

Ascite is a less specific sign in the detection of ischemia evaluated at 78% in our series but it appears that it is more sensitive compared to other signs with a sensitivity of 70%. These findings are consistent with the results published by Sheedy [7] and Zalcman. Cartel [6], meanwhile, reported a sensitivity and specificity of the respective 71% and 45%. These differences are explained by the presence of intercurrent diseases.

Taken separately, these signs are specific but less sensitive. However, it appears that the combination of CT signs of severity increase sensitivity for detection of ischemia. The most sensitive association is wall thickening and ascite with a sensitivity of 43%. The sensitivity of this same association is 25% in the study of Zalcman [5]. This difference is explained by the variation of threshold pathological wall thickening and presence of intercurrent diseases.

Images for this section:
**Fig. 1:** Mechanical obstruction secondary to a volvulus due to adhesions. Axial abdominal CT scan with contrast shows a distension of small bowel with a very thin wall giving the appearance of a virtual wall (arrowhead).
Fig. 2: Mechanical obstruction secondary to a volvulus due to adhesions. Axial CT scan with contrast shows distended small bowel loops with C-shaped loop (a) (closed loop) (b and c) reflecting occlusion by strangulation. The ileal loop has a thickened wall (arrowhead), reflecting intestinal ischemia. The bowel upstream (d) is dilated. We note the presence of the feces sign (*).
**Fig. 3:** Mechanical obstruction secondary to a volvulus due to adhesions. Surgical exploration confirmed the ischemia and the adhesion was found (arrow).
Conclusion

The excellent performance of CT in the diagnosis of ischemia in acute small bowel obstruction made this examination a gold standard for this indication for an optimal management.

Personal information

References