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## Case Report

# FDG-avid antrum-pylorus ulcer, adjacent lymph node, and abdominal wall nodule mimicking gastric cancer with metastases <sup>☆</sup>

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## ABSTRACT

Gastric cancer presents with similar clinical symptoms as gastric ulcer, and the morphologic features of gastroscopy overlap considerably. We report a 58-year-old man with the clinical presentation of recurrent gastric discomfort and black stools. A suspected malignant tumor of the gastric antrum-pylorus was observed on gastroscopy. Contrast-enhanced CT showed enhancement of the lesion. PET/CT revealed an FDG-avid lesion at the gastric antrum-pylorus, an intense FDG-uptake perigastric lymph node, and an enlarged nodule with high FDG uptake in the right abdominal wall. Subsequent surgical pathology revealed an inflammatory ulcer of the gastric antrum-pylorus with reactive hyperplastic lymph node, while the lesion in the right abdominal wall was a scar nodule. This case suggests that when multiple FDG-avid lesions accompany an atypical gastric ulcer, it can easily lead to misdiagnosis, and therefore more emphasis should be placed on histopathological analysis.

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## Introduction

The earliest known gastric ulcer patient who died in 167 AD was discovered as early as 1975 through archaeological excavations of the tomb, and pathologists speculate that his death may have been due to diffuse peritonitis caused by a perforated gastric ulcer [1]. Since then, there has been a gradual in-

crease in awareness of peptic ulcers. Common causes of peptic ulcers include *H. pylori* infection and non-steroidal anti-inflammatory drugs [2]. *H. pylori* infection is also a major carcinogenic factor in gastric cancer [3]. In most cases, the clinical symptoms of gastric cancer and gastric ulcers are similar. Upper abdominal pain is the most common clinical symptom in 81% of patients with upper peptic ulcers [4]. It is often necessary to consider the patient's clinical symptoms, diagnostic imaging, and gastroscopy findings to determine the nature of the gastric lesion in clinical practice. First, gastroscopy is

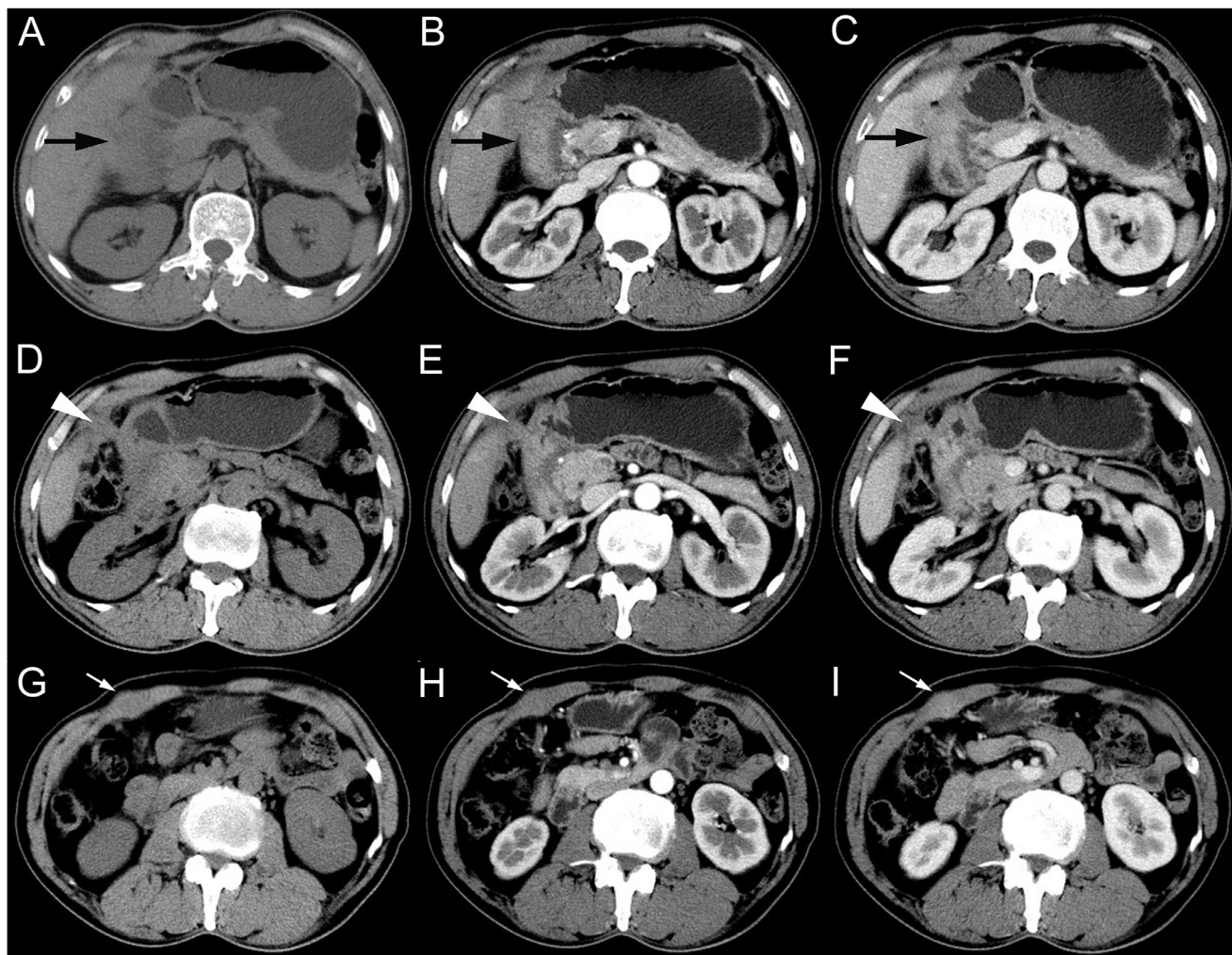
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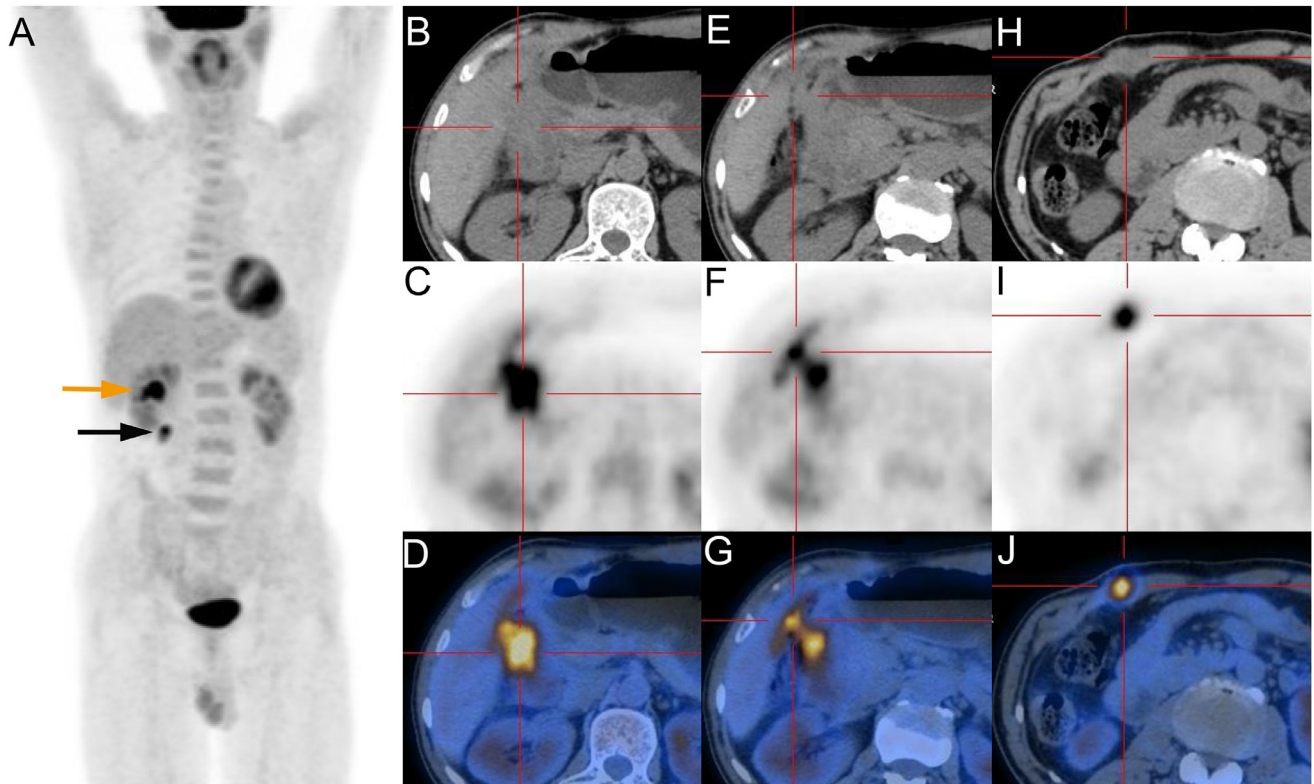


**Fig. 1** – Non-enhanced CT and contrast-enhanced CT of the abdomen showed marked thickening of the gastric wall at the antrum-pylorus (A, B, C, long black arrows), enlarged lymph node in the gap between the stomach and the liver (D, E, F, white triangular short arrows), and enlarged abdominal wall nodule (G, H, I, long white arrows).

the optimal and most direct way to evaluate gastric mucosal lesions, but sometimes it is difficult to differentiate between benign ulcers, and malignant lesions relying only on gross observations of the gastric mucosa. It has been shown that 5% of malignant ulcers are misdiagnosed on gastroscopy as benign, and 7% of benign lesions are diagnosed as malignant [5]. When gastric wall thickening is present, the sensitivity of CT for diagnosing early gastric cancer or potentially malignant lesions is 100%, but specificity is as low as 50% [6]. The double-contrast upper gastrointestinal radiography also tends to miss gastric cancer, especially in shallow depressed ulcer foci [7]. PET/CT is not a good screening or diagnostic option for upper peptic ulcers. It is often chosen as a staging modality when the lesion has classic signs of malignancy and needs to be surgically removed. The misdiagnosed case we reported was highly suggestive of gastric cancer with distant metastases on a series of examinations before the histopathological results of the antrum-pylorus were available.

### Case report

A 58-year-old man maintained recurrent stomach discomfort for 6 months and recurrent episodes of black stools for 1 month. One year ago, he underwent open cholecystectomy for gallbladder stones. He was clear that neither he nor his family had any history of malignant neoplasm. The emergency blood test results showed that his serum tumor markers levels were all within the normal range. First, he underwent an abdominal CT scan (Fig. 1). Non-enhanced CT images showed the gastric lumen was adequately filled with water and revealed marked thickening of the gastric wall (thickness of 2.1 cm) at the antrum-pylorus junction (Fig. 1A). Contrast-enhanced CT scan showed moderate heterogeneous enhancement of the thickened stomach wall in the arterial phase (Fig. 1B) and persistent enhancement in the venous phase (Fig. 1C). CT examination could not definitively diagnose whether the gastric le-



**Fig. 2** – The MIP map (A) of whole-body  $^{18}\text{F}$ -FDG PET/CT shows 2 foci of high glucose metabolism in the right abdomen (orange arrow, overlapping displayed the gastric lesion and the FDG-avid lymph node; black arrow, right abdominal wall nodule). Pathologically hyper glucose metabolism was present in the thickened antrum-pylorus gastric wall (B, CT; C, PET; D, fused PET/CT), the lymph node adjacent to the gastric antrum (E, CT; F, PET; G, fused PET/CT), and the abdominal wall nodule (H, CT; I, PET; J, fused PET/CT). (Color version of the figure is available online.)

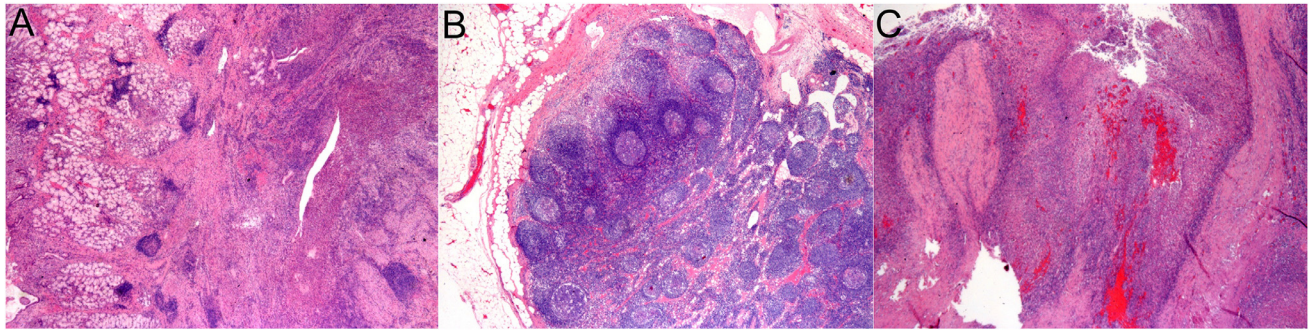
sion was benign or malignant. Thus, he was scheduled for a gastroscopy.

Gastroscopy observed mucosal congestion and edema at the gastric antrum. The pyloric duct observed on gastroscopy was narrow, accompanied by a ring of uneven mucosal elevation with small erosive foci, and large ulcerative foci on its surface. At that time, the gastroscopist diagnosed the patient with a malignant tumor of the gastric antrum-pylorus. In addition, the gastroscopist extracted some tissue from the bulging lesion for pathologic examination. His supervising physician was also highly suspicious that he might have gastric cancer. The patient underwent PET/CT (Fig. 2) 3 days later, and the whole-body MIP map (Fig. 2A) showed 2 FDG-avid foci on the right side of the abdomen. PET/CT images showed the thickened gastric wall at the junction of the gastric antrum and pylorus with focal high FDG uptake (Fig. 2B, C, D). In addition, we found a slightly hyperdense lymph node with abnormal FDG uptake in the gap between the gastric antrum, and the liver (Fig. 2E, F, G). It was also found that a nodule with high FDG uptake was located in the right abdominal wall (Fig. 2H, I, J). Five days later, the gastroscopic biopsy pathology suggested that the gastric antrum-pyloric lesion tissue was inflammatory. Given the limited tissue obtained using gastroscopic biopsy and the multiple FDG-avid foci suggested on PET/CT, the possibility of a malignant lesion of the stomach was still considered.

On the other hand, the patient had persistent bleeding from the gastric ulcer lesion, and his black stool symptoms did not resolve. Therefore, open surgery was scheduled for him, ie, resection of the distal stomach, including the diseased portion. During surgery, extensive adhesions and edema of the greater omentum were found in the gallbladder, perigastric, and perihepatic areas. The abdominal wall nodule with abnormally increased glucose metabolism was located at the previous surgical incision for cholecystectomy. The high FDG-uptake lymph node and abdominal wall nodule were removed while the peritoneal adhesions were released. The final surgical pathology showed an inflammatory infiltrate in the thickened gastric wall of the antrum-pylorus and did not reveal any malignancy cells (Fig. 3A). The perigastric lymph node (Fig. 3B) and abdominal wall nodule (Fig. 3C) with high glucose metabolism were diagnosed as reactive hyperplasia due to inflammatory infiltration.

## Discussion

Gastric ulcers and gastric cancer are both life-threatening diseases. 50% of gastric ulcer patients are prone to develop gastric cancer over a long period without treatment; therefore, even inflammatory ulcerative lesions are at risk of malignancy



**Fig. 3 – Postoperative pathology showed that the thickened gastric wall at the antrum-pylorus was a benign ulcer (A). The lymph node in the hepato-gastric omental space was inflammatory hyperplasia resulting in high FDG uptake (B). The nodule with high FDG uptake in the abdominal wall was an inflammatory scar nodule leftover from previous surgery (C).**

[8]. Research studies have shown that the incidence of gastric cancer is 2-3 times higher in men than in women, and the median age of onset is 70 years [9,10].

It has been shown that the diagnostic sensitivity of gastroscopy for malignant gastric ulcers is 0.82, and the specificity is 0.95 [11]. The main reasons for the high false-positive rate of endoscopic diagnosis of gastric malignancy may include the subjective over-suspicion of the endoscopist (ie, not to miss any tumor) and the presence of acute bleeding from the ulcer lesion affecting the observation. In addition, gastric ulcer foci presenting with acute bleeding are often not eligible for biopsy, and it is not unusual for the next treatment decision to be made in such cases based only on the preliminary judgment of the gastroscopist. Therefore, when it is difficult to make a differential diagnosis between malignant and benign ulcers based on visual observation of the gastric mucosa under gastroscopy, especially for long-standing unhealed ulcers, it is necessary to perform multiple repeat gastroscopies or in combination with biopsies. If the macroscopic endoscopic appearance and histologic analysis suggest benignity, subsequent repeat endoscopic evaluation may not be necessary [5].

Endoscopic ultrasonography (EUS) is not usually used as a screening tool due to its low accuracy in the differential diagnosis of malignant and benign lesions in the stomach, especially for ulcerative lesions, and submucosal micro infiltrative lesions. Benign ulcers often appear as slight hypoechoic areas on EUS. Small depressions in benign ulcers with a flat, smooth base and an intact, uniformly thickened surrounding mucosal, and submucosal layer. Malignant ulcers often appear as hypoechoic ulcerative masses on EUS, with deep, crater-like depressions and disruption of the surrounding mucosal and submucosal layers that are poorly visualized. Another point of differentiation is that the image of ulcer fibrosis had a fan-shaped spread pattern, whereas malignant tumors had an arched-shaped pattern. When ulcer fibrosis is accompanied by micro infiltration of malignant tumor cells, it still appears as the echogenicity of benign ulcer fibers, and can be easily misdiagnosed [12]. Comparatively, EUS is of superior value in assessing the depth, and breadth of invasion of malignancy in the stomach [13]. Contrast-enhanced EUS may improve the accuracy of determining benign and malignant gastric ulcers. In Nomura's study, it was mentioned that be-

nign ulcers (active and scarred stages) might not observe significant enhancement due to the aggregation of blood vessels from the periphery toward the lesion and the high degree of fibrosis. In contrast, malignant tumors tend to have significant enhancement. It should be noted that when a cancerous mass has an ulcer or ulcerative scar, it may not be enhanced, which also might cause misdiagnosis [14].

Previous studies have considered a gastric wall thickness greater than 1 cm as the threshold for diagnosing gastric malignancy. In Insko's study, the specificity of CT was 42% when 1 cm was used as the threshold for diagnosing gastric malignancy. The specificity was significantly higher (88%), but the sensitivity was significantly lower (50%) when 2 cm was applied as the threshold for diagnosis. However, when gastric wall thickening greater than 1 cm was considered with other features, including locoregional thickening, asymmetric thickening, and lesions with enhancement, as diagnostic criteria, not only high sensitivity was ensured, but specificity (90%) was also significantly improved simultaneously [6]. Multidetector computed tomography (MDCT) combined with 3D virtual gastroscopy can visualize the ulcer margins and morphologic changes and the thickness of the gastric wall, and it has been shown to have high sensitivity (more than 80%) and moderate specificity (73.1%-77.8%) in distinguishing benign and malignant gastric ulcers [15]. Most malignant tumors of the stomach show different degrees of enhancement on contrast-enhanced CT due to differences in the tissue composition and degree of differentiation. For well-enhanced gastric cancer, focal thickening of the gastric wall can be mostly observed, with a progressive enhancement from the internal mucosa to the external gastric wall of the mass from the arterial phase to the delayed phase [16]. Our reported patient with a benign lesion of the gastric antrum-pylorus also showed progressive enhancement from the arterial phase to the delayed phase, so the diagnosis cannot be made simply from the enhancement pattern alone.

FDG is a glucose analog consumed by both malignant and inflammatory lesions. It has been shown that the degree of FDG uptake correlates with the severity of the ulcer, ie, increased FDG uptake may indicate increased inflammatory activity, and possible continued disease progression [17]. PET/CT is not specific for the differential diagnosis of gastric ulcers

and gastric cancer. It is usually during the staging of malignancy that a locoregional thickened lesion with focal high FDG uptake in the stomach is unexpectedly detected on PET/CT images. In such cases, it is often difficult to correctly determine the nature of the gastric lesion. For example, Zhang et al. reported a patient with cervical cancer who also had a difficult-to-diagnose gastric ulcer. PET/CT images showed locoregional thickening of the gastric wall in the antrum region with high FDG uptake, being suspected of gastric metastasis of cervical cancer or primary gastric cancer [18]. We reported a patient whose difficulty point of diagnosis was the FDG-avid lymph node in the space between the gastric antrum and the liver and a strange nodule with increased FDG uptake in the abdominal wall, which too easily led to the diagnosis of gastric cancer with metastases. However, no matter how carefully the diagnostic images were analyzed, a malignant gastric tumor was also highly suspected. This case suggests that patients with imaging findings of gastric wall abnormalities other than typical erosions and ulcers should undergo repeated endoscopy and, if necessary, biopsy. In addition, benign gastric ulcers should be included in the differential diagnosis even if naked eye gastroscopy suggests a malignant lesion.

## Conclusion

In the presence of focal gastric wall thickening with focal high FDG uptake, even if gastroscopy suggests possible malignancy, take care to take benign gastric ulcers into account when making the imaging diagnosis. PET/CT can detect more lesions, but it can also bias the diagnosis by not specifically differentiating between inflammatory, and neoplastic lesions.

## Ethics approval

We use research materials in strict compliance with the rules of the 1964 Declaration of Helsinki.

## Consent for publication

The patient signed a consent form for the release of his/her data (and/or photographs).

## Patient consent

Information about any identifiable patients has been withheld, and we guarantee that it will not compromise the veracity of the scientific report.

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