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## Retroportal lamina or mesopancreas? Lessons learned by anatomical and histological study of thirty three cadaveric dissections

Mahdi Bouassida<sup>a,b,\*</sup>, Mohamed Mongi Mighri<sup>a,b</sup>, Mohamed Fadhel Chtourou<sup>a,b</sup>, Selim Sassi<sup>a,b</sup>, Hassen Touinsi<sup>a,b</sup>, Hassen Hajji<sup>a,b</sup>, Sadok Sassi<sup>a,b</sup><sup>a</sup> Department of Surgery, Mohamed Tahar Maamouri Hospital, Mrezga, 8000 Nabeul, Tunisia<sup>b</sup> Université Tunis-El Manar, Faculté de Médecine de Tunis, 15, rue Djebel Akhdhar, Tunis, Tunisia

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## ABSTRACT

**Objective and background:** Despite its importance in pancreatic head carcinoma, the retroportal lamina is still under studied, with only two anatomical cadaveric dissections in the English literature, with recent controversies about the concept of a mesopancreas.

**Methods:** Resection of the mesopancreas was performed in 33 fresh cadavers. The pancreas and mesopancreas were separated from each other and the mesopancreas was immunohistochemically investigated.

**Results:** The retroportal lamina is roughly rectangular in shape. Its dimensions are: height 6.2 cm (5–8), 2.5 cm wide (1.5–4). It contains a right hepatic artery arising from the superior mesenteric artery in 13.3% of cases. Microscopic examination revealed areolar tissue, adipose tissue, peripheral nerve, nerve plexus, lymphatics and capillaries. However, fibrous sheath and fascia were not found around these structures.

**Conclusion:** A right hepatic artery arising from the superior mesenteric artery is a frequent anatomic variation. Surgeons must be aware of this to ensure the integrity of the hepatic artery blood supply in patients treated by pancreaticoduodenectomy. Despite controversy about the reality of the mesopancreas (postulated in analogy to the mesorectum), because of the absence of fibrous sheath or fascia, its complete removal in pancreatic head carcinoma is feasible by a subadventitial dissection of the superior mesenteric artery which can be considered as the real limit of the mesopancreas.

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## 1. Introduction

Retropancreatic invasion is a major concern in pancreatic head carcinoma. Posterior clearance has been recognized as an independent risk factor for disease recurrence and hence patient survival. Nevertheless, the retropancreatic tissue's space, or retroportal lamina or mesopancreas, remains under studied with only two previous anatomical cadaveric dissections, followed by histological studies, reported in the English literature. We report in the present study, the results of thirty three cadaveric dissections of the retroportal lamina, focusing on its margins, its content, and especially on arterial variants which must be well known to avoid potentially disastrous complications during pancreatic surgery.

## 2. Materials and methods

This cadaveric study was carried out by the Department of Surgery of Nabeulin conjunction with the Department of Forensic Medicine and Pathology of Sousse, between January 2007 and January 2008. Thirty three 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. A large mobilization of the right hepatic flexure of the colon, followed by an extended Kocher's maneuver, allowing the exposure of the infra-hepatic inferior vena cava (IVC) and the distal portion of the left renal vein (LRV) were performed. The loose attachments of the posterior gastric wall to the anterior surface of the pancreas were removed. 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. All the tissue between the pancreas and the aorta, superior mesenteric artery (SMA), inferior vena cava, superior mesenteric vein and posterior abdominal wall were preserved: cranio-caudal dissection of the right semi-circumference of the SMA (subadventitial dissection) and celiac trunk (CT) up to the posterior surface of superior mesenteric and portal vein with total retroportal lamina excision were undertaken. Specimens containing the entire duodenum, pancreatic head and neck, gallbladder, cystic duct, common bile duct, retroportal lamina were removed. 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

\* Corresponding author. Université Tunis-El Manar, Faculté de Médecine de Tunis, 15, rue Djebel Akhdhar, Tunis, Tunisia.

E-mail address: [bouassidamahdi@yahoo.fr](mailto:bouassidamahdi@yahoo.fr) (M. Bouassida).

micrometer thick sections were taken from the block and examined by an experienced pathologist after hematoxylin and eosin staining.

### 3. Results

The tissue between the pancreatic parenchyma and the SMA consists of fatty tissue and contains blood and lymphatic vessels, as well as lymph nodes draining the pancreatic head and the uncinate. Its shape is roughly rectangular. Its dimensions are: height 6.2 cm (5–8), 2.5 cm wide (1.5–4) (Fig. 1).

Macroscopically, in the dissected en-bloc specimen of pancreas and retroportal lamina, a right hepatic artery arising from the superior mesenteric artery was found in 4 cases (13.3%). The median length of these right hepatic arteries was 8 cm (7–9 cm), the median diameter was 4 mm (Fig. 2). Two inferior pancreaticoduodenal arteries arising from the superior mesenteric artery were identified in all cases.

Microscopic examination revealed areolar tissue, adipose tissue, peripheral nerve, nerve plexus, lymphatics and capillaries. 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, but fibrous sheath and fascia were not found around these structures (Fig. 3).

### 4. Discussion

In 1955, Michels proposed an internationally recognized classification of hepatic arterial anatomy based on the results of two hundred autopsies.<sup>1</sup> He found that standard visceral arterial anatomy occurred in only 55–60% of individuals.

The most common variant is a replaced right hepatic artery arising from the SMA.<sup>1,2</sup> According to a recent review, this variation has been reported in 11–21% of patients.<sup>3</sup> In our series, this variation was found in 13.3% of cases. Knowledge of such aberrant arterial anatomy, in patients about to undergo pancreaticoduodenectomy, can lead to measures to preserve the vessels, and avoid fatal hepatic ischemia. These findings suggest that visceral angiography, or indeed three-dimensional CT reconstruction which has largely replaced angiography should play a critical part in the pre-operative evaluation before pancreaticoduodenectomy.<sup>4,5</sup> Recently, a posterior approach with cranio-caudal dissection at the origin of the superior mesenteric artery and the celiac trunk, all along their right

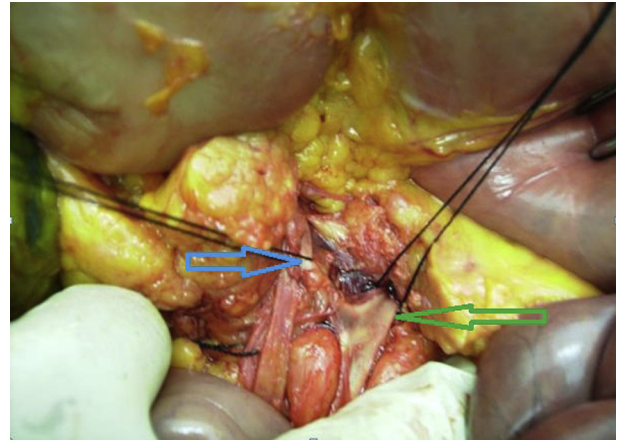


Fig. 2. Replaced right hepatic artery (blue arrow) arising from the superior mesenteric artery (green arrow).

semi-circumference, was revisited for special indications as in presence of replaced right hepatic artery.<sup>6</sup> It has the advantage of better vascular control in cases with arterial anatomical variations, and aims to reduce the incidence of non-R0 resections.

On the other hand, invasion of the retropancreatic tissues was recognized as a risk factor affecting patient survival, and it is important to ensure its complete excision through a standardized procedure aiming for an R0 resection.<sup>7</sup> Indeed, it was recently reported that the most frequent site of R1 resection is within the retropancreatic retroportal lamina, with a standardized pathological examination.<sup>8</sup> The available literature on the surgical anatomy of the pancreas contains only two anatomical and histological previous studies of the retroportal lamina. Gockel et al.<sup>9</sup> in 2007 described the mesopancreas as a firm and well-vascularized perineural lymphatic layer located dorsal to the pancreas and reaching behind the mesenteric vessels. In the second study, Agrawal et al.<sup>10</sup> were unsure about the reality of the mesopancreas (postulated in analogy to the mesorectum) because of the absence of fibrous sheath or fascia. They stated 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-bloc' excision is not possible. In our study, fibrous sheath or fascia were not found, but we feel that a total retroportal lamina excision is possible by a subadventitial dissection of the superior mesenteric artery.

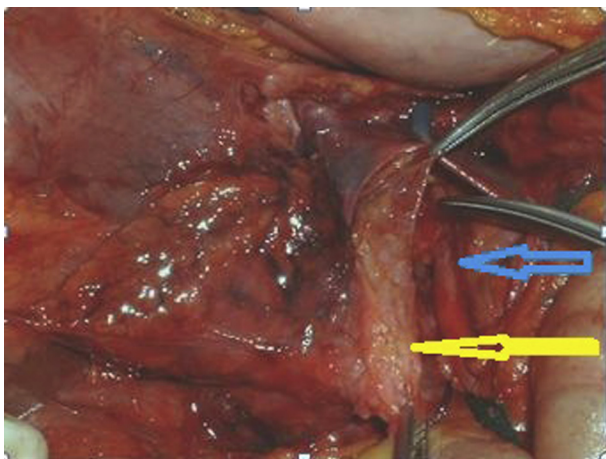


Fig. 1. Retroportal lamina (yellow arrow) limited by the superior mesenteric artery (blue arrow).



Fig. 3. Microscopic view of the retropancreatic tissue ( $\times 100$ ) with a vessel (red arrow) and nerve fibers (yellow arrow).

Given our observations, we suggest that the retropancreatic tissue, extending between the head, neck and uncinate process of the pancreas to the aorto-caval groove should be referred to as the retroportal lamina in preference to mesopancreas.

## 5. Conclusion

Despite recent controversy about its existence, given the absence of fibrous sheath or fascia, the retroportal lamina (preferred to mesopancreas) is a definite anatomical entity, containing a right hepatic artery arising from the superior mesenteric artery in 13.3% of cases. This relatively frequent anatomic variation must be borne in mind to maintain the integrity of the hepatic artery blood supply in patients treated by pancreaticoduodenectomy. Complete removal of retroportal lamina, improving posterior clearance and R0 resection in pancreatic head carcinoma is feasible by a subadventitial dissection of the superior mesenteric artery which can be considered as the real limit of the mesopancreas.

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### Funding

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### Author contribution

Mahdi Bouassida performed the conception and design of the study.

Mohamed Mongi Mighri performed the analysis of the data.

Mohamed Fadhel Chtourou performed the acquisition of the data.

Selim Sassi performed the dissections.

Hassen Touinsi revised the article critically for important intellectual content.

Hassen Hajji performed the dissections.

Sadok Sassi revised the article critically for important intellectual content.

### Conflict of interest

No conflict of interest to declare.

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