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Different Anesthetic Techniques for Radiofrequency Ablation of Hepatocellular Carcinoma

A protocol of thesis submitted for partial fulfillment of M.D. degree in anesthesiology

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا
عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ﴾

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List of Abbreviations

Abbrev	Meaning
µg	Micrograms
µL	Microliters
µmol	Micromole
ACTH	Adrenocorticotrophic Hormone
AFP	Alpha-fetoprotein
ALP	Alkaline Phosphatase
ALT	Alanine Transaminase
AST	Aspartate Transaminase
BCLC	Barcelona Clinic Liver Cancer
C	Celsius
CBC	Complete Blood Count
CBF	Cerebral Blood Flow
CLIP	The Italian Cancer of the Liver Program
CLT	Cadaveric Liver Transplantation
cm	centimetres
CMRO₂	Cerebral Metabolic Rate
CNS	Central Nervous System
COPD	Chronic Obstructive Pulmonary
CPP	Cerebral Perfusion Pressure
CT	Computed Tomography
CTP	Child-Turcotte-Pugh Score
CUPI	The Chinese University Prognostic Index
d	Day
DD	Differential diagnosis
DDAVP	Diamino-8-D-arginine vasopressin
dL	Deciliter
EASL	European association for the study of the liver
ECG	Electrocardiograph
EDTA	Ethylene Diamine Tetraacetic Acid
EEG	Electroencephalogram
ET	Extubation Time

Abbrev	Meaning
FFP	Fresh-frozen plasma
FiO₂	Fraction of inspired oxygen
g	Grams
GABA	Gamma-Aminobutyric Acid
GFR	Glomerular Filtration Rate
h	Hours
HCC	Hepatocellular Carcinoma
HCV	Hepatitis C Virus
HPS	Hepatopulmonary Syndrome
HR	Heart Rate
HRS	Hepatorenal Syndrome
ICP	Intracranial Pressure
ICU	Intensive Care Unit
INR	International Normalization Ratio
IR	Ischemia-Reperfusion
IV	Intravenous
K⁺	Potassium
kg	Kilograms
kPa	kilopascal
L.E.	Egyptian Pound
LDLT	Live-Donor Liver Transplantation
LMA	Laryngeal Mask Airway
M1	Metastatic Spread
MAC	The Minimum Alveolar Concentration
MAP	Mean Arterial Pressure
Max.	Maximum
MELD	Model for End-Stage Liver Disease
mEq/L	Milliequivalent Per Liter
mg	Milligrams
min	Minutes
ml	milliliters
mm	millimetres

Abbrev	Meaning
mmHg	Millimeter mercury
MRI	Magnetic Resonance Imaging
MSCT	Multislice Computed Tomography
N1	Lymph Node Involvement
N₂O	Nitrous Oxide
NA	Not Applicable
Na⁺	Sodium
ng	Nanograms
NMBAs	Neuromuscular Blocking Agents
OT	Orientation Time
PaCO₂	Partial pressure of arterial carbon dioxide
PAO₂	Partial pressure of alveolar oxygen
PaO₂	Partial pressure of arterial oxygen
Patm	Atmospheric pressure
PBC	Primary biliary cirrhosis
PEEP	Positive End-Expiratory Pressure
PEI	Percutaneous Ethanol Injection
PH₂O	Partial pressure of water vapor at body temperature
PI	Propofol/Isoflurane
PP	Propofol/Propofol
PPH	Portopulmonary hypertension
PS	Performance Status
PSC	Primary sclerosing cholangitis
RF	Radiofrequency
RFA	Radiofrequency Ablation
RR	Respiratory Rate
SaO₂	Arterial Oxygen Saturation
SD	Standard Deviation
sec	Seconds
SEO	Spontaneous eye opening
SS	Sevoflurane/Sevoflurane

Abbrev	Meaning
TACE	Transarterial Chemoembolization
TNM	Tumour-Nodes-Metastases
US	Ultrasound
vs.	Versus
yrs	Years
α	Alpha
β	Beta
γ -GT	Gamma-Glutamyl Transpeptidase

Introduction

Hepatocellular carcinoma (HCC) is a significant worldwide health problem. The burden of HCC has been increasing in Egypt with a doubling in the incidence rate in the past 10 years as it is the third common among cancers in men with >8000 new cases predicted by 2012 . Up to 90% of HCC cases in the Egyptian population are attributed to HCV; Egypt has the highest prevalence of HCV in the world with ~13.8% of the population infected and seven million with chronic HCV liver disease (*Goldman et al, 2007*).

Patients with early-stage HCC should be considered for any of the available curative therapies, including surgical resection, liver transplantation and percutaneous image-guided ablation. Liver transplantation is the only option that provides cure of both the tumor and the underlying chronic liver disease. However, the lack of sufficient liver donation greatly limits its applicability. The optimal treatment for HCC is surgical excision with curative intent. Unfortunately, only 5% to 15% of newly diagnosed patients with HCC undergo a potentially curative resection. Image-guided percutaneous ablation is the best therapeutic choice for non-surgical patients with early-

stage HCC. While ethanol injection has been the chief percutaneous technique, radiofrequency ablation has emerged as the most effective method for local tumor destruction and is currently used as the primary ablative modality at most institutions (*Lencioni et al, 2005a*).

Radiofrequency (RF) tumor ablation refers to the direct application of radiofrequency energy therapy to a specific focal tumor (or tumors) in an attempt to achieve eradication, or substantial tumor destruction. Though the technique was described as early as 1891 for ablation of neurosurgical tumors, Rossi et al described the percutaneous ablation of hepatic tumors by radiofrequency current in 1993 (*Rossi et al, 1996*).

Radio-frequency ablation can be used percutaneously to treat liver tumors as well as laparoscopically or at laparotomy, where it can be combined with resection or utilized as the sole treatment modality. Although it is considered as a safe maneuver, complications following the procedure have been noted which may be related to the needle placement like bleeding, infection, tumor seeding along the needle tract, or damage to the duct, vessel or hollow viscera. General and