



ELSEVIER

Contents lists available at ScienceDirect

Journal of Liver Transplantation

journal homepage: www.elsevier.com

Letter to the editor

Life expectancy after liver transplantation for primary biliary cirrhosis, primary sclerosing cholangitis, or hepatitis B cirrhosis ☆☆☆



ARTICLE INFO

Article history:

Received 2 November 2021

Accepted 3 November 2021

Available online 6 November 2021

Key words:

Survival

OPTN

Epidemiology

Life table

Mortality

Several recent studies have reported on life expectancy after liver transplantation for the most common etiologies: HCC [1,2], alcoholic liver disease [3], NASH [4], and Hepatitis C [5]. The present brief work examines three less common ones: primary biliary cirrhosis (PBC), primary sclerosing cholangitis (PSC), and Hepatitis B Cirrhosis. We also investigated whether survival has improved since 2002.

The data and methods used here are the same as those in the prior studies [1–5]. Briefly, we analyzed de-identified data from the OPTN database, which contains information on 130,665 first time, single organ liver transplants. We restricted attention to patients meeting three criteria: (1) reason for transplant as PBC (etiology code 4220), PSC (4240–4245), or Hepatitis B Cirrhosis (4102), (2) age 35 to 74 years, and (3) transplanted during the MELD era, calendar years 2002 to 2018.

Demographic and medical characteristics of the patients are given in Supplemental Table 1, and the Cox (proportional hazards regression) survival models in Supplemental Table 2. Long-term survival was similar in the three cohorts (comparing PSC to PBC, hazard ratio 0.95, $P = 0.54$; comparing Hep B to PBC, HR = 1.04, $P = 0.64$). For our purposes, therefore, the three groups could usefully be combined. The resulting life expectancies are shown in the Table below. Survival improved over the study period; overall, mortality rates fell by 1.8% per calendar year (hazard ratio of 0.982). Upon further examination, we found that the improvement was restricted to the first year post transplant – improvement at 3.6% per calendar year. There was no improvement in survival amongst the subset of patients who had already survived one year post transplant. As in the other studies, life expectancy was much reduced from normal, and varied according to age, medical risk factors, and health status.

Table 1

Table

Life expectancies based on the multivariate models of Supplemental Table 2. The groups considered here are patients who have diabetes (“Yes”), those without (“No”), and overall (“All Tx”).

Starting time	Current Age	Male		All Tx	GP	Female		All Tx	GP
		Yes	No			Yes	No		
From tx	40	20	23	23	39	21	25	25	43
	50	17	19	19	30	18	21	20	33
	60	14	16	16	22	15	17	17	25
	70	11	13	13	15	12	14	14	17
1-yr post	41	19	23	22	38	21	24	24	42
	51	16	19	18	29	17	20	20	33
	61	13	15	15	21	14	16	16	24
	71	11	13	13	14	12	14	13	16
5-yr post	45	17	20	19	34	18	21	21	38
	55	13	16	16	26	15	17	17	29
	65	11	13	13	18	12	14	14	21
	75	9	11	10	11	10	11	11	13

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.liver.2021.100052](https://doi.org/10.1016/j.liver.2021.100052).

References

- [1] Kwak JH, Shavelle R, Brooks J. Life expectancy after liver transplantation for hepatocellular carcinoma with cirrhosis. *Prog Transplant* 2021;31(1):62–71. doi: [10.1177/1526924820978603](https://doi.org/10.1177/1526924820978603).
- [2] Shavelle RM, Kwak JH, Saur R, Brooks JC, Rosenthal P. Life expectancy after liver transplantation for non-cirrhotic hepatocellular carcinoma. *Prog Transpl* 2021;31(2):117–25. doi: [10.1177/15269248211002793](https://doi.org/10.1177/15269248211002793).
- [3] Shavelle R.M., Saur R.C., Kwak J.H., Brooks J.C., Hameed B. Life expectancy after liver transplantation for alcoholic cirrhosis. *Prog Transpl*. Manuscript under review. 2021.
- [4] Shavelle R.M., Saur R.C., Kwak J.H., Brooks J.C., Hameed B. Life Expectancy after Liver Transplantation for NASH. Manuscript under review. 2021.

- [5] Saur R.C., Kwak J.H., Shavelle R.M. Life Expectancy after Liver Transplantation for Hepatitis C Cirrhosis. Manuscript under review. 2021.

Robert M. Shavelle*
Rachel C. Saur
Ji Hun Kwak
Jordan C. Brooks
Bilal Hameed

Life Expectancy Project, San Francisco, CA, United States
Division of Gastroenterology, University of California, San Francisco, United States

*Corresponding author: Robert M. Shavelle, PhD, Life Expectancy Project, 1439 – 17th Avenue, San Francisco, CA 94122-3402.
E-mail address: Shavelle@LifeExpectancy.org (R.M. Shavelle).

Received 2 November 2021
Accepted 3 November 2021

Available online 6 November 2021

Supplemental Table 1. Patient demographics and medical risk factors (figures are column percentages)

Variable	Categories	PBC N=2,434	PSC N= 2,856	Hep B N= 1,494
Age (years)	35-44	10	24	16
	45-54	31	31	34
	55-64	40	32	37
	65-74	19	13	13
Sex	Male	14	67	80
Race	White	75	81	37
Transplant year	2002-2005	27	24	34
	2006-2009	23	23	23
	2010-2013	21	21	18
	2014-2018	29	32	25
MELD score at transplant	6-10	7	11	20
	11-18	31	30	26
	19-24	24	25	14
	25-40	33	29	28
	Missing/Other	5	5	12
Donor type	Living	12	13	3
Weight	Underweight (BMI<18)	1	2	1
	Normal weight (18-25)	40	45	41
	Overweight (25-30)	34	35	34
	Obese (30+)	25	18	24
Presence of Hepatitis C	Yes	2	2	5
Diabetes	Yes	13	12	22
Functional status at transplant (Karnofsky Performance Status)	100% (normal)	1	2	3
	90% - Minor symptoms of disease	4	5	6
	80% - Normal activity with effort	13	16	11
	70% - Cares for self, but unable to carry on normal activity	13	13	10
	60% - Requires occasional assistance	10	11	7
	50% - Requires considerable assistance	9	8	5
	40% - Disabled	8	7	6
	30% - Severely disabled	6	6	6
	20% - Very sick	12	9	15
	10% - Moribund	3	2	4
	Missing/Other	21	21	27
Ascites	Yes	79	67	71
Hepatic encephalopathy	No	34	49	39
	Mild (1-2)	56	44	48
	Severe (3-4)	9	6	12
	Unknown/missing	1	1	1

Donor age	0-19	12	9	11
	20-49	52	57	52
	50-79	35	33	36
	80+	1	1	1
Portal Vein Thrombosis	Yes	8	7	8
Time spent on waitlist	<180 days	56	52	67
	181-365 days	15	17	12
	> 365 days	29	31	21
Length of Hospital Stay Post Transplant	0-10 days	52	55	56
	11 to 30 days	36	35	34
	31+ days	10	9	9
	Missing	2	1	1
Previous malignancy	Yes	8	9	17
Ventilator use at transplant	Yes	4	3	6
Working at time of transplant	Yes	14	26	14
Dialysis within 1 week of tx	Yes	10	6	8

Supplemental Table 2. Univariate and multivariate hazard ratios (P-values) -- from Cox Proportional Hazards Regression models with multiple factors.§

Variable	Categories	Univariate	Multivariate
Age (years)§	(Continuous)	1.04 (<0.0001)	1.04 (<0.0001)
Sex§	Male	1.10 (0.14)	1.23 (0.14)
Race§	White	1.07 (0.34)	1.04 (0.66)
Transplant year§	(Continuous)	1.01 (0.53)	1.00 (0.77)
Etiology	PBC (cf Hep B)	0.95 (0.54)	0.94 (0.55)
	PSC (cf Hep B)	0.94 (0.47)	0.97 (0.77)
MELD score at transplant	6-10	1 (ref)	1 (ref)
	11-18	0.95 (0.61)	0.97 (0.76)
	19-24	0.89 (0.33)	0.93 (0.51)
	25-40	0.86 (0.21)	0.89 (0.71)
Donor type	Living	0.70 (0.004)	0.75 (0.02)
Weight	Underweight	0.92 (0.80)	0.92 (0.81)
	Normal weight	1 (ref)	1 (ref)
	Overweight	1.04 (0.62)	1.00 (0.96)
	Obese	1.02 (0.85)	1.02 (0.81)
Presence of Hepatitis C	Yes	1.87 (<0.0001)	1.91 (<0.0001)
Diabetes	Yes	1.47 (<0.0001)	1.38 (0.0002)
Functional status at transplant	70-100%	1 (ref)	1 (ref)
	0-60%	1.1 (0.26)	1.08 (0.27)
Ascites	Yes	1.07 (0.37)	1.04 (0.63)
Hepatic encephalopathy	Yes	1.87 (<0.0001)	1.91 (<0.0001)
Donor age	<20	0.69 (0.001)	0.70 (0.002)
	20 and up	1 (ref)	1 (ref)
Portal Vein Thrombosis	Yes	0.98 (0.90)	0.95 (0.72)
Time spent on waitlist	<180 days	1 (ref)	1 (ref)
	180-365 days	0.89 (0.22)	0.92 (0.40)
	>365 days	0.87 (0.07)	0.88 (0.09)
Length of Hospital Stay	0-10 days	1 (ref)	1 (ref)
	11-30 days	1.31 (0.0001)	1.31 (0.0002)
	31+	2.31 (<0.0001)	2.21 (<0.0001)
Previous malignancy	Yes	1.23 (0.05)	1.09 (0.41)
Ventilator use	Yes	1.20 (0.33)	1.23 (0.26)
Working at transplant	Yes	0.79 (0.02)	0.85 (0.12)
Dialysis within 1 wk of tx	Yes	1.37 (0.02)	1.37 (0.02)

§ The univariate results are based on models with only the one stated factor. The multivariate results are based on multiple models, each of which includes terms for age, sex, race and transplant year. For example, the hazard ratios for MELD scores are based on a model with five factors. Of course, the multivariate hazard ratios for age, sex, race, and transplant year each vary by model. For simplicity, the values shown here are the ones for the model with MELD score.