

# ECG Changes during Radiofrequency Ablation of Liver Metastasis under General Anaesthesia - A Dilemma with Cardiac Event

## Abstract

Electrocardiogram (ECG) monitoring is one of the mandatory monitoring during surgery under anaesthesia for identifying any cardiac event like arrhythmias or ischemic changes. The operating room is increasingly being studded with various electrical equipments. These electrical gadgets may interfere with the ECG monitoring and thus produce various artifacts mimicking arrhythmias or ischemic changes. We report a case of ECG changes induced artifactually by the use of radiofrequency ablation (RFA) for ablating hepatic metastasis under general anaesthesia. Our case emphasizes that awareness of such artifacts in ECG during radiofrequency ablation is required and if it occurs it should be cautiously interpreted and managed.

**Keywords:** Electrocardiogram; Artifacts; Radiofrequency Ablation; Malignancy; Anaesthesia

## Case Report

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## Introduction

Electrocardiogram (ECG) monitoring is an essential monitoring for patient undergoing surgery. It is a tool to pick up the cardiac event like arrhythmias or ischemic changes especially under general anaesthesia when patient may not manifest symptoms. The operating room is increasingly being studded with various electrical equipments. These electrical gadgets may interfere with the ECG monitoring. Newer ECG monitors are equipped with filters to filter these electrical interferences from other gadgets. In spite of these advanced monitors, ECG artifacts mimicking serious ECG rhythms requiring intervention may occur during surgery. We report a case of ECG changes induced artifactually by the use of radiofrequency ablation (RFA) for ablating hepatic metastasis under general anaesthesia.

## Case

A 46 year female weighing 78 kg was scheduled for exploratory laparotomy for retroperitoneal sarcoma excision and RFA of liver metastasis. On preanaesthetic evaluation, patient denied of any preexisting disease. Hemogram, biochemistry investigations, 12 lead electrocardiogram and chest X-ray were within normal limits. Computed Tomography (CT) scan revealed leiomyosarcoma (size 5.3x5x5.7cm) anterior to right common iliac vessels in retroperitoneal region and a solitary lesion (size 2x1.8 cm) in segment VIII of liver. In the operating room, routine monitors including 5 lead ECG, non-invasive blood pressure and pulse oximeter were attached. The ECG showed a normal sinus rhythm with a pulse rate of 82 beats/min. An intravenous

access was secured. The combined spinal epidural (CSE) block was administered in left lateral position in the L2-3 interspace using midline approach. After administering intrathecal 0.3 mg of morphine, epidural catheter was inserted and fixed at 10 cm to skin. Anaesthesia was induced with intravenous fentanyl (150 µg), propofol (150 mg) and atracurium (70 mg). After ventilation with sevoflurane (1.5%) in oxygen for three minutes, trachea was intubated with endotracheal tube size 7 mm. Anaesthesia was maintained with sevoflurane in oxygen (Minimum Alveolar Concentration, MAC 1) along with boluses of fentanyl and atracurium as required. Surgery was started and after excision of the pelvic mass, RFA procedure was initiated. RFA ablation of solitary liver metastasis was under done ultrasound guidance using RF ablation probe (3-5 cm) (Angiodynamics RitaModel 1500X, Manchester, GA 31816). A ablation of 3.5 cm circumferential areas was targeted using multipronged RFA probe under ultrasound guidance at 95° C and 150 watts power for 7 minutes. Just after initiation of RFA, ECG showed various non specific rhythms mimicking ischemic changes (Figure 1). Since patient was hemodynamically stable, we continued with the RFA procedure with a watch in hemodynamics and further ECG changes. The ECG changes persisted throughout the procedure of RFA ablation but with stable haemodynamics. After the completion of the RFA, ECG returned to the basal pattern. The surgery was completed and hemostasis was achieved. After the surgery, residual neuromuscular blockade was reversed and patient was extubated uneventfully. Patient remained hemodynamically stable postoperatively and repeats ECG was having normal sinus rhythm with stable haemodynamics.



**Figure 1:** ECG and Blood pressure just after initiation of RFA (A) and after completion of RFA (B).

## Discussion

ECG monitoring is an mandatory monitoring intraoperatively and allows the anaesthesiologists to identify various arrhythmias and ischemic changes during the surgical intervention. Any patient with preexisting cardiac disease or surgeries with major fluid shift are more prone to manifest such ECG changes. Any ECG rhythm changes during the surgery should be interpreted cautiously and managed as per clinical situation. At times, various ECG artifacts may occur due to inappropriate ECG electrode misplacement, or loose connections. The electrical interference occurs due to use of electrical gadgets in the operating room. These electrical gadgets may interfere in the ECG monitoring leading to artifacts that may mimic some harmful rhythms and thus create dilemma in management these rhythms [1,2]. ECG artifacts may mimic serious arrhythmias and thus unnecessary use of drugs or electrical therapy depending upon the seriousness of artifacts arrhythmias [1].

The present generation ECG monitors are equipped with filtering mode that filters other electrical activities in the vicinity of the monitor. With this mode being active, the cardiac monitors will choose the appropriate filter based on the situation and avoid any ECG artifacts [3]. In spite of these filtering modes, certain equipments still may cause ECG artifacts as happened in our case with the use RFA. RFA is a safe and effective treatment for hepatic metastases [4,5]. The RFA ablation of lesion under the guidance of ultrasound has been found to be useful as it allows to monitor the RF probe needle track around the lesion and also monitors extent of ablated lesion [6,7]. RFA

conducts current between the ground plate and RFA probe in the range of radiofrequency signals. This current generates the heat around the probe (multipronged probe used in our case) and thus destroys the malignant tissues. In our case, probe was inserted in the liver and was near to the heart electrical conduction. This may cause the electrical conduction deficit in the heart but may also cause artifacts in ECG being monitored from the nearby leads. The differentiation between true cardiac event or artifact becomes difficult in such situations. RFA may also affect and malfunction the pacemaker or implantable cardioverter defibrillator (ICD). Usually these all changes become normal once the RFA is stopped.

The awareness of such artifacts is essential to avoid unnecessary treatments of the patient which may cause the harm by their side effect profile [1]. Also measures should be taken to avoid occurrence of these ECG artifacts. There are no recommendations in the literature regarding use of RFA probe and ECG changes prevention. It appears that shielding the portion of the RFA probe and its cables during ablation may be beneficial to avoid ECG artifacts. At times inappropriate earthing or current leakage from the electrical gadgets used during surgery may also interfere with ECG recordings [8]. It is prudent to keep the earthing away from the ECG monitoring sites. Also, the loop of current flow of the electrical gadget probe and its grounded electrode should not cross the heart or the ECG leads.

## Conclusion

To conclude, we emphasize that ECG rhythms change during the use of radio frequency ablation of malignant lesion should be cautiously interpreted and managed.

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