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## CASE REPORT

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# Bone Metastases from Gastrointestinal Stromal Tumour: Correlation with Positron Emission Tomography–Computed Tomography

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### ABSTRACT

*Bone metastasis from gastrointestinal stromal tumour is a rare outcome of this uncommon disease. This report is of a 73-year-old man with gastrointestinal stromal tumour who developed bone metastases after complete tumour resection. The condition is worthy of attention as there are new imaging modalities and biological target agents available. This report highlights the positron emission tomography–computed tomography findings of this rare outcome of gastrointestinal stromal tumour, and the current imaging trends for gastrointestinal stromal tumours are discussed.*

**Key Words:** *Gastrointestinal stromal tumors; Neoplasm metastasis; Positron-emission tomography; Tomography, X-ray computed*

### INTRODUCTION

Gastrointestinal stromal tumour (GIST) is a rare disease that accounts for 0.1% to 3.0% of all gastrointestinal neoplasms. The stomach is the most common site of origin (70%), followed by the small intestine (20%); the condition is rare in the oesophagus and large bowel.<sup>1</sup>

Clinical symptoms of GIST depend largely on the tumour size and location. Small tumours are usually asymptomatic and are an incidental finding, while large tumours usually present with gastrointestinal haemorrhage, abdominal pain, palpable mass, weight loss, nausea, and vomiting. Dysphagia and tumour perforation are rarely reported.<sup>2,3</sup>

Although complete surgical excision of the primary tumour offers the best chance of cure, tumour recurrence and metastases remain common (up to 60%). The liver is the most common site of metastasis (60%), followed by the peritoneum. Metastases to the bone, lung, and lymph node are rare.<sup>4</sup>

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This report reviews the diagnosis, treatment, and clinical progress of a 73-year-old man with GIST who had multiple bony metastases noted on a positron emission tomography–computed tomography (PET-CT) scan 1 year after complete tumour resection. The aim of this report is to illustrate the PET-CT findings of this rare outcome of an uncommon condition.

### CASE REPORT

A 73-year-old man presented in 2007 with insidious onset of non-specific food-related chest tightness for several months. This symptom was aggravated by hunger and relieved by food. The patient was otherwise healthy and underwent oesophagogastroduodenoscopy (OGD), during which a 2-cm tumour was found in the cardia of the stomach.

Biopsy demonstrated that the gastric body transitional mucosa were invaded by an ulcerated tumour. The tumour consisted of pleomorphic epithelioid and focal spindle cells arranged in closely packed lobules. Immunohistochemical staining showed that the tumour cells were diffusely and strongly positive for CD117 (C-kit) and CD34, but negative for desmin, cytokeratin (Cam 5.2 and AE1/AE3), and S-100 protein. These features, especially CD117-positivity, were suggestive of GIST.

The patient underwent complete tumour resection with partial gastrectomy. Preoperative CT showed no

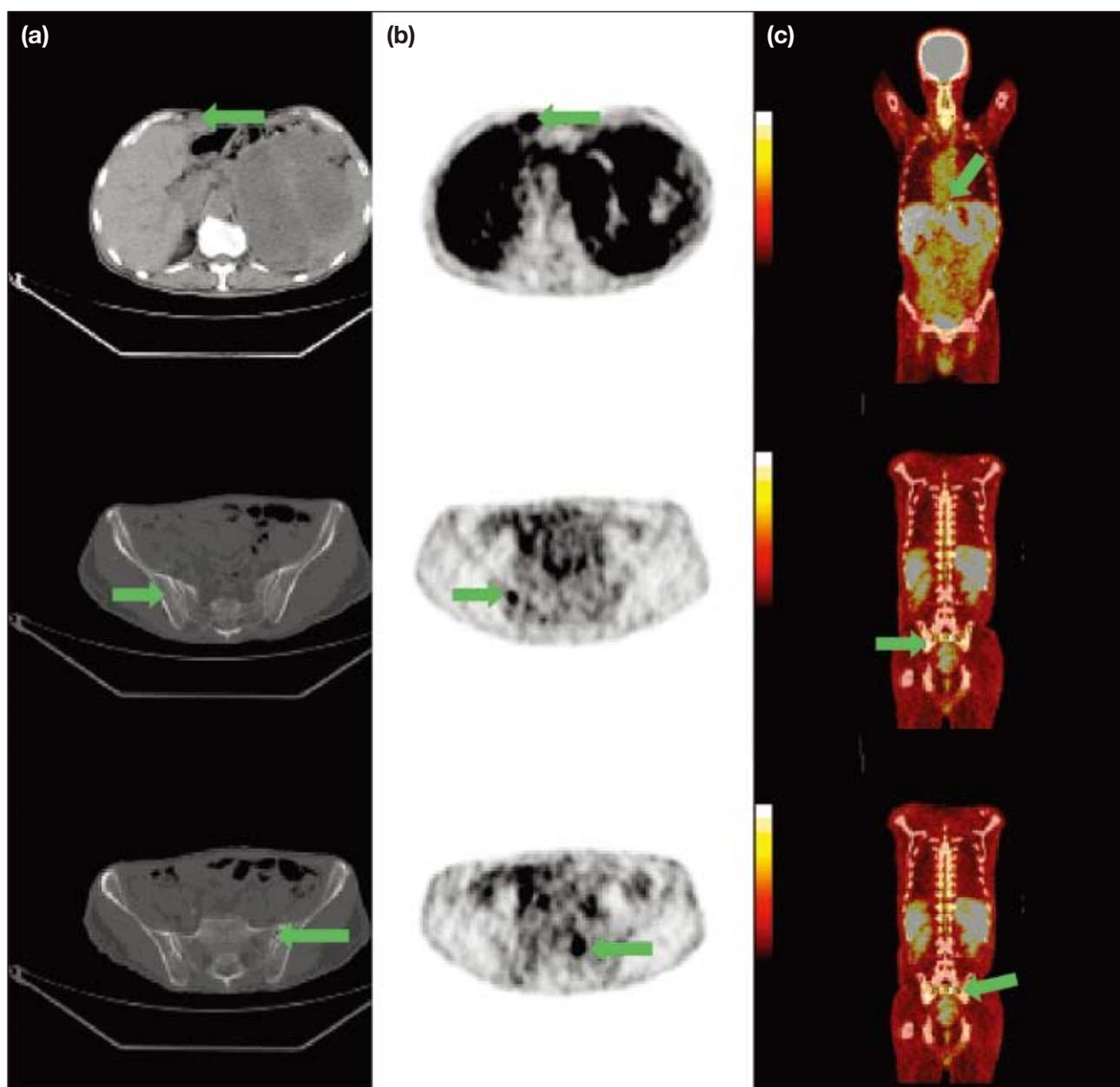
regional or distant tumour spread, and the pathology report showed clear resection margins.

The patient remained asymptomatic for 6 months after surgery, after which he experienced non-specific abdominal symptoms. Acute small bowel obstruction was suspected, so emergency laparotomy was performed.

Intraoperatively, multiple tumour recurrences were noted. One tumour was located at the proximal jejunum causing mechanical obstruction. Other tumours located

near the splenic hilum were invading the retroperitoneum and pancreas. Dense adhesions between the gastric remnant and the left hepatic lobe were also found. The adhesions were divided and the tumours were debulked for symptom relief. The patient was referred to the oncology department for treatment with imatinib.

Baseline PET-CT showed a 13-cm tumour, consistent with recurrent GIST, under the left hemidiaphragm (Figure 1). The peripheral soft tissue showed heterogeneously increased fluorodeoxyglucose (FDG) uptake,



**Figure 1.** Positron emission tomography images showing the gastrointestinal stromal tumour under the left hemidiaphragm and the peritoneal metastasis [top row, column (c)]. Bony metastasis in the right iliac bone and left side of the sacrum are shown in the images in the second and third rows, respectively. Column (a) shows the corresponding lytic lesions on computed tomography and column (b) shows the increased fluorodeoxyglucose uptake. The arrows show the areas of interest.

with a maximum standard uptake value ( $SUV_{max}$ ) of 7 to 10. There were also large non-FDG avid areas of low attenuation compatible with tumour necrosis. The mass abutted and compressed the liver, spleen, pancreas, upper pole of the left kidney, and the adjacent bowel. A 3-cm mass, compatible with GIST, abutted the posterior aspect of the spleen. Multiple hypodense lesions up to 2.5 cm in diameter were scattered in both hepatic lobes. These lesions had moderate-to-marked increase in FDG uptake and were compatible with metastatic GIST, with an  $SUV_{max}$  of approximately 8.

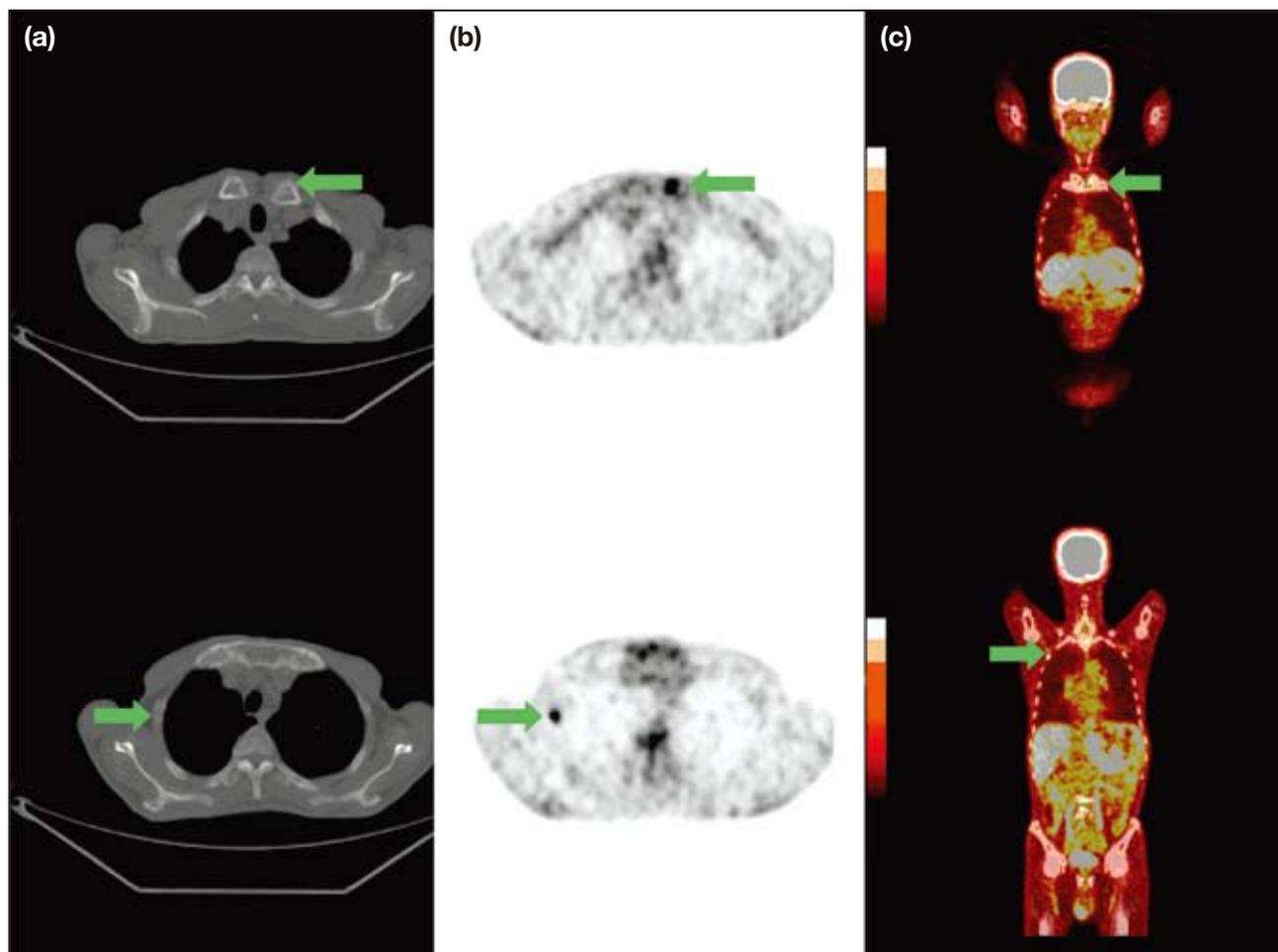
A few hypermetabolic foci were seen in the skeleton on the PET images. These lesions involved the anterior aspect of the T6 vertebral body, the medial end of the left clavicle (Figure 2), the lateral aspect of the right second rib, the right posterior ilium, and the left upper sacrum. The lesions had an  $SUV_{max}$  of approximately 5 and were consistent with bony metastases, although this is rare in patients with GIST.

Treatment with imatinib continues and further follow up by PET-CT is anticipated.

## DISCUSSION

GISTs are a subset of gastrointestinal mesenchymal tumours. The term was created for tumours that are neither leiomyomas nor schwannomas. However, as immunohistochemical staining techniques have improved, the term GIST now refers to a distinct group of mesenchymal tumours, previously designated as leiomyoma, leiomyoblastoma, and leiomyosarcoma.

Typically, GISTs are immunohistochemically positive for the KIT tyrosine kinase receptor, which is perhaps their single defining feature. The C-kit-positivity parallels that seen in the interstitial cells of Cajal, the pacemaker cells regulating automotor activity. It is currently thought that GISTs originate from a precursor cell pool with differentiation towards the Cajal cell phenotype. The CD117 protein acts as a specific antigen and constitutes a portion



**Figure 2.** Positron emission tomography images showing the osteolytic lesions in the left medial clavicle [top row, column (c)] and the right second rib [bottom row, column (c)]. Column (a) shows the corresponding lytic lesions on computed tomography and column (b) shows the increased fluorodeoxyglucose uptake. The arrows show the areas of interest.

of the KIT enzyme, which is present in most GISTs. Therefore, detection of CD117 with a specific diagnostic test helps to confirm the diagnosis of GISTs.<sup>3</sup>

Although it is widely accepted that surgery is the treatment of choice, the rates for recurrence and distant metastases are high (up to 60%) even when clear resection margins are achieved. Pathology reports indicate that these metastases can occur but they do so with insufficient frequency to warrant routine treatment. Imatinib, a C-kit growth factor tyrosine kinase inhibitor, is a new biological target therapy for treating metastatic or advanced GISTs.

Different imaging modalities have been used to assess GIST. The aim of radiological examination is to locate the GIST lesions, evaluate local invasion, and detect distant metastases. With multidetector row CT, the exophytic nature of the tumour can be demonstrated, and some authors have advocated dynamic contrast CT for differentiating mucosal lesions (carcinoma) from submucosal lesions (GIST).<sup>5</sup> However, imaging features are not pathognomonic and confirmation of the diagnosis requires specific immunohistochemical techniques.

For staging GIST, the performance of PET alone is comparable to that of CT.<sup>6</sup> PET is also widely used as a follow-up assessment tool during chemotherapy, and is thought to have superior sensitivity for assessing the early treatment response to CT alone.<sup>6,7</sup> The combination of PET and CT can further enhance the sensitivity<sup>7</sup> by detecting a reduction in  $SUV_{max}$ , bidimensional diameter, and attenuation, as the tumour tends to liquefy as a result of imatinib therapy.<sup>8</sup> Therefore, a baseline PET-CT scan before treatment is essential, as early treatment response is predictive of prolonged treatment success.<sup>9</sup>

GIST is associated with a high rate of local recurrence and distant metastases, even after complete tumour resection. The diagnosis of GIST must be confirmed immunohistochemically by the presence of C-kit protein. CT is commonly used for staging, while PET-CT is better for assessing an early response to imatinib.

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