

Recent Trends in Management of syndromes Related to Liver Cell Failure

Essay

*Submitted for Partial Fulfillment of Master Degree
In General Intensive Care*

By

Mahmoud Saeed Alquddousy

M.B.,B.Ch.

Faculty of Medicine – Menoufia University

Under Supervision of

Prof. Dr. Ahmed Ibrahim Ibrahim

*Professor of Anesthesia, Intensive Care and Pain Management
Faculty of Medicine - Ain Shams University*

Prof. Dr. Hazem Mohammed Abd Elrahman

*Professor of Anesthesia, Intensive Care and Pain Management
Faculty of Medicine - Ain Shams University*

Dr. Amr Sobhy Abd Elkawy

*Lecturer of Anesthesia, Intensive Care and Pain Management
Faculty of Medicine - Ain Shams University*

**Faculty of Medicine
Ain Shams University
2017**

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَقُلْ رَبِّ زِدْنِي عِلْمًا

صدق الله العظيم

سورة طه آية (١١٤)



Acknowledgement

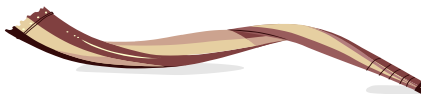
First, thanks are all due to **Allah** for Blessing this work until it has reached its end, as a part of his generous help throughout our life.

My profound thanks and deep appreciation to **Prof. Dr. Ahmed Ibrahim Ibrahim**, Professor of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University, for his great support, advice, and remarks that gave me the confidence and encouragement to fulfill this work.

I am deeply grateful to **Prof. Dr. Hazem Mohammed**, Professor of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University, for adding a lot to this work by his experience and for his keen supervision.

I am also thankful to **Dr. Amr Sobhy Abd Elkawy**, Lecturer of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University, for his supervision, co-operation and direction that extended throughout this work.

I am extremely sincere to **my family** and **my wife** who stood beside me throughout this work giving me their support.



Mahmoud Alquddousy

Contents

List of Abbreviations	I
List of Tables	V
List of Figures	VI
Introduction and Aim of the Essay	1
Anatomy and physiology of the liver	4
Pathophysiology of liver cell failure	22
Hepatocerebral syndrome	48
Hepatocardiac syndrome	77
Hepatopulmonary syndrome	92
Hepatorenal syndrome	108
Summary	125
References	130
Summary in Arabic	--

List of Abbreviations

Abb.	Full Term
AaPO₂	Alveolar-arterial oxygen gradient
ABG	Arterial blood gas
A-II	Angiotensin II
AKI	Acute kidney injury
ANP	Atrial natriuretic peptide
ATP	Adenosine Tri-phosphate
BNP	Brain natriuretic peptide
CCM	Cirrhotic cardiomyopathy
CEE	Contrast-enhanced transthoracic echocardiogram
CLcr	Creatinine clearance
CRD	Cognitive drug research system
CRRT	Continuous renal replacement therapy
CT	Computed tomography
DDLT	Deceased donor liver transplantation
DNA	Deoxyribonucleic acid
ECs	Endogenous cannabinoids
EDHF	Endothelium derived hyperpolarizing factor
EEG	Electroencephalogram
eNOS	Endothelial Nitric Oxide Synthase
ET-1	Endothelin-1
ETBR	Endothelin B receptors
FHF	Fulminant Hepatic Failure
GABA	Gamma-aminobutyric acid
GFR	Glomerular filtration rate
GPB	Glycerol Phenylbutyrate
HE	Hepatic Encephalopathy
HESA	Hepatic encephalopathy scoring algorithm
HO-1	Heme oxygenase-1
HPS	Hepatopulmonary syndrome

Abb.	Full Term
HSC	Hepatic Stellate Cells
IAC	International Club of Ascites
IL-18	Interleukin 18
iNOS	Inducible NO synthase
IPVD	Intrapulmonary vasodilatation
KIM 1	Kidney injury molecule-1
LA	Left atrium.
LDLT	Living donor liver transplantation
L-FABP	Liver-type fatty acid binding protein
LOLA	L-Ornithine and L-Aspartate
LT	Liver transplantation
LV	Left ventricle
LVADs	Left Ventricular assist devices
LVEF	Left ventricular ejection fraction
M	Macrophage
MARS	Molecular absorbent recirculating system
MELD	Model for end-stage liver disease
MRI	Magnetic Resonance Imaging
NE	Norepinephrine
NGAL	Neutrophil-gelatinase-associated lipocalin
NMDA	N-methyl- D-aspartate
NO	Nitric Oxide
NSAID	Nonsteroidal anti-inflammatory drug
OLT	Orthotropic liver transplantation
ONSD	Optic nerve sheath diameter
OP	Ornithine phenylacetate
PaCO₂	Partial pressure of carbon dioxide
PaO₂	Partial pressure of arterial oxygen
PGI₂	Prostacyclin
PHES	Psychometric hepatic encephalopathy score
PoPH	Portopulmonary hypertension
PTX	Pentoxifylline

Abb.	Full Term
RA	Right atrium
RAAS	Renin angiotensin-aldosterone system
RBANS	Repeatable battery for assessment of neurologic status
RBC	Red blood cell
RRT	Renal replacement therapy
RV	Right ventricle
SA	Spider angioma
SaO₂	Oxygen saturation
SBP	Spontaneous bacterial peritonitis
SEC	Sinusoidal Endothelial Cells
SNS	Sympathetic nervous system
SONIC	Spectrum of neurocognitive impairment in cirrhosis
TCD	Transcranial Doppler
TIPS	Transjugular intrahepatic portosystemic shunt
TLR	Toll Like Receptors
TNF-α	Tumor necrosis factor-alpha
V/Q	Ventilation-perfusion
VEGF	Vascular endothelial growth factor
VP	Vasopressin

List of Tables

Table	Title	Page
1	Advantages and disadvantages of diagnostic tests for hepatic encephalopathy.	62
2	Underlying causes that may precipitate hepatic encephalopathy.	64
3	Proposal for diagnostic and supportive criteria for cirrhotic cardiomyopathy.	79
4	Summary of Type I Versus Type II Hepatopulmonary Syndrome.	93
5	Diagnostic criteria for the hepatopulmonary syndrome.	96
6	Staging severity of the hepatopulmonary syndrome.	97
7	The International ascites club hepatorenal definition.	108
8	Hepatorenal diagnostic criteria.	110
9	Hepatorenal syndrome type 1 and type 2.	111
10	Additional criteria to distinguish HRS from acute renal failure of different etiologies.	112
11	International ascites club criteria for the diagnosis of hepatorenal syndrome.	113
12	Differential diagnosis of hepatorenal syndrome.	114
13	Drug effects in cirrhosis.	119

List of Figures

Figure	Title	Page
1	Posterior view of the liver.	5
2	Schematic demonstration of the vascular relations of the liver segments.	8
3	Basic structure of a liver lobule.	9
4	Blood supply of the liver	11
5	Insulin actions on the liver.	17
6	Bilirubin formation and excretion.	21
7	Pathways of cell death.	26
8	Newer molecular paradigms in the sinusoids in cirrhosis.	29
9	Summary of the pathophysiology of portal hypertension.	32
10	The different factors and mechanisms involved in the pathogenesis of hepatic encephalopathy.	35
11	Pathogenesis of hepatic encephalopathy	36
12	Schema of the relationships among splanchnic vasodilation, hyperdynamic circulatory syndrome and portal hypertension in liver cirrhosis.	39
13	Possible mechanisms of hepatopulmonary syndrome.	41
14	Ventilation-perfusion mismatch; diffusion limitation of oxygen.	43
15	Pathogenesis of hepatorenal syndrome.	44
16	Hyperdynamic circulation in the pathophysiology of hepatorenal syndrome	46

Figure	Title	Page
17	Testing for Asterixis (Flap Test)	52
18	Progression of cerebral and cerebellar changes and symptoms.	55
19	Proposed mechanisms of action of rifaximin	68
20	Algorithm for HE treatment and prophylaxis.	69
21	Interactions between the heart and the liver.	77
22	Echocardiography to assess diastolic dysfunction in cirrhotic cardiomyopathy	82
23	3D echocardiography	83
24	Transjugular intrahepatic portosystemic shunt (TIPS).	90
25	Illustration of a positive contrast-enhanced echocardiogram.	98
26	Evaluation of hypoxemia in patients with chronic liver disease.	101
27	Pulmonary angiography of the right and left lungs.	102
28	Post-embolization chest radiograph.	105
29	Pathophysiology and treatment of hepatorenal syndrome.	117



Introduction and aim of the essay





Anatomy and Physiology of the Liver





Pathophysiology of Liver Cell Failure





Hepatocerebral Syndrome





Hepatocardiac Syndrome

