



Intracardiac Thrombosis during Liver Transplantation: A 22-Year Single-Institution Study

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Introduction

- Intracardiac thrombosis (ICT) during orthotopic liver transplantation (OLT) is an uncommon event associated with a high mortality rate.
- Investigations to elucidate risk factors predisposing patients to ICT, intraoperative management, and treatment outcomes have been attempted.
- This study aims to identify risk factors for ICT during OLT.
- It also aims to examine the incidence, clinical presentation, intraoperative treatment, survival rate, and postoperative complications in this patient population.

Methods

- A retrospective chart review was conducted on patients who underwent OLT for a 22-year period (January 1, 1998 to December 31, 2019) at our institution.
- ICT diagnosis was confirmed with clot visualization by intraoperative transesophageal echocardiography (TEE).
- Each patient's medical record was abstracted for demographic data, comorbid conditions, stage of surgery when ICT developed, anatomical location of ICT, intraoperative management, and outcome.
- Coagulation abnormalities were evaluated via prothrombin time, international normalized ratio (INR) and thromboelastogram (TEG) before and after ICT.

Results

- Of 3,607 OLTs performed, 34 (0.9%) patients were diagnosed with ICT during OLT.
- The primary diagnosis for liver failure was highly variable, showing no statistically significant association with ICT occurrence (Table 1).
- 19 (55.9%) patients had a history of deep vein thrombosis, portal vein thrombosis, pulmonary embolism, and/or thrombosis of other vessels with 8 (88.9%) patients taking warfarin preoperatively.
- ICT diagnosis was found in all stages of OLT surgery, ranging from pre-anhepatic, anhepatic, to post-perfusion period (Table 2).
- Clinical presentation widely ranged from an abrupt onset of refractory hypotension to no significant hemodynamic change. 25 (73.5%) patients showed severe coagulopathy on laboratory results immediately after intraoperative diagnosis of ICT presented with no clot for INR and/or TEG.
- All 11 (32.3%) patients diagnosed with left-sided ICT experienced intraoperative cardiac arrest and died intraoperatively or immediately postoperatively.
- 6 (17.6%) patients with right-sided ICT was treated with heparin and tissue plasminogen activator (tPA).
- 5 (83.3%) of the 6 survived but developed strokes as complications. 14 (41.2%) patients with right-sided ICT received heparin only and 13 (92.8%) patients survived without significant complications.
- 3 (8.8%) patients with right-sided ICT received heparin and tPA with failure of thrombus dissolution and death.

Table 1: Patient Demographics and Characteristics

Demographics and Characteristics		Value	
Sex	Male	14 (41.2%)	
	Female	20 (58.8%)	
Age (years)		Range: 41.8 - 70.2	
		Mean: 62.5	
		Standard deviation: 6.9	
End-Stage Liver Disease Etiology	Alcoholic liver disease	4 (11.8%)	
	Alpha-1 antitrypsin deficiency	1 (2.9%)	
	Cryptogenic cirrhosis	3 (8.8%)	
	Hepatitis C	5 (14.7%)	
	Hepatocellular carcinoma	5 (14.7%)	
	Intrahepatic shunting	2 (5.9%)	
	Nonalcoholic steatohepatitis	15 (44.1%)	
	Polycystic liver disease	4 (11.8%)	
	Primary biliary cirrhosis	2 (5.9%)	
	Primary sclerosing cholangitis	1 (2.9%)	
	Secondary biliary cirrhosis	1 (2.9%)	
	Co-morbidities	Atrial fibrillation	7 (20.6%)
		Coronary artery disease	5 (14.7%)
Chronic kidney disease (GFR 15-90 mL/min)		14 (41.2%)	
Diabetes mellitus		18 (52.9%)	
End Stage Renal Disease (GFR < 15 mL/min)		6 (17.6%)	
Hepatic Encephalopathy		27 (79.4%)	
Hepatorenal syndrome		7 (20.6%)	
Portal hypertension		20 (58.8%)	
Malignancy (other than hepatocellular carcinoma)		3 (8.8%)	
Prior placement of trans jugular intrahepatic portosystemic shunt		7 (20.6%)	
History of Hypercoagulable State		Deep vein thrombosis	7 (38.9%)
		Portal vein thrombosis	10 (55.6%)
		Pulmonary embolism	2 (11.1%)
	Superior mesenteric vein thrombosis	1 (5.6%)	
	Other vessel thrombosis	2 (11.1%)	
	Clopidogrel	1 (11.1%)	
Preoperative Usage of Anticoagulation or Antiplatelet Medication	Heparin	1 (11.1%)	
	Warfarin	8 (88.9%)	
	Timing of the Intracardiac Thrombosis (Intraoperative Stage)		
Pre-anhepatic	5 (14.7%)		
Anhepatic	17 (50.0%)		
Post-reperfusion	12 (35.3%)		

Conclusions

Patients with left-sided ICT had 100% mortality rate. For the ICT limited to the right heart, patients who only received heparin survived the surgery without significant complications. Patients who received heparin and tPA survived but developed a stroke. Patients with failure of thrombus dissolution did not survive.

Table 2: Intracardiac Thrombosis Location, Laboratory Values, and Patient Outcomes

Anatomical Location of ICT	PT (seconds) / INR Pre-ICT	PT (seconds) / INR Post-ICT	Medication Treatment for ICT	Dissolution of ICT	1-month Survival after Surgery	Stroke
Right	56.1/6	20.4/1.7	None	Yes	Yes	No
Right	42.4/3.7	37.6/3.3	None	Yes	Yes	No
Right	30.1/2.8	>100/No clot	Heparin	Yes	Yes	No
Right	>100/No clot	>100/No clot	Heparin	Yes	Yes	No
Right	>100/No clot	95.6/13.1	Heparin	Yes	Yes	No
Right	21/1.9	20.5/1.8	Heparin	Yes	Yes	No
Right	23.7/2.2	>100/No clot	Heparin	Yes	Yes	No
Right	38.9/3.9	>100/No clot	Heparin	Yes	Yes	No
Right	22.2/1.9	36.7/3.8	Heparin	Yes	Yes	No
Right	26.8/2.4	50.9/5.4	Heparin	Yes	Yes	No
Right	18/1.5	19.5/1.6	Heparin	Yes	Yes	No
Right	70.2/8.8	61.4/7.3	Heparin	Yes	Yes	No
Right	22.2/1.9	38.9/3.9	Heparin	Yes	Yes	No
Right	27.1/2.5	50.9/5.4	Heparin	Yes	Yes	No
Right	20.9/1.8	>100/No clot	Heparin	No	No	n/a
Right	37/3.2	112.7/9.6	Heparin	Yes	Yes	No
Right	29.4/2.6	>320/No clot	Heparin	Yes	Yes	No
Right	25.2/2.2	30.7/2.9	Heparin and tPA	Yes	Yes	Yes
Right	25.7/2.3	58.1/6.5	Heparin and tPA	Yes	Yes	Yes
Right	34.5/3.5	>100/No clot	Heparin and tPA	Yes	Yes	Yes
Right	65.4/7.4	65.4/7.4	Heparin and tPA	Yes	Yes	No
Right	24.3/2.2	>100/No clot	Heparin and tPA	Yes	No	n/a
Right	37.3/3.7	>100/No data	Heparin and tPA	No	No	n/a
Left	15/1.2	No data	None	No	No	n/a
Left	25.9/2.3	>320/No clot	Heparin and tPA	No	No	n/a
Both	>100/no clot	No data/No clot	None	No	No	n/a
Both	21.4/1.8	>100/No clot	None	No	No	n/a
Both	>100/No clot	>100/No clot	Heparin	No	No	n/a
Both	17.6/1.4	99/13.1	Heparin and tPA	No	No	n/a
Both	>100/No clot	>100/No clot	Heparin and tPA	No	No	n/a
Both	>100/No clot	35.2/3.4	Heparin and tPA	No	No	n/a
Both	25.1/2.2	No data	Heparin and tPA	No	No	n/a
Both	53.3/6	>100/No clot	Heparin and tPA	No	No	n/a
Both	>320/No clot	>320/No clot	Heparin and tPA	No	No	n/a

Reference

Liver Transpl 2015;21:1280-5