Cardiopulmonary resuscitation in undiagnosed situs inversus totalis in emergency department: An intensivist challenge

Sukhen Samanta, Sujay Samanta, Tanmoy Ghatak
Department of Critical Care Medicine, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, Uttar Pradesh, 1Department of Anesthesia and Intensive Care, Post Graduate Institute of Medical Education and Research, Chandigarh, India

ABSTRACT
Situs inversus totalis is a rare congenital condition. A 34-year-old woman with undiagnosed situs inversus was referred to our emergency department with cardiac arrested state. She underwent cardiopulmonary resuscitation (CPR) and defibrillation with a modified approach. We faced different challenging aspects during intensive care management. Ultrasonography in CPR in our patient was very helpful. We restricted our discussion on special aspect of SIT in emergency and intensive care unit.

Key words: Cardiopulmonary resuscitation, defibrillation, situs inversus totalis

Address for correspondence:
Dr. Sukhen Samanta,
New PG Hostel, Room No. 218,
Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow - 226 014,
Uttar Pradesh, India.
E-mail: dr.sukhensamanta@gmail.com

INTRODUCTION
Situs inversus totalis (SIT) is an uncommon congenital anomaly characterized by transposition of abdominal viscera with a right sided heart (dextrocardia). Its incidence is 2 in 10,000 among the general population with unknown etiology (probably due to clockwise rotation).[1] SIT is commonly associated with Kartagener's syndrome.[2] Major changes in cardiopulmonary resuscitation (CPR) recommendation published in latest CPR guideline (2010) emphasized on early (before rescue breathing) and high-quality chest compressions with minimum interruption followed by rapid defibrillation. They also described CPR in special situations but did not mention CPR in situs inversus or dextrocardia situation.[3] We faced a hypoxic cardiac arrest in an undiagnosed SIT with severe pancreatitis (diagnosed latter on) in emergency department (ED). We successfully revived the patient. With best of our knowledge, no one has reported CPR and intensive care unit (ICU) challenges in this group of patients. After taking consent from the patient we decided to report the case.

CASE REPORT
A 34-year-old woman presented in our ED with chief complaints of severe acute epigastric pain referred to back, vomiting, and sudden onset breathlessness followed by Type I respiratory failure (arterial blood gas report). Somehow, intubation was delayed and she developed hypoxic cardiac arrest. Immediate critical care help was asked. After receiving initial 5 cycles of CPR she was intubated and mechanically ventilated with 100% oxygen and tidal volume and respiratory rate being 450 ml and 10, respectively. Adequate depth chest compression with full recoil and at a rate of hundred was performed at typically described on sternal position. Her carotid pulse was feeble and non-sustainable. ECG in monitor showed ventricular fibrillation (VF). 200 J Direct current (DC) shock was given in the conventional apex-axial position (left antero-lateral) after 5 cycles of CPR. But even after DC shock, rhythm was not reverted into sinus. ABG showed severe acidosis
with mild hyperkalemia. Intravenous adrenaline (ADR) 1 mg and sodium bicarbonate (8.4%) correction were given. Repeat DC shock after 1 minute of CPR and ADR failed to revert into sinus rhythm and no return of spontaneous circulation (ROSC). Then one intensivist continued CPR and other quick screened precordial with echocardiography (MicroMaxx Sonosite, Gurgaon, India) to see cardiac contractility if any. Intensivist found no heart chamber view in parasternal long axis, short axis, apical four chamber, and subcostal view as in all conventional site and surprisingly heart chamber was found visible in right side of the chest (CPR was stopped for few seconds only). We started CPR with slight modification. We place the heel of right hand on the right sternal margin (lower half of the sternum) and left heel of the other hand on top of the first (right handed) and tried to depress it 5 cm with each compression and allowing adequate chest wall relaxation. After 5 cycle effective CPR, we delivered DC shock again. During defibrillation, sternal paddle was on the right sterna margin and the apex paddle was under right breast tissue (right antero-lateral). This time rhythm reverted to sinus after defibrillation with 200 J (biphasic). We continued CPR for another few minutes and ultimately ROSC was achieved. ADR 0.1-0.5 mcg/kg/min was continued as infusion in titration. ROSC time was 8 minutes. She was shifted in ICU. Invasive monitoring lines were inserted under ultrasonography (USG) vision. There were no other features suggestive of Kartagener syndrome in this patient or any congenital anomaly except this situs inversus and also had no other congenital structural heart disease. She was managed in ICU with mechanical ventilation, antibiotics, renal replacement therapy, and enteral-parenteral nutrition. Detailed radiological and cardiological evaluation and consultation were taken. Her brain MRI study was normal. Echocardiography (Echo) shown improved ejection fraction. Her pancreatitis required 40 days to resolve without any surgical intervention. She was then extubated uneventfully with intact neurological status and discharged from hospital next 5 days.

**DISCUSSION**

Dextrocardia with complete situs inversus is associated with lower rate of congenital heart disease in comparison to incomplete situs inversus but it may be associated with cardiac anomalies like transposition of the great arteries, double outlet right ventricle, ventricular septal defect, atrial septal defect, absent coronary sinus, single ventricle, total anomalous pulmonary venous connection, and pulmonary artresia. So, a detailed Echo study is essential. CT scan is best for thoracic and abdominal organ anomaly detection [Figures 1 and 2]. USG is a useful tool in bed side screening. It is helpful in detecting undiagnosed gross anomaly quickly. The diagnostic features in plain chest X-ray include dextrocardia, stomach bubble in right side, and liver shadow on the left side. Prolonged paralysis is reported with succinyl choline in SIT, so preferably avoid it. SIT in Kartagener syndrome is associated with ciliary motility dysfunction (dynesin defect) and airway anomalies cause difficult laryngoscopy and intubation. Repeated lung infection with purulent secretion in lung is also reported with bronchiectatic changes. Bronchospasm is very common requiring bronchodilators, steroids, and antibiotics. Chest physiotherapy, postural drainage, and incentive spirometry are also helpful. Correct ECG electrodes placement is important in the case of SIT [Figure 3]. It should be in the opposite direction to the conventional leads position. In our case, ECG demonstrated sinus rhythm with inversion of P wave in lead I with Q wave and inverted T wave as described in situs inversus. All the invasive lines like central venous cannulation, arterial cannulation in major artery, pulmonary artery catheter insertion should always be under USG guided. Small air with saline injection through central venous cannulation help in detecting internal jugular or subclavian vein draining into right atrium or not. Heat moist exchanger...
or heated humidifier is essential in mucociliary dysfunction. In significant cardiac arrhythmias (unstable hemodynamics) and cardiac arrest, DC shock should be applied with defibrillator paddle on the right side. CPR 2010 guideline described defibrillator pad/paddles positions (anterolateral, anteroposterior, anterior-left infrascapular, and anterior-right infrascapular). They also highlighted that all the position are equally effective to treat ventricular or supraventricular arrhythmias. But in our case, left anterolateral was totally ineffective as heart axis was in the opposite direction and no electrical stimulation to the heart. For this reason, we went for right anterolateral approach.

Effective chest compression required a slightly rightward approach. Intravenous ADR injection in a systole during CPR is recommended, but also useful in VF as ADR convert fine VF into coarse VF. This course VF is better respond to defibrillation. If Echo/USG is available they may be used for few seconds to exclude anatomical cause in a situation of proper CPR with ineffective outcomes. Don’t fear regarding interruption in CPR during echocardiography as it may save your ineffective CPR time and help in early ROSC. Here, USG/Echo have roll in ineffective RSOC in high-quality CPR. Moreover, it is very easy and doesn’t require advanced skill.

**CONCLUSION**

We diagnosed a SIT in cardiac arrest condition, performed high quality CPR, and managed in ICU with positive outcome. To the best of our knowledge, this is the first report of CPR in SIT. We did slight modification in the CPR technique and emphasizing on USG in this situation. So, an approach to a patient with diagnosed or undiagnosed SIT is a challenging job for intensivist in view of resuscitation and intensive care management.

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