

Portal vein reconstruction with interposition of cryopreserved aortic graft: A case report and literature review

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Abstract. Pancreatic cancer is one of the most aggressive malignancies with poor rates of survival especially in the event radical procedures are not feasible. However, improvements in surgical techniques have led to the successful association of vascular resection followed by reconstruction without a significant increase in the rates of postoperative complications. In the present article, we present the case of a 49-year-old patient diagnosed with pancreatic head cancer invading the portal vein. After discussing with the patient the risks and the benefits of the surgical procedure, the patient was submitted to pancreatoduodenectomy en bloc with portal vein resection while the continuity of the portal vein was reestablished by using a cadaveric graft originating from the abdominal aorta. The postoperative outcome was uneventful. In conclusion, in selected cases, arterial cadaveric grafts may be used in order to establish the continuity of the portal vein with good results. However, it should be emphasized that these are demanding procedures which should be carefully analyzed before deciding upon the opportunity for performing them.

Introduction

Improvements in the field of surgical oncology along with advancements reported to date in medical oncology and radiotherapy have led to an increase in the rates of resectability of pancreatic head tumors and therefore, to an increase in the proportion of patients reporting a significant benefit in terms of survival (1,2). However, the close anatomic relationship between the pancreatic head and the surrounding vascular structures is still responsible for the presence of local invasion in a significant number of cases (3). In this respect, attention was focused on determining whether the presence of such a vascular encasement should be considered as a formal contraindication for resection or if, in certain cases, vascular resection makes sense in order to improve the long-term outcomes (4). Promising results have been reported to date in regards to portal vein resection followed by reconstruction; in such cases, similar rates of long-term survival have been reported when compared to standard pancreatic resections (5). Therefore, portal vein resection is no longer a formal contraindication for resection and attention was focused on identifying the best graft for portal reconstruction.

Case report

After obtaining the approval of the Ethics Committee of 'Fundeni' Clinical Institute (no. 752/2020), data of the patient were retrospectively reviewed.

The 49-year-old patient with no significant medical history was investigated for diffuse abdominal pain, weight loss of 7 kg in the last three months and jaundice. The biochemical

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tests revealed the presence of cholestasis, with serum levels of total bilirubin of 9.2 mg/dl and direct bilirubin of 7.5 mg/dl, cytolysis, with aspartate aminotransferase (AST) of 344 U/l and alanine aminotransferase of 599 U/l. Meanwhile the serum levels of cancer antigen (CA19-9) were significantly increased (CA19-9, 425 U/ml). The patient was submitted to magnetic resonance imaging (MRI) which demonstrated the presence of a 4/5/3 cm pancreatic head mass with no demarcation line with the portal vein on a distance of 2.2 cm. No sign of invasion of the hepatic pedicle or of the superior mesenteric vessels were observed. The patient was further submitted to an endoscopic ultrasound in order to retrieve a biopsy which demonstrated the presence of a moderately differentiated pancreatic adenocarcinoma. Due to the presence of a good general status and due to the absence of other signs of unresectability, the patient was submitted to per primam resection, a pancreatoduodenectomy en bloc with portal vein resection being performed. The length of the resected portal vein was of 3.5 cm so an end to end anastomosis was not feasible. Due to this reason the decision for using a cadaveric graft was taken, the continuity of the portal vein being re-established by placing a cadaveric cryopreserved abdominal aorta graft measuring 3.5 cm. The anastomosis between the portal vein and the cadaveric aortic graft were performed by using a running suture of polypropylene 5-0 (Fig. 1). The duration of the surgery was 230 min while the estimated blood loss was of 200 ml; no intraoperative complications were encountered. During the perioperative period, the patient was submitted to low-molecular heparin injection, the patency of the graft being demonstrated by Doppler ultrasound which was performed on the second and seventh postoperative days. The patient was discharged on the eight postoperative day and received recommendation to continue the administration of low-molecular heparin for the next 30 days. The histopathological studies demonstrated the presence of a moderately differentiated pancreatic adenocarcinoma invading the portal vein on a total length of 2.8 cm; meanwhile, all the resection margins of the specimen were free of disease. At the one month follow-up, the patient reported a good general condition and was deferred to the oncology department in order to be submitted to adjuvant chemotherapy.

Discussion

Initially performed in the late 1950's, pancreatic head resection en bloc with venous resection and reconstruction were considered at that moment as unjustified due to the high rates of perioperative complications. Therefore, venous invasion has been considered for a long period of time as a formal contraindication for surgery; however recent meta-analyses came to demonstrate that the method can be safely applied without a significant increase in perioperative morbidity and meanwhile, with significant benefits in terms of survival (5-8). These similar rates of long-term survival which have been reported after standard pancreatoduodenectomy when compared to pancreatoduodenectomy en bloc with venous resection have been explained by the fact that local venous invasion is rather the sign of a locally advanced disease and not of a biologically aggressive lesion (9). Meanwhile, improvements in the surgical techniques concerning vascular reconstruction, of the



Figure 1. Final aspect of the portal vein reconstruction by using a cadaveric graft of the abdominal aorta.

perioperative and postoperative management have led to the successful incorporation of such resections as part of pancreatic surgery (10-16).

According to the extent of local invasion of the portal vein, different types of procedures have been proposed to date; therefore, resection of the portal vein might be a lateral one or a circumferential one (17-19). Cases in which the estimated degree of narrowing after lateral resection is larger than 30% of the portal lumen are rather submitted to a circumferential resection than to a lateral one followed by lateral venorrhaphy (18); meanwhile, in cases in which a circumferential resection is needed, the type of reconstruction is to be established depending on the length of the resected segment as well as of the diameter of the two venous stumps (16,17). In cases in which the extent of portal vein resection is limited and the two stumps have similar diameters, an end to end anastomosis might be the option of choice; generally it is estimated that defects shorter than 2 cm are suitable for an end to end anastomosis (18). Meanwhile cases in which the resulting defect does not allow an end to end anastomosis, a graft may be needed in order to re-establish the venous continuity. In order to minimize the risks of perioperative complications, multiple types of reconstructions have been proposed including: autologous vein, cadaveric arterial or venous grafts, bovine pericardial or synthetic grafts such as Gore-Tex, polytetrafluoroethylene or Dacron prostheses (18). Whenever a venous graft of a synthetic prosthesis is used, there is a significant risk of graft thrombosis which might reach 17% of cases, depending on the extent of resection, timing and graft harvesting and type of reconstruction (19-22).

When it comes to the utility of arterial cadaveric grafts for vascular reconstructions, the method has been initially implemented in vascular surgery in order to provide different types of arterial reconstructions. Cryopreserved aortic graft was successfully implemented for aortic reconstruction and have proven to have significant benefits; therefore, according to Harlander-Locke *et al*, this method is associated with decreased risks of graft infection, aneurysm formation and limb loss. The authors conducted a multicenter retrospective study which involved 220 patients and demonstrated that at a 5-year follow up 97% of cases reported a patent aortic

graft (19). Once the method proved its efficacy in vascular surgery, it was also successfully implemented in visceral surgery. Therefore, it avoids the risks associated with the use of synthetic allografts such as Dacron or Gore-Tex by diminishing the infectious risks. In a study conducted by Mascoli *et al*, aortic graft reconstruction of the portal vein was successfully reported in three cases; two patients benefited from a thoracic aorta graft while the third one benefited from an abdominal aorta graft, the median length of the graft being 6 cm. Meanwhile the authors reported the superiority of the method when compared to venous graft reconstruction due to the fact that arterial grafts have a lower risk of developing postoperative complications such as thrombosis, stenosis or infection (22). Therefore, it seems that arterial grafts are more resistant to surgical manipulation, do not have valves, are more effective in reducing the occlusion risk due to external visceral compression and are associated with a lower risk of graft infection (23,24).

In conclusion, cryopreserved cadaveric arterial grafts appear to be safely used in portal vein reconstruction after pancreatoduodenectomy en bloc with portal vein resection for locally advanced pancreatic cancer. Therefore, arterial grafts seem to have certain advantages when compared to venous grafts or synthetic prosthesis such as a lower risk of postoperative graft infection, thrombosis or stenosis. However, findings concerning this method have been scarcely reported so far, or only for a small number of cases. Thus, larger studies are necessary in order to standardize it and to analyze which cases could benefit most after this type of reconstruction.

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Availability of data and materials

Data are available at request from the corresponding author.

Authors' contributions

NB, IB and OS contributed to the conception and design of the present study. CD, BS, FG, IB, VB consulted the relevant references and performed the literature data collection. IB and NB wrote the first draft of the manuscript. VB revised the manuscript. All authors read and approved the final manuscript for publication.

Ethics approval and consent to participate

The Ethics Committee of 'Fundeni' Clinical Institute approved the study (no. 752/2020).

Patient consent for publication

Patient consent for publication was obtained and signed by the patient on 21/04/2021.

Competing interests

The authors declare that they have no competing interests.

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