

The Utility of Cross-Sectional Imaging in Predicting Etiology of Abnormal Liver Tests in Early Post-Liver Transplant Patients

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Introduction

There is a growing number of patients who require liver transplantation (LT). Within the first three months post-transplantation, there can be fluctuations in a patient's liver enzymes which may be indicative of multiple potential pathologic processes. In order to protect the lifespan of the recently transplanted liver, we must understand the etiology of these lab abnormalities.

Cross-sectional imaging through computed tomography (CT) or magnetic resonance cholangiopancreatography (MRCP) is typically among first line workup. Endoscopic retrograde cholangiopancreatography (ERCP) may be needed to intervene on pathology within the liver bile ducts.

This study plans to address the current ambiguity regarding the reliability of MRCPs and CTs in context of recent surgical anatomy through the evaluation of performance characteristics of MRCP and/or CT in accurately predicting biliary etiology for elevated liver tests as compared to ERCP.

Methods

- This is a retrospective analysis of patients undergoing liver transplant at KECK Medicine of USC from 2005 to 2023
- Inclusion criteria: patient ages 18 to 70, abnormal liver tests within 3 months of transplant and with cross sectional imaging, follow-up for at least 1 year post-transplant
- Exclusion criteria: patients with normal liver tests within the first 3 months post-transplant, less than 1 year follow-up
- Sub-group analysis performed comparing patients who underwent CT/MRI and (ERCP)
- Primary outcome: comparison of findings on cross-sectional imaging and determine concordance or discordance with ERCP
- Secondary outcomes: rate of upstaging diagnosis at time of ERCP as compared to imaging
- Statistical analysis: Frequencies and percentages will be measured for categorical variables; mean and standard deviation were calculated for continuous variables

Table 1: Patient Demographics

	N = 39 patients
Age (years, ±SD)	63.4 (23.3)
Male gender; n (%)	28 (72.0)
Ethnicity; n (%)	
Caucasian	16 (41.0)
Hispanic	10 (25.6)
African American	2 (5.1)
Asian	4 (10.3)
Other	7 (17.9)
Etiology of Liver Disease; n (%)	
Non-alcoholic fatty liver disease (NAFLD)	6 (15.4)
Alcohol-related liver disease	6 (15.4)
Hepatitis B (HBV)	1 (2.6)
Hepatitis C (HCV)	6 (15.4)
Autoimmune hepatitis (AIH)	2 (5.1)
Other*	6 (15.4)
Multiple etiologies	12 (30.8)
Age at time of liver transplant (years ±SD)	56.4 (13.4)
Type of liver transplantation; n (%)	
Cadaveric	35 (89.7)
Living donor	4 (10.3)
Type of anastomosis; n (%)	
Duct-to-duct	25 (64.1)
Roux hepaticojejunostomy	14 (35.9)

SD = standard deviation; *Other diagnoses including primary sclerosing cholangitis (PSC); polycystic liver disease, primary biliary cirrhosis (PBC), alpha-1 antitrypsin disease and cryptogenic cirrhosis

Table 2: Characteristics in LT Patients with Acute Liver Test Elevation

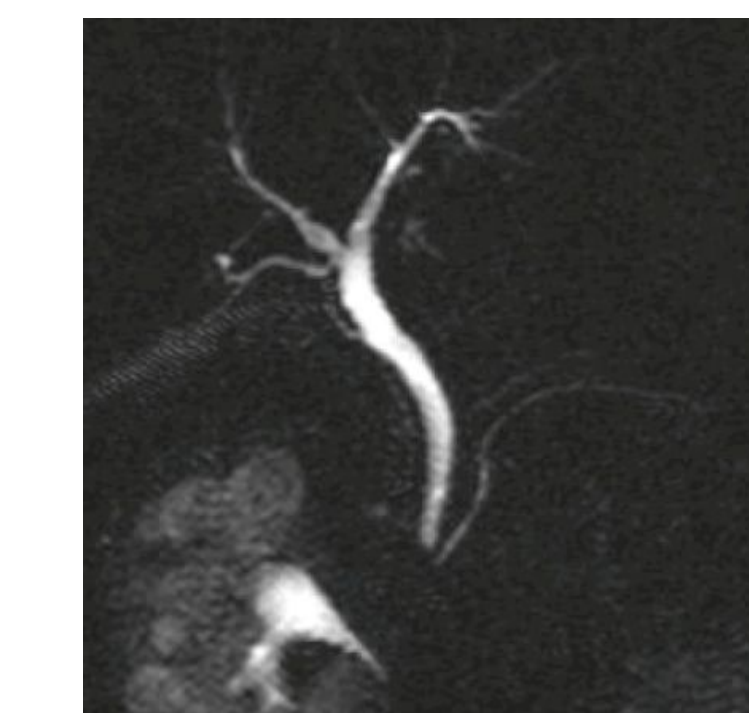
	N = 39 patients
Days to Abnormal Liver Tests; days SD	32.8 (31.1)
Liver Tests (mean SD)	
AST (U/L)	114.2(257.9)
ALT (U/L)	126.7 (157.6)
Alkaline Phosphatase (IU/L)	216.4 (137.6)
Total Bilirubin (mg/dL)	3.3 (5.1)
CT Findings; n (%)	27 (69.2)
Intrahepatic Duct Dilatation	0 (0.0)
Extrahepatic Duct Dilatation	1 (2.6)
Duct Stenosis	0 (0.0)
Filling Defect	1 (2.6)
Unremarkable biliary findings	14 (35.9)
MRCP Findings; n(%)	20 (51.3)
Intrahepatic Duct Dilatation	7 (17.9)
Extrahepatic Duct Dilatation	3 (7.7)
Duct Stenosis	1 (2.6)
Filling Defect	1 (2.6)
Unremarkable biliary findings	9 (23.1)
ERCP; n (%)	10 (25.6)

Table 3: Comparison of Imaging and Endoscopic Findings

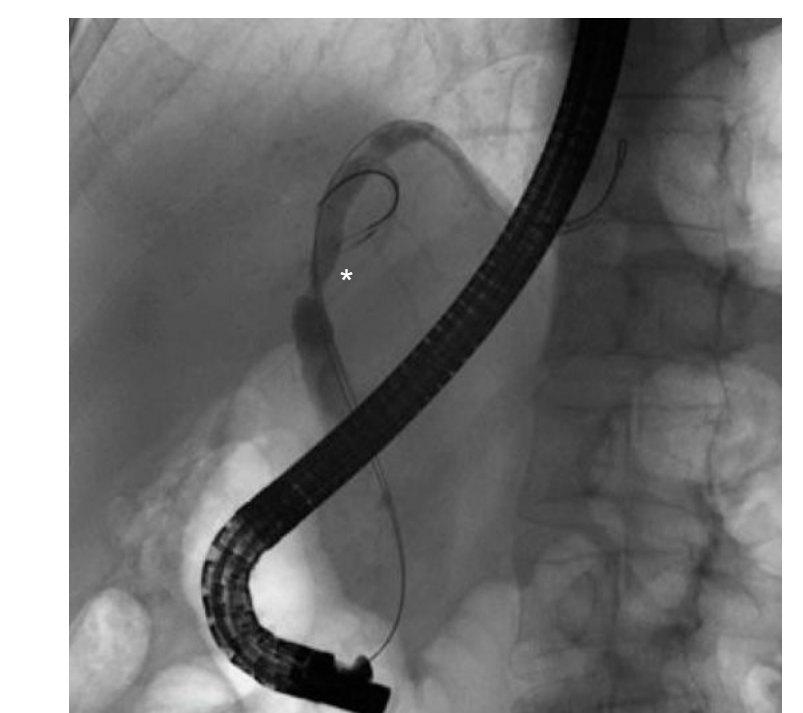
	N = 10
Age (years, ±SD)	59.8 (16.3)
Type of liver transplantation; n (%)	
Cadaveric	9 (90.0)
Living donor	1 (10.0)
Type of anastomosis; n (%)	
Duct-to-duct	9 (90.0)
Roux hepaticojejunostomy	1 (10.0)
Days to Abnormal Liver Tests; days ± SD	36.5 (30.0)
Liver Tests (mean ± SD)	
AST (U/L)	70.4 (64.5)
ALT (U/L)	96.6 (83.2)
Alkaline Phosphatase (IU/L)	271.0 (113.3)
Total Bilirubin (mg/dL)	4.1 (6.6)
ERCP Findings; n (%)	
Intrahepatic Duct Dilatation	2 (2.0)
Extrahepatic Duct Dilatation	3 (3.0)
Duct Stenosis	4 (40.0)
Filling Defect	0 (0.0)
Unremarkable biliary findings	3 (3.0)
Discordance of Findings; n (%)	
Between MRCP and ERCP	3 (3.0)
Between CT and ERCP	5 (5.0)
Upstaged Findings based on ERCP	3 (3.0)
Anastomotic stricture not seen on imaging	2 (2.0)
Multifocal intrahepatic strictures not seen on imaging	1 (1.0)
Liver Biopsy Performed Prior to ERCP; n (%)	2 (20.0)
Final Diagnosis consistent with Liver Biopsy*	2 (100.0)

*Liver biopsy diagnosis includes reperfusion injury and acute cellular rejection

Figure 1: Example MRCP vs ERCP Findings



Unremarkable MRCP



ERCP showing anastomotic stricture*

Results

- 39 patient charts were analyzed of which the mean age was 63.4 years and 72% were male.
- The most common etiology of liver disease was NAFLD (15.4%), HCV (15.4) and combination of multiple liver pathologies (for example NALFD and HCC, etc) (Table 1)
- Most patients (89.7%) underwent orthotopic cadaveric liver transplant and had duct to duct biliary anastomosis (64.1%).
- Multiple imaging modalities with both CT and MRCP was performed in 41% of patients, of which 43.8% had discordant liver or biliary findings. In 71.4% of these patients, MRCP identified either a intraductal filling defect or stricture not seen on CT. CT did identify patients with hematomas not seen on MRCP.
- An ERCP was performed in 10 (25.6%) patients following CT/MRCP. There was discordant findings between MRCP and ERCP in 3 (30%) patients and between CT and ERCP in 5 (50%) patients. A biliary diagnosis was upstaged during ERCP in 3 (30%) patients.

Summary

In patients with acute liver test elevation within 3 months of liver transplantation, cross-sectional imaging may not be a reliable source to identify potential biliary etiologies as seen in 30% of patients having upstaged diagnoses based on ERCP findings. In addition, cross-sectional imaging findings between CT and MRCP appear inconsistent with 43.8% of patients having discordant findings between tests.

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