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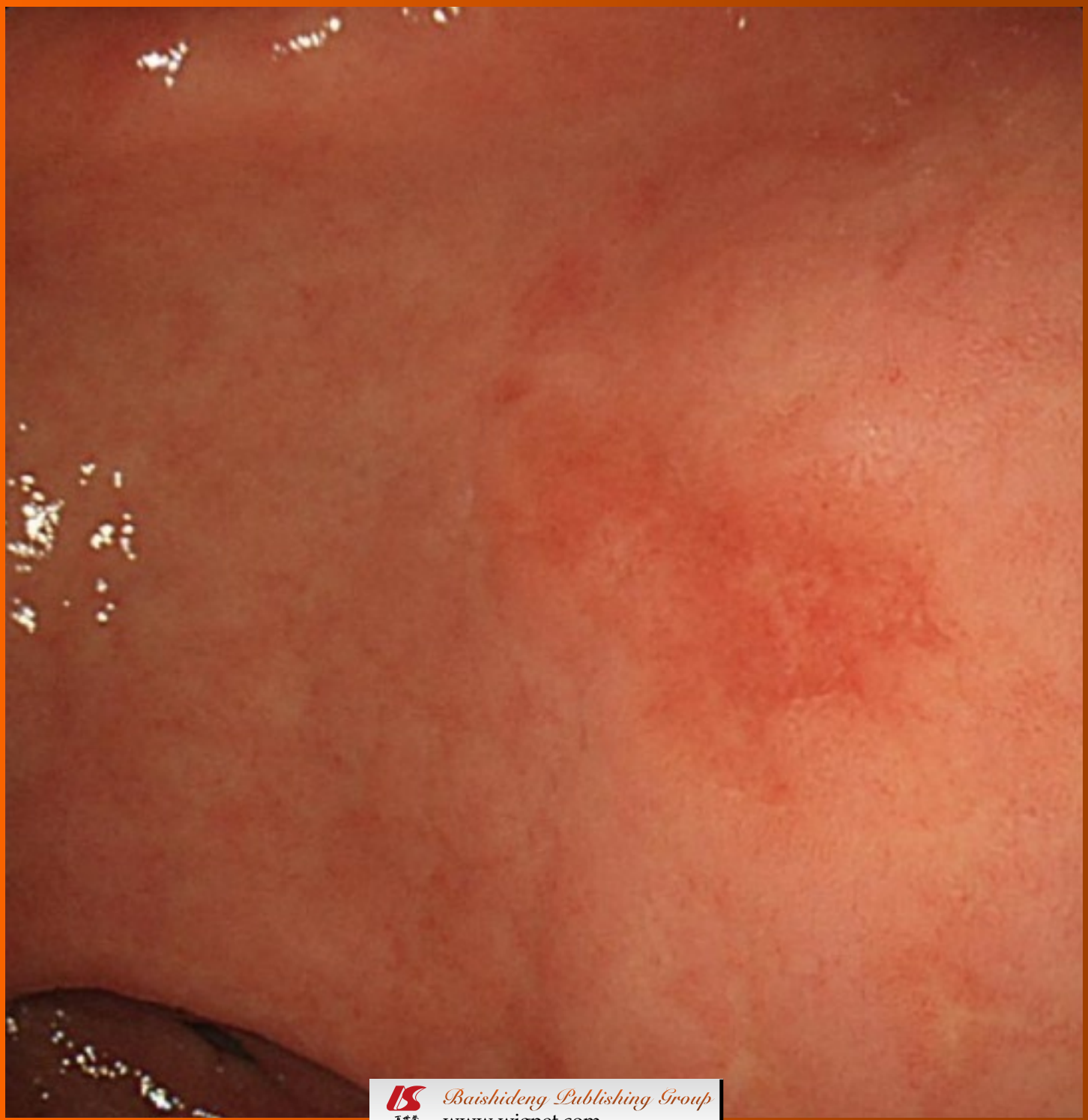

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EDITORIAL

Endoscopic diagnosis of pancreaticobiliary maljunction

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Abstract

Pancreaticobiliary maljunction (PBM) is a congenital anomaly defined as a junction of the pancreatic and bile ducts located outside the duodenal wall, usually forming a markedly long common channel. As the action of the sphincter of Oddi does not functionally affect the junction in PBM patients, continuous pancreatobiliary reflux occurs, resulting in a high incidence of biliary cancer. PBM can be divided into PBM with biliary dilatation (congenital choledochal cyst) and PBM without biliary dilatation (maximal diameter of the bile duct ⩽ 10 mm). The treatment of choice for PBM is prophylactic surgery before malignant changes can take place. Endoscopic retrograde cholangiopancreatography (ERCP) is the most effective examination method for close observation of the pattern of the junction site. When the communication between the pancreatic and bile ducts is maintained, despite contraction of the sphincter on ERCP, PBM is diagnosed. In these patients, levels of pancreatic enzymes in the bile are generally elevated, due to continuous pancreatobiliary reflux *via* a long common channel. Magnetic resonance cholangiopancreatography and 3D-computed tomography can diagnose PBM, based on findings of an anomalous union between the common bile duct and the pancreatic duct, in addition to a long common channel. Endoscopic ultrasonography and intraductal ultrasonography can demonstrate the junction outside the duodenal wall, and are useful for the diagnosis of associated biliary cancer. Gallbladder wall thickness on ultrasonography can be a screening test for PBM.

Key words: Pancreaticobiliary maljunction; Pancreatobiliary reflux; Congenital choledochal cyst; Endoscopic retrograde cholangiopancreatography; Endoscopic ultrasonography; Magnetic resonance cholangiopancreatography

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INTRODUCTION

The main pancreatic duct and the common bile duct open into the duodenum, where they frequently form a common channel, the incidence of which is reported to be from 55%[1] to 82%[2]. The length of the common channel ranges from 1 mm to 12 mm, with an average length of 4.4 mm[3]. The sphincter of Oddi is located at the distal end of the pancreatic and bile ducts; it regulates the outflow of bile and pancreatic juice. A common channel can be so long that the sphincter action does not functionally affect the junction, resulting in two-way regurgitation (pancreatobiliary reflux: regurgitation of pancreatic juice into the common bile duct, and biliopancreatic reflux:

regurgitation of bile juice into the pancreatic duct). Pancreaticobiliary maljunction (PBM) forms a markedly long common channel, and is divided into PBM with, and without, biliary dilatation[4-7]. Pancreatobiliary reflux has been shown to induce carcinogenesis in the biliary tract; similarly, biliopancreatic reflux can induce pancreatitis[4-6].

PANCREATICOBILIARY MALJUNCTION

PBM is a congenital anomaly defined as a junction of the pancreatic and bile ducts located outside the duodenal wall, usually forming a markedly long common channel. PBM occurs predominantly in females, and is often found in Asian populations. PBM can be divided into PBM with biliary dilatation (congenital choledochal cyst (CCC) (Figure 1) and PBM without biliary dilatation (Figure 2)[4-7]. CCC is an anomaly in which the extrapancreatic bile duct, or the extra and intrahepatic bile ducts, are dilated in various ways. The Alonso-Lej classification[8] , which is based on the shape of the dilated bile duct, is notable, and includes a cystic type (Type Ⅰ), a diverticular type (Type Ⅱ), and a cyst in the duodenum (choledochal cyst, Type Ⅲ). Type Ⅰ is almost always associated with PBM, but Type Ⅱ and Ⅲ rarely have PBM. Bile duct diameter greater than 10 mm on a cholangiogram is the most commonly used definition of dilatation[7].

In PBM patients, since the action of the sphincter of Oddi does not functionally affect the junction, continuous reciprocal reflux between pancreatic juice and bile occurs, resulting in various pathological conditions in the biliary tract and pancreas. As the hydro pressure within the pancreatic duct is usually greater than that in the bile duct, pancreatic juice frequently refluxes into the biliary duct in PBM patients, which results in a high incidence of cancer in the biliary tract[4-7]. In our previous study, bile duct and gallbladder cancers were seen in 14% and 22% of 49 CCC patients, respectively, but, in 70% of 53 PBM patients without biliary dilatation, only gallbladder cancer was detected.

Once PBM is diagnosed, prophylactic flow-diversion surgery (bile duct resection and bilioenteric anastomosis) is performed for CCC. On the other hand, any treatment of PBM without biliary dilatation and without cancer is controversial. Prophylactic cholecystectomy is performed in many institutes, as most biliary cancers that develop in PBM patients without biliary dilatation are gallbladder cancers. However, some surgeons propose excision of the extrahepatic bile duct, together with the gallbladder, for PBM patients without biliary dilatation, because of the risk of bile duct cancer[9,10].

ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY

Endoscopic retrograde cholangiopancreatography (ERCP) is the most effective examination method for close observation of the pattern of the junction site. When the communication between the pancreatic and bile ducts is

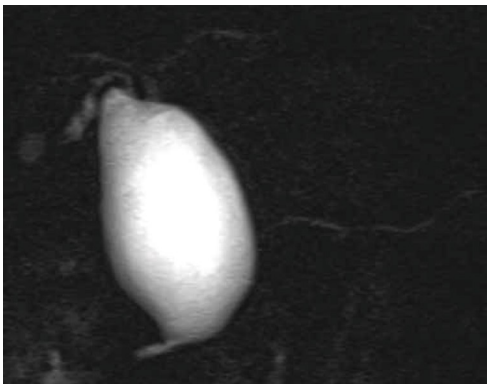

Figure 1 Magnetic resonance cholangiopancreatography showing pancreaticobiliary maljunction with biliary dilatation (congenital choledochal cyst.

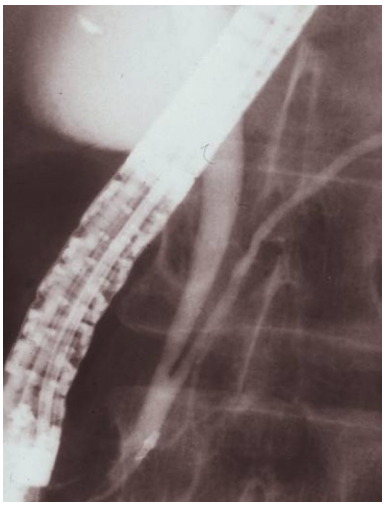

Figure 2 Endoscopic retrograde cholangiopancreatographyshowing pancreaticobiliary maljunction without biliary dilatation.

maintained despite contraction of the sphincter on ERCP, PBM is diagnosed (Figure 3A and B). The finding can also be assessed with cholangiography, *via* the biliary drainage tube or during operation[4-7].

Pancreatography *via* the minor duodenal papilla can also demonstrate pancreatobiliary reflux in PBM patients. When injected endoscopically *via* the minor duodenal papilla, the contrast medium is refluxed into the bile duct through a long common channel without outflow into the duodenum[5].

Biliary levels of pancreatic enzymes, especially amylase, are generally elevated due to continuous pancreatobiliary reflux *via* a long common channel in PBM patients. There are some cases with a relatively long common channel that are not classified as PBM because the sphincter of Oddi includes the pancreaticobiliary ductal junction. We defined a high confluence of pancreaticobiliary ducts (HCPBD) as a common channel length ⩾ 6 mm, in which the communication was occluded when the sphincter was contracted (Figure 4A and B), and investigated the clinical significance of a relatively long common channel[5-7]. In HCPBD patients, the amylase level in the bile was frequently elevated, and hyperplastic change of the gallbladder epithelium was frequently observed. Gallbladder cancer occurred in

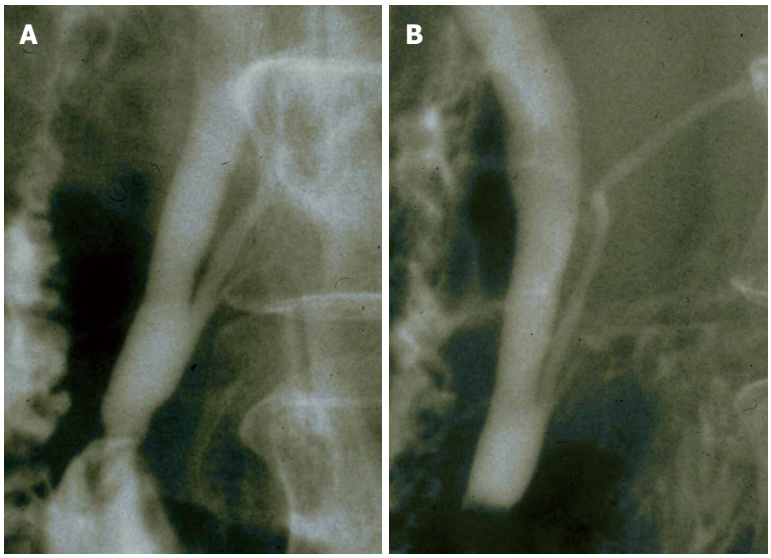

Figure 3 Endoscopic retrograde cholangiopancreatography of a pancreaticobiliary maljunction patient. A: Showing a long common channel; B: The communication between pancreatic and bile ducts was maintained despite contraction of the sphincter.

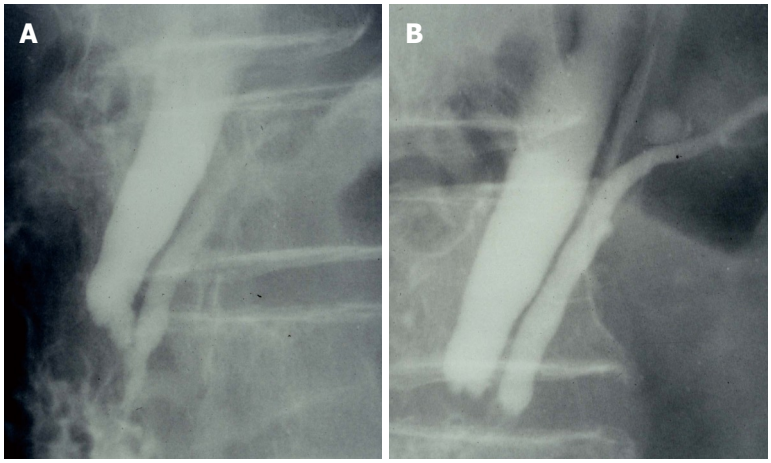

Figure 4 Endoscopic retrograde cholangiopancreatography of a patient with high confluence of pancreaticobiliary ducts. A: A common channel of 9 mm in length; B: The communication between pancreatic and bile ducts was destroyed by sphincter contraction.

11% of the 84 HCPBD patients. These findings suggest that pathophysiological changes similar to PBM occur in HCPBD. However, in HCPBD patients, there was no difference between the sexes, whereas in PBM there was (male:female ratio, 1 : 0.7 in HCPBD and 1 : 3.4 in PBM), and the average age at the time of diagnosis was significantly older in HCPBD patients than in PBM patients without biliary dilatation (average age, 62.0 years *vs* 56.7 years, respectively). The elevated amylase level in the bile in HCPBD patients was lower than that of PBM patients (average 48 665 IU/L *vs* 250 025 IU/L, respectively) and the rate of associated gallbladder cancer was lower in HCPBD patients than in PBM patients. These differences in sex, age at diagnosis, bile amylase level, and rate of associated gallbladder cancer between HCPBD and PBM patients appear to be related to whether pancreatobiliary reflux occurs consistently or intermittently[5-7].

MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY AND 3D-COMPUTED TOMOGRAPHY

Magnetic resonance cholangiopancreatography (MRCP) has become a common non-invasive method for obtaining high quality images of the pancreaticobiliary tree.

Reconstruction images on 3D-computed tomography (CT) can also show pancreaticobiliary images. MRCP and 3D-CT can diagnose PBM, based on findings of an anomalous union between the common bile duct and the pancreatic duct, in addition to a long common channel. However, in some cases in which a common channel is not so long and cannot be depicted on MRCP, the MRCP diagnosis of PBM is not possible[11]. For a definite diagnosis of PBM, ERCP is necessary in order to exclude various false positive or negative results on MRCP or 3D-CT. Diagnostic accuracy can be increased with dynamic MRCP with secretin stimulation or three-dimensional MRCP. Although a large amount of contrast must be injected to evaluate the whole image of CCC on ERCP, it can be achieved with MRCP and 3D-CT.

Pancreaticobiliary reflux in PBM patients can be visualized radiologically using secretin-stimulated dynamic MRCP. In normal pancreaticobiliary dynamics, the extrahepatic and intrahepatic bile ducts show no change following secretin injection. On the other hand, in PBM patients, the volume of the extrahepatic bile duct and the gallbladder increases, due to the regurgitation of pan-

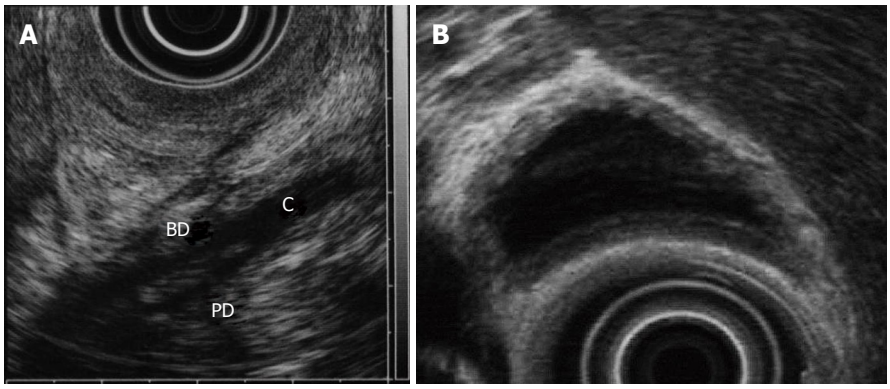

Figure 5 Endoscopic ultrasonography of a pancreaticobiliary maljunction patient. A: The confluence of pancreatic duct and bile duct in the proximal portion of the duodenal wall; B: thickness of inner low echoic layer of the gallbladder. BD: bile duct; PD: pancreatic duct; C: common channel.

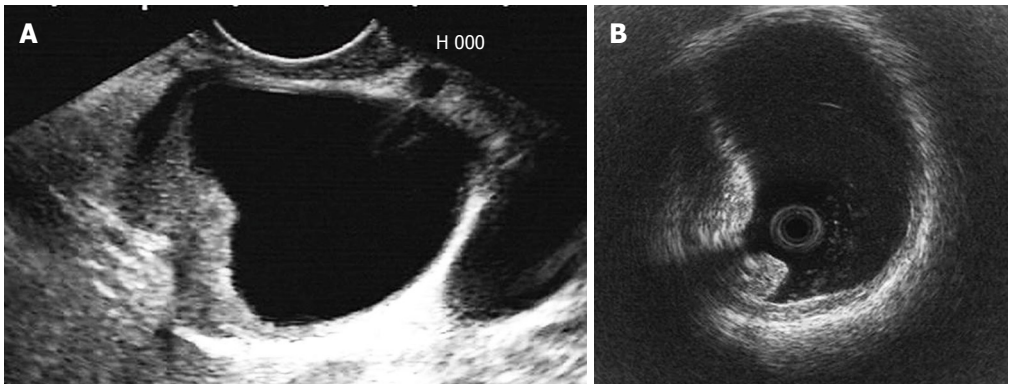

Figure 6 Ultrasonography of a congenital choledochal cyst patient with bile duct cancer in the dilated bile duct. A: Endoscopic ultrasonography; B: Intraductal ultrasonography.

creatic fluid secreted after the injection of secretin into the bile duct[12].

ENDOSCOPIC ULTRASONOGRAPHY

In PBM, endoscopic ultrasonography (EUS) can detect the confluence of pancreatic duct and bile duct in the proximal portion of the duodenal wall, the so-called common channel (Figure 5A). Therefore, EUS allows definite diagnosis of PBM. When PBM is known about in advance, it may be relatively easy to depict the confluence. PBM often shows a thickness of the inner low echoic layer of the gallbladder (Figure 5B), which means histologically mucosal hyperplasia. Therefore, when we find that sonographic finding by means of EUS, we have to keep the presence of PBM in mind. In fact, several investigators have reported that EUS could confirm the PBM in 4 (2.9%) of 137 patients who underwent screening US[13].

Bile duct and gallbladder cancers are often seen in PBM. The efficacy of EUS for the diagnosis of gallbladder cancer is well known[14]. However, it is often difficult, even when using EUS, to distinguish mucosal hyperplasia from early gallbladder cancer to indicate whether the depth of invasion of the cancer is mucosa or muscularis propria of the gallbladder.

EUS is also useful for the diagnosis of bile duct cancer. Since, in particular, congenital bile duct dilation is well-known as a high risk condition for bile duct cancer in the dilated bile duct (Figure 6A), in these cases, EUS should be preoperatively performed for the diagnosis of tumor spreading and staging.

INTRADUCTAL ULTRASONOGRAPHY

Intraductal ultrasonography (IDUS) is performed over-the-guidewire during the ERCP, and is useful for the depiction of the confluence of pancreatic duct and bile duct.

IDUS is also useful for the diagnosis of bile duct cancer (Figure 6B)[15,16]. However, IDUS has limitations for the diagnosis of bile duct and gallbladder lesions because of shallow US penetration (< 2.0 cm) and maneuverability of passage of probe in case of bile duct stricture or a narrow cystic duct.

Direct choledochoscopy with or without biopsy is useful to confirm the diagnosis of bile duct cancer.

ULTRASONOGRAPHY

Mark dilatation of the common bile duct on ultrasonography (US) suggests CCC. The epithelium of the gallbladder frequently becomes hyperplastic due to exposure to refluxed pancreatic juice. Gallbladder wall thickness on US during medical checkups may serve as an indication of PBM without the need for biliary dilatation, and can serve as a screening test for PBM[17].

CONCLUSION

When the communication between the pancreatic and bile ducts is maintained despite contraction of the sphincter on ERCP, PBM is diagnosed. MRCP and 3D-CT can be used to diagnose PBM, based on the discovery of an anomalous union between the common bile duct and the

pancreatic duct, in addition to a long common channel. EUS and IDUS can demonstrate the junction outside the duodenal wall, and they are useful for the diagnosis of associated biliary cancer. Gallbladder wall thickness on US can be a screening test for PBM.

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Mini-laparoscopy in the endoscopy unit: Safety and outcomes in over one thousand patients

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Abstract

AIM: To investigate the safety of consecutive mini-laparoscopy guided liver biopsies for the diagnosis and staging of liver diseases.

METHODS: In this study we retrospectively analyzed the safety of mini-laparoscopic liver biopsy performed in an endoscopy unit in 1071 patients. We measured the incidence of bleeding and evaluated the management and outcome of bleeding interventions.

RESULTS: The most common etiologies of liver injury were viral hepatitis and autoimmune liver disease. 250 patients had macroscopically and histologically proven cirrhosis. 13 patients had no pathological findings. 33% of all patients had bleeding that required argon plasma coagulation of the puncture site during laparoscopy. Significant bleeding occurred more often in patients with liver cirrhosis compared to non-cirrhotic liver diseases but was effectively treated with laparoscopic coagulation.

CONCLUSION: In conclusion, mini-laparoscopy liver bio psy can be performed safely and effectively in high risk patients with advanced liver disease; mini-laparoscopy with liver biopsy can be done safely in an endoscopy unit.

Key words: Mini-laparoscopy; Cirrhosis; Argon plasma coagulation

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INTRODUCTION

Although noninvasive techniques for the diagnosis and

staging of liver disease have been developed in recent years, histological evaluation still remains the most accurate method for the assessment of severity and stage of liver diseases[1,2]. However, in patients with acute or advanced liver disease, there may be an increased risk of bleeding complications with percutaneous liver biopsy, even when done under ultrasound guidance[3,4]. Furthermore, recent studies have shown that liver histology obtained by blind biopsy underestimates the stage of liver disease and misses the diagnosis of cirrhosis in up to 25% of patients, especially in early and incomplete cirrhosis or macronodular cirrhosis[5]. To overcome the limitations of safety and diagnostic accuracy in percutaneous liver biopsy, laparoscopic liver biopsy has been touted as a safe and effective diagnostic tool in patients with liver disease[6,7]. The development of the so-called mini-laparoscopy by using a small diameter laparoscope allows for a minimally invasive procedure for macroscopic evaluation of the peritoneal cavity and safe biopsy of the liver[8,9]. In this study, we retrospectively analyzed the safety of 1071 consecutive mini-laparoscopy guided liver biopsies, all performed in an endoscopy unit.

MATERIAL AND METHODS

Patients

The medical records of 1071 consecutive patients undergoing diagnostic mini-laparoscopy performed in our endoscopy unit at Johannes Gutenberg University Mainz, Germany from January 2000 until April 2006 were reviewed. All patients gave written informed consent before undergoing mini-laparoscopy. Patients with INR values above 1.5 and platelet counts below 50.000/μL received 2 to 4 units of fresh frozen plasma or 1 to 2 units of platelet concentrate immediately before the intervention respectively. Furthermore, every patient received an abdominal ultrasound prior to mini-laparoscopy to exclude ascites. All patients were treated as day cases with post interventional observation. Since this study represents a retrospective analysis, no IRB approval was required.

Technique of mini-laparoscopy

Mini-laparoscopy was performed using intravenous procedural sedation, as described previously[6]. The abdominal wall was cleaned with Betadine solution and covered with sterile drapes. Puncture site of the abdominal wall was performed at the point of Kalk, located 2 cm left and cephalad of the umbilicus. The puncture itself was performed with a Veress needle with 2.3 mm diameter (Richard Wolf GmbH, Knittlingen, Germany) through a trocar of 2.75 mm diameter (Richard Wolf GmbH, Germany) after local anesthesia of the puncture site with 10 mL of mepivacaine 1% (AstraZeneca, London, UK). After forming a pneumoperitoneum by insufflation of approximately 2 liters nitric oxide, the Veress needle was replaced by the optical instrument (Richard Wolf GmbH, Germany). A xenon light source (Richard Wolf GmbH, Germany) was used for illumination of the abdominal cavity. For optimal visibility of the liver, a rotating operation table (Maquet GmbH, Rastatt, Germany) was used and patients were slightly rotated to the left while the upper body was elevated. Besides macroscopic assessment of the liver, the upper abdomen was systematically examined for signs of portal hypertension such as splenomegaly, dilated intra abdominal vessels or peritoneal carcinosis. Liver biopsy was performed under direct laparoscopic visualization with an 18G biopsy needle (Bard Inc., Covington, USA) *via* a second 3 mm incision in the upper right quadrant of the abdomen. If vigorous bleeding was detected immediately after the liver biopsy or the bleeding did not stop after approximately two minutes, a small trocar with a diameter of 3 mm was inserted at the liver biopsy puncture site of the abdominal wall and the bleeding puncture site was treated with argon plasma coagulation (APC) (Söring GmbH, Quickborn, Germany) under direct visualization. If necessary, in patients with high risk of bleeding, the second trocar was inserted in the right upper abdominal quadrant before performance of the liver biopsy in order to rapidly apply APC immediately after the biopsy. Coagulation was considered successful when no further signs of active bleeding could be observed after 2 min.

Table 1 Etiology of liver disease in non-cirrhotic patients

Viral hepatitis	Autoimmune liver disease	Liver disease of other origins
n = 319	*n* = 141	*n* = 349
Chronic hepatitis C *n* = 263 (82%) Chronic hepatitis B *n* = 56 (18%)	Autoimmune hepatitis *n* = 49 (35%) Primary biliary cirrhosis *n* = 48 (34%) Primary sclerosing cholangitis *n* = 32 (23%) Overlap syndrome *n* = 13 (9%)	Non-alcoholic fatty liver disease *n* = 99 (28%) Alcoholic liver disease *n* = 18 (5%) Primary/secondary hepatobiliary neoplasia *n* = 53 (15%) Toxic liver injury *n* = 59 (17%) Others *n* = 120 (34%)

Table 2 Etiology of liver disease in cirrhotic patients

Viral hepatitis	Autoimmune liver disease	Liver disease of other origins
n = 119	*n* = 20	*n* = 111
Chronic hepatitis C *n* = 96 (85%) Chronic hepatitis B *n* = 23 (15%)	Autoimmune hepatitis *n* = 8 (40%) Primary biliary cirrhosis *n* = 6 (30%) Primary sclerosing cholangitis *n* = 6 (30%)	Alcoholic liver disease *n* = 52 (47%) Others *n* = 59 (53%)

Statistical analysis

Statistical significance levels were calculated by chi square test.

RESULTS

1071 patients had mini-laparoscopy with the intent of

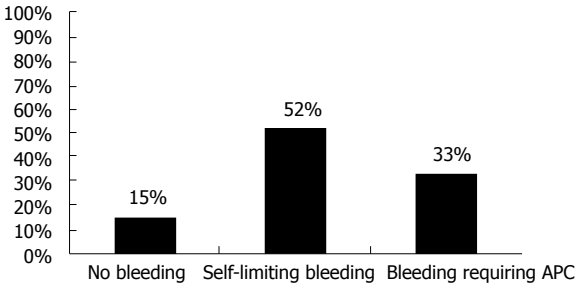

Figure 1 Overall occurrence of bleeding in mini-laparoscopic liver biopsies. APC: argon plasma coagulation.

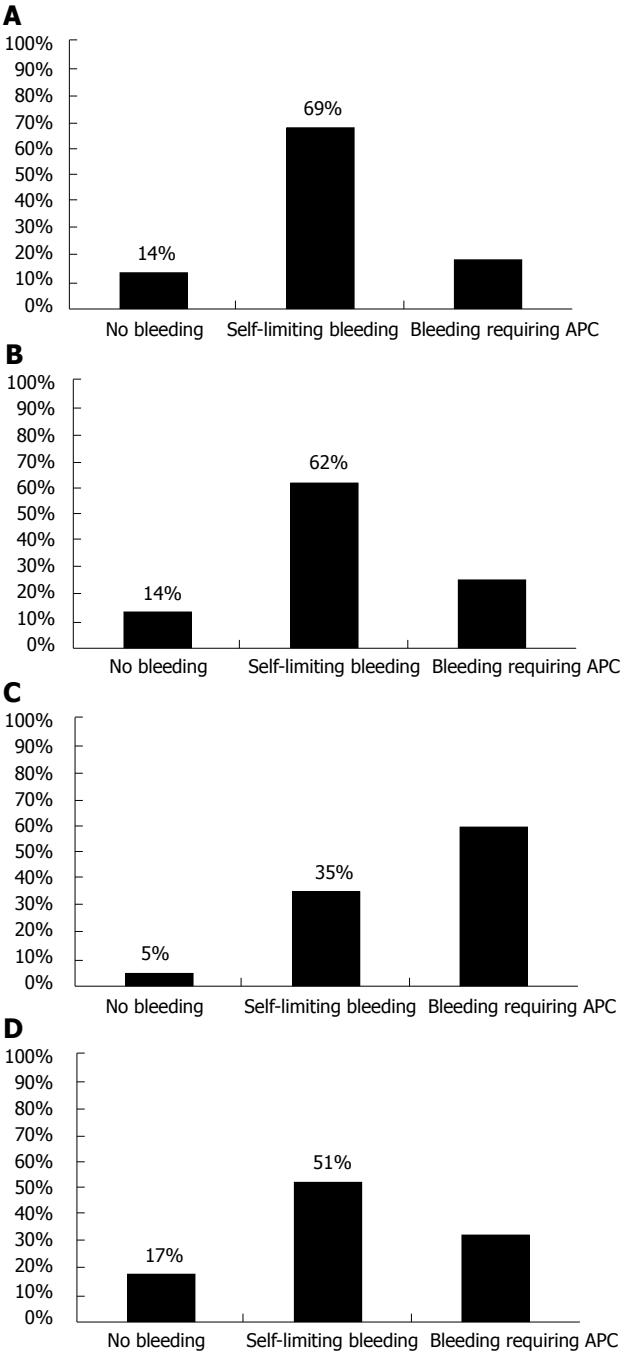

Figure 2 Occurrence of bleeding in mini-laparoscopic liver biopsies in regard to the underlying disease. A: Viral hepatitis; B: Autoimmune hepatitis; C: Cirrhosis; D: Other; APC: argon plasma coagulation.

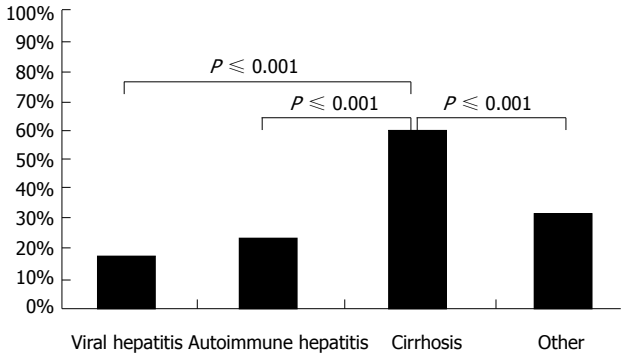

Figure 3 Occurrence of bleeding requiring argon plasma coagulation in regard to underlying disease.

liver biopsy. Indication for mini-laparoscopy and liver biopsy was for diagnosis of acute or chronic liver disease of unknown origin and for staging of cirrhosis. Patients with a history of abdominal surgery were not considered for mini-laparoscopy due to potential intra abdominal adhesions. Gender distribution was 55% males versus 45% females and the median age was 48 (± 14) years and 50 (± 14) years respectively. The etiology of the underlying liver disease is shown in Tables 1 and 2. Five hundred and fifty seven (52%) patients displayed minor self-limiting bleeding after the puncture of the liver and 161 (15%) showed no bleeding at all. In 353 cases (33%) of all mini-laparoscopic liver biopsies, prolonged bleeding occurred that required APC of the puncture site (Figure 1).

In order to determine whether the underlying liver injury influenced the risk and severity of bleeding, patients were stratified into four groups by type of liver disease: viral and autoimmune hepatitis, the most frequent disease entities; liver cirrhosis, the category with the highest expected risk of bleeding; and liver diseases of other origins. There were no significant differences in the severity of the bleeding between patients with viral and autoimmune hepatitis. Both groups displayed either no bleeding in 14% or self-limiting bleeding in 69% and 62% respectively. APC was used to treat bleeding in 17% of patients with viral hepatitis and in 24% of patients with autoimmune mediated liver disease (Figure 2A and B). In patients with liver cirrhosis, 5% of cases showed no signs of bleeding and 35% had only minor bleeding after liver biopsy (Figure 2C); APC was used in 60% of all cases. Patients with liver diseases of different origins than the ones mentioned above had no or mild bleeding in 17% and 51% respectively. APC was required in 32% of all cases (Figure 2D). Significant bleeding with the need for APC occurred with greater frequency in patients with liver cirrhosis compared to patients without advanced liver disease ($P \leqslant 0.001$, Figure 4).

DISCUSSION

Diagnostic laparoscopy is a valuable tool in the diagnosis of a variety of gastrointestinal illnesses. It is useful in the staging of upper GI-tract malignancies such as gastric

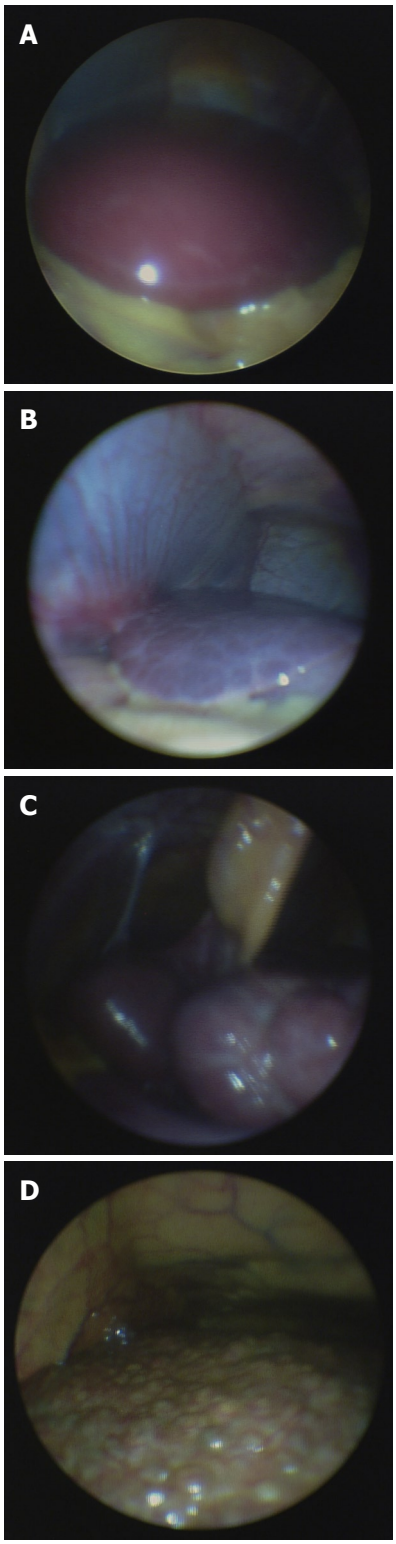

Figure 4 Laparoscopc images of different stages of liver disease. A: Healthy liver; B: Fibrotic liver; C: Macronodular cirrhosis; D: Micronodular cirrhosis.

and pancreatic cancer and sensitive for the diagnosis of peritoneal carcinosis[10-13]. When used for the evaluation of liver disease, it allows for a macroscopic inspection of the liver and the ability to perform targeted biopsies of focal lesions on the liver surface. Splenic biopsies can also be performed *via* a diagnostic laparoscopy[14]. For these diagnostic non-surgical procedures, the minimally invasive technique of mini-laparoscopy which requires smaller insertions to the abdominal wall than conventional laparoscopy has been shown to be useful[15].

In our study, we evaluated the occurrence and immediate management of bleeding after liver biopsy during mini-laparoscopy performed in an endoscopy unit. The primary reason for choosing mini-laparoscopy over percutaneous biopsy was to have the ability to treat potential bleeding complications and perform macroscopic evaluation of the liver since the severity of liver injury can be underestimated if based only on the histological result of the biopsy material[16]. Besides the additional macroscopic information, mini-laparoscopic liver biopsy enables the histological assessment of liver injury in patients with advanced cirrhosis where percutaneous biopsy would be contraindicated due to the high risk of a bleeding complication[17]. In this study, we demonstrate that bleeding from liver biopsy occurred significantly more frequently in patients with cirrhosis than non-cirrhotic patients, resulting in an increased need for APC of the biopsy site. Presumably as a result of APC, there were no major post-interventional bleeding complications in any patients. Liver biopsy was performed safely even in patients with decompensated Child C cirrhosis with portal hypertension and marked coagulopathy after administration of fresh frozen plasma and/or platelets.

Some recently published studies describe a lower risk than that of previous reports, indicating that the safety of this procedure has improved[18,19].

These findings confirm previously published data[20,21] where mini-laparoscopy showed similar safety data compared to percutaneous biopsy but mini-laparoscopy was more sensitive in assessing the severity of the liver disease.

In conclusion, mini-laparoscopy guided liver biopsy performed in an endoscopy unit is a safe and effective technique for the evaluation of patients with liver diseases. It enables the macroscopic assessment of the liver and the ability to perform liver biopsy in patients with high risk of bleeding, allowing for the management of complications and enabling histological diagnosis in patients with advanced liver disease or cirrhosis.

COMMENTS

Background

Histological assessment of liver injury still represents the most important diagnostic tool in the evaluation of liver diseases. However, percutaneous liver biopsy may be associated with bleeding complications in patients with advanced liver disease. Thus, a safe method for obtaining liver histology in this high risk patient population is crucial.

Research frontiers

Due to non-invasive assessment of liver fibrosis with fibroscan® technology or radiographic imaging, liver histology may not be necessary in some patients. However, to date, liver biopsy seems crucial in most cases. Whether non-invasive techniques will replace liver biopsy in the future remains to be determined by further research.

Innovations and breakthroughs

The authors demonstrated that the assessment of liver histology is possible even in critically ill patients with compromised liver function.

Applications

Mini-laparoscopy, not only a valuable tool for liver biopsy in patients with advanced liver disease, can also be used for tumor staging in patients with intra abdominal malignancies. Especially, peritoneal carcinosis can be detected in an early stage before visualization with radiological techniques is possible.

Peer reviews

Overall, this is an interesting and well written retrospective study about mini-laparoscopy and liver biopsy in a large series of 1071 consecutive patients. A prospective randomized control study of mini-laparoscopy versus percutaneous biopsy was recommended. However, patients with advanced liver disease or compromised liver function or blood coagulation should not be included in such a study as it is known that these patients have a higher risk of bleeding complications after percutaneous biopsy.

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BRIEF ARTICLES

Ultraslim endoscopy with flexible spectral imaging color enhancement for upper gastrointestinal neoplasms

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Abstract

AIM: To conduct a preliminary study on the effect of flexible spectral imaging color enhancement (FICE) used in combination with ultraslim endoscopy by focusing on the enhanced contrast between tumor and non-tumor lesions.

METHODS: We examined 50 lesions of 40 patients with epithelial tumors of the upper gastrointestinal tract before endoscopic submucosal dissection using ultraslim endoscopy with conventional natural color imaging and with FICE imaging. We retrospectively investigated the effect of the use of FICE on endoscopic diagnosis in comparison with normal light.

RESULTS: Visibility of the epithelial tumors of the upper gastrointestinal tract with FICE was superior to normal light in 54% of the observations and comparable to normal light in 46% of the observations. There was no lesion for which visibility with FICE was inferior to that with normal light. FICE visualized 69.6% of hyperemic lesions and 58.8% of discolored lesions better than conventional endoscopy with natural color imaging. FICE significantly improved the visibility of lesions with hyperemia or discoloration compared with normocolored lesions.

CONCLUSION: This study suggests that the use of FICE would improve the ability of ultraslim endoscopy to detect epithelial tumors of the upper gastrointestinal tract.

Key words: Ultraslim endoscopy; Upper gastrointestinal neoplasms; Flexible spectral imaging color enhancement

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INTRODUCTION

Recent practical application of ultraslim endoscopy has led to the rapid spread of transnasal endoscopy as a screening method that causes less pain than peroral endoscopy for the patient during esophago-gastro-duodenoscopy (EGD)[1,2]. Garcia *et al*[3] reported that ultraslim transnasal endoscopy required a significantly shorter recovery time with significantly lower costs for recovery rooms, personnel expenses, intravenous access devices and oxygen monitors compared to conventional peroral endoscopy with a sedated patient. In addition, transnasal ultraslim endoscopy is appropriate for patients with trismus, those who cannot accept insertion for peroral

endoscopy without sedation, and patients with stenosis of the upper gastrointestinal tract in the pharynx or lower regions[4].

However, there are some disadvantages caused by the downsizing of scopes. Compared with conventional endoscopy, ultraslim endoscopy provides less resolution due to the smaller number of pixels and less illumination. Lower power for supplying air and water necessitates a longer time for yielding good images and the smaller diameters of forceps channels limit the usable instruments, resulting in smaller specimens and less information from tissues from a biopsy. For these reasons, ultraslim endoscopy is mainly used for screening purposes rather than detailed close examination. Thus, the ability of ultraslim endoscopy for detection and early diagnosis of gastric cancer should be studied in detail.

Flexible spectral imaging color enhancement (FICE) is one of the diagnostic methods using specific light spectra based on spectral image processing technology (Fujinon Corporation, Saitama, Japan). Currently, it is mainly employed for detailed diagnostic workups for superficial lesions in the gastrointestinal tract using high-resolution magnifying endoscopy and is gradually spreading. Visible light consists of wavelengths from red to purple. A spectral image, the image captured by each wavelength, of a specific wavelength is electrically amplified and reconstructed to create a FICE image. FICE provides comparison of spectral images of diseased and surrounding normal areas for enhancement of the contrast by combining wavelengths with greater differences in signals[5,6].

In the present study, we focused on the enhanced color contrast between tumor and non-tumor areas in FICE images and conducted a preliminary retrospective study on the effect of FICE used in combination with ultraslim endoscopy for observation of superficial epithelial tumors of the upper gastrointestinal tract.

MATERIAL AND METHODS

Our institution introduced the ultraslim endoscopy system for EGD in April 2007 and had examined 380 patients, mainly for screening, by February 2008. During this period, we examined 53 lesions in 42 patients with epithelial tumors of the upper gastrointestinal tract who underwent endoscopic submucosal dissection (ESD). The examination was conducted using ultraslim endoscopy with conventional natural color imaging and with FICE imaging before ESD, after obtaining the consent of the patient. Based on the observation of these 53 lesions, we retrospectively investigated the effect of the use of FICE on the visibility of upper gastrointestinal tumorous lesions. The lesions consisted of 3 superficial carcinomas of the esophagus, 3 gastric non neoplastic polyps, 19 gastric adenomas and 28 early gastric cancers.

We used the EG-530N2 (tip diameter 5.9 mm, forceps channel diameter 2.0 mm, four-way bending; Fujinon Corporation, Saitama, Japan) for ultraslim endoscopy of the upper gastrointestinal tract. For FICE imaging, we selected a wavelength set of 525 nm (4), 495 nm (5) and 495 nm (4) for R, G and B respectively, which provides optimal illumination and highlights hyperemic changes commonly seen in epithelial tumors.

We used a five-point scale (Table 1) to evaluate the visibility of lesions which is related to the ability of screening to detect lesions, based on comparison of conventional images and FICE images mainly in long- and middle-distance views.

In addition, the lesions were classified as discolored, hyperemic or normocolored (no color differences from surrounding mucosa) for comparison of visibility in the observation with FICE. Fisher's exact probability test was used for statistical analysis.

Table 1 Five-point scale for evaluation of observation with flexible spectral imaging color enhancement

Point	Evaluation of observation with FICE
1	FICE fails to visualize lesions detectable with conventional images
2	FICE is slightly inferior to conventional images
3	FICE is comparable to conventional images
4	FICE is superior to conventional images
5	FICE allows detection of lesions not easily detected with conventional images or clearer visualization of areas poorly defined with conventional images

FICE: flexible spectral imaging color enhancement.

Table 2 Results of evaluation of visibility during observation with flexible spectral imaging color enhancement

Evaluation of FICE	1	2	3	4	5	Subtotal
Superficial carcinoma of the esophagus	0	0	2	1	0	3
Gastric non neoplastic polyp	0	0	3	0	0	3
Gastric adenoma	0	0	8	11	0	19
Early gastric cancer	0	0	11	17	0	28
	0	0	24	29	0	53

FICE: flexible spectral imaging color enhancement.

RESULTS

No lesions were graded 1 or 2, inferior to conventional images, for visibility with FICE. In 24 of the 53 lesions (45.3%), visibility with FICE was graded 3, comparable to conventional images. In 29 of the 53 lesions (54.7%), visibility with FICE was graded 4, superior to conventional images (Table 2, Figures 1-3).

Regarding color hue changes in the lesions, 17 of 25 lesions (68.0%) with hyperemic changes were better visualized with FICE than conventional images (FICE 4, Figures 1-3). Eleven of 18 discolored lesions (61.1%) were also better visualized with FICE. However, nine of ten normocolored lesions (90%) detected with conventional images were similarly visualized with FICE (Table 3). In short, FICE significantly improved the visibility of lesions with hyperemia ($P = 0.0027$) or discoloration ($P = 0.0159$) compared with normocolored lesions.

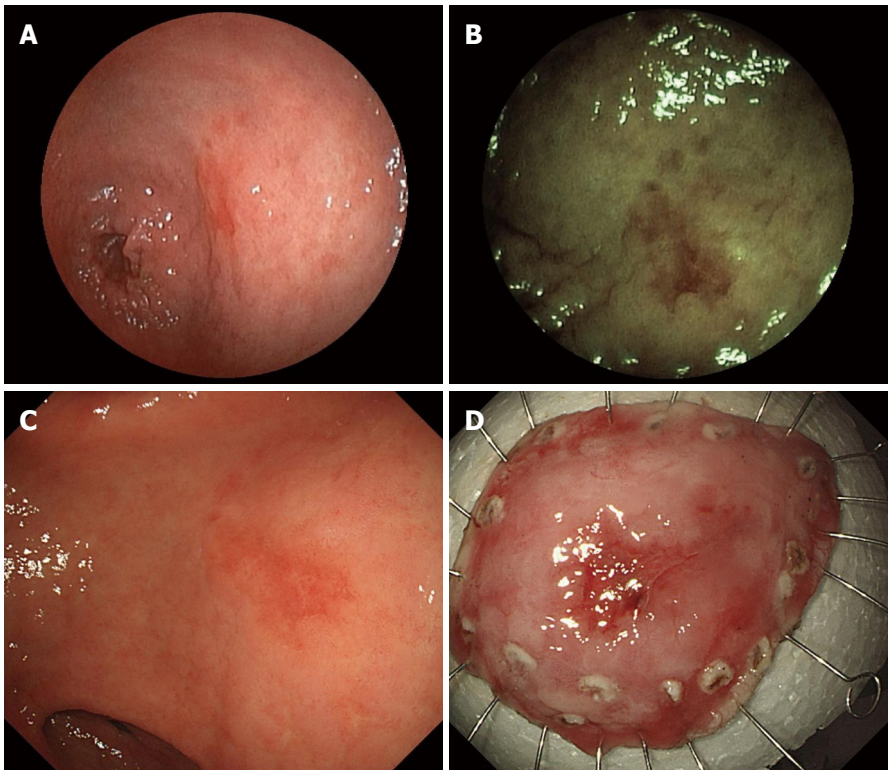

Figure 1 A slightly depressed lesion with hyperemia was found on the surface of the posterior wall of the lower body of the stomach. The hyperemia of the lesion is highlighted and the boundary is more clearly visualized with flexible spectral imaging color enhancement (FICE). The visibility with FICE was graded 4. Endoscopic submucosal dissection (ESD) was performed for local complete resection of the moderately differentiated adenocarcinoma limited to within the mucosa. A: Conventional image with ultraslim endoscopy; B: Image with FICE: The hyperemia of the lesion is highlighted and the boundary is more clearly visualized with FICE (FICE 4); C: Conventional image with conventional esophagogastroduodenoscopy; D: Dissected section after ESD.

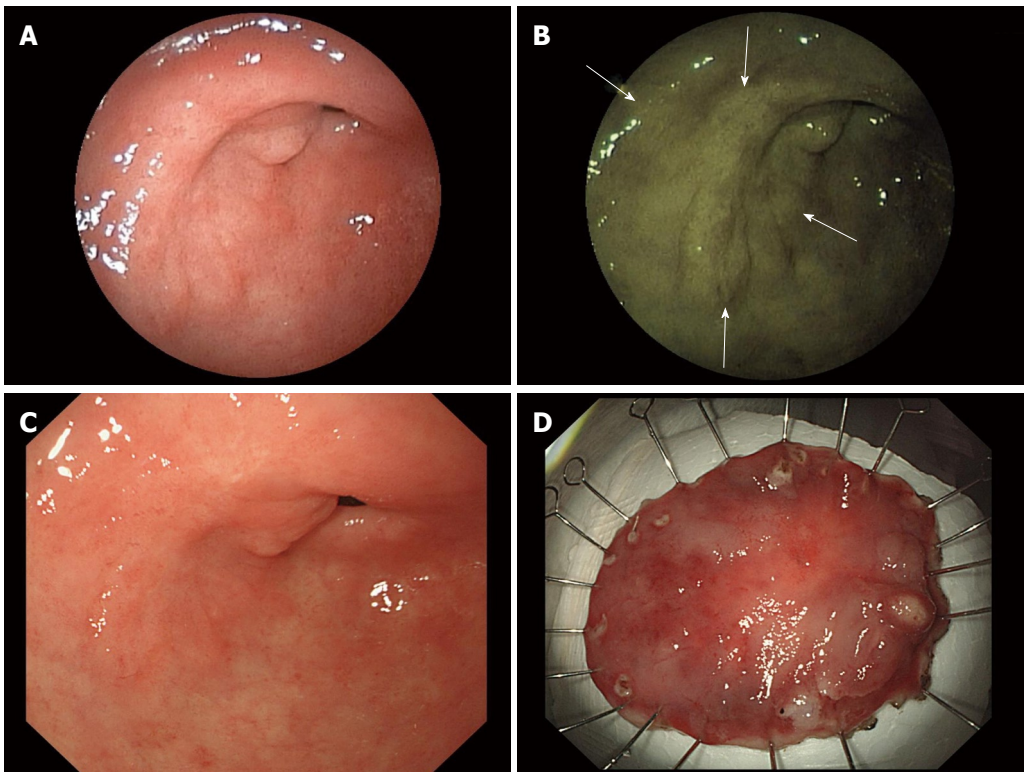

Figure 2 A discolored change was found in the anterior wall and surrounding areas of the gastric antrum. Color contrast between the lesion and surrounding mucosa with atrophic changes is highlighted and the boundary is more clearly visualized with flexible spectral imaging color enhancement (FICE). The visibility with FICE was graded 4. Endoscopic submucosal dissection (ESD) was performed for local complete resection of the well-differentiated adenocarcinoma limited to within the mucosa. A: Conventional image with ultraslim endoscopy; B: Image with FICE: Color contrast between the lesion and surrounding mucosa is highlighted and the boundary is more clearly visualized (FICE 4); C: Conventional image with conventional esophagogastroduodenoscopy; D: Dissected section after ESD.

DISCUSSION

To aid examination and diagnosis using conventional endoscopy, conventional chromoendoscopy with the spraying of a dye such as indigo carmine highlights the surface irregularities of lesions and is a common and very useful method for defining lesions. However, there are problems: additional costs for spraying the dye, the time involved and the inability to highlight the capillary patterns which is important for the early diagnosis of cancer[7].

Virtual chromoendoscopy systems were developed to correct these problems[5]. FICE uses spectral estimation technology to pick up different given wavelengths from all wavelength components from the CCD and produces images using arithmetical processing. FICE provides real-time switching at the flick of a switch. In addition,

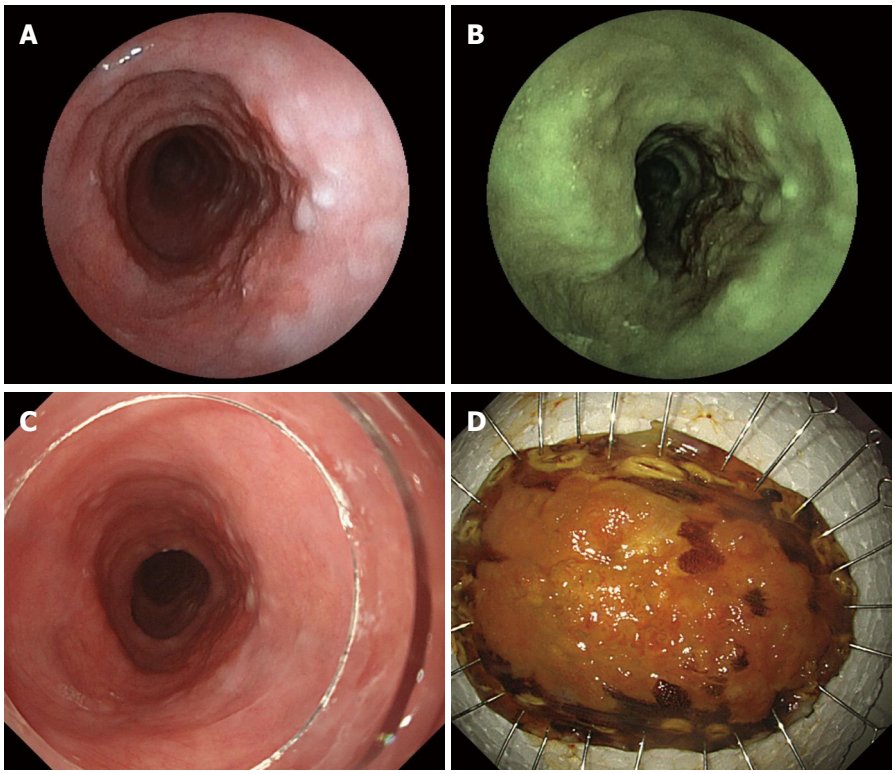

Figure 3 A rough, slightly elevated squamous lesion with hyperemia in a semicircle is found 25 cm distal from the superior incisor line. The hyperemia of the lesion is highlighted and the boundary is more clearly visualized with flexible spectral imaging color enwhancement (FICE). The visibility was graded 4. Endoscopic submucosal dissection (ESD) was performed for local complete resection of the squamous cell carcinoma including the muscularis mucosae. A: Conventional image with ultraslim endoscopy: A rough, elevated squamous lesion with hyperemia in a semicircle is found; B: Image with FICE: The hyperemia of the lesion is highlighted and the boundary is more clearly visualized with FICE (FICE 4); C: Conventional image with conventional esophagogastroduodenoscopy; D: Dissected section sprayed with Iodin after ESD.

Table 3 Evaluation of color hue changes and visibility of lesions with flexible spectral imaging color enhancement observation

Evaluation of FICE	1	2	3	4	5	Subtotal
Hyperemic[b]	0	0	8	17	0	25
Discolored[a]	0	0	7	11	0	18
Normocolored	0	0	9	1	0	10
	0	0	24	29	0	53

[a]P = 0.0159 *vs* Normocolored; [b]P = 0.0027 *vs* Normocolored; FICE: flexible spectral imaging color enhancement.

as FICE electrically amplifies spectral images of given wavelengths and reconstructs the images, it offers brighter images with subtle highlighted color changes and hyperemic areas on the surface of the mucosa[8]. Therefore, we obtained sufficient illumination for long-distance observation with FICE in all cases in this study.

FICE observation of superficial epithelial tumors of the gastrointestinal tract resulted in superior visibility for 54.7% and comparable visibility for 45.3% compared with conventional images. These results suggested that FICE would be useful as a diagnostic aid for ultraslim endoscopy which is becoming more common. FICE significantly improved the visibility of lesions with hyperemia (68.0%) and discoloration (61.1%) compared with conventional images. The results showed that, due to the characteristics of FICE, observation by ultraslim endoscopy with FICE more clearly visualized the color contrast between diseased and normal lesions than observation with conventional images. FICE was also expected to improve the visibility of lesions with color contrast in the mucosa in long-distance observation by lower-resolution ultraslim endoscopy.

Yoshida reported that a review of endoscopic observation of gastritis-like early gastric cancer diagnosed as benign by conventional endoscopy revealed discolored lesions in 29 of 132 cases (22.0%), hyperemic lesions in 83 cases (62.9%) and normocolored lesions in 20 cases (15.2%)[7]. These lesions, not easily diagnosed by conventional endoscopy, may be overlooked in observations with conventional ultraslim endoscopy. Of these lesions, discolored and hyperemic lesions accounted for 84.9%. FICE was considered to prevent overlooking lesions with such color changes.

This study suggests that the use of FICE would improve the ability of ultraslim endoscopy to detect epithelial tumors of the upper gastrointestinal tract under conditions without the spraying of a dye or a biopsy.

ACKNOWLEDGEMENTS

This study was conducted in collaboration with Fujinon Corporation (Saitama, Japan).

COMMENTS

Background

The reduction in the endoscope diameter would improve the acceptance of unsedated endoscopy. However, ultraslim endoscopy provides less resolution due to smaller number of pixels and less illumination. Flexible spectral imaging color enhancement (FICE) is one of the diagnostic methods using specific light spectra based on spectral image processing technology (Fujinon Corporation, Saitama, Japan). We focused on the effect of FICE used in combination with ultraslim endoscopy for observation of superficial epithelial tumors of the upper gastrointestinal tract.

Research frontiers

The analysis and enhancement of diagnostic accuracy of ultraslim endoscopy is a new frontier for upper gastrointestinal cancer surveillance.

Innovations and breakthroughs

FICE provides comparison of spectral images of diseased and surrounding normal areas for enhancement of the contrast by combining wavelengths with greater differences in signals.

Applications

Our study suggests that the use of FICE would improve the ability of ultraslim endoscopy to detect epithelial tumors of the upper gastrointestinal tract under conditions without the spraying of a dye or a biopsy.

Terminology

Ultraslim endoscopes: a shaft diameter of 6 mm or less which allows them to be passed through the nose or mouth. Flexible spectral Imaging Color Enhancement (FICE): Visible light consists of wavelengths from red to purple. A spectral image, the image captured by each wavelength, of a specific wavelength is electrically amplified and reconstructed to create a FICE image.

Peer review

Overall, the manuscript is good. The authors show flexible spectral imaging color enhancement could improve ultraslim endoscopy in detection of epithelial tumors of the upper gastrointestinal tract. Therefore I could recommend publication if several points were discussed.

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CASE REPORT

Duodenal tuberculosis presenting as gastric outlet obstruction: A case report

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Flores HB, Zano F, Ang EL, Estanislao N. Duodenal tuberculosis presenting as gastric outlet obstruction: A case report. *World J Gastrointest Endosc* 2011; 3(1): 16-19 Available from: URL: http://www.wjgnet.com/1948-5190/full/v3/i1/16.htm DOI: http://dx.doi.org/10.4253/wjge.v3.i1.16

Abstract

Gastric outlet obstruction is commonly associated with malignancies and peptic ulcer disease. However, when no malignancy is seen and the patient is non-responsive to conventional peptic ulcer treatment, other etiologies need to be explored. We report a case of gastric outlet obstruction due to duodenal tuberculosis. The patient is a 31 year old male who presented with 1 year history of recurrent epigastric pain and an a cute episode of vomiting. Endoscopy revealed duode nal stricture. Computed tomography scan showed pyloro antral thickening. The patient was referred to the surgery service and underwent an exploratory laparotomy and gastrojejunostomy. A duodenal mass and calcified lymph nodes were noted on exploration and biopsy revealed a tuberculous origin. The patient was started on anti-tuberculosis medications and had impro ved on discharge. Gastroduodenal tuberculosis is rare and pyloric stenosis resulting from tuberculosis is even rarer. This, however, should be considered in patien ts who come from areas where the disease is endemic.

Key words: Duodenal tuberculosis; Tuberculosis; Gastric outlet obstruction; Duodenal stricture

INTRODUCTION

Tuberculosis is a major health problem worldwide. In the Philippines, it is endemic. The most common manifestation is a pulmonary disease but involvement of the gastrointestinal tract is not uncommon. Gastrointestinal tuberculosis often involves the ileocecal region. The stomach as well as the duodenum are rare sites for tuberculosis and are usually a result of secondary spread from a primary pulmonary disease. An autopsy series reported an incidence of only 0.5%[1]. A primary case of gastroduodenal tuberculosis is an even rarer disease and only a few cases are reported in the literature[1-5].

CASE REPORT

A 31 year old male was admitted to our institution with a 1 year history of recurrent epigastric pain and an acute episode of vomiting. Epigastric pain was characterized as intermittent, mild and gnawing in character. The patient also reported a slight undocumented weight loss. No other associated signs and symptoms were noted. No medications had been taken and he had not consulted medical staff. The patient had an acute episode of vomiting, prompting a consultation and subsequent admission.

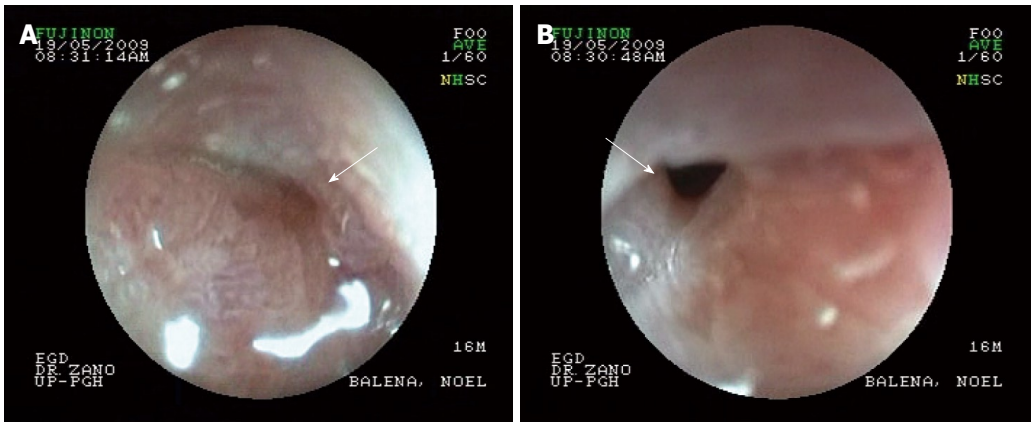

Figure 1 Endoscopic view of the 2nd part of the duodenal of the patient showing narrowing of lumen/stricture (white arrow). The gastroscope was unable to pass beyond this point.

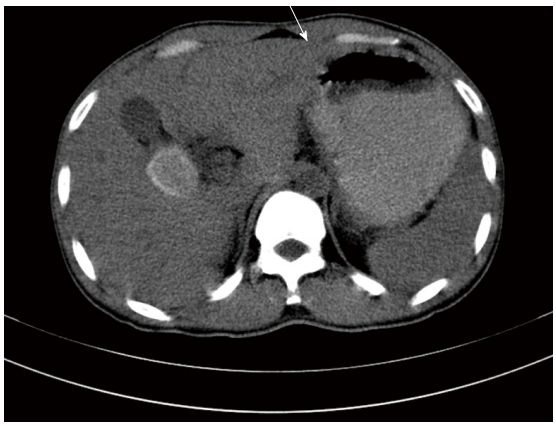

Figure 2 Abdominal computed tomography scan showing pyloroantral thickening and distended stomach.

The patient had no known co-morbidities and no history of hospitalization. He had no history of tuberculosis and no known exposure to the disease. The patient's family history was also unremarkable.

Physical examination only revealed direct tenderness in the epigastrium. There was no note of lymphadenopathies and the rest of the physical exam was unremarkable. Body mass index was 21. Complete blood count was within normal limits. Chest x-ray was normal. Esophago gastroduodenoscopy revealed duodenal stricture at the 1st part of the duodenum (Figure 1). Computed tomography of the whole abdomen showed pyloroantral thickening and a distended stomach (Figure 2). The impression then was gastric outlet obstruction secondary to duodenal stricture, probably secondary to peptic ulcer cicatrization to rule out duodenal malignancy.

The patient was referred to the surgical service. He underwent exploratory laparotomy and gastrojejunostomy. A duodenal mass and calcified lymph nodes were noted intraoperatively. Excision of the mass was done as well as biopsy of the calcified lymph nodes. Post-operative recovery was uneventful. On histopathological examination, a chronic granulomatous inflammation with Langhans-type giant cell in the duodenal wall and the calcified lymph node showed caseation necrosis and multi-loculated giant cells were noted (Figure 3A and B). The patient was then diagnosed as having duodenal stricture secondary to primary duodenal tuberculosis.

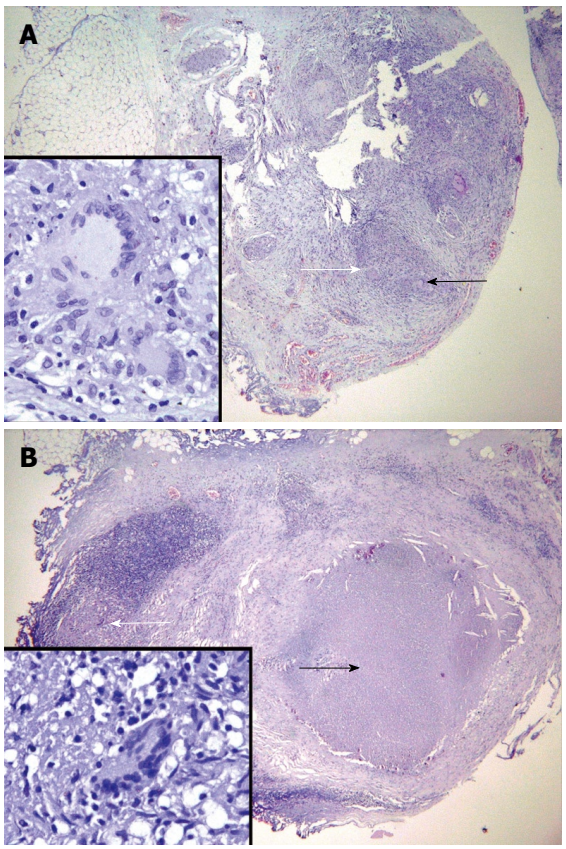

Figure 3 Histopathological examination image. A: Duodenal mass showing chronic granulomatous inflammation (white arrow) with Langhans-type giant cell (black arrow); B: Calcified lymph node showing caseation necrosis (black arrow) and a multinucleated giant cell (inset, white arrow).

The patient was started on quadruple anti-tuberculous medication and had improved on discharge. The patient was symptom free 3 mo later.

DISCUSSION

Gastric outlet obstruction is commonly associated with malignancies and peptic ulcer disease. However, when no malignancy is seen and a patient is non-responsive to conventional peptic ulcer treatment, other etiologies need to be explored. In this case, our patient presented with gastric outlet obstruction and a diagnosis of ulcer cicatrization was first made since it is one of the more common causes of duodenal strictures. Also, his young age made the diagnosis of malignancy less likely. Since the patient already presented with gastric outlet obstruction, surgery was deemed necessary for the patient and the diagnosis of gastroduodenal tuberculosis was made post-operatively. In other reported cases of gastroduodenal tuberculosis, medical management was a sufficient treatment modality[2]. However, for those presenting with obstruction, surgery may be necessary to relieve the obstruction and make the diagnosis.

The diagnosis of this disease is difficult and is often made post-operatively. There are no pathognomonic clinical features. A review of 23 consecutive cases of gastroduodenal tuberculosis (15 year span) in India noted that vomiting (60.8%) and epigastric pain (56.5%) are the most common presenting symptoms. Other symptoms noted are weight loss, upper GI bleeding and fever. The mean age at presentation in this series was 34.4 years with the duration of symptoms varying from 2 d to 15 years[1]. Most reported cases of duodenal tuberculosis come from areas with high prevalence of tuberculosis such as India and Africa. Hence, a high index of suspicion is needed when a patient is from a place endemic for tuberculosis. Another emerging concern is the increasing prevalence of Human Immunodeficiency Virus (HIV) infection. The annual risk of developing active tuberculosis when co-infected with HIV is 20-30 times the risk in non-HIV infected individual[6]. In the Philippines there is a low prevalence of HIV infection[7]. Thus, the HIV test was not done for this case since the patient had no high risk behavior. However, for those patients with risk factors (e.g. multiple sexual partners, men who have sex with men, intravenous drug users) and those from areas with high prevalence of HIV infection, testing for HIV co-infection may be beneficial. However, there is a lack of data on changes in the frequency or clinical manifestations of abdominal tuberculosis[6].

The radiological features of duodenal tuberculosis are also non-specific. On barium studies, patients were found to have either one or a combination of mucosal ulcerations, luminal narrowing, extrinsic compression and proximal dilatations[2]. Endoscopy may not be diagnostic and biopsies may only show nonspecific inflammation[8]. In our case, biopsy was not performed during endoscopy since the patient was already deemed to require surgery due to the obstruction. Most case reports also diagnosed duodenal tuberculosis post-operatively. Diagnosis is made through histopathological findings of caseation necrosis and Langhans type giant cell.

Management of duodenal tuberculosis is still primarily medical. Studies have shown that if the diagnosis is made prior to surgery, most lesions improve with appropriate treatment[9]. Even in patients with strictures, balloon dilatation has been shown to work together with medication[10]. In this case, no trial of medication was done since biopsy was not performed pre-operatively. Performing biopsy pre-operatively may have changed the management if the biopsy proved to be diagnostic. Also, performing a tuberculosis polymerase chain reaction test may have helped in the diagnosis if tuberculosis was made as part of the differentials. However, the cost-effectiveness of this study may need to be assessed.

In conclusion, gastroduodenal tuberculosis is rare and pyloric stenosis resulting from tuberculosis is even rarer. There are no specific signs or symptoms and no characteristic endoscopic findings. It is our recommendation that among patients with a similar presentation who come from areas endemic for tuberculosis, every effort should be made to confirm the diagnosis to avoid unnecessary surgeries.

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CASE REPORT

Endoscopic retrieval of a gastric trichobezoar

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Abstract

A 9-year-old girl presented with a chief complaint of abdominal pain. Esophagogastroduodenal endoscopy (EGD) identified a long and large gastric trichobezoar extending into the duodenum. We attempted endoscopic retrieval after informed consent was obtained from the patient's mother. Initially, a gasper with 5-prolongs, commonly used for retrieval of endoscopically excised polyps, failed to remove the whole trichobezoar. When a net was used instead, it proved impossible to remove the trichobezoar completely. Therefore, we withdrew the scope from the mouth, leaving the net grasping the tricobezoar firmly in the stomach. Subsequently, we were able to retrieve about 70% of the trichobezoar manually by grasping the snare part of the net directly. A second pass found no deep laceration or perforation endoscopically. The remaining trichobezoar was completely retrieved with the net. The procedure was completed within 15 min. The retrieved specimens were 34 cm in length and 100 g in weight. The patient was discharged uneventfully 5 d thereafter. She was advised to visit a psychiatrist to avoid suffering from a relapse. Follow-up EGD showed no trichobezoar, and the patient's frontal hair grew back.

Key words: Gastric bezoar; Trichobezoar; Endoscopic retrieval; Grasper; Retrieval net

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INTRODUCTION

Bezoars are collections of indigestible materials that accumulate to form a mass in the gastrointestinal tract. Most are commonly found in the stomach, and they can be categorized into five major groups: (1) phytobezoars; (2) pharmacobezoars; (3) trichobezoars; (4) lactobezoars; and (5) foreign body bezoars, according to their composition. Trichobezoars, composed of hair, usually occur in young women and cases which extend throughout the small bowel into the cecum, are known as the Rapunzel syndrome[1]. Gastric trichobezoars are generally more difficult to remove endoscopically and, thus, most reported cases require surgery[2]. Herein we report a case of a gastric trichobezoar successfully retrieved with endoscopy.

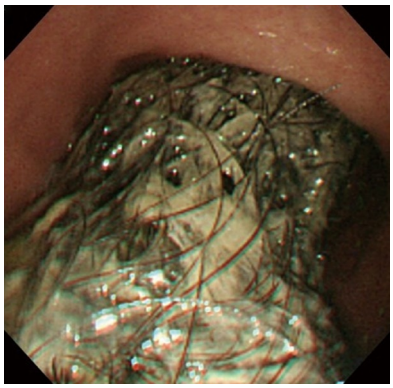

Figure 1 A transnasal esophagogastroduodenal endoscopy identified a long and large gastric trichobezoar ex tending into the duodenum.

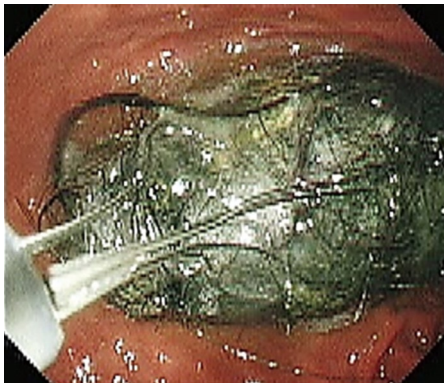

Figure 2 A standard gastroscope (GIFQ260; Olympus, Tokyo, Japan) was used for retrieval. A gasper with 5-prolongs (Olympus, Tokyo, Japan), commonly used for retrieval of polyps excised endoscopically, was used to retrieve the gastric trichobezoar.

CASE REPORT

A 9-year-old girl presented with a chief complaint of abdominal pain. She had experienced bullying at her elementary school for two years. Over the same period, her mother noticed her habit of trichotillomania (hair pulling) and trichophagia (hair eating). The girl was unconscious of this habit but had tried to vomit the eaten hair when it was noticed or she was warned. She had no prior history of medical problems or mental disturbance. At first, she visited a nearby hospital because of abdominal pain. Physical examination showed a healthy 9-year-old girl with a body weight of 33 Kg and a height of 1.33 m. There was frontal balding and mild tenderness without defense or rigidity in the epigastric region, although no abdominal mass was palpable. An abdominal computed tomography (CT) revealed an inhomogenous mass in the stomach. Therefore, she was sent to our hospital for further investigation and treatment. Laboratory data were within normal limits except for a slight elevation of C-reactive protein (CRP; 1.3 g/dL).

Endoscopic technique

A transnasal esophagogastroduodenal endoscopy (EGD) identified a long and large gastric trichobezoar extending into the duodenum (Figure 1). We attempted endoscopic retrieval after informed consent had been obtained from the patient's mother. A standard gastroscope (GIFQ260; Olympus, Tokyo, Japan) was used after intravenous administration of midazolam (7 mg). To avoid bowel movement and to relax the lower esophageal sphincter, scopolamine butylbromide (20 mg) was administered intravenously before endoscopic removal. Carbon dioxide (CO_2) was administered using a CO_2 regulator (Olympus UCR; Olympus, Tokyo, Japan) connected to the endoscope supply tube for insufflation during the endoscopic procedure.

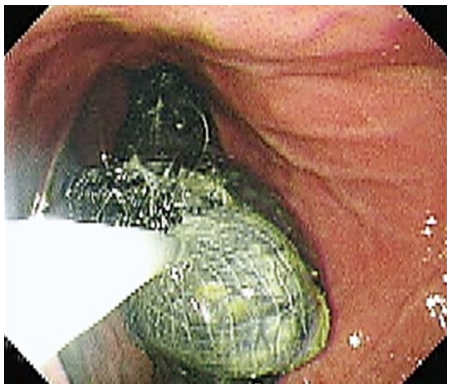

Figure 3 A net for collecting the removed colorectal polyps was used instead of a grasper for endoscopic retrieval.

Initially, we used a gasper with 5-prolongs, commonly used for retrieval of endoscopically excised polyps, (Olympus, Tokyo, Japan). However we could only remove completely the portion of the trichobezoar present in the stomach as passage of esophagogastric junction (EGJ) was impossible (Figure 2). We then attemted retrieval using a net, also commonly used for retrieval of excised colorectal polyps (Figure 3). The trichobezoar did pass EGJ in part but we could not retrieve the whole of it with the endoscope. Therefore, we withdrew the scope from the mouth leaving the net grasping the trichobezoar firmly in the stomach. Subsequently, we were able to retrieve about 70% of the trichobezoar manually by grasping the snare part of the net directly. A second pass found mild erosion at the EGJ, although no deep laceration or perforation was detected endoscopically. The remaining trichobezoar was completely retrieved with the net. The whole procedure was electronically recorded and was completed within 15 min. The retrieved specimens were 1.8 cm × 3.2 cm × 34 cm in length and 100 g in weight (Figure 4). The patient was discharged uneventfully 5 d after endoscopic retrieval. She was advised to visit a psychiatrist to avoid suffering from a relapse. Follow-up EGD showed no trichobezoar, and her frontal hair grew back.

DISCUSSION

Endoscopic retrieval or surgical removal are chosen for bezoar removal based on the size and composition. As gastric trichobezoars are generally more difficult to remove endoscopically, most of the reported cases required surgery[2]. Laparoscopic removal is cosmetically

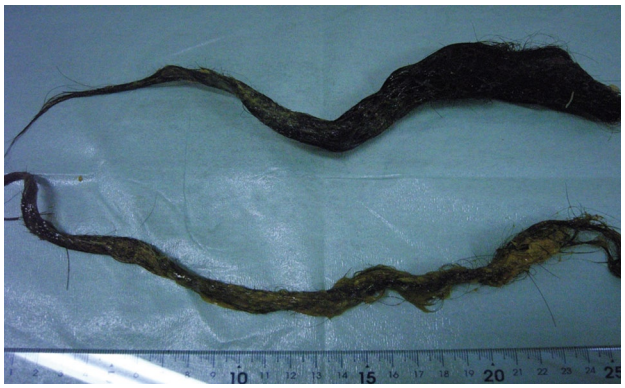

Figure 4 The retrieved specimens were 1.8 cm × 3.2 cm × 34 cm in length and 100 g in weight.

superior to open laparotomy[3,4]. However, if possible, endoscopic removal is less invasive and can save time, cost and abdominal damage. To the best of our knowledge, however, there are only two successful cases reported in the English literature[5,6]. Soehendra used a Nd: YAG laser to disrupt the bezoar followed by the retrieval of its fragments, requiring more than 100 passages of the endoscope in three sessions of 2 to 3 h[5]. This procedure is, therefore, troublesome and needs special equipment. Meanwhile, Saeed carried out successful retrieval using a two-channel endoscope, an overtube, and a grasping forceps with the patient under intubation[6].

In our case, we used a single channel endoscope, a grasper, and a net to remove the trichobezoar completely in one session (two passages of endoscope) with the patient under sedation and without intubation. We conducted the endoscopic procedure under sedation instead of general anesthesia after discussion with the anesthetists and pediatric surgeons in our hospital. We would have performed the procedure under general anesthesia if we could not have completed the endoscopic retrieval safely within 30 min. The shape of the trichobezoar in our case was most important for successful endoscopic retrieval. If the maximal diameter had been too large to pass the esophagogastric junction, we would not have been able to retrieve it endoscopically. Considering the whole procedure retrospectively, the grasping power of a grasper with 5-prolongs was not as great as that of a net, although the trichobezoar could not be removed with the endoscope even used together with a net. If we had used a two channel endoscope backloaded with an overtube according to Saeed's suggestion, the bezoar would have been grasped more firmly, enabling the passage of the EGJ more easily. However, holding the snare part of the net directly following withdrawing the endoscope from the mouth, eventually enabled us to retrieve the grasped trichobezoar successfully. Furthermore, we used CO_2 insufflation to avoid esophageal perforation associated with laceration caused by endoscopic retrieval.

In conclusion, we have reported a case of a gastric trichobezoar successfully retrieved endoscopically using a net made for polyp retrieval. Endoscopic removal of a gastric trichobezoar is less invasive and cost effective than surgical removal and this procedure should, therefore, be considered as an option for treatment with various endoscopic accessories.

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Meetings

Events Calendar 2011

January 14-15, 2011
AGA Clinical Congress of Gastroenterology and Hepatology: Best Practices in 2011
Miami, FL 33101, United States

January 20-22, 2011
Gastrointestinal Cancers Symposium 2011
San Francisco, CA 94143, United States

January 28-29, 2011
9. Gastro Forum München
Munich, Germany

February 04-05, 2011
13th Duesseldorf International Endoscopy Symposium
Duesseldorf, Germany

February 13-27, 2011
Gastroenterology: New Zealand CME Cruise Conference
Sydney, NSW, Australia

February 24-26, 2011
Inflammatory Bowel Diseases 2011-6th Congress of the European Crohn's and Colitis Organisation
Dublin, Ireland

February 24-26, 2011
2nd International Congress on Abdominal Obesity
Buenos Aires, Brazil

February 26-March 1, 2011
Canadian Digestive Diseases Week
Westin Bayshore, Vancouver
British Columbia, Canada

March 03-05, 2011
42nd Annual Topics in Internal Medicine
Gainesville, FL 32614, United States

March 14-17, 2011
British Society of Gastroenterology Annual Meeting 2011
Birmingham, England, United Kingdom

March 17-19, 2011
41. Kongress der Deutschen Gesellschaft für Endoskopie und Bildgebende Verfahren e.V.
Munich, Germany

March 17-20, 2011
Mayo Clinic Gastroenterology & Hepatology 2011
Jacksonville, FL 34234, United States

March 25-27, 2011
MedicReS IC 2011 Good Medical Research
Istanbul, Turkey

April 07-09, 2011
International and Interdisciplinary Conference Excellence in Female Surgery
Florence, Italy

April 15-16, 2011
Falk Symposium 177, Endoscopy Live Berlin 2011 Intestinal Disease Meeting, Stauffenbergstr. 26
Berlin 10785, Germany

April 18-22, 2011
Pediatric Emergency Medicine: Detection, Diagnosis and Developing Treatment Plans
Sarasota, FL 34234, United States

April 20-23, 2011
9th International Gastric Cancer Congress, COEX, World Trade Center, Samseong-dong
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April 25-27, 2011
The Second International Conference of the Saudi Society of Pediatric Gastroenterology, Hepatology & Nutrition
Riyadh, Saudi Arabia

April 28-30, 2011
4th Central European Congress of Surgery
Budapest, Hungary

May 07-10, 2011
Digestive Disease Week
Chicago, IL 60446, United States

May 12-13, 2011
2nd National Conference Clinical Advances in Cystic Fibrosis
London, England, United Kingdom

May 21-24, 2011
22nd European Society of Gastrointestinal and Abdominal Radiology Annual Meeting and Postgraduate Course
Venise, Italy

May 25-28, 2011
4th Congress of the Gastroenterology Association of Bosnia and Herzegovina with international participation, Hotel Holiday Inn
Sarajevo, Bosnia and Herzegovina

June 11-12, 2011
The International Digestive Disease Forum 2011
Hong Kong, China

June 13-16, 2011
Surgery and Disillusion XXIV Spigc II ESYS, Napoli, Italy

June 22-25, 2011
ESMO Conference: 13th World Congress on Gastrointestinal Cancer
Barcelona, Spain

September 10-11, 2011
New Advances in Inflammatory Bowel Disease
La Jolla, CA 92093, United States

September 10-14, 2011
ICE 2011-International Congress of Endoscopy, Los Angeles Convention Center, 1201 South Figueroa Street
Los Angeles, CA 90015, United States

September 30-October 1, 2011
Falk Symposium 179, Revisiting IBD Management: Dogmas to be Challenged, Sheraton Brussels Hotel
Brussels 1210, Belgium

October 19-29, 2011
Cardiology & Gastroenterology Tahiti 10 night CME Cruise
Papeete, French Polynesia

October 22-26, 2011
19th United European Gastroenterology Week
Stockholm, Sweden

October 28-November 02, 2011
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Washington, DC 20001, United States

November 11-12, 2011
Falk Symposium 180, IBD 2011: Progress and Future for Lifelong Management, ANA Interconti Hotel, 1-12-33 Akasaka, Minato-ku
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2011 Advances in Inflammatory Bowel Diseases/Crohn's & Colitis Foundation's Clinical & Research Conference
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Instructions to authors

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The major task of *WJGE* is to report rapidly the most recent results in basic and clinical research on gastrointestinal endoscopy including: gastroscopy, intestinal endoscopy, colonoscopy, capsule endoscopy, laparoscopy, interventional diagnosis and therapy, as well as advances in technology. Emphasis is placed on the clinical practice of treating gastrointestinal diseases with or under endoscopy. Papers on advances and application of endoscopy-associated techniques, such as endoscopic ultrasonography, endoscopic retrograde cholangiopancreatography, endoscopic submucosal dissection and endoscopic balloon dilation are also welcome.

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squared test, Ridit, probit, logit, regression (linear, curvilinear, or stepwise), correlation, analysis of variance, analysis of covariance, *etc*. The reviewing points include: (1) Statistical methods should be described when they are used to verify the results; (2) Whether the statistical techniques are suitable or correct; (3) Only homogeneous data can be averaged. Standard deviations are preferred to standard errors. Give the number of observations and subjects (*n*). Losses in observations, such as drop-outs from the study should be reported; (4) Values such as ED50, LD50, IC50 should have their 95% confidence limits calculated and compared by weighted probit analysis (Bliss and Finney); and (5) The word 'significantly' should be replaced by its synonyms (if it indicates extent) or the *P* value (if it indicates statistical significance).

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6 21st century heart solution may have a sting in the tail. *BMJ* 2002; **325**: 184 [PMID: 12142303 DOI:10.1136/bmj.325.7357.184]

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15 Morse SS. Factors in the emergence of infectious diseases. Emerg Infect Dis serial online, 1995-01-03, cited 1996-06-05; 1(1): 24 screens. Available from: URL: http://www.cdc.gov/ncidod/eid/index.htm

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16 **Pagedas AC**, inventor; Ancel Surgical R&D Inc., assignee. Flexible endoscopic grasping and cutting device and positioning tool assembly. United States patent US 20020103498. 2002 Aug 1

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