



Intraoperative management of gas embolism during hystroscopic myomectomy

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INTRODUCTION

Hysteroscopy is one of the most common procedures due to its minimally invasive nature to diagnose and treat intrauterine pathologies. Despite its benefits of faster recovery and shorter intraoperative time, this procedure is associated with the risk of air and gas embolism which can lead to serious complications. Since the uterus has many large non collapsible veins, gas or air can enter into the systemic circulation during incision with sub-atmospheric pressure which creates a pressure gradient where gas will travel from uterine veins to the right heart. The gas can cause such a significant pressure change that leaves the previously closed foramen ovale to reopen. Therefore, surgeries that involve a larger surface area of vessels being exposed such as endometrial resection of myomectomy will increase the risks of gas embolism.

Operative hysteroscopy tends to have a higher risk of air embolism, reaching an incidence rate of 10-50%. These gases are the result of electrocoagulation or from room air. Air could enter during dilation and curettage in the cervix or during repeated instrumentation leading to a piston-like action or if it is inadequately removed from the irrigation system. Usually, more than 3ml/kg of air is required for significant clinical effects.

REFERENCES

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PERIOPERATIVE COURSE

- 47-year-old morbidly obese (BMI: 40.5) female with PMHx of essential hypertension, anemia, GERD, moderate persistent asthma with daily albuterol use, mild cardiomegaly, chronic left leg DVT, bilateral pulmonary embolism, uterine fibroids, and acute abnormal uterine bleeding.
- Patient was seen for preoperative evaluation and considered a low cardiovascular risk for a planned hysteroscopic myomectomy. She was on 1 tab of 2.5 mg of Eliquis twice daily and asked to stop it 2 days prior to surgery.
- 22G IV was successfully placed in her left AC. She was induced with Versed 2mg, Fentanyl 100mg, Lidocaine 3mL, Propofol 200mg, Rocuronium 30mg. At this time, an oral airway was placed and she was easily bag ventilated prior to the placement of a LMA . Ventilator was on SIMV/PC mode with Pinsp of 12, RR of 15, and PEEP of 5.
- Her vitals remained stable with HR 80-90, BP 100-120/60-80, and O2 saturation in high 90s throughout the procedure. Forty minutes into the procedure, her end tidal CO2 suddenly decreased significantly during sharp curettage of the myoma and the procedure was stopped immediately. Her blood pressure started dropping and was followed by an immediate cessation of cardiac pulsation. Meanwhile, there was no change in airway pressure or tidal volume.
- Pt was then intubated and CPR was initiated. TEE was performed, images shown below. ECMO was placed for this witnessed cardiac arrest.

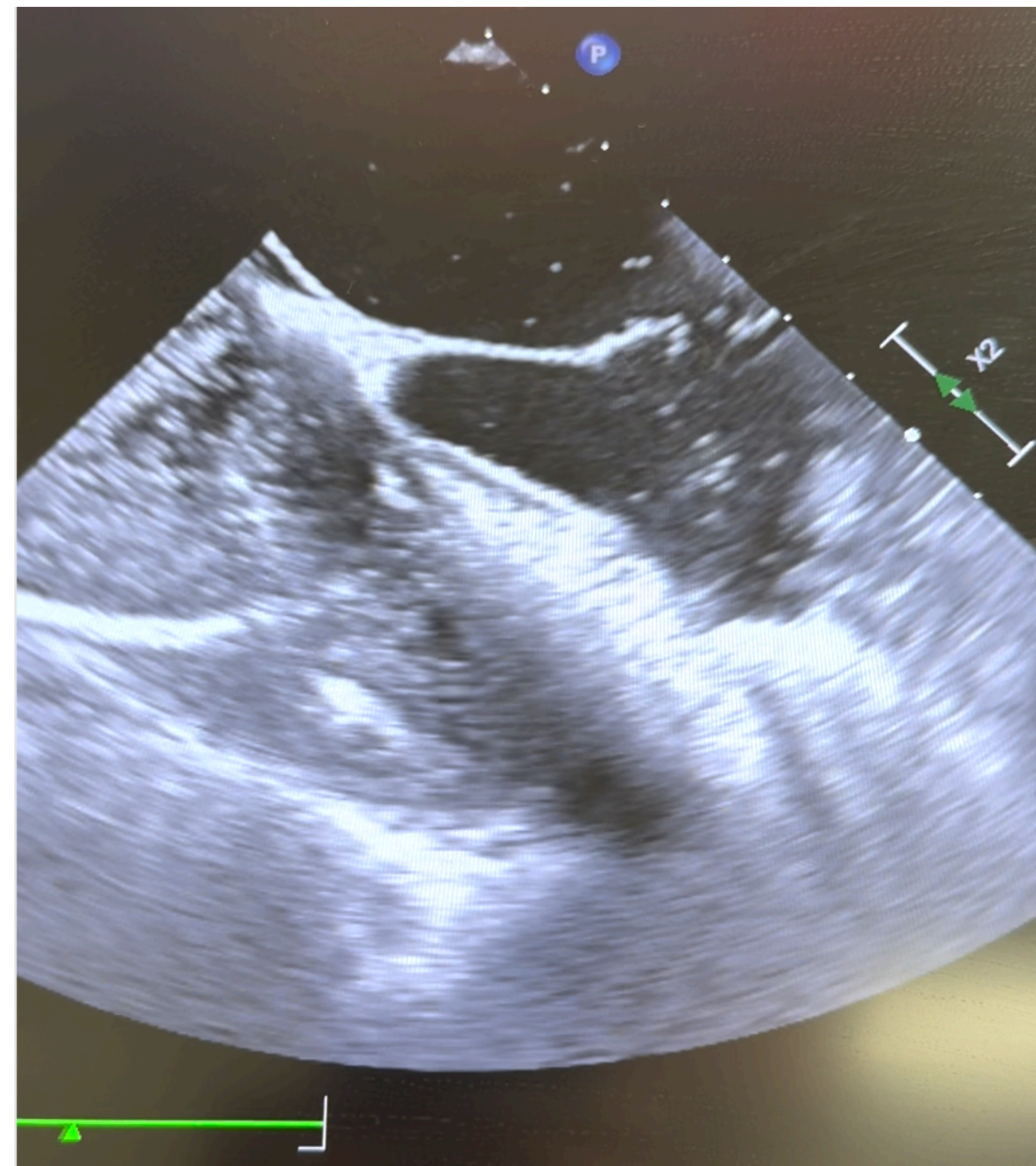


Image 1: TEE mid esophageal four chamber view in between chest compressions: massive air is present in the right atrium and ventricle with a dilated RA and RV. Some air is also found in both the left atrium and the under-filled left ventricle.

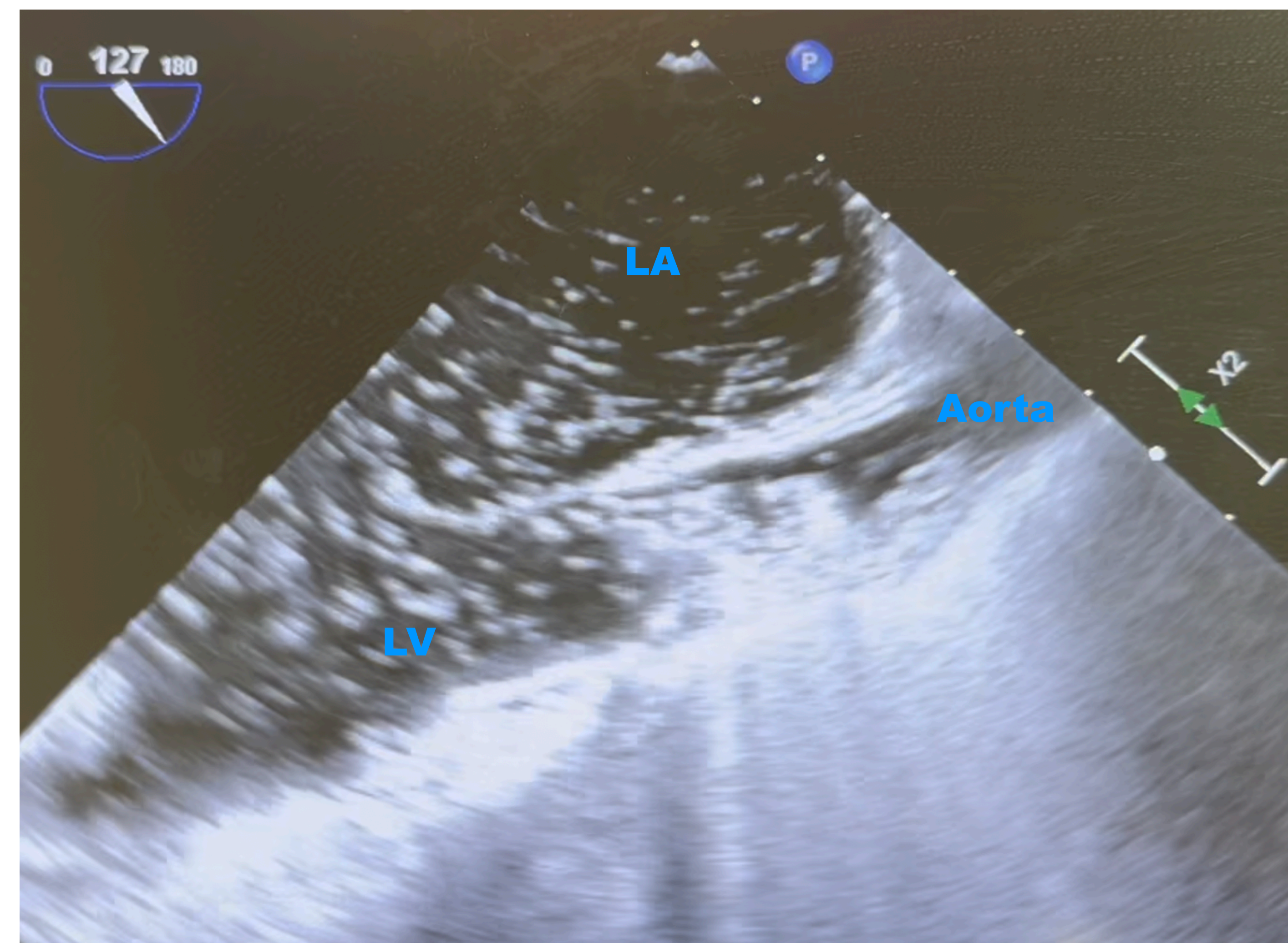


Image 2: TEE view of the left atrium and left ventricle during chest compressions: significant air present in the left side of the heart. Air likely traveled through the patent foramen ovale from the right to left atrium then to the coronary arteries and the brain.

DISCUSSION

Based on the patient's history of unprovoked deep vein thrombosis, pulmonary embolism was initially higher on the differential. The initial physiological change that was appreciated was the fall in EtCO2 which was then followed by SpO2 and BP. The air lock within the right ventricle was so significant that despite immediate action, the patient went into cardiovascular collapse. Autopsy report showed the presence of a patent foramen ovale, likely indicating that the gas embolism possibly travelled from the right atrium through the PFO to the left atrium, then down the coronary arteries, leading to cardiac arrest. Prevention and early detection of the presence of air and gas embolism is key to decreasing mortality and morbidity. Once detected, the surgical procedure should be terminated. Patient should be placed on 100% oxygen and positioned in Durant's maneuver (trendelenburg and left lateral decubitus), so that air does not become trapped in the right ventricle, which would obstruct the outflow tract. A central venous catheter can be placed in attempt to remove air from the venous circulation. Inotropoic support and CPR should be initiated if necessary. Hyperbaric oxygen may also be effective despite the limitations of immediate initiation.

CONCLUSION

Close monitoring, especially of EtCO2, and rapid identification can prevent such fatal complications from occurring. But further studies are still necessary to formulate proper guidelines to decrease chances of air/gas embolism. Raising awareness regarding the frequency of air/gas embolism during operative hysteroscopy will provide better training in event of emergencies. Meanwhile, patients with known PFO and VSD should be treated with extra precautions.