Acute Renal Failure after Orthotopic Liver Transplantation

Essay

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in Intensive Care

By

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بِسْمِ اللّهِ الرّحمَنِ الرّحيمِ

[...رَبِّ أَوزِعنِي أَن أَشكُرَ نِعمَتَكَ
الَّتِي أَنْعَمْتَ عَلَيَّ و عَلى والِدَيَّ
و أَنْ أَعْمَلَ صَالِحاً تَرْضَاهُ و أَدْخِلْنِي
بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ]

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List of Abbreviations

ARF	Acute renal failure
AKI	Acute kidney injury
AKIN	Acute kidney injury network
ADQI group	Acute dialysis quality initiative group
ATN	Acute tubular necrosis
APACHE	Acute physiology and chronic health evaluation
ARDS	Acute respiratory distress syndrome
ANP	Atrial natriupetic peptide
AVP	Arginine vasopressin
BMI	Body Mass Index
CIN	Contrast induced nephropathy
CTP	Child-turcotte Pugh
CGRP	Calcitonin gene related peptide
CVP	Central venous pressure
CNI	Calcineurin inhibitors
CAD	Coronary artery disease
CVVHD	Continous veno venous hameo (dia) filtration
DCT	Distal convulted tubule
ESLD	End stage liver disease
DM	Diabetes mellitus
EVR	Everolimus
HRS	Hepatorenal syndrome
HTN	Hypertension
HCV	Hepatitis C virus
HBV	Hepatitis B virus
HBVmn	Hepatitis B associated membranous nephopathy
HD	Hemodialysis
HCC	Hepatocellular carcinoma
GFR	Glomelular filtration rate
LT	Liver transplantation

List of Abbreviations *(Cont...)*

MELD	Model of end stage liver diseases
MPCN	Membranoproliferative glomelurorephitis
MAP	Mean arterial blood pressure
MMF	Mycophenolate mofetil
MTOR	Mammalian target rapamycin
MPB	Modified piggy tecquine
MDRD	Modification of diet in renal disease formula
NSIADS	Non steroidal anti-inflammatory drugs
No	Nitric oxide
NGAL	Neutrophil gelatinase associate lipocalin
SCR	Serum creatinine
SNS	Systemic nervous system
SBP	Spontonous bacterial peritonitis
SFS	Small for size
SRL	Sirolimus
SVRI	Systemic Vascular Resistance Index
OLT	Orthotopic liver transplantation
PVT	Portal vein thrombosis
PCT	Proximal convulted tubule
RRT	Renal replacement therapy
ROTSM	Rotational thromboelastomethy
RAAS	Renin angiotensin aldestone system
TXA	Thromboxane A2
TEG	Thromboelastogran
TIPS	Transjugular intrahepatic portosystemic stent shunt
TMA	Thrombotic microangiopathy
UCSF	University of California San Francisco

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Introduction

Access to orthotopic liver transplantation (OLT) has dramatically altered the management of advanced liver disease, changing the role of the physician from merely managing its complications to proactively assessing potential recipients for this life-saving intervention ***(Hui-Hui and Paul, 2011).***

Numerous advances in the perioperative management, like expertise in surgical techniques, better preoperative optimization, intraoperative monitoring and management, changes in immuno-suppression regime and advances in postoperative management not only increased the number of this procedure but also outcome ***(Nandhakumar et al., 2012).***

Acute renal failure (ARF) is considered to be a common, serious complication after orthotopic liver transplantation (OLTx) in the early postoperative period. The incidence has been reported to be from 17%– 64%, with a 8%–17% requirement for renal replacement therapy and a relation to poor patient outcomes ***(Pham et al., 2009) (Biagioni et al., 2011).***

ARF was considered with the presence of serum creatinine >1.5 mg/dl or diueresis < 500ml/24 hr within the first days after surgery ***(Tinti et al., 2010).***

The etiology of post transplantation acute kidney injury(AKI) is multifactorial.The most common causes are as follows: acute tubular necrosis resulting from an ischemic renal injury, pre-existent hepatorenal syndrome (HRS),nephrotoxic side effects of immunosuppressive drugs, and the patient's preoperative condition. Many studies have agreed that AKI is not a transient phenomenon, but a major complication that contributes to poor outcomes and overall mortality ***(Iglesias et al., 2010).***

While awaiting OLT, patients often develop varying degrees of renal impairment, ranging from prerenal azotemia to hepatorenal syndrome and acute tubular necrosis ***(Barri et al., 2009).***

Intraoperative injury to the kidneys could be induced by unstable hemodynamics (massive blood loss, hypotension status, low urine output and large requirement for blood products), surgical technique or nephrotoxic drugs ***(Park et al., 2008).***

Early prediction of AKI using practical and reliable indicator is clinically important for prompt intervention in order to prevent or retard its progression ***(Pham and Wilikinson, 2009)***.

New promising biomarkers such as neutrophil gelatinase associated lipocalin or kidney injury molecule-1and cystatin c

have been developed for the prevention of delayed AKI treatment ***(Fuat et al., 2011).***

Both preoperative and postoperative AKI are associated with poor outcomes and increased mortality. Reducing risk factors for development of renal dysfunction and management of AKI and may improve the long-term outcomes of liver transplant recipients ***(Gonwa et al., 2006).***

Aim of the Work

The aim of the work is to review the acute renal failure as a post-operative complication after liver transplantation in the intensive care unit and the strategies to deal with to achieve the most favourable outcome.

The objectives of the work are to determine risk factors, causes, the possible management & the outcome of acute renal failure after orthotopic liver transplantation.

Chapter (1)
Anatomy and Renal Physiology

Anatomy of the kidney:

Kidneys are located in the abdominal cavity, more specifically in the paravertebral gutter and lie in a retroperitoneal position at a slightly oblique angle. There are two, one on each side of the spine. The asymmetry within the abdominal cavity caused by the liver typically results in the right kidney being slightly lower than the left, and left kidney being located slightly more medial than the right. The left kidney is typically slightly larger than the right ***(Cotran et al., 2005 and Glodny et al., 2009).***

The kidney has a bean shaped structure; each kidney has a convex and concave surface. The concave surface, the renal hilum, is the point at which the renal artery enters the organ, and the renal vein and ureter leave. The kidney is surrounded by tough fibrous tissue, the renal capsule, which is itself surrounded by perinephric fat, renal fascia (of Gerota) and paranephric fat. The anterior (front) border of these tissues is the peritoneum, while the posterior border is the transversalis fascia. The superior border of the right kidney is adjacent to the liver and to the spleen. Therefore, both move down on inhalation. The kidney is approximately 11614 cm in length, 6 cm wide and 4 cm thick ***(Glodny et al., 2009).***

The relationship of neighboring organs to the kidneys is important. Superiorly, the suprarenal (adrenal) glands sit adjacent to the upper pole of each kidney. On the right side, the second part of the duodenum (descending portion) abuts the medial aspect of the kidney. On the left side, the greater curvature of the stomach can drape over the superomedial aspect of the kidney, and the tail of the pancreas may extend to overlie the renal hilum. The spleen is located anterior to the upper pole and is connected by the splenorenal (lienorenal) ligaments**.** Inferiorly to these organs, the colon typically rests anteriorly to the kidneys on both sides. Posteriorly, the diaphragm covers the upper third of each kidney, with the 12th rib most commonly crossing the upper pole. The kidneys sit over the psoas (medially) and the quadratus lumborum muscles (laterally) ***(Wein et al., 2007).***

Renal Parenchyma:

On cross-section, the kidney is seen to contain three principal areas: the pelvis, the medulla, and the cortex. The renal pelvis is a large collecting area for the urine that drains from the many collecting ducts of the nephrons. The minor (smaller) calices collect urine as it drains from the papilla of the renal pyramids. The normal kidney has 8 to 18 minor calices and 2 to 3 major calices ***(Stanton and Koeppen, 2007).***

The medulla contains 8 to 18 renal pyramids, the bases of which are adjacent to the outer cortex, whereas the apices open up into the minor calices. The pyramids consist of collecting tubules, collecting ducts, long loops of Henle, and vasa recta.

The papillae are the opening at the tins of the renal pyramids through which urine exit the collecting ducts. The renal cortex which is the outer rim of the kidney is about 1 cm thick. The cortex contains all of the glomeruli as well as 85% of the nephron tubules. Fifteen percent of nephrons send their loops of Henle deep into the medulla and are called juxtamedullary nephrons ***(Stanton and Koeppen, 2007).***

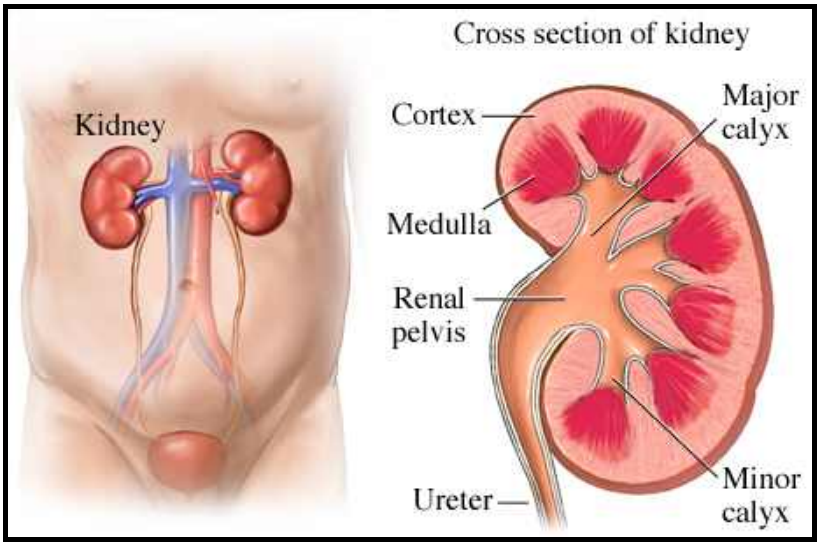

Figure (1): Anatomy of the kidney ***(Ganong, 2005)***

Renal Lymphatics and Innervation:

There are two lymphatic systems in the kidney. One system is composed of vessels that are located both in the renal capsule and immediately under the capsule in the outer cortex. The other lymphatic system is composed of vessels that accompany and wrap around the arterial blood vessels. All the lymphatic vessels, as well as blood vessels and nerves, exit the kidney through the hilum, and lymph drains into the para-aortic lymph nodes ***(Ganong, 2005).***