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Venovenous ECMO as Salvage Therapy for Pulmonary Hemorrhage

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INTRODUCTION

- ECMO is a temporary mechanical circulatory support system used for emergent management of cardiac or pulmonary failure or both.¹
- It can be configured as veno-arterial (VA-ECMO) for cardiogenic shock or veno-venous (VV-ECMO) for respiratory failure.
- Conventional use of ECMO involves systemic anticoagulation to maintain circuit patency.
- Contraindications to systemic anticoagulation is considered a relative contraindication to ECMO use and necessitates a careful assessment of overall utility.^{2,6}
- We report the successful use of VV-ECMO as salvage therapy for severe acute respiratory distress due to diffuse alveolar hemorrhage (DAH) with brief anticoagulation use.

CASE DESCRIPTION

- History**
- 48-year-old male - PMH of HTN, T2DM, BMI 34.35 Kg/m², OSA, asthma, GERD, and anxiety presented with three hours of chest pain.
- Physical Exam**
- On arrival, Temp – 97.9 F, HR 120s bpm, BP 139/92 mmHg, SpO2 86%.
 - General: ill-appearing, diaphoretic
 - Lung: Respiratory distress, bilateral rales/crackles in lung bases
 - Cardiovascular: Tachycardic, regular rhythm, no lower extremity edema or JVD
- Initial Evaluation**
- EKG: ST elevations in avR, globally diffuse ST depressions, new onset LBBB (Fig 2)
 - CXR/CTA chest – cardiomegaly, bilateral infiltrates consistent with pulmonary edema (Fig 1 A-C)
 - Bedside Echocardiogram – global hypokinesis, LVEF < 10%.
- Hospital Course**
- Intubated in ED, in cardiogenic shock with a BP of 71/58.
 - Emergent Left Heart Cath – severe multi-vessel disease involving the left main, LCx, and dominant RCA with chronic subtotal occlusion.
 - Mechanical circulatory support with an Impella 5.5, Vasopressors, and Inotropic support initiated. Evaluated for CABG, poor candidate.
 - Day 3 - CRRT for acute kidney failure was started.
 - Day 4 - multi-vessel percutaneous intervention with drug-eluting stents in LAD and RCA with dual antiplatelet therapy (DAPT).
 - Day 7 - Bedside tracheostomy performed.
 - Day 10 - Cardiopulmonary arrest from blood clots obstructing tracheostomy unrelated to placement, initiated on VV-ECMO. (Fig. 1D-F)
 - Emergent bronchoscopy - pulmonary hemorrhage with diffuse bloody secretions at carina. Nebulized tranexamic acid (TXA) administered without resolution of hemoptysis.
 - The patient was placed on VV-ECMO for 11 days for salvage therapy.
 - During ECMO therapy, therapeutic anticoagulation was withheld for 10 days and only trialed for 24 hours in addition to DDAVP.
 - After being weaned from ECMO, he was discharged to an acute rehab facility on hemodialysis. (Fig 1G)

LABS/IMAGING

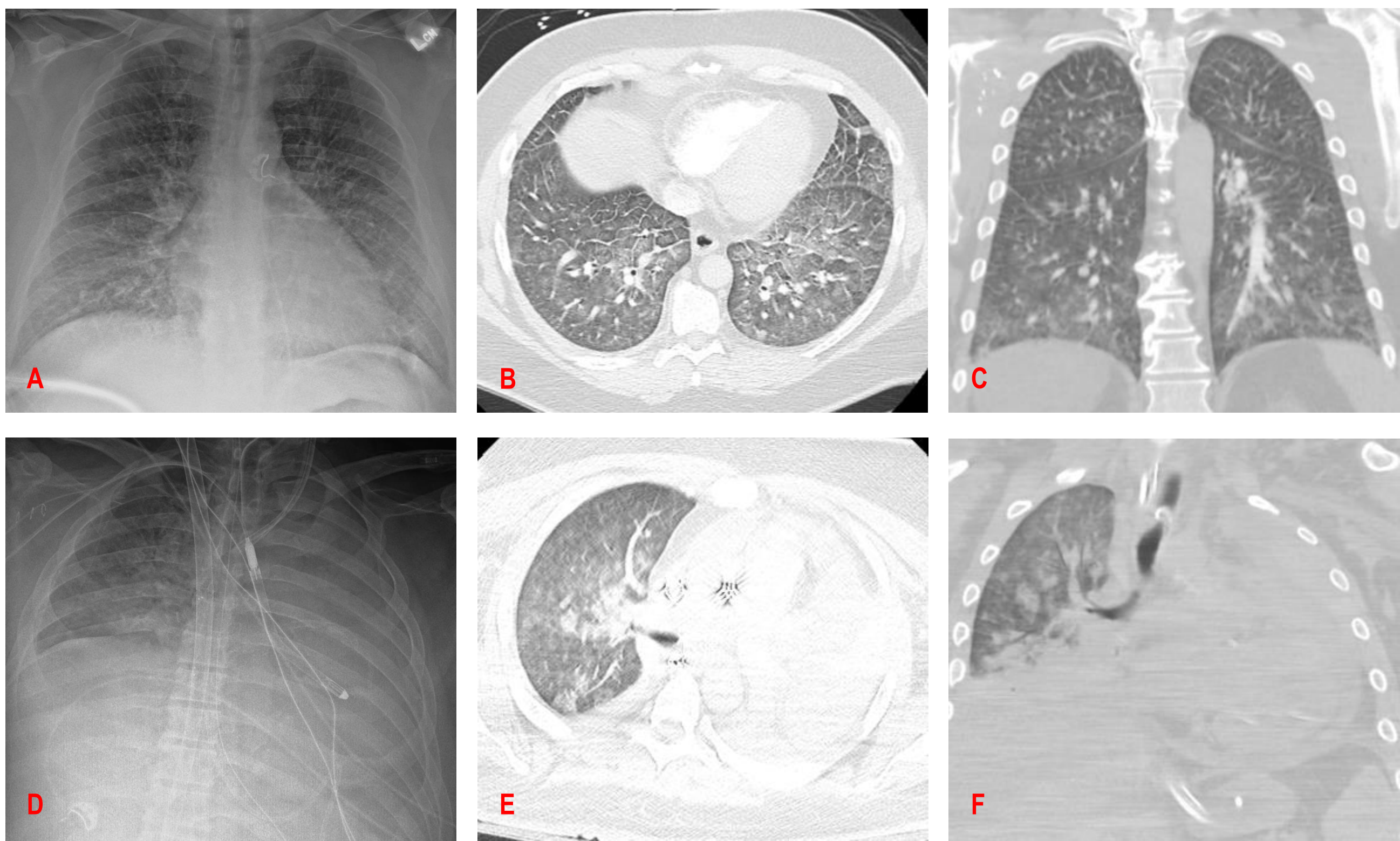


Fig 1.
A. Chest radiograph in ED.
B. CTA Chest, axial view.
C. CTA Chest, coronal view.
D. Chest radiograph shortly after initiation of ECMO.
E. CTA Chest after ECMO initiation, axial view.
F. CTA Chest after ECMO initiation, coronal view.
G. Chest radiograph prior to discharge.

LABS/IMAGING

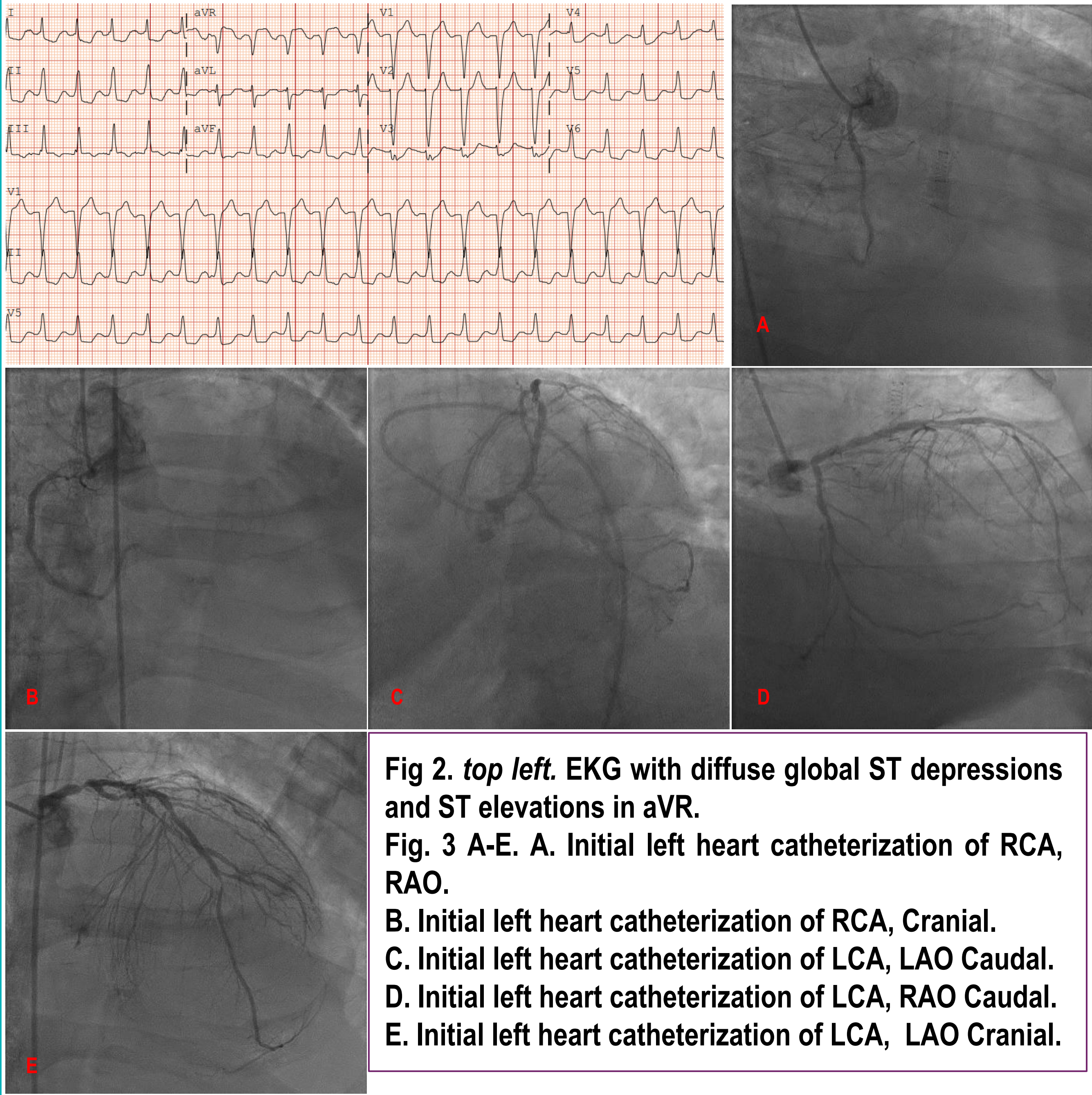


Fig 2. top left. EKG with diffuse global ST depressions and ST elevations in avR.
Fig. 3 A-E. A. Initial left heart catheterization of RCA, RAO.
B. Initial left heart catheterization of RCA, Cranial.
C. Initial left heart catheterization of LCA, LAO Caudal.
D. Initial left heart catheterization of LCA, RAO Caudal.
E. Initial left heart catheterization of LCA, LAO Cranial.

LABS/IMAGING

ADMISSION LAB VALUES		
Component	Value	Reference Range
WBC	12.3	4.0 - 10.9 10 ³ /uL
Hgb	14.8	13.5 - 18.0 g/dL
Glucose	471	70-130 mg/dL
Sodium	131	136 - 144 mmol/L
Potassium	4.4	3.6 - 5.0 mmol/L
Chloride	98	101 - 111 mmol/L
CO2	20	22 - 32 mmol/L
Creatinine	1.2	0.7 - 1.2 mg/dL
BUN	16.0	8.0 - 20.0 mg/dL
BNP	157	0.0 - 100.0 pg/mL
Troponin I	0.73	0.00 - 0.03 ng/mL
TSH	2.731	0.450 - 5.330 uIU/mL

DISCUSSION

- Systemic anticoagulation is essential for maintaining ECMO circuit patency. Ongoing hemorrhage is a relative contraindication to ECMO.^{1,2}
- Risk factors for pulmonary hemorrhage: severe acute respiratory distress syndrome (ARDS) from cardiogenic shock, DAPT use, pulmonary hypertension, and T2DM.³
- An elevated BMI may offer some protection; BMI > 30 kg/m² was associated with reduced ICU mortality in ECMO therapy.⁴
- While continuous anticoagulation is standard of care, limited retrospective studies suggest that DVT prophylaxis dosages can achieve similar survival rates while also reducing oxygenator dysfunction.⁵

CONCLUSION

- Further study of ECMO use for treatment of pulmonary hemorrhage is necessary for assessment of clinical utility.

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