Case Report

Perioperative anesthetic management of a combined right atrial thrombectomy with living donor liver transplantation

Rajkumar Subramanian, Shweta A. Singh, Subhash Gupta[1], Sanjoy Kumar Majhi[2], Rajneesh Malhotra[3]

Departments of Anesthesiology and [1]Surgery, Center for Liver and Biliary Sciences, Max Super Speciality Hospital, Departments of [2]Cardiac Anaesthesia and [3]Cardiothoracic and Vascular Surgery (CTVS), Max Super Speciality Hospital, Saket, New Delhi, India

Abstract

Hepatocellular carcinoma (HCC) with vascular invasion is usually considered inoperable. We describe a case of HCC with vascular invasion and right atrial thrombus that was successfully down staged. Patient underwent combined right atrial thrombectomy and living donor liver transplantation (LDLT) in the same setting. Perioperative anesthesia management and perioperative concerns of two major combined procedures are discussed.

Keywords: Cardio pulmonary bypass, combined right atrial thrombectomy and LDLT, hepato cellular carcinoma and transplant, minimally invasive cardiac surgery

Introduction

Hepatocellular carcinoma (HCC) is the commonest primary liver malignancy in India with an age adjusted incidence ranging between 0.2% and 7.5% per 100,000 population per year.[1,2] Here, we report the perioperative anesthetic management of a patient of HCC with vascular invasion and right atrial thrombus.

Case Report

A 30-year-old male, diagnosed with hepatitis C virus-related cirrhosis with diffuse HCC and vascular invasion was referred to our center with complaints of pedal edema, abdominal distension, and occasional palpitation. His imaging studies showed vascular invasion to left and middle hepatic veins, Inferior vena cava and right atrium (RA). His Model for End Stage Liver Disease score was 28 with modified Child–Turcotte–Pugh status A. On examination, he was well nourished, with stable vitals, with good cardiorespiratory reserve, and a room air saturation of 98%. His preoperative investigations are shown in Table 1.

Patient and their relatives were counseled about the risk of deterioration associated with tumor downstaging as well as high chances of tumor recurrence following transplantation. Tumor was downstaged using transarterial chemoembolization followed by external beam radiotherapy, which the patient tolerated well. A multidisciplinary team discussed the case and it was decided to proceed with living donor liver transplantation (LDLT) with vascular and atrial thrombectomy using minimally invasive cardiac surgery (MICS).

Standard fasting orders were placed and blood products were arranged as per protocol. Anesthesia was induced with 200 μg of fentanyl, etomidate 12 mg, and rocuronium of 50 mg. Trachea was intubated with 8 mm cuffed orotracheal tube. Anesthesia was further maintained with oxygen, air, and

Address for correspondence: Dr. Shweta A. Singh, Department of Anesthesiology, Centre for Liver and Biliary Sciences, Max Super Speciality Hospital, Saket, New Delhi - 110 017, India.
E-mail: drshwetasingh29@gmail.com

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isoflurane (MAC 0.8). Fentanyl infusion at 1 μg/kg/hour and atracurium infusion at 0.5 mg/kg/hour were started. After excluding peritoneal metastasis with staging laparoscopy left femoral artery and left radial artery were cannulated for monitoring invasive blood pressure. Cardiac output, stroke volume variation (SVV), and systemic vascular resistance measurement was initiated using FloTrac [EV1000 Clinical Platform, 2010 Edwards Lifesciences, USA] based on arterial pulse contour assessment. Under ultrasound (USG) guidance, a nine FRench (FR) advanced venous access and seven FR triple lumen catheter were inserted in left internal jugular vein for connecting rapid transfuser system, infusing vasopressors and to monitor central venous pressure, respectively.

Table 1: Preoperative investigations

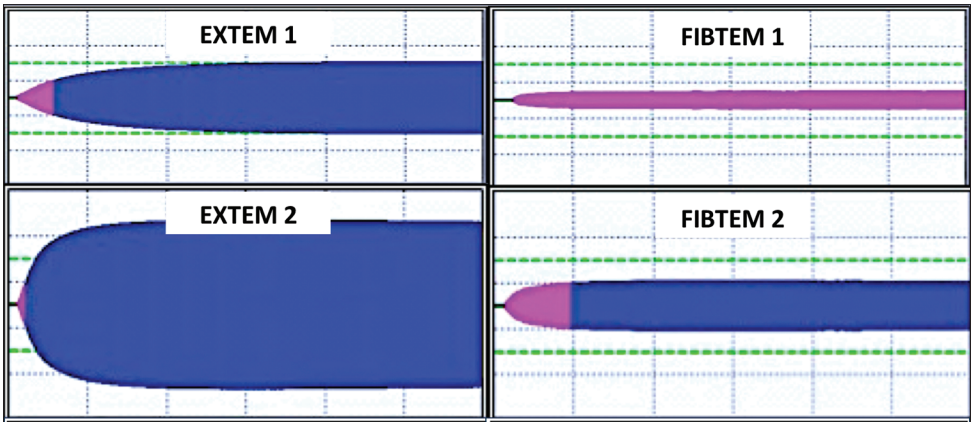
Hemoglobin: 10.1 gm/dl	Echocardiography: 1.9 * 2.1cm mass in RA
Platelet: 130*103/microliter	Pulmonary artery systolic pressure - 27 mm Hg,
Serum Creatinine: 0.7 mg/dl	Ejection fraction 60%
Sodium: 134 meq/liter	Normal valves & chambers
Bilirubin: 1.4 milligram/dl	Cardiac Magnetic Resonance Imaging:
Albumin: 1.9 gram/dl	Well defined mass in RA with tumor abutting inter atrial septum
INR: 1.3	Trans Esophageal Echocardiography:
Fibrinogen: 156mg/dl	Large heterogeneous mass 3.7* 2.8 cms mass from inferior vena cava/RA junction and extending into RA. Turbulence across tricuspid valve noted.
FDP:>20	
D - Dimer: 1940	

dl=Deciliter, INR=International Normalized Ratio, FDP=Fibrin Degradation Products, RA=Right atrium, Cm=Centimeter, mmHg=Millimeters of mercury

Venous cannulas were placed in the superior vena cava (SVC) and right femoral artery and vein after administering 100 U/Kg of heparin IV. Transesophageal echocardiography (TEE) at this stage confirmed extent of thrombus and cardiopulmonary bypass (CPB) cannula placement. An oropharyngeal temperature probe was used as per protocol. After the surgical incision for MICS was placed, CPB was initiated using two units of packed red blood cells and the patient was cooled to 24°C. Intraoperatively ACT and rotational thromboelastometry (ROTEM) done at various time points to guide heparin, protamine administration, and transfusion of blood products. Figure 1 shows ROTEM at baseline (A&B) and after fresh frozen plasma correction of coagulopathy (C&D).

At the end of cardiac surgery, following TEE assessment of total thrombectomy patient was weaned off CPB. The patient was in sinus rhythm with epinephrine 0.03 mcg/Kg/minute infusion and no regional wall motion abnormality on TEE. Femoral cannulas were removed surgically and vascular repair done before administering protamine. The SVC cannula was decannulated after protamine infusion and firm pressure applied over the cannulation site for 30 minutes. The patient was positioned for LDLT and a Modified Mercedes Benz incision made in the abdomen.

Arterial blood gases were done intermittently to assess and correct acidosis, electrolyte imbalance, abnormal blood glucose, and anemia. Fluid therapy was based on hemodynamics,



EXTEM			
	EXTEM 1	EXTEM 2	Reference
CT (sec)	76	78	36 -79
CFT (sec)	296	64	34 – 159
α angle	46	77	63 -83
A10 (mm)	29	67	43 -65
A20 (mm)	37	73	50 -71
MCF (mm)	41	74	50 -72

FIBTEM			
	FIBTEM 1	FIBTEM 2	Reference
CT (sec)	165	93	n.d
CFT (sec)	-	530	n.d
α angle	-	62	n.d
A10 (mm)	9	20	7 -23
A20 (mm)	9	22	8 -24
MCF (mm)	9	22	9 -25

Figure 1: EXTEM (ROTEM channel for extrinsic pathway assessment using Tissue Factor as activator in EXTEM) and FIBTEM (ROTEM channel for checking fibrinogen deficiency and platelet dysfunction using Cytochalasin D) traces before and after coagulopathy correction

SVV, and hourly urine output. 5 L of ascitic fluid drained initially was gradually replaced with 10 cc of 20% albumin IV infusion. A total of 5% dextrose was used to maintain blood sugar levels. Balanced salt solution was used as maintenance fluid. Additional fluid boluses were administered when SVV exceeded 10. Titrated infusions of noradrenaline, vasopressin, and phenylephrine were used to maintain a mean blood pressur of 65–70 mm Hg and SVR in the range of 800–1200. An adequate urine output of >0.5 mL/Kg/hour was ensured. Total transfusions, intravenous fluids, and urine output are described in Table 2.

The total anhepatic time was 87 minutes, with cold and warm ischemia time of 57 and 18 minutes, respectively. A standard right lobe graft of 892 gm was harvested and implanted in the recipient. Methylprednisolone 500 mg was administered during anhepatic phase. After a smooth reperfusion following anastomoses of graft and recipient hepatic veins and portal vein, hepatic artery and bile duct were anastomosed.

After the 12 hours of extensive surgery, the patient was electively sedated and ventilated. Blood gases, electrolytes, and urine output were monitored and managed. Fluids were administered depending upon drain output, serum lactate. and SVV. Vasopressors were gradually weaned off. Following normalization of lactates and confirming good portal flow on Doppler, trachea was extubated. Passive and active chest and limb physiotherapy was instituted and immunosuppression continued. By third postoperative day (POD) antibiotics were deescalated, invasive lines removed, liquid diet was started and patient mobilized.

On POD4, patient developed paroxysmal atrial fibrillation with fast ventricular rate which was managed with intravaneous (IV) amiodarone bolus followed by infusion and transthoracic echocardiography (TEE) to rule out Right Atrial (RA) thrombus. Injection clexane was started for thromboprophylaxis at 60 mg subcutaneous BD. After 24 hours of amiodarone infusion and restoration of sinus rhythm oral amiodarone was started. Rest of intensive care unit (ICU) and hospital stay was uneventful. Patient was discharged on POD28 with instructions to continue standard immunosuppression and 3 monthly follow-up with serial alpha fetoprotein levels, abdominal USG, and whole body positron emission tomography (PET) scan.

Table 2: Total Infusions and output during LDLT

	Dissection phase (180 min)	Anhepatic phase (87 min)	Neohepatic phase (168 min)
Packed Red blood cells	2	4	1
Fresh frozen plasma	4	-	2
Cryoprecipitate	-	-	4
Crystalloids	2 L	500 mL	500 mL
Urine output	175 mL	125 mL	250 mL

Total amount of fluids and transfusions along with urine output with respect to various phases of LDLT

Histopathology of explanted cirrhotic liver reported complete necrotic tumor emboli in hepatic veins. Specimen from RA thrombus showed an organizing thrombus without any viable tumor cells. After 1 year follow-up, patient showed no tumor recurrence.

Discussion

HCC in our patient was beyond Milan criteria but since the vascular thrombus was bland and nonexpansile without any contrast enhancement or neo vascularization, we decided to proceed with combined right atrial thrombectomy and LT.

Conventionally, a combined procedure requires adequate exposure through sternotomy and laparotomy. The "one - exposure technique" is also been described wherein the sternotomy incision is extended laterally on both subcostal lines. However, large incisions increase bleeding, wound infection, wound dehiscence, and postoperative pain; thereby delaying rehabilitation. To avoid these, MICS was planned to access right atrial thrombus.[3] MICS usually requires one lung ventilation (OLV). In order to avoid excessive airway manipulation, intraoperative change of endotracheal tube, atelectasis associated with OLV which would further increase the chances of postoperative pulmonary complications,[4] MICS was done without OLV.

Combined cardiac surgery with LT is known to increase the risk of fibrinolysis[5] due to use of extracorporeal circuits like Extracorporeal membrane oxygenation (ECMO) and cardiopulmonary bypass (CPB) and prolonged ischemia time. Use of CPB during combined cardiac and liver transplant is known to reduce stress on the new heart during hepatic reperfusion. But prolonged use of CPB increases the risk of coagulopathy and systemic inflammatory response as well. In a coagulopathic patient with liver failure this was an added concern. However, transfusion of blood products was guided by ROTEM which helps detect fibrinolysis.

Intraoperative arrhythmias are common in LT due to metabolic changes and electrolyte imbalances. Commonest causes being hypocalcemia due to increased citrate load, hyperkalemia and acidosis which builds up in the anhepatic period. Arrhythmias can occur frequently following cardiac surgery due to mechanical disruption of conduction pathways in an irritable myocardium. Vigilant monitoring, aggressive electrolyte correction, and timely thromboprophylaxis are required to prevent cardiac and thromboembolic events.

Development of acute kidney injury (AKI) postoperatively is another commonly reported cause of morbidity after a combined procedure possibly due to massive fluid shifts, hypovolemia, multiple transfusions, CPB-induced hypoperfusion, and complete crossclamping of IVC. Judicious fluid management, avoidance of nephrotoxic drugs, limited use of CPB, avoiding a complete crossclamping of IVC and use of piggyback technique during anastomosis of vessels prevented AKI in our patient.

Conclusion

In our patient with advanced HCC with vascular invasion, tumor downstaging followed by LDLT offered the best chance of survival. Combined LT with cardiac surgery is challenging but a well-planned combined procedure ensured a good outcome in a patient who could not undergo a staged procedure due to extensive thrombus.

Patient consent has been taken to publish details of his case history and management for academic purpose.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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