Scoring Systems and Surgery in Cirrhotic Patients
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It is well known that patients with cirrhosis have a reduced life expectancy. For instance Gines et al. (1) reported a median survival time of 8.9 years for patients with newly diagnosed cirrhosis. The median survival time decreased to 1.6 years in patients after the onset of the first major complication of cirrhosis (ascites, jaundice, encephalopathy, or gastrointestinal haemorrhage). Anaesthesia and surgery are known to have decompensatory effects on patients with cirrhosis with a consequent increase in morbidity and mortality rates. Patients with cirrhosis who have major morbidity or die following surgery (either hepatic or non-hepatic) experience significant post-operative bleeding, renal failure and sepsis. Aranha et al. (2) reported an overall 25% perioperative mortality rate in patients with cirrhosis who underwent open cholecystectomy. They compared the mortality rates of three groups of patients having open cholecystectomy: non-cirrhotic patients (1.1%), patients with cirrhosis with a prothrombin time less than 2.5s greater than the control value (9.3%), and patients with cirrhosis with a prothrombin time more than 2.5s greater than the control value (83%).

During anaesthesia and surgery, liver blood flow is altered. The liver anatomically and physiologically adapts to altered perfusion pressure and blood flow. The organ has a dual blood supply (hepatic artery and portal vein). Under normal conditions, each blood source provides the liver with approximately 50% of its oxygen supply. The hepatic artery can provide more than 50% of the oxygen supply by vasodilating during periods of reduced portal blood flow. Thus intraoperative decreases in blood pressure and cardiac output can result in a decrease in portal blood flow. Similarly, surgical manipulation in the splanchnic bed may also reduce portal blood flow. The ability of the hepatic artery to respond by vasodilatation to alterations in portal blood flow is blunted by anaesthesia (particularly agents such as halothane) and especially by high anaesthetic concentrations. Even patients with a healthy liver can experience alterations in hepatic blood flow and cellular ischaemia during anaesthesia and surgery, as evidenced by asymptomatic liver enzyme elevations. With cirrhosis the flow relationship between the hepatic artery and portal vein is not well maintained, and the liver architecture is disrupted by fibrosis and regenerative nodules. These pathologic alterations of the normal patterns of liver blood flow may make the cirrhotic liver more prone to ischaemia. Inflammatory mediators are known to be released as a result of hepatic ischaemia and this can result in the development of multiorgan system failure. A similar linkage of pathology between organs has been proposed to explain the occurrence of multiorgan failure in the presence of acute lung injury where inflammatory mediators released from the lung cause dysfunction of other organs such as the kidney and liver (3,4).

From an anatomic and physiologic perspective, the lungs are poised to affect distal organs. The pulmonary vasculature not only receives the entire cardiac output, but also harbours a large reservoir of margined neutrophils (up to a third of all neutrophils outside the bone marrow). Thus, significant potential exists for the lungs to interact with, and contribute to, the circulating pool of inflammatory cells. In addition to effects on circulating cells, injury to the alveolar-capillary interface may cause release, or allow efflux of inflammatory mediators from the alveolar space into the general circulation. Given the vast surface area of the lung in contact with the blood, a stimulus resulting in release of even small quantities of inflammatory mediators per cell, could result in a significant influx of these mediators into the vascular space. A similar proposal could be made for the liver since in each case the liver is as likely to be able to influence plasma inflammatory mediators.

Most studies have shown that emergency surgery, chronic lung disease and the need for blood transfusion as well as intraoperative hypotension are associated with a higher probability of mortality in patients with cirrhosis. All these factors are indicative of a compromise of oxygen delivery to the liver.

Most readers will be aware of the Child-Pugh score and will know that it is used to predict mortality in patients with liver failure undergoing hepatic or non-hepatic surgery. Essentially the
score grades the severity of the underlying status of the patient by plasma bilirubin and albumin concentrations, prothrombin time and the presence of ascites and encephalopathy. Patients are then classified into grades A, B and C with the latter having the worst underlying abnormality and risk. Perhaps it will not be so clear however, that the score was originally designed for patients undergoing portocaval shunts because of bleeding oesophageal varices. The original description of the Child-Pugh score (5) was in 38 patients with cirrhosis—one-third being due to alcoholic cirrhosis. The percentage of patients dying in each of the grades was 29%, 38%, and 78% in A, B and C, respectively. In another study using the same score Turcotte et al (6) looked at the records of 189 patients of whom 61% had alcoholic cirrhosis who were also undergoing portocaval shunt procedure for oesophageal varices. Mortality was 7.7% in A, 25.9% in B and 53.1% in C. It is apparent that although the mortality certainly increases through the grades the ability of the score to only predict those likely to die is not particularly satisfactory since many patients in both studies who died were in grades A and B. Patients with cirrhosis may not solely present to the anaesthetist for hepatic surgery and clearly most anaesthetists would be interested in a predictive scoring system which had been validated in a prospective study of patients undergoing all forms of surgery. In this way the patient could be reliably informed about the risks that are involved in anaesthesia and surgery in the presence of cirrhosis.

There have been studies, which have looked at the Child-Pugh score prospectively in patients undergoing non-hepatic surgery, and there have also been studies that have attempted to refine the Child-Pugh score. Most other studies have been either small or retrospective. In this issue of the journal Moemen et al (7) have prospectively examined a modified Child-Pugh score (the addition of serum sodium and creatinine, white cell count and PaO$_2$/PAO$_2$) versus the unmodified score in an attempt to refine the score for patients with cirrhosis caused by diseases other than alcohol and in those undergoing non-hepatic surgery.

Garrison et al. (8) reviewed retrospectively, 100 consecutive, cirrhotic patients who underwent non-shunt intra-abdominal surgical procedures. Thirty patients died and major complications occurred in another 30 patients. Fifty-two variables were compared between survivors without complication, survivors with complications, and non-survivors. A computer-generated, multivariate discriminant analysis yielded an equation predictive of survival. Utilizing coagulation parameters, presence of active infection, and serum albumin, the equation was able to predict survival with 89% accuracy. In a similar fashion, amount of operative transfusions, absence of postoperative ascites, pulmonary failure, gastrointestinal bleeding, and culture-positive urine predicted survival with 100% accuracy.

Mansour et al. (9) also examined retrospectively, fifty-five clinical, laboratory, and operative variables were analyzed to identify factors predictive of poor outcome in 100 patients. The mortality rate after emergency surgery was 50%, compared to 18% for elective cases ($p = 0.001$). Other factors that predicted mortality included the presence of ascites ($p = 0.006$), encephalopathy ($p = 0.002$), and elevated prothrombin time ($p = 0.021$) — a similar finding to the Child-Pugh score. The mortality in Child's class A patients was 10%, compared to 30% in class B and 82% in class C patients.

Ziser et al. (10) also retrospectively reviewed the records of patients with cirrhosis who underwent any surgical procedure under anaesthesia between 1980 and 1991 (n= 733). Univariate and multivariate analyses were used to identify the vari-ables associated with perioperative complications and short- and long-term survival. The perioperative mortality rate (within 30 days of surgery) was 11.6% and the perioperative complication rate was 30.1%. Multivariate factors that were associated with perioperative complications and mortality included male gender, a high Child-Pugh score, the presence of ascites, a diagnosis of cirrhosis other than primary biliary cirrhosis (especially cryptogenic cirrhosis), an elevated creatinine concentration, the diagnosis of chronic obstructive pulmonary disease, preoperative infection, preoperative upper gastrointestinal bleeding, a high American Society of Anaesthesiologists (ASA) physical status rating, a high surgical severity score, surgery on the respiratory system, and the presence of intra-operative hypotension.

The score as modified by Moemen et al. (7) proved to be a more accurate and specific predictor of mortality. The study was prospective and enrolled 210 patients. As can be seen from table 3 in the paper the Child-Pugh score had many patients who died or suffered postoperative morbidity in the A and B scores (particularly the B class) whilst the modified score had no patients in class A with either mortality or morbidity. In fact most patients who died or had significant morbidity were in class B of the original score 78% of patients with morbidity and 67% of those who died. In the modified score, of those with morbidity 57% were in class B and 43% in class C; whilst the percentages of those who died were 22% in class B and 78% in class C.

Of the 47 patients (22.4%) with complications, 14 (6.8%) suffered from sepsis as the most common postoperative complication. Multivariate analysis identified 4 risk factors with strong
association to postoperative complications in descending order of importance; high modified Child-Pugh score, elevated total bilirubin, leucocytosis and malnutrition. Forty-five patients (21.4%) died within 30 postoperative days and univariate analysis identified blood transfusion as the only intra-operative variable associated with an increased mortality risk, added to 11 preoperative variables associated with an increased mortality rate. Multivariate logistic regression analysis identified 5 risk factors independently associated with short-term postoperative mortality in descending order of importance; the presence of encephalopathy, high ASA physical status, the presence of ascites, the presence of malignancy and emergency surgery. Many of these factors have been identified in other published work but have not largely been verified in a large prospective study. Many of these factors relate to variables that may result in a compromised liver oxygen delivery – either oxygen carriage in the blood or reduced liver blood flow. Perhaps in a similar follow-on study it may be possible to link these findings with the hypothesis I mentioned earlier in the editorial where I suggested that the morbidity and mortality might be due to the release of inflammatory mediators from the ischaemic liver.

References