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Original article

Indications and results of liver retransplantation: experience with 1181 patients in the hospital universitario La Fe

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A B S T R A C T

Liver retransplantation (LrT) is the only therapeutic option for irreversible failure of a hepatic graft and accounts for 2.9%-24.0% of all liver transplantations (LT). It is technically difficult and has a high level of immediate morbidity and a lower survival than primary LT. Our aim was to determine the rate of LrT and its indications, morbidity, post-operative mortality and actuarial survival in the retransplanted patient.

Patients and method: A historical cohort study of 1181 patients transplanted between 1991 and 2006.

Results: Of the 1260 LT performed, 79 were LrT. At the time of the first LT there were no differences between those patients and those that did not require an LrT. The LrT rate was 6.3% and the most frequent causes were: hepatic artery thrombosis (31.6%), recurrence of cirrhosis due the HVC (30.4%) and primary graft (21.5%). The ischemia times, perfusion syndrome and hepatic congestion were no different between the primary LT and the LrT. On the other hand, red cell transfusions were higher in LrT (6.3±4.9 vs 3.5±3.0 units, *P*<.001). The post-operative morbidity and morbidity (up to 30 days after the LT) was higher in retransplanted patients (68.4% vs 57.0%, *P*=.04 and 25.3% vs 10.9%, P<.001; respectively). The actuarial survival at 1 and 5 years was 83% and 69% in those without LrT, 71% and 61% in early LrT and 64% and 34% in delayed LrT (*P*<.001).

Conclusions: Despite the increased morbidity and mortality of LrT, it appears that this treatment alternative is still valid in those patients with an early loss of the liver graft. On the other hand, when the graft loss is delayed, it needs to be defined, what would be the minimum acceptable results to indicate LrT and which patients could benefit from this treatment.

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Indicaciones y resultados de retrasplante hepático: experiencia del hospital universitario La Fe (1.181 pacientes)

Palabras clave:
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Causas
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RESUMEN

El retrasplante hepático (ReTH) constituye la única opción terapéutica para el fracaso irreversible de un injerto hepático y corresponde a un 2,9-24,0% de todos los trasplantes hepáticos (TH). Técnicamente es difícil y conlleva un elevado índice de morbilidad inmediata y una menor supervivencia que el TH primario. Nuestro objetivo fue determinar la tasa de ReTH y las indicaciones, morbilidad, mortalidad postoperatoria y supervivencia actuarial del paciente retrasplantado.

Pacientes y método: Estudio de cohorte histórica de 1.181 pacientes trasplantados entre los años 1991 y 2006.

Resultados: De los 1.260 TH realizados, 79 fueron ReTH. Al momento del primer TH, no hubo diferencias con aquellos pacientes que no necesitaron ReTH. La tasa de ReTH fue del 6,3% y las causas más frecuentes fueron: trombosis de la arteria hepática (31,6%), recidiva de la cirrosis por VHC (30,4%) y fallo primario del injerto (21,5%). Los tiempos de isquemia, síndrome de reperfusión y congestión hepática no difieren entre el TH primario y el ReTH. Por el contrario, la transfusión de hematíes fue mayor en el ReTH (6,3 ± 4,9 vs. 3,5 ± 3,0 unidades, $p < 0,001$). La morbilidad y mortalidad postoperatoria (hasta los 30 días posterior al TH) fue mayor en los pacientes retrasplantados (68,4 vs. 57,0%, $p = 0,04$ y 25,3 vs. 10,9%, $p < 0,001$, respectivamente). La supervivencia actuarial a 1 y 5 años fue 83% y 69% en aquellos sin ReTH, 71% y 61% en ReTH precoz y 64% y 34% en ReTH tardío ($p < 0,001$).

Conclusiones: Pese a una elevada morbilidad y mortalidad del ReTH, parece que esta alternativa terapéutica continúa siendo válida en aquellos pacientes con una pérdida precoz del injerto hepático. Por el contrario, cuando la pérdida del injerto es tardía, se hace necesario definir cuáles serían los resultados mínimos aceptables para indicar el ReTH y qué pacientes se pueden beneficiar con este tratamiento.

Introduction

Liver retransplantation (Re-LT) is the only therapeutic option for the irreversible failure of a graft. Currently Re-LT is 2.9%-24.0% of all liver transplants (LT).[1-3] In the Spanish Register of Liver Transplants database, up to the year 2007, 14,852 LT had been registered, of which 1,327 were Re-LT that is 8.9% of the total.[4]

Re-LT is technically more difficult, especially if it is late, and has a high rate of immediate complications, the most noteworthy being intraabdominal haemorrhage and, above all, postoperative infection, leading to sepsis and multiorgan failure. Among late complications, we find recurrence of initial disease and chronic rejection. It is important to highlight that 50% of deaths after this procedure are in the first 3 months, and that, in general, Re-LT results are worse than primary LT results. Currently, Re-LT survival from the 1st to the 5th year is 78.2% and 67.1% respectively.[5]

The main objective of this review is to determine: The rate of Re-LT (defined as the percentage of liver retransplantations of total transplants in each series),[6] and in a secondary fashion, indications for Re-LT, type of retransplantation according to time of evolution subsequent to primary LT (early, when performed during the first 30 days; or late when it is performed after this period).[7] Postoperative morbidity (defined as those medical and surgical complications that arise during the first 30 days post Re-LT; including infections, sepsis, multiorgan failure, postoperative hemoperitoneum and the need for reoperation); postoperative mortality (defined as death within the first 30 days postoperatively) and patient actuarial survival, on the first and fifth year post-Re-LT.

Materials and methods

Design. Historical cohort study, carried out on a population of patients that underwent LT at La Fe University Hospital in Valencia (HULF), between January 1991 to December 2006, with follow-up of all patients until June 2008.

Inclusion and exclusion criteria. Inclusion criteria were: All patients ≥18 years of age who received a first liver transplant at HULF. Exclusion criteria were: All patients who received a second retransplantation, those that received a split liver in their first LT, combined transplants (liver and other organs) or who received a transplant of another organ before or after LT.

Patients. From January 1991 to December 2006, the liver transplant unit of HULF carried out 1,337 LT. Of these, 51 did not comply with the inclusion criteria (45 were under 18 years of age at the moment of LT and 6 had received their 1st LT at another unit). Of the 1,286 LTs included, 26 complied with exclusion criteria (4 were 3rd LT, 3 received a split liver, 16 were combined transplants and 3 had received transplants

of other organs). As a result, the final sample was 1,260 LTs performed on 1,181 patients, with a total of 79 Re-LTs.

Statistical analysis. Clinical data are collected on an ad-hoc database and then summarised and analysed using the SPSS 15.0 for Windows® statistical program. Measures of central tendency are summarised as mean and median, and dispersion measures as SD and range (maximum and minimum values), according to whether the sample has a normal distribution or not. To determine statistical significance the following tests are used: Fisher exact test and Chi square, for discreet variables; and Student "t" and Mann-Whitney "U" for continuous variables. Survival analysis is performed using the Kaplan-Meier method and rates are compared using the log-rank method and the Cox regression model.

Results

During the study period, 1,181 patients were analysed. Mean age at the time of the first LT was 52.6±9.9 years and 70.4% of these were males. Main indications for LT were HCV cirrhosis and alcoholic cirrhosis (Table 1).

A total of 79 Re-LT (6.3%) (79/1260) were performed.

Table 1 – Characteristics of the patients without retransplantation and with retransplantation at the time of receiving their first liver transplant*

Variable	All	Patients without Re-LT	Patients with Re-LT (first transplant)	Value of P
n	*1181*	*1102*	*79*	
Age of receptor	52.6±9.9	52.9±9.7	47.9±11.5	<.001
Sex of receptor				
Males	831 (70.4)	783 (71.1)	48 (60.8)	.053
Females	350 (29.6)	319 (28.9)	31 (39.2)	
Indication for LT				
Autoimmune cirrhosis	61 (5.2)	55 (5.0)	6 (7.6)	.312
Cirrhosis HBV	123 (10.4)	119 (10.8)	4 (5.1)	.236
Cirrhosis HCV	591 (50.0)	546 (49.5)	45 (57.0)	.203
Alcoholic cirrhosis	443 (37.5)	421 (38.2)	22 (27.8)	.066
Hepatocarcinoma	330 (27.9)	309 (28.0)	21 (26.6)	.780
Other causes	81 (6.9)	71 (6.4)	10 (12.2)	.060
Age of donor	45.2±18.9	45.5±19.0	41.9±18.1	.107
Sex of donor				
Males	704 (59.6)	659 (59.8)	45 (57.0)	.619
Females	477 (40.4)	443 (40.2)	34 (43.0)	
Cause of ME donor				
TBI	417 (35.3)	391 (35.5)	26 (32.9)	.966
Stroke	686 (58.1)	638 (57.9)	48 (60.8)	
Anoxia	64 (5.4)	60 (5.4)	4 (5.1)	
Cerebral tumour	14 (1.2)	13 (1.2)	1 (1.3)	
Cold ischemia	379.1±180.3	378.7±180.9	384.8±173.0	.771
Hot ischemia	45.8±18.4	45.6±18.3	48.1±20.1	.276
Total ischemia	425.0±183.3	424.4±183.8	434,0±176.8	.650
Blood used	3.6±3.0	3.5±2.9	4.0±3.5	.186
Reperfusion syndrome	212 (18.0)	201 (18.2)	11 (13.9)	.334
Liver congestion				
Moderate	342 (29.0)	313 (28.4)	29 (36.7)	.290
Severe	82 (6.9)	77 (7.0)	5 (6.3)	
Postoperative morbidity	666 (56.4)	628 (57.0)	38 (48.1)	.124

Continuous variables are summarized as mean±standard deviation.
Discrete variables are summarized as n and percentage.
LT indicates liver transplants; Re-LT: liver retransplantation.

Table 2 – Indications for liver retransplantation

Indication for Re-LT	n, %	Interval of time between first and second transplant	
		<30 days (early)	>30 days (late)
Failure of first transplant	17 (21.5)	17 (70.8)	
Thrombosis of liver artery	25 (31.6)	7 (29.2)	18 (32.7)
Budd-Chiari	3 (3.8)		3 (5.5)
Relapse of HBV	1 (1.3)		1 (1.8)
Relapse of HCV	24 (30.4)		24 (43.6)
Chronic rejection	7 (8.9)		7 (12.7)
Tumour recurrence	1 (1.3)		1 (1.8)
Secondary biliary cirrhosis	1 (1.3)		1 (1.8)
Total	*79 (100)*	*24 (100)*	*55 (100)*

Re-LT indicates liver retransplantation.

Table 3 – Characteristics of patients without retransplantation and with retransplantation at the time of receiving their first liver transplant

Variable	Patients without Re-LT	Patients with Re-LT (second transplant)	Value of P
n	*1102*	*79*	
Age of receptor	52.9±9.7	49.8±11.2	.006
Sex of receptor			
Males	783 (71.1)	48 (60.8)	.053
Females	319 (28.9)	31 (39.2)	
Age of donor	45.5±19.0	36.8±18.3	<.001
Sex of donor			
Males	659 (59.8)	55 (69.6)	.085
Females	443 (40.2)	24 (30.4)	
Cause of ME donor			
TBI	391 (35.5)	41 (51.9)	.015
Stroke	638 (57.9)	37 (46.8)	
Anoxia	60 (5.4)	1 (1.3)	
Cerebral tumour	13 (1.2)	0 (0.0)	
Cold ischemia	378.7±180.9	416.6±91.7	.073
Hot ischemia	45.6±18.3	46.3±24.0	.748
Total ischemia	424.4±183.8	462.9±98.6	.073
Blood consumption	3.5±3.0	6.3±4.9	<.001
Reperfusion syndrome	201 (18.2)	21 (26.6)	.067
Liver congestion			
Moderate	313 (28.4)	16 (20.3)	.144
Severe	77 (7.0)	9 (11.4)	

Continuous variables are summarized as mean±standard deviation.
Discrete variables are summarized as n and percentage.
Re-LT indicates liver retransplantation.

Mean age at the time of the first LT was 47.9±11.5 years, for those patients requiring Re-LT, and 52.9±9.7 years for those not requiring retransplantation (P<.001). The other biodemographic characteristics, indication for LT, and postoperative morbidity, were not significantly different between both groups (Table 1).

Table 4 – Postoperative morbidity and mortality of patients without retransplantation and with retransplantation at the time of receiving their second liver transplant

Variable	Patients without Re-LT	Patients with Re-LT (second transplant)	Value of P
n	1102	79	
Perioperative morbidity	628 (57.0)	54 (68.4)	.048
Respiratory distress	22 (2.0)	4 (5.1)	.090
Acute renal failure	227 (20.6)	40 (50.6)	<.001
Infection	144 (13.1)	22 (27.8)	<.001
Bacteraemia	84 (7.6)	14 (17.7)	.002
Sepsis	73 (6.6)	9 (11.4)	.107
Multiorgan failure	70 (6.4)	11 (13.9)	.010
Postoperative hemoperitoneum	124 (11.3)	24 (30.4)	<.001
Post-operative mortality	120 (10.9)	20 (25.3)	<.001

Re-LT indicates liver retransplantation.

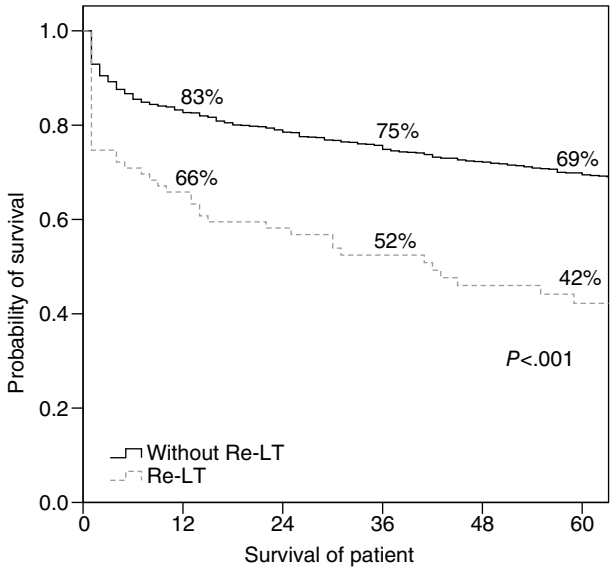

Figure 1 – Actuarial patient survival without liver retransplantation and with liver retransplantation. Re-LT indicates liver retransplantation.

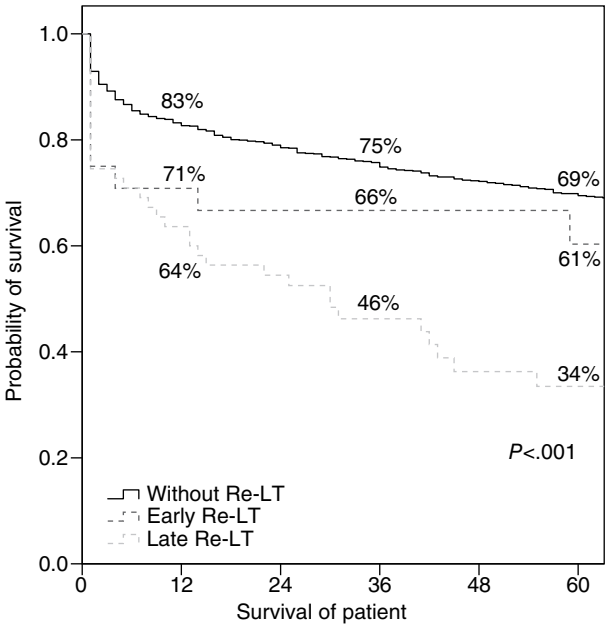

Figure 2 – Actuarial patient survival without liver retransplantation and with early and late liver retransplantation. Re-LT indicates liver retransplantation.

The most frequent causes of Re-LT were liver artery thrombosis (31.6%), recurrence of cirrhosis due to HCV (30.4%), and primary graft failure (21.5%); and related to the time of Re-LT, 100% of primary graft failures and 28% of liver artery thrombosis were seen in Re-LT cases within 30 days of the first LT, as shown in Table 2.

At the time of Re-LT the mean age of the receptors was 49.8±11.2 years, less than that of non-retransplanted patients. Donors for Re-LT were significantly younger (36.8±18.3 vs 45.5±19.0) and the most frequent cause of brain death is head trauma (51.9% vs 35.5%), whereas in the non-retransplanted group the main cause of donor death was stroke (57.9% vs 46.8%). These differences are summarised in Table 3.

With relation to transplant surgery, no differences were seen between cold, hot or total ischemia, presence of reperfusion syndrome, or liver congestion. In contrast, blood used, quantified in units of red blood cell concentrates transfused, was greater in the retransplantation group than in primary LTs (6.3±4.9 vs 3.5±3.0).

Postoperative morbidity was greater in the retransplantation group (68.4% vs 57.0%; *P*<.05), with a relative risk of 1.20 [$CI_{95\%}$: 1,02-1,40]. Statistically significant differences were also seen in relation to percentage of acute renal failure, infections, bacteraemia, multiorgan failure, and postoperative hemoperitoneum. Postoperative mortality was higher in retransplantations (25.3% vs 10.9%) with a relative risk of 2.32 [$CI_{95\%}$: 1.53-3.52] (Table 4).

The median follow-up of all patients was 51 (0-205) months, with a mean global survival of 128.2±2.9 months. Retransplanted patients had a lower global survival than non-retransplanted

patients (82.6±10.5 vs 131.4±3.0 months) with a relative risk of mortality of 1.47 [$CI_{95\%}$: 1,26-1,71]. Finally, actuarial survival at 1, 3, and 5 years for both groups was 83%, 75%, and 69% vs 66%, 52%, and 42% respectively (Figure 1).

Actuarial survival at 1, 3, and 5 years was significantly better in patients with primary LT in comparison with those that had late retransplantations (>30 days from primary LT), with values of 83%, 75%, and 69% vs 64%, 46%, and 34% respectively; *P*<.001 (Figure 2).

Discussion

Performance of Re-LT means the previous graft has failed, but, at the same time, it is the only treatment for irreversible graft failure and constitutes 10%-20% of worldwide LT.[8] Currently, in Spain, the rate of Re-LT defined as the number of Re-LT for each LT performed, is 8.9%[4]; and in the cohort of patients we analysed, this rate was 6.3%, which is significantly lower than the national rate. This difference could possibly be explained by the different inclusion criteria for the Re-LT waiting list used by different transplant teams, based on the poor results obtained in different retransplantation series, the lack of optimum donors, or the high rate of mortality for those patients on the waiting list. On the other hand, these arguments are the object of a constant ethical debate related to Re-LT.[9] The scarcity of organs conditions the optimization of indications for Re-LT and, on other occasions, reasons for retransplantation are influenced by the relationship established with the patients based on a certain sense of guilt or responsibility in the face of a failed procedure.

No significant differences were seen at the time of the first LT, between those patients that were not subsequently retransplanted and those that were, the only exception being mean age at the time of LT that was less in retransplanted patients. However, this difference does not seem to be related to the loss of the first liver graft, since up to this moment there are no studies that indicate the age of the receptor is a risk factor for Re-LT.

The main reasons for Re-LT described in the medical literature are: Primary graft function failure, liver artery thrombosis, chronic rejections, and recurrence of primary disease.[3,10] In our patients, the most frequent cause of Re-LT was recurrence of primary disease (33.0%), mainly due to recurrence of liver cirrhosis due to HCV (30.4%), as was pointed out by Landaverde et al in our previous review[11] and in different clinical series in which recurrence of primary disease was the cause of 8.5% (1.8%-40.0%) of Re-LT, with recurrence of cirrhosis due to HCV being the most significant.[1,3,8,10-20] The indication of Re-LT due to recurrence of HCV has increased over the years, from 7% in 1990 to 38% in 1995.[21] At present, approximately a third of transplanted patients develop cirrhosis due to graft HCV in 5 years. On the other hand, there is no effective prophylactic antiviral therapy for HCV and antiviral treatment has a limited efficacy post-LT. Patients with recurrent cirrhosis, who do not respond to antiviral drugs, require Re-LT due to the fact that if Re-LT is not performed, survival at 3 years is only 10% once initial decompensation has occurred.[22]

In order of frequency, the second cause of Re-LT in our series was liver artery thrombosis (31.6%), which was more frequent than in any other study reviewed, in which this conditions was only the cause of 22.0% (8.7%-29.3%) Re-LT.[1,3,8,10-20] Liver artery thrombosis in 31% of cases is seen before the end of the first month post-LT, and has significant clinical repercussion, requiring an early Re-LT. The remainder of cases appear later, even years later, and in many cases have no evident clinical repercussions, therefore, after diagnosis, it is more difficult to establish a need for Re-LT.[23,24] In our series, 28% of liver artery thromboses were of early diagnosis and 100% of these patients required early Re-LT. There was only one case of early rethrombosis, which required a third liver graft.

In our patients, another frequent reason for Re-LT, was primary graft failure (21.5%), and all required retransplantation before the end of the first month post-LT. In several communications this indication for Re-LT constitutes 26.1% (7.3%-46.3%).[1,3-8,10-20] Primary graft failure is described as a process that begins immediately after LT and requires an urgent Re-LT in 80% of cases; sometimes it begins as severe graft dysfunction without normal recovery, and, therefore, progressive deterioration of the patient makes it necessary to perform a deferred substitution of the organ (20%).[25] The cause is unknown, but alterations of liver microcirculation seem to influence the appearance of this condition.[26]

With regard to donor characteristics for Re-LT, Linhares et al report that those grafts of poor quality, characterized by haemodynamic instability, advanced age and associated donor morbidity; as also those that have suffered damage during preservation, mainly consistent in periods of prolonged cold ischemia, could explain the higher mortality rate in these patients.[27] In our series of retransplanted patients, mean donor age was less than 40, and the main cause of brain death was head trauma; whereas in non-retransplanted cases mean donor age was over 45 and the main cause of brain death was stroke. In spite of this, even using donors with better characteristics, morbidity, mortality and global survival of patients with Re-LT continues to be better in non-retransplanted patients.

In most published studies, receptor age, based on univariate or multivariate analysis, constitutes a risk factor for early mortality.[8,17,28-33] Lindares et al believe that the association of comorbidities and greater age at the time of Re-LT can increase the mortality rate of these patients.[27] In our series, the age of the patients at the time of Re-LT is significantly lower than that of non-retransplanted patients and there aren't differences in relation to associated morbidity during the time previous to transplant. However, global survival of retransplanted patients, continues to be significantly less than in non-retransplanted patients. Therefore, as well as age and comorbidities, there must be other variables that explain the higher rate of early mortality and worse survival in retransplanted patients.

During Re-LT surgery haemorrhage is the main surgical complication, in up to 36% of patients. Usually it presents as diffuse bleeding, with no specific bleeding point in up to 80% of cases, and it generally requires large blood transfusions

and reoperations to control it.[5,34,35] In our study, the group of retransplanted patients behaved as described in most published series, the use of blood in this group of patients was significantly greater, it was necessary to transfuse almost double the amount of units or red blood concentrates than in non-retransplanted cases (6.3±4.9 vs 3.5±3.0); and the rate of postoperative hemoperitoneum and number of reoperations due to this cause was practically 3 times greater in patients undergoing Re-LT (30.4% vs 11.3%). It is important to point out that this complication is significantly greater in the group of late retransplanted patients, in which hemoperitoneum is seen in 36.4% (20/55). However, early retransplanted patients have hemoperitoneum in 16.7% (4/24) of cases, which is a similar rate to that seen in non-retransplanted patients.

We found a higher rate of morbidity in Re-LT, mainly, as already mentioned, due to haemorrhagic complications: Infections were also significant, reaching a rate of 60% with predominance of bacteria (*enterococci,* etc.), fungi and virus, such as CMV.[5] In our series, infectious complications were seen in 28% of retransplanted patients. Problems of vascular origin are also frequent, mainly arterial thrombosis, as already mentioned, although in our group of patients there was only one case of arterial rethrombosis, corresponding to 4% of the cases of arterial thrombosis in Re-LT. Biliary complications, which affected 23%[5] of cases, are mainly fistulas and stenosis of the bile ducts. In our series, 65.8% (52) of patients had undergone reconstruction of the common bile duct by end-to-end anastomosis, over a Kehr drainage tube. After withdrawing the Kehr drainage, 11.5% presented coleperitoneum, which was resolved by percutaneous drainage in 33% of cases and the rest were treated conservatively. There were 5 patients (6.3%) that had a fistula of their biliary anastomosis, 3 of them underwent hepaticojejunostomy and 2 common bile duct anastomosis, only 1 case required external drainage and the rest were managed conservatively. Six patients suffered biliary stenosis. Five (6.3%) were anastomotic (all on the common bile duct anastomosis), 4 were reoperated and a Roux in Y hepaticojejunostomy was performed and 1 received a bile duct endoprosthesis, and 1 case had an non-anastomotic stenosis (1.3%) that was managed with external-internal drainage. Finally, there were 2 patients (2.5%) who presented bilioma that required percutaneous drainage, and 2 patients (2.5%) had papilla stenosis that was resolved by endoscopic papillotomy. A total of 19 patients (24.1%) had biliary complications, a similar rate to that of other published series.

Postoperative mortality is higher in Re-LT, with a rate above 20%,[5] the main causes being severe infection (40%-60%), haemorrhage (10%-20%) and disease relapse (6%-12%).[5,10,36] In our series, 46 of the 79 retransplanted patients (58.2%) died after Re-LT, 20 of them within the first 30 days (25.3%) and 27 within one year (34.2%). The main causes of postoperative mortality were sepsis associated with multiorgan failure in 60% and postoperative haemorrhage in 25%. In those patients with late mortality (after the initial 30 days post-Re-LT), the main causes of death were: Disease recurrence in 38.5% (23.1% recurrence of HCV cirrhosis and 15.4% hepatocarcinoma tumour recurrence); followed by chronic rejection and de novo tumours, both with a rate of 11.5%.

Survival is markedly less in retransplanted patients. In a retrospective review of Re-LT carried out by the University of California, Los Angeles (UCLA), survival at 1 and 5 years was 62% and 47% respectively,[29] similarly Bussutil et al working with a cohort of 450 Re-LT cases, reported a survival at 1 and 5 years of 59% and 52% respectively.[37] In our series, actuarial patient survival at 1 and 5 years was greater in non-Re-LT patients (83% and 69% vs 66% and 42%). When we compared actuarial survival in retransplanted patients with non-retransplanted patients, according to the indication for Re-LT, no differences were seen in those undergoing retransplantation due to primary graft failure (765% and 63%) and early liver artery thrombosis (diagnosis and Re-LT within 30 days from first graft; 57% and 57%); however, there were significant differences between those patients undergoing retransplantation due to late arterial thrombosis (56% and 38%), recurrence of HCV cirrhosis (67% and 32%), and other indications for late Re-LT (69% and 34%), such as HBV cirrhosis, chronic rejection, tumour recurrence, secondary biliary cirrhosis and Budd-Chiari syndrome.

In spite of the high morbidity and mortality rates of Re-LT, this therapeutic alternative continues to be valid in those patients with early loss of liver graft. In contrast, when the graft loss is late, the results of Re-LT are not as encouraging; therefore, in these patients it is necessary to define the minimum acceptable results to indicate Re-LT, since 2 out of 3 cases will not be alive 5 years after Re-LT.

Our study undoubtedly has methodological defects, since it is a retrospective analysis of a historical cohort, with biases that are difficult to control. For this reason, to validate our conclusions, we need to carry out new studies, in which the baseline characteristics at the time of transplant of retransplanted and non-retransplanted patients are more homogeneous. It would also be important to carry out an analysis of the evolution of retransplantation according to different indications, since it is evident that early cases of Re-LT evolve very differently from late ones.

Conflict of interest

The authors state that they have no conflicts of interest.

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