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MANAGEMENT AND OUTCOMES OF ANEURYSMS FOUND IN DECEASED DONOR LIVERS: A REVIEW OF PUBLISHED CASES

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Introduction. The organ shortage has prompted transplant surgeons to accept grafts from deceased donors, which can lead to complex reconstructions. The presence of an aneurysm can complicate the arterial anastomosis of the liver transplant, leading to postoperative vascular complications such as hepatic artery thrombosis or stenosis. **Objective:** review published cases of donor liver aneurysms and their management. **Materials and methods.** After an exhaustive literature search, only 4 published cases of liver transplants from grafts with aneurysms in their vascular territory have been found. **Results.** These vascular anomalies were corrected by vascular reconstructions and no postoperative arterial complications were observed. **Conclusion.** Although no particular arterial configuration precludes the use of a donor liver for transplant, more arterial complications can be anticipated with complex arterial reconstructions. However, properly managed arterial anomalies do not necessarily compromise graft outcome. Therefore, our review of the literature shows the possibility of using these organs for liver transplantation, which would otherwise be discarded.

Keywords: liver transplantation, hepatic aneurysm, extended criteria donor, vascular abnormalities.

INTRODUCTION

The organ shortage has prompted transplant surgeons to accept grafts from deceased donors with severe vascular anomalies that may require complex reconstructions [1]. Recognition and adequate reconstruction of such variants are essential in the evolution of liver transplantation, since alterations in arterial flow usually cause graft loss due to biliary and/or parenchymal ischemic complications. In the literature, arterial anomalies have been linked to an increased incidence of arterial complications. Most of these studies were based on a relatively small number of grafts and none have analyzed the effect of the techniques for managing these anomalies on post-transplant complications. The optimal treatment of these findings in the donor liver is also unclear [2].

The discrepancy between supply and demand and the increase in morbidity and mortality of patients on the waiting list has led to a search for alternatives to the standard pool of brain-dead organ donors. The most immediate source of organs capable of expanding the donor pool is that of donors with extended criteria, also called marginal donors. These, although not universally defined, include a wide range of donors with unfavorable characteristics, historically associated with worse graft and patient survival [advanced age, steatosis, hypernatremia, donor in asystole, etc.]. Asystole donation is associated with severe ischemia-reperfusion injury, which is responsible for delayed graft function and biliary ischemia. However, if carefully selected and matched to appropriate recipients, asystole donor livers can be used safely and effectively [3].

Aneurysms of the visceral arteries are rare entities that affect the celiac trunk, splenic, superior mesenteric or inferior mesenteric artery and their branches. The prevalence of visceral artery aneurysms is 0.1% to 2%. Depending on the size and location of the aneurysm, mortality from rupture ranges from 25% to 100%. The splenic artery is the most commonly affected artery (60%), followed by the hepatic artery (20% to 50%) [4].

The presence of an aneurysm can complicate the arterial anastomosis of the liver transplant, leading to postoperative vascular complications such as thrombosis or stenosis of the hepatic artery. Careful arterial reconstruction of this vascular anomaly can reduce this risk of vascular complications and make it possible to use a graft that would have been discarded [5].

We performed a review of the literature on published cases of aneurysms found in this donor vascular territory and their management.

MATERIALS AND METHODS

The search was carried out in several databases: Pubmed, Scopus, Cochrane library, EMBASE, SciELO and LILACS; and in all of them the same search criteria were followed. The following algorithm was used: “liver donor aneurysm”. The search was conducted on August 2, 2023. Studies published in Spanish and English were

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included. All publications that did not deal with donor liver aneurysms were discarded. No filters of any kind (text availability, article type, publication date, …) were applied After reviewing the literature, 4 published cases were found.

RESULTS

In the first case described in 2012, a celiac trunk aneurysm (1.7 cm of transverse diameter) was found during the back-table surgery. The whole liver transplantation was performed to re-transplant a 43-year-old woman with end-stage liver disease (MELD score 30) that was caused by chronic rejection. The Model for End-Stage Liver Disease (MELD) is an objective and easily reproducible prognostic index of mortality based on three simple analytical variables: bilirubin, serum creatinine and the prothrombin time/International Normalized Ratio (INR) of protrombine time. The implementation of MELD as an organ allocation system has reduced mortality on the waiting list without affecting post-transplantation survival. A heterologous segmental hepatic arterial graft was used to guarantee optimal arterial flow. The hepatic artery was sewn end-to-end to the common hepatic artery and subsequently during the implantation the end of the donor common hepatic artery was sewn end-to-end to the native common hepatic artery of the recipient. The recipient is alive and well 6 months later, without any vascular or biliary complications [6].

In the second case described in 2015, a Michels type V variant was verified with a left accessory hepatic artery arising from an aneurysm of the left gastric artery of 2.3 × 2.3 cm and a second aneurysm of the common hepatic artery of 2.7 × 2.5 cm. At the bench-time, it was created a main common arterial trunk using four vascular sutures: the left hepatic artery (elongation) to a tubular splenic patch; the splenic patch to the gastric stump of the spleno-gastric carrefour; the splenic side of the carrefour to the right hepatic artery; the spleno-gastric carrefour to a mesenteric patch in order to obtain a good arterial stump for the anastomosis in the recipient. The new common arterial trunk (graft) was sutured to the common hepatic artery at the gastro-duodenal origin and the left accessory hepatic artery to the homologous branch of the recipient. After 36 months of follow-up, the patient was in good conditions with normal biochemistry. Contrast-enhanced computerized tomography 3D reconstruction showed arterial patency without any stricture and/or kinking of the reconstructed arteries [1].

In the third case described in 2020, computerized tomography demonstrated a proper hepatic artery aneurysm of 64 × 49 mm in diameter, which extended to the origin of the right and left hepatic arteries; the common hepatic artery arose from the superior mesenteric artery. At back table it was resected the aneurysm and reconstructed the left and right hepatic arteries on a vascular graft obtained from the donor's distal tract of the superior mesenteric artery. All collaterals of the mesenteric graft were accurately ligated, apart from the ileocolic bifurcation, which was used for the anastomosis. Liver transplant was performed using the piggy-back technique without venovenous bypass. For arterialization, it was anastomosed the mesenteric graft to the recipient's hepatic artery at the origin of the gastroduodenal artery. The postoperative course was uneventful, and no complications were observed after a total follow-up of 6 months [7].

In the fourth case described in 2021, it was identified a celiac artery aneurysm (CAA) 18 mm in diameter, with the common hepatic, splenic, and left gastric arteries originating from the aneurysm. The recipient's proper hepatic artery was dissected down to the level of the hepatic artery bifurcation to create the anastomosis. The donor's hepatic artery was divided away from the aneurysmal dilatation to the level of the common hepatic artery. The hepatic artery reconstruction was performed in an end-to-end fashion using a Carrel patch from the recipient's proper hepatic artery bifurcation to donor's common hepatic artery. Since discharge, the recipient had had 2 episodes of colestasis, which were managed by endoscopic retrograde cholangiopancreatography with sphincterectomy, dilation, and stent placement. The flow through the arterial anastomosis has demonstrated optimal post-operative flow patterns since transplant [5].

Summary of cases (Table)

Reconstruction scheme (Fig.)

DISCUSSION

Liver transplantation represents the treatment of choice for patients with end-stage liver disease and in recent years there have been improvements in immunosuppressive regimens, preservation solutions, anesthesia, surgical techniques, donor and recipient selection, and antibiotic therapy; however, the availability of liver grafts remains scarce [6].

The increasing median age of deceased donors and the increasing frequency of serious vascular anomalies today encourages transplant centers to be ready to manage such variations and vascular problems successfully [1].

Today professionals are forced to use the group of extended criteria donors (ECD) as a logical consequence of donor scarcity and significant changes in the socioeconomic and healthcare fronts and new development in the field of medicine. Consequently, the number of potentially younger organ donors has decreased and many centres in Europe report on an increasing median donor age in their population. ECD grafts are thought to be of lower than average quality, associated with poor posttransplant outcomes or an increase in disease transmission. Grafts, however, can be used safely through

careful selection of both donor and recipient risks. Although there is no precise definition for what constitutes an ECD liver, frequently cited characteristics are listed: advanced age; macrovesicular steatosis; donation after cardiac death (DCD); organ dysfunction at procurement; cause of death: anoxia, cerebrovascular accident; disease transmisión: Hepatitis B virus, Hepatitis C virus, CDC high-risk donors, HIV positive, extrahepatic malignancy, cold ischemia time (CIT) greater than 12 hours [8]. In short, careful donor and recipient selection remains crucial to optimize outcome after liver transplantation from ECD [9].

Despite the success demonstrated with liver transplantation, vascular complications remain the Achilles heel of the intervention. They usually occur at the anastomotic site, with thrombosis, hepatic artery stenosis, and other vascular complications associated with high morbidity and mortality. These complications can cause endothelial necrosis, necrosis of the biliary tree, or even loss of the graft, which would require a new transplant. Vascular variations or anomalies that require complex vascular reconstructions predispose to technical mistakes and the risk of vascular complications [1].

The presence of an aneurysm in a donor liver can complicate vascular reconstruction, distorting the arterial supply of the graft [5]. Our review of the literature on liver donor aneurysms shows only 4 case reports and data on the long-term outcomes of these grafts are sparse, illustrating the apprehension of transplant surgeons about using these grafts, which have the potential to achieve good results.

Although it is true that there were no significant complications in the reported cases, it must be taken into account that the follow-up period is short. A reconstruction as complex as the one mentioned by V. Tondolo (2015) [1], has a high rate of vascular complications and it would be necessary to consider whether this risk compensates the benefit of the transplant. Furthermore, the donor-recipient combination must be taken into account, since a patient in need of retransplantation, for example, may not be the best option for this type of donor. On the other hand, in the cases reported by F. Di Francesco (2012) [6] and O. Slivca (2021) [5], the need for arterial reconstruction would have to be considered if other options, such as the CHA-CHA anastomosis, were not possible. This option is not contemplated in the clinical case notification. Finally, we find the graft used in the case reported by De Carlis, R (2020) [7] interesting, although in our center we usually use the iliac bifurcation for this purpose.

Although there were no arterial complications in the studies analyzed, reconstruction involving multiple anastomoses significantly increases the risk. However, the incidence of chronic rejection and graft loss was similar in grafts with normal and abnormal arterial anatomy according to some studies [2].

It is essential that abnormalities in vessel wall integrity are evaluated in the operating room and infectious sources are excluded. The use of Doppler ultrasound in the immediate postoperative period allows early diagnosis of vascular complications and rapid treatment [5].

There are several strengths to this review. On the one hand, thorough literature search was conducted across multiple databases. On the other hand, discussion analyzes the risks/benefits of complex reconstructions versus discarding the grafts.

Our study was limited by a small sample size, given the few published cases of aneurysms in the liver of a deceased donor. Furthermore, this is not a comprehensive review, but rather a presentation of a problem in liver transplantation that can occur and the solutions that have been sought so far. Finally, more long-term follow-up on outcomes would be beneficial if available.

In summary, properly managed arterial anomalies do not necessarily compromise graft outcome. Although no particular arterial configuration precludes the use of a donor liver as a full or reduced graft, more arterial complications can be anticipated with complex arterial reconstructions [2]. More studies are needed to develop guidelines that advise on how to act in response to these findings in liver transplantation.

Table

Main characteristics of the cases described

Work	Location	Dimensions	Reconstruction	Anastomosis	Post-transplant complications
Di Francesco F. (2012)	Celiac trunk	1.7 cm (TD)	Heterologous segmental hepatic arterial graft	CHA-CHA	No
Tondolo V. (2015)	CHA LGA	2.7 × 2.5 cm 2.3 × 2.3 cm	Splenic patch, spleno-gastric carrefour, mesenteric patch	Graft-CHA/GDA	No
De Carlis R. (2020)	PHA	6.4 × 4.9 cm	Vascular graft from the donor's distal tract of the SMA	Graft-CHA/GDA	No
Slivca O. (2021)	Celiac trunk	1.8 cm (TD)	Carrel patch	CHA-PHA	Colestasis

Note. TD – transverse diameter; CHA – common hepatic artery; LGA – left gastric artery; SMA – superior mesenteric artery; GDA – gastroduodenal artery; PHA – proper hepatic artery.

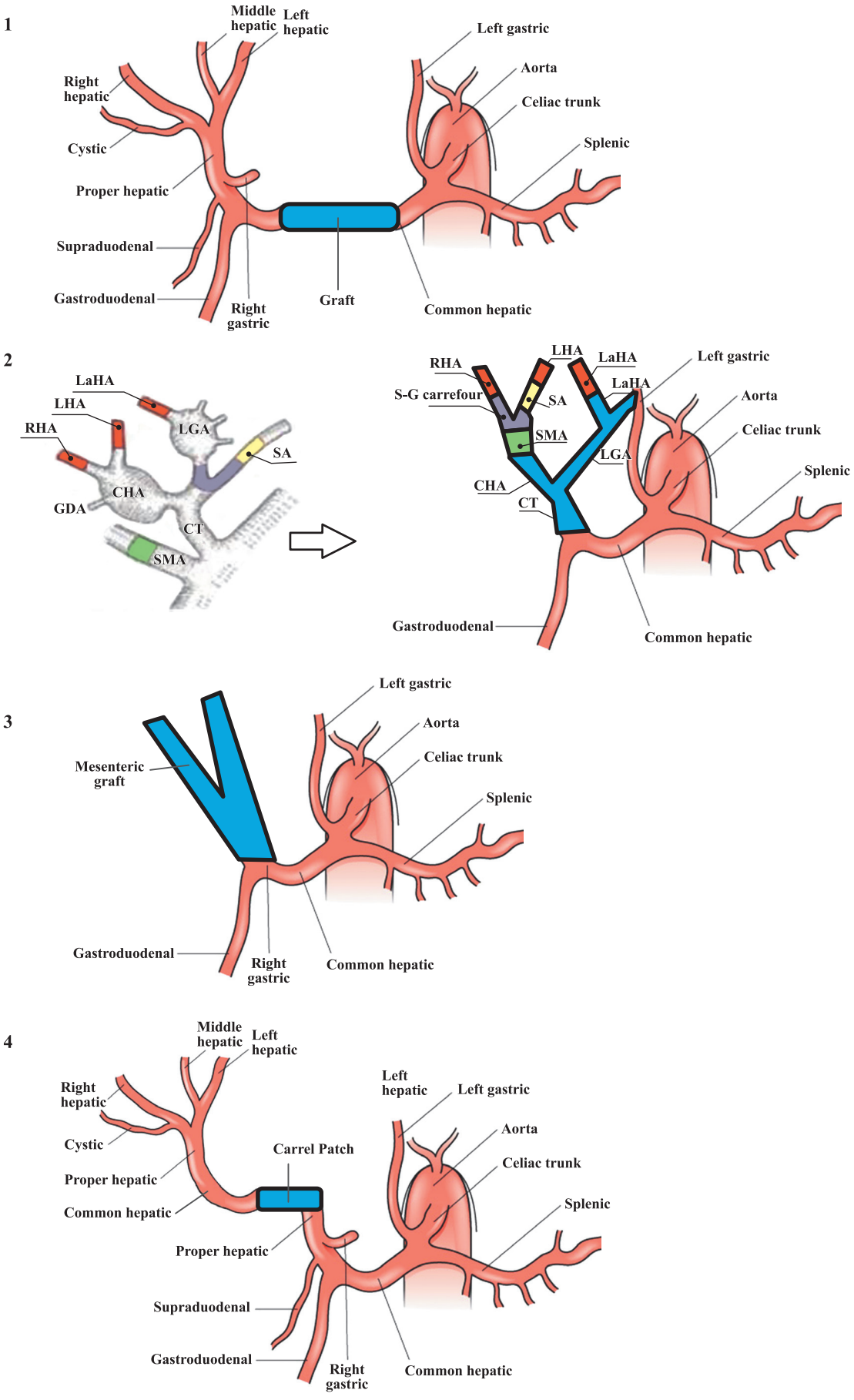

Fig. Reconstruction of the cases described. CHA – common hepatic artery; RHA – right hepatic artery; LHA – left hepatic artery; LGA – left gastric artery; GDA – gastroduodenal artery; SMA – superior mesenteric artery; LaHA – left accessory hepatic artery; SA – splenic artery; CT – celiac trunk; S-G carrefour – spleno-gastric carrefour

CONCLUSION

The presence of an aneurysm in the vascular territory of the liver donor should not be an absolute contraindication for its use as a liver graft. Although vascular anomalies and complex reconstructions may be associated with a higher risk of complications, our review of the literature shows the possibility of using these organs for liver transplantation. Anyway, further studies are necessary for more substantial conclusions.

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