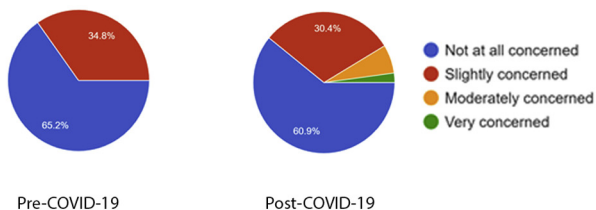




Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Were you concerned about your ability to practice independently after fellowship?



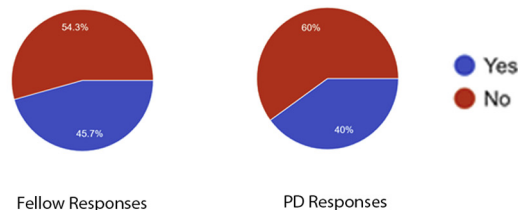
Pre-COVID-19

Post-COVID-19

a

Fellow Responses

Has COVID-19 limited fellows from reaching their potential?

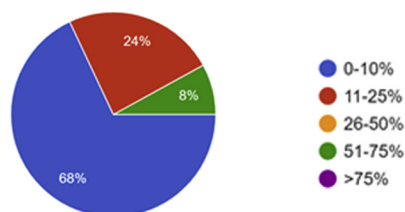


Fellow Responses

PD Responses

b

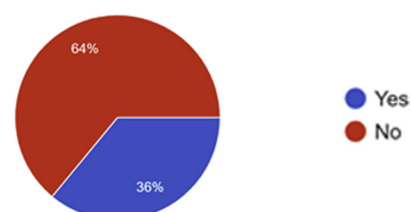
What percent reduction in ability compared to previous years have fellows suffered due to COVID-19?



PD Responses

c

Do you think fellows will be less skilled at certain procedures than previous years?



PD Responses

d

Figure 3. (a–d) Assessment of fellow competency.

of fellows did not have a job offer at the time of the survey, and an additional 10% did not have a signed job contract. Job hunting amidst the reductions in demand is increasingly challenging, and these data may provide important insight to incoming fellows starting their employment search.

The main limitation to these data is the survey nature of the study. Response biases may skew results toward individuals who were most affected by the COVID-19 pandemic, while social desirability bias may result in underreporting of disruptions in training or exaggeration of expected case volumes.

In summary, this survey indicates that the COVID-19 pandemic has had a major negative impact on IR training and employment. As hospitals across the United States begin to adapt to the world after COVID-19, methods to optimize training in Early Specialization in Interventional Radiology and integrated IR/diagnostic radiology training pathways need to be determined to maintain the development of excellent IR physicians and in turn ensure a bright future for our specialty.

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Spontaneous Major Hemorrhage in COVID-19 Patients: Another Brick in the Wall of SARS-CoV-2–Associated Coagulation Disorders?



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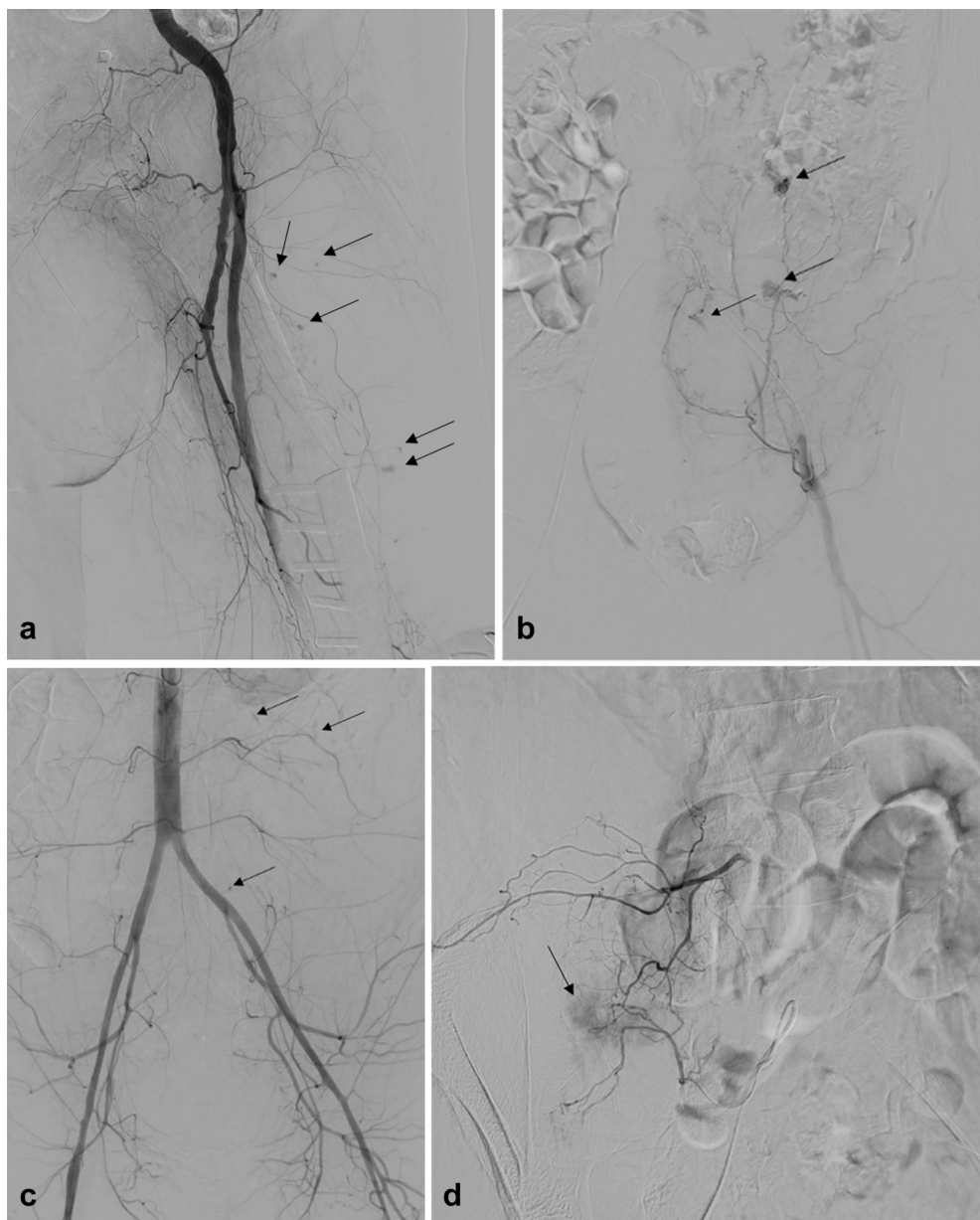


Figure. Typical angiographic findings in patients with COVID-19 experiencing major spontaneous hemorrhage. Diagnostic angiography typically demonstrated multiple tiny foci of arterial bleeding (black arrows) affecting distal vascular territories of (a) left lateral circumflex femoral artery, (b) left inferior epigastric artery, (c) third and fourth left lumbar arteries, and (d) right ileolumbar arteries. In each case, successful embolization of the entire arterial segment accounting for the bleeding was achieved with polyvinyl alcohol particles of varying size: 250–355 μm in panels (a) and (b) and 355–500 μm in panels (c) and (d).

consecutive patients admitted to the emergency department between March 1 and April 30, 2020, with a positive nasopharyngeal swab test for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), 16 (1.9%) experienced at least 1 severe arterial bleeding episode, defined as any imaging-proven, clinically overt sign of arterial hemorrhage coupled with a decrease in hemoglobin count ≥ 3 mg/dL and requiring intervention. A single patient (1/16; 6.2%) was excluded owing to an iatrogenic hepatic injury, bringing the incidence of spontaneous hemorrhage to 1.8% (15/818). The median time interval between onset of 2019 novel coronavirus disease (COVID-19) symptoms and occurrence

of hemorrhage was 23 days (interquartile range: 19–35 d); all patients had severe, radiologically proven interstitial pneumonia and required ventilator support during their hospital stay. Thirteen of 15 patients (86.7%) were receiving prophylactic antithrombotic treatment (low-molecular-weight heparin) according to current internal guidelines; at the time of bleeding onset, no patient was above the therapeutic range of anticoagulation or had deep vein thrombosis and/or pulmonary embolism.

Hemorrhage was initially evaluated with contrast-enhanced, multiphase computed tomography and then treated with an interventional radiology procedure.

Diagnostic angiography showed the bleeding site in all cases (lumbar/ileolumbar [8/15; 53.3%], inferior epigastric [2/15; 13.3%], inferior gluteal [1/15; 6.7%], lateral circumflex femoral [1/15; 6.7%], sigmoidal [1/15; 6.7%], right bronchial [1/15; 6.7%], and internal thoracic artery [1/15; 6.7%]). The typical angiographic pattern (found in 12 of 15 patients; 80%) consisted of multiple, tiny bleeding foci affecting distal vascular territories (**Fig a–d**). Considering this peculiar bleeding pattern and the critical condition of most patients, embolization with polyvinyl alcohol particles of the entire arterial segment accounting for the hemorrhage was usually performed. Technical and complete clinical success was achieved in all patients; no procedure-related complications were recorded (1).

The origin of severe hemorrhage in patients with COVID-19 is unclear. Prophylactic antithrombotic treatment has been established as a well-known risk factor; however, the reported incidence of major spontaneous hemorrhage in general admission patients receiving low-molecular-weight heparin at prophylactic dosage is < 1% (2), below the disease-specific incidence observed in the present population (1.8%). A possible explanation could lie in the pathophysiology of SARS-CoV-2 infection, which is characterized by an increase of proinflammatory cytokines in serum (systemic cytokine storm), directly correlated with both disease severity and subtle coagulation disorders. Furthermore, widespread endothelial cell damage has been hypothesized to occur (3). Functional implications of this pathogenic mechanism include diffuse microvascular damage with both a substantial component of microvascular thrombosis [microCLOTS hypothesis (3)] and imbalances in platelet recruitment. The latter could then result in multiple bleeding foci typically affecting distal microcirculation, as suggested by observations in the present population and confirmed by pathologic findings (4), and occurring late in the disease course (median time to bleeding onset 23 d).

In conclusion, major spontaneous hemorrhage represents a quite uncommon, but dramatic complication of SARS-CoV-2 infection, possibly representing the other, less noted side of disease-specific coagulation disorders. Failure to acknowledge such a risk could significantly worsen the prognosis of patients with COVID-19.

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Transforming Positive Pressure IR Suites to Treat COVID-19 Patients



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During the coronavirus disease 2019 (COVID-19) pandemic, the role of interventional radiology (IR) became integral secondary to the minimally invasive nature of treatments, the efficiency of image-guided techniques, and the nominal reliance on inpatient hospital resources. IR divisions are forced to adapt to care for a growing population of patients with coronavirus while maintaining a safe work environment and preventing cross-infection. As most procedural suites with fluoroscopic capability are positive-pressure rooms, here the authors describe an experience with a positive-pressure IR suite to create a safe, optimized environment for health care workers and patients. No institutional review board approval was required, as human and animal subjects were not involved.

Procedure suites were chosen based on maximal potential air exchange, most direct patient transit path, and space for donning and doffing of personal protective equipment (PPE). Designated procedure suites were cleared of all nonessential mobile equipment, and the remaining equipment was covered in plastic to allow easy disinfection between patients. In consultation with hospital infection prevention and control personnel, the largest and most secluded IR suite was chosen for the treatment of patients with COVID-19 (**Fig 1**). If present, a small

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