RESEARCH PAPER

Virtual COVID-19 Clinical Teaching Session: A Substitute for 'Sheltered in Place' Medical Students

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The novel SARS-CoV-2 virus, or COVID-19, has caused a pandemic in the past year that has significantly impacted the health care system and medical education. This virus has uniquely impacted emergency medicine, as many COVID-19 patients suffer from acute respiratory distress or failure and require emergent stabilization. While physicians, residents, and medical students would all benefit from hands-on training on the medical management and stabilization of COVID-19 patients, this is not feasible due to risk of transmission and spread of the virus. Students have missed countless hours of hands-on clinical education because of the shift to online learning or emergency remote learning due to these concerns. A PowerPoint presentation was given via Webex by emergency medicine physicians and residents to medical students in hopes of bridging this gap. The lecture presented information on diagnosis, clinical management, and clinical course of COVID-19 positive patients in the emergency department. Students were able to engage with emergency medicine physicians and ask questions in real time. A pre-session survey and post-session survey were administered via Google Forms to assess students' confidence in six different domains. There was significant improvement in all six domains of the survey when comparing the pre-session and post-session survey confidence intervals with a p<0.05 being statistically significant. Storytelling by physicians on certain aspects of patient management, such as advocating for patients in the clinical setting, was found to be a useful tool in conveying information to students. This presentation highlights the utility and effectiveness of an interactive approach to the virtual education of medical students during the COVID-19 pandemic while adhering to online learning and social distancing formats. In addition, this model can be applied to substitute for other clinical learning opportunities that are not currently available to students due to the pandemic.

Virtual | COVID-19 | Emergency Department | Medical Student | Pandemic

The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), also known as Coronavirus Disease 2019 (COVID-19), has become a pandemic, putting a strain on health care delivery (1). Moreover, COVID-19 has uniquely affected the field of emergency medicine. This virus has challenged, and in some cases, redefined traditional approaches to patient management in the emergency department. The sheer number of cases has threatened to overwhelm healthcare facilities and has led to supply shortages across the country.

The clinical aspect of medical education has come to a halt for many medical students across the country as a result of the COVID-19 pandemic (2). Most medical students are not currently able to participate in clinical experiences due to the high risk of exposure and transmission of the virus. Being excused from clinical duties, medical students are unable to gain valuable and necessary experience regarding COVID-19. How can in-person, clinical rotations translate to an online module or lecture? An article in Educasereview discusses the reality of the current educational solutions, specifically emergency remote teaching. The article notes the lack of a robust educational ecosystem in favor of a temporary, reliable solution that will disappear with the conclusion of the emergency state for which it was created (3). Some institutions are attempting to provide emergency remote teaching in lieu of clinical rotations for medical students, while others are pressing pause on their students' clinical education (4). Emergency remote teaching differs from the traditional definition of online education. It provides temporary teaching resources not necessarily built to substitute educational experiences in the long term, instead focusing on providing

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the minimum necessary for continuing education. As students become increasingly responsible for their clinical learning, their resources are now limited to textbooks, literature, case studies and in some cases, online instruction (5).

The COVID-19 crisis presents an opportunity for lessons on management of critically ill patients, infection prevention and control, disaster preparedness, and resource allocation. It is imperative that current medical professionals as well as medical students learn from patient cases to improve COVID-19 management techniques and protocols. With safety concerns and personal protective equipment (PPE) restrictions prohibiting medical students from learning in the clinical environment, a type of temporary solution is in demand. The aim of this session was to enhance medical student understanding of COVID-19, including patient presentation and clinical course, current approaches to management, and hospital operations.

Materials

A PowerPoint presentation was given on WebEx due to current remote learning measures. During this presentation, students were able to view the PowerPoint slides and ask questions using a sidebar \chat" function. Example COVID-19 cases were presented within this PowerPoint and case management for each example was discussed. The session began with a presentation about the current clinical picture surrounding a COVID patient and the reality of daily life as an emergency medicine physician. Details covered included the presenting symptoms of COVID-19 positive patients, necessary medical workup, imaging, and management. The presentation also discussed PPE, daily routine with PPE and sanitation procedures.

Following the PowerPoint presentation, there was a COVID-19 question and answer session led by a panel of eight faculty physicians and five residents. This was an integral portion of the session, as it was one of the first opportunities students had to discuss COVID-19 in an educational setting and to ask questions. Medical students had questions regarding current literature on clinical guidelines and were curious about the differences between the publications, recommendations, and actual practice. Additionally, they were interested in being part of the clinical experience in some way. The organizers felt that the most effective way to bring students up to speed was through sharing their stories and personal experiences taking care of COVID-19 patients. The efficacy of using storytelling in education has been well documented (6). It provides context to the content and builds community within the educational system (7). In this circumstance, storytelling proved to provide an interactive, engaging, and beneficial learning experience for the medical students.

A pre-session survey and post-session survey were administered to all participants. The pre-session survey was sent to students an hour prior to the start of the session and was completed via Google Forms. Participants were asked to rate their confidence in 6 domains, using a 1-5 scale (1= Not at all confident, 2= Slightly confident, 3= Somewhat confident, 4= Fairly confident, 5= Completely confident). The six domains were 1) Confidence regarding general knowledge about COVID-19 including spread and number infected, 2) Understanding of COVID-19 presenting symptoms and manifestations, 3) Understanding about management of COVID-19 patients in the emergency department, 4) Understanding about COVID-19 patient clinical courses, including outcomes and prognosis, 5) Confidence in managing a COVID-19 patient at a medical student level and 6) Confidence of knowledge regarding current COVID-19 testing protocols.

The post-session survey was sent out to attendees immediately following the conclusion of the session. Participants were asked to again rate their confidence after the session in the same 6 domains following the same scale. The post-session survey also included a free-text space for students to submit comments regarding the session. Details can be seen in Survey Outline below.

Survey Outline

The survey below was administered via Google Forms: Please rate the following items on a scale of 1 to 5, using the scale below for reference

1 = Not at all confident
2 = Slightly confident
3 = Somewhat Confident
4 = Fairly confident
5 = Completely confident

1) Confidence regarding general knowledge about COVID-19 (spread, number infected, etc.)
2) Understanding about COVID-19 presenting symptoms and manifestations
3) Understanding about management of COVID-19 patients in the emergency department
4) Understanding about COVID-19 patient clinical courses (outcomes, prognosis, etc.)
5) Confidence in managing a COVID-19 patient at a medical student level
6) Confidence about current COVID-19 testing protocols
7) (Optional, free text) Please use this space to leave any comments regarding the session (what you felt was helpful, what could be improved, etc.)

Data analysis was performed using Excel. Average confidence ratings were calculated for each item on both the pre-session and post session surveys. Two sample t-tests assuming equal variances were conducted for each item to determine significant differences between pre-session and post-session ratings. 95% confidence intervals for each item were calculated.

Results and Discussion

A total of 64 students completed the pre-session survey and 44 students completed the post-session survey. The largest difference between pre-session survey and post-session survey confidence rankings was for item 3, "Understanding about management of COVID-19 patients in the emergency department". There was a 1.67 difference in pre-session survey and post-session survey averages for this item, changing from 2.17 to 3.84, respectively. The smallest difference between pre-session survey and post-session survey confidence rankings was for item 1, "Confidence regarding general knowledge about COVID-19 including spread and number infected" There was an 0.61 difference in pre-session survey and post-session survey averages for this item, changing from 3.16 to 3.77, respectively. The average improvement from pre-survey to post-survey confidence was 1.13. Improvement between pre-session confidence rating and post-session confidence rating was significant in all 6 domains with $p<0.05$ being statistically significant. Pre-session survey averages and post-session survey averages for each survey item 1-6 are shown in Chart 1 below, with the 95% confidence interval represented by the error bars.

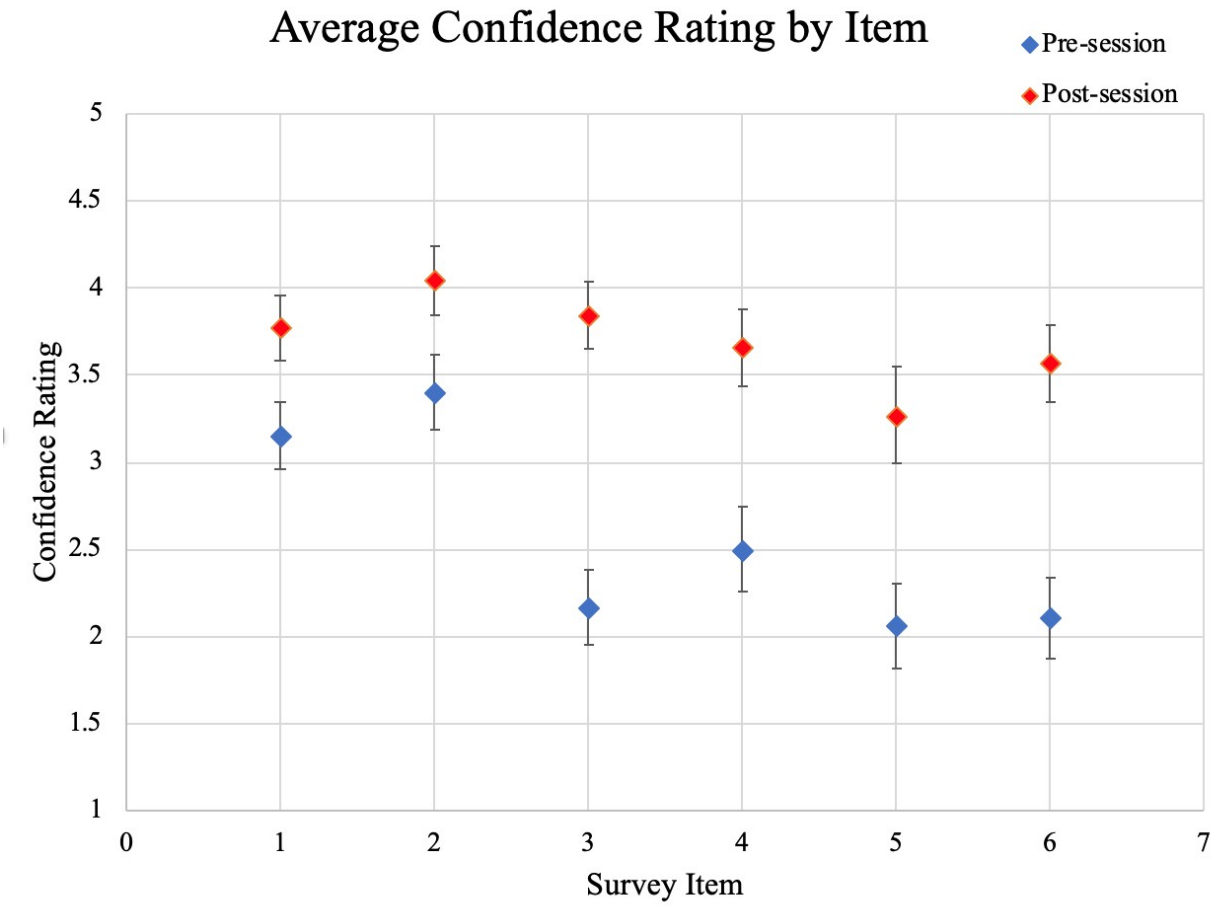

Fig 1. Chart represents mean confidence ranking for each survey item before and after the presentation. Error bars represent the 95% confidence interval. N=64 for pre-session responses and N=44 for post-session responses.

Discussion

The goals for this meeting were as follows; educate students using the personal experiences and challenges of The University of Toledo College of Medicine and Life Sciences (UTCOMLS) Emergency Department staff during the pandemic, prepare students to take care of COVID-19 patients when they return to clinic, and answer any questions from students about the evolving clinical environment. The faculty provided valuable insight, emphasizing the evolving nature of their protocols and the importance of staying up to date with the current research. The faculty and residents continued to fill in the gaps of the clinical picture in the acute management of COVID-19 patients using storytelling. For example, a resident discussed her experience advocating for the admission of a non-COVID-19 patient. She walked students through the case of a heart failure patient who was COVID-19 negative. The admission center was hesitant due to lack of available beds and suggested sending the patient to a different hospital. She explained her thought-process that patients should be admitted at this hospital as their cardiologist could have easier access to them and why that was important. As she told the story, she emphasized the value of being a true advocate for your patients. Learning how to advocate for your patients is a crucial skill learned almost solely in the clinical setting. Without being able to observe this skill or put it into practice, hearing the resident's first-hand account provided a unique learning opportunity for medical students.

To better clarify the nature of the anecdotes students found useful, another example is in regards to a resident's discussion about a patient on a nonrebreather mask. "We are proning awake patients now, not just intubated (as previously done)." The exchange can be seen in Table 1. Dr. Moussa built on this by explaining the careful management of these patients. He continued speaking to his experience of pharmacological treatment for COVID-19 patients in the emergency department and beyond. Students continued voicing their questions in the chat and were met with answers containing

physicians' personal experiences. An example can be seen in Table 2.

Table 1. Webex chat transcription example 1

Time Stamp of Webex	Physician/Student	Comment
0:30:55	Faculty	We are proning awake patients now, not just intubated (as previously done)
0:31:09	Student 1	Is that improvement from proning in general or just for covid
0:31:43	Faculty	Its used in ARDS to improve oxygenation, we used it more liberally. starting in the last couple weeks.
0:32:50	Resident	In terms of physiology, it improves hypoxia due to V/Q mismatch.

Table 2. Webex chat transcription example 2

Time Stamp of Webex	Physician/Student	Comment
0:33:56	Student 2	In terms of AC (anticoagulation) are we using NOACs/DOACs (novel oral anticoagulants direct acting oral anticoagulants)? Heparin ggt (gamma-Glutamyl transpeptidase)? Or just aspirin?
0:34:49	Resident	People are not being anti-coagulated unless admitted. Heparin is preferred.
0:39:53	Faculty	I personally have not used steroids because of concern it will worsen. Havent really seen the ICU [Intensive care unit] do it either. Problem is when you have a COPD (Chronic obstructive pulmonary disease) patient and you are trying to decide is it COPD or COVID, because steroids will improve the COPD.
0:35:17	Faculty	Heparin drip is easy to titrate and turn on and off so that's what we use in the hospital.

Following the session, students showed a greater degree of confidence in all six survey domains. The largest difference between pre-session survey and post-session survey confidence rankings was for item 3, "Understanding about management of COVID-19 patients in the emergency department". The presentation included case-based discussion, which allocated a significant amount of time for discussion of patient management. This may account for the greater improvement in confidence for this item. The improvement in confidence in this domain is encouraging given that the primary goal for this presentation was to better students' understanding of COVID-19 patient management.

The smallest difference between pre-session survey and post-session survey confidence rankings was for item 1, "Confidence regarding general knowledge about COVID-19 including spread and number infected." One reason that there was a smaller change in confidence for this item could be that the primary focus of the

presentation was clinical management, with general knowledge on COVID-19 not being discussed in great detail.

At the end of the post-session survey, learners were able to give feedback on the session. Comments included, "this" was an extremely useful presentation for students and helped us see what is happening on the front line… this level of knowledge is integral to our understanding once we join the clinical scene." Other comments noted that the sidebar "chat" option was helpful, and that seeing computed tomography (CT) scans and images for clinical management enhanced understanding.

One limitation to this presentation was that there was a brief (approximately 10 minute) period of time during which there were audio/video difficulties due to the online presentation format. Because of this, some participants were not able to hear a short portion of the presentation, which may have impacted their reported post-session confidence ratings. However, the online presentation was supplemented with an ongoing "chat" in the sidebar, where participants could pose questions to be answered by emergency medicine residents. Additionally, following the lecture, there was a question and answer session with a panel of 13 emergency medicine physicians. These two additional features allowed participants to clarify any information covered during the period with technical difficulties. Another limitation is that the assessment was administered as a self-report survey rather than an objective assessment to gauge improvement in knowledge. It may be beneficial to develop a tool that objectively assesses participant knowledge in these domains and administer this assessment before and after the presentation.

Conclusion

This lecture presented an opportunity for students to learn more about diagnosis, clinical management, and the clinical course of COVID-19 positive patients in the emergency department. The improvement in students' confidence scores across all six domains supports that this presentation was effective in improving student knowledge regarding COVID-19 in the emergency department. The ability to adapt in real time to changing clinical guidelines is a skill that clinical students need to emulate on their return to the clinical setting. If the students are exposed to examples of adaptation through storytelling, it could ease the reintegration of learners back into the clinical rotations. The physicians emphasized that the best way for students to prepare to return to clinic is to continue to stay up to date on the literature as well as participate in interactions like these to gain as much clinical perspective as possible. COVID-19 is a novel virus with a poorly described clinical course. Therefore, it is essential for healthcare professionals and students to learn as much as possible from each patient case and to share information on COVID-19 with the healthcare community. The interactive format of this online approach to learning offers one way for students to continue learning in a meaningful way while adhering to distancing guidelines.

Conflict of interest

Authors declare no conflict of interest.

Authors' contributions

Conceptualization: M.M., S.S., M.R., C.P. Data curation: J.A., S.S., M.R., C.P. Formal analysis: S.S., M.R., C.P. Methodology: M.M., S.S., M.R., C.P. Supervision: M.M. Writing { original draft: J.A. Writing { review & editing: J.A., S.S., M.R., C.P., M.M., J.G.

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