



The survival rate survey of the patients undergoing liver transplants

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Abstract

Introduction: Liver transplantation is a widely distinguished and highly practical therapy for liver cirrhosis. In any case, liver transplant surgery assumes a risk of influential complications. In this way, the survival rate of liver transplant patients at Razi Healing Center in Rasht from 2017 to 2022 was investigated.

Materials and Methods: In this retrospective cohort study, liver transplant patients referred to Razi Hospital in Rasht, Iran, from 2017 to 2022 were studied. Patient demographic and clinical information were collected. Survival was determined using Kaplan-Meier estimates. Log rank was used to determine differences between study groups in survival.

Results: Out of 46 patients who underwent liver transplantation surgery, 54.3% of patients survived. Also, the most common causes of death for the samples of this study were COVID-19 and hemorrhage. Patients with autoimmune cirrhosis due to hepatitis have a significantly higher risk of death than those with cirrhosis due to other factors. Postoperative vascular thrombosis was found to be significantly associated with reduced patient survival. Patient outcomes improved significantly in the second part of the six-year liver transplant study. The study highlights the importance of increasing experience in liver transplant surgery and postoperative care to improve outcomes.

Conclusion: According to the results of this study, patients with autoimmune cirrhosis due to hepatitis have a higher risk of death than those with cirrhosis due to other causes. In addition, postoperative vascular thrombosis is believed to significantly reduce patient survival. The study highlights the importance of increasing experience in liver transplant surgery and postoperative care to improve outcomes for these patients.

Keywords: Liver transplant, Surgery, Survival, Liver failure

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Introduction

Liver cirrhosis is a cancerous growth of liver cells that manifests itself as a mass in the upper right part of the abdomen with general symptoms such as pain, weight loss for unknown reasons, and weakness. This type of cancer occurs when liver cells grow at an abnormal rate and form a tumor, which can be malignant (cancerous) or benign (non-cancerous). When these cancer cells start in the liver, they are known as primary liver cirrhosis. Hepatocellular carcinoma is a liver cirrhosis with undifferentiated liver cells. Liver transplantation is an elective treatment for cirrhosis, acute liver failure, and liver cirrhosis (1). It has been demonstrated to be highly effective not only in treating acute or chronic liver failure but also in treating primary liver cirrhosis (2). Liver transplantation (LT) may be healing or life drawing out for suitably chosen patients with intense liver disappointment, progressed cirrhosis, hepatic danger, or natural metabolic disarranges. Given tremendous enhancements in surgical methods, organ conservation and acquirement, and immunosuppression over the past few decades, advanced LT is characterized by surprising advancements in post-transplant persistent survival, joint survival, and quality of life (3). The 15% mortality rate of liver transplant beneficiaries at one year may be seen as an accomplishment in comparison with the holding up list mortality, however, it in any case clears out room for much enhancement. This treatment has been utilized in Iran since 1993 (4). Liver transplant recipients are subjected to various short and long-term risks. Short-term risks are related to technical issues, such as vascular and venous thrombosis, biliary complications, or medical issues after transplantation, such as infection, and transplant rejection (5). Given the severe shortage of donated organs, it is crucial to identify patients who can benefit the most from liver transplantation in terms of survival (6). Over 60 years have passed since the first liver transplant was performed. The survival rate of liver transplant recipients in the first year is 80-90%, and associated problems such as operation-induced complications, transplant rejection, and sepsis have decreased over time (7, 8). In a study conducted on European countries from 2002 to 2004, the 1-year and 5-year survival rates of liver transplant recipients were reported to be 90% and 80%, respectively (9). In another investigation in

Italy, the 10-year survival rate was found to be 72% (10). In Sabet et al.'s study, conducted in 2009, the 1-year survival rate was 84%, while the 3-year and 6-year rates were both 82% (11). Recognizing the predictive factors of mortality in patients with advanced liver failure is one of the main challenges faced by researchers (10). Liver diseases are among the most prevalent digestive diseases and account for the majority of referrals to medical centers. A liver transplant is the primary treatment for patients afflicted with acute or chronic liver failure. The transplantation needs to be performed in a fully-equipped hospital and is quite costly in terms of all types of resources. The present study aims to investigate the survival rate of liver transplant recipients referring to Razi Hospital in Rasht, Iran from 2017 to 2022 and also the factors associated with the survival of these patients and better control for undesirable and intervening factors.

Materials and Methods

In this retrospective, cohort study, liver transplant patients referring to Razi Hospital in Rasht, Iran from 2017 to 2022 were investigated. A census sampling technique was used to select the patients to be investigated. The patients' information including their age, sex, the reason for a liver transplant, blood group, underlying cancer, postoperative infection and thrombosis, intraoperative and postoperative complications, and Meld scores before and after surgery was collected, and SPSS Software, Version 22 for subsequent statistical analyses. was used.

Statistical analysis

The normality of the data was tested using Kolmogorov-Smirnov test, and the equality of the variances was tested using Levene's test. Survival rates were determined via the use of Kaplan-Meier estimates. Log-rank was employed to determine the differences between the groups under investigation in terms of their survival rate. The significance level was set at 0.05 for all of the tests.

Results

During these 5 years from 2017 to 2022, 46 patients underwent liver transplants at Razi Hospital in Rasht, Iran. The mean age of the patients was 48.85 ± 12.02 years. Of the total patients, 27 cases (58.7%) were

male. The blood group in 47.8% of the cases was O+. Fifty-four point three percent of the patients were alive until the end of the study (Table 1).

Table 1. The patient's demographic information and clinical/Para clinical findings.

Variable	Frequency and percentage		
	Frequency	percentage	
Age group (year)	< 30	3	6.5
	30 – 50	19	41.3
	> 50	24	52.2
Gender	Male	27	58.7
	Female	19	41.3
Blood group	A+	14	30.4
	B+	9	19.6
	O+	22	47.8
	A-	1	2.2
Outcome	Alive	25	54.3
	Death	21	45.7
Meld Score	< 20	40	87
	> 20	6	13
Background cancer	No	36	78.3
	HCC	6	13
	Cholangiocarcinoma	3	6.8
	Angiosarcoma	1	2.2
Postoperative thrombosis	Yes	6	13
	No	43	93.5
Postoperative infection	Yes	12	26.1
	No	34	73.9
The cause of cirrhosis	Cryptogenic	8	18.2
	PSC	14	30.4
	AIH	7	15.9
	NASH	10	21.7
	Biliary	2	4.5
	Wilson	1	2.3

COVID-19 and bleeding were the most frequent causes of mortality (each of them causing 4 deaths) (Figure 1). Moreover, in one of the patients, the co-occurrence of

cholangiocarcinoma and hepatocellular carcinoma (HCC) was observed.

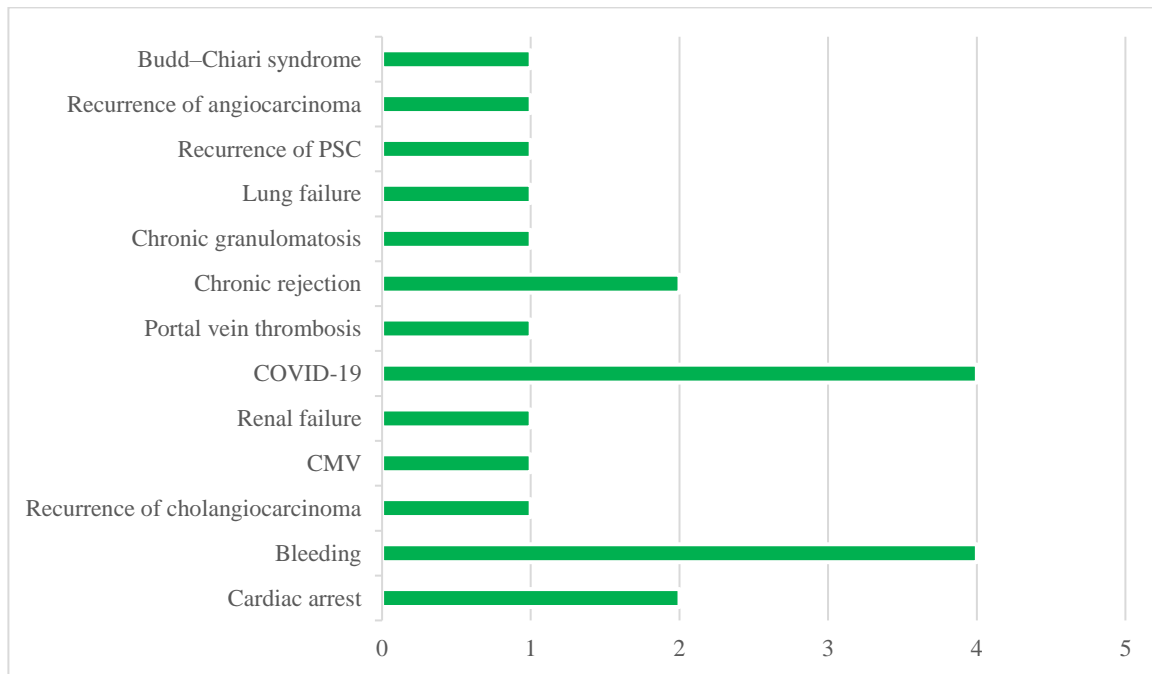


Figure 1. Comparison of the causes of mortality (%).

Patients with autoimmune hepatitis-induced cirrhosis were at significantly greater risk of death compared to

those whose cirrhosis was induced by other factors (Table 2).

Table 2. Comparison of the variables based on the outcome of the disease.

Variable	Frequency and percentage		P	
	Alive	Death		
Age group (year)	< 30	0	3 (100)	0.148
	30 – 50	11 (57.9)	8 (42.1)	
	> 50	14 (58.3)	10 (41.7)	
Gender	Male	17 (63)	10 (37)	0.162
	Female	8 (42.1)	11 (57.9)	
Blood group	A+	9 (64.3)	5 (35.7)	0.392
	B+	3 (33.3)	6 (77.7)	
	O+	12 (54.5)	10 (45.5)	
	A-	1 (100)	0	
Meld Score	< 20	23 (57.5)	17 (42.5)	0.268
	> 20	2 (33.3)	4 (66.7)	

Background cancer	No	20 (55.6)	16 (44.4)	0.549
	HCC	4 (57.1)	3 (42.9)	
	Cholangiocarcinoma	1 (33.3)	2 (66.7)	
	Angiosarcoma	0	1 (100)	
Postoperative thrombosis	Yes	1 (16.7)	5 (83.3)	0.047
	No	24 (60)	16 (40)	
Postoperative infection	Yes	7 (58.3)	5 (41.7)	0.747
	No	18 (52.9)	16 (47.1)	
The cause of cirrhosis	Cryptogenic	6 (75)	2 (25)	0.222
	PSC	6 (46.9)	8 (57.1)	0.336
	AIH	1 (14.3)	6 (85.7)	0.021
	NASH	6 (60)	3 (40)	0.685
	Biliary	1 (50)	1 (50)	0.900
	Wilson	1 (100)	0	0.354

Based on the results obtained from the log-rank test, vascular thrombosis after surgery was found to be

significantly associated with a decrease in the patient's survival (Table 3).

Table 3. Results of log-rank test based on the variables under investigation.

	Variable	Estimate	std. error	P
Age group (year)	< 30	3	1.63	0.58
	30 – 50	8	1.08	
	> 50	7	4.28	
Gender	Male	12	3.63	0.04
	Female	4	2.17	
Blood group	A+	7	1.82	0.95
	B+	3	2.98	
	O+	9	1.53	
	A-	8	-	
Meld Score	< 20	8	1.35	0.59
	> 20	1	0	
Background cancer	No	7	1.19	0.44
	HCC	20	2.61	
	Cholangiocarcinoma	15	9.79	
	Angiosarcoma	18	-	

Postoperative thrombosis	Yes	2	1.22	0.003
	No	9	2.52	
Postoperative infection	Yes	4	4.33	0.68
	No	8	1.45	
The cause of cirrhosis	Cryptogenic	7	2.82	0.45
		8	1.52	
	Primary sclerosing cholangitis (PSC)	6	1.87	0.78
		9	1.97	
	Autoimmune hepatitis (AIH)	3	1.19	0.003
		9	3.12	
	Non-alcoholic steatohepatitis (NASH)	20	3.16	0.16
		7	1.19	
	Biliary	1	-	0.30
		8	1.42	
Wilson	14	-	0.95	
	8	1.27		

The findings presented in Table 4 indicate that patient outcomes improved significantly in the 2nd part of the 6 years of liver transplant under investigation in this study as compared to its 1st part. More specifically, the survival rate of the patients undergoing liver transplantation in the 2nd triennium was more than twice as much as that in the 1st triennium (70.4% vs. 31.6%, respectively). This might be because the department of liver transplant in this medical center was newly established at that time. Later, with further developments in the department as well as the employment of a fellow in liver transplant, the patient's outcomes improved significantly.

Discussion

Liver transplant has been used in Iran as a therapy for over two decades. In this study, a total of 46 liver transplant patients were investigated. The mean age of the patients was 48.85±12.02 years. The patients' survival was 80.43% in the first month, 36.95% in the first year, and 8.69% in the 3 years after the surgery. Germani et al. conducted a study to analyze donor,

Table 4. Comparison of patients' outcomes in the 1st and 2nd triennium of liver transplant at Razi Hospital in Rasht.

Year of transplantation	Frequency and percentage	Outcome		P
		Alive	Death	
2017 - 2019	19 (41.3)	6 (31.6)	13 (68.4)	0.009
2020 - 2023	27 (58.7)	19 (70.4)	8 (29.6)	
Sum	46 (100)	25 (54.3)	21 (45.7)	

graft, and recipient variables from the European Liver Transplant Registry database between January 1988 and June 2009. The study compared etiologies and periods and generated separate training datasets to develop three- and 12-month survival models, which were then validated. A sub-analysis was conducted for recipients older than 50 years. The results of the study showed that out of 4,903 patients evaluated, the one-, five-, and ten-year patient and graft survival rates were

74%, 68%, 63%, 63%, 57%, and 50%, respectively. Despite an increase in donors over 60 years from 1.8% to 21%, survival rates were better in the 2004-2009 period than in previous periods ($p < 0.001$). In addition, the study found that paracetamol-related acute liver failure had a higher incidence of suicide or non-adherence ($p < 0.001$). Furthermore, male recipients, recipients aged over 50 years, incompatible ABO matching, donors over 60 years, and reduced size were independently associated with death or graft loss. In conclusion, despite increases in donor/recipient age, survival after liver transplantation has improved. However, the study suggests that recipients over 50 years paired with donors over 60 years had a very high mortality/graft loss within the first year (11). Bertacco and colleagues conducted a study that analyzed a prospective database of liver transplantation in adult recipients who passed away within three months following the procedure. Of the 335 liver transplants performed during the study period (2012 -2016), 24 adults and two pediatric patients died within 90 days. According to the study's results, sepsis was identified as the leading cause of early mortality following liver transplantation. The study further highlighted that infections were the primary cause of morbidity and mortality in LT recipients, with 80% of patients experiencing at least one infective episode within the first year. Bacteremia, which was primarily caused by respiratory or abdominal infections due to drainage or vascular access, typically arose during the first 90 days after transplantation. Mortality rates varied from 24% to 36% but rose to 50% in cases where the septic shock was present (12). In another study by Vincenzo Mazzaferro, liver transplantation for hepatocellular carcinoma is evolving and the so-called expanded criteria are still being debated. This study aimed to investigate the effectiveness of liver transplantation after the successful removal of hepatocellular carcinoma. Patients aged 18 to 65 years with hepatocellular carcinoma beyond Milan criteria, absence of macrovascular invasion or extrahepatic spread, estimated 5-year post-transplant survival of at least 50%, and good liver function (Child-Pugh A-B7) were selected. In this study, they concluded that after effective and stable resection of eligible hepatocellular carcinomas beyond the Milan criteria, liver transplantation improved tumor event-free survival and overall survival compared with non-transplant therapy

after tumor response staging, which could be Expanding criteria for hepatocellular carcinoma transplantation will help (13). In a study conducted by Kyoung-Sun Kim et al., electrocardiography (ECG) is routinely performed as a preoperative cardiac evaluation tool, and the effect of myocardial ischemia detected by ECG on postoperative outcomes is uncertain. This evaluation aimed to use ECG as a predictor of postoperative mortality in patients undergoing patient transplantation. Electronic medical records of patients undergoing LT were retrospectively reviewed and analyzed. The primary endpoint was 1-year postoperative mortality. Of 1430 patients, 78 (5.5%) showed ischemic changes in ECG. The 1-year mortality of patients with an ischemic change on the ECG was significantly higher than that of patients without it (11.5% vs. 4.0%; $P = 0.004$). In a Cox proportional hazards model, ischemic change in ECG (hazard ratio [HR], 2.91; 95% CI, 1.43–5.92; $P = 0.003$), modeled for end-stage liver disease score (HR 1.06; 95% CI: 1.09–1.04; $P < .001$), and revised cardiac risk index (HR, 2.84; 95% CI, 1.86–4.35; $P < .001$) were independent predictors of mortality. They were one year old. However, MPS abnormality and echocardiographic wall motion abnormalities were absent. This study concluded that in patients undergoing LT, preoperative ischemic ECG findings should not be ignored, as they are associated with increased mortality, and thorough evaluations for the diagnosis of coronary artery disease are warranted in patients with these findings (14). Rana and colleagues conducted the taking after considering the point of the mortality rates to distinguish high-risk periods and to join the cause of passing into the examination of post-transplant survival. They performed a review investigation on joined together Organize for Organ Sharing information for all grown-up beneficiaries of liver transplants from January 1, 2002, to October 31, 2011. Our examination included multivariate calculated relapse where the essential result degree was persistent passing of 49 288 beneficiaries. The most noteworthy mortality rate by day post-transplant was on the day (0.9%). The foremost noteworthy chance components were as follows: for one mortality from specialized disappointment, intensive care unit confirmation chances proportion (OR 3.2); for one mortality from unite disappointment, warm ischemia >75 min (OR 5.6); for one-month mortality from

contamination, a past transplant (OR 3.3); and for one-month mortality from join disappointment, a past transplant (OR 3.7). They found that the most elevated mortality rate after liver transplantation is inside the primary day and the primary month post-transplant. Those two high-risk periods have common, as well as diverse, chance components for mortality (15). The study conducted by Watt et al. analyzed The National Institute of Diabetes and Digestive and Kidney Diseases LT Database of 798 liver transplant recipients who underwent the procedure between 1990 and 1994, with follow-up until 2003. The study found that out of the recipients, 327 died, with the leading causes of death after one year being hepatic, malignancy, cardiovascular disease, infection, and renal failure. Furthermore, the incidence of renal-related death increased significantly over time. (16). A. Bertacco et al Check out a review observational examination of grown-up patients who experienced LT within the period 2012 to 2016 and passed on within 90 days after LT was conducted. Prohibition criteria were intraoperative passing, part liver, and domino transplant. Passing was considered a subordinate variable and classified into 3 diverse bunches: passing by sepsis, vascular occasions not related to the unit, and essential non-function. Giver and beneficiary factors were considered and analyzed utilizing Fisher's correct test. Significant affiliations (P esteem $< .05$) were found between renal work bolster, transplantation, and the number of new solidified plasma units transfused in one bunch and early passing due to sepsis within the other. The hypothesis of distinguished a few chance variables related to the particular cause of early passing in liver transplantation. The clinical suggestions of these discoveries are the capacity to stratify patients at a higher chance of early passing by arranging more serious and exact administration for them (17). In the study conducted by Salizzoni et al., 1000 liver transplant surgeries performed on 910 patients mainly suffering from cirrhosis were investigated. The overall 1-year, 5-year, and 10-year survival rates were found to be 87%, 78%, and 72%, respectively (9). It seems that the survival rate of liver transplant patients is affected by several factors (11, 12, 16). In the current study, 21.6% of the patients had underlying cancer, which could lower their survival. Another important issue was that this study was conducted during the COVID-19 pandemic in Iran, which could lead to an increase in the

mortality of the patients under investigation. David P. Vogt et al., analysis included 433 patients who survived at least 1 year after liver transplantation from November 1, 1984, to December 31, 2001. In total, 586 liver transplants were performed. This period. The 1-, 5-, and 10-year overall survival rates as well as the 5- and 10-year survival rates of patients who survived one year were analyzed based on Kaplan-Meier survival estimates. Variables inspected included determination, sex, age, and transplantation. The causes of passing were moreover analyzed. By and large 1, 5, and 10-year survivals were 85%, 73%, and 55%, respectively. The 5 and 10-year survivals for those patients who lived for a year were 86% and 65%, respectively. Fifty-one percent of the causes of late passing were graft-related, 71% from repetitive essential illness. Cardiovascular occasions and de novo malignancies were mindful for 65% of the no graft-related passing. At last, the long-term survival in patients who survive for the primary year after liver transplantation is fabulous. Repetitive essential illness is mindful of the larger part of graft-related passing. Cardiovascular occasions and de novo threat cause most of the no graft-related passing (18). In a similar investigation between 1989 and July 2010, all patients who kicked the bucket three months after liver transplantation were included. Statistic characteristics, preoperative and preoperative information, benefactor characteristics, postoperative complications, and causes of mortality were collected. Among the 788 performed liver transplantations, 76 patients kicked the bucket in the serious care unit (11%). The most common signs of liver transplantation were alcoholic cirrhosis (30%), hepatitis C (28%), hepatocarcinoma (15%), and primitive or auxiliary biliary cirrhosis (10%). Fifty percent of the patients were categorized as Child C. The most causes of passing were non-function or brokenness with transplantation contra-indication unite (18%), sepsis (18%), neurological complications (12%), hemorrhagic stun (13%), (9%), multiorgan disappointments (5%), cardiac complications (6%). These come about to emphasize the need for superior control of sepsis, discharge, and immunosuppresses (19).

Conclusions

The results of the present study indicated that patient outcomes improved significantly in the 2nd part of the 6 years of liver transplant under investigation in this study as compared to its 1st part. More specifically, the survival rate of the patients undergoing liver transplantation in the 2nd triennium was more than twice as much as that in the 1st triennium (70.4% vs. 31.6%, respectively). This might be because the department of liver transplant in this medical center was newly established at that time. Later, with further developments in the department as well as the employment of a fellow in liver transplant, the patient's outcome improved significantly.

Regarding the increase in the cases of acute or chronic liver failure and because liver transplant is the final treatment for most of these cases, it seems that in addition to the development of liver transplant centers, increasing experience in liver transplant surgery and postoperative care will improve outcomes.

Author contribution

RGH, KM, and PS prepared, coded, and validated all figures and wrote the original manuscript. **RGH** and **PS** analyzed the data. **KM** and **PS** did the research and methodology. Then, they managed, modified, and edited the manuscript from scientific and technical points of view. All authors read the manuscript in full and approved the final edited version.

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Conflict of interest

The authors declare that they have no competing interests.

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