

# Anesthesia Patients with Concomitant Cardiac and Hepatic Dysfunction



Julianne Ahdout, MD<sup>a,\*</sup>, Michael Nurok, MBChB, PhD<sup>b</sup>

## KEYWORDS

• Anesthesia • Liver dysfunction • Cardiac dysfunction • Perioperative management

## KEY POINTS

- Patients with concomitant cardiac and hepatic dysfunction pose additional challenges and carry increased perioperative risk.
- Cirrhosis is associated with a wide range of cardiovascular abnormalities, including hyperdynamic circulation, cirrhotic cardiomyopathy, and pulmonary vascular abnormalities.
- Cirrhotic cardiomyopathy is characterized by increased cardiac output and compromised ventricular response to stress.
- Coronary artery disease has a significant unfavorable impact on mortality and morbidity in cirrhotic patients, especially following major surgery such as liver transplant.
- Cardiac studies done preoperatively should include electrocardiography and also echocardiography if risk factors for left ventricular dysfunction, cardiomyopathy, valvular lesions, or pulmonary vascular disorder are present.

## INTRODUCTION

Hepatocardiac diseases can be categorized into heart diseases affecting the liver, liver diseases affecting the heart, and conditions affecting the heart and the liver at the same time. An estimated 1 in 700 patients scheduled to undergo elective surgery has abnormal liver enzyme levels. In addition, some investigators have estimated that as many as 10% of patients with advanced liver disease undergo surgery in the last 2 years of their lives.<sup>1</sup> Patients with hepatic dysfunction carry a particularly high risk for morbidity and mortality in the perioperative period caused by both the stress of surgery and the effects of general anesthesia.<sup>2</sup> Cardiac dysfunction increases the risks of

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<sup>a</sup> Department of Anesthesiology, Cedars-Sinai Medical Center, 8700 Beverly Boulevard, North Tower, Room 4209, Los Angeles, CA 90048, USA; <sup>b</sup> Cardiac Surgery Intensive Care Unit, Cedars-Sinai Medical Center, 127 South San Vicente Boulevard, Suite A3106, Los Angeles, CA 90048, USA

\* Corresponding author.

E-mail address: [Julianne.ahdout@cshs.org](mailto:Julianne.ahdout@cshs.org)

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anesthesia and surgery for patients who experience it. Namely, patients with coronary artery disease are at higher than average risk of perioperative cardiac complications.<sup>3</sup> Thus, patients with concomitant cardiac and hepatic dysfunction pose additional challenges and carry more risks perioperatively. Identifying and assessing surgical risk in any patient is a crucial task for anesthesiologists, but especially for patients with a growing list of chronic comorbidities. It is important for anesthesiologists to understand not only hepatic dysfunction and cardiac dysfunction independently but also the complex interaction between coexisting cardiac and hepatic dysfunction and the unique challenges that entails.

## **PATHOGENESIS AND PHYSIOLOGY**

Clinically, anesthesiologists divide patients with liver disease into 2 major groups:

1. Patients with parenchymal liver disease (eg, acute and chronic viral hepatitis, liver cirrhosis)
2. Patients with cholestasis

### ***Liver Cirrhosis and the Cardiovascular System***

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Cirrhosis is associated with a wide range of cardiovascular abnormalities, including hyperdynamic circulation, cirrhotic cardiomyopathy, and pulmonary vascular abnormalities. The pathogenic mechanisms of these cardiovascular changes are multifactorial and include neurohumoral and vascular dysregulations. Accumulating evidence suggests that cirrhosis-related cardiovascular abnormalities play a major role in the pathogenesis of multiple life-threatening complications, including hepatorenal syndrome, ascites, spontaneous bacterial peritonitis, gastroesophageal varices, and hepatopulmonary syndrome.<sup>4</sup>

Patients with cirrhosis from any cause have an enhanced activity of the sympathetic nervous system and hyperdynamic circulation showing increased cardiac output and reduced systemic vascular resistance (**Fig. 1**). These changes may induce myocardial remodeling and left ventricular hypertrophy, resulting in systolic and diastolic functional abnormalities and cardiomyopathy.<sup>5</sup>

### ***Hyperdynamic State***

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Parenchymal liver disease is associated with a hyperdynamic circulatory state manifested by:

1. Increased heart rate
2. Increased cardiac output and circulatory blood volume
3. Reduction in systemic vascular resistance and arterial blood pressure
4. Peripheral vasodilatation
5. Increased arteriovenous shunting<sup>6</sup>

The hyperdynamic circulation is a result of decreased systemic vascular resistance (SVR) and a compensatory increased cardiac output to maintain tissue perfusion. The clinical manifestations of hyperdynamic circulation include warm skin, spider angiomas, palmar erythema, and a bounding pulse.

The hyperdynamic circulation is thought to be caused by peripheral and splanchnic vasodilatation, which is secondary to increased production and activity of vasodilatory factors as well as decreased vascular reactivity to vasoconstrictors. This condition leads to reduction in the effective arterial blood volume,<sup>5</sup> which leads to a diminished renal blood flow in cirrhotic patients. This diminished flow in turn stimulates the

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