Differentiation of ectopic pancreatic tissue from gastric tumor

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Original Article

ABSTRACT

Background: Gastric ectopic pancreas is a rare developmental anomaly which is difficult to differentiate from submucosal tumor such as gastric stromal tumor by imaging methods. Since the treatments of the gastric ectopic pancreas and gastric stromal tumor are different, a correct diagnosis is essential.

Aim: To identify and investigate ectopic gastric pancreatic tissue from gastric tumors.

Patients and Methods: This prospective study was carried out from October 2021 to January 2023. During this period a total of 50 patients underwent a laparoscopic approach to investigate the resected tissue Histopathologically in addition to computed tomography (CT) imaging, all the included patients admitted to the Department of General Surgery, Al-Azhar University Hospitals, Al-Azhar University (Assiut Branch).

Results: Significant difference in the distribution of tumors in the gastric fundus between the two groups ($P < 0.001$). Furthermore, GPT were more likely to have the presence of peritumoral infiltration or fat-line of peritumor ($P < 0.001$). Moreover, there were significant differences in the necrosis, calcification, surface ulceration, and lymph node. Significant differences in CT attenuation and degree of enhancement (<0.001).

Conclusion: Histopathology and CT imaging studies differentiate between ectopic pancreatic tissues from gastric tumors. Ectopic pancreatic tissue is a rare pathological condition that can present as acute cholecystitis of gastric tumor..

Key Words: Computed tomography imaging, histopathology, gastric pancreatic tissue, gastric tumor.

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INTRODUCTION

Ectopic pancreas (EP), also recognized as heterotopic, aberrant, accessory, or pancreatic rest, is a rare congenital condition in which pancreatic tissue is detected in areas where is normally absent and it has no vascular, anatomical, or ductal association with the orthotopic pancreas[1].

Choristoma in the form of ectopic or heterotopic pancreas is an embryological abnormality and is defined as aberrantly located pancreatic tissue without anatomical, vascular, or neural connection to the pancreas. The sites usually involved include the stomach, duodenum, jejunum, and spleen, however, heterotopic pancreas is rarely encountered at other sites including the ileum, mesentery, lungs, gallbladder, liver, bile ducts, Meckel's diverticulum, and the mediastinum[2].

Although EP is foremost asymptomatic and the lesion is found incidentally during surgical investigations or gastrointestinal endoscopies, it may manifest as epigastric pain (27%), nausea, and vomiting (27%), ulceration (27%), weight loss (18%), and dyspepsia. Furthermore, pathologic conditions found in the pancreas can infrequently occur in the ectopic lesion. Since EP is a rare entity, there are no gold standards for the diagnosis. Nevertheless, resection and histopathologic examination are still considered the optimal diagnostic tools[3].

In most cases, the condition is an incidental finding during autopsy or laparotomy for unrelated reasons. However, the heterotopic pancreas has the potential to lead to all the metaplastic and neoplastic conditions that affect the orthotropic pancreas. Preoperative diagnosis is not possible, and histopathological examination is mandatory for establishing a definite diagnosis. The incidence of heterotopic pancreas at all sites ranges from 0.55 to 13.7% in autopsies and 0.2% in laparotomies[4].

The clinical significance of the presence of a heterotopic pancreas in the gallbladder is uncertain because of its incidental finding at microscopic exploration after extirpation for cholecystopathy. As a rare entity, it is not usually considered in the initial differential diagnosis[5].

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Therefore, this study aims to identify and investigate ectopic pancreatic tissue from gastric tumors.

PATIENTS AND METHODS:

Study design and population

This prospective study was carried out from October 2021 to January 2023. During this period a total of 50 patients underwent laparoscopic approach to investigate the resected tissue Histopathologically in addition to computed tomography (CT) imaging, all the included patients admitted to the Department of General Surgery, Al-Azhar University Hospitals, Al-Azhar University (Assiut Branch).

Ethical considerations

Approved by the ethics committee of Faculty of Medicine, Al-Azhar University (Assiut Branch) and did not require informed consent. All procedures performed in studies involving human participants were in compliance with the 1964 Helsinki Declaration and its later amendments.

Methods

Clinical records

Parameters selected for analyses were the following: age, sex, size, site (stomach, duodenum, small intestine, and others including esophagus, colon, and extra-GI tract), predominant growth pattern (chiefly submucosa, predominantly intramural, mainly outgrowth and others including extra-GI as well as unspecified), presence of ulceration, adhesion, rupture, pedicle, liver metastases, peritoneal dissemination, and surgical procedures.

Surgical procedure

Laparoscopic approach following general anesthesia, patients were placed in the supine position with their legs separated. The pneumoperitoneum was established to an insufflation pressure of 10−15 mmHg five trocars were used. Before the procedure, we used a gastroscope to identify the tumor location and estimate the distance between the upper border of the tumor and the esophagogastric line before the procedure. There are four types of laparoscopic resection for epigastric pancreatic tissue wedge resection, resection by opening whole layers of the stomach wall and closing with sutures or a linear stapler, mucosa-preserving resection, and proximal gastrectomy with pyloroplasty. After mobilization, one of these was selected according to various criteria such as tumor location and size, distance between the upper border of the tissue and esophagogastric line, and manner of growth.

Histopathology studies

Macroscopic examination revealed a gastric measuring 75 mm into 25 mm. The average wall thickness was 3 mm. The mucosa showed focal ulceration and a single solid, whitish, intramural nodule measuring 6 mm in the neck region. Thick biliary sludge and multiple small stones were present in the lumen. Multiple representative sections were submitted for analysis. Microscopic examination of the sections from the gallbladder neck revealed a well-circumscribed, intramural nodule of aberrant pancreatic tissue. Both exocrine and endocrine pancreatic tissues were present, consisting of acini and ducts along with a few islets of Langerhans. The remainder of the section showed chronic inflammatory reaction with epithelial changes consistent with chronic cholecystitis.

CT imaging

All Enhanced CT images were obtained from multidetector CT scanners all patients drank 600–800 ml of water before CT examination. The CT scan parameters were set as follows: for SOMATOM Sensation 16, beam collimation = 1.2 mmx16, pitch = 1, kVp/effective mA = 120/300, rotation time = 0.5 s and reconstruction section thickness = 5 mm, for SOMATOM, Definition AS+, beam collimation = 1.2 mm × 32, pitch = 1, kVp/effective mA = 120/160, rotation time = 0.5 s, and reconstruction section thickness = 5 mm. The scanning delay for arterial imaging was determined by using automated scan-triggering software Arterial scanning automatically began 7.0 s after the trigger attenuation threshold (100 HU) was reached at the level of the superior abdominal aorta and parenchymal scanning began at a delay of 45 s after arterial scanning. Gastric ectopic pancreas (GEPs) or gastric stromal tumor (GST), but were blinded to their histological subtypes. **The following CT features of the primary gastric lesion were assessed:** (1) the long diameter (LD) and short diameter (SD), (2) the ratio of Long diameter to short diameter (LD/SD), (3) location of the lesion (cardia, fundus, body, antrum), (4) contour of the lesion (round; oval; irregular), (5) Growth pattern (endophytic, exophytic, mixed), (6) the presence of peritumoral infiltration or fat-line of peritumor, wherein, the peritumoral infiltration was defined as a dense band-like perigastric fat infiltration, the fat-line of peritumor was defined as a fat space between the tumor and serosal layer, (7) the presence of necrosis, wherein, the necrosis was defined as the presence of non-enhancement low-density area within the tumor, (8) the presence of calcification, (9) the presence of surface ulceration, (10) the presence of lymph node, wherein, the lymph node was defined as the shortest axis length of the largest lymph node was more than 10 mm, (11) the CT attenuation value of unenhancement phase (CTu), (12) arterial enhancement (CTa) of the tumor, which measured the CT value at a represent region of interest (ROI), (13) parenchymal enhancement (CTp), (14) the CT attenuation

value of arterial phase minus unenhancement phase (DEAP), (15) the CT attenuation value of portal venous phase minus unenhancement phase (DEPP).

Statistical analysis

Statistical analysis was done using SPSS 15.0 (SPSS Inc., Chicago, IL, USA). The $\chi 2$ test was used for categorical variables, and Student's t-test was used to compare continuous variables between the two groups. All tests were two-sided, and a P value of less than 0.05 was considered statistically significant. Statistical analyses were performed using IBM SPSS Statistics version 25. The recurrence-free survival was assessed by Kaplan–Meier analysis and the log-rank test.

RESULTS:

The mean age was 38.53±10.87 with minimum, maximum and median age (24–88) (40) years-old, percentage of male 72% and female 28%, the size was varied from each patient 16% less than 5 cm, 22% greater than 5 cm, 24% less than 10 cm and 38% greater than 10 cm, the site was varied among patients (16% gall bladder), 18% for each esophagus and stomach, 10% duodenal, 14% for each small intestine and colon, 6% extra GI tract and 4% multiple site (Table 1).

Table 1: Demographic data and Clinical data of included patients

Demographic and Clinical Data	
Age	
Mean±SD	38.53±10.87
Min–Max (median)	(24–88) (40)
Sex	
Male (N %)	36 (72%)
Female (N %)	14 (28%)
Size	
<5 (N %)	8 (16%)
>5 (N %)	11 (22%)
<10 (N %)	12 (24%)
>10 (N %)	19 (38%)
Site	
Gall bladder (N %)	8 (16%)
Duodenal (N %)	5 (10%)
Small Intestine (N %)	7 (14%)
Esophagus (N %)	9 (18%)
Colon (N %)	7 (14%)
Extra-GI tract (N %)	3 (6%)
Stomach (N %)	9 (18%)
Multiple Sites (N %)	2 (4%)

Significant difference in the distribution of tumors in gastric fundus between two groups ($P < 0.001$). Furthermore, GPT were more likely to have the presence of peritumoral infiltration or fat-line of peritumor ($P < 0.001$). Moreover, there were significant differences in the necrosis, calcification, surface ulceration, lymph node. Significant differences in CT attenuation and degree of enhancement (<*0.001*) (Table 2, Figs. 1 and 2).

Table 2: Histopathological and computed tomography findings

Histopathology and computed tomography findings	GPT [*n* (%)]	GST [*n* (%)]	*P value*
Differentiation of cases	44 (88)	6 (12)	
Qualitative analysis			*<0.0001*
Cardia (N %)	8 (18)	3 (50)	
Fundus (N %)	11 (25)	2 (33)	
Body (N %)	12 (27)	1 (16)	
Antrum (N %)	6 (14)	3 (50)	
Contour (N%)	12 (27)	4 (66)	
Round (N ٪)	6 (14)	5 (83)	
Oval (N ٪)	4 (9)	2 (33)	
Irregular (N ٪)	44 (100)	4 (66)	
Growth Pattern			*<0.002*
Endophytic (N %)	28 (64)	2 (35)	
Exophytic (N %)	14 (31.5)	3 (50)	
Mixed (N %)	2 (4.5)	1 (15)	
Peritumoral Infiltration or Fat-line of Peritumor			*<0.05*
Yes (N ٪)	10 (23)	3 (50)	
No (N ٪)	34 (77)	1 (16.67)	
Necrosis (N ٪)	0	1 (16.67)	
Calcification (N ٪)	0	1 (16.67)	
CT Attenuation Value			*<0.001*
CTu (Hu)	41.50±9.10	44.24±7.09	
CTa (Hu)	70.40±18.20	55.47±14.88	
CTp (Hu)	94.10±12.12	65.90±17.88	
Degree of Enhancement			*<0.001*
DEAP	20.37±11.81	16.06±6.07	
DEPP	37.44±15.70	21.16±12.08	
LD	54.49±17.69	38.44±1 6.17	
SD	21.94±11.81	12.6±9.09	
LD/SD	1.39±0.29	1.20±0.30	

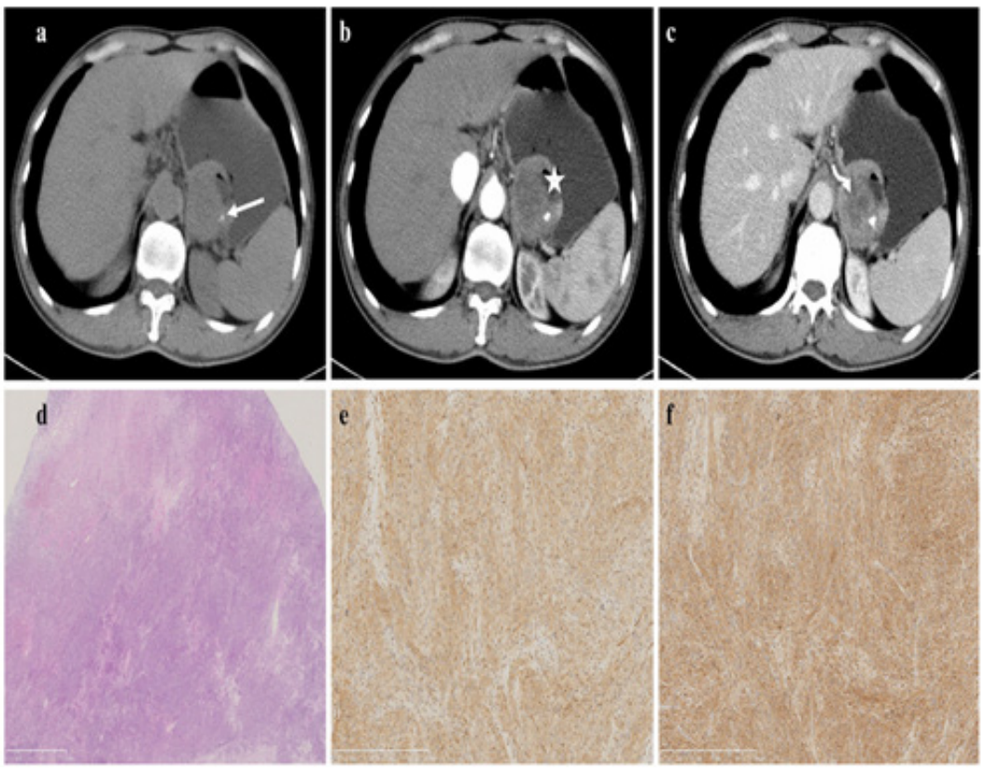

Fig. 1: Stromal tumor in gastric fundus (a–c). Axial computed tomography scans (non-enhanced, arterial and portal phase) show an irregular mass with mixed growth pattern. Ulceration (*), calcification (arrow), necrosis (bend-arrow) is presented in the lesion and the mass shows mind to moderate heterogeneous enhancement (d–f). Histological and immunohistochemical images show that stromal tumor is positive for DOG1 (e) and CD117 (f).

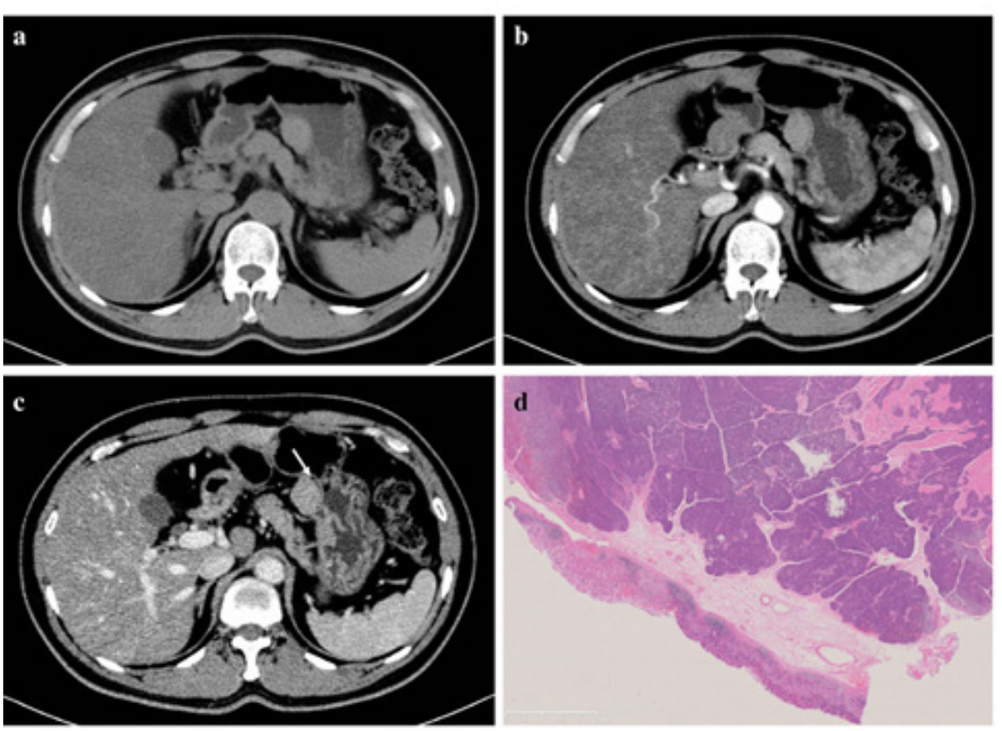

Fig. 2: Ectopic pancreas in gastric body (a–c). Axial computed tomography scans (nonenhanced, arterial and portal phase) show an oval Exophytic mass in the gastric body and also the fat-line of peritumor (arrow). The lesion shows homogeneous enhancement and equal attenuation to the pancreas (d). The lesion was confirmed as ectopic pancreas pathologically.

DISCUSSION

GEPs is a pancreatic tissue which was found outside its normal localization and without any anatomical or vascular connection with pancreas. Although the majority of patients with GEPs were asymptomatic, a few patients may have clinical manifestations due to stimulation of hormones and enzymes secreted by the ectopic pancreas[5]. As the most common subepithelial lesion, GST accounts for 90% of gastric submucosal tumor, and it is difficult to differentiate GEPs from GST, so we compare the CT features and histopathology studies of GEPs and GST to help us make the correct diagnosis.

Pancreatic heterotopia is a rare anomaly that is mostly found in the stomach and duodenum. The gallbladder is an extremely rare location for heterotopic pancreas. The first reported case of heterotopic pancreas in the gallbladder dates back to 1916 in a description by Alqahtani *et al*.[5]. So far, less than 40 cases of such occurrence have been reported. It is usually an incidental finding during autopsies or laparotomies due to unrelated reasons. The overall incidence ranges from 0.55 to 13.7% in autopsies and 0.2% in laparotomies. Different theories have been proposed for the origin of this aberrant tissue at unusual sites. The most widely accepted hypothesis is that the tissue becomes separated from the developing pancreas during the rotation of the gastrointestinal tract during the embryonic period.

As previously observed by Agha *et al*.,[6] on laparoscopy a distinct 3x2x1 cm mass was identified at the gastric antrum and was dissected off the duodenum. An antrectomy and antecolic gastrojejunostomy were performed with no complications. The patient had an uneventful postoperative course and was discharged home on postoperative day 5. Histopathology of the mass showed pancreatic heterotopia with ducts and acini in the antral wall of the stomach.

As mentioned by Mundackal *et al*.,[7] the feature of peritumoral infiltration is very closely correlated with the histological feature of a lobular structure of the acinous tissue at the margin. Since most GEPs were exophytic growth pattern and GEPs was not a true neoplasm but a hamartoma that flat pancreatic acinar formation and duct development histologically, so it is of high possibility for GEPs to have fat space between the tumor and serosal layer. As for GST, the main endoscopic finding of it is a nonspecific smooth bulge covered with normal mucosa, which is common to all subepithelial lesions, so the possibility for GST to have fat space between the tumor and serosal layer is extremely low.

Furthermore, Sohrabi *et al*.[8] reported the metastatic risk of GST increases according to the tumor size irrespectively of the mitotic count and the probability of malignancy was significantly increased when the tumor was larger than 5 cm in diameter.

Our study demonstrated that the CT attenuation values of CTu, CTa and CTp of GEPs were significantly higher than that of GST. Besides, the degree of enhancement was much heavier for the GEPs than that of GST, both in the DEAP and DEPP. In line with Paramythiotis *et al*.,[9] the majority of GEPs appeared as homogeneously extramucosal masses with similar or higher attenuation to pancreas and this result may be attributable to the histologic similarity of GEPs to normal pancreatic tissue, especially acini. Microscopically, GEPs consist of pancreatic acini and ducts and rarely contain islet cells. As mentioned by LeCompte *et al*.,[10] if the GEPs was mainly composed of pancreatic acini, the lesions would show greater enhancement and have a higher CT attenuation value in portal venous phase than the pancreas.

Our result showed that GEPs mainly consisted of pancreatic acini and GEPs contained many ducts and a few acini, and it is similar to the report of Deprez *et al*.,[11], Noh *et al*.,[12] Our study also showed that the LD and SD of GEPs were shorter than GST, but the previous study regarding the CT features of GEPs did not regard it as a characteristic CT finding in line with Zhou *et al*.[13] But for GST, as we know, GST had malignant potential and fast growth rate so as to tumor cell prone to degeneration, which undoubtedly decreased the degree of enhancement of GST in line with Barbu *et al*.[14].

CONCLUSION

Histopathology and CT imaging studies differentiate between ectopic pancreatic tissues from gastric tumors. Ectopic pancreatic tissue is a rare pathological condition that can present as acute cholecystitis or gastric tumor.

CONFLICT OF INTEREST

There are no conflicts of interest.

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