

Long-Term Outcome of Liver Transplant Recipients After the Development of Renal Failure Requiring Dialysis: A Study Using the National Health Insurance Database in Taiwan

T.-J. Wang^{a,b}, C.-H. Lin^c, S.-N. Chang^c, S.-B. Cheng^{d,e}, C.-W. Chou^f, C.-H. Chen^{b,g,h,i}, K.-H. Shu^{b,j}, and M.-J. Wu^{b,j,k,l,*}

^aDivision of Nephrology, Department of Internal Medicine, Chia-yi Branch, Taichung Veterans General Hospital, Taiwan; ^bDivision of Nephrology, Department of Internal Medicine, Taichung Veterans General Hospital, Taichung, Taiwan; ^cAssociate Investigator Department of Medical Research, Taichung Veterans General Hospital, Taichung, Taiwan; ^dDepartment of Surgery, Taichung Veterans General Hospital, Taichung, Taiwan; ^eDepartment of Medicine, Chung Shan Medical University, Taichung, Taiwan; ^fDivision of Hematology/Medical Oncology, Department of Internal Medicine, Taichung Veterans General Hospital, Taichung, Taiwan; ^gDepartment of Medical Research, Taichung Veterans General Hospital, Taichung, Taiwan; ^hCenter for Quality Management, Taichung Veterans General Hospital, Taichung, Taiwan; ⁱDepartment of Life Science, Tunghai University, Taichung, Taiwan; ^jSchool of Medicine, Chung Shan Medical University, Taichung, Taiwan; ^kRong Hsing Research Center for Translational Medicine, Institute of Biomedical Science, College of Life Science, National Chung Hsing University, Taichung, Taiwan; ^lGraduate Institute of Clinical Medical Science, School of Medicine, China Medical University, Taichung, Taiwan

ABSTRACT

Background. The aims of this study were to identify the incidence of renal failure requiring dialysis and to investigate the long-term outcome after renal failure in liver transplantation (LT) patients.

Methods. The primary database used was the Taiwan National Health Insurance Research Database. Subjects with LT from 1997 to 2009 were included. Patients were grouped into the dialysis cohort if they once received hemodialysis owing to any pattern of renal failure during peri-transplantation periods or after LT. Otherwise, they were categorized into the nondialysis cohort. We conducted a retrospective observational study on the correlation of renal failure requiring dialysis and its effect on LT recipients.

Results. The analysis included data of 1,771 LT recipients with a mean follow-up time of 3.8 ± 2.9 years. The mean age was 43.2 ± 19.3 years, and 69.4% were male. Overall patient survival was 86.2% at 1 year, 82.2% at 3 years, and 80.5% at 5 years. Renal failure requiring dialysis had developed in the 323 patients (18.2%). Among them, 26 individuals (1.5%) had progressed to end-stage renal disease without renal recovery after perioperative hemodialysis. Individuals who developed renal failure requiring dialysis had a higher mortality compared with LT recipients never requiring dialysis (hazard ratio, 8.75; 95% confidence interval, 7.0–10.9).

Conclusions. Renal failure requiring dialysis development after LT is common and carries high mortality in Chinese liver allograft recipients. Recognizing risk factors permits the timely institution of proper treatment, which is the key to reducing untoward outcomes.

RENAL dysfunction arising after liver transplantation (LT) is a common complication. But long-term outcomes associated with renal failure requiring dialysis among orthotopic liver transplant recipients are largely unknown. The aims of the present study were to explore the incidence and examine the long-term outcome of renal failure

*Address correspondence to Dr Ming-Ju Wu, Division of Nephrology, Department of Medicine, Taichung Veterans General Hospital, Taiwan, No 1650 Taiwan Boulevard Sect 4, Taichung, Taiwan 40705, ROC. E-mail: wmj530@gmail.com

requiring dialysis among LT recipients in a representative cohort in Taiwan.

METHODS

The database used in this study is from the National Health Insurance Research Database (NHI-RD) in Taiwan. The NHI-RD was queried for all patients who underwent LT in Taiwan from the beginning of 1997 to the end of 2009. In all, 1,813 patients were identified. We excluded 8 patients with preceding renal transplantation, 10 patients with end-stage renal disease (ESRD) before LT, 2 patients with missing information, and 22 patients who died within 7 days after LT. Ultimately, 1,771 patients with LT were included in the analysis.

Diagnostic codes and procedure codes based on ICD-9-CM were retrieved for analyses in this study. Recipients were characterized by sex, age, and comorbidities. Patients were grouped into the dialysis cohort if they once received hemodialysis owing to any pattern of renal failure during peri-transplantation periods or after LT. Otherwise, they were categorized into the nondialysis cohort. The dialysis modality was also recorded as intermittent hemodialysis (iHD) or continuous renal replacement therapy (CRRT).

The primary outcome considered was mortality. The end point of follow-up was the occurrence of death or the end of study on December 31, 2010.

Statistical Analysis

Data are expressed as mean \pm SD unless otherwise specified. The Student *t* test was used to test difference of continuous variables (eg, age) between the dialysis and nondialysis cohorts. The distributions of baseline characteristics (sex, age, and comorbidities) were compared between the cohorts with and without dialysis by means of chi-square test. Follow-up time (in person-years) was

calculated for each subject from the initial LT until ESRD, mortality, the end of the study. The incidence rates of ESRD or mortality were calculated in the follow-up period until the end of 2010. Survival data were analyzed with the use of the Kaplan-Meier method, and survival curves were compared with the use of the log-rank test. The multivariate Cox proportion hazard regression was used to examine the effect of dialysis exposure on the risk of mortality, as shown by hazard ratio (HR) with 95% confidence interval (CI). A two-tailed *P* value of $<.05$ was considered to be statistically significant. All statistical analyses were performed with the use of SAS statistical software (version 9.2 for Windows; SAS Institute, Cary, North Carolina).

RESULTS

Among the 1,771 LT recipients, the mean age was 43.2 ± 19.3 years and 69.5% were male. The mean follow-up duration was 3.8 ± 2.9 years. Renal failure requiring dialysis had developed in 323 patients (18.2%). The baseline characteristics of the LT recipients that developed renal failure requiring dialysis compared with those that never requiring dialysis are summarized in Table 1. Seventy patients (4.0%) had pre-transplantation chronic kidney disease (CKD). A significantly greater number of elder LT recipients that required dialysis was noted. Significant differences were also identified in hepatitis C virus (HCV) carrier status, diabetes mellitus, CKD, hypertension, malignancy, biliary atresia, acute hepatic failure, primary biliary cirrhosis, and hepatic cancer between the dialysis and nondialysis cohorts ($P < .05$).

Overall patient survival was 86.2% at 1 year, 82.2% at 3 years, and 80.5% at 5 years. Mortality outcomes for LT

Table 1. Baseline Characteristics Between Liver Transplant (LT) Patients With Dialysis and Without Dialysis Identified in 1997–2009, *n* (%)

Variable	Total (<i>n</i> = 1,771)	Nondialysis (<i>n</i> = 1,448)	Dialysis (<i>n</i> = 323)	<i>P</i> Value*
Sex				.843
Women	540 (30.5)	443 (30.6)	97 (30.0)	
Men	1,231 (69.5)	1,005 (69.4)	226 (70.0)	
Age, y				.003
Mean \pm SD	43.2 \pm 19.3	42.4 \pm 19.9	46.8 \pm 16.0	
<18	289 (16.3)	257 (17.7)	32 (9.9)	
18–39	176 (9.9)	144 (9.9)	32 (9.9)	
40–59	1,099 (62.1)	888 (61.3)	211 (65.3)	
≥ 60	207 (11.7)	159 (11.0)	48 (14.9)	
Comorbidities				
HBV	922 (52.1)	744 (51.4)	178 (55.1)	.225
HCV	401 (22.6)	308 (21.3)	93 (28.8)	.004
Cirrhosis	1,652 (93.3)	1,357 (93.7)	295 (91.3)	.122
DM	402 (22.7)	310 (21.4)	92 (28.5)	.006
CKD	70 (4.0)	33 (2.3)	37 (11.5)	<.001
Hypertension	310 (17.5)	232 (16.0)	78 (24.1)	<.001
Hyperlipidemia	161 (9.1)	232 (16.0)	37 (11.5)	.102
Malignancy	443 (25.0)	381 (26.3)	62 (19.2)	.008
Biliary atresia	231 (13.0)	217 (15.0)	14 (4.3)	<.001
Acute hepatic failure	144 (8.1)	105 (7.3)	39 (12.1)	.004
Primary biliary cirrhosis	222 (12.5)	194 (13.4)	28 (8.7)	.020
Hepatic cancer	421 (23.8)	364 (25.1)	57 (17.7)	.004

Abbreviations: HBV, hepatitis B virus; HCV, hepatitis C virus; DM, diabetes mellitus; CKD, chronic kidney disease.

*Chi-square test.

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