Anaesthesia for Elective Hepatic Resection

An essay
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Anesthesiology

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Sherif Soliman

List Of Abbreviations

Abbreviation	Meaning
A1AT	Alpha one antitrypsin.
APTT	Activated partial thromboplastin time.
ABZ	Albendazole.
ACT	Activated clotting time.
ARDS	Adult respiratory distress syndrome.
ARF	Acute renal failure.
ASA	American society of anaesthesia.
ATP	Adenosine triphosphate
ALT	Alanin aminotransferase
AST	Aspartate aminotransferase
BUN	Blood urea nitrogen
CAD	Coronary artery disease.
c AMP	Cyclic adenosine monophosphate
COPD	Chronic obstructive pulmonary diease.
COP	Cardiac output
CPT	Chest physiotherapy
CT	Computed tomography.
CTP score	Child-Turcott- Pugh score.
CVP	Central venous pressure
CVD	Cardiovascular disease.
ECG	Echocardiography
ESLD	End stage liver disease.
ERP	Enhanced recovery program.
ERCP	Endoscopic retrograde cholangiopancreatography.
FDP	Fibrin degradation product
FFP	Fresh-frozen plasma
FHF	Fulminant hepatic failure.
FNH	Follicular nodular hyperplasia
FTc	Corrected flow time.
GABA	G- amino butyric acid.
GDFT	Goal directed fluid therapy

List Of Abbreviations

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Abbreviation	Meaning
GFR	Glomerular filteration rate.
GGT	Gamma glutamyle transpeptidase
HCC	Hepatocellular carcinoma.
HPS	Hepatopulmonary syndrome.
HO-1	haemoxygenase-1
ICU	Intensive care unit
ICP	Intracranial pressure
IHPBA	International hepato-pancreato-biliary Association.
INR	Interational normalized ratio.
IVC	Inferior vena cava
LDLT	Living donor liver transplantation.
LDH	Lactate dehydrogenase.
MELD	Model for end stage liver disease.
MPAP	Mean pulmonary artery pressure.
MAC	Minimum alveolar concentration
NO	Nitric oxide.
NCRNNE	Noncolorectal nonneuro-endocrine.
NSAIDs	Non steroidal anti-inflammatory drugs.
OLT	Orthotopic liver transplantation.
P_AO_2	Alveolar O_2 tension
PaO_2	Arterial O_2 tension
PAC	Pulmonary artery catheters.
PCWP	Pulmonary capillary wedge pressure.
PCA	Patient controlled analgesia.
PEEP	Positive end expiratory pressure
PKC	Protein kinase C.
PPH	Portopulmonary hypertension.
PT	Prothrombin time.
PVR	Pulmonary vascular resistance.
rFVIIa	Activated Recombinant Factor VII
ROTEM	Rotational Thromboelastometry

List Of Abbreviations

(Cont...)

Abbreviation	Meaning
SBP	Spontaneous bacterial peritonitis.
TA	Tranexamic acid
TED	Trans-esophageal Doppler.
TEG	Thromboelastograph
TIPS	Transjugular intrahepatic portosystemic.
TNF	Tumour necrosis factor.
TRALI	Transfusion – related acute lung injury.
UDP	Uridine diphosphate.
VLDL	Very low density lipoprotein.
VTE	Venous thromboembolism

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Introduction

The liver is the only mammalian organ that can regenerate functionally into active parenchyma after tissue loss. Exploitation of this physiological property has allowed for the liver resection surgery to develop, and it is now a commonly performed procedure ***(Simmonds et al., 2006).***

The emergence of liver resection as a safe and effective treatment for both benign and malignant liver disease is relatively recent due to the high mortality rate traditionally associated with the surgery. Currently, the surgical literature still questions the mortality and morbidity incidence and prevention techniques associated with hepatectomy. Improved knowledge of hepatic anatomy makes it possible to limit the extent of the resection and reduce blood loss. From an anesthetic standpoint, a number of questions are relevant. How can blood loss during the operation be reduced? Since hepatic resection temporarily disrupts hemostasis. How can safe postoperative analgesia be assured? Is an epidural safe in these circumstances? ***(Redai et al., 2004).***

These recent advances in surgical and anesthetic management have reduced the operative risk of hepatic resection significantly. Although these advances have been multifactorial, anesthetic approaches derived from simple partial hepatectomies, as a safe and effective treatment for both benign and malignant, and from liver transplantations have had a major impact on the practice and gave greater capacity to perform complex resections safely ***(Emond et al., 1996).***

The main indications for hepatic resection are malignant lesions (90%) and benign lesions (10%) ***(Lentschener and Ozier , 2002).*** But with

the introduction of the new era of living donor liver transplantation (LDLT), elective hepatic resection (right or left hepatectomy) attracts our attention to the safety of the donor and becomes the most important and the most common indication for elective liver resection ***(Raia et al., 1989).***

Anesthesia and surgery are known to have decompensatory effects on patients with compromised liver function, to the extent that previous publications have reported greater morbidity and mortality in patients with cirrhosis undergoing nonhepatic procedures. Retrospective investigations have identified multiple clinical and laboratory variables that contributed to increased peri-operative morbidity and mortality rates in cirrhotic patients who underwent hepatic surgery. Moreover, it has been shown that there is a correlation between the number of risk factors identified by multivariate analyses and the rate of peri-operative complications. Hepatic ischemia and subsequent liver dysfunction also is associated with a profound deterioration in prognosis ***(Picker et al., 2008).***

Because of the central role of the liver in the metabolic and immunological response to stress as the liver is vital for protein synthesis, glucose homeostasis, bilirubin excretion, and toxin removal, And the major role in metabolism of many drugs and anesthetics, its function is often compromised during liver surgery. Anesthesiologists have always sought an anesthetic technique that would provide anesthesia without accumulation of drugs or their potentially toxic or pharmacologically active metabolites due to reduced liver metabolism, thus seeking to protect endangered organs from further damage. Recently, a number of perioperative regimes have been described to prevent complications using anesthetic techniques to provide optimal care for patients exposed to liver surgery ***(Chibber et al., 2007) (Jarrar et al., 1999).***

During the 1970s, peri-operative mortality for hepatic resection was quoted around 20%, commonly because of uncontrollable bleeding and postoperative liver failure. Extended knowledge of liver anatomy, physiology, underlying patho-physiology, preoperative evaluation ,assessment, preparation, smarter anesthetic management and refinement of surgical technique have contributed to a reduction in quoted peri-operative mortality to around 3%, tending towards zero in experienced centers. Yet patients with parenchymal liver disease (e.g. Cirrhosis) have significantly higher rates of complications and mortality ***(Simmonds et al., 2006).***

Postoperative hepatic failure is a significant challenge as a postoperative complication . Although low residual liver volume was found to be associated with postoperative liver failure, the regenerative ability of the liver is remarkable, and the residual, otherwise healthy liver is expected to double in size within the first week following the resection ***(Thasler et al., 2002).***

There is a broad scope of issues that anesthesiologists are responsible for and these largely depend on the department and hospital requirements. These issues may range from peri-operative anesthetic management and pain relief to the postoperative complications and the intensive care management ***(Krenn et al., 2004).***

In this essay, important points in liver anatomy and physiology ,the patho-physiology and the indications for elective resection of the liver will be reviewed , the preoperative evaluation, assessment and preparation will be discussed. the intra-operative anesthetic approach as well as the management of certain intra-operative problems e.g. correction of coagulation abnormalities, inadvertent hypothermia during the prolonged

surgical procedure as well as electrolyte disturbance will be thoroughly illustrated. The early postoperative care will also be discussed.

AIM OF WORK

The aim of the present work is to review the current medical literature addressing the subject of anesthesia for elective hepatic resection to help in a detailed understanding of the pathophysiology the pre-operative evaluation , assessment and optimization of the anesthetic approach and to take measures that minimize and deal with the intra-operative and the post-operative complications.

Anatomical and Physiological Review

A very good understanding of the anatomy and physiology of the liver will enable optimal perioperative management. Familiarity with the surgical anatomy and physiology of the liver is essential for safe performance of hepatic surgery ***(D'Angelica et al., 2006) .***

ANATOMICAL CONSIDERATION

The liver is a large organ that occupies the right upper quadrant of the abdominal cavity. It lies almost entirely under cover of the ribs and costal cartilages and extends across the epigastric region**.** Weighing approximately 1500gm in the adult. It accounts for about 1/50 of the adult body weight and 1/20 of the newborn body weight ***(Blumgart and Hann, 2000)***

The greater part of the liver is situated under cover of the right costal margin, and the right hemi-diaphragm separates it from the pleura, lungs, pericardium, and heart. The liver extends to the left to reach the left hemi-diaphragm. The convex upper surface of the liver is molded to the under surface of the domes of the diaphragm. The posteroinferior or visceral surface, is molded to adjacent viscera and is therefore irregular in shape, it lies in contact with the abdominal part of the esophagus, the stomach, the duodenum, the right colic flexure, the right kidney and suprarenal gland, and the gallbladder ***(Blumgart and Hann, 2000).***

In 1998, as a response to the confusion created by the various anatomic nomenclatures applied to the liver, the International Hepato-Pancreato-Biliary Association (IHPBA) appointed a committee that was