

The correlation between the embryological development of the pancreas and the local extent of the pancreatic tumors

Irina Balescu¹, Nicolae Bacalbasa^{2,3}, Lucian Pop⁴, Valentin Varlas^{2,5}, Andrei Voichituiu^{2,4}

¹Department of Visceral Surgery, Ponderas Academic Hospital, Bucharest, Romania

²Department of Obstetrics and Gynecology, "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania

³Department of Visceral Surgery, Center of Excellence in Translational Medicine, Fundeni Clinical Institute, Bucharest, Romania

⁴Department of Obstetrics and Gynecology, "Alessandrescu-Rusescu" National Institute of Mother and Child Care, Bucharest, Romania

⁵Department of Obstetrics and Gynecology, Filantropia Clinical Hospital, Bucharest, Romania

ABSTRACT

Progression reported so far in the field of hepato-bilio-pancreatic surgery led to a significant increase of the number of cases diagnosed with borderline or locally advanced pancreatic tumors which are successfully submitted to radical surgery. However, it has been observed that local invasion of the vascular structures respects the embryological and anatomical development of the pancreatic parenchyma.

The aim of the current paper is to analyze the correlation ship between the embryological development of the pancreas, location, extent and possible therapeutic strategies in borderline or locally advanced pancreatic head cancer.

Keywords: pancreatic head cancer, dorsal pancreas, ventral pancreas, vascular invasion

INTRODUCTION

Pancreatic cancer remains one of the most deathful malignancies worldwide, being associated with poor rates of survival especially in cases in which a radical surgical procedure is not feasible [1-3]. Although initially it has been considered that the presence of vascular involvement should be considered as a formal contraindication for resection, more recent studies came to demonstrate the efficacy in the field of venous resection, nowadays venous invasion being no longer considered as a contraindication for surgery; moreover, cases in which a venous resection is performed seem to have a similar long-term outcome when compared to cases submitted to standard pancreatoduodenectomy [4,5]. When it comes to the role of arterial resection, this is still under investigation, although certain centers routinely perform it with acceptable rates of perioperative complications and improved long-term outcomes when compared to cases submitted solely to systemic therapy [6,7].

The aim of this paper is to discuss about the embryological and anatomical development of the pancreas and to investigate whether a correlation can be established between these elements and the patterns of local spread of pancreatic head tumors.

NOTIONS OF EMBRYOLOGICAL DEVELOPMENT OF THE PANCREAS

The pancreatic head develops by the fusion between the ventral and dorsal primordium of the pancreas which usually occurs in the seventh week of gestation; therefore, initially the ventral pancreatic primordium arises in conjunction with the common hepatic bile duct in the fourth week of gestation, rotates clockwise and fusions with the dorsal counterpart [8]. The two parts present significant differences in regard to their histological content, the ventral pancreas presenting smaller and more closely placed pancreatic lobules in association with a lower content of fatty tissue [9]. The dorsal part of the pancreas

Corresponding author:
Nicolae Bacalbasa
E-mail: nicolae_bacalbasa@yahoo.ro

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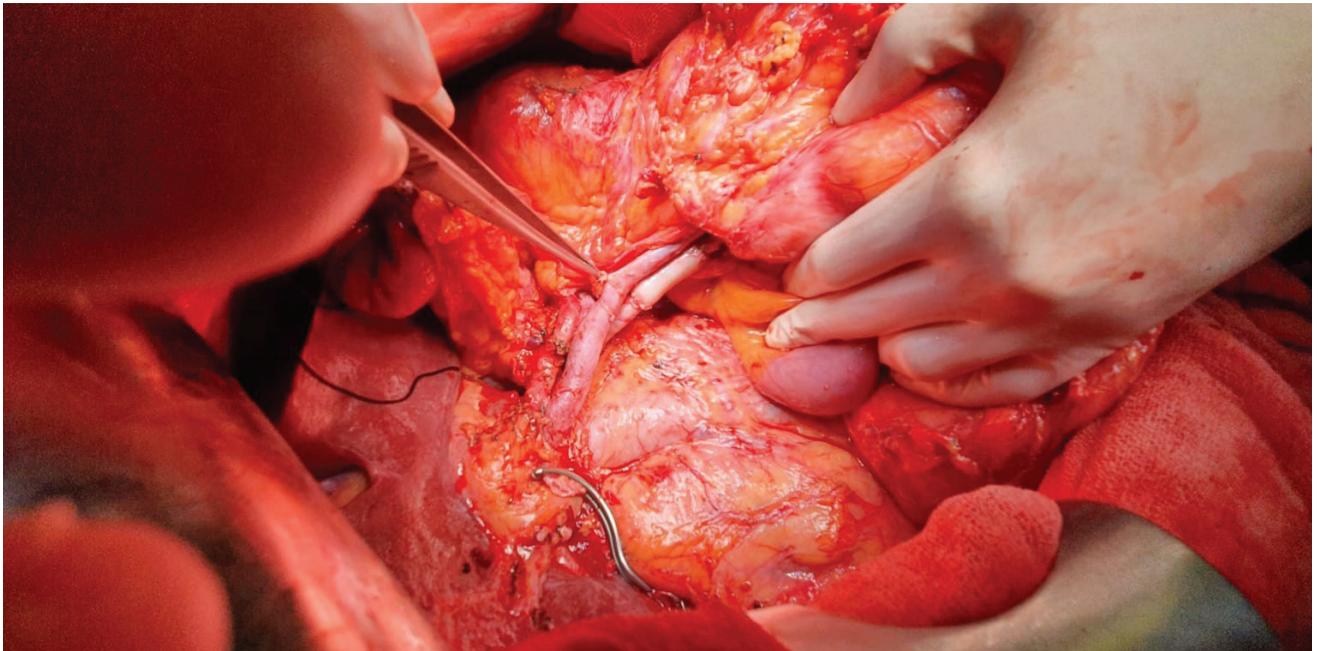


FIGURE 1. Intraoperative aspect: pancreatic head carcinoma originating from the uncinate process invading the superior mesenteric artery. The tumor was resected en bloc with the superior mesenteric artery which was further successfully reconstructed by using a cadaveric graft while the portal vein was entirely preserved

gives birth to the anterior part of the pancreatic head, body and tail of the pancreas while the ventral part is responsible for the posterior part of the pancreatic head and of uncinate process [10]. Meanwhile, the ventral pancreas comes in close connection with the superior mesenteric vein. However, other studies came to demonstrate that the uncinate process has a dual origin, from the ventral primordium – the upper two thirds and the dorsal primordium – the lower third. Once these two parts fuse, the ventral part will report an accelerated development, creating the largest part of the uncinate process in adult [11]. These notions are important to be well understood by the surgeon, atypical, conservative resections being proposed especially for benign pancreatic pathology based on the embryological development [12].

THE IMPACT ON THE EMBRYOLOGICAL DEVELOPMENT OF THE PANCREAS ON THE APPARITION OF LOCAL INVASION IN PANCREATIC HEAD CARCINOMA

Studies conducted so far came to demonstrate that there is a close connection between the embryological development of the pancreas and the pathway of spread of different neoplastic processes. In the study conducted by Makino et al. on 58 patients with pancreatic head carcinoma the authors demonstrated that cases with ventral pancreas carcinomas usually presented pancreatic head plexus or superior mesenteric arterial plexus invasion while cases presenting tumors originating from the dorsal part of the pancreas usually reported common hepatic artery plexus invasion or hepato-duodenal ligament

invasion; therefore the authors concluded that nerve plexus invasion in pancreatic head carcinoma is strongly correlated with the embryological development of the pancreas and might provide significant information in order to determine the further surgical strategy [13].

Another interesting study which investigated the impact of the perineural invasion in cases presenting tumors developed from the ventral primordium of the pancreas has been published by Noto et al. in the American Journal of Surgical Pathology. The study included six patients diagnosed with pancreatic uncinate process invading the superior mesenteric vein and developed in close proximity of the superior mesenteric artery; in all cases resection of the vein and preservation of the artery were successfully performed, diffuse involvement of the perineural plexus at the origin of the superior mesenteric artery and close positive resection margins being reported in four cases. These data come to demonstrate once again that tumors originating from the ventral primordium of the pancreas trend to spread to the superior mesenteric vein, uncinate process and, in certain cases invade the nervous plexus at the origin of the superior mesenteric artery. Therefore, in such cases the authors underlined the fact that the possible invasion of the superior mesenteric artery would be never left behind if, in such cases, a superior mesenteric artery resection is associated [14].

Moreover, other authors consider that the tumors originating from the ventral pancreas usually invade the mesopancreato duodenum and spread to the superior mesenteric artery; therefore, they recom-

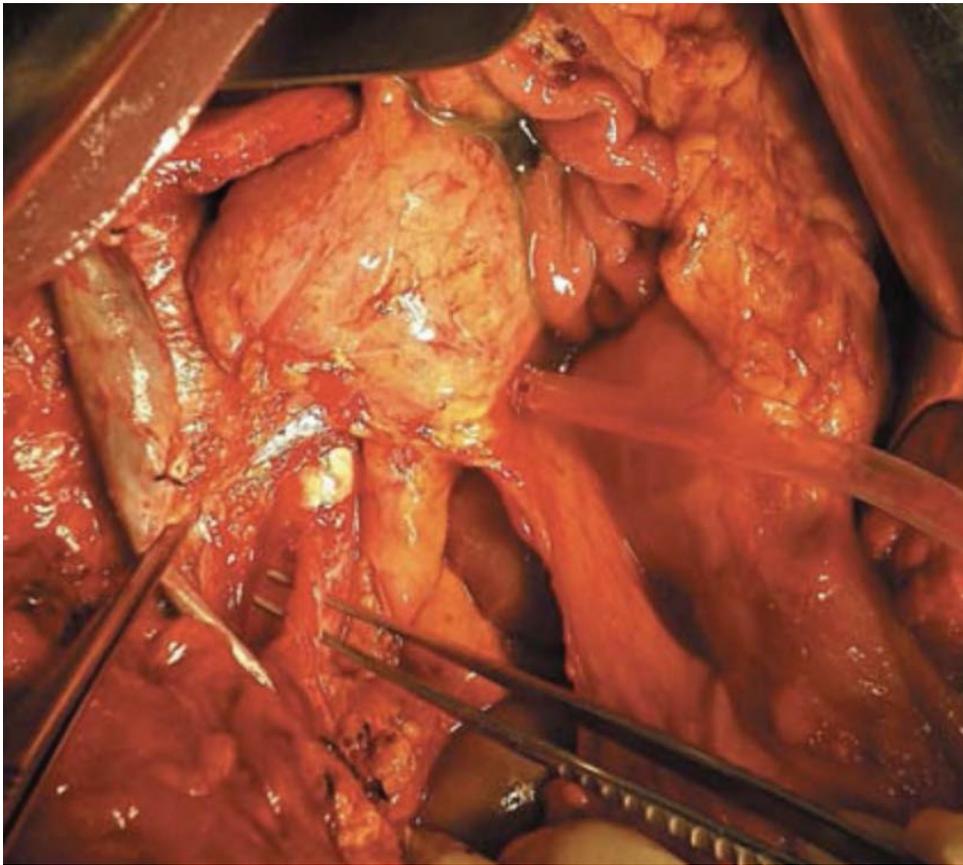


FIGURE 2. Intraoperative aspect: pancreatic head tumor invading the portal vein and the superior mesenteric artery – the portal vein was reconstructed by placing a cadaveric graft while the artery was reimplanted in the abdominal aorta

mend routine resection of the superior mesenteric artery in order to maximize the chances to achieve an R0 resection [15].

Intraoperative aspects which come to demonstrate the impact of the development of pancreatic head tumors on the presence of vascular invasion are presented below.

CONCLUSIONS

An adequate knowledge of the embryological development of the pancreas is mandatory in order to achieve complete R0 resection in pancreatic head tumors and therefore to increase the chances to achieve an improved survival rate.

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