



ICU Care of Acute Post-Operative Complications of Liver Transplantation

**Essay for Partial Fulfillment of
'Master Degree Essay' in Intensive Care**

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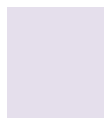
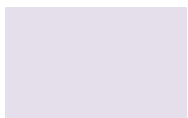


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List of Abbreviations

ADH	Alcohol Dehydrogenase.
AHT	Arterial Hypertension.
AIDS	Acquired Immunodeficiency Syndrome.
AKI	Acute Kidney Injury.
AKIN	Acute Kidney Injury Network.
APCs	Antigen Presenting Cells.
ARDS	Adult Respiratory Distress Syndrome.
AST	Aspartate Transaminase.
ATP	Adenosine Triphosphate
BBB	Blood Brain Barrier.
BMI	Body Mass Index.
CBD	Common Bile Duct.
CCP	Cerebral Perfusion Pressure.
CMV	Cytomegalo-virus.
CNIs	Calcineurin Inhibitors.
CNS	Central Nervous System.
CPAP	Continuous Positive Airway Pressure.
CRRT	Continuous Renal Replacement Therapy.
CT	Computed Tomography.
CTP	Cild-Turcotte-Pugh.
DDLT	Deceased Donor Liver Transplantation.
DKA	Diabetic Keto-Acidosis.
DM	Diabetes Mellitus.
ECM	Extra-Cellular Matrix.
ERCP	Endoscopic Retrograde Cholangiopancreatography.
ET-1	Endothelin-1.
FCH	Fibrosing CholestaticHepatitis.
FHF	Fulminant Hepatic Failure.
GFR	Glomerular filtration rate.
GM-CSF	Granulocyte-macrophage colony-stimulating factor
GW/RW	Graft Weight to the Recipient's Weight ratio
HAT	Hepatic Artery Thrombosis.
HBe Ag	Hepatitis B Envelope Antigen.
HBIG	Hepatitis B Immuno-globulin.

HBV	Hepatitis B Virus.
HCC	Hepato-Cellular Carcinoma.
HCV	Hepatitis C Virus.
HE	Hepatic Encephalopathy.
HIV	Human Immunodeficiency Virus.
HMG-CoA	Hydroxymethylglutaryl-CoA
HRS	Hepato-renal Syndrome.
HSV	Herpes Simplex Virus.
HSCs	Hepatic Stellate Cells.
ICP	Intra-cranial Pressure.
ICU	Intensive Care Unit.
IGF-1	Insulin like Growth Factor.
IL	Interleukin-1.
INR	International Normalized Ratio.
IVC	Inferior Vena Cava.
IV	Intra-venously.
KGL	Potassium Gluconate.
LDL	Low-density Lipoprotein.
LDLT	Living Donor Liver Transplantation.
Log	Logarithm.
LSECs	Liver Sinusoidal Endothelial Cells.
LT	Liver Transplantation.
MA	Metabolic alkalosis.
MELD	Model for End Stage Liver Disease.
MEOS	Microsomal Ethanol-Oxidizing System.
MHCI	Major Histo-comptibility Complex I.
MMF	Mycophenolate Mofetil
MRI	Magnetic Resonance Imaging.
MRSA	Methicillin-resistant Staphylococcus Aureus.
NAS	Non-Anastomotic Stricture.
NIPPV	Non-invasive positive pressure Ventilation.
NK	Natural Killer cells.
NKT	Natural Killer T cells.
NO	Nitric Oxide.
NPC	Non-Parenchymal Cells.
OLT	Orthotopic Liver Transplantation.

PAI-1	Plasminogen Activator Inhibitor.
PBC	Primary biliary Cirrhosis.
PCR	Polymerase Chain Reaction.
Peg-INF	Pegylated Interferone.
PELD	Pediatric End-Stage Liver Disease.
PPC	Post-operative Pulmonary Complications.
PSC	Primary Sclerosing Cholangitis.
PVT	Portal Vein Thrombosis.
RBCs	Red Blood Cells.
RIFLE	Risk, Injury, Failure, Loss, End-stage kidney disease.
SBp	Spontaneous Bacterial Peritonitis.
SBT	Spontaneous Breathing Trials.
SFSS	Small For Size Syndrome.
SIRS	Systemic Inflammatory Response Syndrome.
SVR	Sustained Virologic Response.
TAFI	Thrombin Activatable Fibrinolysis Inhibitor.
TPA	Tissue Plasminogen Activator.
TNF-alpha	Tumor Necrosis Factor Alpha.
UCSF	University of California, San Francisco.
UKELD	United Kingdom model for End-Stage Liver Disease.
UNOS	United Network for Organ Sharing.
VLDL	Very Low Density Lipoprotein

Introduction



Introduction

Liver transplantation is the treatment of choice for patients with decompensated cirrhosis, acute liver failure, small hepatocellular carcinomas (HCCs), and chronic end-stage liver disease of different causes (*Lucey et al., 2013*).

The improvement in anesthesia and surgical skills, organ support device adoption, understanding of transplant immunology, and better intensive care management of complications resulted in increased survival rate of liver transplanted patients (*Feltraco, et al., 2011*). However, liver transplantation remains a complex operation which is associated with significant morbidity and mortality (*Moreno and Berenguer, 2006*).

During and in the immediate postoperative period, the liver is subjected to multiple potentially damaging factors which affect the operative outcome. These factors include hypotension, hypoxia, ischemia and hepato-toxic drugs as well as donor-related factors (steatosis of the liver, the use of vasoactive drugs, hemodynamic changes), surgical-related aspects (intra-operative or post-operative hemorrhage, vascular or biliary complications). Therefore, the postoperative outcome of each patient depends mainly on patient's preoperative state, the quality of the donated organ, and the complexity of the surgery (*Murray and Carithers, 2006*).

Improvements in pre-transplant treatment of cirrhosis-related organ dysfunction, intraoperative patient management, and improvements in the treatment of rejection and infections helped for better outcome of the patients. However, many important factors including unexpected peri-operative complications still make immediate post-operative care challenging and the early outcome unpredictable (*Feltraco, et al., 2011*).

Early post-operative management is crucial as significant changes may occur in both the graft and distant organs so, immediately after the operation, patients are transferred to the surgical intensive care unit (ICU) where they are maintained on mechanical ventilation till becoming fully conscious and able to breathe on their own and able to protect their airway. During the ICU stay, there is a need for close attention to management of fluid and electrolytes, which may be significantly altered as a result of prolonged operation and massive fluid shifts. Also, immunosuppressive agents are started early post-operative based on specific protocols and on the patient's renal function with their doses adjusted according to blood levels and functional status of the transplanted liver and renal function (*Eghtesad et al., 2005*).

Immediate achievement of physiological status including omission of mechanical ventilation, omission of invasive monitoring, and prevention of any type of complication is the major goal. Immediate enteral nutrition with immunonutrition and probiotics restores mucosal barrier function and decreases infections and other complications after liver transplantation in a natural manner (*Mueller et al., 2004*).

If the graft function proves satisfactory and there are no early surgical complications, such patients can be rapidly weaned from sedation and ventilation, extubated, and discharged to the general ward within 48 hours (*Vukcevic and Marik, 2007*).

Also in the early post-operative period, the pattern of liver function test results are monitored and any major alteration in liver function should initiate a series of studies for early detection of signs of dysfunction and according to the results, the adequate treatment is initiated as early as possible (*Eghtesad et al., 2005*).

The main complications in the immediate postoperative period are related to the graft function (graft dysfunction and rejection), the surgical technique, systemic problems (pulmonary, renal, or neurological complications) as well as infections (bacterial, fungal, and viral).

In the long term, the complications typically result from prolonged immunosuppressive therapy, and include diabetes mellitus, systemic arterial hypertension, de novo neoplasia, and organ toxicities, particularly nephrotoxicity (*Moreno and Berenguer, 2006*).

Reaching the correct diagnosis is essential for all complications as different therapies often have implications on the graft function and patient outcome. However, the differential diagnosis is difficult due to the similarities of clinical manifestations and laboratory abnormalities of most liver transplant complications. Therefore, the role of post-liver transplantation critical care management is to prevent serious complications, reverse life-threatening complications and offers longer survival (*Vukcevic and Marik, 2007*).