

The liver in surgery

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“Those who wish to succeed must ask the right preliminary questions”

ARISTOTLE, Metaphysics

The liver is undoubtedly the most complex physiological organ in the body. With rapid advances in the field of surgery, its role in healing and recovery is now well recognised. Any surgery planned on a patient with a compromised liver requires that the surgeon concerned have an understanding of the resulting altered physiology and how to “accommodate” it surgically. Two articles in this issue highlight the need for “special understanding”. Both are welcome insights into the growing need for interdisciplinary care in our patients. Especially so in our present era where new surgical techniques coupled with advancements in medicine and anaesthesia allow for more complex surgeries in patients who are more ill^(1,2).

Prior to the era of performing major liver resections, an asymptomatic patient with a normal electrocardiogram was passed as “fit” for surgery. However with the adoption of improved operative techniques of total hepatic vascular exclusion and portal exclusion alone in cirrhotic patients, which can reduce venous return to the heart by as much as 50%, the pre-operative norm is now a 2D-echocardiogram of the heart at least, and perhaps a MUGA or MIBI scintiscan. In my experience, the pick-up rate for underlying cardiac diseases that would not tolerate such procedures is approximately 3%. The liver, unlike the heart however, is subtle with its function; always there in the background but when absent, the effect is debilitating to the patient.

Two points of clarifications must be made. Firstly, hepatologists are of prime importance in the co-management of patients with liver compromise. Secondly, a surgical evaluation of a patient with a compromised liver is not performed by the hepatologist. To ascertain the feasibility of a particular operation in any surgical field, in a

patient with compromised liver function, requires an understanding of basic hepatology and an in-depth knowledge of the surgical procedure to be undertaken. Such a “chimeric” individual would need to be the surgeon about to perform the operation. His knowledge of hepatology would serve two purposes. Firstly, to recognise that an early referral to the hepatologist is necessary. Secondly, to modify his technique (whether it be an orthopaedic, otorhinolaryngologic or ophthalmologic) to accommodate the compromised liver.

This point carries with it an obvious imperative. Training of surgeons must be adequate to produce such “chimeric” individuals. The notion that a surgeon is a master technician and entirely dependant on a physician for help in medical matters pre- and postoperatively is outdated. Bad intraoperative decisions resulting from ignorance can never be reversed by a plethora of pre- and postoperative referrals to our physician colleagues.

Let me illustrate. A right-hemicolectomy in a patient with severe liver impairment and portal hypertension will not do well if his liver function was not stratified preoperatively, necessary intra-operative measures were not instituted to take into account the “third spacing” and tissue oedema and finally, postoperative liver support not initiated to protect the liver. The surgeon’s role technically would have been meticulous haemostasis in view of the portal hypertension. Secondly, maintaining the oncotic pressure by adequate albumin infusions so as to prevent tissue oedema and the sutures and staples from breaking down. Thirdly, reinforcing all anastomoses to prevent leaks. Fourthly, the use of fibrin glues as a support for a laboured haemostatic system. Finally, preventing drops in blood pressure with resultant changes in portal flow that would further compromise liver function. It must be appreciated that the act of anaesthesia at induction in itself reduces portal flow and can compromise liver function. Postoperative

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liver dialysis would also be a viable option if the situation arose as will be illustrated later.

If surgeons hold on to a philosophy that the compromised liver is best appreciated by our physician colleagues, then, if anything extraordinary happens, we will always say that a surgical procedure that turned out badly was a victim of the existing medical condition. The technique was perfect but the patient's liver was not. The philosophy we bring to the patient when we assess him is thus important. Do we know enough of his medical condition to modify our technique so that we can have the perfect result? A physician will never fully appreciate all the surgical steps involved. And it would be unfair to expect him to. The ability to modify a technique so as to accommodate whatever biochemical or physiological aberrations that may occur in these compromised patients, and institute the appropriate pre- and postoperative treatment, is what defines a surgeon, as opposed to a technician.

There are many aspects of liver function that could be addressed. However, there are four main functions that have a direct bearing on the outcome of surgery and require intraoperative decision-making.

Haemostatic mechanisms. We are all aware of factors II, V, VII, IX and X that need replacement in the form of fresh frozen plasma, but there exists as well a propensity to venous thromboembolism when there is a deficiency in protein C and S (which work to prevent clotting). This can occur in severe liver disease as well as those with advanced liver cancer and those who have been on anti-neoplastic therapy.

Albumin. The maintenance of the oncotic pressure serves not only to prevent ascites but tissue oedema and "third spacing" as well. This is critical when anastomoses are performed; be they arterial, venous or bowel. Tissue oedema, which occurs intraoperatively, leads to sutures becoming loose when the oedema subsides postoperatively and hence leaks occur later. Tissue oedema which occurs later after the operative period places stress on the anastomoses and "tearing" may occur, leading in turn to leaks. It is important therefore to always ensure an optimum level of serum albumin. To achieve this sometimes requires about three days prior admission with intravenous albumin administration followed by five days of albumin support postoperatively.

Hepatorenal syndrome. A functional renal failure due to circulating cytokines which shunt blood from the renal cortex to the renal medulla

must be addressed early with dialysis^(3,4). Currently, liver dialysis using the molecular adsorbent recycling system (MARS)^(5,6) is an attractive alternative because not only is fluid balance corrected, but circulating toxins are cleared, helping to reverse this syndrome.

Hepatopulmonary syndrome. This is similar to the hepatorenal syndrome caused by pulmonary vascular dilatation resulting in right-to-left shunting and hypoxaemia. This requires prolonged ventilatory support and carries a grave prognosis. Inhaled nitric oxide⁽⁷⁾ has been used in post-transplant patients with success.

There are many other common aspects of liver optimisation, which are readily found in major textbooks of medicine, hepatology and surgery. The newest and most promising is that of liver dialysis. The MARS system is but one of many bioartificial liver systems. In the late 1990s, I worked with a previous model called the Hemocleanse system. These earlier systems were beset with problems of bleeding as a result of the long extracorporeal circuit needed to wash the blood. Today, these problems have been overcome, and the consensus is for early dialysis before severe liver decompensation occurs.


Many good systems exist to stratify liver function. The most common is the Child-Pugh's system, which looks at two clinical (encephalopathy and ascites) and three biochemical (serum albumin, prothrombin and bilirubin levels) parameters. Thus, it indicates whether the cirrhotic liver is compensated (Grade A), decompensating (Grade B), or decompensated (Grade C). Certain liver diseases, like primary biliary cirrhosis, autoimmune hepatitis, and hepatitis B or C cirrhosis, can be gauged by the model for end-stage liver disease (MELD)⁽⁸⁾ score. Very simply, this takes the bilirubin, serum creatinine and the international normalisation ratio (INR), and uses a formula to come out with a figure to denote the severity of the liver disease. The higher the score, the worse the prognosis. This formula is essentially used in transplant circles to reduce waiting time mortality on the transplant list. However, observing the trend in the score in patients with liver diseases, gives one a good idea as to whether the liver disease is stable or deteriorating.

Understanding hepatitis B and C is the next big thing in liver patients going for surgery. In hepatitis B, an important question to ask is the following: Is there active viral replication or not? Raised liver enzymes in a patient with a high hepatitis B viral DNA count must be treated first, prior to surgery. Such patients run the risk of a flare and liver

failure postoperatively. Luckily, surgeons live in the era of antivirals. Two weeks of antivirals by a hepatologist in such patients can reduce the portal hypertension and stabilise the liver for surgery. Patients on chemotherapy pose a formidable challenge as well. Very often unless the situation mandates, waiting at least three weeks after cessation of chemotherapy prior to surgery, helps stabilise the bone marrow and allows for any drug-induced hepatitis to settle down.

Where do we surgeons stand? As technicians, we are heavily reliant on our physician colleagues to manage medical conditions. However, as operating physicians, it is incumbent on us to ask the right questions so as to work with our medical colleagues. We have to modify our operations, embrace new techniques and keep abreast of new drugs and therapies, so we can better stratify the risk to our patients and advise them accordingly. Under these circumstances, the survival benefit to our patients will be unquestionable.

It has always intrigued me to hear a surgeon described as having “good hands”. Let me just say this: the hands are the “slaves” of the brain. In the final analysis, when the stitch is placed, it would not be important how fast it was put in but

whether it was put in the right place with the right amount of tension and whether the right type of suture was used. And, leading up to the stitch, whether the tissues were treated with respect and there was minimal bleeding..... and whether the appropriate operation was performed in the first place. 

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