Ain Shams University
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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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**2011**

بسم الله الرحمن الرحيم

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صدق الله العظيم

(البقرة : ٣٢)

# Acknowledgements

*Thanks are all to God, for blessing this work until it reached its end, as a little part of his generous help throughout my entire life.*

*I can hardly find the words to express my gratitude to Prof. **Dr. Amir Ibrahim Salah**; Professor of Anesthesia ,Intensive care and Pain Management, Faculty of Medicine, Ain Shams University, for his close supervision, continuous help and encouragement throughout the whole work.*

*It has been an honour working under the supervision of **Prof. Dr. Ahmed Kamal El Dorry,** Professor of Radiodiagnosis, Faculty of Medicine, Ain Shams University.*

*I'm greatly indebted to Assistant Prof. **Dr. Hanan Mahmoud Farag,** Assistant Professor of Anesthesia, Intensive care and Pain Management, Faculty of Medicine, Ain Shams University, for her continuous support throughout the whole work.*

*I'm greatly thankful to Assistant Prof. **Dr. Dalia Abd El Hamid Mohamed,** Assistant Professor of Anesthesia, Intensive care and Pain Management, Faculty of Medicine, Ain Shams University, for the great help and cooperation during the whole work.*

*I'd like also to express my sincere appreciation and gratitude to Dr. **Mostafa Gamal El Dein Mahran** Lecturer of Anesthesia , Intensive care and Pain Management, Faculty of Medicine, Ain Shams University, for his great help and continuous assistance.*

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# List of Abbreviations

| Abbrev | Meaning |
|---|---|
| **µg** | Micrograms |
| **µL** | Microliters |
| **µmol** | Micromole |
| **ACTH** | Adrenocorticotropic 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 |
| **$CMRO_2$** | 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 |
| **$FiO_2$** | 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 |
| **$N_2O$** | Nitrous Oxide |
| **NA** | Not Applicable |
| **$Na^+$** | Sodium |
| **ng** | Nanograms |
| **NMBAs** | Neuromuscular Blocking Agents |
| **OT** | Orientation Time |
| **$PaCO_2$** | Partial pressure of arterial carbon dioxide |
| **$PAO_2$** | Partial pressure of alveolar oxygen |
| **$PaO_2$** | Partial pressure of arterial oxygen |
| **Patm** | Atmospheric pressure |
| **PBC** | Primary biliary cirrhosis |
| **PEEP** | Positive End-Expiratory Pressure |
| **PEI** | Percutaneous Ethanol Injection |
| **$PH_2O$** | 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 |
| **$SaO_2$** | 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