



Brief Episodes of Newly Developed Intraoperative Atrial Fibrillation Predicts Worse Outcomes in Adult Liver Transplantation

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ABSTRACT

Background. Although patients undergoing liver transplantation (LT) are frequently exposed to predisposing factors of atrial fibrillation (AF) such as autonomic imbalance, surgical stress, and elevated catecholamine levels, the occurrence of intraoperative AF (IOAF) has not been fully examined in LT candidates.

Methods. Data from 1059 patients who underwent adult LT from 2006 to 2010 were analyzed. Among patients with preoperative normal sinus rhythm, the incidence, prognosis, and detailed characteristics of newly developed IOAF were assessed. Their risk factors and clinical implication, including hepatic graft survival and mortality, were also examined.

Results. Thirteen (1.2%) cases of AF newly developed intraoperatively. A higher Model for End-Stage Liver Disease score (adjusted odds ratio, 1.077 [95% confidence interval, 1.015–1.143]; $P = .015$) and fulminant hepatic failure (adjusted odds ratio, 6.844 [95% CI, 1.944–24.096]; $P = .003$) were associated with its occurrence. Eight cases of newly developed AF occurred immediately after hepatic graft reperfusion; the other 3 cases occurred during the pre-anhepatic or anhepatic phase. The majority of patients (9 cases) experienced only brief episodes of AF lasting <1 hour. Despite all patients with newly developed AF eventually converting to sinus rhythm within 1 week after surgery, the episode of IOAF was independently associated with mortality (adjusted hazard ratio, 5.097 [95% confidence interval, 2.189–11.868]; $P < .001$) after adjustment for Model for End-Stage Liver Disease score.

Conclusions. For LT recipients, even a brief episode of newly developed IOAF seems to be an important prognosticator, regardless of AF duration.

THE INCIDENCE of intraoperative arrhythmia is high, and it is essential for the anesthesiologist to evaluate risk factors and their outcome. Intraoperative occurrence of arrhythmia is clinically important because it can be associated with significant hemodynamic instabilities [1]. Specifically, patients undergoing liver transplantation (LT) are frequently associated with various kinds of arrhythmia, including torsade de pointes [2,3], abnormalities in QT interval [4,5], ventricular arrhythmia associated with QT prolongation [6], and atrioventricular conduction disturbances [7]. Furthermore, regardless of the extent of drop in body temperature, ventricular arrhythmogenic potential developed immediately after portal vein unclamping before the occurrence of systolic hypotension [8].

Patients undergoing LT are frequently exposed to predisposing factors of atrial fibrillation (AF) such as autonomic imbalance, surgical stress, and elevated catecholamine levels.

This work was supported by a grant (2017-7013) from the Asan Institute for Life Sciences, Asan Medical Center, and was supported by the Basic Science Research Program through the National Research Foundation of Korea funded by the Ministry of Science, ICT & Future Planning (grant no. 2016R1C1B1012164).

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Table 1. Patient Characteristics According to the Development of Newly Developed IOAF

Characteristic	No IOAF (n = 1046)	Newly Developed IOAF (n = 13)	Total (N = 1059)	P
Preoperative variables				
Age, y	50.6 ± 8.7	45.4 ± 8.7	50.5 ± 8.7	.032
Male sex	780 (74.6%)	5 (38.5%)	785 (74.1%)	.022
MELD score	18.8 ± 9.8	31.5 ± 11.2	19.0 ± 9.9	.006
Underlying comorbidities				
Hypertension	112 (10.7%)	3 (23.1%)	115 (10.9%)	.611
Diabetes mellitus	202 (19.3%)	3 (23.1%)	205 (19.4%)	.460
History of cardiovascular disease	82 (7.8%)	6 (46.2%)	88 (8.3%)	<.001
Fulminant hepatic failure	67 (6.4%)	7 (53.8%)	74 (7.0%)	<.001
Preoperative laboratory variables				
Brain natriuretic peptide, pg/mL	47.0 (22.5–103.5)	140.5 (38.0–496.0)	47.0 (23.0–107.0)	.046
Albumin, g/dL	2.8 ± 0.6	2.7 ± 0.2	2.8 ± 0.6	.205
Total bilirubin, mg/dL	2.8 (1.6–8.8)	34.7 (19.9–45.0)	2.8 (1.6–9.1)	.008
Creatinine, mg/dL	0.8 (0.7–1.1)	2.3 (1.8–2.4)	0.8 (0.7–1.1)	.082
Prothrombin time (INR)	1.7 ± 0.7	2.8 ± 0.4	1.7 ± 0.7	.048
Preoperative echocardiographic variables				
Left ventricular ejection fraction, %	64.8 ± 4.5	62.2 ± 6.2	64.7 ± 4.6	.095
Left atrial diameter, mm	40.2 ± 5.3	38.7 ± 10.5	40.2 ± 5.4	.427
LVEDV, mL	107.1 ± 30.9	77.7 ± 15.6	106.7 ± 30.9	.001
Mass index, g/m ²	94.3 ± 20.4	87.9 ± 16.4	94.2 ± 20.3	.283
E/E'	10.3 ± 3.0	10.6 ± 1.8	10.3 ± 3.0	.590
Corrected QT interval, ms	446.7 ± 35.4	423.3 ± 25.1	446.4 ± 35.4	.015
Intraoperative variables				
Orthotopic liver transplantation	96 (9.2%)	6 (35.3%)	102 (9.6%)	.001
Re-transplantation	18 (1.7%)	1 (5.9%)	19 (1.8%)	.716
Surgical time, min	862.3 ± 163.3	749.6 ± 124.7	860.5 ± 163.3	.004
Total ischemia time, min	120 (98–150)	133 (116–165)	121 (98–150)	.210
Intraoperative RBC use, unit	10 (6–18)	10 (2–14)	10 (6–18)	.144
Intraoperative FFP use, unit	16 (9–24)	12 (10–20)	16 (9–23)	.333
Postreperfusion syndrome	537 (51.2%)	13 (76.5%)	550 (51.6%)	.069
Mean PAP before reperfusion, mm Hg	15.2 ± 4.5	19.8 ± 6.5	15.2 ± 4.5	.011
Mean ABP before reperfusion, mm Hg	77.5 ± 12.0	87.2 ± 14.3	77.6 ± 12.0	.020
CVP before reperfusion, mm Hg	8.7 ± 3.7	9.2 ± 4.5	8.7 ± 3.7	.592
HR before reperfusion, beats/min	89.9 ± 17.2	109.6 ± 31.1	90.2 ± 17.5	.026
QT interval before reperfusion, ms	498.9 ± 44.1	467.1 ± 52.7	498.5 ± 44.3	.032
Atrial blood gas analysis result 10 min before graft reperfusion				
pH	7.3 ± 0.1	7.4 ± 0.1	7.3 ± 0.1	.493
HCO ₃ ⁻ , mmEq/L	17.6 ± 3.3	17.3 ± 3.6	17.6 ± 3.3	.801
Base excess, mmEq/L	-7.2 ± 4.0	-7.1 ± 4.8	-7.2 ± 4.0	.965
Na ⁺ , mmol/L	136.6 ± 4.3	139.3 ± 6.9	136.7 ± 4.4	.176
K ⁺ , mmol/L	3.8 ± 0.6	3.7 ± 0.4	3.8 ± 0.6	.704
Lactate, mmol/L	4.6 ± 2.0	7.0 ± 3.6	4.6 ± 2.1	.005
Postoperative outcome variables				
Mortality	174 (16.6%)	6 (46.2%)	180 (17.0%)	.019
Survival day	1374.8 ± 643.3	724.4 ± 641.3	1366.8 ± 647.0	.006
Final graft loss	177 (16.9%)	6 (46.2%)	183 (17.3%)	.021
Graft survival day	1371.2 ± 646.7	724.4 ± 641.3	1363.3 ± 650.3	.006

Values are expressed as mean ± SD or median (interquartile range) unless indicated otherwise.

Abbreviations: ABP, arterial blood pressure; CVP, central venous pressure; FFP, fresh-frozen plasma; HR, heart rate; INR, international normalized ratio; IOAF, intraoperative atrial fibrillation; MELD, Model for End-Stage Liver Disease; LVEDV, left ventricular end-diastolic volume; PAP, pulmonary arterial pressure; RBC, red blood cell.

Postoperative AF is common after LT surgeries and is associated with increased morbidity and mortality [9]. However, the occurrence of newly developed intraoperative AF (IOAF) has not been fully examined in LT candidates. Therefore, we evaluated newly developed IOAF during LT and assessed patient outcomes regarding the duration of AF.

PATIENTS AND METHODS

In this retrospective study, data from 1349 LTs from April 2006 to June 2010 were analyzed. All data were retrieved from our previous study, which analyzed atrioventricular conduction disturbances emerging immediately after hepatic graft reperfusion [7]. Among the 1349 LTs, 35 recipients underwent re-transplantation, and these cases were counted separately. After excluding 78 pediatric cases

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