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.

Inpatient Transthoracic Echocardiography during the COVID-19 Pandemic: Evaluating a New Triage Process

To the Editor:

Implementation of recommendations for echocardiography during the coronavirus disease 2019 (COVID-19) pandemic[1-3] with physician-level review has been reported to reduce systemwide echocardiography volumes while increasing the proportion of appropriate requests.[4] However, the process of specifically triaging echocardiography for patients with possible or confirmed COVID-19 has not been thoroughly evaluated.

At our large academic medical center, we adapted current recommendations into a detailed triage process using physician-level review

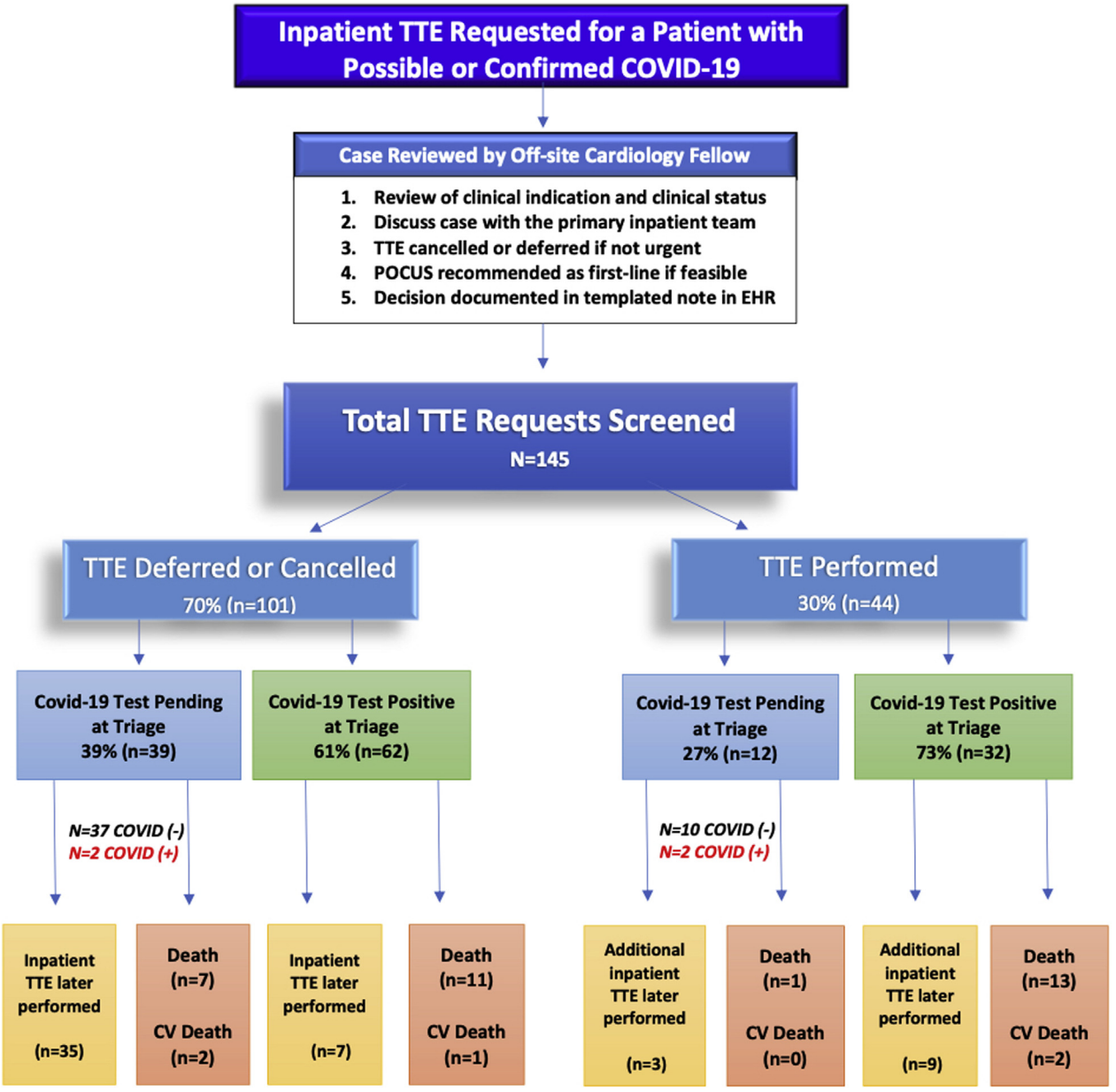

Figure 1 Flowchart of the number of patients who were screened in the triage process with their respective triage decisions, COVID-19 testing status at the time of triage, and in-hospital outcomes. "Inpatient TTE later performed" refers to TTE that was initially deferred or canceled and then later performed. "Additional inpatient TTE later performed" refers to repeat inpatient TTE that was performed after initial TTE was performed at triage. *COVID (–)*, COVID-19 test result negative; *COVID (+)*, COVID-19 test result positive; *CV*, cardiovascular; *EHR*, electronic health record; *POCUS*, point-of-care ultrasound.

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to determine whether to perform, defer, or cancel inpatient transthoracic echocardiography (TTE) requests on the basis of indication and clinical urgency. We compared clinical status between patients in whom TTE was deferred or canceled and those in whom it was performed, and we assessed in-hospital outcomes on the basis of triage decision (Figure 1).

A total of 145 TTE requests for patients ≥18 years of age hospitalized with possible or confirmed COVID-19 were triaged from March 19, 2020, through April 22, 2020. In-hospital outcomes, including subsequent TTE, length of stay, all-cause death, and adjudicated cardiovascular death, were assessed through May 6, 2020.

The median age of our cohort was 66 years (interquartile range, 53–76 years), and 43% were women. At triage, 94 (65%) had confirmed COVID-19, and 51 (35%) had COVID-19 test results pending. Forty-four patients (30%) underwent TTE, and TTE was deferred or canceled on triage in 101 (70%). Among those with confirmed COVID-19 at triage, TTE was performed in 32 (34%) and deferred or canceled in 62 (66%), seven of whom (11%) underwent TTE later. Among these seven patients, only one was found to have a left ventricular ejection fraction < 50%; this patient initially underwent point-of-care ultrasound, and TTE was performed the day after triage. Among patients with deferred or canceled TTE who were eventually COVID-19 negative ($n = 37$), 35 (95%) underwent TTE within 24 hours of the order. No TTE requests were categorized as "rarely appropriate" by appropriate use criteria.[5]

Compared with patients with deferred or canceled TTE, more patients in the TTE-performed group were in the intensive care unit (68% vs 38%), were mechanically ventilated (55% vs 22%), or required intravenous vasopressors (46% vs 14%) at triage; patients in the TTE-performed group also had longer intensive care unit stays (median, 8 vs 1 days) and hospital stays (median, 16 vs 10.5 days; $P < .05$ for all variables). The TTE-performed group had a numerically higher incidence of inpatient death (14 of 44 [32%] vs 18 of 101 [18%], $P = .08$). The proportion of cardiovascular deaths was similar between groups (two of 14 deaths [14%] in the TTE-performed group vs three of 18 [17%] in the TTE-deferred/canceled group, $P > .99$). No sonographers who performed TTE on patients with COVID-19 over the study period were diagnosed with COVID-19.

We found that physician review on the basis of current guidelines selected TTE for more critically ill patients and reduced the number of transthoracic echocardiographic examinations for patients with confirmed COVID-19 by 60% (from 98 requests to 39 that were ultimately performed). This process did not significantly delay TTE for patients with pending COVID-19 test results and appeared to be safe in our initial experience, with no apparent adverse cardiovascular outcomes that could be attributed to deferring or canceling a request. Further outcomes studies on quality improvement initiatives implemented during the COVID-19 pandemic will be needed to ensure high-quality cardiovascular care.

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Contrast Echocardiography in VV-ECMO-Dependent Patients with COVID-19

To the Editor:

The use of contrast echocardiography in patients receiving venovenous extracorporeal membrane oxygenation (VV-ECMO) for severe acute respiratory failure is not widely published, and there is understandable caution surrounding its use in this population. The coronavirus disease 2019 pandemic resulted in an unprecedented burden on critical care facilities[1] due to severe acute respiratory failure. Our center is one of five nationally commissioned VV-ECMO services in the United Kingdom and has seen VV-ECMO activity quadruple during the first pandemic surge. Consequently, there has been growing emphasis on transthoracic echocardiography (TTE) to diagnose cardiac complications of coronavirus disease 2019 supported with VV-ECMO.[2,3]

Mechanically ventilated patients receiving VV-ECMO are among the most challenging in whom to obtain diagnostic images on TTE. Predictably, we found that as the volume of VV-ECMO patients increased, so too did the requirement for TTE using ultrasound-enhancing agents (UEAs). Contrast echocardiography is routinely