Original Article

Radiofrequency ablation of hepatocellular carcinomas: A new spectrum of anesthetic experience at a tertiary care hospital in Pakistan

ABSTRACT

Background: Radiofrequency ablation (RFA) is a minimally invasive technique of tumor destruction for patients with hepatic cancer who are not candidates for conventional therapy. The therapy required general anesthesia (GA) or sedation to ensure patient safety and comfort. The study is aimed to report and evaluate factors that influenced the periprocedural anesthetic management, drugs used, and complications during and immediately after RFA procedure for hepatocellular carcinoma.

Methods: For this retrospective study, we included 46 patients who underwent percutaneous RFA under GA or conscious sedation from January 2010 to June 2013 in Aga Khan University Hospital, Pakistan. The patients' characteristics, hepatic illness severity (Child-Pugh classification), anesthetic techniques, drugs, and complications of procedure were collected on a predesigned approved form. The data were assessed and summarized using descriptive statistics.

Results: The majority of patients were female (57%) and mostly classified as American Society of Anesthesiologist III (65.2%). The preoperative hepatic illness severity in most patients was Child-Pugh Class A (76.10%). Thirty-eight patients (69.09%) had only single lesion and majority number of lesions were <3 cm (65.45). GA was the main anesthetic technique (87%) with laryngeal mask airway as an airway adjunct predominantly (70%). The mainly used anesthetic agents for hypnosis and analgesia were propofol and fentanyl, respectively. Pain was the only significant complaint in postoperative period but only in nine (19%) patients and mild in nature.

Conclusions: Percutaneous RFA is a safe treatment of hepatocellular cancer. The procedure required good anesthetic support in the form of sedation-analgesia or complete GA that ensures maximum patient comfort and technical success of the procedure.

Key words: General anesthesia, hepatocellular carcinoma, pain, radiofrequency ablation, sedation

Introduction

Radiofrequency ablation (RFA) defined as the direct application of radiofrequency energy therapy to a specific focal tumor (or tumors) in an attempt to achieve eradication or substantial tumor destruction.[1] Advantages of RFA include low morbidity, few complications, outpatient use, and repeatability for recurrence of lesions.[2] It has been accepted as a safe and effective technique for treating unresectable hepatocellular carcinoma (HCC).[3]

This treatment requires general anesthesia (GA) or sedation.[4] A significant problem in managing such patients is pain due to procedure. Even with appropriate conscious sedation,

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patients may experience pain during ablation procedures. In addition, most patients experience Grade 1 or 2 pain for several days or, occasionally, 1–2 weeks.[5] There are some patients and procedure-related factors that influence anesthetic management. Team collaboration is highly required between radiologist, anesthesiologist, and staff in radiological suite in planning and conduct of RF procedure. RFA is a relatively new procedure in Pakistan. 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. The aim of this study was to retrospectively analyze and evaluate factors that influenced the periprocedural anesthetic management and identify complications during and immediately after RFA procedure for HCC.

Materials and Methods

This retrospective study was conducted in a tertiary care university hospital. After approval from the Departmental Research Committee and Hospital Ethics Review Committee (3055-Ane-ERC-14), we included elective RFA procedures for HCC under GA or sedation since January 2010 till June 2013. We excluded emergency cases and patients already admitted in ICU. All files were reviewed and crosschecked by the primary and secondary author. Information was obtained from preanesthesia clinic notes, preoperative and intraoperative anesthesia forms, and any other relevant primary physician's notes in the patient's file were recorded. The data were collected on a predesigned approved form with respect to anesthetic technique employed and postprocedure outcome. The clinical, radiological, and anesthetic data of individual patients were collated and analyzed. All patients underwent routine hematological, biochemical, and coagulation investigations and computed tomography scan for tumor localization and estimation of tumor volume. Interventional radiologist performed the RFA procedure.

Patients were treated using a RF 3000 (Boston Scientific, USA) radiofrequency generator system having a power output of 10–50 RF watts and continuous low volume isotonic saline perfusion monopolar RF needle of 1–2 mm diameter, of varying lengths (15–25 cm). Needle was inserted under ultrasound guidance through subcostal or direct puncture access, and throughout the procedure, monitoring was undertaken with ultrasound probe (3.5–5 MHz probe). The amount of radio energy (watts/s) to be delivered was calculated according to the volume of the tumor. All statistical analysis was performed using Statistical Packages for Social Science version 19 (SPSS Inc., Chicago, IL, USA).

Age, weight, height, American Society of Anesthesiologist (ASA), gender, comorbid, anesthetic management, pain control, and complications were target observations of the patients. Frequency and percentage were computed for qualitative observation and were analyzed by Chi-square test. Mean ± standard deviation and median (interquartile range) were presented for quantitative variables and were analyzed by independent sample *t*-test and Mann–Whitney test. Normality of quantitative data was also be checked by Kolmogorov–Smirnov test.

Results

Forty-six patients who underwent RFA procedures for hepatocellular cancer with GA or sedation during the 3½-year period were evaluated. The demographic characteristics and Child-Pugh classification of patients are stated in Table 1. Of 46 patients, 43% are male and 57% are females. The majority of patients were labeled as ASA III (65.2%) and fall into Child-Pugh Class A hepatic illness severity (76.10%). Thirty-eight patients (69.09%) had only single lesion in liver, whereas seven patients had two lesions. The total number of lesions were 55 and out of these, 36 were <3 cm, 17 were 3–5 cm, and only two were >5 cm [Table 2].

RFA was performed under GA in 40 patients (87%), whereas 6 patients (13%) tolerated it well in sedation [Figure 1a]. One patient in the sedation group does not tolerate pain and discomfort and hence, converted into GA. The primary anesthesia induction technique was intravenous with propofol in GA [Figure 1b and c], patients with predominantly laryngeal mask airway (LMA) as an airway adjunct in 70% and endotracheal tube (ETT) in 30% patients [Figure 1e]. Various

Table 1: Demographic characteristics and Child-Pugh classification of patients (*n*=46)

Variables	Mean±SD/*n* (%)
Age (years)	56.65 (11.68)
Weight (kg)	66.12 (12.62)
Height (cm)	160.9 (10.28)
Gender (%)	
Male	20 (43.5)
Female	26 (56.5)
ASA status (%)	
II	15 (32.6)
III	30 (65.2)
IV	1 (2.2)
Severity of hepatic illness (%)	
Child-Pugh Class A	35 (76.10)
Child-Pugh Class B	10 (21.70)
Child-Pugh Class C	1 (2.20)

SD: Standard deviation; ASA: American Society of Anesthesiologist

analgesics such as pethidine and tramadol were used for intraoperative pain relief, but predominantly fentanyl was used in 28 patients [Figure 1d]. Prophylactic antiemetic either metoclopramide or ondansetron was used in 23 patients. Dexamethasone was used in only 1 patient. Propofol again is primary drug used in five patients whose RF procedure was done under sedation and fentanyl as an analgesic. In four patients, sedation was given by continuous infusion technique and two patients were given boluses. Only one patient was given prophylactic antiemetic with ondansetron.

Table 2: Radiological data

Variables	*n* (%)
Total lesions in liver	55
Patients with lesions in liver (%)	46
Patients with single lesion	38 (69.09)
Patients with two lesions	7 (12.72)
Patients with three lesions	1 (1.81)
Size of lesions (cm) (%)	
<3	36 (65.45)
3-5	17 (30.90)
>5	2 (3.63)

Pain was the only significant postoperative problem, and it was found in total nine patients (9/46 = 19%). Eight patients indicated pain at ablation site and one pointed toward back. According to charts in medical records, the pain intensity was measured by verbal rating scale (none, mild, moderate, and severe). Seven patients marked their pain as mild intensity and two complained moderate to severe, requiring analgesia in recovery room. These two patients were given intravenous pethidine 10 mg as bolus till intensity decreases. Most patients were discharged 24 h after the procedure.

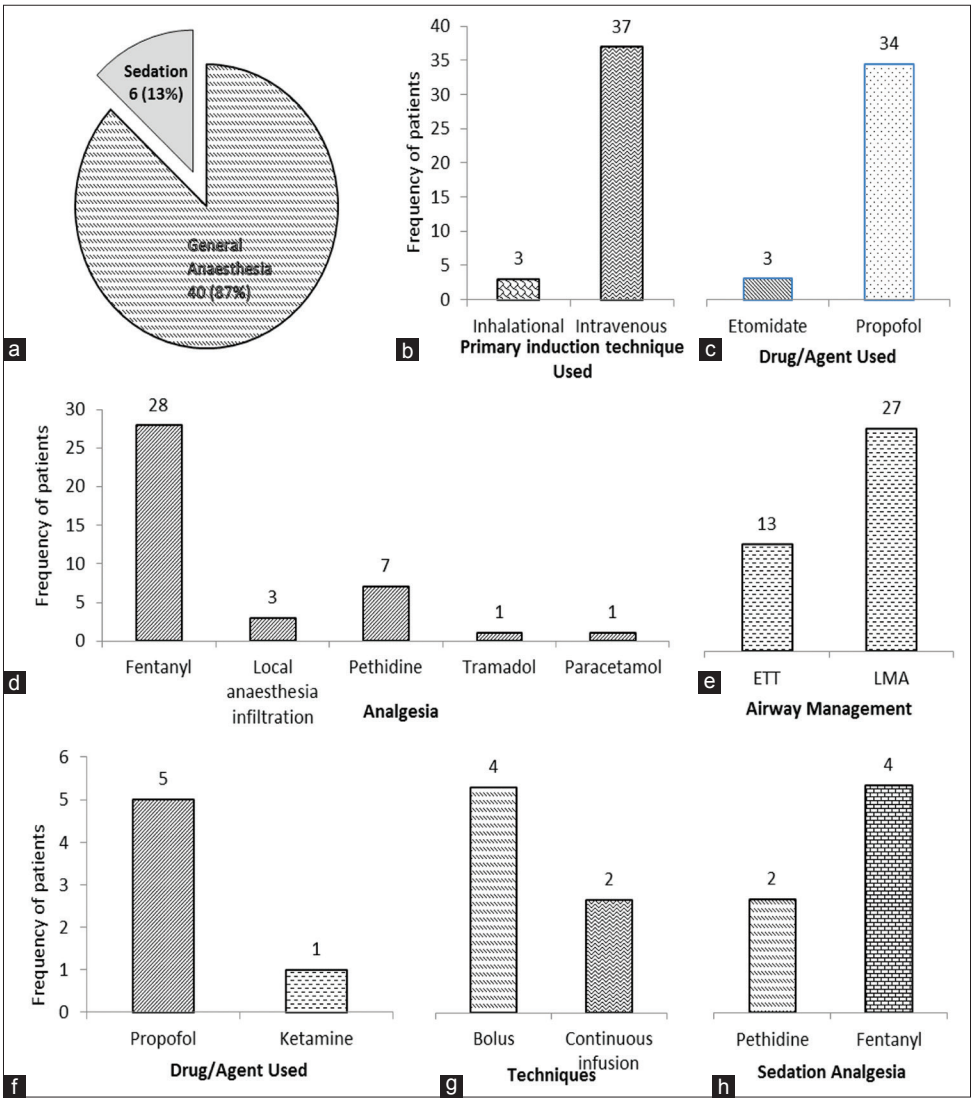

Figure 1: Anesthesia-related data. (a) Total patients in general anesthesia and sedation, (b-e) Data related to patients underwent general anesthesia with regard to induction technique, drugs for intravenous induction, analgesics for procedural pain and airway management, (f–h) Drugs, techniques, and analgesic agents used during sedation

Discussion

HCC is the fifth most common cancer worldwide; with more than one million new cases diagnosed each year. The incidence of HCC varies widely, being most common in Southeast Asia sub-Saharan Africa and much less in North America and Western Europe. Annual incidence in Pakistan is 8/100,000.[6]

RFA is an accepted method of treatment of HCC in patients who are not candidates for liver transplantation or those in whom surgical resection cannot be performed.[7] It was introduced in 1990 by McGahan *et al*.[8] and most work is appreciated in Europe until 1993 by Rossi *et al*.[9] Interventional radiologist under ultrasound or CT guidance performs it percutaneously. The goal of RFA is to induce thermal injury to the tissue through electromagnetic energy deposition. The procedure is believed to be a revolution in the treatment of cancer by minimally invasive technique, having a good technical efficacy, low morbidity, and good outcomes in terms of patient survival, quality of life, and palliation.[1] In our institute, the services of the anesthesiology department are called upon for the successful conduction of the procedure. This treatment modality is offered at very few institutions in our country and no local data available, so we are sharing our experience regarding periprocedural anesthetic considerations, sedation, pain management, and procedural complications.

The role of the anesthesiologist in HCC ablation therapy is to facilitate patient safety and satisfaction as well as to ensure that the patient will have minimal pain during the procedure. Thorough preoperative evaluation is must and should emphasize on history and examination, investigations, and assessment of patient stability to tolerate anesthesia and procedure since these patients may have significant comorbidities. Baseline hematological and biochemical laboratory investigations with special attention to coagulation status should be ordered as well as electrocardiography (ECG) and chest X-ray are also needed. We found from our medical records that all patients were seen by an anesthesiologist (consultant or trainee) before the procedure. In our institute, platelet count more than 100,000 and prothrombin time, activated partial thromboplastin time, and international normalized ratio within normal range is mandatory for the performance of RFA. The procedure can be performed on outpatient basis, but as we have started recently, the radiologist, gastroenterologist, and anesthesiologist were of this opinion to admit our patients a day before to optimize medical conditions, especially coagulation status and also keep them admitted postoperatively for potential complications of bleeding and persistent pain.

The ASA monitoring standards were followed in all patients (non-invasive blood pressure, ECG, pulse oximetry, and end-tidal CO_2). The differences in usage of sedation and anesthesia between different countries have been accredited to cultural differences. Deep conscious sedation with local anesthesia may be adequate in many cases, and it is usually given by midazolam-fentanyl combination.[10] The combination of fentanyl and midazolam provides excellent sedation and helps minimize the discomfort associated with feeling hot from the heat generated by RFA. Both drugs are easily titratable and quick onset and offset which is ideal for this procedure. We usually performed GA with LMA in our cases. The decision to put ETT was mainly based on the degree of ascites, number of lesions, and controlled apnea during location of lesion (deep, subdiaphragmatic).

Intraprocedural pain during ablation procedures can develop in spite of appropriate conscious sedation techniques. It has been postulated that RFA of a tumor in a superficial location or a central tumor in contact with a large vessel is more likely to cause severe pain during an ablation, but the level of pain is unpredictable.[11] Lee *et al.*[12] did a study on factors related to intraprocedural and postprocedural pain in RFA and found that a tumor adjacent to the parietal peritoneum is an independent predictor of a higher level of intraprocedural pain based on multivariate analysis, and those who had undergone multiple ablations and procedures with a longer duration of ablation reported more severe pain. They conclude that modification of intraprocedural anesthesia and analgesia should be considered in patients with risk factors for increased pain. In our patients, fentanyl is used for management of procedural pain during RFA. In the postprocedure period, we found complaint of mild pain by only nine patients which managed accordingly. Our patients either received intravenous ondansetron or metoclopramide in intraoperative period and that is why we do not have any significant nausea and vomiting problems postoperatively. Following RFA procedure, the patients were monitored for 1 h in recovery room of radiology suit and then shifted to their respective wards.

There are some limitations of this study that should be noted. First, it is retrospective in nature. Second, this is a single-center study and results could not be reproducible constantly in other settings. Third, although few anesthesiologists and

radiologists performed this procedure at our institution, a wide variability of the experience still 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. Choice of the anesthetic technique depends on both patient factors and the site, and size of the tumor. Anesthesia and sedation by anesthetic personnel appear to be safe and effective. Good anesthetic support ensures both maximum patient comfort and technical success of the procedure.

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Conflicts of interest

There are no conflicts of interest.

References

1. Wells SA, Hinshaw JL, Lubner MG, Ziemlewicz TJ, Brace CL, Lee FT Jr. Liver ablation: Best practice. Radiol Clin North Am 2015;53:933-71.
2. Dupuy DE, Goldberg SN. Image-guided radiofrequency tumor ablation: Challenges and opportunities – Part II. J Vasc Interv Radiol 2001;12:1135-48.
3. Howard JH, Tzeng CW, Smith JK, Eckhoff DE, Bynon JS, Wang T, *et al.* Radiofrequency ablation for unresectable tumors of the liver. Am Surg 2008;74:594-600.
4. Sabo B, Dodd GD 3rd, Halff GA, Naples JJ. Anesthetic considerations in patients undergoing percutaneous radiofrequency interstitial tissue ablation. AANA J 1999;67:467-8.
5. Livraghi T, Solbiati L, Meloni MF, Gazelle GS, Halpern EF, Goldberg SN. Treatment of focal liver tumors with percutaneous radio-frequency ablation: Complications encountered in a multicenter study. Radiology 2003;226:441-51.
6. Bhurgri Y. Karachi cancer registry data-implications for the National Cancer Control Program of Pakistan. Asian Pac J Cancer Prev 2004;5:77-82.
7. Bruix J, Sherman M. Practice Guidelines Committee, American Association for the Study of Liver Diseases. Management of hepatocellular carcinoma. Hepatology 2005;42:1208-36.
8. McGahan JP, Browning PD, Brock JM, Tesluk H. Hepatic ablation using radiofrequency electrocautery. Invest Radiol 1990;25:267-70.
9. Rossi S, Di Stasi M, Buscarini E, Quaretti P, Garbagnati F, Squassante L, *et al.* Percutaneous RF interstitial thermal ablation in the treatment of hepatic cancer. AJR Am J Roentgenol 1996;167:759-68.
10. Tobias JD, Leder M. Procedural sedation: A review of sedative agents, monitoring, and management of complications. Saudi J Anaesth 2011;5:395-410.
11. Rhim H. Complications of radiofrequency ablation in hepatocellular carcinoma. Abdom Imaging 2005;30:409-18.
12. Lee S, Rhim H, Kim YS, Choi D, Lee WJ, Lim HK, *et al.* Percutaneous radiofrequency ablation of hepatocellular carcinomas: Factors related to intra-procedural and post-procedural pain. AJR Am J Roentgenol 2009;192:1064-70.