



# Portal Vein Reconstruction during Pancreaticoduodenal Resection Using an Internal Jugular Vein as a Graft

Gancho Kostov, Rossen Dimov

*Department of Special Surgery, Medical University of Plovdiv, Plovdiv, Bulgaria*

**Corresponding author:** Gancho Kostov, Department of Special Surgery, Medical University of Plovdiv, 15A Vassil Aprilov Blvd., 4002 Plovdiv, Bulgaria; E-mail: [caspela@abv.bg](mailto:caspela@abv.bg); Tel.: +359 895 762 972

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## Abstract

Portal vein involvement by malignant tumours of the head of the pancreas is observed in almost 50% of the patients. In the past, this finding usually rendered the tumor inoperable. Over the past 30 years, the operative morbidity and mortality rate of pancreatectomy combined with portal vein resection has greatly decreased, and portal vein resection in pancreatic surgery has become a well-tolerated operative procedure in large-volume centres. Options for a venous reconstruction after SMV/PV resection include prosthetic, autologous or cryopreserved cadaveric vein grafts.

Vascular resection and reconstruction provides great opportunity for R0 resection and improvement of oncological results in patients with pancreatic tumors and involvement of venous vessels, in the absence of distant metastases. If a longer graft length is required, there is the option of using either synthetic prosthesis or cryopreserved grafts. Their weak sides can be avoided by the use of jugular vein graft. Portal vein resection will be performed more often, safely and aggressively over the next years.

## Keywords

pancreaticoduodenal resection, portal vein reconstruction

## INTRODUCTION

Pancreatic cancer is the fourth most common cause of death due to cancer worldwide. Over 80% of patients have a locally advanced or metastatic cancer at the time of diagnosis, giving them an expected overall survival of just 6 months. Those who undergo surgery have improved overall survival.<sup>1</sup> Portal vein involvement by malignant tumors of the head of the pancreas is observed in almost 50% of the patients. Such findings in the past would make tumours to be considered inoperable.<sup>2</sup> In multicenter studies, it was found that perioperative morbidity and mortality is almost the same for patients with pancreaticoduodenal resection

and pancreaticoduodenal resection with vascular reconstruction.<sup>3</sup> The possibilities for reconstruction after the portal vein (PV) and/or superior mesenteric vein (SMV) include: 1) The use of a prosthetic graft such as polytetrafluoroethylene (PTFE) graft; 2) Prosthetic, autologous or cryopreserved cadaveric vein grafts; 3) Autologous grafts for the SMV/PV can be taken from internal jugular, femoral, common iliac, external iliac, renal and splenic veins.

## CASE REPORT

*We report a case of resection of the portal vein and use of a graft from the internal jugular vein and its subsequent*

anastomosis with portal, superior mesenteric, inferior mesenteric and splenic vein due to anatomic variation and separate connection between them and the need for a graft longer than 5 cm. A 72-year-old patient presented with complaints of discomfort in the epigastric region, nausea and vomiting, jaundice, fatigue and 10-kg unintended weight loss within six months. Recently, he noticed that his urine turned dark, and his sclerae were yellowing. From blood tests: AST 817, ALT 1162, LDH 805, GGT 1201, AF 1157, total bilirubin 343.5, direct bilirubin 172.5, CA 19-9 453, CEA 114.

The CT (Fig. 1) revealed a liver with no evidence of solid lesions. The common bile duct was 16 mm; the intrahepatic and pancreatic ducts were dilated. A 3×3-cm tumor was found in the head of the pancreas, with lobular structure and slightly accumulating contrast material. The superior mesenteric artery was intact.

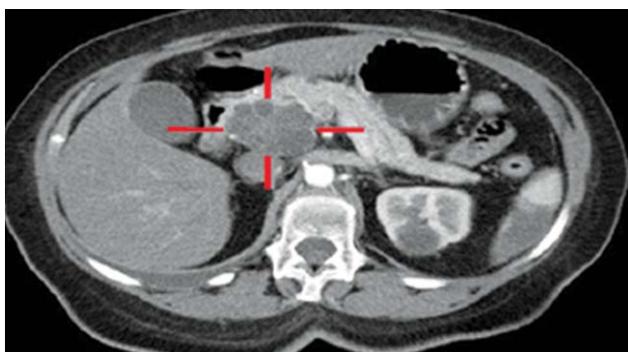


Figure 1. CT of abdomen.

Description of ERCP: a tumor 27×30 mm, compressing the lumen of the common bile duct, was detected. Above the tumor, the common bile duct was distended up to 22 mm. A 10 Fr 6.5 cm prosthesis was inserted and bile secretion began. We performed endoluminal echography with a biopsy from the tumor (Fig. 2). The histological result confirmed moderately differentiated ductal adenocarcinoma.

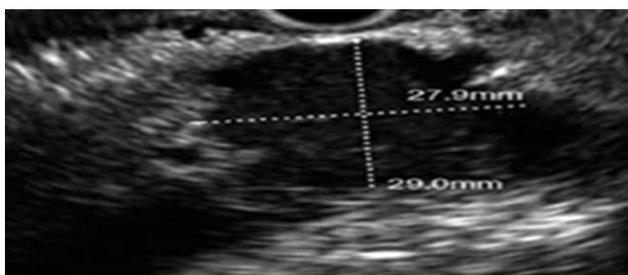


Figure 2. Endo luminal ultrasonography.

After the bilirubin level decreased and the patient's general condition improved, an open pancreaticoduodenal resection was performed within two weeks. The duodenum was mobilized by the Kocher maneuver – the retro duodenal space and the head of the pancreas were presented, with no evidence of infiltration to the cava vein. The dissection in the area revealed enlarged lymph nodes which were removed and sent for histological analysis. The gastroduodenal artery was visu-

alized and ligated. Subsequent dissection in the triangle of Calot resulted in cystic duct and artery ligation. Dissection of the bile duct and the last one was transected. The duodenum under the pylorus was then transected and the endoscopic prosthesis was removed. The pancreas was also transected near the uncinate process. The initial part of the jejunum was divided after releasing the Treitz ligament. Subsequent dissection and detachment of pancreatic head from surrounding tissues leaving only PV/SMV area non-mobilized. Infiltration of the tumor into the portal vein wall was suspected. After partial resection of the portal vein wall and frozen section analysis, the result revealed massive cancer infiltration and uncleaned resections lines. PV/SMV resection was performed after meticulous dissection. Because of anatomic variation, we needed a long graft. Therefore, we harvested a 5cm venous graft from the left internal jugular vein. It was anastomosed subsequently with PV, SMV, IMV and splenic vein (Fig. 3). When the blood flow through the graft was restored, the small intestine, the colon and the spleen gradually regained their normal color and venous edema decreased. Further on, the operation was carried out in the standard manner.

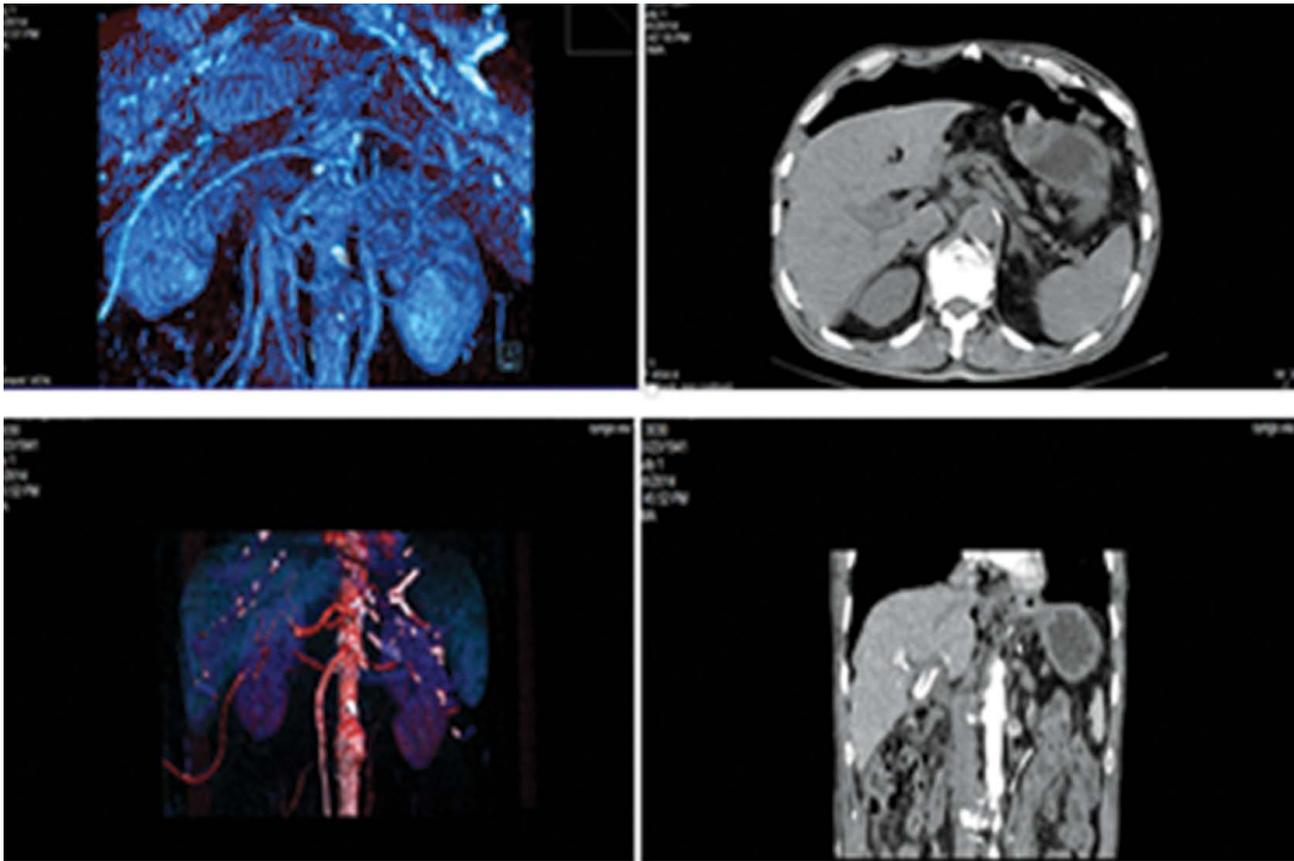


Figure 3. Anastomosis between IJG graft PV/SMV/SV.

The final pathological report confirmed a ductal adenocarcinoma of the pancreas and complete R0 resection with negative lymph nodes. An uneventful post-operative period followed. CT scan was performed prior to hospital discharge and 1 month after surgery, without evidence of thrombosis of the graft. Another CT was performed, within three months with no evidence of local recurrence or metastatic spreads, with sufficient patency of the graft (Fig. 4).

## DISCUSSION

Anatomical variation of the portal vein tributaries was described by Thompson.<sup>4</sup> The IMV drainage, however, follows one of the three common patterns: 1) it often drains directly into the SV, 2) it may empty into the SMV, and 3) it may join the confluence of the SV and SMV.<sup>5,6</sup> Superior mesenteric-splenic-portal vein confluence involvement by malignancy is no longer a contraindication for resection of pancreatic head cancer.<sup>7</sup> Options for a venous reconstruction after SMV/PV resection include prosthe-



**Figure 4.** Control CT scan: no evidence of recurrence or metastatic spread. Vascular reconstruction show sufficient vascular patency of the graft.

tic, autologous or cryopreserved cadaveric vein grafts. The pros of synthetic-polytetrafluoroethylene (PTFE) vascular grafts are its universal availability, readily prepared for in various lengths and various diameters, whereas the cons are having a relatively rigid vascular wall, having a tendency to become infectious and thrombotic. The advantage of cryopreserved veins are the availability in various lengths and diameters, although its use is limited to specific institutions (our institution does not have such a tissue bank). The disadvantages are that their homologous nature provokes allogeneic immune reaction and the possibility of transmitting serious pathogens.<sup>8</sup> The grafts from the left renal or internal jugular vein have several advantages: absence of valves and diameter corresponding to that of the portal vein. The renal graft has a maximum length of 2-3 cm, whereas that of the internal jugular vein can be as long as 5-7 cm.<sup>9,10</sup> This is one of the reasons why we preferred using a jugular graft in this case, and of course presence of an experienced thyroid surgeon possessing the technical skills to execute it. Over the past 30 years, the portal vein resection in pancreatic surgery has become a well-tolerated operative procedure in large-volume centres. In support of these statement, Zhou et al. and Yu et al. conducted a meta-analysis that confirmed that there was no difference in the perioperative morbidity and mortality rates between the two groups.<sup>11,12</sup>

## CONCLUSIONS

Vascular resection and reconstruction provides great opportunity for R0 resection and improvement of oncological results in patients with pancreatic tumors and involvement of venous vessels in the absence of distant metastases. If a longer graft is required, the synthetic prosthesis or cryopreserved grafts are the options. Their weak sides can be avoided by using a jugular vein graft. Of course, the final decision is individual and depends on the specific situation and the surgeon's preferences. Pancreaticoduodenal resection with vascular reconstruction provides acceptable perioperative morbidity and mortality rate. Portal vein resection will be performed more often, safely and aggressively over the next years. In addition to radical surgery, adjuvant chemo radiation therapy and molecular targeting therapy might improve the prognosis for a pancreatic cancer patient.

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## Реконструкция воротной вены при панкреатодуоденальной резекции с использованием внутренней яремной вены в качестве трансплантата

Ганчо Костов, Росен Димов

Кафедра специализированной хирургии, Медицинский университет – Пловдив, Пловдив, Болгария

**Адрес для корреспонденции:** Ганчо Костов, Кафедра специализированной хирургии, Медицинский университет – Пловдив, бул. „Васил Априлов“ №15А, 4002 Пловдив, Болгария; E-mail: [caspela@abv.bg](mailto:caspela@abv.bg); Тел.: +359 895 762 972

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### Резюме

Поражение воротной вены злокачественными опухолями головки поджелудочной железы наблюдается почти у 50% пациентов. В прошлом это открытие делало опухоль неоперабельной. За последние 30 лет операционная заболеваемость и смертность от панкреатэктомии в сочетании с резекцией воротной вены значительно снизились, а резекция воротной вены в хирургии поджелудочной железы стала хорошо переносимой хирургической процедурой в крупных центрах. Варианты венозной реконструкции после резекции ВВВ / ВВ (верхняя брыжеечная вена / воротная вена) включают протезные, аутологичные или криоконсервированные трупные венозные трансплантаты.

Резекция и реконструкция сосудов предоставляют прекрасные возможности для резекции R0 и улучшения онкологических результатов у пациентов с опухолями поджелудочной железы и поражением вен при отсутствии отдалённых метастазов. Если требуется более длинный трансплантат, можно использовать синтетический протез или криоконсервированные трансплантаты. Избежать их слабостей можно с помощью трансплантатов яремной вены. В ближайшие годы резекция воротной вены будет выполняться ещё чаще, безопаснее и агрессивнее.

### Ключевые слова

панкреатодуоденальная резекция, реконструкция воротной вены