RESEARCH ARTICLE

Pancreaticobiliary Ductal Anatomy in the Normal Population

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Abstract

Background: The complex anatomy of the pancreaticobiliary duct was crucial in management of pancreatic and biliary tract disease. Materials and Methods: Fresh specimens of pancreas, common bile duct (CBD), and duodenum were obtained en bloc from autopsies of 160 patients. Results: Ninety-three male and 67 female patients were included. The length of the pancreas ranged from 9.8-20 cm (mean, 16.20 +/- 1.70 cm). The intrapancreatic portion of the CBD showed patterns of three types: most common (85.30%) was type A, in which the anterior surface of the common bile duct was totally covered, while its posterior surface was partially covered, by the pancreatic parenchyma. On dissection of the accessory duct of Santorini, the accessory duct was traceable to the duodenal wall in 67.6%. The anatomy of the Wirsung-choledochus confluence was grouped into five different types. The common channel was found in 75.60% and its length varied from just a common junction (so-called "V-type" anatomy) to 15 mm (Y-type-b). Separate papillae (so-called "II-type") were found in 15.3% of specimens. Conclusions: Several important points regarding the anatomy of the pancreaticobiliary junction and pancreatic ductal system were illustrated in this study.

Keywords: Pancreaticobiliary duct - pancreaticoduodenectomy - pancreatic disease - distal pancreatectomy

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Introduction

The complex anatomy of the pancreaticobiliary duct was crucial in management of pancreatic disease. It is useful not only for pancreaticoduodenectomy or distal pancreatectomy, but also for limited resection of the pancreas for low-grade malignancy such as mucin-producing tumors or cystic lesions of the pancreas. We have reported pancreaticobiliary anatomy in Thai people and demonstrated several important points regarding the anatomy of the pancreaticobiliary junction and pancreatic ductal system in a Thai population (Wilasrusmee and Pongchairerks, 1999). Due to the background of uncertainty regarding the significance of these anatomical variations, and because precise data is still lacking. We used simple methodology carried out this study to add some basic data for this complex anatomical region and sought to confirm the pattern of this complex anatomy that might be helpful in surgery for pancreatic cancer.

Materials and Methods

Fresh specimens of the pancreas, common bile duct, and duodenum were obtained en bloc from the autopsies of 160 patients who had died of causes not related to trauma or disease of these organs. Dissection of pancreaticobiliary duct area was performed according to previously described in our report (Wilasrusmee and Pongchairerks, 1999). The length of each pancreas was measured with Vernier caliper. Vertical transaction of pancreatic body was performed at 1cm left to the superior mesenteric vessels.

After the major pancreatic duct was identified, cannulation was performed with a 5-Fr polyethylene tube towards the pancreatic head(Figure 1). Methylene blue was injected via this cannula in order to delineate the pancreatic ducts and the major and minor pancreatic papillae. The duodenum was opened and the sites of major and minor papillary openings were identify according to the methylene blue flowed out of them. Subsequently, the cannula was removed and the pancreas was then retransected at its head, 1 cm right of the superior mesenteric vessels. After this transection, another 5-Fr polyethylene tube was cannulated through the pancreatic duct until it traversed the papilla of Vater. The common bile duct was then opened and a 6-Fr polyethylene tube was passed into it towards the papilla. Dissection of the pancreatic ducts stained with methylene blue and the two ducts cannulated as described was carefully performed to identify Intrapancreatic portion of the common bile duct, ducts of Wirsung and Santorini, openings of the common bile duct and pancreatic ducts on the duodenal mucosa, and common channel (junction of the common bile duct and pancreatic duct). The locations of the major pancreatic duct at the previously transected surfaces of its head and

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body, which were 1 cm right and 1cm left of the superior mesenteric vessels were located in relation to the anterior, posterior, superior, and inferior surfaces of the pancreas.

Results

Ninety-three male and 67 female patients were included in this study. Their ages ranged from 15 to 78 years (mean 35.38 +/- 10.98 years). The length of the pancreas ranged from 9.8-20 cm (mean, 16.20 +/- 1.70 cm). The intrapancreatic portion of the common bile duct showed patterns of three types; most common (85.30%) was type A, in which the anterior surface of the common bile duct was totally covered, while its posterior surface was partially covered, by the pancreatic parenchyma. On dissection of the accessory duct of Santorini, the accessory duct was traceable to the duodenal wall in 67.56%. The anatomy of the Wirsung-choledochus confluence was grouped into five different types.

The classification of ductal structure and common channels was done according to Skandalakis et al. (1997). The common channel (junction of the common bile duct and pancreatic duct) was found in 75.60% of specimens and its length varied from just a common junction (so-called "V-type" anatomy) to 15 mm (Y-type-b). Y-type: a, with a short common channel 1.5-10 mm in length was found in 52.60% (Figure 2) and Y-type: b, with a common channel longer than 10 mm was found in 19.45%.Separate papillae (so-called "II-type") were found in 15.27% of specimens. Separate openings in the same papilla (so-called "U-type") were found in 12.68% of specimens. The Wirsung duct at the pancreatic neck was most often located posterior and superior in relation to the surface of pancreas.

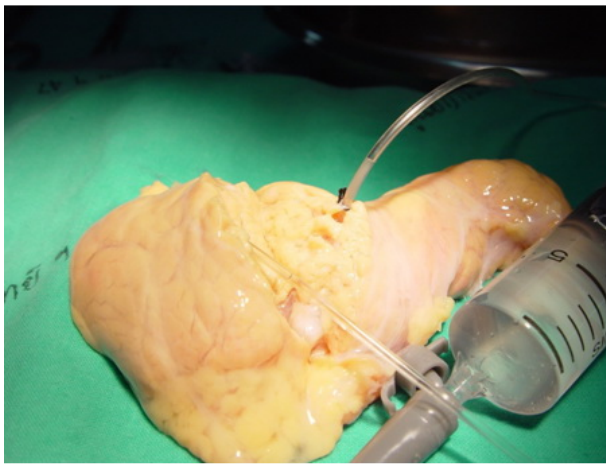

Figure 1. Cannulation of major pancreatic duct

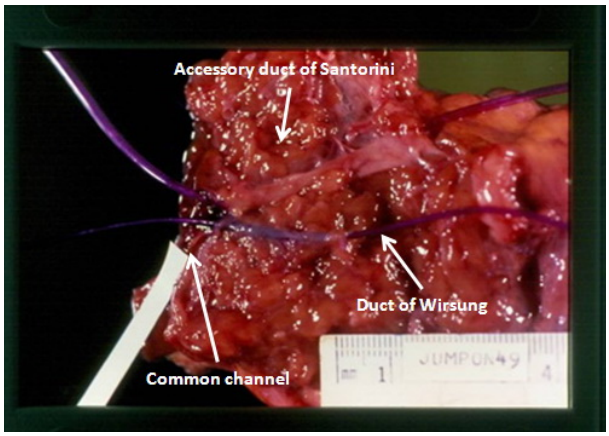

Figure 2. Short common channle of Wisung-choledochus confluence

Discussion

In this study, length of the pancreas, the location of the pancreatic ducts in relation to the surface of the pancreas, the length and types of the common channels, as well as the anatomy of the ampulla, were studied, using methylene blue infusion via the pancreatic duct cannulation and careful dissection. Variation in the anatomy of the peri-ampullary region has frequently been reported in the literature. However, most of these reports were derived from radiological studies, by endoscopic retrograde cholangio-pancreaticography (ERCP) or magnetic resonance cholangio-pancreaticography. In this report, we confirmed our previous studied by dissection fresh specimen postmortem, using simple methodology which could be utilized in any centers. The advantage of this type of study, in contrast to radiological methods, was that one could virtually realize the three-dimensional relationship of each structure, without the use of sophisticated radiological or computerized interpretation.

However, three-dimensional imaging has been recently developed to evaluate this anatomical relation(Miyamoto et al., 2014). Standard procedure of measurement may be difference from post-mortem. It would be relevant to compare and describe the standard measurement from each modality. Pancreaticobiliary reflux (PBR) can occurs when enzyme-rich pancreatic juice refluxes from the pancreatic duct into the lower pressure biliary tree. This pathological reflux can occur either because of an anatomically abnormal pancreaticobiliary junction or because of a functionally impaired sphincter of Oddi, despite a normal radiological appearance. The pancreaticobiliary maljunction (PBM) is defined as pancreatic and bile ducts joining outside of the duodenal wall with a long common channel which was first described in 1916 in association with choledochal cyst formation (Alkhatib et al., 2012). However, the incidence and significance of this condition is still controversial (Kamisawa et al., 2003; Alkhatib et al., 2012). PBM is an important anatomical finding due to its association with gall bladder and bile duct carcinoma, even in the absence of radiological abnormality such as dilated or cystic malformation of biliary tree (Deng et al., 2011; Yoshida et al., 2013). Carcinogenic effect of the pancreatic reflux to the biliary mucosa may play an important role in both benign and malignant conditions of the biliary tree (Ogura et al., 1999; Williams et al., 2012). Common pancreaticobiliary channels have been reported to occur in 11%-80% of populations (Wilasrusmee and Pongchairerks, 1999). In this study, the prevalence was 76.70%; however, the prevalence of long common channels (Y-type: b) was greater than that reported by previous report (Kamisawa et al., 2002) (19.45% versus 4%, respectively).

The possible clinical significance of the anatomy of the pancreaticobiliary duct makes it important to study which types, and the limits of variation, that can be regarded as "normal", and the relative risk when some patients demonstrate what is considered to be "anomalous" anatomy. Junctional union between the common bile duct (CBD) and the pancreatic duct outside the duodenal wall has an abnormal position beyond the influence of the sphincter of Oddi (Testoni et al., 2006). In this pathologic condition, reflux of pancreatic juice into the biliary tract system occurs because of the lack of Oddi's sphincter function (Toouli and Craig, 2000; Beltran, 2012). It is frequently associated with various pancreaticobiliary diseases, including choledochal cyst, bile duct cancer, gallbladder cancer, gallbladder adenomyomatosis, recurrence pancreatitis, and pancreas divisum (Wang et al., 1998; Takuma et al., 2012). The presence of an accessory pancreatic duct was shown by careful dissection in this study to have occurred in 56.31% of the specimens, similar to data reported previously (Wilasrusmee and Pongchairerks, 1999; Tanaka, 2002). However, the minor papilla was clearly demonstrated in only 8.74% of our sample by the methylene blue injection method. If this finding is valid, it may suggest that most of the accessory ducts in our specimens drained into the Wirsung ducts instead of draining into the minor papillae. In other words, the duct of Santorini was present in complete form and opened into the minor papilla in only 8.74% of our population. The II-type, with two separate papillae, one papilla for the common bile duct and another papilla for the pancreatic duct was found in 15.72%.

In this study, we included only patients without periampullary disease. Correlation between anatomical variation and periampullary disease cannot be analyzed. The knowledge of the complex anatomical relation is crucial for diagnosis and management, however the anatomy variations related to the pathogenesis of diseases cannot be shown in this study.

In conclusion, several important points regarding the anatomy of the pancreaticobiliary junction and pancreatic ductal system were illustrated in this study. Comparing to previous report, we found similar prevalence of pancreaticobiliary duct anatomy and its variation. Some of these data were different from those reported in the literature for other population groups. These results can be used in pancreatic cancer surgery.

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