

Monitoring and managing hepatic disease in anaesthesia

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Editor's key points

- Hepatic disease can lead to multisystem organ dysfunction with multiple significant anaesthetic implications.
- Pathophysiological alterations can occur in pharmacological responses, the systemic and pulmonary circulations, coagulation, and neurological function.
- Perioperative risk is determined by both patient-specific and procedural factors.

The liver metabolizes drugs, food, and toxins; synthesizes pro-coagulants and anticoagulants; and regulates temperature, glucose, and metabolism. When patients with liver disease need surgery, anaesthesiologists face several perioperative challenges. Patients with liver disease have physiological perturbations that range from mild hyperbilirubinemia of no clinical consequence to severe coagulopathy and metabolic disarray (Fig. 1). This article reviews the current body of knowledge of perioperative assessment, monitoring, and management of hepatic disease in patients who will undergo surgery.

Perioperative risk assessment

Patients with liver disease who undergo non-hepatic surgery have greater transfusion requirements, high infection risk, cardiac compromise, longer hospital stays, and increased operative mortality.^{1–6} Patient-specific risk factors, various scoring systems, and surgical procedures stratify risk for these patients.^{6–9} Independent risk factors for complications and mortality are outlined in Table 1.

The Child–Turcotte–Pugh (CTP) classification system, originally devised in 1964 to predict outcomes in cirrhotic patients undergoing portosystemic surgery, assesses perioperative risk for patients with liver disease who undergo hepatic or non-hepatic surgery.^{8–10} Scores are calculated from five variables: serum albumin, serum bilirubin, ascites, prothrombin time (PT), or INR (modified CTP score), and grade of encephalopathy to stratify patients into three groups (Class A=score 5–6; Class B=score 7–9; Class C=score 10–15).¹¹ This scoring system relies on a subjective assessment of ascites and encephalopathy and does not consider preoperative infection, aetiology of cirrhosis, or surgery type.⁶ Original studies suggested high mortality rates in Class A patients (10%), Class B patients

Summary. Patients with liver disease have multisystem organ dysfunction that leads to physiological perturbations ranging from hyperbilirubinaemia of no clinical consequence to severe coagulopathy and metabolic disarray. Patient-specific risk factors, clinical scoring systems, and surgical procedures stratify perioperative risk for these patients. The anaesthetic management of patients with hepatic dysfunction involves consideration of impaired drug metabolism, hyperdynamic circulation, perioperative hypoxaemia, bleeding, thrombosis, and hepatic encephalopathy.

Keywords: liver; liver, cirrhosis; liver, disease; liver, function; liver, metabolism

(82%), and Class C patients (82%) who undergo abdominal surgeries.^{12–13} A newer study reports lower mortality rates after abdominal operations: Class A=2%; Class B=12%; Class C=12%.¹⁴ Improvements in surgical technique, anaesthetic management, and perioperative care might explain the difference in these findings.

The model for end-stage liver disease (MELD) score is a validated and prognostic tool that estimates disease severity and survival in patients with liver disease. The MELD score is objective, ranges from 6 to 40 points, and is calculated from the serum bilirubin, serum creatinine, INR, and aetiology of liver disease.¹⁵ The MELD score has been validated across a number of liver diseases (alcoholic hepatitis and variceal bleeding)¹⁶ and surgeries (abdominal, orthopaedic, and cardiovascular).^{5, 8, 17–19} In patients who have undergone abdominal surgery, an elevated MELD score was a better predictor of poor perioperative outcome than CTP classification.¹⁷ Patients with MELD scores >15 should avoid elective surgery.²⁰ In 2002, the United Network for Organ Sharing adopted the MELD score as a method of allocation of organs to estimate survival. The incorporation of hyponatraemia, an important prognostic factor in patients with cirrhosis, into the MELD score might improve risk stratification among patients awaiting liver transplantation.²¹

The type of surgical procedure influences perioperative outcomes in patients with hepatic disease. During abdominal surgery, reflexive systemic hypotension from visceral traction and blood loss can reduce hepatic arterial blood flow.^{22–23} Patients with extensive liver disease who undergo abdominal surgery have a mortality rate of 30%.^{12–24} Mortality rates in cirrhotic patients who undergo open cholecystectomy are 23–50%; cardiac surgery, 16–31%; laparotomy for trauma, 45%; and oesophageal surgery, 17–26%.^{25–33} Patients with

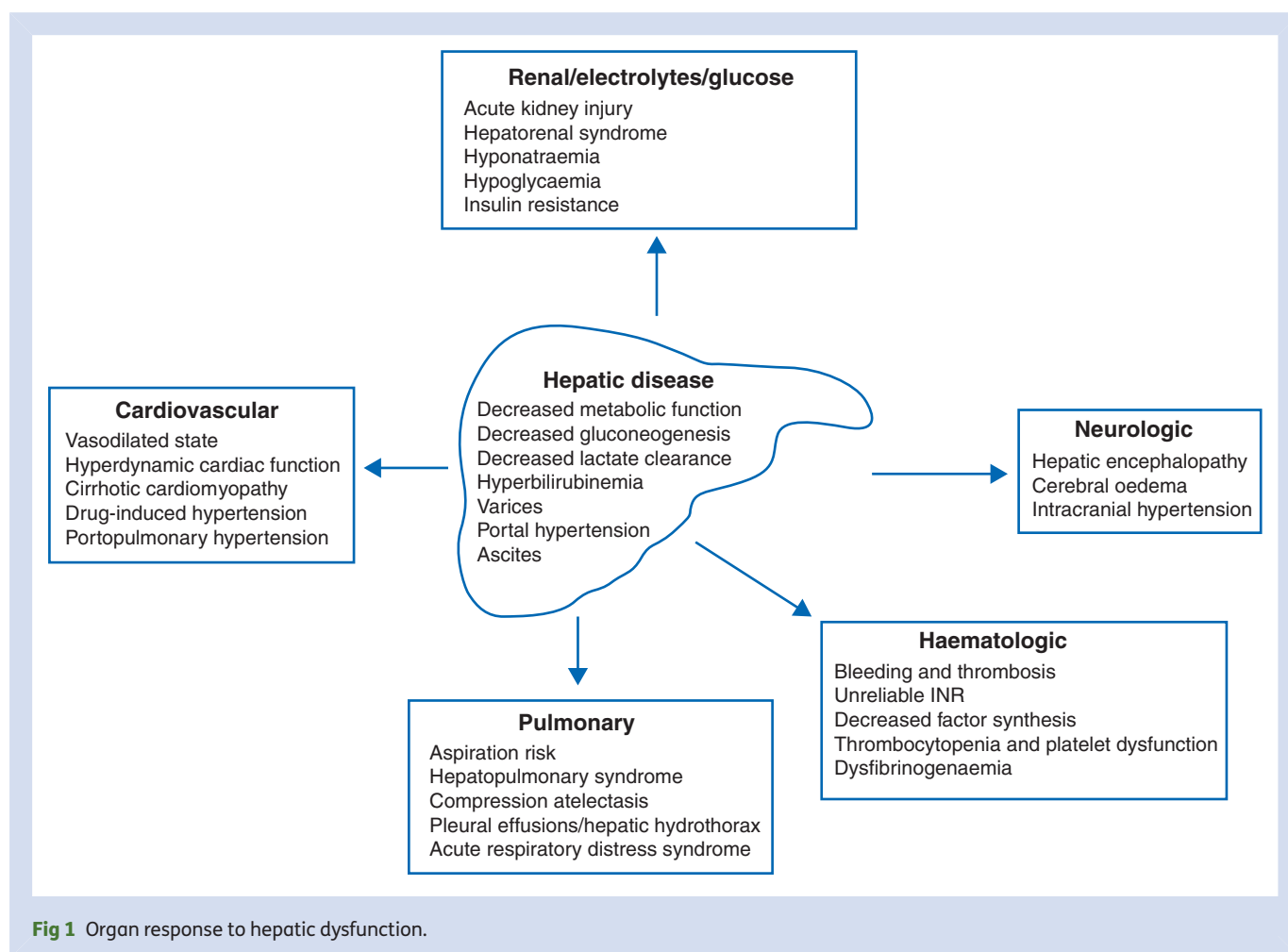


Table 1 Perioperative risk factors associated with complications and mortality^{1–33}

Scoring system

- Modified Child–Turcotte–Pugh (CTP)
- Model for end-stage liver disease (MELD)
- ASA-PS IV or V

Patient-specific risk factors

- Male gender
- Age >70 yr
- Preoperative infection
- Cirrhosis other than primary biliary cirrhosis
- Elevated creatinine
- Chronic obstructive pulmonary disease
- Intraoperative hypotension
- Upper gastrointestinal bleeding
- Ascites

High-risk surgeries

- Abdominal surgery
- Open cholecystectomy
- Cardiothoracic surgery
- Trauma laparotomy
- Oesophageal surgery
- Emergency surgery

coagulopathy or CTP Class C cirrhosis are at even higher risk during open cholecystectomies, abdominal surgeries, and cardiovascular procedures.^{25 27 29 30 32} Contraindications to elective surgery include fulminant hepatic failure, acute viral or alcoholic hepatitis, chronic active symptomatic hepatitis, CTP Class C cirrhosis, severe coagulopathy (platelet count <50 000 μl^{-1} , uncorrectable PT >3 s above control), hypoxaemia, heart failure, and acute kidney injury.^{3 34}

Management of anaesthetic medications and metabolism

The metabolic activity and clearance of anaesthetic medications is impaired in patients with liver disease. Without adjusted doses of medications, duration of drug action is extended and toxic levels can result.^{35 36} Emergence from anaesthesia can be delayed.

Hepatic metabolism takes place via two pathways: phase 1, biotransformation via the cytochrome P450 system (which requires delivery of oxygen via hepatic perfusion); and phase 2, glucuronide conjugation. The first is decreased in liver disease; the second is relatively spared when dysfunction begins.³⁷

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