

# Anesthetic Management for Radiofrequency Ablation in Patients with Hepatocellular Carcinoma in a Developing Country

## Abstract

Radiofrequency ablation (RFA) is a novel minimally invasive technique of tumor destruction by heat in hepatic malignancies. It is one of the most common interventional medical procedures performed throughout the world. The study is aimed to report and evaluate the choices and techniques, drugs used and complications of anesthesia for percutaneous RFA in patients with hepatocellular carcinoma during the period of January, 2010 to December, 2012 in Siriraj Hospital in Thailand. The patients' characteristics, pre-anesthetic problems, anesthetic techniques, drugs, duration of anesthesia, and anesthesia-related complications were assessed and summarized by using descriptive statistics. During the study period there were 400 RFA procedures. Mean age  $63.0 \pm 11.4$  years. The majority of them was male (69.0%) and classified in ASA physical status II (68.3%). Most common pre-anesthetic problems were liver disease (57.5%), hypertension (46.8%), hematologic disease (37.3%) and diabetes mellitus (35.3%). Intravenous sedation (99.3%) was the main anesthetic technique. The mainly used anesthetic agents were propofol, fentanyl and midazolam. The duration of anesthesia ranged from 15 to 270 minutes. The overall anesthesia-related complication rate was 23.8%. Hypotension (16.5%) was the most frequent anesthetic complication. Almost all of the RFA procedures, intravenous sedation technique can be used effectively. However, clinical signs should be carefully observed and the anesthetic personnel had to optimize the patient's condition for safety and beware of complications.

**Keywords:** radiofrequency ablation, anesthetic management, efficacy, safety, hepatocellular carcinoma, developing country

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**Abbreviations:** RFA, radio frequency ablation; ASA, american society of anesthesiologists; SD, standard deviation; %: percentage

## Introduction

Radiofrequency ablation (RFA) is one of the most common interventional medical procedures performed throughout the world. It is an alternative treatment option for hepatic tumor patients. These tumors are ablated by radiofrequency. Radiofrequency is the heating and destruction of tissues in which a high-frequency alternating current increases the temperature of the tissues beyond  $60^{\circ}\text{C}$ , causing in a region of necrosis nearby the electrode. This ultrasonic energy is a strong stimulus that requires deep sedation and anesthesia levels during the radiofrequency procedure. RFA is considered to be equally effective as surgical resection in the patients with solitary tumor nodules of  $\leq 2\text{cm}$ .<sup>1</sup> However, the appropriate method of treatment still depends on several critical factors including age, patient physical status, and severity of hepatic dysfunction.

Over the years, the patients also have changed. There are increasingly patients at the extremes of health status and patients with a multitude of comorbid problems. In our center, most of these procedures are performed by radiologists under some forms of anesthesia. The choices and techniques of anesthesia and drug selection vary according to the condition of the patients, familiarity of the anesthesiologists and satisfaction of the radiologists.<sup>2</sup> Little is known about how practices in anesthesia and monitoring during RFA procedure in the radiology unit outside the operating room in the developing countries. Consequently, the anesthesia-related complication rates have changed over time. The aim of this study

was to report and evaluate the choices and techniques of anesthesia, drug usage and complications during and immediately after the RFA procedure. Moreover, this present study was also conducted in order to adapt and keep data for further research in the near future.

## Materials and methods

Data were reviewed from anesthetic, procedure records and history charts of hepatic tumor patients who underwent percutaneous RFA procedure during a period from January, 2010 to December, 2012 at Siriraj Hospital, Thailand. The general data included gender, age, weight, height and American Society of Anesthesiologists (ASA) physical status. The anesthetic data included pre-anesthetic problems, choice of anesthesia, anesthetic drug usage, duration of anesthesia, and anesthesia-related complications. Results were reported as mean and standard deviation (SD) or percentage (%) when appropriate.

## Results

There were 400 RFA procedures performed during the study period. The majority of the patients were male (69.0%) with ASA physical status II (68.3%). Mean age was 63.0 (11.4) years. The mean duration of anesthesia was 83.0 (44.1) minutes. Most of pre-anesthetic problems were liver disease (57.5%), hypertension (46.8%), hematologic disease (37.3%), and diabetes mellitus (35.3%), (Table 1). Clinical monitoring observed by the anesthetic personnel consisted of noninvasive blood pressure, heart rate, pulse oxymetry, and electrocardiogram.

Table 2 shows anesthesia-related data. Almost all of the procedures were carried out under intravenous sedation (99.3%)

and general anesthesia (0.5%). Propofol, fentanyl, midazolam and pethidine were anesthetic drugs commonly used for this procedure. In addition, these anesthetic drugs are usually utilized in a combination regimen. Anesthesia-related complications during and immediately after the procedure are demonstrated in Table 3. No serious anesthetic complications occurred during the study. The overall anesthesia-related complication rate was 29.8%. The majority of these complications was cardio respiratory system in nature and was associated with sedation and analgesia. Hypotension (16.5%) which was promptly corrected by administration of vasopressor and fluid loading was the most frequent anesthesia-related complication. Other anesthesia-related complications were upper airway obstruction (6.3%), hypertension (2.8%), bradycardia (1.3%), hypotension and bradycardia (2.8%), and hyper salivation (0.3%).

**Table 1** Characteristics of patients, duration of anesthesia and pre-anesthetic problems

Patient number (n)	400
Age (yr) (mean, SD)	63.0 (11.4)
Gender (%): Male	276 (69.0)
Female	124 (31.0)
Weight (kg) (mean, SD)	55.1 (12.1)
Height (cm) (mean, SD)	163.1 (8.4)
ASA physical status (n, %)	
I	7 (1.8)
II	273 (68.2)
III	120 (30.0)
Duration of anesthesia (min) (mean, SD)	83.0(44.1)
Pre-anesthetic problems (n, %)	
Liver disease	230 (57.5)
Hypertension	187 (46.8)
Hematologic disease	149 (37.3)
Diabetes mellitus	141 (35.3)
Cardiovascular disease	52 (13.0)
Electrolyte imbalance	52 (13.0)
Respiratory disease	36 (9.0)
Others	91 (22.8)

**Table 2** Anesthesia related data (n, %)

Anesthetic Technique	
Intravenous sedation	397 (99.3)
General anesthesia	2 (0.5)
Monitored anesthesia care	1 (0.2)
Anesthetic Drugs	
Propofol	382 (95.5)
Fentanyl	366 (91.5)
Midazolam	311 (77.8)
Pethidine	42 (10.5)
Ketamine	21 (5.3)
Morphine	2 (0.5)

**Table 3** Anesthesia related complications during and immediately after procedure (n, %)

Overall	119 (29.8)
Hypotension	66 (16.5)
Upper airway obstruction	25 (6.3)
Hypertension	11 (2.8)
Bradycardia	5 (1.3)
Hypotension and Bradycardia	11 (2.8)
Hypersalivation	1 (0.3)

## Discussion

RFA is a relatively new technique for the treatment of small hepatic tumors that cannot be treated with surgical procedure. This technique applies alternating high-frequency electrical currents to the cancerous tissue. The intense heat leads to thermal coagulation that can destroy the tumors. The technology of RFA has been enhanced over the past 20 years and the methods of anesthesia have been improved as well.<sup>3</sup> However, RFA is an invasive procedure and is normally denied by the patient because of anxiety and severe discomfort and pain. Importantly, sedation and anesthesia can decrease the fear of the procedure by inducing amnesia and reducing pain and discomfort so that the patients can undergo the procedure in a comfortable state.

The role of the anesthesiologist in hepatocellular carcinoma ablation therapy is to facilitate patient safety and satisfaction as well as to ensure that the patient will have minimal pain during the procedure. To date, there is evidence that percutaneous RFA procedure can be safely performed with sedation or general anesthesia. Although the use of sedation/anesthesia during this procedure is supposed to be extensively accepted, data from different studies indicate that patterns of use of sedative and analgesic drugs may principally depend on cultural, or even regional and local differences. In fact, the data used to evaluate the safety of sedation/anesthesia during RFA procedure were derived mainly from several studies conducted in the developed countries. There are limited data in the developing countries.

Our study demonstrated that intravenous sedation technique was commonly used for RFA procedure in a radiology unit outside the operating room. Sedation for RFA procedure is intended to provide moderate to deep sedation as defined by the American Society of Anesthesiologists (ASA).<sup>4</sup> The proper administration of sedation and analgesia for this procedure is as essential to the successful procedure as skillful maneuvering of the radiologist. Recently, there are concerns about our practice or sedation and analgesia, involving issues of safety, patient satisfaction, and cost. The goal of anesthesia during this procedure is to relieve the patient's preexisting pain and anxiety as well as the pain of the procedure itself, and the amount of postoperative pain expected. The level of sedation/anesthesia is balanced with the stimulus of the procedure. In addition, skin local anesthesia is usually utilized in combination with sedation and/or anesthesia. The supplementation of local anesthetic agent may result in reducing total dose of anesthetic drugs, less post-procedural pain, and increasing patient satisfaction as well as facilitating patient discharge.

The differences in usage of sedation and anesthesia between different countries have been accredited to cultural differences. In Siriraj Hospital, a combination of local anesthesia and intravenous sedation technique is commonly used for various procedures outside the operating room including percutaneous RFA procedure.<sup>5-8</sup> The commonly used anesthetic drugs are shorter-acting benzodiazepines (midazolam) and narcotics (fentanyl) because of their relatively rapid onset and rapid offset.<sup>8,9</sup> Importantly, these anesthetic drugs can be reversed by the appropriate medication (flumazenil and naloxone). Additionally, the use of propofol had been widely used by anesthesiologists during the procedure. It has anxiolytic, hypnotic, amnestic, antiemetic and anesthetic properties. Propofol also potentiates the effects of narcotics and sedatives. However, propofol associated with cardio respiratory depression including hypotension, respiratory depression and airway obstruction.<sup>10,11</sup> In addition, the use of propofol for sedation requires specific training and experience and should be rigorously offered only under optimal conditions.<sup>12,13</sup>

In evaluating the stimulus for hepatic tumor ablation, there is a body wall component of somatic pain, ranging from T5 to T9 skin dermatomes where the procedural needles are passed through the skin. In addition, the visceral pain pathways transfer stimuli from the liver and upper abdominal organs during tumor ablation procedures. The celiac plexus block might be combined with sedation or general anesthesia. However, we rarely use celiac plexus block for RFA of hepatic tumors in our center. Importantly, the leadership of our center in Thailand would better serve our patients in practicing anesthesia and management of its complications. This management addresses the safety concerns, offers high patient satisfaction, increases productivity, and decreases recovery time.

The incidence rates of complications per treatment and per procedure were 2.2% and 1.5%, respectively. The treatment mortality rate was 0.03%.<sup>14</sup> Complications of RFA can arise in three general ways. The first way develops from the ablative procedure itself. The second way results in complications relate to the RFA device passed through tissue to a target organ such as bleeding, pneumothorax, and infection. The third way associates with sedation and anesthesia.<sup>15</sup> This study does not focus on procedure-related complications. The patients undergo RFA with deep sedation or with general anesthesia are the potential for risks. The present study clearly recommends that cardiovascular complications may be significantly more frequent in patients who undergo RFA procedure. The most common complication was hypotension. In Siriraj Hospital, there were no serious anesthesia-related complications occurred during the study. Furthermore, the incidence rate of anesthesia-related complications during and after RFA procedure is comparable with other outside operating room procedures.<sup>5-7</sup>

There are several limitations of this study that should be noted. First, the present report is retrospective in nature. The main limitation of this study is its reliance on self-reported data. These self-reporting data may tend toward an underestimation of unpleasant data. Second, this is a single-center study. These results could not be reproducible constantly in other settings. Third, there are several anesthesiologists and radiologists performed this procedure. A wide variability of the experience might be occurred. The authors therefore assume that the data are realistic and reveal daily clinical practice. Finally, our results may not be applicable to patients in the developed countries.

## Conclusion

RFA is a minimally invasive procedure for treatment of small hepatic tumors that cannot be treated with surgical procedure. It requires some forms of anesthesia. Anesthesia and sedation by anesthetic personnel appear to be safe and effective. There was no need for special techniques or drugs in anesthesia. However, clinical signs should be cautiously observed and the anesthetic personnel had to optimize the patient's condition for safety and beware of complications.

## Conflicts of Interests

The authors do not have any Conflict of interests.

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