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## Case and Review

# Endosonographic Appearances of a Rare Duodenal Tumour, Brunner's Gland Hamartoma

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## Keywords

Brunner glands · Hamartoma · Gastrointestinal haemorrhage · Endosonography

## Abstract

Brunner's gland hamartoma (BGH) is a rare sub-epithelial tumour of the duodenum, which may cause haemorrhagic or obstructive gastrointestinal symptoms. Their accurate histological diagnosis often remains elusive before resection. Although endoscopic ultrasonography (EUS) is considered an excellent modality to study lesions within the gastrointestinal wall, only a few reports have described endosonographic characteristics of BGHs. A reliable pre-resection diagnosis with EUS may not only allay fear of malignancy but may as well avert a major surgery for the patients. In this report, we present a rare case of a large BGH in a young female who presented with acute gastrointestinal bleeding. Here, the endosonographic features assuaged the concern for malignancy while aiding in complete and uneventful surgical resection of the tumour via a submucosal plane.

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## Introduction

With less than 200 cases reported in the literature so far, Brunner's gland hamartoma (BGH) is one of the rare benign intestinal tumours which is mostly encountered in the duodenum [1]. This tumour arises from hyperplastic or hamartomatous proliferations of Brunner's glands normally present in the submucosa of the duodenum. With increasing size, the tumour may result in pain, luminal obstruction, or/and upper gastrointestinal (GI) bleeding. Upon endoscopy, although BGHs are easily visible as sub-epithelial polypoidal lesions in the duodenal wall, the ascertainment of histopathology and source of origin remains challenging before resection. Due to its sub-epithelial location, mucosal bite biopsies are almost always inconclusive. Moreover, the cross-sectional imaging is often unable to decipher the origin and may at times confuse it with a malignant duodenal or pancreatic neoplasm.

Endoscopic ultrasonography (EUS) is considered an excellent imaging modality for the examination of sub-epithelial GI lesions. EUS can elicit the layer of origin, the internal contents, and the vascularity of deep-seated lesions while simultaneously paving the way for the acquisition of a tissue specimen. As BGHs are rare, only a few reports have described their EUS characteristics. In this report, we describe a case of a large duodenal BGH with a focus on its endosonographic appearances. In the same context, a review of the literature was conducted.

## Case Report

A 43-year-old Chinese female was hospitalized with epigastric discomfort and multiple episodes of loose, black-coloured stools. There was no history of nausea or vomiting. She was apparently well until 3 days ago when symptoms started. She denied recent consumption of any analgesics (e.g., non-steroidal anti-inflammatory drugs), smoking or consumption of alcohol. There was no family history of GI disease. Physical examination revealed tachycardia (heart rate 113 beats per minute) but normal blood pressure. The abdomen was soft and non-tender with no palpable masses, and there were no stigmata of chronic liver disease. Digital rectal examination did not elicit any stools. Initial blood investigations were only remarkable for the presence of normocytic, normochromic anaemia with a serum haemoglobin value of 7.5 g/dL (normal range: 11.5–15.1). Renal and liver function tests were unremarkable.

After adequate intravenous fluid resuscitation and transfusion of one unit of red blood cells, an urgent upper GI endoscopy was performed. Intravenous proton-pump inhibitor (Pantoprazole) therapy, with a bolus of 80 mg followed by an infusion at 8 mg/h, was initiated before the endoscopy. During endoscopy, a large, sessile polyp was noted in the duodenal bulb which was causing partial luminal obstruction (Fig. 1). However, passage of the adult gastro-scope (Olympus® GIF-H260) into the second part of the duodenum was possible, with only a slight amount of contact bleeding from the surface of the polyp. The surface of the polyp had superficial ulcerations, but without any adherent clot or visible vessel. Additionally, in the stomach, there were endoscopic features suggestive of gastritis, and the rapid urease test for the presence of *Helicobacter pylori* infection was positive. The mucosal biopsies from the duodenal polyps were non-diagnostic and only revealed granulation tissue with focal erosions. There were no dysplastic or malignant features. To investigate the lesion further, a computed tomographic scan with intravenous iodinated contrast (Omnipaque™ 350) of the abdomen

was subsequently performed. A single heterogeneously enhancing mass of large size (2.4 cm × 2.4 cm × 5.6 cm) was seen in the proximal duodenum arising from its walls.

To evaluate this sub-epithelial lesion, an EUS was performed with a radial echoendoscope (GF-UE160-AL5, Olympus®, Tokyo, Japan) attached with a balloon (Fig. 2, Fig. 3). A large (44 mm in maximum diameter), heterogeneous lesion with faint hypoechogenicity was identified in the duodenal bulb. The lesion arose from the 3rd echoic layer (consistent with submucosa). The 4th echoic layer representing the muscularis propria was not breached. The structure had a broad stalk (20 mm in length). The lesion contained several large anechoic areas with post-acoustic enhancement which were consistent with cysts. Doppler views demonstrated multiple colour signals in the lesion (Fig. 4). In view of this apparent vascularity, fine needle aspiration was not performed. Based on the EUS findings of a submucosal tumour with cystic spaces and vascularity, the following differential diagnoses were considered: Brunner's gland tumour, pancreatic rest, and neuroendocrine tumour.

Due to the broad base of the lesion and the constrained physical space in the duodenal bulb, which might have precluded manoeuvring of endoscopic accessories, an attempt with endoscopic resection was considered difficult. Furthermore, there was an apparent risk of haemorrhagic complications with endoscopic resection due to multiple colour Doppler signals. Consequently, the polyp was surgically approached with a longitudinal duodenotomy, and complete resection was carried out up to the submucosal layer. No other intra-abdominal abnormality was found on routine examination. The patient had an uneventful post-operative recovery and was discharged 10 days later. No endoscopic recurrence of the duodenal polyp was observed after 6 months.

The pathological sample contained a large (measuring 6.0 cm × 3.0 cm × 2.0 cm), lobulated polypoidal mass with superficial ulcerations (Fig. 5, Fig. 6). Deep margins of the tumour were limited to the submucosa. Histopathological examination showed multiple lobules of hyperplastic Brunner's glands separated by hypertrophied smooth muscle fibres, consistent with the diagnosis of a BGH, and they were without dysplastic or malignant features.

## Discussion

Brunner's glands are branched acinotubular glands which are anatomically positioned in the submucosa and deep mucosa of the duodenum and rarely in the pylorus and jejunum. The alkaline viscous mucous from these glands counteracts the acidic chyme from the stomach, thus preventing acidic mucosal damage in the duodenum while also creating a conducive alkaline pH for intestinal enzymes. Small-sized, innocuous hyperplastic proliferations (defined as 1 cm or less in size) of Brunner's glands are commonly encountered on routine endoscopic examination. But, proliferation into a BGH is a rare event. For example, in a large autopsy series, the overall incidence of all benign duodenal tumours was 0.008%, and only 10.6% of these benign duodenal lesions were from Brunner's glands [2]. Most patients are middle-aged patients where BGH may present with dyspepsia, epigastric pain, upper GI bleeding or obstruction. The proximal duodenum is the most common location for such lesions [3], and the incidence of such tumours decreases in a caudal direction. The underlying pathogenesis of such uncontrolled hamartomatous growth is unclear, though several causative factors (e.g., *H. pylori* infection, chronic pancreatitis and local irritation) have been postulated [4, 5].

In most situations, an endoscopically conspicuous polypoidal lesion is identified in the duodenum, whose diagnosis remains unclear before resection. The sub-epithelial tumour is covered with intact or ulcerated mucosa. The endoscopic appearances are not characteristic for BGH. Other duodenal tumours, such as adenomas, neuroendocrine tumours, GI stromal tumours, pancreatic rests and pancreatic and ampullary neoplasms, may be indistinguishable in endoscopic appearances from the BGH. Furthermore, the endoscopic mucosal biopsies are of low yield, especially because of the submucosal location of a BGH. Similarly, the radiological imaging modalities, like computed tomography examination, may also not aid in the diagnosis of a BGH; however, the presence of extramural extension or distant metastasis will not be consistent with this tumour.

EUS is an excellent imaging modality to assess GI sub-epithelial lesions. Only a few cases have reported the endosonographic appearances of BGHs (Table 1) [6–18]. The lesions arise from deep mucosa or submucosa and do not breach the muscularis propria layer. The echogenicity may vary from hypoechoic to hyperechoic depending on the amount of fibro-muscular tissues in the stroma. More often, a heterogeneous echogenicity within the lesion is observed. Homogenous appearances are more consistent with Brunner's gland adenoma rather than hamartoma [19]. Since Brunner's glands can normally be present inside the duodenal wall but outside the tumour, the boundaries of the lesion are often indistinct on EUS. Several anechoic dilated areas are visible inside the tumour consistent with Brunner's cysts on histopathology. Only a few reports have commented on the prominent vascularity of the lesions on Doppler ultrasonography [7]. Abundant Doppler signals were observed in our case. As a BGH is composed of benign cellular components, EUS-guided fine needle aspiration is unlikely to yield a diagnosis. Despite having no help from tissue diagnosis, the endosonographic appearances alone may suffice to confidently diagnose a BGH and to rule out other differential diagnoses of duodenal sub-epithelial lesions (Table 2).

The only therapy for a BGH is resection which provides definitive cure. Endoscopic resection of such tumours is increasingly being reported, although it is often challenging due to a physically constrained duodenal lumen. Surgical resection with duodenotomy generally is sufficient for complete removal of the tumour; however, pancreatoduodenectomy has also been performed in view of the uncertainty of a pre-operative diagnosis. In our case, the accurate description on EUS was helpful in avoiding a radical surgery. Given the rarity of the disease, there is no consensus to guide follow-up. Endosonographic follow-up is not warranted as the BGHs are benign lesions with almost no risk of breaching the muscularis propria. No endoscopic recurrence was observed in our case 6 months after resection.

The present case highlights the importance of considering BGH in the differential diagnosis of duodenal tumours. The report also describes the peculiar endosonographic features of a BGH, which may guide appropriate resection.

### Statement of Ethics

Patient consent has been obtained, no patient identifiers have been used, and the case was anonymised.

### Disclosure Statement

The authors have no disclosures to make directly related to the study and have no conflict of interest.

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### Author Contributions

All authors contributed to the preparation, review and editing of the manuscript.

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**Fig. 1.** The large sessile polyp arising from the anterior-superior wall of the duodenal bulb. Superficial ulcerations over its surface are visible.



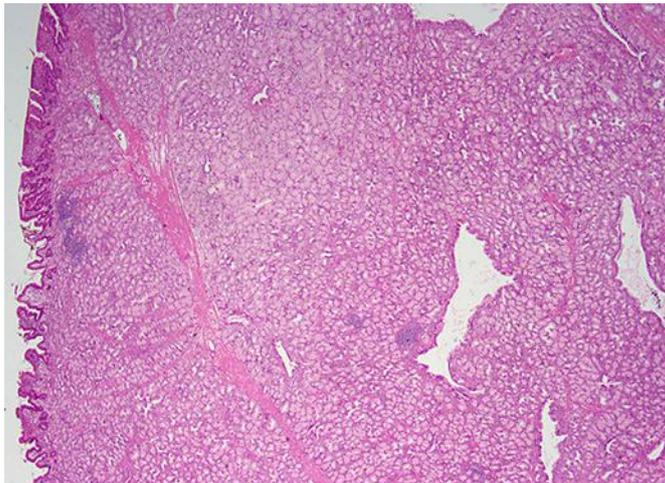
**Fig. 2.** A round lesion (depicted with yellow stars) of heterogeneous echogenicity is visible in the mucosal and submucosal layers of the duodenum on radial EUS (7.5 MHz). The muscularis propria (yellow arrow) is not breached.



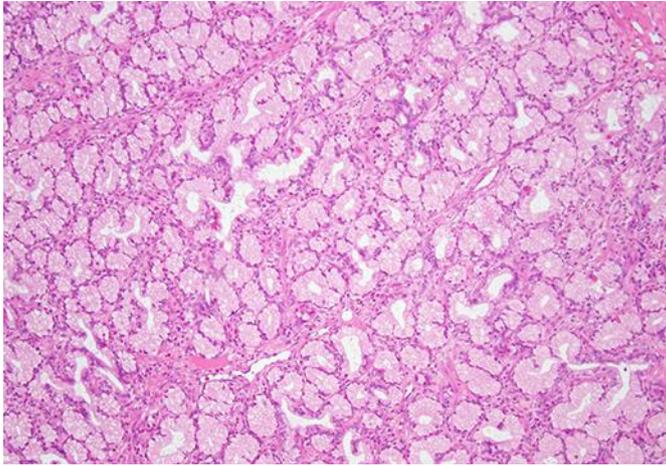
**Fig. 3.** Multiple anechoic areas (consistent with cysts) are visible inside the lesion on higher magnification.



**Fig. 4.** Multitudes of vascular signals are seen inside the lesion on Doppler imaging.



**Fig. 5.** HE section of BGH at low magnification ( $\times 20$ ) showing submucosal expansion by lobules of hyperplastic Brunner's glands with overlying gastric epithelium.



**Fig. 6.** BGH at higher magnification ( $\times 100$ ) illustrating multiple lobules of Brunner's glands characterized by cuboidal to columnar cells with clear cytoplasm. No cellular atypia is identified.

**Table 1.** Studies describing detailed EUS features of BGHs

Year [ref.]	Authors	Size on EUS	N	EUS-imaging features	EUS FNA	Doppler signals	Treatment
1996 [6]	Inai et al.	Not provided	1	Heterogeneous echogenicity; in mucosa and submucosa; unclear borders and margins; cystic lesions inside the tumour	Not done	Not reported	Not reported
1997 [7]	Ueno et al.	Not provided	1	Subtle hypoechoogenicity; origin in submucosa; cystic lesions inside the tumour	Not done	Abundant colour signals	Surgical resection
1997 [8]	Weisselberg et al.	Not provided	1	Variable echogenicity; in mucosa and submucosa; cystic lesions inside the tumour	Not done	Not reported	Surgical resection
2000 [9]	Block et al.	2.4×3.0 cm	1	Mixed echogenicity; in submucosa	Not done	Not reported	Surgical resection
2001 [10]	Changchien et al.	1st case: 2.7 cm 2nd case: 1.4 cm	2	1st case: Heterogeneous and hyperechoic; in mucosa and submucosa; cystic lesions inside the tumour 2nd case: Echogenicity intermediate between muscularis propria and mucosal layers; in mucosal layer; cystic lesions inside the tumour	Not done	Not reported	1st case: Surgical resection 2nd case: Endoscopic resection
2003 [11]	Kaufman et al.	Not provided	1	Homogenous and hyperechoic; in submucosa; 2 cystic lesions inside the tumour	Not done	No vascular signals in the stalk of tumour	Endoscopic resection
2008 [12]	George et al.	Not provided	1	Uniformly hyperechoic (confused with lipoma); in submucosa	Not done	Not reported	Endoscopic resection
2010 [13]	Babich et al.	1.1 cm × 1.0 cm	1	Predominantly isoechoic; in submucosa; central cystic lesion in the tumour	Not done	Not reported	Endoscopic resection
2011 [14]	Carboni et al.	3.5 cm	1	Mixed echogenicity; in submucosa	Not done	Not reported	Surgical resection
2013 [15]	Stoos-Veic et al.	4 cm × 6.3 cm	1	Hypoechoic; probably originated in muscularis propria; cystic lesions inside the tumour	FNA yielded benign epithelial cells (non-diagnostic)	Not reported	Surgical resection
2015 [16]	Barbeiro et al.	1.1 cm	1	Hypoechoic; in submucosa	Not done	Not reported	Endoscopic resection
2016 [17]	Hsieh et al.	1.86 cm × 1.08 cm	1	Isoechoic; in submucosa; cystic lesions inside the tumour	Not done	Not reported	Endoscopic resection
2017 [18]	Peloso et al.	4 cm	1	Mixed echogenicity; in submucosa; no clear plane between tumour and pancreatic head	Not done	Not reported	Surgical resection
Our case	Hussain et al.	4.4 cm	1	Faintly hypoechoic; in mucosa and submucosa; multiple cystic lesions in the tumour	Not done	Multiple vascular signals	Surgical resection

**Table 2.** EUS characteristics of sub-epithelial duodenal tumours

Lesion	Echo layer of origin	EUS features	Fine needle aspiration	Clinical characteristics
Gastrointestinal stromal tumour (GIST)	4th or rarely 2nd	Variable echogenicity (usually hypoechoic); large lesions may have cystic components; lymphadenopathy in high-risk tumours	Spindle cells	Has malignant potential; treatment depends on the stage of disease
Neuroendocrine tumour	1st or 2nd layer	Hypoechoic, may potentially breach all layers	Not required	Has malignant potential; endoscopic biopsies may yield diagnosis
Lipoma	3rd layer	Hyperechoic, well circumscribed	Not required	Benign; resection is curative in symptomatic patients
Pancreatic rest	3rd layer	Hypoechoic, anechoic tubular structures inside consistent with rudimentary ducts	Not required	Requires resection in symptomatic cases
Brunner's gland hamartoma	2nd or 3rd layer	Heterogeneous echogenicity; no breach of muscularis propria; anechoic or cystic areas inside the tumour; prominent vascular signals	Not required	Benign; resection in symptomatic patient is curative