Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Epicardial Echocardiography—A Plausible Alternative Cardiac Imaging Technique in COVID-19 Pandemic

To the Editor:

Coronavirus disease 2019 (COVID-19), because of its high infectivity rate, created havoc across the globe.[1] Healthcare workers are the most affected community, having high mortality across the world. Severe acute respiratory syndrome coronavirus 2 enters cells through angiotensin- converting enzyme-2 receptors, which are expressed mostly in lung and intestines.[2] So, the virus load is increased in aerodigestive tract secretions. Any procedure involving the aerodigestive tract causes aerosolization, which increases the risk of direct and cross-contamination among healthcare workers.[3] Transesophageal echocardiography (TEE), being an aerodigestive tract procedure, commonly is used in cardiac surgery to evaluate the heart and its associated structures.

Even though various techniques and maneuvers are suggested in recent literature to reduce aerosolization during TEE usage, the risk of infection still persists.[4] The TEE probe remains in contact with the aerodigestive tract secretions, posing a potential contamination risk to healthcare workers handling the TEE probe for imaging as well as during disinfection. Usage of a protective sleeve over the TEE probe may not avoid the virus exposure completely. Moreover, a protective sleeve over the TEE probe makes the maneuver of the probe more difficult to acquire images and also compromises the image quality. Hence, the American Society of Echocardiography recommends an alternate method for TEE to be used whenever possible in COVID-19 patients.[5]

Epicardial echocardiography (E-echo) is not an uncommon imaging modality in perioperative cardiac settings. E-echo is well known to produce high-quality images, especially of the anterior cardiac structures compared to TEE.[6-8] In addition to it, epiaortic echocardiography gives more valuable information about aortic diseases perioperatively.[9] E-echo can be performed easily by using a transthoracic probe or TEE probe (Fig 1-3).

Advantages of E-echo and epiaortic echocardiography over TEE in the midst of COVID-19 pandemic are as follows:

1. There is no aerosolization with E-echo/epiaortic echocardiography.
2. Usually, E-echo has been performed with a protective cover over the probe, which eliminates the direct contact of the probe with patients' body fluids. Thus, decontamination of the probe is simple and easy to perform. Further, it reduces the virus exposure to healthcare workers significantly compared to TEE.
3. Except for a transparent cover over the echocardiography machine while using it for suspected/confirmed COVID-19 cases, no special preparation is needed. So, there is no significant change in image quality.

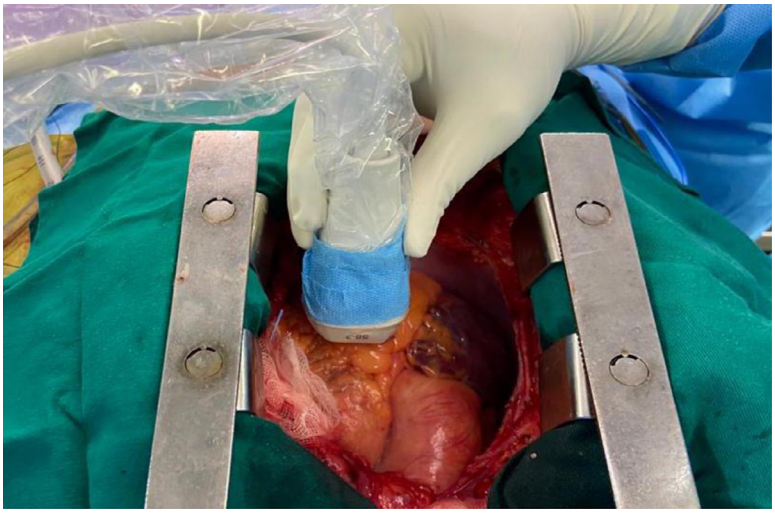

Fig 1. Echo probe covered with sterile sleeve placed over epicardium.

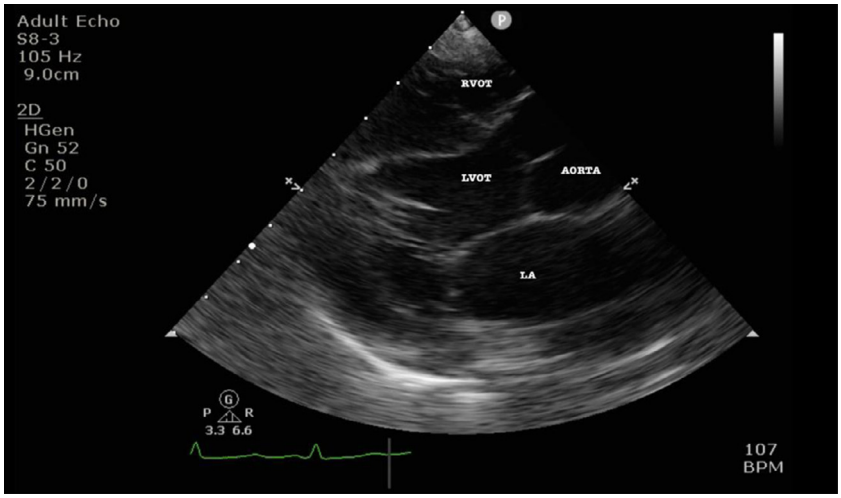

Fig 2. Epicardial left ventricular long-axis view. RVOT, right ventricular outflow tract; LVOT, left ventricular outflow tract; LA, left atrium.

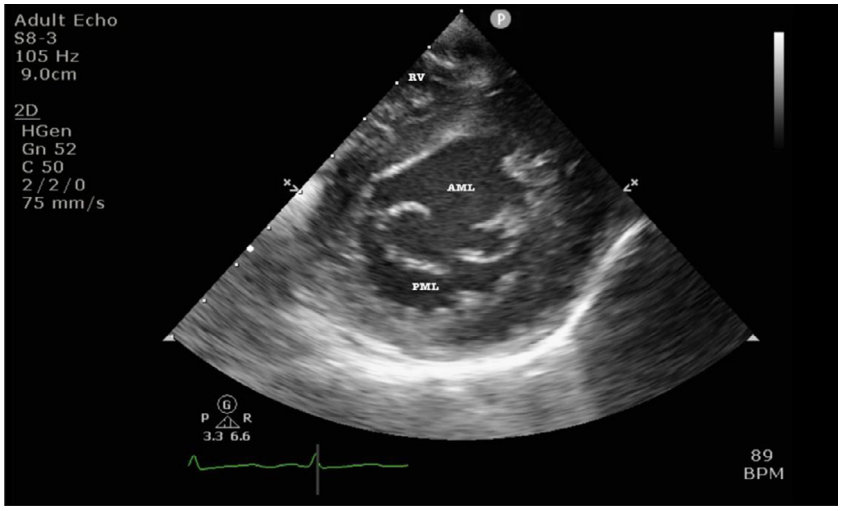

Fig 3. Epicardial left ventricular basal short-axis view. RV, right ventricle; AML, anterior mitral leaflet; PML, posterior mitral leaflet.

Limitations of E-echo over TEE are as follows:

1. Hemodynamic and rhythm disturbances can occur due to direct cardiac compression. However, it is minimal on the adult heart and can be avoided by gentle probe handling.
2. Infection risks cannot be neglected, which can be minimized by sterile handling and reducing the examination duration.
3. Apical views are not possible due to space constraints while using a standard epicardial probe, which can be overcome by using a TEE probe.
4. E-echo may cause distraction for the surgeon, leading to prolongation of surgery.

Although TEE supplanted E-echo in cardiac surgery, the COVID-19 pandemic mandates us to search for an alternative option to TEE in intraoperative cardiac imaging. Thus, E-echo can be a viable alternative to TEE during this COVID-19 pandemic.

Conflict of Interest

None.

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Pneumomediastinum in Mechanically Ventilated Coronavirus Disease 2019 Patients

To the Editor:

Currently, coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2, is a global health threat that has resulted in more than 300,000 deaths.[1] Severe acute respiratory syndrome coronavirus 2 primarily targets the pulmonary system and causes hypoxemic respiratory failure and acute respiratory distress syndrome (ARDS). Pneumomediastinum is a well-known life-threatening complication related to the use of mechanical ventilation, especially in ARDS patients. However, publications highlighting the characteristics and outcomes of COVID-19 patients who develop pneumomediastinum after intubation and mechanical ventilation are very limited. Herein, we present our institution's experience with 4 patients (Table 1). The median age of the patients was 56 years (range 41-74 y). Two were male, and 2 were female. All patients had significant risk factors for developing severe COVID-19, including comorbidities, obesity, and the elevation of inflammatory markers. None was a smoker or had any underlying lung diseases. All patients were intubated using direct laryngoscopy, due to acute hypoxemic respiratory failure from COVID-19 pneumonia. Assist volume- control ventilation was implemented in all patients. The positive end-expiratory pressure (PEEP) values and tidal volume before the patients developed pneumomediastinum ranged from 16- to- 20 cmH_2O and 350- to-520 mL, respectively. One patient underwent prone intervention for 6 days on and off. The diagnosis of pneumomediastinum was confirmed by chest x-ray (Fig 1). Due to their persistent hypoxemia from severe ARDS, we could not decrease the ventilator settings of any of the patients after they had developed pneumomediastinum. All patients ultimately died due to septic shock and multiorgan failure from severe COVID-19. We did not perform autopsies.

We searched the Medline database for pneumomediastinum in mechanically ventilated COVID-19 patients and discovered 1 previously reported case series from the United Kingdom.[2] Wali et al. described 5 COVID-19 patients who developed pneumomediastinum after tracheal intubation and mechanical ventilation and proposed that the pneumomediastinum was at least partly due to large-bore tracheal tubes (initially used size

Table 1
Patient characteristics and hospital courses

Case	1	2	3	4
Age/ Sex	74/ female	48/ female	41/ male	64/ male
Comorbidities	HTN, DM, HLD	Obesity (BMI 47)	Obesity (BMI 35)	Obesity (BMI 34)
Smoking status	Non-smoker	Non-smoker	Non-smoker	Non-smoker
Presenting symptoms	Fever, cough, diarrhea, vomiting	Dyspnea, cough	Dyspnea, cough, fever	Dyspnea, fever, cough, diarrhea, vomiting
Inflammatory markers	CRP 16, DD 303, IL6 75	CRP 35, DD 1084, IL6 159	CRP 7, DD 866, IL6 10	CRP 20, DD 3009
COVID-19 treatment	Hydroxychloroquine, IL6 inhibitor trial	Hydroxychloroquine	Hydroxychloroquine	Hydroxychloroquine, convalescent plasma
Day of intubation	D 1	D 0	D 4	D 2
ETT size	7.5	7 (2 attempts)	7.5	8
Highest PEEP	16	20	15	18
Highest Tidal Volume	350	350	520	400
Prone intervention	No	No	No	Yes
Day from intubation	13	4	2	6
CXR	Massive pneumomediastinum and subcutaneous emphysema	Right-sided tension pneumothorax, pneumomediastinum	Small left pneumothorax, pneumomediastinum, marked subcutaneous emphysema	Large right pneumothorax (70%)
Severity	Severe	Severe	Mild	Severe
Management	Left intrapleural chest drain	Needle decompression, Right intrapleural chest drain	Left intrapleural chest drain	Needle decompression, Right intrapleural chest drain
Outcome	Death (LOS 17 days)	Death (LOS 6 days)	Death (LOS 30 days)	Death (LOS 10 days)

Endotracheal tube (ETT), positive end-expiratory pressure (PEEP), Chest x-ray (CXR), C-reactive protein (CRP (mg/dl), normal <0.4 mg/dl), D-dimer (DD (ng/ml) normal < 230 ng/ml), interleukin-6 (IL6 (pg/mL), normal < 15.5 pg/mL), length of stay (LOS)