



# Clinical time course and CT detection of metastatic disease to the small bowel

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## Abstract

**Purpose** The purpose of this study was to identify the CT characteristics of metastatic disease of the small bowel and define the clinical time course between primary tumor diagnosis and small bowel metastasis detection.

**Methods** A retrospective search of a pathologic database for metastases to small bowel identified 242 cases. Exclusion criteria were cases without CT ( $N=49$ ), serosal or mesenteric metastases ( $N=114$ ), or cases of direct invasion to small bowel ( $N=63$ ). The clinical records and imaging were reviewed for 16 patients.

**Results** Melanoma was the most common malignancy to metastasize to small bowel (7 of 16 patients). Only one of the 16 cases was detected at the time of initial diagnosis of their primary malignancy. The average time from diagnosis of the primary malignancy or remission to the time of detection of the small bowel metastasis was 7.2 and 8.3 years, respectively. The most common symptoms were gastrointestinal bleeding ( $N=5$ ) and small bowel obstruction ( $N=5$ ). In 3 cases, the masses were not identified on pre-operative CT.

**Conclusion** Metastases to the small bowel often occur many years after the initial diagnosis of the primary malignancy or entering remission and may be symptomatic. Attention to the small bowel is particularly important in melanoma patients, who may have multiple small bowel metastases, even after many years of being disease free. As oncology patients undergo numerous surveillance scans and improved therapies allow for longer survival, detection of these masses at a small size can facilitate elective resection to avert urgent surgical intervention.

**Keywords** Computed tomography · Small bowel metastases · Gastrointestinal bleeding · Small bowel obstruction

## Introduction

CT plays a critical role in the staging and follow-up of cancer patients. Identifying sites of metastatic disease is important to guiding treatment, both at the time of initial diagnosis and during or after treatment. Although many cancer patients receive frequent follow-up CTs, the detection of metastatic disease to the bowel is important as these can become symptomatic, causing obstruction, intussusception,

or gastrointestinal bleeding, and in some cases, require urgent surgical intervention [1–5].

While there is more extensive literature on primary small bowel tumors [6–10], few studies have addressed the clinical and imaging findings of metastatic disease to the small bowel. A large autopsy series found that melanoma has a high rate of metastasizing to bowel, with metastases to the gastrointestinal tract in 43.5% of patients [11]. Melanoma metastases are often multiple due to hematogenous dissemination. In addition, they can cause symptoms such as abdominal pain, nausea, and vomiting, though a portion may be asymptomatic. The metastases to bowel can also serve as lead points for intussusception, increasing the likelihood of becoming symptomatic.

Another study evaluated metastatic disease to the gastrointestinal tract from lung cancer [12]. Squamous cell carcinoma of the lung was the most common type of lung cancer to metastasize to the gastrointestinal tract. In addition, abdominal symptoms due to metastatic disease to the

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bowel were the presenting symptoms of the lung cancer in some patients.

Finally, renal cell carcinoma metastases to bowel most commonly presented due to gastrointestinal bleeding. These lesions tended to be hyperenhancing, and some presented over a year following nephrectomy.

The objective of this retrospective study is to evaluate the clinical time course and imaging characteristics of pathologically proven metastatic disease to the small bowel.

## Materials and methods

### Patients

Following approval by the institutional review board, a search of the pathologic database from 01/01/2006 to 07/31/2018 identified 242 patients with pathologically proven metastatic lesions to small bowel (Fig. 1). Cases were included in the study if the patients were 18 years or older and had a metastasis involving the small bowel. Excluded were patients with (1) serosal metastases or mesenteric masses, such as those from ovarian and other gynecological malignancies ( $N=114$ ) and (2) direct invasion, such as cecal cancer invading the ileum ( $N=63$ ). Patients without a CT of the abdomen and pelvis within 6 months preceding the date of the pathological specimen were also excluded ( $N=49$ ). Serosal or mesenteric masses and cases of direct invasion were not felt to represent the same mode of disease spread as true metastases.

Patient charts were reviewed to determine the extent of disease at the time of the small bowel metastasis and the point in the disease course. Operative or procedure notes were also reviewed for the indication and operative findings.

### Imaging

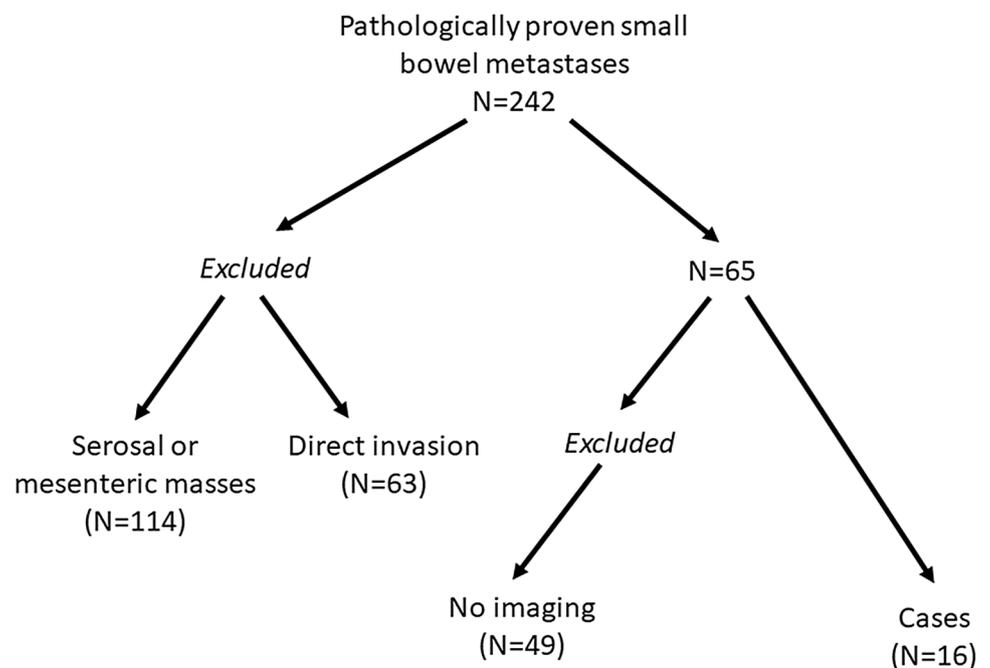
All patients had a CT of the abdomen and pelvis within the 6 months preceding the pathologic specimen. Due to the retrospective nature of the study, protocols varied and included non-contrast examinations, single portal venous phase studies, and multiphase studies (arterial and venous phase or urogram protocol with delays). Some of the studies were done with positive oral contrast. Each was reviewed retrospectively by one abdominal imaging fellow, who measured the small bowel mass(es) in axial and coronal planes and the degree of enhancement relative to the bowel wall.

## Results

### Patient characteristics

16 patients were included in the study (10 male, 6 female). The mean age of the patients was 62.4 years (standard deviation 12.5 years, range 29–81 years). The most common primary malignancy was melanoma (7). The other malignancies were renal cell carcinoma (3), pancreatic adenocarcinoma (2), colon adenocarcinoma (1), appendiceal mucinous adenocarcinoma (1), angiosarcoma (1), and lung adenocarcinoma (1) (Table 1).

**Fig. 1** Inclusion and exclusion criteria

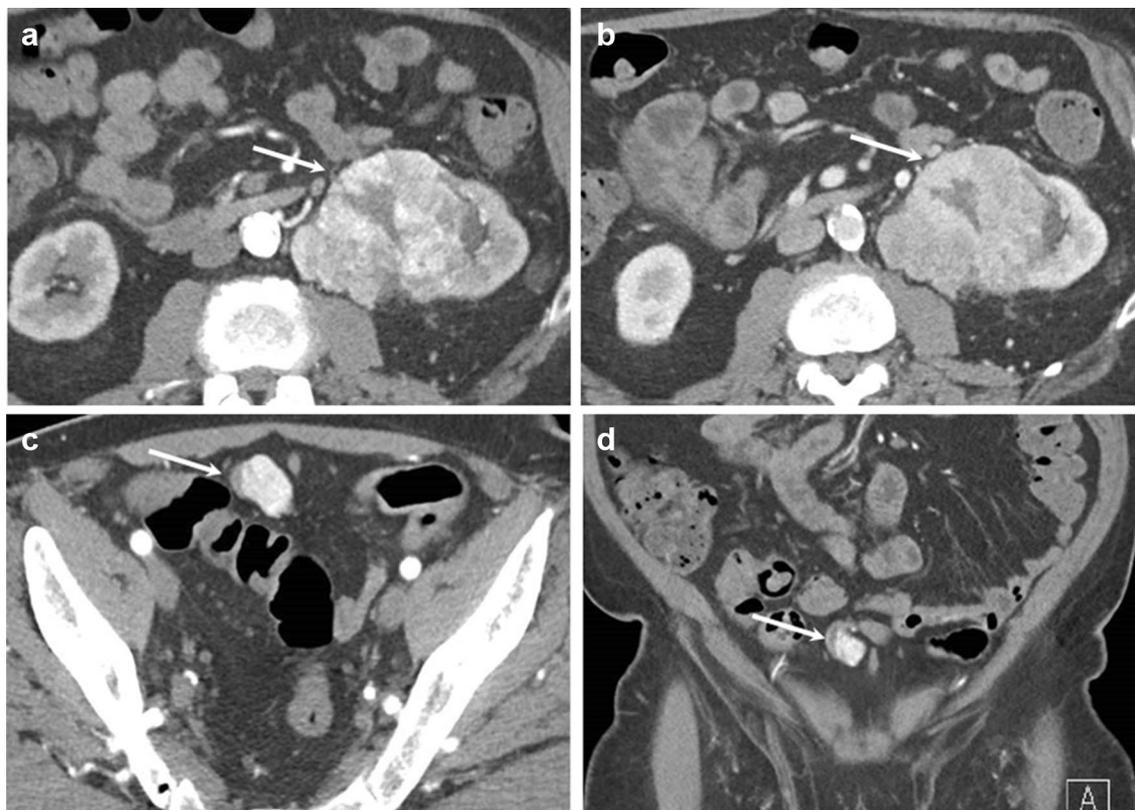


**Table 1** Patient characteristics

Age	62.4 ± 12.5 years Range 29–81 years
Gender	10 male, 6 female
Primary malignancy	Melanoma (7) Renal cell carcinoma (3) Pancreatic adenocarcinoma (2) Colon adenocarcinoma (1) Appendiceal mucinous adenocarcinoma (1) Angiosarcoma (1) Lung adenocarcinoma (1)
Time since initial diagnosis of malignancy (N=16)	7.2 ± 11.9 years Range 0–46 years
Time since remission (N=5)	8.3 ± 7.2 years Range 4–21 years

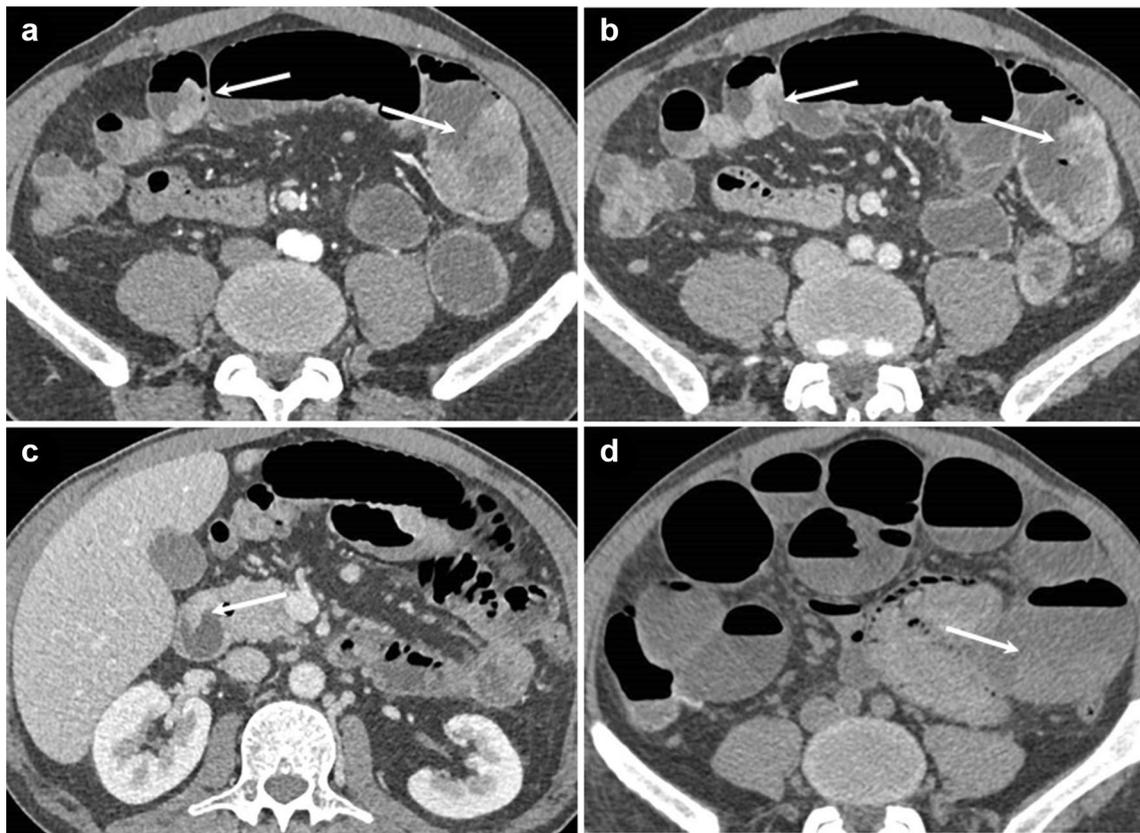
The average time from initial diagnosis of the malignancy to detection of the small bowel metastasis was 7.2 years (standard deviation 11.9 years, range 0–46 years). The average time from remission to detection of the small bowel metastasis in the 5 patients who were in remission was 8.3 years (standard deviation 7.2 years, range 4–21 years). The time of detection from initial diagnosis ranged from zero in one patient with renal cell carcinoma (Fig. 2) to 46 years after the initial diagnosis of melanoma, though that patient already had metastatic disease. Another patient who presented with abdominal pain after 21 years of being disease free from melanoma was found to have multiple small bowel metastases, and progressed to small bowel obstruction shortly thereafter (Fig. 3). Lastly, a patient who had had local recurrence of renal cell carcinoma 4 years prior presented with abdominal pain, which was initially thought to be a medication side effect, but was found to have a small bowel metastasis (Fig. 4).

Clinical presentations are detailed in Table 2. 5 of the 16 patients presented with gastrointestinal bleeding. 5 patients presented with malignant small bowel obstruction and 1 had intussusception (Fig. 5). One patient had the mass resected due to risk of obstruction and bleeding. 3 patients



**Fig. 2** A large, arterially hyperenhancing left renal mass (a, b) was incidentally found in a 73-year-old man who presented with delirium. On the initial scan, the patient also had an arterially hyperenhanc-

ing small bowel mass (c, d). The small bowel mass was resected at the time of nephrectomy and was found to be a metastasis from the patient's clear cell renal cell carcinoma



**Fig. 3** A 49-year-old man with melanoma resected 21 years ago presented with abdominal pain and was found to have multiple small bowel metastases. The small bowel masses are hyperenhancing in

the arterial (a) and venous (b) phases. A mass was also present in the duodenum (c). The patient progressed to small bowel obstruction a few days later (d)

were asymptomatic but had their small bowel mass resected concurrently with another surgery for a primary or different metastatic lesion. 13 patients had resection of their small bowel mass. Two had biopsy and one had autopsy. Among patients who were symptomatic, the average time from imaging to resection was 12.7 days (standard deviation 12.5 days, range 0–36 days).

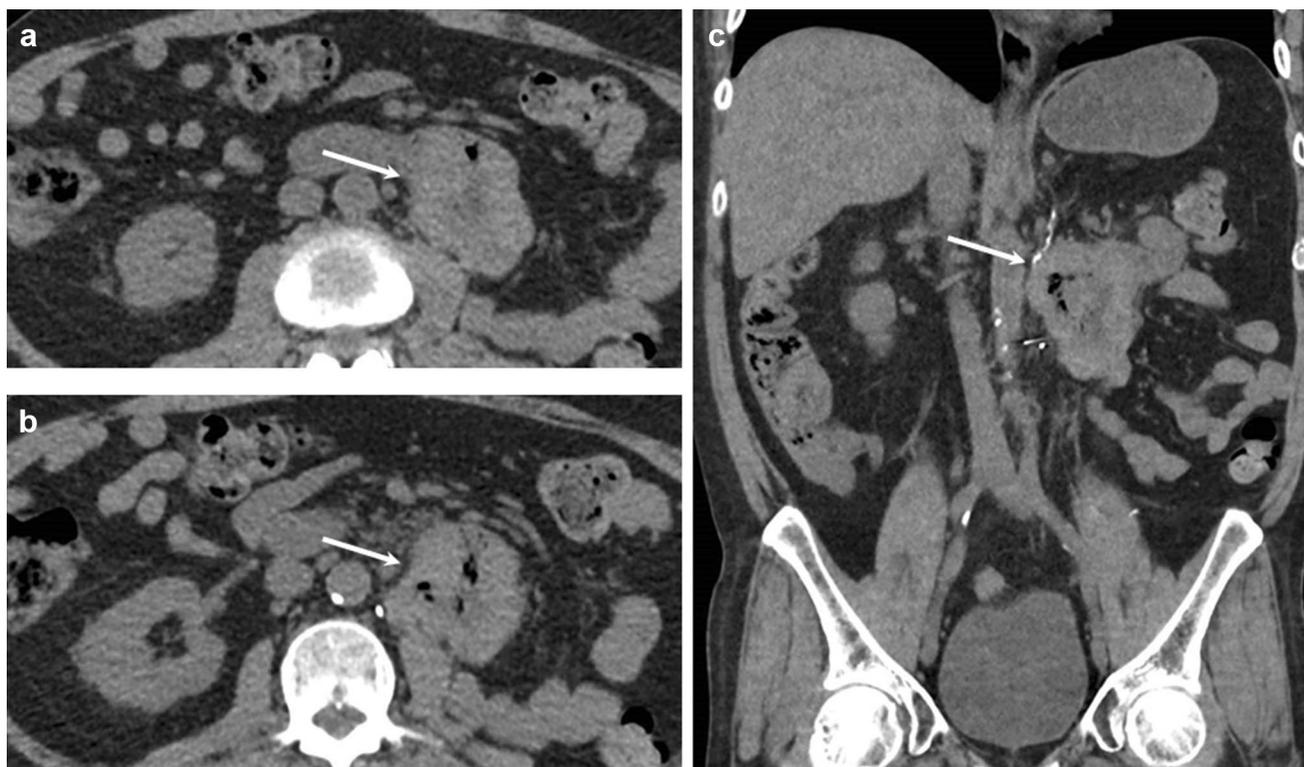
Among the 15 patients who had their small bowel mass detected after the initial diagnosis, 11 had preexisting metastatic disease. Three of these four patients whose metastatic disease was limited to the small bowel presented with gastrointestinal bleeding, and one presented with small bowel obstruction.

### Imaging characteristics

All patients had a CT within the 6 months preceding their pathologic specimen. The average time interval between imaging and the surgery, biopsy, or autopsy was 14 days (standard deviation 14 days). Two patients had non-contrast examinations. Nine patients had a single portal venous phase examination, and five had multiphase studies. Three of these

were dual-phase studies with arterial and venous phases, one had non-contrast, arterial, portal venous, and delays, and one had portal venous phase and delays. Seven of the studies were performed with positive oral contrast. Some of the masses were conspicuously seen in the presence of positive oral contrast (Fig. 5c, d).

11 patients had an intraluminal mass, while 2 had exophytic masses. None of the metastases manifested purely as wall thickening. Two patients had masses in the duodenum; the remainder of the patients had masses in the jejunum or ileum. Three patients with melanoma had multiple small bowel masses. The mean greatest dimension was 4 cm (standard deviation 2.4 cm, range 1.1–10 cm). Six of the masses were over 5 cm in greatest dimension on imaging. The majority were isoattenuating to bowel wall in portal venous phase. Three patients had hyperattenuating metastases. One renal cell carcinoma and one melanoma metastasis were hyperattenuating on both arterial and portal venous phases. Another renal cell carcinoma metastasis was hyperattenuating on arterial phase, but because the mass was located in the pelvis, was not included in the field of view on the portal venous phase.



**Fig. 4** Non-contrast CT in a 57-year-old man with renal cell carcinoma shows focal enlargement at the duodenal jejunal junction suggestive of a centrally necrotic mass. This was a biopsy-proven small bowel metastasis

**Table 2** Clinical characteristics

Symptomatic patients ( $N=11$ )	Gastrointestinal bleeding (5) Small bowel obstruction (5) Intussusception (1)
Asymptomatic patients ( $N=4$ )	Risk of obstruction and bleeding (1) Concurrent resection for primary or metastatic lesion (3) Autopsy (1)
Type of intervention	Surgical resection (13) Biopsy (2) Autopsy (1)
Time from imaging to surgical resection in symptomatic patients ( $N=13$ )	$12.7 \pm 12.5$ days Range 0–36 years

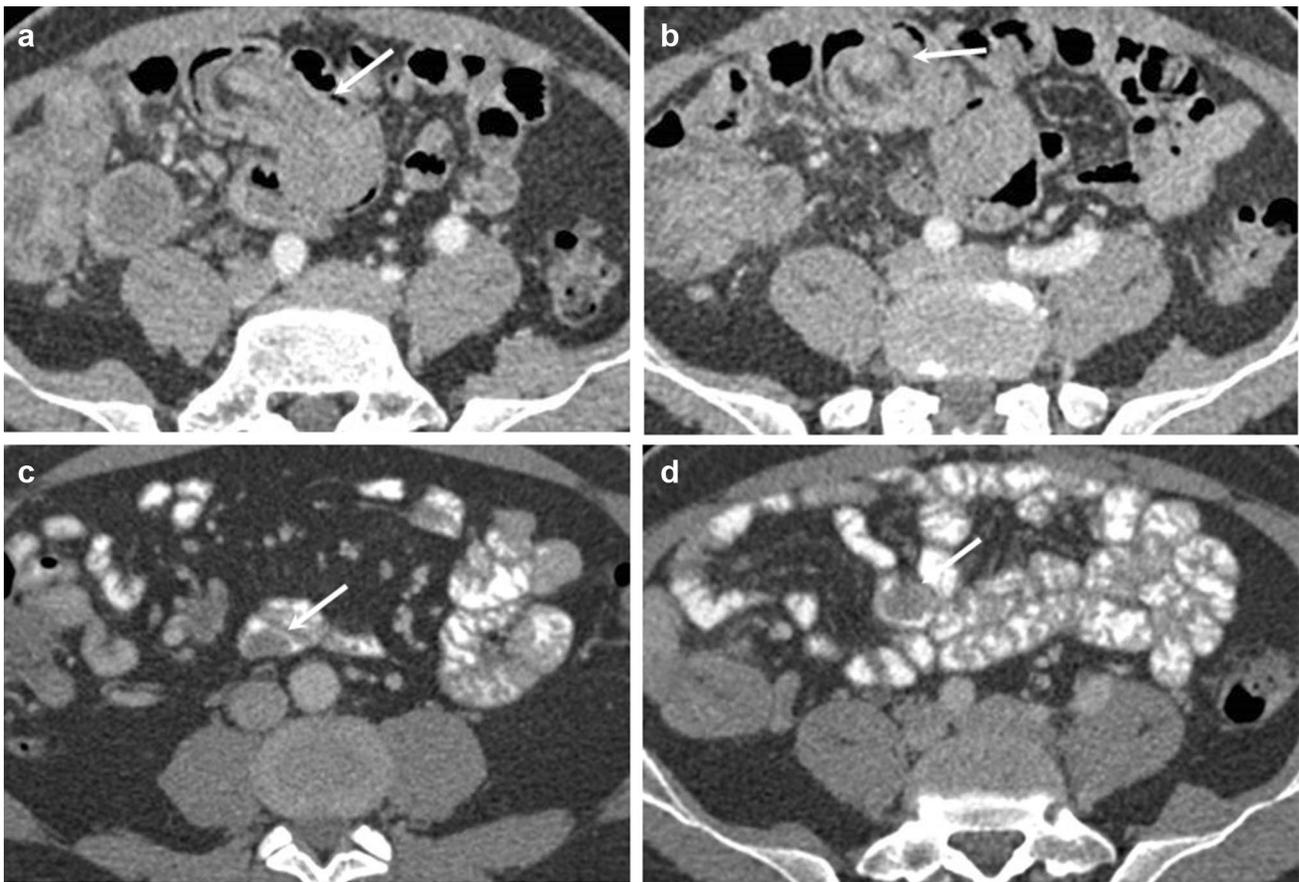
In 2 patients with pancreatic adenocarcinoma and one with colon adenocarcinoma, a mass was not seen on pre-operative CT. In two of these patients, a small bowel mass was found incidentally during completion pancreatectomy 6 days after imaging and partial hepatectomy 4 days after imaging. In the last patient, surgery for small bowel obstruction 4 days after the scan disclosed a mass as the cause. The greatest dimensions of these masses provided in the gross pathology descriptions were 1, 1.4, and 1.7, respectively.

## Discussion

In this retrospective case series of pathologically proven metastases to the small bowel, there was a relatively long latent period from the time of initial diagnosis of primary malignancy or remission to the time of detection of the small bowel metastasis. The most common primary malignancy was melanoma, which is especially known to recur at any time, even after a long remission. In only one patient was the metastasis detected at the time of initial diagnosis. In the majority of the cases, there was already distant metastatic disease at the time of diagnosis of the small bowel metastasis. The most common symptoms were gastrointestinal bleeding and small bowel obstruction.

Interestingly, a mass was not detected pre-operatively on routine surveillance scans in three patients (19% of cases in this series), although on gross pathology the mass was found to be of detectable size (at least 1 cm). This suggests that the incidence of small bowel metastases may be higher than apparent in this study. Smaller masses may not come to clinical attention if the patient is not symptomatic and undergoes systemic therapy for widespread metastatic disease.

While two of these patients were not symptomatic from their small bowel metastases, there was a significant change in the surgical plan as the masses were detected during



**Fig. 5** Small bowel intussusception in a 51-year-old man with metastatic melanoma. The patient presented with abdominal pain and acidosis and on CT was found to have an entero–entero intussusception

(a) due to a small bowel mass (b). A prior study showed multiple intraluminal small bowel masses (c, d)

surgery for other intra-abdominal lesions. One of the cases in which the mass was not detected on imaging presented with small bowel obstruction. While the patient went to surgery regardless, it is clinically useful to be able to provide the reason for obstruction, particularly if it is due to a mass. Oncology patients who have recurrent or intermittent small bowel obstructions may in fact have a metastasis causing their symptoms rather than an adhesion or benign stricture.

One major limitation of this study is the small sample size. Despite the long time period included, only 16 cases met the inclusion and exclusion criteria. Serosal metastases or cases of direct invasion were excluded, as these were felt to be a different mode of disease spread. While the number of cases included is small, this should not be interpreted to mean that metastases to small bowel are exceedingly rare. Many of the patients who have small bowel metastases already have widespread metastatic disease, so those will not be pathologically proven unless they become symptomatic. Further supporting this hypothesis is that the vast majority of cases in this study were symptomatic, leading to surgical resection.

Another limitation of the study is the use of one reviewer as opposed to a consensus among multiple reviewers. Additionally, the use of a pathologic database likely also led to selection bias, as those cases that did not undergo resection or biopsy were not included. This method of case selection likely affected the proportion of metastases that were found to be symptomatic, and may have affected other results, such as mass size, as well.

Further work is needed to optimize detection of small bowel masses clinically, particularly in light of the finding that three of the sixteen patients did not have a mass detected on pre-operative imaging. While some of the metastases were conspicuous against a background of positive oral contrast, it is unclear from this small retrospective study whether some masses were not seen due to the lack of oral contrast and whether the benefits of positive oral contrast, if any, outweigh its drawbacks. Imaging protocols also varied in this series due to its retrospective nature, and it is unclear whether the use of multiphase studies in patients for whom it is not otherwise necessary would add incremental benefit in a large population. Advanced post-processing techniques,

such as volume rendering and cinematic rendering, may play a role in enhancing detection of small bowel pathology [13].

These findings suggest that attention should be paid to the small bowel on routine surveillance scans, as metastases to the small bowel tend to occur years after the initial diagnosis of malignancy or even after years of remission. Furthermore, gastrointestinal symptoms in oncology patients should also be cause for careful attention to the small bowel. Although the total number of cases in this series was small, a significant number of lesions were not seen on CT. Further work is needed to optimize the detection of metastases to the small bowel mucosa on CT, as these can have a significant clinical impact.

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