TERMINATION PATTERN OF THE MAIN AND ACCESSORY PANCREATIC DUCTS AMONG TANZANIANS

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ABSTRACT

The pancreas has the main and occasionally a patent accessory pancreatic ducts that carry secretions to the duodenum. Anatomical studies on these ducts are limited. The present study observed the anatomy of the two ducts in eighty six Tanzanians' autopsy subjects to find out if the pattern is similar to those reported from other populations. The patent accessory pancreatic duct, and common channel formed by union of accessory pancreatic duct and common bile duct were present in 29.1% and 7% respectively, and shorter common channels formed by the main pancreatic and common bile duct were observed. These are novel findings and have not been reported before. The variations on the pattern of the two ducts have anatomical and clinical implications. Adequate knowledge of these variations is important for clinical and surgical procedures of the pancreaticobilliary system.

Key words: Pancreas; Pancreatic ducts, Common bile duct; Duodenum

INTRODUCTION

Smaller ducts collect the secreted contents from the exocrine pancreas into the larger pancreatic duct (PD) that opens into the second part of the duodenum (Standring, 2005). Two pancreatic ducts have been described draining the pancreas. They include the main pancreatic duct (of Wirsung) which drains the tail, body and neck of the pancreas, and the accessory pancreatic duct (of Santorin) which is not commonly seen as patent duct and normally drains into main pancreatic duct (MPD). However, the accessory pancreatic duct (APD) has been described to be patent and working in 9% of the population (Moore and Dalley, 2006) draining the head of the pancreas and opens directly into the minor duodenal papilla.

Termination of the MPD occurs in two ways; the commonest form is where it joins the common bile duct (CBD) before traversing the duodenal wall. In the second form, it opens directly into the duodenum without joining the CBD (Karp *et al.,* 1993; Standring, 2005).

Termination patterns involving the MPD and APD in African subjects have received little attention and therefore studies are needed to document the anatomy of these ducts. In the present study, we observed termination patterns of the two pancreatic ducts among Tanzanian population in specimens obtained during autopsy and dissection, and compare with pattern reported from other populations.

MATERIALS AND METHODS

Eighty-six autopsy subjects from Muhimbili National Hospital mortuary were used in this study regardless of their age or sex following ethical clearance. Convenience sampling was conducted due to availability of subjects. Subjects with any history of abdominal surgery or grossly abnormal pancreas were excluded from the study. Midline surgical incision on anterior abdominal was done to expose pancreas and duodenum. Duodenum was opened to display the duodenal papilla and the

estimated entrance point for the PD and CBD on the outer surface of the duodenal wall was made. MPD and APD were exposed by removal of some pancreatic tissues on the dorsal aspects of the pancreas starting from the junction of the ducts on the duodenal wall or CBD, then proceeding towards the tail of the pancreas. Duodenal wall was dissected to expose the intramural portion of the ducts. For subjects with a common channel (CC), the length of the channel was measured by placing a thread on entire length of the duct and then measured on a ruler. Photographs of the patterns were taken.

RESULTS

Number of pancreatic ducts

Observations on the ducts that drained the pancreas showed 61 (70.9%) cases had one PD that opened into the duodenum, while 25 (29.1%) showed two PD; these were MPD and APD (**Figure 1**). However, among these cases, the APD united with the CBD to form a CC in 6 (7%) male subjects and non-in female (**Figure 2**). The MPD and APD enter separately into the duodenal wall and open on the major and minor duodenal papilla respectively.
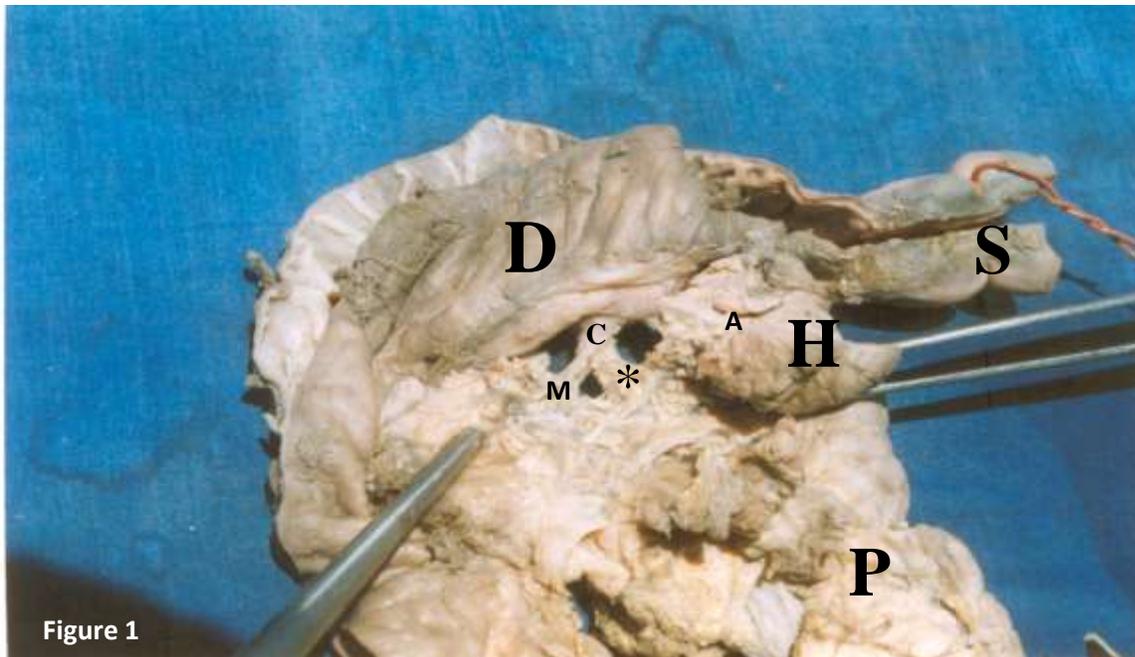
Figure 1: Photograph of the pancreas (**P**) and duodenum (**D**) from an adult male cadaver showing the main pancreatic duct (**M**) and the accessory pancreatic duct (**A**). The main pancreatic duct (**M**) unites with the common bile duct (**Asterisks**) to form a common channel (**C**). The accessory pancreatic duct (**A**) from the head of the pancreas (**H**) opens directly into the duodenum (**D**) through the minor duodenal papilla. Note the distal part of the stomach (**S**).

Union of the common bile duct and pancreatic duct

Observations revealed the union of the PD and CBD in 54(62.8%) cases (49 adult males and 5 adult females); while 32(37.2%) cases (all males) did not show union between the two ducts. Union appeared to be extramural or intramural on the duodenal wall. Extramural union was present in 15 (17.4%) cases. Here the PD

joined the CBD obliquely between 2 -10 mm from the duodenal wall. The resulting CC measured 0.7cm – 1.5 cm long and traversed the duodenal wall to open into the major duodenal papilla. Intramural union was observed in 39 (45.3%) cases of those who had union of the two ducts. In these cases the PD and CBD entered the duodenal wall separately but they united within the duodenal wall to form CC that opened into a

single duodenal papilla and single duodenal opening. Their fusions were revealed following dissection of the duodenal wall but with variations in positions of the union. These included union too close to the duodenal wall and some within the duodenal mucosa. This union resulted into the formation of a common duodenal ampula (common channel) which measured between 1 - 3 mm long.

Figure 2: Photograph of the pancreas (**P**) and duodenum (**D**) from an adult male cadaver showing main pancreatic duct (**M**), the accessory pancreatic duct (**A**) and the common bile duct (**Asterisks**). The main pancreatic duct (**M**) enters separate into the duodenum (**D**) while, the accessory pancreatic duct (**A**) from the head of the pancreas (**H**) unites with the common bile duct (**Asterisks**).

DISCUSSION

Previous studies on the PD and CBD have shown that they may enter the duodenal wall separately or join together forming a CC before opening into the duodenal lumen [Karp *et al.,* 1993]. But interestingly in this study, the termination pattern of these two ducts was found to be variable, and involved the presence of APD and the length of the CC.

Among 86 of the studied cases, 70.9% had one PD that drained the pancreas to the duodenum, while in 29.1% there were two;

MPD and APD. This implies that the frequency of APD is much higher among Tanzanians than those reported elsewhere [Kitunguu, 2006, Moore and Dalley, 2006]. In previous studies, it has been reported that only 9% of people had complete separate and working APD that open into the duodenum at the minor duodenal papilla [Moore and Dalley, 2006]. Past studies proposed that its presence might be linked with a lower incidence of acute pancreatitis [Gambill, 1976; Kamisawa, 2004; Kamisawa *et al.*, 2003a; Kamisawa *et al.*, 2003b]

Clinical studies have showed that patients who suffer from acute pancreatitis have non-patent APD [Matsumoto *et al.*, 2001]. It is thought to prevent acute pancreatitis by lowering the pressure in the MPD [Kamisawa *et al.*, 2003a; 2003b] by acting as a collateral channel. In Tanzania like many other African countries, there are no studies on the anatomy of the APD and its association with the incidence of acute pancreatitis. Hence this calls for further research on its significance.

In normal anatomy, the MPD joins the CBD to form a CC that enters the second part of the duodenum [Ackerman, 1981; Gambill, 1976; Moore and Dalley, 2006] but in some cases may open separately [Reuber and Montgomery, 1982].

Interestingly, in this study we observed that the APD joined the CBD forming a CC that entered duodenum in 7% (6) of subjects. These observations have not yet been documented, indicating further variations on the anatomy of the pancreas among Tanzanians. However, the significance of APD in its union with the CBD is not clearly known.

In the previous studies, it has been shown that a CC can be formed extramurally or intramurally before it enters the duodenum [Reuber and Montgomery, 1982]. Generally, the intramural channels are shorter than the extramural channel. In the current study, both channels appear to be shorter than the reported parameters. Extramural channels appeared to have a range of 0.7cm -1.5cm in length compared to reported length of 0.8cm -1.9cm and 0.5cm -5cm [Kitunguu, 2006; Matsumoto *et al.*, 2001]. By definition, a long channel is the one which is longer than 1.5 cm [Kamisawa, 2004; Kamisawa *et al.*, 2003b], but in this study, we observed CC with average length of 1.01cm. This provides clue that, the Tanzanians do have shorter CC. The significance of this observation is not clearly understood at this time although past studies have associated long CC with a higher incidence of pancreatitis [Ackerman, 1981; Karp *et al.*, 1993].

In conclusion, the course and termination pattern of the PD among Tanzanians is slightly different from those reported elsewhere. They have higher frequency of functional APD, and shorter CC compared to other reported findings and it is formed either by the union of the CBD and MPD or by the union of CBD and APD. The union of APD with CBD needs further investigation to elucidate its surgical and clinical significance in relation to pancreatitis and cholelithiasis. Adequate knowledge on these anatomical variations is important to clinicians and surgeons during routine procedures involving the pancreaticobillary system.

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