

# Autologous grafts for vascular resections after extended resections for locally advanced or borderline resectable pancreatic tumors

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## ABSTRACT

*Once the surgical techniques improved, vascular resections have been proposed in order to increase the radicality in borderline or locally advanced pancreatic cancer. Traditionally, vascular reconstructions in such cases have been performed by using synthetic grafts; however, these prostheses have been associated with significant complications such as infection, thrombosis or leaks, leading to a very difficult postoperative recovery. Therefore, attention was focused on replacing these artificial materials with biological ones such as cadaveric grafts, autologous grafts or even animal grafts. These grafts proved to be more efficient when it comes to the rates of perioperative complications, thrombosis, infection or leakage being more rarely reported. The aim of the current paper is to discuss about the most frequently used biological grafts.*

**Keywords:** locally advanced pancreatic cancer, vascular resection, cadaveric grafts, autologous grafts, bovine pericardium

## INTRODUCTION

Pancreatic head carcinoma represents one of the most challenging neoplastic disease due to the fact that is associated with extremely poor rates of survival; therefore, in cases diagnosed with advanced stages of

the disease the five year overall survival is less than 3% [1]. However, cases in which the pancreatic lesion is confined to the pancreatic head and is considered to be resectable represent almost 20% of patients; in such cases, if surgery is possible it seems that the five year overall survival rate reaches 30%, the most important

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condition for achieving a long-term survival being the achievement of negative resection margins [1,2]. The presence of venous invasion of the portal vein, portal confluent or of the superior mesenteric vein seems not to influence the overall survival rates especially if radical resection is achievable; therefore, in such cases if negative resection margins are achievable it seems that similar rates of survival are to be expected [3,4]. As for the efficacy of arterial resection, things are still controversial, a clear benefit in terms of survival not being always reported; however, arterial resection has been proposed in tertiary centers most often in association with venous resections, attention being focused on identifying the best type of vascular reconstruction [5-7].

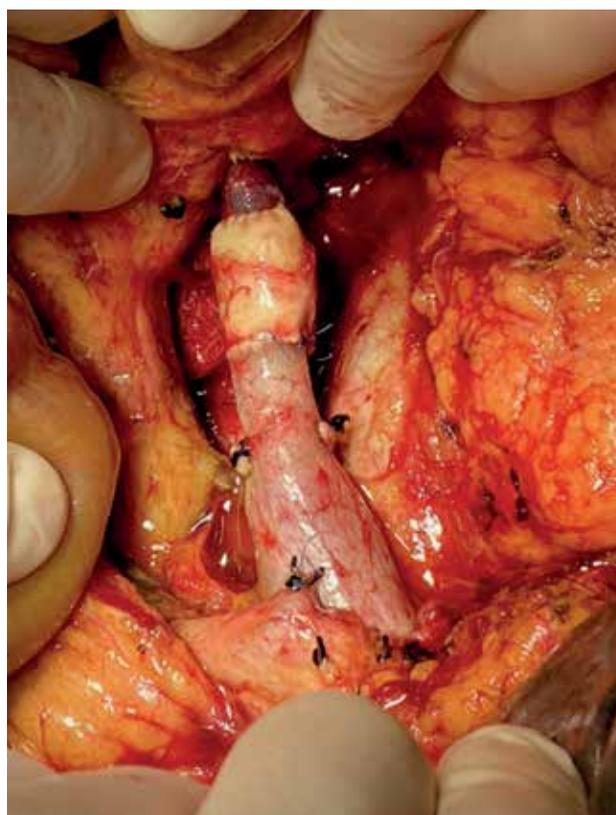
### Rationale for searching an alternative for synthetic grafts

Synthetic grafts have been traditionally used for a long period of time in order to re-establish the continuity of the vascular structures which need to be resected in order to achieve radical resection in borderline or locally advanced pancreatic lesions [7].

Although these grafts are usually more easily to be procured, preserved and overall cheaper when compared to biological grafts, they proved to be associated with significant complications such as graft thrombosis, graft infection or leakage. In cases in which a pancreatic leak develops postoperatively, a significant risk of postoperative hemorrhage is to be expected [7]. These complications should not be considered as a danger for the early postoperative period, they can also influence the long-term survival rate. Therefore, a patient who experiences a postoperative graft thrombosis will need a prolonged anticoagulant therapy or, even worse, other invasive procedure in order to re-establish the normal outflow at this level, a patient which will develop a graft infection is susceptible to be further affected by a severe systemic sepsis and will need prolonged antibiotic therapy while a case who will experience a leak might also need re-operation and a longer hospital stay. All these conditions will lead to an impaired postoperative evolution which will make impossible for the patient the administration as planned of the adjuvant systemic therapies; therefore, such patients will benefit from the administration of the consolidation adjuvant chemotherapy regimens with a significant delay; moreover, if a septic syndrome is developed, the immunity is expected to be diminished and therefore, the development of systemic neoplastic impregnation leading to distant metastases might be encountered. This aspect represents the worst scenario, the patient having minimal chances to benefit from the radicality of the resection. Therefore, although the patient had been submitted to surgery with curative intent, the failure of the immune system and the impossibility to administrate the consolidation treatment as planned will significantly shorten the overall survival.

## TYPES OF BIOLOGICAL GRAFTS

Nowadays, the most frequently used biological grafts are represented by cadaveric grafts, autologous grafts and animal grafts. Cadaveric grafts became widely used after implementation of harvesting techniques and national programs of visceral transplantation. They have the benefit of being well tolerated by the receiver and, in the meantime of being associated with low risks of perioperative complications. One of the most widely used cadaveric grafts which have been widely used to reconstruct the portal vein is represented by the aortic homografts; therefore, aortic grafts present low thrombogenicity, low immunogenicity, large caliber, no need for long term antithrombotic therapy and a proper vascular resistance [8]. In cases in which a vascular resection had not been planned preoperatively a cadaveric graft seems to be the most appropriate option of choice; therefore, it can rarely predispose to the apparition of postoperative complications such as thrombosis or infection (like synthetic grafts), they represent resistant material which seems to be more difficult to be destroyed by an eventual pancreatic or digestive leak and they do not need a supplementary time to be obtained (when compared to autologous grafts which are harvested during the same surgical procedure and therefore they prolong the overall surgical time) [9,10]. Intraoperative aspects of using arterial cadaveric grafts are shown in Figure 1.



**FIGURE 1.** Portal vein reconstruction by using a cadaveric aortic graft

However, it should not be omitted the fact that cadaveric grafts necessitate a special protocol of harvesting, preparation and preservation; meanwhile they can be preserved only in institutions which present bank organs.

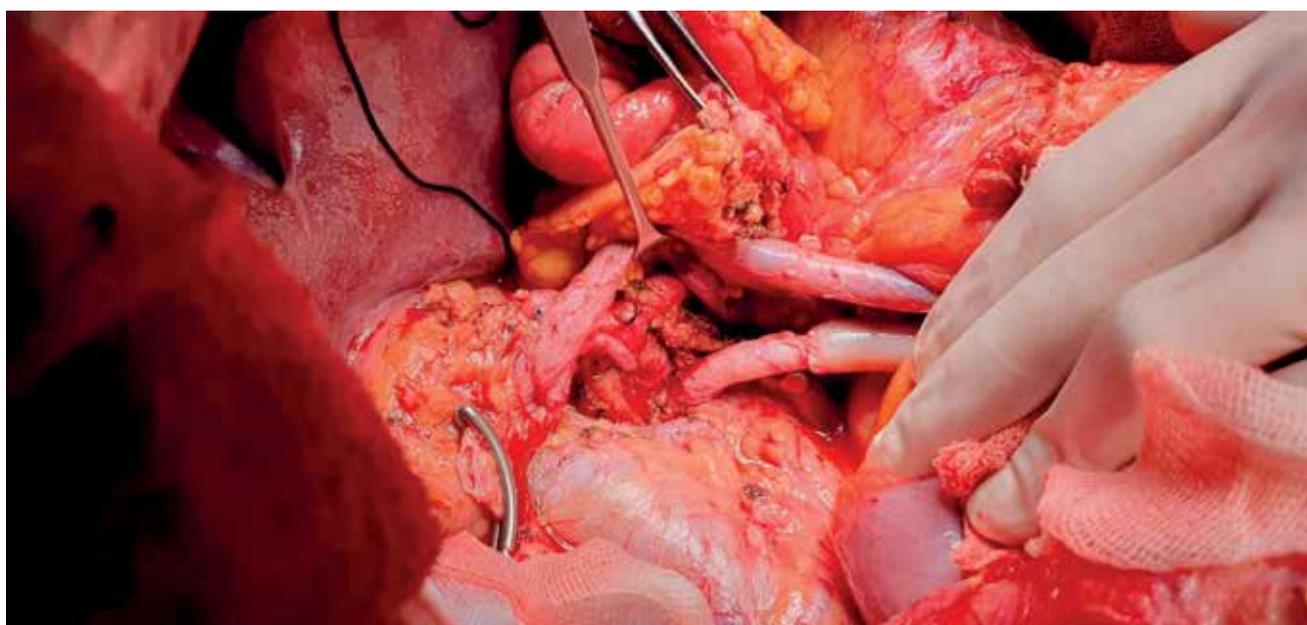
Autologous grafts represent another efficient type of biological graft, which has the great advantage of originating from the same patients; therefore, minimal graft related complications are to be expected. The most commonly preferred such grafts are represented by saphenous, left renal or internal jugular vein [11-13]. As expected autologous grafts present the advantage of total compatibility with the host, being harvested from the same patient; therefore the risk of perioperative graft related complications is minimal. However, they have the disadvantage of prolonging the surgical procedure, their harvesting being in fact a supplementary surgical time, a separate incision and automatically a separate surgical procedure which might induce itself other complications. One of the first studies which was conducted on this issue was published by Lee et al in 2010; the study included 323 patients who were submitted to pancreatoduodenectomy, in 19 cases, portal axis resection followed by autologous graft reconstruction being needed; in 15 cases the harvested segment for venous reconstruction was represented by the greater saphenous vein while in the remaining four cases reconstruction was performed after harvesting the femoral vein, the diameter of the saphenous vein being too small in order to allow using it; the authors reported minimal complications after harvesting these venous segments, the most commonly encountered ones being related to the development of transient leg oedema. As for the long-term follow up, there were three

cases who developed a deep venous thrombosis. Meanwhile the median cancer related survival was of 17,3 months demonstrating therefore that femoral or greater saphenous vein can be safely harvested and used for reconstruction after extended pancreatic resections, a significant benefit of survival being achieved [11].

Intraoperative aspects of superior mesenteric artery reconstruction using an autologous saphenous graft are presented in Figure 2.

Other interesting types of vascular reconstructions after such extended resections are represented by those which use the peritoneum or of the falciform ligament as replacing structure [14,15]. This method seems to be associated with low rates of perioperative complications and good long-term function [15]. However, these types of reconstructions are rather feasible if lateral and not circumferential resections are needed [14,15].

A newer alternative is represented by the biological grafts with animal origin; the most frequently used such prosthesis originates from bovine pericardium and is associated with promising results [16,17]. Similarly, to cadaveric human grafts, this animal grafts necessitate a special process of harvesting, preparation and preservation and therefore these products are usually available at higher prices. Even though, they proved to be extremely well tolerated by the human body and therefore became an option of choice when compared to synthetic grafts. The method has been also successfully applied in cardiac surgery, bovine pericardium being used in order to replace the affected segment of the human pericardium [18].



**FIGURE 2.** The final aspect after pancreatoduodenectomy en bloc with superior mesenteric artery resection. The portal vein was entirely preserved while the superior mesenteric artery was reconstructed by placing a homograft of saphenous vein

## CONCLUSIONS

Vascular prostheses and grafts have been submitted to permanent changes in the last decades in order to find the perfect structure which is expected to be asso-

ciated with minimal graft related risks. Although they usually have higher prices and are associated with a more demanding process of harvesting, they are to be preferred when compared to synthetic grafts.

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