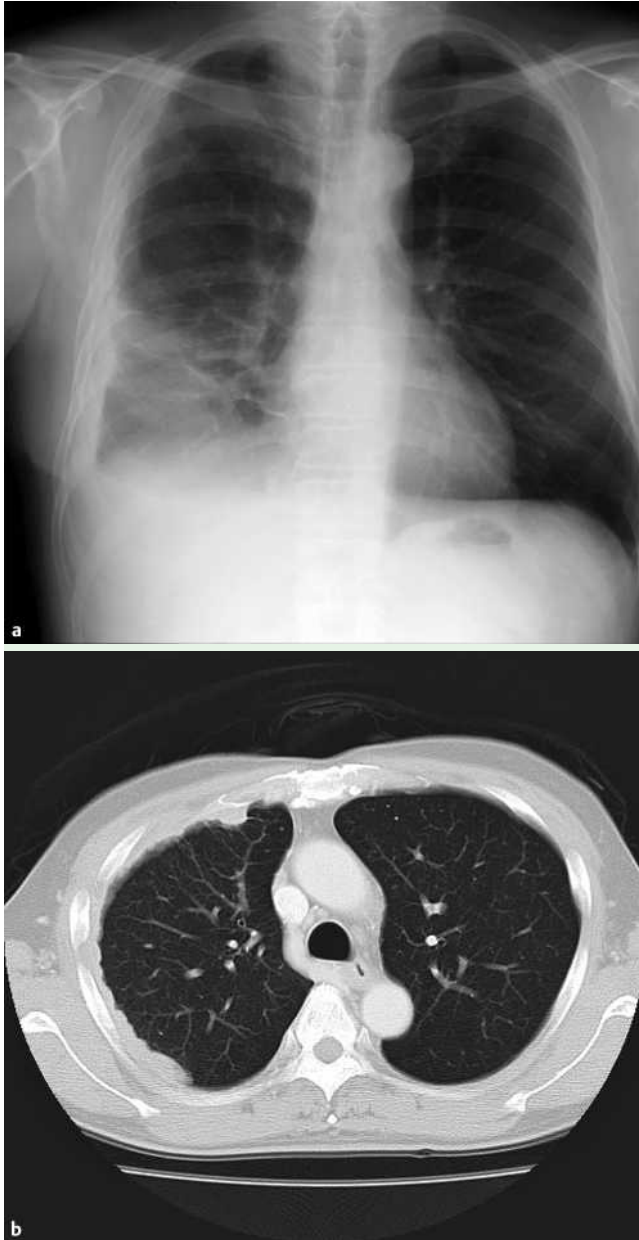
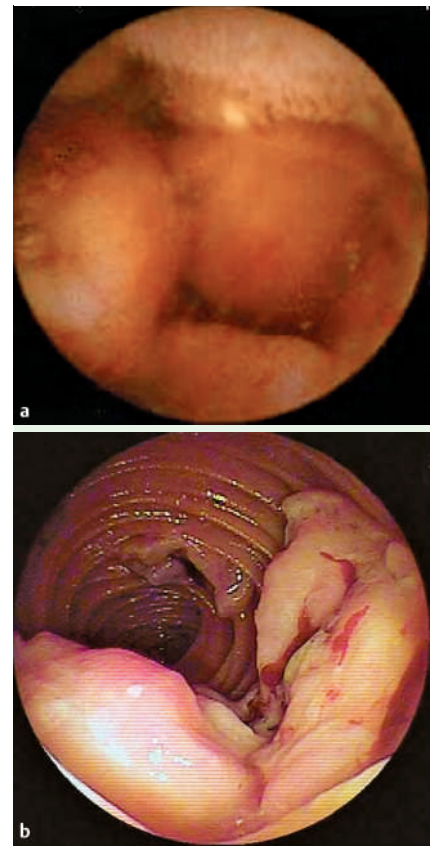


## Diagnosis of small-bowel metastasis of malignant pleural mesothelioma by capsule endoscopy and double balloon enteroscopy



**Fig. 1** a A chest radiograph showing right-sided pleural thickening and a pleural effusion. b A computed tomographic scan of the chest showed diffuse pleural thickening of the right hemithorax.



**Fig. 2** a Video capsule endoscopy revealed multiple protruding lesions with slight but continuous oozing, and these were found from the proximal jejunum to the terminal ileum. b Multiple protruding lesions measuring 20–30 mm were clearly shown by double-balloon enteroscopy. These protrusions were covered with normal mucosa, with central ulceration and evidence of mild bleeding.

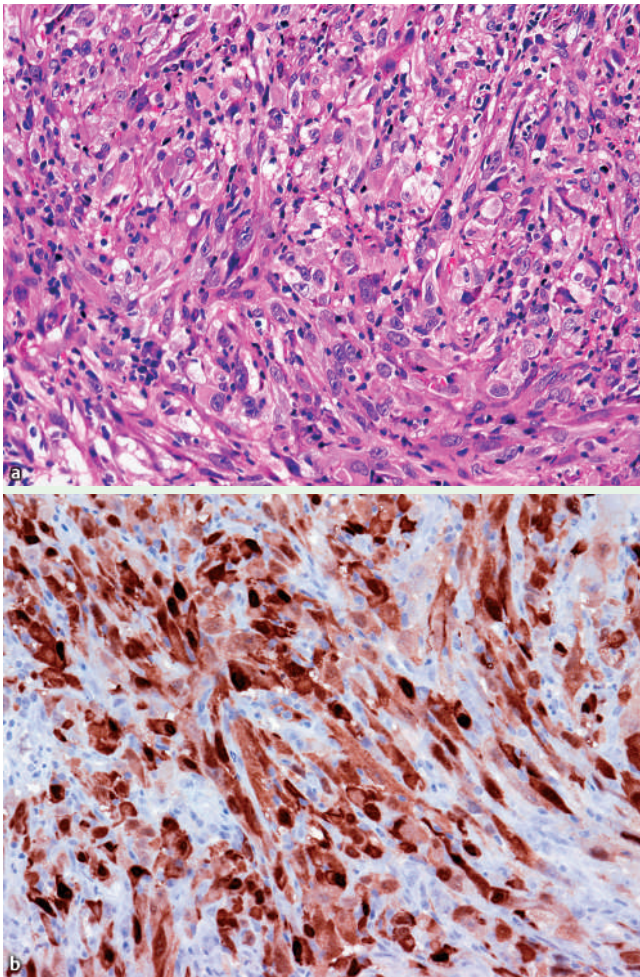
A 62-year-old man who was diagnosed with malignant pleural mesothelioma (● Fig. 1) underwent right extrapleural pneumonectomy. He was followed up with chest radiographs, computed tomographic scans, and laboratory investigations, none of which showed any findings. Nine months later, he was readmitted for the investigation of tarry stools and iron deficiency anemia. Esophagogastroduodenoscopy, total colonoscopy, red blood

cell scintigraphy, and computed tomography did not identify any cause for the gastrointestinal bleeding. Video capsule endoscopy, however, revealed multiple protruding lesions with slight but continuous oozing throughout the entire small intestine (● Fig. 2a); and double-balloon enteroscopy identified protrusions that were covered with normal mucosa with central ulceration and mild bleeding (● Fig. 2b). Examination of biopsy speci-

mens showed these protrusions to contain tumor cells which ranged in appearance from large polyhedral cells to spindle-shaped cells (● Fig. 3a). Immunohistochemical examination revealed tumor cells positive for the mesothelial markers, calretinin and WT1 (● Fig. 3b), and the protrusions were diagnosed as metastatic malignant mesothelioma of the small bowel.

Malignant pleural mesothelioma is an aggressive tumor and its incidence has increased significantly in recent years [1]. Small-bowel metastasis from malignant pleural mesothelioma has never been reported before, so this apparently is the first case. Furthermore, we obtained clear endoscopic images of the lesions while the patient was still alive.

Some patients with gastrointestinal bleeding remain undiagnosed even after upper endoscopy and total colonoscopy [2], and most of these patients will have bleeding sites in the small bowel. Video



**Fig. 3** a The tumor cells ranged in appearance from large polyhedral cells to spindle-shaped cells, with vesicular nuclei and prominent nucleoli and with a moderate amount of cytoplasm (hematoxylin and eosin stain, original magnification  $\times 20$ ). b The tumor cells showed cytoplasmic and nuclear staining for calretinin (original magnification  $\times 20$ ).

capsule endoscopy and double-balloon enteroscopy have been introduced recently for the evaluation of the small bowel. Iddan et al. [3] were the first to report on capsule endoscopy and it is now widely accepted as an investigation for small-intestinal screening. Even tri-vascular bleeding was detected in this case by capsule endoscopy, although red blood cell scintigraphy had failed to detect its source. A similar result was confirmed previously by Hartmann et al. [4]. Double-balloon enteroscopy, which was developed by Yamamoto et al. [5], enabled us to obtain biopsy specimens, which circumvented a limitation of capsule endoscopy. The combination of capsule endoscopy and double-balloon enteroscopy contributed significantly to our reaching a diagnosis in this case.

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