

# Ultrasonography in diagnosing colorectal cancers in patients presenting with abdominal distension

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**A**bdominal distension is a common problem in clinical practice, but, because of its trivial signs and symptoms, many patients ignore it as a potential cause for concern.<sup>1</sup> Common pathological causes of abdominal distension include hepatomegaly, splenomegaly, intra-abdominal masses or inflammation, intestinal obstruction, colorectal tumours and ascites.

Colorectal cancer, one of the common gastrointestinal diseases encountered in clinical practice,<sup>2-4</sup> tends to be symptomless early in its course. Many methods have been used to diagnose colorectal cancer, including faecal blood testing,<sup>5</sup> flexible sigmoidoscopy,<sup>6</sup> double-contrast barium enema,<sup>7</sup> endoscopic or virtual colonoscopy,<sup>8</sup> and DNA markers.<sup>9</sup> Although abdominal ultrasonography is widely used to diagnose patients with acute abdomen,<sup>10-11</sup> its role in diagnosing colorectal cancers has not been tested. The aim of our study was to determine the accuracy of abdominal ultrasonography for diagnosis of colorectal cancers in patients presenting with abdominal distension.

## METHODS

### Participants

Our study was conducted between January 2001 and July 2004 in the emergency department of the National Taiwan University Hospital, a tertiary hospital serving about 110 000 patients annually. All consecutive adult patients admitted with a complaint of abdominal distension (defined as a sensation of fullness or bloating) were considered for inclusion in the study. Patients were excluded if they were pregnant; had abdominal trauma, liver cirrhosis with ascites, or rectal cancer palpable on digital examination; or had had abdominal surgery within the previous 4 weeks.

### Investigations

A detailed medical history was obtained and a physical examination was performed by a member of the emergency or surgical house staff. After giving informed consent, the patient underwent an ultrasonographic examination, performed by staff emergency physicians or staff surgeons who had com-

## ABSTRACT

**Objective:** To determine the usefulness of abdominal ultrasonography for diagnosing colorectal cancer in patients presenting with abdominal distension.

**Design, setting and participants:** A prospective case series of consecutive adult patients with abdominal distension admitted to the National Taiwan University Hospital between January 2001 and July 2004. All participants were examined by abdominal ultrasonography. Those with suspected colorectal tumours on ultrasonography had follow-up colonoscopy, while all other patients had computed tomography scans.

**Main outcome measures:** Accuracy of abdominal ultrasonography for diagnosing colorectal cancer in patients with abdominal distension; incidence of colorectal cancer.

**Results:** Of 511 patients eligible for inclusion in our study, 97 (19.0%) were confirmed to have colorectal cancer. For diagnosis of colorectal cancer, ultrasonography had a sensitivity of 92.8% (95% CI, 85.2%–96.8%); a specificity of 98.8% (95% CI, 97.0%–99.6%); a positive predictive value of 94.7% (95% CI, 87.6%–98.0%); a negative predictive value of 98.3% (95% CI 96.4%–99.3%); and an accuracy of 97.7%.

**Conclusion:** Ultrasonography is a sensitive tool for diagnosing colorectal cancer in patients presenting with abdominal distension.

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pleted the fundamental gastrointestinal ultrasonographic training course provided by the Society of Ultrasound in Medicine, Taiwan. Ultrasonography was performed with a handheld 3.75–6 MHz curved array transducer (Toshiba SSA-340A, SSA-550A; Tochigi-Ken, Japan) over the patient's abdomen, screening along the caecum, ascending colon, hepatic flexure, transverse colon, splenic flexure, descending colon, sigmoid colon and rectum. Any additional or abnormal ultrasonographic changes were described and the ultrasonographic diagnosis was recorded. To reduce interference from gas in the bowel (which blurs the ultrasound image), the patient's position was changed from supine to the right or left lateral decubitus position during the ultrasonographic examination. Because normal bowel loop is compressible, an incompressible lesion within the colon or extending outside the colonic wall was suggestive of a colorectal tumour. Ultrasonographic diagnosis of a colorectal tumour was based on a proximal colon dilatation with a distal colon collapse and a mass lesion inside the transitional colon (Box 1).

Patients with suspected colorectal tumours detected on ultrasonography underwent follow-up colonoscopy. Those

with negative results on ultrasonography had a computed tomography (CT) scan. Colonoscopy and CT scans were performed by staff gastrointestinal endoscopists and radiologists, respectively, who were blinded to the results of ultrasonographic investigation. Finally, the attending emergency physicians compared the ultrasonographic diagnoses with colonoscopy or CT reports. A definitive diagnosis of colorectal cancer required histological confirmation.

From our results we calculated the sensitivity, specificity, accuracy, positive predictive value and negative predictive value<sup>12</sup> of ultrasonography for diagnosing colorectal cancer.

## RESULTS

During the study period, 596 consecutive adult patients with abdominal distension were admitted to the emergency department, of whom 85 were excluded because they met the exclusion criteria (Box 2). The remaining 511 patients agreed to participate in the study. There were 288 men and 223 women, with a mean age of 58.2 years (range, 16–93 years). In this group, common symptoms associated with abdominal distension were abdominal pain (71%), con-

**1 Longitudinal scan showing proximal colon dilatation with a mass lesion (arrows) inside the descending colon**



stipation (41%) and vomiting (22%). The results of ultrasonography compared with colonoscopy and CT scanning are shown in Box 3. A total of 97 patients (19.0%) with abdominal distension had colorectal cancer. In 90 of 95 cases of suspected cancer reported on ultrasonography, colonoscopic findings supported the diagnosis; 409 of the 416 negative ultrasonographic reports were supported by CT findings.

Three of the five patients with false positive findings had bowel adhesions that caused changes in the shape and lumen of the colon; the other two had non-colonic cancer metastases with intra-abdominal dissemination mimicking thickening of the colonic wall. Of the seven patients with false negative findings, five had cancers that were masked by bowel gas, and the other two had cancers in the middle and upper rectum.

Cancer staging in the 97 patients with confirmed colorectal cancer was as follows: Dukes A (1 patient), Dukes B (16 patients), Dukes C (46 patients) and Dukes D (34 patients).

In the diagnosis of colorectal cancers, ultrasonography demonstrated a sensitivity of 92.8% (95% CI, 85.2%–96.8%); a specificity of 98.8% (95% CI, 97.0%–99.6%); a positive predictive value of 94.7% (95% CI, 87.6%–98.0%); a negative predictive value of 98.3% (95% CI, 96.4%–99.3%); and an accuracy of 97.7%.

## DISCUSSION

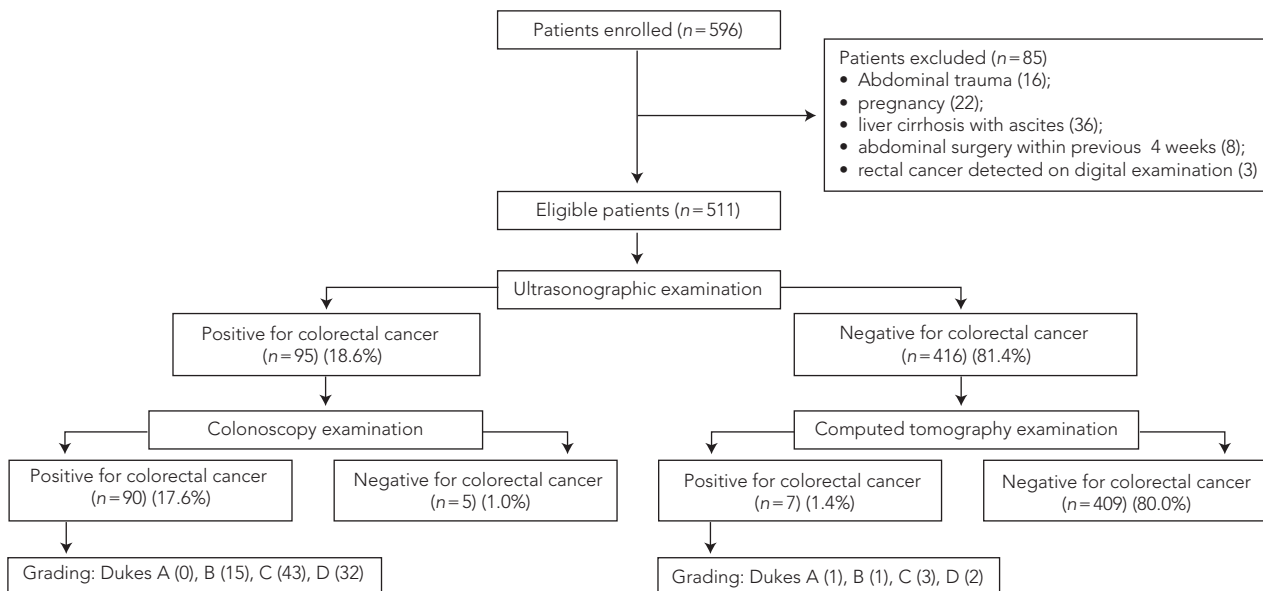
Our study found that about a fifth of patients with abdominal distension had colorectal cancer and that more than 80% of these were advanced cancers. This suggests that patients with abdominal distension need prompt abdominal examination to rule out the possibility of colorectal cancer. Our findings also indicate that ultrasonography is a sensitive tool for diagnosing colorectal cancer in patients presenting with abdominal distension.

Although ultrasonography has been widely used in patients with acute abdomen,<sup>10-11</sup> our study is the first, to our knowledge, to use ultrasonography to diagnose colorectal cancers in patients with abdominal distension. It was used only in a special subgroup of patients, and most of the cancers diagnosed were at an advanced stage. We are not suggesting that ultrasonography be used routinely as a substitute for colonoscopy<sup>8</sup> or barium enema<sup>7</sup> in screening for colorectal cancer.

Our study was not a standard comparison of different diagnostic methods. Patients with suspected colorectal cancer detected on ultrasonography had follow-up colonoscopy, while all other patients had a CT scan. The use of colonoscopy to screen all patients with abdominal distension for colorectal cancer would have been neither safe nor cost-effective. CT, which does not require bowel preparation and carries no risk of colonic perforation, is safer than colonoscopy in patients with low risk of colorectal cancer.

Although our results showed that ultrasonography had high sensitivity for detecting colorectal cancer, the technique has three important limitations. Firstly, because ultrasound cannot penetrate gas,<sup>10</sup> abdominal pathologies can be masked by the presence of gas in the bowel. Thus, repeat ultrasonographic examination is indicated in patients with unclear ultrasonographic findings due to marked bowel gas. Secondly, because ultrasound cannot penetrate bone,

## 2 Patient selection and follow-up protocol



### 3 Comparison of ultrasonographic diagnoses of colorectal tumours with colonoscopy or CT diagnoses

Ultrasonographic diagnoses of colorectal cancer	Colonoscopy/CT diagnoses of colorectal cancer*	
	Positive	Negative
Positive (n = 95)	90	5
Negative (n = 416)	7	409
<b>Total (n = 511)</b>	<b>97</b>	<b>414</b>

CT = computed tomography. \* Colonoscopy was performed if ultrasonography was positive; CT if ultrasonography was negative. ◆

colorectal tumours in the middle and lower third of the rectum can be missed. Thirdly, the accuracy of ultrasonographic examination is operator-dependent. An ultrasonographer requires adequate training, skill and experience<sup>10</sup> to perform ultrasonography and interpret the results accurately.

In conclusion, we believe that ultrasonography is a useful initial screening tool for colorectal cancer in patients presenting with abdominal distension. Compared with colonoscopy and CT scanning, ultrasonography is easily available; does not involve radiation, bowel preparation, or sedation; carries no risk of colonic perforation; and is less expensive than the other methods. Further studies to confirm the usefulness of ultrasonography for diagnosis of colorectal cancer are warranted.

### COMPETING INTERESTS

None identified.

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