Case Report

Emergency chest exploration and repair of the right internal jugular vein during Extracorporeal Membrane Oxygenator institution

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Running title:
Sternotomy for ECMO induced vascular injury.

Abstract:
A 38-year-old female with severe septic shock and multiorgan failure secondary to MDR-ESBL E. coli secondary to septic abortion. She had a miscarriage at 22 weeks of gestation after IVF pregnancy, complicated by cervical tear, developed ARDS, required ventilation, ECMO and CRRT. She had an ECMO cannula induced tear in the right internal jugular vein 1 cm before joining the subclavian vein to form the innominate vein. She had a cardiac arrest after extracorporeal membrane oxygenation (ECMO) institution, required resuscitation. The iatrogenic Rt Internal jugular vein tear was managed in the cardiac operating room. She was well managed by a multidisciplinary team in the ICU and after a prolonged ICU stay, she was discharged to home.

Key Words:
Extracorporeal Membrane Oxygenator (ECMO); Transvaginal ultrasound scan (TCS); In vitro fertilization (IVF); intrauterine fetal death (IUFD); cervical stitch for cervical incompetence (Cervical Cerclage).

Background:
Extracorporeal membrane oxygenation (ECMO) therapy has shown promising results for patients with severe respiratory failure unresponsive to conventional mechanical ventilation. ECMO is indicated in severe and refractory ARDS in association with the protective strategy. Cardiac or major vascular perforation is a rare but known complication associated with extracorporeal membrane oxygenation (ECMO). Reports of vascular or cardiac perforations during cannulation are sporadic and have included injury to the SVC, RA and right ventricle. The historical rate of hemorrhagic pericardial tamponade for respiratory ECMO in the ELSO registry is 0.53%. The high level of suspicion to detect and treat vascular complications at the right moment to avoid fatal results is crucial. We present a rare case of right internal jugular venous

injury induced by extracorporeal membrane oxygenation (ECMO) cannulation for management of the adult respiratory syndrome (ARDS), post septic abortion.

Case Report:

A 38-year-old lady transferred to our hospital with severe septic shock and multi-organ failure secondary to septic abortion. She had IVF pregnancy, Gestational age 22 weeks, on her follow up appointment, accidently during TVS; cervix was found dilated, with no labour pains and good fetal movement.

The patient had an emergency cervical circlage and discharged. The next day, she started vaginal bleeding with abdominal pain and fever. Ultrasound confirmed IUFD and in a few minutes she aborted. In the operative room bilateral cervical tears were found and repaired.

Later on, the patient developed (ARDS) adult respiratory distress syndrome Fig 1 and (MOF) multiple organ failures. She was transferred to our hospital with Septic Shock, DIC, ARDS and MOF. She was mechanically ventilated with ARDS protocol, high inotropic supports and CRRT was commenced as well.

TTE done showed good bi-ventricular systolic function. There was no pericardial effusion. Despite all efforts, she was unable to maintain adequate oxygenation. She had Murray score more than 3, PaO2/FIO2 91mm Hg, severe hypercapnia with PaCO2 >74 mm Hg and PH 7.14. Proper written consent was taken and bedside VV-ECMO was planned Fig 2. Using the Seldinger technique; the left femoral vein and right internal jugular vein were cannulated. After about 2 minutes of the institution of ECMO, the patient had a cardiac arrest that was revived by successful cardiopulmonary resuscitation. ECMO was stopped immediately. Immediate bedside USG revealed massive right haemothorax and pericardial effusion. The patient was unstable, requiring high inotropes. After consultation with the cardiac surgery team, the patient was transported to the cardiac operative room for emergency surgical exploration because of pericardial effusion.

Emergency sternotomy was performed; mediastinum and pleural cavities were explored. There were large pericardial effusion, large hematoma in the mediastinum and right Pleural cavity with full of blood. Heart & great vessels were intact and there was no active bleeding site. Intraoperative Cini revealed the catheter in the upper part of the chest; however, the contrast did not visualize the site of the injury. Therefore, it was decided to explore the right internal jugular vein through extension to the right supraclavicular incision. Upon exploration of the right internal jugular vein, the catheter was removed then there was massive bleeding coming from the posterior aspect of right internal jugular vein 1 cm before joining the subclavian vein to form the innominate vein that was primarily repaired using 4-0 Prolene, by Vascular surgeon. As the patient needed ECMO, new cannula was inserted in the right femoral vein and VV-ECMO

was instituted. Closure was done as standard and was shifted to Cardiac ICU with inotropic support and VV-ECMO.

The patient was managed in the ICU with the involvement of multiple departments, according to her ongoing multiple problems. She was successfully weaned from VV-ECMO on postoperative day 7, extubated on the postoperative day 13 and was discharged to home on the postoperative day 63.
She was under rehabilitation department services for her weakness which improved gradually. On her follow up visit, TTE revealed normal biventricular functions with LVEF around 54.1 % and no regional wall motion abnormalities. There were neither pericardial nor pleural effusions. Now she is fully independent, walking and caring a normal functional life.

Discussion:

The first description of successful extracorporeal membrane oxygenation (ECMO) was reported by HILL and colleagues in 1972[1]. VV-ECMO is indicated for adult respiratory distress syndrome, pneumonia, trauma and post lung transplantation as a bridge to recovery [2]. It is achieved by peripheral cannulation of the femoral vein as outflow and the jugular vein as inflow.
Although ECMO is a life-saving treatment modality, correct positioning of cannulas during placement of VV-ECMO is crucial for avoiding complications and to ensure effective oxygenation[3]. Vascular complications are the major cause of morbidity and mortality in ECMO patients. These complications include limb ischemia, dissection, pseudo aneurysm formation, groin infection and bleeding[4]. Injury usually occurs during initial placement or at time or removal of cannulas. Such vascular injuries can be suspected with hemodynamic changes or decrease in hemoglobin level and be confirmed on imaging. TEE can be an effective modality in confirming proper positioning of cannulas as most patients requiring VV-ECMO are not suitable for transportation to a catheterization or interventional radiology laboratory. Fluoroscopy guidance may however, provide better confirmation[5].
In our patient, the vascular complication was quickly recognized as a new pericardial effusion with massive pleural effusion and emergent sternotomy vs thoracotomy was planned. However, median sternotomy by cardiac surgery was achieved for better exposure, to detect unknown cause of pericardial effusion and to manage any possible injury of SVC, RA or IVC. Apart from this, decision for extension in the neck was promptly decided, when no intrapericardial injury was found and fluoroscopy revealed injury to neck vessel. The iatrogenic right internal jugular vein injury was small, so primary repair was done by vascular team. This patient was perfectly managed by multi-departments accordingly and after a prolonged stay, she was discharged to home in a stable condition with follow up recommendation. She was also under the care of rehabilitation department services for smooth and rapid recovery. Her follow up visit transthoracic echocardiogram was unremarkable.

Conclusion:

The utilization of ECMO for critically ill patients with respiratory failure is rapidly increasing. Although these procedures can be lifesaving, recognition and proper management of vascular

complications play a major role in successful outcome and a committed multidisciplinary team is vital for a smooth and uneventful recovery of a patient.

Disclosure Statement:

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All the above authors have no conflict of interest

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Images:

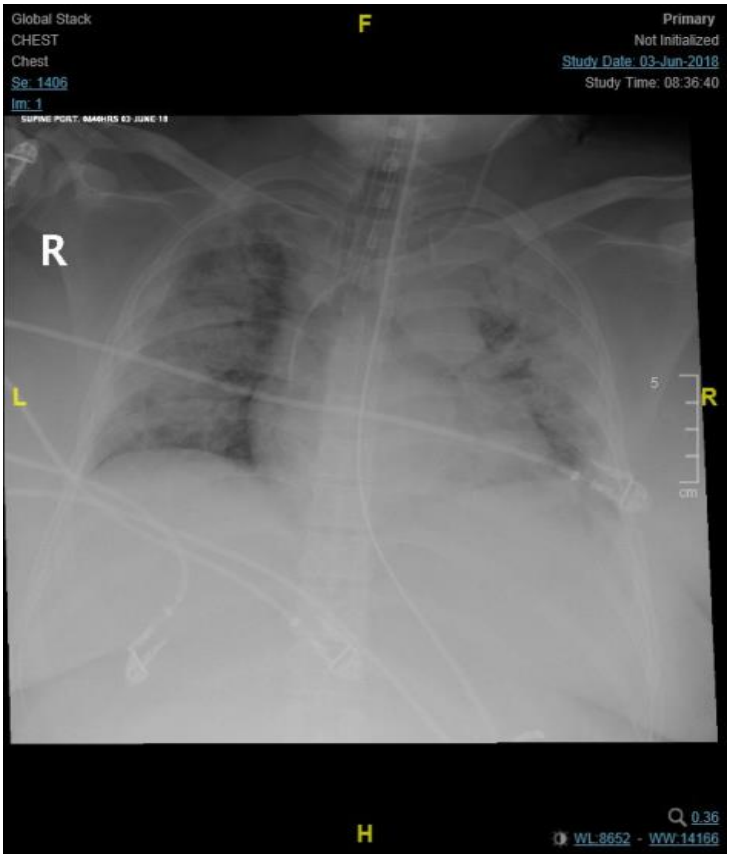
Fig 1.

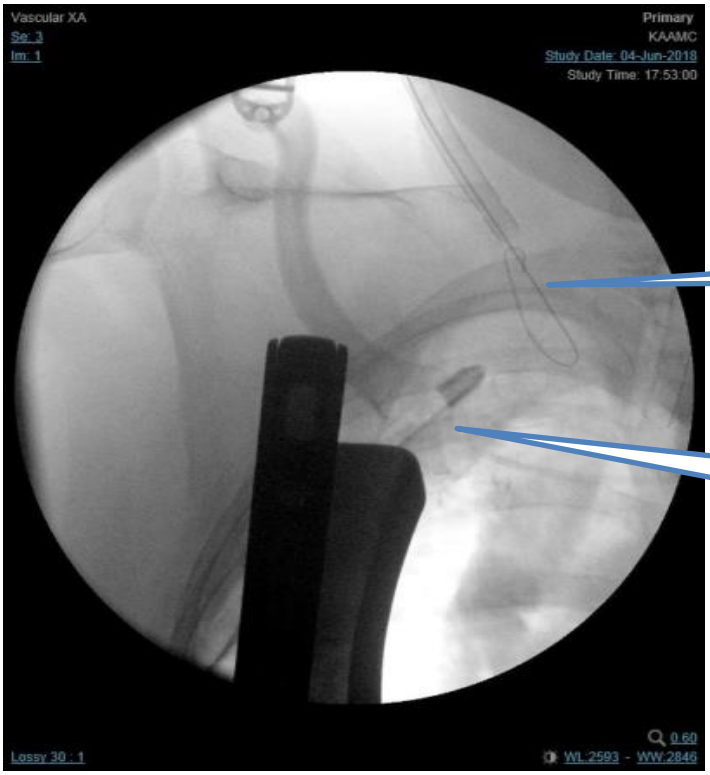
CXR demonstrating ARDS Pre-ECMO

Fig 2.

A : Looping of the guide wire

B: Intraoperative Cini ; IVC, ECMO catheter in the upper part of chest





Looping of guide wire

IVC, ECMO catheter in the upper part of chest