

# Vascular reconstructions using synthetic prostheses after extended pancreatic resections for locally advanced pancreatic cancer

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## ABSTRACT

Pancreatic cancer represents one of the most aggressive malignancies affecting patients worldwide which are usually associated with high rates of vascular invasion. In order to achieve radical resection, in such cases extended vascular resections have been proposed with promising results. Once resected, the vascular structures should be reconstructed by direct re-anastomosis if a short length is resected or by placing a graft. The aim of the current paper is to review the most important aspects regarding the vascular reconstructions by using synthetic prostheses.

**Keywords:** locally advanced pancreatic cancer, vascular resection, synthetic prosthesis

## INTRODUCTION

Pancreatic cancer represents one of the most aggressive malignancies affecting patients worldwide which is usually diagnosed in advanced stages of the disease; this aspect is usually explained through the fact that patients remain asymptomatic for a long period of time. In all this interval the tumor grows and invades the adjacent structures inducing the apparition of certain worrisome features such as accelerated weight loss, vomiting, jaundice or intractable epigastric pain with dorsal irradiation [1-3]. Unfortunately when the patient finally addresses to the physician, large pancreatic tumors invading the surrounding vital structures are discovered. Traditionally, cases in which vascular occurs were considered as unresectable and were further orientated to the oncology services for initiation of palliative chemotherapy. In

such cases the overall survival rarely surpassed one year [4,5].

## THE RATIONALE OF PERFORMING PANCREATIC RESECTIONS EN BLOCK WITH VASCULAR RESECTIONS

In the last decades, once the techniques of vascular surgery improved as well as the perioperative management of these patients did, extended pancreatic resections en block with venous resections of the invaded portions have been proposed [2-5]. As expected, the most frequently associated resection initially was represented by portal vein resection; surprisingly, when comparing the long-term outcomes of patients submitted to standard pancreatoduodenectomy to those submitted to pancreatodu-

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odenectomy en bloc with portal vein resection were similar therefore demonstrating that the presence of venous invasion is not the sign of a more biologically aggressive disease but of a longer period of evolution of the disease or of a particular origin of the tumor in the close proximity of the porta vein. Meanwhile, other authors went further and tried to associate arterial resections in cases in which the surrounding arteries were invaded. However, this approach is still strongly debated, conflicting results being reported so far. Therefore, arterial resection of affected segments of the superior mesenteric artery, celiac trunk or hepatic artery has widely reported but the procedure is not yet part of the standard therapeutic strategies. Even though, in highly selected cases – young patients, good biological status, well differentiated tumors a significant benefit in terms of survival is reported in cases in which arterial resections are associated when compared to the once reported after systemic therapy [5-8].

### RECONSTRUCTION TECHNIQUES AFTER VASCULAR RESECTIONS IN BORDERLINE RESECTABLE OR LOCALLY ADVANCED PANCREATIC TUMORS

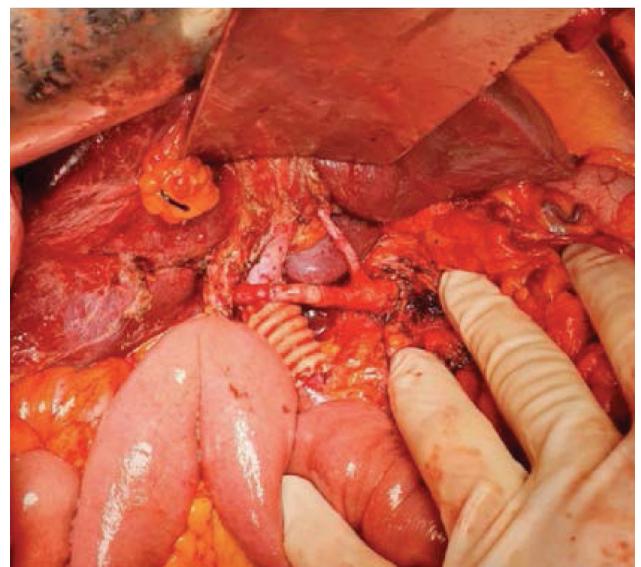
Once the resectional phase is completed, the second part of the surgical procedure, the reconstructive one begins. As expected, the first reconstruction which is to be performed is the vascular one. According to the extent of the vascular involvement, resection can be a lateral or a circumferential one. In cases in which a limited, lateral resection is performed, per primam anastomosis of the vascular walls can be rarely performed due to the risk of developing postoperative vascular stenoses which can further lead to the apparition of parenchymatous disfunctions such as liver ischemia or gastro-intestinal ischemia. Therefore, most often in such cases a patch is used in order to reestablish the vascular integrity without affecting the caliber of the reconstructed structure. In cases in which a segmental, circumferential resection is performed, the type of reconstruction depends on the length of the resected segment. Therefore, in cases in which limited resections are performed, the two vascular stumps can be mobilized and anastomosed through an end to end suture; however, in the daily practice this situation is rarely encountered, most often larger segments being excised. In such cases graft placement is needed [9-11].

Synthetic grafts have been traditionally considered to be the most accessible materials for vascular reconstructions. So far different materials such as polytetrafluoroethylene, goretex or dacron grafts have been used. These grafts have the advantage to be easily to be procured [12-14]. Meanwhile, due to the fact that is synthetical materials, they are usually confectioned in different shapes and diameters, ac-

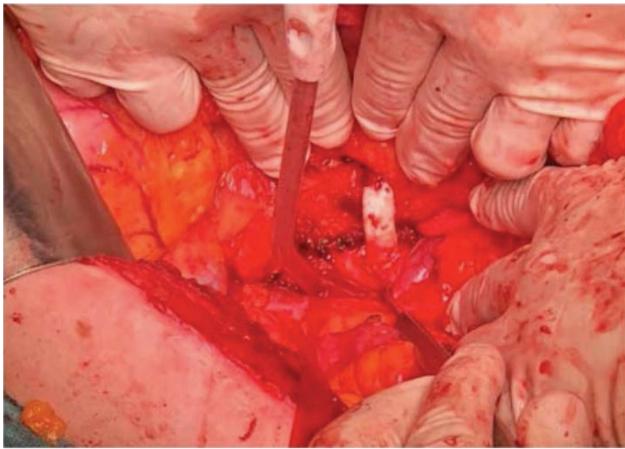
ording to the standard dimensions of the vascular structures. Therefore, synthetic grafts still remain the option of choice especially in cases in which vascular resections have not been planned; therefore, in cases in which vascular invasion is an intraoperative surprise, synthetic grafts represent usually the most accessible mean of reconstruction, which should be available at any hour [12]. In order to prevent the apparition of serious adverse effects such as graft infection, various strategies have been proposed such as perioperative administration of antibiotics, graft immersion in an antibiotic solution before implantation, placement of an omental flap between the vascular anastomosis and the digestive reconstructions or minimizing the rates of intraoperative biliary or digestive spillage [13]. Meanwhile in order to avoid graft thrombosis, these surgical procedures are usually performed after systemic administration of heparin while the grafts are usually rinsed with heparin solution before being implanted. Although such complications have been described, most authors underlined the fact that they did not significantly impact on the perioperative mortality rate (c). In one of the largest meta-analyses conducted on this issue by Labori et al., the authors demonstrated that the rates of early graft thrombosis were of 7,5% in cases in which synthetic grafts have been used versus 5,6% in cases in which autologous vein grafts were placed, 6,7% in cases in which autologous parietal grafts were used and 2,5% in cases in which allografts were placed [14]. These data come to demonstrate once again that synthetic grafts are associated with acceptable rates of perioperative complications.

Intraoperative aspects after placing synthetic grafts are shown in the pictures below.

However, we should not omit the fact that synthetic grafts are also associated with certain early



**FIGURE 1.** Intraoperative aspect after pancreatoduodenectomy en bloc with portal vein resection which was reconstructed by placing a synthetic graft



**FIGURE 2.** The final aspect after pancreatoduodenectomy en bloc with superior mesenteric artery resection. The continuity of the superior mesenteric artery was re-established by placing a Dacron prosthesis

postoperative complications such as graft thrombosis or graft infection; meanwhile, late complications such as severe adherential syndrome have been also demonstrated; therefore, if reoperation is needed, severe adherences between the prosthetic graft and the surrounding viscera should be expected, increasing therefore significantly the risk of developing severe intraoperative complications such as intractable intraoperative bleeding. Therefore, attention was focused on identifying other types of grafts with lower

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risks of generating local complications. In this respect attention was focused on biological materials such as cadaveric or even autologous grafts. Once the techniques of organ harvesting have been widely implemented and improved, harvesting of the larger vessels has been also associated. Although biological grafts are associated with significantly lower rates of perioperative complications such as thrombosis or infection they have the great disadvantage to be harder to be procured and preserved until the moment of their implantation. Another promising biological graft is represented by bovine pericardium, which has the advantage of being a natural material but which is, similarly to cadaveric grafts, more difficult to be procured and prepared and, in consequence more expensive [15-18].

## CONCLUSIONS

Synthetic allografts have been for a long period of time the option of choice for vascular reconstructions after resection of locally advanced and borderline lesions of the pancreas. This type of graft has the benefits of being cheap, facile to be procured and to be preserved for long periods of time. However, we should not omit the fact that significant complications such as graft thrombosis or infection might occur leading to a serious deterioration of the perioperative outcomes.

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