An unusual cause of right ventricular wall rupture during radiofrequency ablation of hepatocellular carcinoma

Sir,

Radiofrequency ablation (RFA) is a relatively safe procedure for ablation of hepatocellular carcinoma (HCC) not mandating a surgical procedure with a reported complication rate of 2.0%–2.2% with mortality rates being in the range of 0.003%–0.11%.[1-3] Major complications that present as hypotension generally include pneumothorax, hemothorax, arrhythmia, and hemorrhage which may present as early as 20 min as with arrhythmias or as late as 12 h in case of hemoperitoneum.[4] Pericardial tamponade is an extremely rare complication of RFA, with only eight cases reported in the literature at the time of this writing. However, this case is the first to have a myocardial injury leading to massive cardiac tamponade unresponsive to nonoperative management requiring open thoracic surgery under cardiopulmonary bypass (CPB).

A 61-year-old male presented to us for monitored anesthesia care with ascites for 1 year and fatigability for 3 months

with alcoholic liver cirrhosis (Child–Turcotte–Pugh 8, Model for End-Stage Liver Disease 12) diagnosed a year back with portal hypertension with a regenerative nodule in Segment II of the liver. He was anti-hepatitis C virus positive, untreated in view of decompensated cirrhosis on regular follow-up at the liver clinic with surveillance imaging. He had no other comorbid illness, except for opioid addiction. He was started on sofosbuvir and ribavirin once HCC was diagnosed in Segment II and VII by a dynamic magnetic resonance imaging and a plan for RFA was made.

The patient was taken up for RFA under local anesthesia and ultrasound guidance with monitored anesthesia care involving a radial artery catheter for intra-arterial pressure monitoring in view of his decreased effort tolerance and to look for sudden hypotension in case of inadvertent intravascular local anesthetic or any of the above causes of hypotension listed above. During ablation of Segment II, there was sudden unexplained hypotension, the procedure was abandoned, and noradrenaline infusion and fluid boluses were administered to maintain perfusion pressure and intravascular volume while an ultrasound on the lines of extended focused abdominal sonography for trauma revealed a large pericardial effusion that was immediately drained via a catheter inserted via subxiphoid approach by the on-call cardiologist under fluoroscopic guidance, draining 450 ml of hemorrhagic fluid. Hemodynamics stabilized after this drainage, and the patient was closely monitored to look for recurrent hypotension in case the hemorrhagic pericardial effusion was not reactive. Hypotension occurred again 15 min later which temporarily improved on draining further 300 ml of hemorrhagic pericardial fluid. Noradrenaline infusion was continued and 2 units of packed red blood cells was transfused. Computed tomographic (CT) angiography revealed no vascular injury. A plan was made to shift the patient to the operating room due to recurring hypotension, and hence, he was electively intubated and immediately shifted via ambulance to the cardiothoracic operating room where emergency sternotomy was performed. Under CPB, pericardial exploration revealed 1 L of blood and a burnt open diaphragmatic pericardial rent with a right ventricular tear of 1 cm × 1 cm [Figure 1a and b], all of which were repaired and appropriate drains placed. The patient was then taken off CPB with inotropic support of milrinone and noradrenaline infusions. He was shifted to the Liver Intensive Care Unit where progressive improvement was noted in the following month; he spent before getting discharged albeit with a decreased effort tolerance.

The principle of RFA involves flow of alternating current through tissues where ionic agitation and resistive heating of

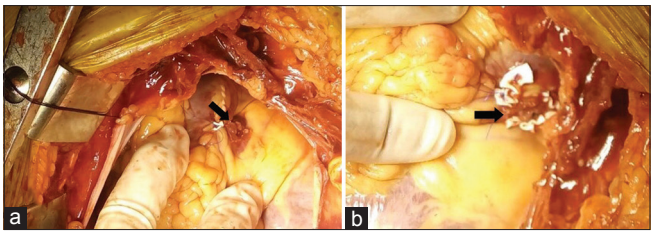

Figure 1: Sternotomy and pericardium exposed revealing (a) 1 cm × 1 cm rent in free wall of right ventricle (black arrow), (b) completed repair of the same rent (black arrow)

tissues occurs which causes irreversible coagulative necrosis of the target tissue. RFA has been shown to be effective for early HCC.[5] Major complications after RFA include, in decreasing frequency, tumor seeding, liver abscess, hemorrhage, pleural effusion, hepatic infarction, bronchobiliary fistula, pneumothorax, hemothorax, bile peritonitis, and bowel penetration.[6] Six of the reported eight cases survived with all of the six requiring only conservative management, and among those who had death as the outcome, one of them needed a sternotomy while the other had been on conservative management.[7-13] A similar case following laser thermal ablation (LTA) has also been recently reported where the patient developed hemorrhagic cardiac tamponade after LTA of a colorectal metastasis in Segment II of the liver due to unpredictable heat diffusion causing indirect thermal injury to the pericardium with resultant hemorrhagic reaction was hypothesized as the most likely cause of tamponade.[14] The patient responded to conservative management as there was no charring of diaphragm or any myocardial wall disruption. None of these patients however had a right ventricular wall rupture which is unique to this case. Most of the hemorrhagic pericardial effusions during RFA are reactive and resolve on conservative management not requiring more than a single drainage, and reaccumulation is usually slow. Hence, hemorrhagic pericardial tamponade requiring frequent drainage during RFA of HCC should make one suspect myocardial injury, especially in the absence of any major vascular injury as in our case. Such collateral damage during RFA may be prevented by color Doppler/CT-guided procedure, laparoscopic RFA, RFA during open surgery, use of angioplasty balloon catheter and creating an artificial pneumoperitoneum.

The presence of the intra-arterial pressure monitoring in this particular case enabled the early diagnosis of hypotension and decreased intravascular volume which was reflected as increase in the systolic pressure variation. A rapid cardiac ultrasound enabled the diagnosis of hemorrhagic pericardial effusion early, thus enabling immediate management and patient survival. This particular case report illustrates the importance of monitored anesthesia care, point-of-care technology, and a team approach in the management of such

patients, especially those with tumors near the diaphragm as with Segment II of the liver in this case.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

Sameer Sethi, Asish Kumar Sahoo, Venkata Ganesh, Chetna Trehan[1]

Department of Anesthesia and Intensive Care, Post Graduate Institute of Medical Education and Research(PGIMER), Chandigarh, [1]Department of Gynecology, Grecian Multispeciality Hospital, Mohali, Punjab, India

Address for correspondence:
Dr. Sameer Sethi,
Department of Anesthesia, Postgraduate Institute of Medical Education and Research, Sector 12, Chandigarh - 160 012, India.
E-mail: sameersethi29@gmail.com

References

1. Shiina S, Tateishi R, Arano T, Uchino K, Enooku K, Nakagawa H, *et al.* Radiofrequency ablation for hepatocellular carcinoma: 10-year outcome and prognostic factors. Am J Gastroenterol 2012;107:569-77.
2. Lee DH, Lee JM, Lee JY, Kim SH, Yoon JH, Kim YJ, *et al.* Radiofrequency ablation of hepatocellular carcinoma as first-line treatment: Long-term results and prognostic factors in 162 patients with cirrhosis. Radiology 2014;270:900-9.
3. Rhim H, Yoon KH, Lee JM, Cho Y, Cho JS, Kim SH, *et al.* Major complications after radio-frequency thermal ablation of hepatic tumors: Spectrum of imaging findings. Radiographics 2003;23:123-34.
4. Poggi G, Riccardi A, Quaretti P, Teragni C, Delmonte A, Amatu A, *et al.* Complications of percutaneous radiofrequency thermal ablation of primary and secondary lesions of the liver. Anticancer Res 2007;27:2911-6.
5. Rhim H, Lim HK, Choi D. Current status of radiofrequency ablation of hepatocellular carcinoma. World J Gastrointest Surg 2010;2:128-36.
6. Curley SA, Marra P, Beaty K, Ellis LM, Vauthey JN, Abdalla EK, *et al.* Early and late complications after radiofrequency ablation of malignant liver tumors in 608 patients. Ann Surg 2004;239:450-8.
7. Moumouh A, Hannequin J, Chagneau C, Rayeh F, Jeanny A, Weber-Holtzscherer A, *et al.* A tamponade leading to death after radiofrequency ablation of hepatocellular carcinoma. Eur Radiol 2005;15:234-7.
8. Gao J, Sun W, Tong Z, Ke S. Successful rescue of acute hemorrhagic cardiac tamponade in patients with hepatocellular carcinoma during percutaneous radiofrequency ablation. Chin Med J 2010;123:1470-2. Available from: http://www. 124.205.33.103:81/ch/reader/view_abstract.aspx?file_no=CMJ20092110&flag=1. [Last accessed on 2017 Apr 23].
9. Loh KB, Bux SI, Abdullah BJ, Raja Mokhtar RA, Mohamed R. Hemorrhagic cardiac tamponade: Rare complication of radiofrequency ablation of hepatocellular carcinoma. Korean J Radiol 2012;13:643-7.
10. Chun JY, Ho CS. Management of pericardial effusion following cardiac perforation during radiofrequency ablation of hepatocellular carcinoma. Semin Intervent Radiol 2014;31:101-3.
11. Zhang Z, Zhuang Z, Xu Z, Mei Q, Ma K, Li X, *et al.* Post-operative pericardial effusion following treatment of small hepatocellular carcinoma with radiofrequency ablation: A case report. Oncol Lett 2014;7:345-8.
12. Chan S, Hung M, Yang N, Yen C. Occurrence of acute hemorrhagic cardiac tamponade during percutaneous radiofrequency ablation of hepatocellular carcinoma. J Radiol Sci 2013;38:93-6. Available from: http://www.rsroc.org.tw/db/jrs/article/v38/n3/380303.pdf. [Last accessed on 2017 Apr 23].
13. Silverman ER, Lai YH, Osborn IP, Yudkowitz FS. Percutaneous radiofrequency ablation of hepatocellular lesions in segment II of the liver: A risk factor for cardiac tamponade. J Clin Anesth 2013;25:587-90.
14. Tombesi P, Di Vece F, Rinaldi S, Bertini M, Sartori S. Hemorrhagic cardiac tamponade after percutaneous laser ablation of a liver metastasis in segment II. Hepatoma Res 2016;2:193.

Access this article online	
Website: www.saudija.org	Quick Response Code
DOI: 10.4103/sja.SJA_731_17	

How to cite this article: Sethi S, Sahoo AK, Ganesh V, Trehan C. An unusual cause of right ventricular wall rupture during radiofrequency ablation of hepatocellular carcinoma. Saudi J Anaesth 2018;12:492-4.