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ORIGINAL ARTICLE

Mesopancreas: Myth or Reality?

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ABSTRACT

Context A recently published study hypothesized the concept of 'mesopancreas', defining it as a firm, well-vascularized structure extending from the posterior surface of the pancreatic head to behind the mesenteric vessels. **Objective** To verify and define mesopancreas from resection specimens obtained from fresh cadavers. **Design** Postmortem anatomical-pathological study. **Setting** Department of Surgery in conjunction with the Departments of Forensic Medicine and Pathology, Government Medical College and Hospital, Jabalpur, MP, India. **Participants** Twenty fresh adult cadavers without any intra-abdominal injury or gross intra-abdominal pathology. **Interventions** Specimens containing the entire duodenum, pancreatic head and neck, gallbladder, cystic duct, common bile duct, superior mesenteric vessels, inferior vena cava and aorta were removed en-bloc. Gross and histopathological examinations of the specimens were carried out. **Main outcome measures** To look for a fibrous sheath or fascia around the retropancreatic structure purported to be a mesopancreas. **Results** Loose areolar tissue, adipose tissue, peripheral nerve, nerve plexus, lymphatic and capillaries were found in the retropancreatic tissue, extending from the head, neck and uncinate process of pancreas to the aorto-caval groove but no fibrous sheath or fascia was found around these structures. **Conclusions** The concept of 'mesopancreas' is anatomically unfounded.

INTRODUCTION

The prognosis of pancreatic cancer is poor, even for those patients who undergo surgical resection. The high rate of positive resection margins after seemingly R0 resections and early recurrences in the pancreatic bed reflects the frequency of tumor extension beyond the pancreatic capsule to adjacent retroperitoneal soft tissue. This prompted the surgeons to 'extend' the boundaries of a conventional pancreatico-duodenectomy to include total pancreatectomy, extended lymph node dissection and portal/mesenteric vascular resections, but there is no level I evidence that an extended pancreaticoduodenectomy results in improved survival. A recently published study hypothesized the concept of 'mesopancreas', defining it as a firm and well-vascularized structure extending from the posterior surface of the pancreatic head to behind the mesenteric vessels [1]. They drew a parallel with 'mesorectum' and suggested that resection of the mesopancreas may be as beneficial as in cases of total mesorectal excision in carcinoma of the rectum.

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Key words Carcinoma, Pancreatic Ductal; Pancreatico-duodenectomy

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As no anatomical textbook mentions the presence of 'mesopancreas', the present anatomical-pathological study was designed to verify and define mesopancreas from resection specimens obtained from fresh cadavers.

MATERIALS AND METHODS

This cadaveric study was carried out by the Department of Surgery in conjunction with the Departments of Forensic Medicine and Pathology, Government Medical College and Hospital, Jabalpur, MP, India between September 2007 and October 2009. Twenty fresh adult cadavers over 18 years of age were used. Cadavers with any intra-abdominal injury or any gross intra-abdominal pathology were excluded. Dissection was started with a midline vertical abdominal incision from the xyphoid to the pubic symphysis. The pancreas was approached by dividing the gastrocolic ligament (greater omentum) and the hepatogastric ligament (lesser omentum). The loose attachments of the posterior gastric wall to the anterior surface of the pancreas were removed. A Kocher maneuver was performed. The body of the pancreas was separated from the left lateral part of the aorta by blunt dissection. The pancreas was divided at the body, 3 cm to the left of the superior mesenteric vessels. The head and neck of the pancreas were deflected to the right lateral side (Figures 1 and 2).

All the tissue between the pancreas and the aorta, superior mesenteric artery, inferior vena cava, superior mesenteric vein and posterior abdominal wall were

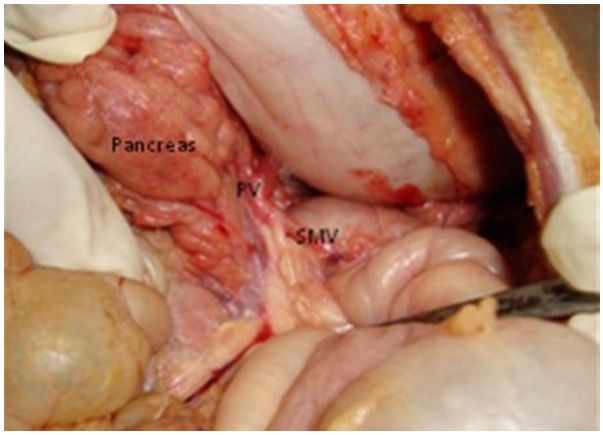

Figure 1. Connective tissue between the portal vein and the pancreas.

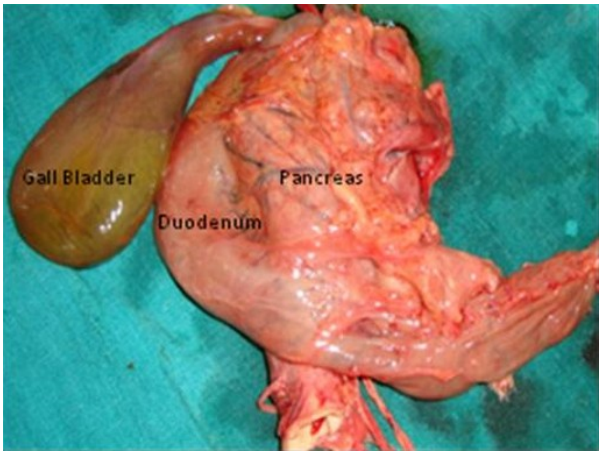

Figure 3. Anterior view of the resected specimen.

preserved. The superior mesenteric vein and the superior mesenteric artery were divided by ligatures below the inferior surface of the pancreas. The middle colic vein was ligated and divided below the inferior surface of the pancreas. The splenic vessels were ligated and divided near the body of the pancreas. The portal vein was ligated and divided 3 cm above the superior surface of the pancreas. The duodenum was divided proximally at its junction with the pylorus and distally at the duodenojejunal junction. A plane was made posterior to the inferior vena cava and aorta. All the lateral branches of these vessels were ligated and divided. The aorta and inferior vena cava were ligated and divided superiorly at the level of the celiac trunk and inferiorly at the level of the renal vessels.

Specimens containing the entire duodenum, pancreatic head and neck, gallbladder, cystic duct, common bile duct, superior mesenteric vein, superior mesenteric artery, inferior vena cava and aorta were removed en-bloc (Figures 3 and 4). Gross examination of the specimens was carried out by an experienced pathologist. The specimens were then fixed in 10% formalin. Serial sagittal sections of the specimens were taken on the 3rd day. Paraffin blocks were made from the sections. Five micrometer thick sections were taken from the block and examined by an experienced pathologist after hematoxylin and eosin staining.

RESULTS

On gross examination, loose connective tissue, fat, peripheral nerves and small blood vessels were found between the head and neck of the pancreas, and the superior mesenteric artery and superior mesenteric vein. These were mainly concentrated between the head of the pancreas and the inferior vena cava (lateral to superior mesenteric vein). No fascia or fibrous layer was found enveloping these structures.

The superior mesenteric vein and superior mesenteric artery were found in very close proximity (separated only by the fascia of Trietz) to the back of the pancreas and required a plane to be developed between the pancreas and the superior mesenteric vein and artery. Once this plane was developed, any distance measured would be artificially created distance and hence a false measurement, forcing us to abandon our efforts to measure the distance between the pancreas and the superior mesenteric vein and artery.

Microscopic examination revealed loose areolar tissue,

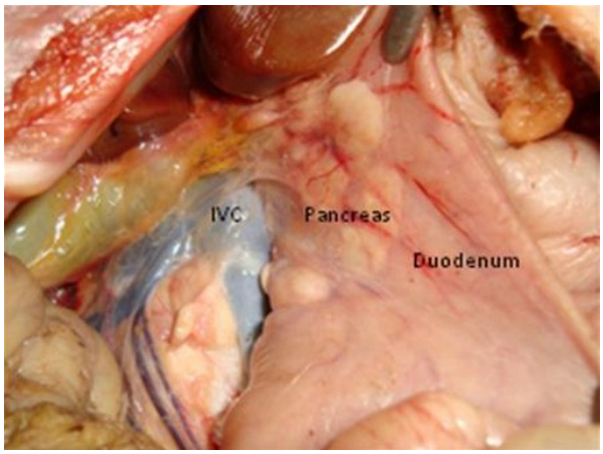

Figure 2. Connective tissue between the inferior vena cava and the pancreas.

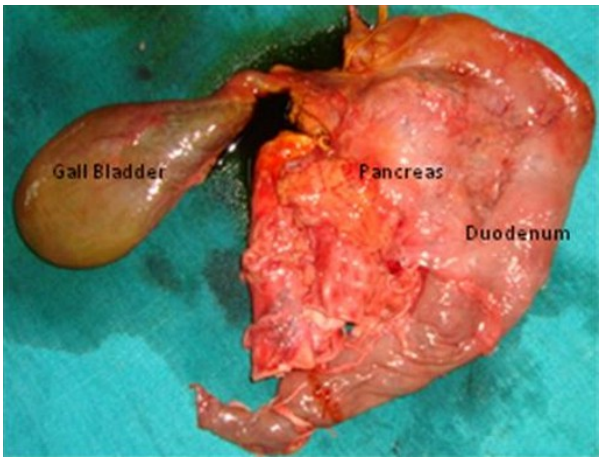

Figure 4. Posterior view of the resected specimen.

adipose tissue, peripheral nerve, nerve plexus, lymphatics and capillaries (Figure 5). All these structures were found just behind the pancreatic head and neck, extending between the neck of the pancreas and the uncinate process of the pancreas to the superior mesenteric artery and the superior mesenteric vein, and from the head of the pancreas to the inferior vena cava. Lymphatics were found up to the aorto-caval groove. No fibrous sheath or fascia was found around these structures, even on microscopy.

DISCUSSION

Curative resection (R0) is the single most important factor determining outcome in patients with pancreatic adenocarcinoma [2, 3]. Unfortunately, most pancreatic cancer resections are histopathologically found to be R1 resections [4, 5]. A disappointing outcome after extended resections seems to have prompted surgeons to turn their attention to the retro-pancreatic resection margin, which is the most common microscopically-positive margin found after a pancreatico-duodenectomy, and independently predicts a poor prognosis in curative-intent resections of pancreatic adenocarcinoma [6, 7]. This current 'hotspot' of retroperitoneal margin, already under surgical and histopathological scrutiny, received additional attention by a recent publication postulating the concept of 'mesopancreas', a very catchy and captivating title for retropancreatic tissue [1]. Gockel *et al*. described mesopancreas as a firm and well-vascularized perineural lymphatic layer located dorsally to the pancreas and reaching behind the mesenteric vessels [1]. The dimensions and extensions of the mesopancreas were correlated with its developmental embryology: on the right, extending to the descending duodenum, on the left extending behind the spleen and caudally extending well below the mesenteric vessels. They also hypothesized its analogy with 'mesorectum' and suggested that its complete resection can ensure the greatest possible distance from the retropancreatic lymphatic tissue which drains the carcinomatous focus in patients with pancreatic cancer. This was hypothesis

Figure 5. Microscopic view of the retropancreatic tissue (Magnification x10, H&E).

based on histological and immunohistochemical examinations showing lymphatic vessels localized in the direct vicinity of the neuronal plexuses between the pancreas and the mesopancreas.

In this context, it is pertinent to revisit the concept of 'mesorectum', first articulated by Heald *et al*. [8]. Mesorectum is the integral visceral mesentery and peri-rectal fatty tissue surrounding the rectum circumscribed by fascias which correspond to the initial field of dissemination of rectal cancer. It is covered by a layer of visceral fascia providing a relatively bloodless plane, the so-called 'holy plane'. It proved to be a real breakthrough in understanding the lymphatic spread of rectal cancer. The 'holy plane of dissection' and technique of total mesorectal excision significantly reduced the local recurrence rate and improved prognosis and went on to become the gold standard surgical technique for rectal cancer. Heald *et al*. classically, defined a surgical plane as a potential space between contiguous organs due to the mobility between tissues of different embryological origins which can be reproducibly created by sharp dissection and continuous traction with no actual tearing [9]. The 'holy plane' is an optimal dissection plane around the cancer which must clear all forms of extension and circumscribe predictably uninvolved tissues. They, correctly, postulated that the plane which surrounds the mesorectum is created by its separate embryological origin; rectum and mesorectum are one distinct lymphovascular entity and there is an inherent probability the tumor may initially be confined within it.

Further anatomical studies confirmed that the 'mesorectum' was carpeted posteriorly and laterally by a posterolateral fibrous envelope belonging to the pelvic visceral fascia and in front by a recto-genital membrane of variable nature corresponding to the 'Denonvilliers fascia' and demonstration of its enveloping fascias by dissection allowed the development of a dissection plane for its total extirpation [10].

The concept of mesopancreas prompts one very basic sceptical query, namely: does it have its enveloping fascias which can be demonstrated by dissection and or histopathology, which will allow the development of a dissection plane for its total extirpation? It stands to reason that, unless the mesopancreas is enveloped by a fascia covering the pancreas, it is not possible to label the pancreatic head and mesopancreas as one distinct lymphovascular entity, and its 'en-block' excision is not possible.

In the present study, no fascia or fibrous layer was found, neither macroscopically or microscopically, enveloping retropancreatic loose areolar tissue containing adipose tissue, peripheral nerves, nerve plexus, lymphatics and capillaries, even on microscopy, making it impossible to remove the mesopancreas with the head of the pancreas 'en-bloc' in a standardized manner. Inversely to the simplicity of rectal embryology, the tissues located at the posterior

surface of the head of the pancreas represent a site of embryologic fusion of peritoneal layers called the Treitz's fusion fascia. The complexity of the vascular, lymphatic and nervous network in the retropancreatic area is not surrounded by a real 'meso', making it impossible to totally remove and 'en-bloc' during a pancreaticoduodenectomy for cancer.

The concept of mesorectum has become well accepted; because of its anatomical rationale, the surgical procedure of standardized total mesorectal excision was easy to teach and disseminate worldwide so large numbers of patients could benefit by it. On the contrary, the concept of mesopancreas is difficult to accept 'since it has no fascial envelope', precluding its standardized incorporation in the surgical technique of pancreaticoduodenectomy. However, recently, a 'hanging maneuver' has been described which allows a safe plane of dissection of resection of the retroperitoneal margin of a pancreaticoduodenectomy specimen, 'away from' the superior mesenteric artery, thus helping in its standardization [11].

The hypothesis of mesopancreas, although anatomically unfounded, reflects the ongoing attention given to the retropancreatic margin of clearance in a pancreaticoduodenectomy for carcinoma of the pancreas. The importance of the retropancreatic margin is further evidenced by attempts to standardize its mapping and description by pathologists [12]. A corollary of these efforts would appear to support the hypothesis indicating neoadjuvant treatment in order to increase the tumor-free margins, therefore reducing the risk of R1 resections.

CONCLUSION

Loose areolar tissue, adipose tissue, peripheral nerve, nerve plexus, lymphatics and capillaries were found in retropancreatic tissue, extending between the head, neck and uncinate process of the pancreas to the aorto-caval groove. There was no envelope of fibrous sheath or fascia around these structures, similar to the mesorectum. The presence of vessels, nerves and lymphatics within the retroperitoneal adipose tissue is not sufficient to justify the identification of these structures as a true 'meso' since the two peritoneal leaves encircling the vessels and linked with the parietal peritoneum are not present. Neither is there a 'holy plane' of dissection, ensuring its complete and easy removal. Hence, it can be concluded that the concept of 'mesopancreas' is a myth, and the name a misnomer.

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Conflict of interest The Authors have no potential conflict of interest

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