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Special article

Controversies in living donor liver transplants

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Adult liver transplants from a living donor are a valid and effective alternative as a treatment in terminal liver disease. However, in the context of a donation from a brain dead donor, as in western countries (Spain), it is very high, and there are still controversial aspects that should be continuously assessed in order to ensure good results. Live donations are currently stable and represent about 5% of the total liver transplants performed in Europe. Morbidity and mortality is around 35% and 0.1%, respectively, probably reasonable figures given the characteristics of the intervention. The 1 and 5 year survival rates of the recipients of a living donor are currently 95% and 75%, which are similar to those coming from brain dead donors. However the level of biliary complications in this patient group is higher, with an incidence of around 35–40%. However, this incidence has not had any effect on the long-term results up until now.

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Controversias en la obtención del injerto hepático procedente de donante vivo

R E S U M E N

El trasplante hepático en adulto con órgano procedente de donante vivo es una alternativa válida y eficaz como tratamiento de la enfermedad terminal hepática. Sin embargo, en el contexto de tasas muy elevadas de órgano procedente de donante en muerte cerebral, como ocurre en los países occidentales (España), continúa manteniendo aspectos controvertidos que obligan a una evaluación continua para asegurar buenos resultados. La donación en vivo se encuentra estabilizada en la actualidad y representa alrededor del 5% de toda la actividad de trasplante hepático en Europa. La morbilidad y la mortalidad están alrededor del 35 y el 0,1% respectivamente, cifras probablemente razonables, dadas las características de la intervención. En cuanto a los resultados de los receptores de un donante vivo, las supervivencias a 1 y 5 años actualmente son del 95 y el 75%, lo que los sitúa en

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cifras similares a los resultados procedentes de donante en muerte cerebral. Sin embargo, el índice de complicaciones biliares en este grupo de pacientes es mayor, con un 35–40% de incidencia, aunque hasta ahora ésta no influye en los resultados a largo plazo.

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Introduction

Obtaining a segment of the liver for transplant is currently one of the most complex interventions available. A careful dissection is required which leaves no room for errors and constant treatment of the parenchyma is needed to guarantee its indemnity through the entire process.¹

A partial hepatic graft can be taken from the left lobe which is the one most commonly used in liver transplants from a live infant donor, or from the right lobe which is most common in a transplant from a live adult donor. Either method requires an exhaustive study prior to and during the surgical procedure to allow for exact anatomical understanding of all the vascular and biliary structures.²

Despite the surgery being very well regulated, a right hepatectomy in a live adult donor to obtain a sufficiently-sized lobe is the procedure which has given rise to the highest number of controversial incidents. This has to do with the donor's remaining hepatic tissue,³ blood surface and the vascular/biliary distribution, amongst others. The aspect that gives rise to the most number of issues is the morbidity and mortality rates that a procedure of this nature can incur.⁴ Indeed, all efforts are aimed towards achieving a safe procedure but there are inherent aspects to such a serious surgical procedure, such as the risk of thromboembolism and the appearance of infectious complications, etc, which give rise to an associated morbidity of almost 25% and a mortality figure of 0.3%.⁵

This document reviews the donor process for obtaining a partial implantation, paying particular attention to the most controversial aspects.

Anatomical assessment of the potential graft

Currently we have the instruments to allow us to carefully assess all the hepatic structures, both vascular and biliary. Both magnetic resonance (MR) and multi-planar computerised tomography (CT) allow us to gain understanding of these structures.⁶ MR has the advantage of allowing all the vascular and biliary studies to be carried out in one examination, although the disadvantage is that it takes considerably more time than the CT. The main disadvantage is that the study of the biliary tract requires independent examination. Either of the 2 are non-aggressive ways for understanding the anatomical layout of the liver and for planning the surgical procedure. From the images obtained there are methods for reconstructing the organ into a three dimensional structure so as to ensure that no doubt exists as to the relationships between all the vascular structures (arteries and veins) and

the biliary tracts. Carrying this out increases the price of the examination so in our opinion carrying it out systematically is not justified.

Vascular structures

The study of the vascular structures allows the following to be seen in detail: a) the hepatic veins, whilst checking for the presence of one predominant right hepatic vein, as well as the existence of average hepatic veins which frequently drain the anterior segments of the right lobe; if they are approximately 1 cm in size their reconstruction is advisable during the transplant; b) the portal vein in which the most important data is the existence of a common right trunk; on some occasions there is very early branching which precludes the existence of a single right portal (currently this finding is not a reason for contra-indication as portal branching of the recipient can be used for achieving a common trunk⁷); and c) the right hepatic artery which tends to be quite uniform in its distribution, with a right trajectory that allows for a sufficient segment for arterial reconstruction without any type of associated graft.

The biliary tract

It is important to obtain good images which allow for visualisation of up to the first veins on the right side. Anatomical anomalies are frequent and the presence of at least 2 hepatic ducts is 60%.⁸ If this was not possible prior to initiating the surgical procedure, it would be necessary to carry out a preoperative cholangiography which will study the anatomy in detail which is essential at the surgical strategy planning stage.

Surgical procedure

The surgical procedure is much standardised and there are few doubts at the point of planning the surgical technique.⁹ However, an exhaustive anatomical study is necessary which allows for the hepatectomy process to be carried out safely and to be controlled at all times.

Isolation of the vascular structures

This initial aspect involves the dissection of the right hepatic artery, the right portal vein, and identification of the right biliary tract. In the same way, the entire right hepatic lobe is separated from the vena cava and the right hepatic vein is identified. This allows for the right lobe to be separated

from the vena cava and the final transect line to be identified via passing a tape between the suprahepatic veins. The isolation of the hepatic vein and the right portal vein allows for the transect line of the parenchyma to be checked via pinching.¹⁰

The biliary tract

In our experience, we have not made any attempt at dissection, despite understanding the anatomy. The main reason for this is based on carrying out this whole process under the most suitable conditions possible for the donor, so we consider that the biliary tract should be dissected at the end of the transect process of the hepatic tissue, when only the vascular structures remain, therefore sectioning of the right biliary tract is made much easier.

Preoperative cholangiography

Once the dissection of the hilum has been carried out, we identify what we believe to be the right biliary tract and it is marked out with a pair of clips. The cholecystectomy and cannulation of the cystic duct is carried out. The cholecystectomy shows us the exact anatomy if we were not already aware of it. A reason for controversy is the great variability of the biliary tract, which could be a reason for contraindication. Undoubtedly the appearance of more than one right duct increases the difficulty of biliary reconstruction in the donor.¹¹ If one adds to this the fact that the index of biliary complications is higher in this type of transplant, it could be indicated that it should not be carried out when the number of right hepatic ducts is more than 2. However it has not been possible to show that the number of hepatic ducts conditions the appearance of postoperative complications. In addition to this, currently and as experience is growing, complications of a biliary origin have reduced substantially and are produced in 30% of the cases.

Transect of the parenchyma

The hepatic transect is much standardised. In our experience the use of the Cusa® ultrasonic scalpel and a monopolar coagulation system such as *tissuelink* allows for careful haemostasis, together with the identification of the different structures that can be found in the section plan, the majority of which are tributaries of the medium hepatic vein and the vein itself in some cases (Figure). Two aspects currently remain controversial.

Section of the biliary tract

Some authors prefer to section the biliary tract at the start of the procedure, but in our experience we prefer to do it once the hepatic transect is virtually finished. The reason for this is so we can identify the structures properly, ascertain the orientation of the biliary tract and establish any tributary almost immediately. The section is always done using scissors and haemorrhage is facilitated to guarantee non-compromise

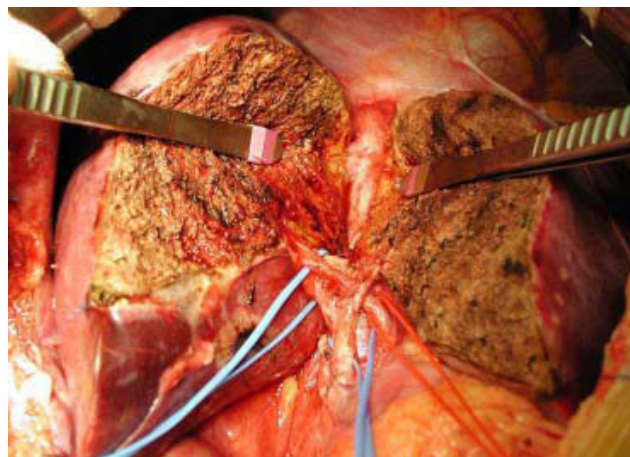


Figure – Operative image of the total transect of the hepatic parenchyma and the right hepatic duct. The vascular structures remain dissected, until the transect is complete, until it is sectioned and the graft is extracted.

of the vascularisation of this section of the biliary tract. Visualisation of the biliary tract in a long segment allows for (with the help of a hernia) the checking of the exact pathway and situation of the biliary branching, thereby avoiding injury to the left hepatic duct.

Inclusion of the middle hepatic vein with the graft

The middle hepatic vein has been the topic of discussion between the different hepatic transplant groups with experience in live donor transplants.^{12,13} The basis of the argument is to try and achieve as adequate as possible drainage of the hepatic segment, under different conditions to the normal physiological state, ie, in patients who tend to have portal hypertension and blood flows that can rise to 3 or 4 times the normal rate. This puts the partial hepatic graft in an uncomfortable situation which can give rise to the syndrome known as “small for size”^{14,15} if correct vein drainage is not guaranteed. The alternatives from a technical point of view go from preservation of the middle hepatic vein with a graft,^{16,17} (which can harm the donor), to performing complex technical procedures in the form of plastys that aim to achieve correct vein drainage.^{18,19} Our experience allows us to highlight the following points: a) exhaustive preoperative assessment of the distribution of the hepatic veins and to identify those which, as well as the right hepatic vein, need to use and anastomose the vena cava (right supplementary hepatic vein or the tributary hepatic vein from the middle hepatic vein); b) keep in mind that the transect procedure in the case of a ligature and the section of a vein compromise drainage, something which is evident in the hepatic surface; c) after the complete section, cleaning the graft should be uniform; if it is not, a venous branch could compromise drainage, which would require releasing the corresponding ligature; and d) the availability of cryo-preserved grafts that allow for the construction of a bridge from the vena cava to the

identified hepatic vein (normally with a diameter of >5 mm). Finally, we must always control the flows through the porta, at the beginning of the surgery, throughout the temporal portocaval shunt and at the point of reperfusion. The aim is not to have >2 L flow. Therefore, if necessary, ligation of the lienal artery is carried out. As with many groups,²⁰ we do not include the middle hepatic vein with the hepatic graft, as our criteria is to always carry out any procedure in the best interests of the donor, therefore, the middle hepatic vein more or less keeps the same trajectory as the left lobe. Venal reconstruction in the recipient is always prepared for with the possibility of using cryo-preserved grafts to guarantee the best possible venal drainage.

Morbidity and mortality

Morbidity and mortality are the main reasons that shed doubt on the justification of this type of transplant. Morbidity and mortality related with live donors continues to raise controversy regarding its use.²¹ One exhaustive preoperative assessment is not enough to guarantee a problem-free postoperative course. The incidence of complications is between 20% and more than 50%. This large variability is due to the way in which the different complications are observed.²² Often only the cases that have required admission to hospital or reintervention are considered to be the important ones. However, correct assessment indicates that the number of complications is nearer 50% than 20%. The more frequent complication has to do with the biliary tract^{23,24} and the appearance of biliary escape which requires conservative treatment and surgical reintervention is only needed in some cases. But postoperative fever and right pleural effusion, etc, are also frequent following surgery. Fortunately, in our experience, all donors have completely recovered and in an initial study into their quality of life they all assessed their situation as satisfactory.

Another aspect is mortality amongst donors. Currently it is calculated that the probability of dying after donation is 0.3% (according to the ELTR). However, the majority of critics show that this is an underestimation. It should be pointed out that the data from the European Register is audited and therefore it is unlikely that this is an underestimation in Europe (Table). However, in the United States and the rest of the world there is no common register which includes all transplants and the publication of negative data such as this is complicated. Aside from this, the mortality data is objective and this greatly conditions the establishment of these types of transplants. The aim is to guarantee a maximum level of care at all times; the preoperative assessment and postoperative follow-up should cover all clinical aspects, not just hepatic function but also the functional state of the whole body. It is impossible to guarantee no mortality at all, but the programme itself can acquire, as is the case the worldwide, a care agreement at the highest level, including weekends. In our experience, of the 60 transplants carried out, our complications index sits at around the 35% mark and fortunately to date all donors are in a perfect state of health.

Table 1 – Early postoperative donor complications (October 1991 to June 2007)

	No. (%)
No complications	1875 (80)
Complications	479 (20)
Biliary escape	95 (4)
Biliary stenosis	16 (0.7)
Hepatic insufficiency	143 (6)
Pulmonary complications	(2)
Pleural effusion	36 (1.5)
Pulmonary embolism	19 (0.8)
Vascular complications	(2)
Haemorrhage	20 (0.8)
Portal thrombosis	11 (0.5)
Pneumonia or pneumothorax	10 (0.5)
Thrombosis arterial	7 (0.3)
Phlebitis	1 (0.04)
Infection	(3.7)
Surgical wound	50 (2)
Other than surgical wound	37 (1.6)
Collection	(0.4)
Infected	2 (0.08)
No infection	6 (0.3)
Gastrointestinal	16 (0.8)
General	10 (0.5)

Source: ELTR (European Liver Transplant Registry). Available from: <http://www.eltr.org>.

Discussion

A transplant in an adult from a live donor is a controversial practice, but mortality on the waiting list itself justifies this type of transplant. The current results indicate a survival rate similar to that of the transplant from a deceased donor, although a higher number of biliary complications are associated with regards stenosis which appears in the long term (over 6 months). The risk that the donor takes should be clearly explained. The current Spanish law which explicitly defends this type of transplant has developed mechanisms that ensure the absence of pressure as much as possible.²⁵ The need for some positive reports by doctors does not form part of the programme, informed consent given before a judge, etc, mean that the process is made necessarily lengthy, exhaustive and for the most part, objective. In the absence of an absolute guarantee, continual assessment of the process is needed to avoid a decrease in the intensity of the agreements between all participants. Only this way will objective results be achieved that fully justify the risk posed to a healthy person.

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