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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Endovascular simulation as a supplemental training tool during the COVID-19 national emergency

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ABSTRACT

The ongoing COVID pandemic raises many concerns as our healthcare system is pushed to its limits and as a consequence, Interventional Radiology training may be compromised. Endovascular simulators allow trainees many benefits to build and maintain endovascular skills in a safe environment. Our experience demonstrates a methodology to maintain IR training with use of didactic and simulation supplementation during the COVID-19 pandemic, which may be helpful for incorporation at other institutions facing similar challenges.

Endovascular simulators allow trainees to gain familiarity with interventional tools and techniques, improve technical skills in a risk-free environment, and can be tailored to individual trainees to supplement areas of weakness or lack of exposure. Access to endovascular simulators is increasing and we recently explored the role of endovascular simulation in a unique training situation. On March 13th 2020, just days after the World Health Organization formally declared COVID-19 a pandemic, President Trump announced a national state of emergency. Healthcare workers (HCW) are of significant risk for developing coronavirus, with thousands of providers becoming infected [1]. By March 20th, more than half of the cases in the United States (US) were in New York state. By March 30th, there were more than 150,000 confirmed coronavirus cases in the US with new emerging “hot spots” in various cities outside of New York [2]. The ongoing COVID-19 pandemic raises many concerns as our healthcare system is pushed to its limits and as a consequence, the trainee experience may be compromised.

We describe a curriculum change enacted during the COVID-19 pandemic due to shortages of personal protective equipment (PPE) and institutional changes affecting trainee exposure. Elective procedures were deferred and PPE including sterile gloves and gowns were rationed for emergency use. Trainees were limited to participating in interventional procedures during emergent cases in order to lessen their exposure and conserve PPE. Given the restrictions strongly affecting Interventional Radiology (IR) trainee education during this time period, we implemented an educational program consisting of didactics and high-fidelity endovascular simulation.

The changes to the curriculum for IR trainees were implemented on March 16th. Mornings were dedicated to didactic education for up to 3 h with case-based instruction. Didactic topics were pre-selected, varied in duration based on trainee participation and were coordinated by IR faculty to prevent content overlap. Afternoons were split between live procedure participation and high-fidelity endovascular simulation. Both self-guided and proctored instruction on the simulator were employed. Groups performing simulation were kept under 3 individuals with mandatory gloving, donning of face masks and cleaning protocols for both the participants and equipment to comply with Center for Disease Control (CDC) recommendations.

Our IR division has access to two VIST G5 endovascular simulation units (Mentice AB, Gothenburg, Sweden) as part of our institutional simulation lab. One of these units, which includes a laptop and monitor, was relocated to the IR division conference room to facilitate use amongst trainees. The VIST G5 has over 20 endovascular modules and supports real clinical devices including catheters and wires with minor modification. Trainees were provided an initial orientation to the simulator and basic use with an instructor (Fig. 1a, b). Trainees were then given access to a profile that contained pre-selected endovascular modules for self-directed learning (Table 1).

All trainees on interventional radiology rotation from March 16th to April 2nd participated in simulation education as a bridge to anticipated redeployments to clinical areas of need. The trainee levels ranged from PGY2 to PGY6. A total of 52 h of simulation were logged over by 6 trainees and instructor. Mean simulation time per trainee was 6 h. Procedural modules completed included IVC filter placement, transarterial chemoembolization, trauma embolization, uterine artery

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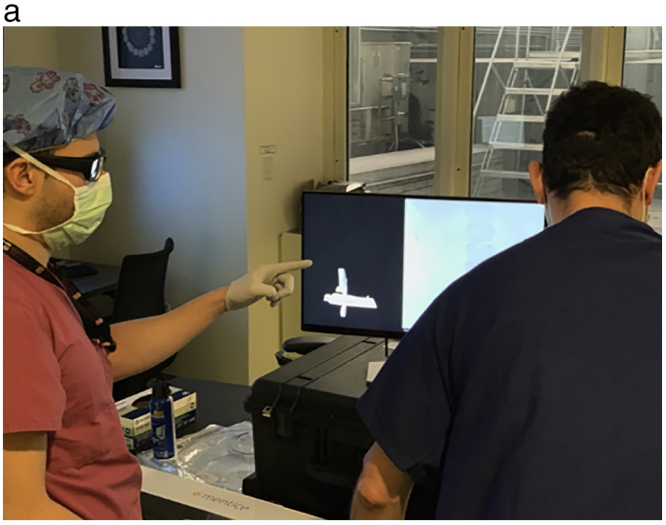
a



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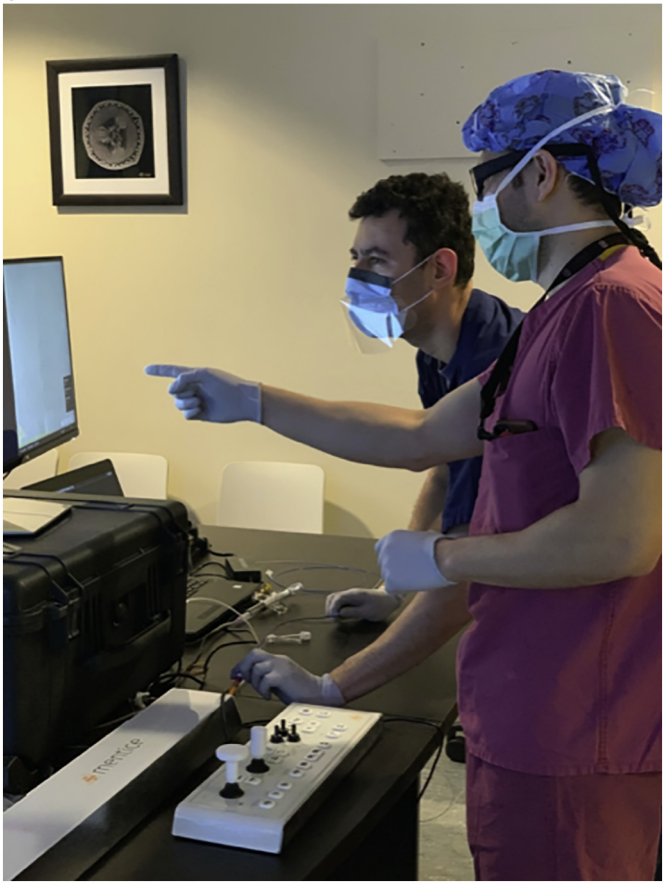

Fig. 1. a and b. Trainees and attending instructor using the simulation unit.

Table 1
Pre-selected endovascular modules separated by level for self-directed learning.

Level	Procedural modules
I	IVC filter placement, transarterial chemoembolization case 1
II	Uterine artery embolization case 1, pelvic trauma embolization case 1
III	Pelvic trauma embolization case 2, prostate artery embolization case 1
IV	Transarterial chemoembolization case 2, prostate artery embolization case 2

embolization and prostate artery embolization. Total didactic time was 36 h. A survey was performed at the conclusion of the education time period with all trainee respondents stating that simulator use was helpful for their IR education. All trainee respondents also stated that they would consider continued simulator use for independent learning as a valuable adjunct to their normal IR rotation.

The goal of this endovascular simulation supplementation was to ensure procedural proficiency within these institutional constraints affecting trainees and advocate for increased use of these potentially underutilized resources when available. Dr. Gould's commentary on using simulation in IR training in the British Journal Radiology 2010 noted that adopting novel training methodologies and performance assessment tools into an established curriculum requires careful consideration of several factors including training objectives, simulators and metrics for performance assessment [3]. However, these considerations for implementation should be weighed against risk of delaying supplemental training during periods of national emergency. Amin et al. stated that despite the limitations created by cost, high-fidelity endovascular simulation should continue to be increasingly utilized in the development of the interventional radiology curriculum. The authors also highlight that it has become even more important to optimize the learning process in an efficient manner in order to develop procedural proficiency [4].

During national emergencies, compromises to IR trainee education can be mitigated by the use of novel education tools such as high fidelity endovascular simulation. Our experience demonstrates a methodology to maintain IR training with use of didactic and simulation supplementation during the COVID-19 pandemic, which may be helpful for incorporation at other institutions facing similar challenges.

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None.

Declaration of competing interest

RW – Clinical Advisor; Mentice AB.

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