Case Report

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A severe complication of myocardial dysfunction post radiofrequency ablation treatment of huge hepatic hemangioma: a case report and literature review

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Abstract: In recent years, radiofrequency (RF) ablation has been increasingly used for treating hepatic hemangiomas attributing to its unique advantages, such as minimal invasiveness, definite efficacy, high safety, fast recovery, and wide applicability. However, complications related to RF ablation had been frequently reported, especially while being used for treating huge hemangioma (≥10 cm). Cautious measures had been taken to prevent the incidence of ablation-induced complications, but still unexpected complications occurred. Herein we reported a case of severe myocardial dysfunction along with systemic inflammatory response syndrome occurring immediately post RF ablation of a 10.7 cm hemangioma. This serious complication was effectively managed by supportive care with the full recovery in a short period of time.

Keywords: Radiofrequency ablation; Hepatic hemangiomas; Myocardial dysfunction; Systemic inflammatory response syndrome

1 Introduction

Hepatic hemangiomas are the most common benign tumors of the liver, which are generally asymptomatic and do not need clinical intervention. When hemangiomas are larger than 5.0 cm and cause abdominal symptoms or increase in size during follow-up, radical interventions need to be considered [1]. Traditionally, surgical resection and surgical enucleation are the most frequently used treatments of choice. However, surgical resection is rather invasive and associated with relatively high risks of perioperative morbidity (27%), mortality (3%) and long hospitalization [2]. In recent years, radiofrequency (RF) ablation has been increasingly employed in the treatment of hepatic hemangiomas due to its unique advantages, such as minimal invasiveness, definite efficacy, high safety, fast recovery, and wide applicability [1, 3-9].

However, complications related to RF ablation have been frequently reported, especially when used for treating huge hemangiomas (≥10 cm). Cautious measures had been taken to prevent the incidence of ablation-induced complications [5, 8, 9], but still unexpected complications occurred. Here we report a case of severe myocardial dysfunction along with systemic inflammatory response syndrome (SIRS), which took place immediately post RF ablation of a 10.7 cm hemangioma.

2 Case report

A 53-year-old female was admitted to our hospital because regular follow-up images showed an enlarging subcapsular hepatic hemangioma within the past 4 years. The tumor mass was not palpable by physical examination. Contrast-enhanced CT showed a typical hepatic hemangioma in the left medial lobe (10.7 cm×8.2 cm) (Figure 1A-1B). Laboratory examinations, including routine blood tests, biochemistry tests for liver, renal and coagulation function, and tumor markers did not show any abnormalities. Chest radiograph showed normal lungs and heart (Figure 2A). The patient has no history of hypertension, diabetes, heart disease and thyroid diseases.

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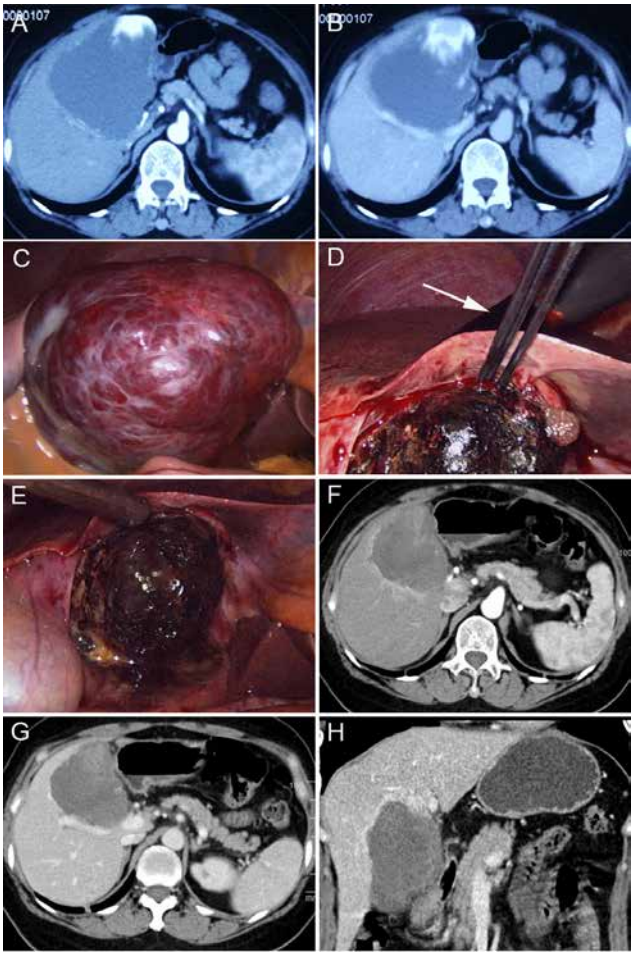

Figure 1: Contrast-enhanced-CT showed a 10.7-cm hepatic hemangioma in the left medial lobe, which is adjacent to the left portal vein and its branch (A and B). The laparoscopic view shows the tumor protrudes the surface of the liver (C). The tissue response to radiofrequency (RF) ablation was monitored by intraoperative US (arrow) (D). The lesion collapsed to a smaller mass after ablation (E).One month after RF ablation, CT scans showed that the hemangioma was completely ablated and remarkably smaller (F-H).

A consensus that laparoscopic RF ablation was the optimal therapy for the tumor was made by a multidisciplinary panel of experts in hepatobiliary tumor treatment. Two hepatobiliary surgeons performed the laparoscopic procedures. Briefly, the patient was placed supine on the surgical table. Under endotracheal inhalation anesthesia, a 10 mm incision was made at the umbilicus. Following a pneumoperitoneum at 14 mmHg, two additional trocars were placed under the direct laparoscopic vision. The laparoscopic exploration found an approximately 10.7 cm tumor mass bulging from the left medial lobe (Figure 1C). Another 10 mm subxiphoid port was created at the midline of abdomen. Under US guidance, the RF probe was introduced into the peritoneal cavity through the subcostal trocars under the direct laparoscopic vision and deployed into the tumor. A Cool-tip ACTC2025 electrode- an internally cooled cluster electrode, and a RF generator (Covidien Healthcare, Ireland) was used for the tumor coagulation. With a 2.5 cm exposed tip, the Cool-tip electrodes can produce ablation zones of 3.0 cm with one session of ablation at the maximum power of 200 W within about 3-5 min. The tissue impedance was continuously monitored by the monitor in the RF generator throughout the procedure and the power output was adjusted accordingly. The ablation procedures were previously described [5]. The tissue response to RF ablation was monitored by intraoperative US (Figure 1D). The sufficiently abated tumor tissue appeared as hyperechoicity due to the outgassing effect caused by heating in the tissue (Figure 1E). The coagulation time was 64 minutes and the total time of surgery was 105 minutes with 8 sessions of ablations in different locations of the tumor. The total blood loss throughout the treatment was 10 ml.

After returning to the ward, the patient was given hydration, low-flow oxiygen inhalation via the nasal catheter and vital signs were monitored. Four hours after the procedure, the patient developed dyspnea and wheezing with pink blood-tinged phlegm, fever with the temperature rising to 38.4°C and transient hemoglobinuria. The patient was tachypneic (22 breaths/minute), with a heart rate of 95 beats/minute, blood pressure of 90/60 mmHg, and oxygen saturation of 74 %. Laboratory examinations showed leukocytosis (WBC 14.5×10^9/L) and significant elevation of cTnI (3.42 ng/mL) and BNP (2470.5 pg/mL) levels. Blood cultures did not show signs of infection. A transthoracic echocardiogram demonstrated a depressed LV systolic function (ejection fraction = 53%) and multiple regional abnormal motions of heart (Table 1). Chest X-ray showed the butterfly sign of alveolar edema with cardiomegaly (Table 1) (Figure 2B). No arrhythmia was found by ECG. Therapy was initiated immediately to treat the acute heart failure and SIRS, including high flow oxygen inhalation by face mask, intravenous diuretics, I.V. methylprednisolone and short-term antibiotic coverage. The patient's clinical condition improved in 12 hours and radiographic appearance of pulmonary edema resolved (Figure 2C), but she continued to complain of shortness of breath along with hypotension. The transthoracic echocardiogram the next day post the RF ablation did not show regional motion abnormalities of LV with the estimated ejection fraction rising to 64%. A repeat transthoracic echocardiogram performed on day 3 demonstrated an ejection fraction of 61%. Seven days after ablation, the patient's cardiomegaly disappeared. The cTnI level was 0.10 ng/mL and BNP level was 270.0 pg/mL. A chest radiograph showed complete resolution of pulmonary edema without cardiomegaly (Figure 2D). The patient was discharged 9 days

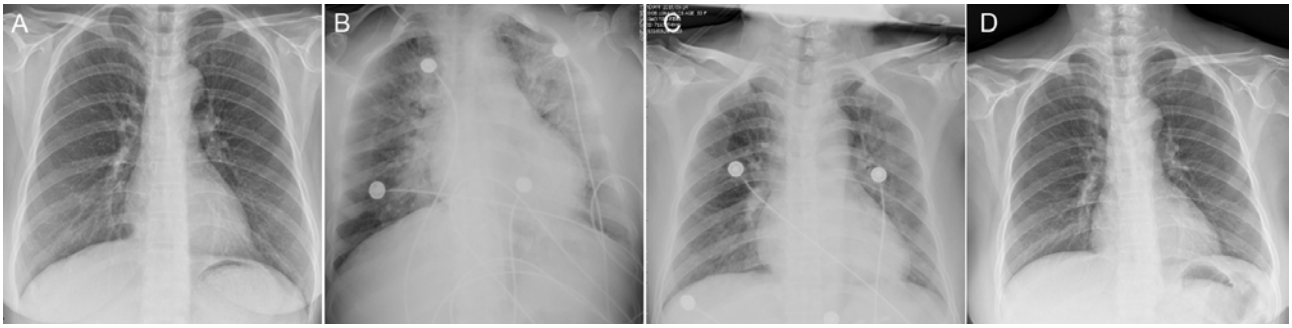

Figure 2: Chest radiograph shows the normal lung before ablation (A). Four hours after ablation, chest radiograph showed the butterfly sign of alveolar edema and cardiomegaly (B). One day after ablation, chest radiograph showed complete resolution of pulmonary edema, but still cardiomegaly (C). Seven days after ablation, chest radiograph showed complete resolution of pulmonary edema and normal heart (D).

Table 1: Patient Characteristics and Clinical Course before and after the Ablation Procedure

Variable	Before ablation	Four hours after ablation	One day after ablation	Two days after ablation	Three days after ablation	Seven days after ablation
Laboratory results						
WBC (4.0~10.0, ×109/L)	4.9	14.5	17.4	18.7	14.5	9.8
CRP (0.0~10.0, mg/L)	5.0	28.0	31.0	19.0	10.0	8.0
PCT (0.0~0.5, mg/mL)	---	0.05	0.04	0.05	0.05	---
cTnI (0.0~0.15, ng/mL)	---	3.42	2.86	1.34	0.38	0.10
BNP (0.0~250.0, pg/mL)	---	2470.5	3787.7	2377.2	2334.0	270.0
LDH (80.0~250.0, ng/mL)	172.7	550.1	756.0	568.8	446.3	242.6
ALT (4.0~40.0, U/L)	10.7	33.9	50.7	49.5	46.6	39.2
AST (4.0~40.0, U/L)	16.8	92.1	134.9	66.2	36.7	33.5
PO2 (83.0~108.0, mmHg)	90.0	74.0	97.1	---	---	---
PCO2 (35.0~45.0, mmHg)	40.0	41.3	36.6	---	---	---
Blood cultures	---	Negative	---	---	---	---
Chest X-ray	Normal	Bilateral edema Heart enlargement	Heart enlargement	---		Normal
Echocardiography						
LVEF（%）	62	53	45	64	61	---
Interventricular septum motion (mm)	10.2	9.0	4.1	8.6	10.3	---
Left ventricular posterior wall motion (mm)	7.3	12.2	9.1	9.1	9.1	---

after ablation without any symptoms and signs and was followed up for 6 months. One month after RF ablation, CT scans showed that the hemangioma was completely ablated and remarkably smaller (Figure 1F-1H).

Ethical approval: The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee.

Informed consent: Informed consent has been obtained from patient included in this study.

3 Discussion

Here, we report a female patient with acute onset of severe myocardial dysfunction after RF ablation for treating her huge hempatic hemangioma. The patient showed acute cardiogenic pulmonary edema and SIRS 4 hours after the procedure. The patient recovered with supportive therapy within 7 days after onset of symptoms.

The incidence of complications post RF ablation is closely associated with the size of hemangiomas and the ablation times [4-8]. Our team initially reported 17 huge hemangiomas ≥ 10 cm in 16 patients were treated with RF ablation using cluster electrodes, showing a high rate of complete ablation (82.4%, 14/17), but ablation-related com-

plications were seen in all 16 patients with hemangiomas ≥ 10 cm, including hemoglobinuria in 16 patients, SIRS in 10 patients, hemolytic jaundice in 9 patients, anemia in 6 patients, elevated serum transaminase in 6 patients, transient renal damage in 1 patient, lower esophageal fistula in 1 patient and acute respiratory distress syndrome in 1 patient[4]. In another study, we added two effective approaches to the RF ablation procedure while treating 21 large hemangiomas in 21 patients, with the expectation of lessening the incidence of complications and achieving a higher success rate, including the utilization of cool-tip cluster electrodes and the close monitoring of the patient's temperature and if the signs of hemoglobinuria, which is a necessary measure to warrant the immediate termination of the procedure if the temperature exceeds 39°C or signs, appeared. Complete ablation was achieved in 90.5% of hemangiomas (19/21) and ablation-related complications declined to 47.6% (10/21) (including hemoglobinuria in 10 patients, SIRS in 4 patients, hemolytic jaundice in 3 patients, anemia in 1 patient and elevated serum transaminase in 4 patients) [5].

This study presents a case of severe acute myocardial dysfunction shortly after RF ablation. Myocardial dysfunction is a common complication in patients with SIRS secondary to sepsis and is associated with an increased risk of mortality of up to 70–90% [10]. Systolic and diastolic myocardial dysfunction have been described in other scenarios of SIRS, such as severe trauma and burns [12-14]. Multiple studies in rodents and cardiomyocyte models confirmed that depressed cardiac contractility occurs almost immediately after burn injury, continues for approximately 36 hours, and resolves 72 hours post-injury if it was properly managed [12-14]. A rapid and robust inflammatory response triggers the onset of defects in left ventricular pressure and sarcomere shortening. Calcium dyshomeostasis and dysregulation of NO also contribute to the depression of cardiac contractility [13]. The clinical characteristics of this case are similar to the cardiovascular dysfunctions following burn injury. However, further research is needed to gain insight into the underlying mechanisms of massive RF ablation-induced myocardial dysfunction.

In conclusion, RF ablation of huge hepatic hemangiomas pose the risk of post-ablation myocardial dysfunction，which may be related to SIRS caused by massive tissue necrosis. With the awareness of this life-threatening complication and the appropriate treatment measures, this serious complication can be managed effectively. Pre-ablation TAE as an adjuvant therapy or multiple ablation sessions is recommended to prevent the risk of SIRS-related myocardial dysfunction.

Conflict of interest statement: Authors state no conflict of interest

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