

Pancreatoduodenectomy *En Bloc* With Superior Mesenteric Artery Resection for Borderline Resectable Pancreatic Cancer – A Case Report and Literature Review

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Abstract. *Background/Aim:* Pancreatic head adenocarcinoma represents the most aggressive digestive malignancy, which affects patients worldwide and is associated with poor outcomes especially due to the fact that most cases are diagnosed when local vascular invasion is already present. *Case Report:* This is a case report of a 44-year-old patient diagnosed with a borderline resectable pancreatic head adenocarcinoma invading the superior mesenteric artery. The patient was submitted to surgery, and intraoperatively the mesenteric artery invasion was found. A pancreatoduodenectomy *en bloc* with superior mesenteric artery resection was performed while the continuity of the arterial structure was re-established by placing a cadaveric graft. *Conclusion:* In selected cases, extended arterial resections might be needed in order to achieve negative

resection margins and therefore, to improve the chances of long-term survival.

Borderline resectable pancreatic cancer refers to cases presenting local invasion or infiltration of the surrounding vascular structures such as portal vein or superior mesenteric artery imposing vascular resections at this level in order to achieve microscopic negative resection margins (1-5). However, in certain cases perioperative complications are significant, enabling therefore the surgeon to contest the efficacy and safety of the method. In the meantime, improving the surgical technique and perioperative management of these cases may significantly diminish perioperative morbidity and mortality rate (4-6). Meanwhile, developing and improving the protocol of vascular harvesting from cadaveric donor offers a good alternative for arterial or venous reconstruction whenever an end-to-end anastomosis is not feasible, and a graft being needed (3-6).

The aim of the current article is to present the case of a 44-year-old patient submitted to pancreatic head resection in association with superior mesenteric artery resection in whom the continuity of the arterial axis was re-established by placing a cadaveric graft.

Case Report

The 44 year previously healthy male patient was investigated for diffuse epigastric pain and weight loss of 13 kg in two months. The abdominal ultrasound raised the suspicion of a

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Key Words: Pancreatic head adenocarcinoma, superior mesenteric artery invasion, radical resection, reconstruction.

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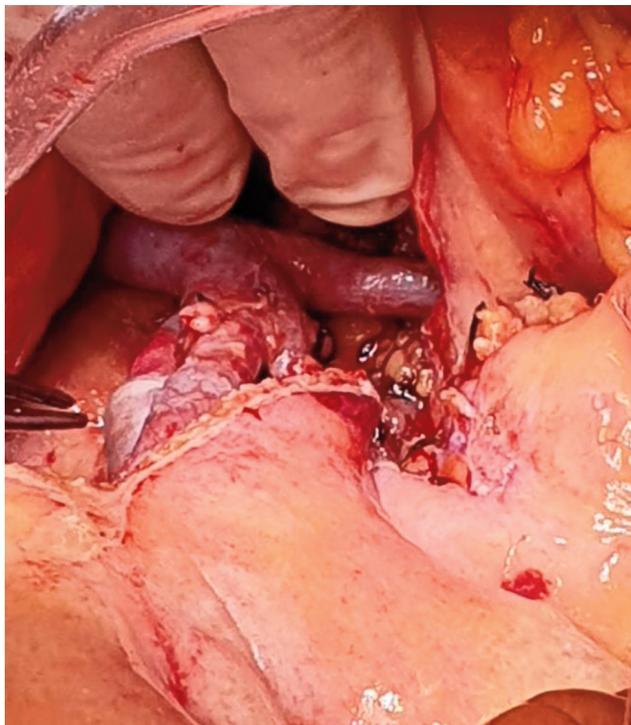


Figure 1. The final aspect after resecting the pancreatic head tumor *en bloc* with the invaded segment of the superior mesenteric artery.

pancreatic head tumor, so the patient was further submitted to an abdominal magnetic resonance imaging and to an endoscopic ultrasound. The magnetic resonance imaging confirmed the presence of a 3/3 cm solid mass at the level of the pancreatic head, developed in close contact with the superior mesenteric artery. The endoscopic ultrasound confirmed this aspect and demonstrated the presence of local invasion of the superior mesenteric artery beginning from approximately 2.5 cm from the origin in the abdominal aorta, on a total length of 2 cm. Furthermore, a biopsy demonstrated the presence of a well differentiated pancreatic head adenocarcinoma. After discussing with the patient the possible risks and benefits of the surgical procedure, the patient agreed to continue with surgery as first line treatment. The tumor was successfully removed through a pancreatoduodenectomy *en bloc* with the invaded segment of the superior mesenteric artery which was found to begin 2 cm distally from the origin in the abdominal aorta and had a length of 2.2 cm. Meanwhile, the entire mesopancreatoduodenum was resected in order to remove the lymph nodes at this level while the nerve plexus surrounding the origin of the superior mesenteric artery was entirely preserved (Figure 1). The portal vein was successfully preserved on its entire length. The reconstruction of the superior mesenteric artery was performed by placing a cadaveric graft originating from

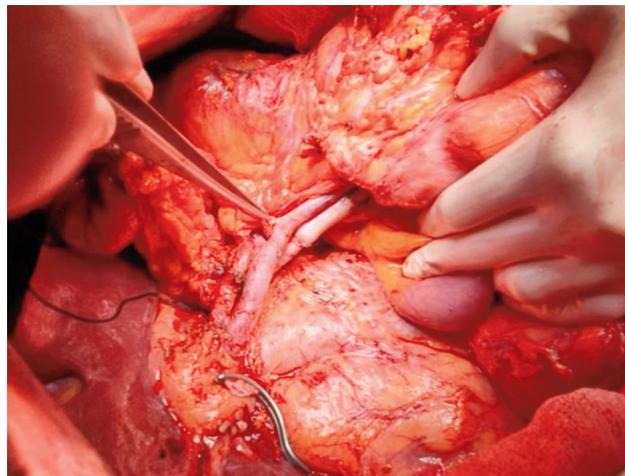


Figure 2. The final aspect after placing the cadaveric venous graft, and an end-to-end anastomosis was performed with the superior mesenteric artery stumps.

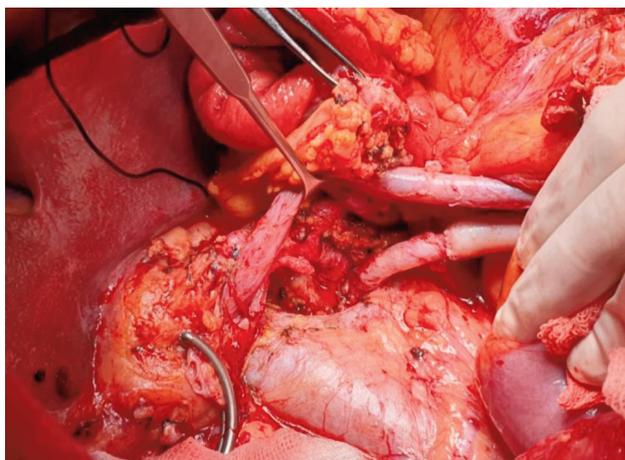


Figure 3. The final aspect after resection and graft placement. The portal vein was entirely dissected and preserved as well as the nervous plexus at the level of the superior mesenteric artery root. The cava vein was also dissected.

an external iliac vein and performing an end-to-end anastomosis (Figure 2, Figure 3). The postoperative course was uneventful, and the patient was discharged on the seventh postoperative day, with indication to continue the low molecular anticoagulant therapy. The histopathological study confirmed the radicality of the resection, all visceral and vascular borders were free of disease, and the nearest positive margin was at 4 mm; meanwhile the arterial invasion was also confirmed. At one month follow up he was deferred to the oncology system in order to be submitted to the standard adjuvant chemotherapy.

Discussion

In borderline and locally advanced pancreatic cancer radical resection remains the key for achieving long-term survival, even though in a significant number of cases vascular resections are needed (7-9); therefore, in such cases higher rates of perioperative morbidity and mortality rates are expected. In order to achieve R0 resection, one of the most important key points is adequate excision of the lymphatic basin of the pancreatic head, also called meso-pancreatoduodenum. However, the nerve plexus surrounding the superior mesenteric artery should be preserved in order to avoid the development of severe postoperative complications such as diarrhea (9-12).

Vascular involvement in pancreatic head adenocarcinoma represented for a long period of time a formal contraindication for resection, and this aspect is considered as the sign of a more biologically aggressive tumor (13, 14). However, with time, once venous resections were widely performed, the rates of long-term survival significantly improved and therefore, became similar to cases submitted to standard pancreatoduodenectomy. Therefore, surgeons went even further and began to perform also arterial resections. Although initially the outcomes were rather poor, with time the surgical technique as well as the perioperative management improved, and the overall complication rate diminished (3-6). In this respect, arterial resections have been successfully implemented in selected cases, most often in association with venous resections (6). The particularity of the case that we presented was the development of the tumor, which respected the portal vein and its' confluent but circumferentially invaded the superior mesenteric artery.

When it comes to the type of reconstruction which can be used in such cases, multiple variants have been proposed; while in cases in which tangential resection is needed a patch placement might be used, in cases with circumferential involvement the options vary from mobilization of the two stumps and end to end direct anastomosis and graft placement (13-15). Initially the most commonly used grafts were represented by synthetic prostheses such as goretex, Dacron – or polytetrafluoroethylene grafts (13, 14). However, due to the high number of complications such as graft thrombosis or severe adherential syndrome, which develops between the graft and the surrounding viscera, attention was focused on creating and using biological grafts (15-17). Once the transplantation procedures and tissue banks have become more commonly available, different structures including vascular grafts were successfully harvested and preserved. Whenever needed, placing a cadaveric graft brings consistent advantages compared to allografts especially due to the lower risk of developing graft related complications such as graft thrombosis. Another promising graft is represented by the bovine pericardium, which is also associated with lower risks of subsequent complications (17, 18).

When it comes to the efficacy in terms of survival of these patients, recent studies demonstrate that the long-term outcomes can be comparable to cases in which venous resections or standard pancreatoduodenectomy were performed. As for the case presented here, the good biological status of the patient, the favorable biology of the tumor and his relatively young age enabled us to consider surgery as the first intent approach (7-10).

When discussing about the radicality of the procedure, we should mention the fact that a negative margin of at least 1 cm is mandatory (19-22). As for the concept of mesopancreatoduodenum, it consists of the two peritoneal folds which comprise the neural, vascular, and lymphatic tissues and it extends distally to the level of the third duodenal portion (23, 24). Moreover, another important issue which should be discussed in the case of pancreatic tumors is whether they are developed from the embryonic dorsal or ventral pancreas (25); tumors originating from the ventral part of the pancreas usually invade the mesopancreatoduodenum and, moreover, they might preferentially invade the superior mesenteric artery. In such cases certain authors proposed an ultraradical surgical procedure, which is called augmented regional pancreatoduodenectomy and consists of routine resection of the pancreatic head *en bloc* with the mesopancreatoduodenum and the superior mesenteric artery (26).

Conclusion

Although arterial resection has been avoided for a long period of time in cases presenting borderline or locally advanced pancreatic head tumors, recent progresses enabled surgeons to successfully combine this procedure in order to increase its radicality and the chances to achieve long-term survival. Moreover, in selected cases arterial resection is not automatically associated with venous resections, especially if the tumor is developed from the ventral part of the pancreas.

Conflicts of Interest

The Authors have no conflicts of interest to declare in relation to this study.

Authors' Contributions

SP, NB, OS – performed the surgical procedures; CD, IB, VC – performed literature review; VC, CD and IB prepared the draft of the manuscript; VC and NB reviewed the final version of the manuscript. All Authors read and approved the final version of the manuscript.

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