



## “A study of the meso-pancreatoduodenum as a regional lymphatic basin for pancreatic head carcinoma”

### Anatomy

**Dr. Shruti Mamidwar**

Associate Professor, Department of Anatomy, GMC, Chandrapur.

**Dr. Abhilasha M**

Vahane, Associate Professor, Department of Anatomy, GMC, Nagpur.

### ABSTRACT

The meso-pancreatoduodenum is the primary site of tumor infiltration in patients with pancreatic head cancer, with numerous patients exhibiting lymph node metastases. Effective dissection of the regional lymphatic basin requires knowledge of the patterns of the arterial branches. The present study examined the patterns of the arteries feeding the pancreatic head and the distribution of the meso-pancreatoduodenum. The present study included 123 patients with pancreatic cancer who underwent contrast-enhanced preoperative 64-multidetector-computed tomography to determine the routes of the inferior pancreaticoduodenal and first jejunal arteries. Surgical specimens and cadavers were also evaluated histologically to clarify the distribution of the meso-pancreatoduodenum. The feeding arteries were divided into three types, with 64.2% of patients having type A, 28.4% having type B and 7.3% having type C branches. The branches emerged from the back or left side of the superior mesenteric artery and ran to the far side of the pancreatic head in an arc. Consequently, the meso-pancreatoduodenum had a roll-shaped appearance, surrounding the trunk arteries and extending to the left side of the superior mesenteric artery. Dissecting the right and left sides of the superior mesenteric artery during lymphadenectomy could improve the effectiveness of resection.

### KEYWORDS:

meso-pancreatoduodenum

### Introduction:

The prognosis of patients with pancreatic head cancer (PHC) is poor. Curative surgical resection is the main treatment modality contributing to good prognosis (1,2). Even following curative pancreaticoduodenectomy, however, numerous patients experience local recurrence around the superior mesenteric artery (SMA) margin (3,4), adversely affecting prognosis. Curative surgical resection requires control of tumor infiltration and lymph node metastasis. Standard lymphadenectomy instead of extended lymphadenectomy has been recommended as the cure for PHC (5). Lymphatic vessels form networks, allowing lymph node metastases to spread. Standard lymphadenectomy should therefore include identification of the primary site of lymph node metastasis and its regional lymphatic basin.

The mesopancreas, is defined as the soft connective tissue located between the SMA and the uncinate process, or the structure situated to the right side of the SMA, and is regarded as the primary site of cancer cell infiltration (3,6,7). Excision of the entire mesopancreas can result in complete clearance of peripancreatic retroperitoneal tissue and improve the prognosis of patients with PHC. However, numerous patients with PHC possess lymph node metastases on the left side of the SMA (8,9), and lymphadenectomy involving the left side of the SMA does not include the mesopancreas.

The meso-pancreatoduodenum (meso-pd), consisting of a cluster of soft connective tissue situated along the inferior pancreaticoduodenal artery (IPDA) and the first jejunal artery (FJA), is thought to be a site of lymphatic spread, and total excision of the meso-pancreatoduodenum (tMPDe) is regarded as necessary for pathological cure (10). Although tMPDe includes the left side of the SMA, arterial branches from the SMA to the head of the pancreas exhibit various patterns. The present study examined the patterns of the arteries feeding the pancreatic head and the distribution of the meso-pd..

### Materials and methods:

It was a record based retrospective study taken place in Anatomy department and surgery department in a tertiary hospital in central India. Between January 2006 and December 2016, 123 patients with pancreatic cancer underwent preoperative 64-multidetector-computed tomography (CT). Written informed consent was obtained from each patient for the use of their data in the present study. Iodinated contrast material (350 mg/ml) was delivered at a dose of 1.8 ml/kg over 30 sec. Early and late arterial phase images were captured at 25 and 40 sec, respectively. These images were examined to determine the routes of the IPDA and the FJA

### Results:

The characteristics of patients enrolled in this study are summarized in Table I. All three types of branching of the IPDA and FJA in the pancreatic head were observed in our patients, with 79 (64.2%) having type A, 35 (28.5%) having type B and 9 (7.3%) having type C branches (Table II). In type A, the vessel common to the IPDA and FJA emerged between the left and dorsal sides of the SMA ( $148 \pm 40.0^\circ$ ). In types B and C, the IPDA and PIPDA emerged from the dorsal side of the SMA, at  $187 \pm 47.0^\circ$  and  $182 \pm 37.4^\circ$ , respectively (Table II). The routes of the IPDA, IPDA/FJA common vessel and PIPDA exhibited bending.

### Discussion:

We previously determined that the manner of lymphatic extension and nerve plexus infiltration of the PHC were dependent on whether the tumor originated from the embryonic dorsal or ventral pancreatic bud (12,13). Tumors confined to the ventral pancreas extend toward the SMA, whereas tumors confined to the dorsal pancreas extend towards the common HA or hepatoduodenal ligament. The SMA margin is important for the carcinoma of the ventral pancreas.

The present study examined the distribution of the meso-pd, which was considered to be the mesentery of the embryonic ventral pancreas. The SMA margin is the most frequent site of PHC recurrence (3), despite the soft tissue on the right side of the SMA being regularly resected by pancreaticoduodenectomy. Lymphatic vessel involvement is common in PHC. Regional lymphatic basin resection is required to avoid local recurrence, since this area is thought to remain the regional lymphatic basin of PHC subsequent to soft tissue resection of the right side of the SMA, resulting in local recurrence. The mesopancreas (3,6,7), defined as the structure located on the right side of the SMA, is the primary site of cancer cell infiltration. However, lymph node metastasis is often observed on the left side of the SMA in patients with PHC (8,9). Resection based on the mesopancreas may therefore be insufficient for curative resection of the regional lymphatic basin.

The meso-pd, consisting of a cluster of soft connective tissue situated along the IPDA and the FJA, is regarded as the site of lymphatic spread, with tMPDe regarded as necessary for pathological cure (10). Patterns of arterial branches differ in the pancreatic head. Dissection of the lymphatic basin in PHC patients requires assessment of these patterns by multi detector CT, thus clarifying the direction of the SMA. At emergence, the arteries feeding the pancreatic head can be classified into three types (11).

By investigating the continuity of the meso-pd histologically in this area of soft tissue, it was revealed by immunohistochemistry that the lymphatic vessels were alongside the collagen fibers. The present study therefore examined the distribution of the meso-pd relative to the continuity of the collagen fibers. The meso-pd originates from the

uncinated process of the pancreas and connects to the PLsma, defined as the left back side of the soft tissue around the SMA (14). The distribution of the meso-pd is the same as the route of the IPDA. Its lower limit was vertically above the third duodenal portion. This soft tissue is also the mesentery of the jejunum, which is the route of the lymphatics and the nerves connecting the jejunum.(15). The mid-gut rotated 270° anticlockwise around the SMA, which acted as the axis. This resulted in a bend in the meso-pd, which subsequently extended to the left of the SMA.

The artery first approached during pancreatoduodenectomy has been revealed to contribute to the determination of resectability and reduction of bleeding; several procedures have been described (16). The present study concluded that the meso-pd, which spans the dorsal and left sides of the SMA is the proper mesentery of the pancreas and duodenum. Therefore, in patients with PHC, dissecting the right and left sides of the SMA during lymphadenectomy may be advantageous.

**Tables:**

**TABLE 1: Location of pancreatic cancers by age and sex.**

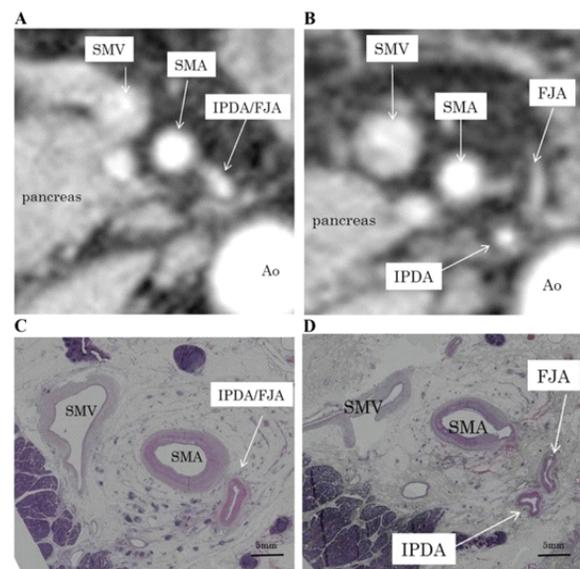
Location of the pancreatic cancer	Pancreatic head	Pancreatic body and tail
Sex, male/female	51/31	25/16
Age, years, mean (range)	63.5 (34–81)	66.5 (45–84)

**Table 2: IPDA branching types of pancreatic cancers.**

IPDA branching type	Number of patients, n (%)	Angle formed by the IPDA or PIPDA
Type A	79 (64.2)	148±40.0°
Type B	35 (28.4)	187±47.0°
Type C	9 (7.3)	182±37.4°

IPDA, inferior pancreaticoduodenal artery; PIPDA, posterior inferior pancreaticoduodenal artery. Type A, Type B and Type C. Type A: The IPDA forms a common vessel with the FJA. Type B: The IPDA branches directly from the SMA. Type C: The AIPDA and PIPDA branch from separate parts of the SMA.

**FIGURE 1:**



(A) CT scan showing the IPDA/FJA common vessel emerging between the left and dorsal sides of the SMA. (B) CT scan showing the IPDA branching from the FJA. (C) Surgical specimen showing the IPDA/FJA common vessel emerging between the left and dorsal sides of the SMA. (D) Surgical specimen showing the IPDA branching from the FJA. Magnification, ×1. CT, computed tomography; IPDA, inferior pancreaticoduodenal artery; FJA, first jejunal artery; SMA, superior mesenteric artery; SMV, superior mesenteric vein; Ao, aorta

**References:**

- Wagner M, Redaelli C, Lietz M, Seiler CA, Friess H, Büchler MW. Curative resection is the single most important factor determining outcome in patients with pancreatic adenocarcinoma. *Br J Surg*. 2004;91:586–594.
- Stojadinovic A, Brooks A, Hoos A, Jaques DP, Conlon KC, Brennan MF. An evidence-based approach to the surgical management of resectable pancreatic adenocarcinoma. *J Am Coll Surg*. 2003;196:954–964.

- Gaedecke J, Gunawan B, Grade M, Szöke R, Liersch T, Becker H, Ghadimi BM. The mesopancreas is the primary site for R1 resection in pancreatic head cancer: Relevance for clinical trials. *Langenbecks Arch Surg*. 2010;395:451–458.
- Heye T, Zausig N, Klauss M, Singer R, Werner J, Richter GM, Kauczor HU, Grenacher L. CT diagnosis of recurrence after pancreatic cancer: Is there a pattern? *World J Gastroenterol*. 2011;17:1126–1134.
- Pedrazzoli S, DiCarlo V, Dionigi R, Mosca F, Pederzoli P, Pasquali C, Klöppel G, Dhaene K, Michelassi F. Standard versus extended lymphadenectomy associated with pancreaticoduodenectomy in the surgical treatment of adenocarcinoma of the head of the pancreas: A multicenter, prospective, randomized study. *Lymphadenectomy Study Group. Ann Surg*. 1998;228:508–517.
- Gockel I, Domeyer M, Wolloscheck T, Konerding MA, Junginger T. Resection of the mesopancreas (RMP): A new surgical classification of a known anatomical space. *World J Surg Oncol*. 2007;5:44.
- Adham M, Singhirunusorn J. Surgical technique and results of total mesopancreas excision (TMpE) in pancreatic tumors. *Eur J Surg Oncol*. 2012;38:340–345.
- Kayahara M, Nagakawa T, Ueno K, Ohta T, Tsukioka Y, Miyazaki I. Surgical strategy for carcinoma of the pancreas head area based on clinicopathologic analysis of nodal involvement and plexus invasion. *Surgery*. 1995;117:616–623.
- Noto M, Miwa K, Kitagawa H, Kayahara M, Takamura H, Shimizu K, Ohta T. Pancreas head carcinoma: Frequency of invasion to soft tissue adherent to the superior mesenteric artery. *Am J Surg Pathol*. 2005;29:1056–1061.
- Kawabata Y, Tanaka T, Nishi T, Monma H, Yano S, Tajima Y. Appraisal of a total mesopancreatoduodenum excision with pancreaticoduodenectomy for pancreatic head carcinoma. *Eur J Surg Oncol*. 2012;38:574–579.
- Horiguchi A, Ishihara S, Ito M, Asano Y, Yamamoto T, Miyakawa S. Three-dimensional models of arteries constructed using multidetector-row CT images to perform pancreaticoduodenectomy safely following dissection of the inferior pancreaticoduodenal artery. *J Hepatobiliary Pancreat Sci*. 2010;17:523–526.
- Kitagawa H, Ohta T, Makino I, Tani T, Tajima H, Nakagawara H, Ohnishi I, Takamura H, Kayahara M, Watanabe H, et al. Carcinomas of the ventral and dorsal pancreas exhibit different patterns of lymphatic spread. *Front Biosci*. 2008;13:2728–2735.
- Makino I, Kitagawa H, Ohta T, Nakagawara H, Tajima H, Ohnishi I, Takamura H, Tani T, Kayahara M. Nerve plexus invasion in pancreatic cancer: Spread patterns on histopathologic and embryological analyses. *Pancreas*. 2008;37:358–365.
- Japan Pancreas Society, corp-author. *Classification of Pancreatic Carcinoma*. 3rd. Kanehara & Co., Ltd.; Tokyo: 2011.
- Shinohara H, Kurahashi Y, Kanaya S, Haruta S, Ueno M, Udagawa H, Sakai Y. Topographic anatomy and laparoscopic technique for dissection of no. 6 infrapyloric lymph nodes in gastric cancer surgery. *Gastric Cancer*. 2013;16:615–620.
- Inoue Y, Saitura A, Yoshioka R, Ono Y, Takahashi M, Arita J, Takahashi Y, Koga R. Pancreatoduodenectomy with systematic mesopancreas dissection using a supracolic anterior artery-first approach. *Ann Surg*. 2015;262:1092–1101.