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Research Article

Duodeno-pancreas ducts: Study by injection dissection method (about 30 cases)

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ABSTRACT

Introduction: Advances in imaging, endoscopy and histo embryology have provided new anatomical knowledge of the pancreas, the mapping of its ducts and its segmentation. These anatomical data have important clinical applications and open up new surgical perspectives, notably limited tumour resections within the head of the pancreas with preservation of the integrity of the duodenum and the bile duct. We performed a preliminary study of the configuration of the duodeno pancreas ducts.

Material and methods: We studied the ducts of 30 pancreases taken from 27 fresh cadavers of African melanoderma subjects and 3 cadavers of Caucasian subjects stored in cold storage, using the injection and dissection method.

Results: The accessory pancreatic duct was present in 21 of 30 cases and opened into a permeable minor duodenal papilla in 10 of 21 cases. The configuration of the accessory pancreatic duct was classic, arising from the main pancreatic duct and running transversely above it to the medial aspect of the second duodenum. The most common configuration of the hepato pancreatic ampulla was the "Ya" type of flati's classification, found in 43.3% of cases, while the "Yb" type accounted for 20% of cases. Drainage of the pancreatic uncus was mainly by branches of the main pancreatic duct in 29 out of 30 cases; in one case, it presented a double drainage by the main and accessory pancreatic ducts.

Conclusion: Our results, with a few variations, are similar to those found in the literature, with the exception of the results for drainage of the uncus.

Keywords: Anatomical, African melanoderma, Duodenum, Caucasian, Pancreatic duct

INTRODUCTION

Advances in imaging, endoscopy and histo embryology have provided new anatomical insights into the pancreas, the mapping of its ducts and its segmentation. These anatomical data have important clinical applications and open up new surgical perspectives, including tumour resections limited to the head of the pancreas with preservation of the integrity of the duodenum and bile duct [1-4]. We performed preliminary work on the configuration of the duodeno pancreas ducts using dissection and injection, two very accessible techniques, to see if our results corroborate those of recent work.

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MATERIALS AND METHODS

We studied duodenum pancreas parts from 27 fresh cadavers of African melanoderma subjects during forensic autopsy in the pathological anatomy departments of Aristide Le Dantec hospital in Dakar and from 3 cadavers of Caucasian subjects preserved in the cold room of the anatomy laboratory in Saint-Etienne (France) after injection of Winkler solution. Among the subjects, we counted 22 men and 5 women. The average age of the subjects was 52 years with extremes ranging from 16 to 87 years. After removal of the duodeno-pancreatic block, the right border of the second duodenum was opened to the full height to access the duodenal mucosa. The mucosa was examined for major and possibly minor duodenal papillae. Then the bile duct was catheterized with a cut off perfusion tube. The pancreas was then transected vertically over its entire height with a scalpel at the level of its body, just to the left of the superior mesenteric

vessels. The main pancreatic duct was located in the sectional area and catheterized by a 18G or 20G venous catheters. Methylene blue stained water was injected into the catheter by hand pressure to locate the duodenal papillae and to study their patency. Subsequently, colored resin or paint dye was injected into the pancreatic and common bile ducts in the anterograde direction. After a waiting period of 2 hours, we proceeded with the dissection of the parenchyma by exposing the intra pancreatic ducts until they terminated at the duodenal mucosa. The cephalo isthmic configuration of the pancreatic ducts, including the uncus and the characteristics of the hepato pancreatic ampulla were studied. The flati classification was used to specify the mode of constitution of the hepato pancreatic ampulla (Figure 1) [5].

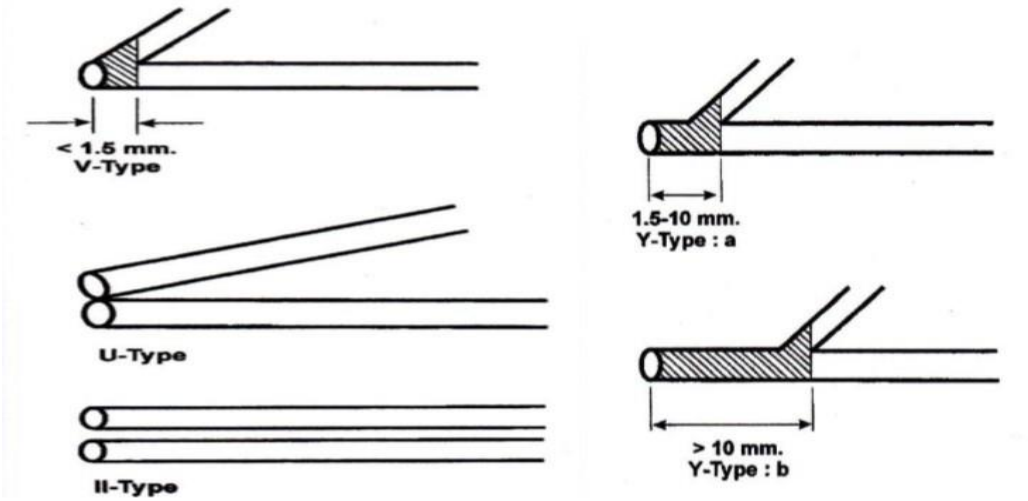

Figure 1. Variations of the hepato pancreatic ampulla according to flati.

RESULTS

Existence of the accessory pancreatic duct

The presence of an accessory pancreatic duct was noted in 21 out of 30 cases (70% of cases).

Configuration of the accessory pancreatic duct

The accessory pancreatic duct had a classic configuration; it originated from the main pancreatic duct at the level of the head of the pancreas or isthmus and ran transversely to the medial border of the 2nd duodenum above the main pancreatic duct, which in contrast bent downwards (Figure 2).

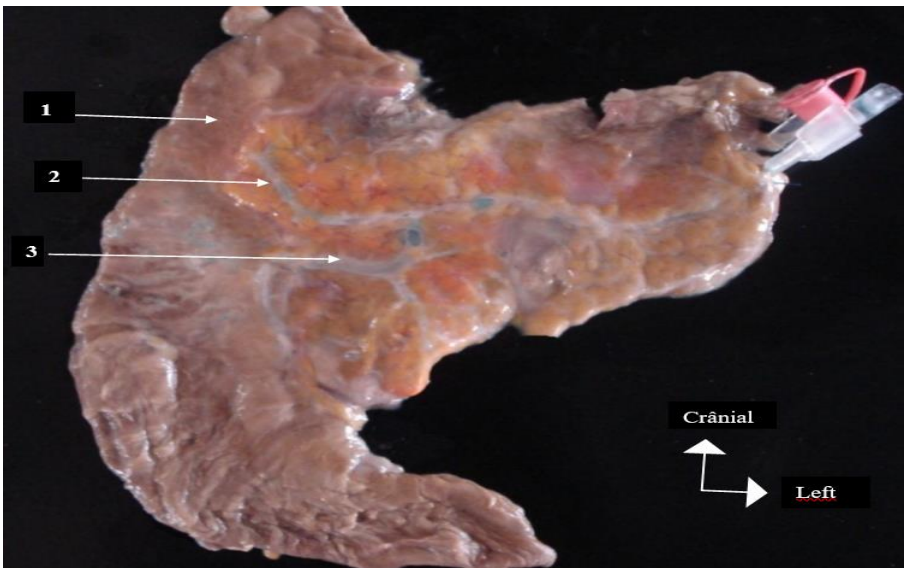

Figure 2. Anterior view of the pancreatic ducts.
1: duodenum
2: accessory pancreatic duct
3: main pancreatic duct

Permeability of the minor duodenal papilla

The minor duodenal papilla was permeable in only 10 of 30 cases (33.3% of cases) after injection of methylene blue into the main pancreatic duct upstream of the accessory pancreatic duct. In 11 cases, methylene blue injected into the accessory pancreatic duct did not cross the duodenal wall.

Configuration of the hepato pancreatic ampulla

In all cases, the junction of the bile duct with the main pancreatic duct was at the level of a hepato pancreatic ampulla, but in a variable manner. This ampulla always terminated at a single major duodenal papilla. According to flati's classification, in 19 cases out of 30 (63.33% of cases), the hepato pancreatic ampulla was "Y" shaped with a common portion between the common bile duct and the main pancreatic duct of more than 1.5 mm (Figure 3).

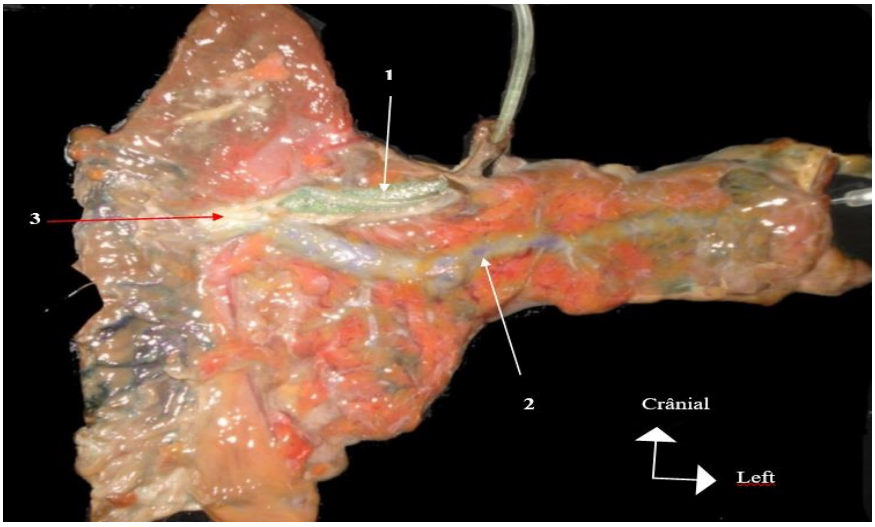

Figure 3. Anterior view of the hepato pancreatic ampulla in a "Y" type
1: bile duct
2: main pancreatic duct
3: common biliary pancreatic portion

We also noted 5 cases (16.67%) of the "V" type with a common portion between the common bile duct and the main pancreatic duct of less than 1.5 mm (Figure 4).

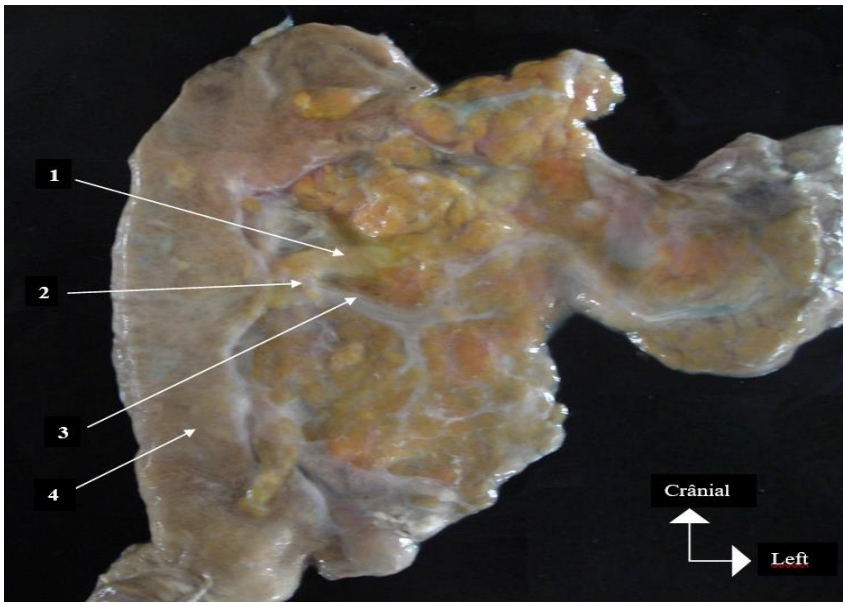

Figure 4. Hepato pancreatic V-shaped ampulla.
1: bile duct
2: common bilio pancreatic duct
3: main pancreatic duct

4: 2nd duodenum mucos

Table 1 shows the different modes of junction between the bile duct and the accessory pancreatic duct found in our study.

Table 1. Distribution of subjects according to the flati classification.

Flati classification	Number	Percentage (%)
II	3	10
U	3	10
V	5	16,7
Ya	13	43,3
Yb	6	20
Total	30	100

Drainage of the pancreatic uncus

The uncus of the pancreas was drained by ducts which in all cases drained into the main pancreatic duct (Figure 5).

In one case, we observed a double drainage: The anterior part of the pancreatic uncus was drained by a branch of the accessory pancreatic duct and the posterior part by branches of the main pancreatic duct (Figures 6 and 7).

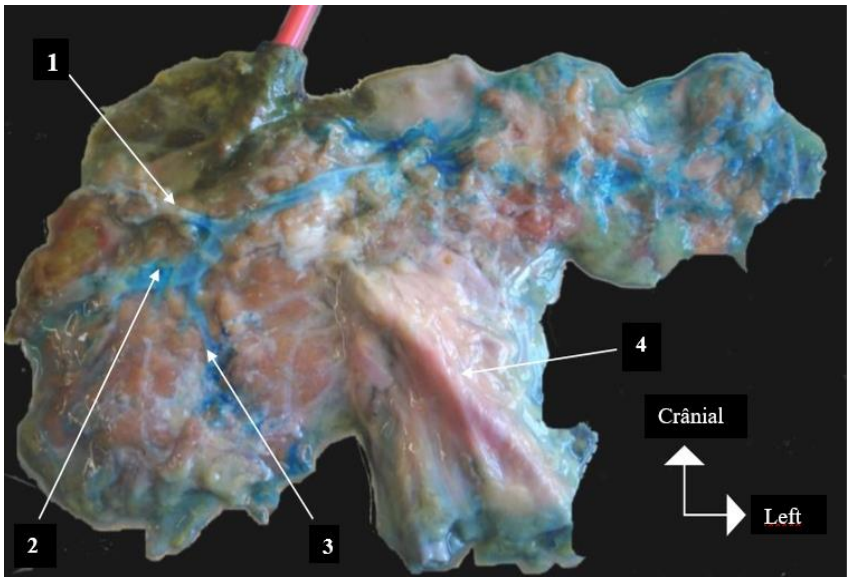

Figure 5. Drainage of the uncus through the main pancreatic duct.
1: accessory pancreatic duct
2: main pancreatic duct
3: branch of the main pancreatic duct draining the uncus
4: inferior mesenteric vessels

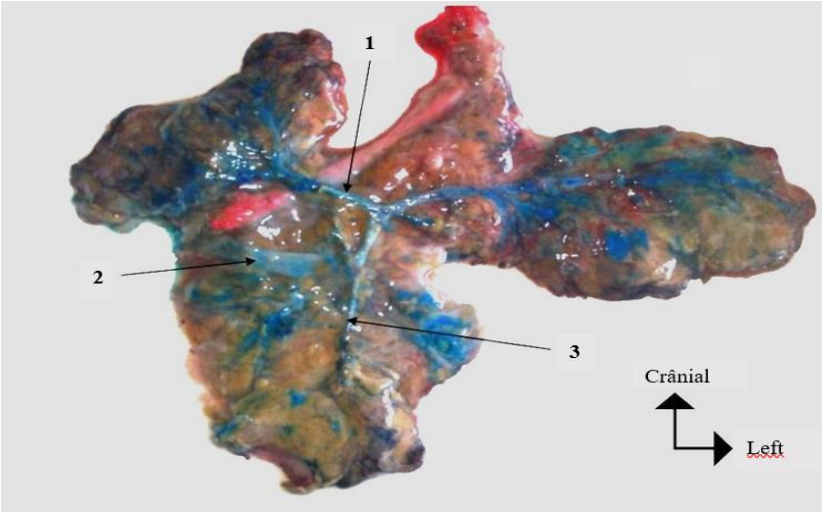

Figure 6. Double drainage of the pancreatic uncus.
1: accessory pancreatic duct
2: main pancreatic duct
3: branch of the accessory pancreatic duct draining the uncus

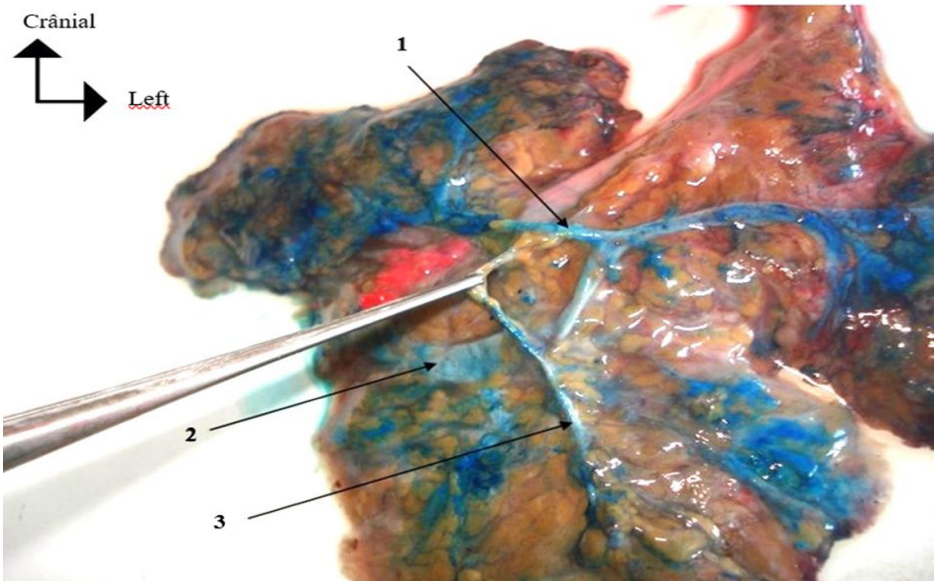

Figure 7. Double drainage of the pancreatic uncus.
1: accessory pancreatic duct
2: main pancreatic duct
3: branch of the accessory pancreatic duct draining the uncus

DISCUSSION

Accessory pancreatic duct and patency of the minor duodenal papilla

In our study, the accessory pancreatic duct was present in 70% of cases and opened into a patent minor duodenal papilla in 10 of 21 cases (47.6% of cases). These proportions are similar to those in the literature. Schmitt found a much higher rate of existence of accessory pancreatic duct (94.1%) [6]. The interest of the existence of the accessory pancreatic duct and its permeability lies in the fact that it constitutes a sort of safety valve by reducing the pressure in the main pancreatic duct. According to the work of Nowak, the absence of an accessory pancreatic duct is a factor in pancreatitis; he found that only 17% of patients with pancreatitis had an accessory pancreatic duct compared to 69% of the control group [7].

In our study, the rate of permeable minor duodenal papillae (33.3%) is similar to that of Millbourn, *i.e.* 33% in a series of 182; Kamisawa found a rate of 43% in retrograde endoscopic pancreatography [8,9]. In the light of the various studies, the proportion of subjects with a permeable minor duodenal papilla varies between one third and one half of the population studied, with one exception: Wilasrusmee reported 8.74% of permeable minor duodenal papillae on injection of methylene blue in 103 pancreases taken from Thai subjects [10].

Configuration of the hepato pancreatic ampulla

Over the years, several classifications of pancreatic ducts have been proposed; including that of Millbourn modified by Sigfusson and that of Dawson [11,12]. In addition, classifications specific to the morphology of the hepato pancreatic ampulla were proposed in the 1990's by Skandalakis and flati [13]. We used the one of flati because it is more recent, and it was also used by Wilasrusmee with a working methodology similar to ours.
In Table 2, we note a clear predominance of the "Ya" type I about half of the cases. The percentage of "Yb" type concerns case out of 5 in the series of wilasrusmee and ours but is found more rarely in 1 individual out of 20 in the series of flati [14].

Table 2. Morphology of the Hepatopancreatic Ampulla (HPA).

Type d'AHP	Flati (N=49)	Jirasiritham (N=160)	Wilasrusmee (N=103)	Our study (N=30)
Ya	57,2%	52,6%	49,51%	43,3%
Yb	4%	19,45%	18,45%	20%
V	14,3%	-	8,74%	16,7%
U	22,4%	12,68%	10,68%	10%
II	2,1%	15,27%	12,62%	10%
Total	100%	100%	100%	100%

The "Yb" type is very important because it corresponds to subjects with a common portion between the bile duct and the pancreatic duct that is long enough, *i.e.* greater than 10 mm; if this common portion exceeds 15 mm, it is considered pathological. Several studies including those of Komi and Schweitzer have shown that a long common portion is a factor in the occurrence of congenital bile duct cysts [15]. Other authors such as Kimura, Misra and Yamauchi have shown that this long common portion is a high risk factor for gallbladder carcinoma related to the reflux of pancreatic fluid into the bile ducts. In this regard, authors such as Thomas and Arnaud recommended prophylactic cholecystectomy in the 1980's [16-20].
The fact that the bile duct and the pancreatic duct have a separate orifice as in flati's type "II" has an important clinical impact because, according to the work of Kubota and Misra, it favours the occurrence of biliary lithiasis by the stasis it causes in the bile duct. This is generally the least common, if not uncommon, type of abruption. We did not find it in our series, probably due to the small size of the sample.
The anatomical study of the hepato pancreatic ampulla in the population is interesting because it allows the identification or estimation of groups at risk for the occurrence of certain pathologies of the biliopancreatic tract.

Drainage of the pancreatic uncus

In our study, the drainage of the pancreatic uncus is mainly provided by branches of the main pancreatic duct (9 cases out of 10) and in one case, more precisely in a Caucasian subject, there is a double drainage by the main and accessory pancreatic ducts. This situation has been described by several anatomists and they consider drainage of the pancreatic uncus through the accessory pancreatic duct to be exceptional. According to Sigfusson, the accessory pancreatic duct only drains the uncus if the main pancreatic duct is missing [21]. Yatto and Siegel stated that drainage of the uncus by a branch from the accessory pancreatic duct was a simple anatomical variation [22].
However, recent work by Takahashi on 15 cases concludes that there is a constant double drainage of the uncus of the pancreas: The anterior part of the head of the pancreas is drained by the accessory pancreatic duct while the posterior part of this head is drained by the accessory pancreatic duct [23]. This thesis is explained by the work of Suda who proposed a new pancreatic segmentation on an embryological basis [24]. According to him, the ventral bud would give the posterior and inferior part of the head of the pancreas and the majority of the uncus while the dorsal bud would give the anterior and superior part of the head, part of the uncus, the body and the tail of the pancreas. As the ventral bud gives the distal part of the main pancreatic duct, while the dorsal bud gives the accessory pancreatic duct, this results in a double drainage of the head and uncus of the pancreas. Thus, he proposes to segment the pancreas into 4 parts, namely the anterior part of the head, the posterior part of the head, the body and the tail of the pancreas. Other authors such as Takada propose a similar pancreatic segmentation. The interest of the question lies in the surgical applications which result from it, in particular the partial segmentectomies at the level of the head of the pancreas. In this regard, Sakamoto states that anterior or posterior segmentectomy of the head of the pancreas corresponds to the resection of the embryological dorsal and ventral buds. Schmitt who carried out work in France on drainage of the uncus found results halfway between ours and those of the Japanese studies. Out of 17 subjects, she found 10 cases of drainage of the uncus by branches of the main pancreatic duct, 3 cases by the accessory pancreatic duct and 4 cases of double drainage. In the light of recent work and the surgical perspectives it opens up, the study of drainage of the uncus of the pancreas deserves further investigation. Differences in results between studies can be explained by racial variations, but also by methodology, as the dissected parts do not always expose all the drainage branches of the pancreatic head. An injection corrosion series of pancreatic ducts could be a good complement to our work.

CONCLUSION

Our results, with a few variations, are similar to those found in the literature, except for the results concerning the drainage of

the uncus. Our results do not corroborate the recent thesis of the double drainage of the uncus of the pancreas by the main and accessory pancreatic ducts. Before drawing conclusions, it is necessary to increase the size of our series to a significant threshold, but also to use complementary methods to dissection such as injection corrosion to improve the knowledge of the pancreatic ducts in the African melanoderma subject.

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