

# Virtual Procedural Supervision During the COVID-19 Pandemic: A Novel Pilot for Supervising Invasive Bedside Procedures in the ICU

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## Abstract

The ability to perform invasive bedside procedures (IBPs) safely and efficiently is a core skill set within critical care medicine. Fellowship training provides a pivotal time for learners to attain baseline proficiency in such procedures to decrease patient complications. The coronavirus disease 2019 pandemic has posed distinct challenges to the traditional model of teaching and supervising IBPs in the intensive care unit, including stewardship of personal protective equipment and limiting health care worker exposure to persons with coronavirus disease 2019. To address these challenges, we piloted a novel method of IBP supervision and teaching using a virtual monitoring system. In this virtual procedural supervision model, the supervising teacher is located outside the patient room, limiting personal protective equipment use and health care worker exposure. An audiovisual monitoring system allowed communication between the teacher and the learner as well as supervisor visualization of the procedural encounter. Virtual supervision was used for central line placement and bronchoscopy in the medical intensive care unit with no complications or instances of the supervisor needing to enter the patient room. Success was felt to depend on camera positioning and preprocedure planning and to be best for advanced learners who would not require tactile feedback. Upper level learners appreciated autonomy granted by this process. Virtual IBP supervision is felt to be a useful tool in specific situations. As with any tool, there are notable strengths and limitations. Success is felt to be optimized when attention is paid to procedural teaching best practices, learner selection, and technological logistics.

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Procedural proficiency is a foundational skill within critical care practice to ensure patient safety. Unfortunately, procedural complications occur, often related to technical errors and operator skill.<sup>1</sup> With respect to critical care procedural training, trainees enter pulmonary critical care medicine fellowship programs with varying levels of competence at performing procedures. Critical care-based training programs are expected to provide the opportunity for the development of a baseline level of proficiency with progression toward mastery of the procedure.<sup>2,3</sup> The ultimate goal of this training is then to enhance operator skill, decrease technical errors, and improve patient outcomes as a result.

Fellowship procedural training is therefore critically important both for patient safety and for meeting Accreditation Council for Graduate Medical Education requirements,<sup>2</sup> in which trainees are expected to graduate with a baseline level of procedural competency.

Currently, the prevailing mode for teaching invasive bedside procedures (IBPs) in the intensive care unit (ICU) follows a traditional experiential and apprenticeship-based model in which 1 supervisor and 1 learner present to the patient's bedside and the learner is observed and instructed in real time. Such supervision is noted to improve both proficiency and safety and reduce preventable

TABLE 1. Virtual Procedural Supervision Encounter Details

Educational setting	Medical intensive care unit
Timing	Daytime shifts
System	InTouch Telehealth devices
Procedures performed	CVC placement and bronchoscopy
Supervisors (n=4)	Early and mid-career attending staff
Learners (n=3)	Second and third year fellows
Complications	None
Consultants entering the room	None
CVC, central venous catheter.	

complications<sup>4,5</sup> as trainees grow their procedural skills. Consistent with situated learning theory, as a learner progresses, that individual is gradually granted increased autonomy.

Unfortunately, given the importance of fellowship procedural training, the coronavirus disease 2019 (COVID-19) pandemic has added several new challenges to the already complex nature of teaching IBPs in the ICU. The ability to provide both safe and effective patient care while protecting health care workers has been challenged in unprecedented ways. Real and potential shortages of personal protective equipment (PPE) have made stewardship of resources paramount. Health care worker access to COVID-19 positive rooms has been limited for safety, risk of infectious spread, and conserving PPE.<sup>6</sup>

These issues pose challenges for traditional supervisory teaching models of IBPs that rely on learner observation and instruction in real time at the bedside. Such a model creates exposure risk for the supervisor and learner and increases PPE use. Although the supervising physician could perform the procedure independently, this would decrease learners' opportunities for procedural training and practice as the course of the COVID-19 pandemic continues to extend beyond the short term. Additionally, in teaching institutions, direct supervisor availability may be limited in the setting of a high volume of critically ill patients, including in circumstances of patient census and spread outside the geographic ICU.

To address the challenges listed above, we piloted a novel method of IBP supervision in the ICU using remote video monitoring in which the supervising provider observes and communicates with the learner performing

the procedure via a mobile tablet-based camera system (*InTouch Telehealth*, Teledoc Health). There is precedent for the use of virtual supervision, with successful implementation in urology,<sup>7</sup> emergency department care,<sup>8</sup> rural settings, and primary care,<sup>9</sup> however without extensive literature regarding use in critical care-based procedural training. Also, there may be utility for routine use in transition to independent practice.<sup>10</sup> As an example, a majority of urology residents who underwent virtual supervision during endourological procedures felt remote monitoring should be standard practice in residency training.<sup>7</sup>

## PATIENTS AND METHODS

### Intervention

In this pilot, learners were fellow level trainees enrolled in pulmonary critical care medicine and critical care internal medicine fellowship programs at Mayo Clinic in Rochester, Minnesota. Supervisors were board-certified critical care faculty working in the medical ICU, the designated hospital COVID-19 unit. Supervisors were stationed immediately outside the room to allow for their timely availability in case of emergency, while limiting exposure and PPE use. Table 1 provides the participant and encounter details.

### Qualitative Assessment

The investigator created structured interview questions sent via e-mail to supervisor and learner participants (Table 2) for the assessment of their experience using this method of virtual IBP supervision. Input was also supplemented through unstructured interviews

TABLE 2. Interview Questions

Supervisor interview questions	Learner interview questions
In what ways was this supervision model successful?	In what ways was this supervision model successful?
In what ways was this supervision model unsuccessful (ie, challenges and limitations to its use)?	In what ways was this supervision model unsuccessful (ie, challenges and limitations to its use)?
Did you provide feedback and/or teaching to the fellow during the procedure? If so, how did that go? Were they able to follow your feedback?	In what ways, if any, did your procedural performance change as a result of this supervision model?
Would you do this type of supervision again? If not, why not? If so, why?	Would you do this type of supervision again? If not, why not? If so, why?
Are there any changes you would recommend for future procedures performed using this supervision model?	As a fellow, in what ways did this affect your learning?
	Are there any changes you would recommend for future procedures performed using this supervision model?

approximating the structured e-mail interview questions. Qualitative input was collected from 4 supervisors and 2 learners, a 100% response rate from faculty and 66% response rate from fellows who engaged in virtual supervision. The structured e-mail questionnaire was completed by 50% of supervisors and 33% of learners. Investigators reviewed results of the structured interview questions and unstructured interviews using thematic analysis to determine themes.

## RESULTS

We identified 5 categories or themes related to virtual supervision: teamwork, comfort, procedural preparation, autonomy, and technology limitations.

### Teamwork

Supervisor participants noted the role of additional team members such as respiratory therapists and nurses to ensure success of virtual supervision. This was primarily related to manipulating the camera to allow the visualization of key parts of the procedure.

*I did not move the camera with controls although [the respiratory therapist] gamely tried to move it for me in room.*

Supervisor 1

### Comfort

Because of potential challenges in achieving high-fidelity image quality of the procedure site and inability to provide tactile feedback,

supervisors felt virtual supervision would be best suited for advanced learners during non-high-risk procedures. Learner interviews revealed impressions related to the psychological comfort of in-person supervision. It was felt that virtual supervision may provide a stepwise increase in autonomy (discussed further below) while preserving a degree of the learner comfort that comes from knowing that there is an attending physician to help troubleshoot challenges that arise.

*Probably wouldn't do it for intubations unless someone I'm very comfortable with, but certainly for lines and bronch with no issues (the two procedures [Learner 1] and I did together).*

Supervisor 2

*Being alone in a room for the first time performing a procedure, makes you kind of nervous. This made the "band-aid" pull slightly easier.*

Learner 1

### Procedural Preparation

Most supervisors found this model to be successful, especially when appropriate camera position was achieved before the procedure. Camera position training was suggested for those responsible for positioning the tablet throughout the procedure.

*The key is positioning of the unit by [the respiratory therapist] or someone in the*

**TABLE 3. Pearls and Pitfalls of Virtual Procedural Supervision**

Reflection	Tips for practice
Know your technology	<ul style="list-style-type: none"> <li>• Note camera motion and zoom capabilities</li> <li>• Include camera testing and position preparation in the preprocedural checklist</li> <li>• Consider camera positioning training for the in-room assistant</li> </ul>
Appropriate learner selection	<ul style="list-style-type: none"> <li>• Best for learners nearing readiness for independent practice</li> </ul>
Minimize distractions	<ul style="list-style-type: none"> <li>• Discuss plan with ICU care team members to limit preventable interruptions during supervision</li> </ul>
Preparation makes perfect	<ul style="list-style-type: none"> <li>• Perform the procedural pre-brief with all procedural team members to discuss logistics and expectations of the procedure</li> </ul>
Effective teaching can still occur virtually	<ul style="list-style-type: none"> <li>• BID teaching model, assessing the learner zone of proximal development before the procedure</li> </ul>

BID, briefing-intraprocedure teaching-debriefing; ICU, intensive care unit.

*room...if the unit is not positioned correctly, I could see you not having a view at all.*

Supervisor 2

**Autonomy**

Learners did appreciate the autonomy offered by performing the procedure “independently” without the supervisor directly in the room as a graduated transition from learner to independent practice.

*Felt like I had more autonomy and was alone (but help was actually right there if I needed). It feels like this should be the logical progression from having someone in the room with you....I think if I was completely a novice at the procedure this model would not work.*

Learner 1

**Technology Limitations**

The tablet device was noted to have limited motion and zooming capabilities, requiring careful attention to placement of the device within the room.

*Hard to see both things at the same time (ultrasound view, needle aspiration/transduction view).*

Supervisor 1

**DISCUSSION**

Overall, noting certain limitations, this tele-teaching and supervision pilot for IBPs was deemed successful, especially in light of the challenges presented during the COVID-19 pandemic. Our experience adds to the existing literature with use in critical care—based procedural training. We believe that on the basis of these findings, there exists a role for further investigation of virtual IBP supervision in both current and future isolation and infectious disease scenarios, as well as for use in transition to independent practice.<sup>10</sup> Primary limitations of our work included small sample size and single center implementation as part of a pilot-type intervention.

On the basis of our findings situated in the literature, we suggest specific tips and practices to promote success of virtual IBP teaching and supervision (Table 3). For example, preparation was deemed essential in the success of this procedure. This includes being familiar with any limitations in technology or audiovisual system, which may require assistance from additional team members to overcome. Literature supports the pre-brief as a key step in effective IBP teaching.<sup>11</sup> The pre-brief also provides opportunity for appropriate learner selection, a critical step in virtual supervision. As discussed above, virtual supervision is felt to be best suited for learners approaching or ready for independent practice. It is therefore important to effectively assess a learner’s zone of proximal

development before proceeding.<sup>12</sup> This can in part be completed by asking the learner to talk aloud through each step of the procedure during the pre-brief.

Evidence-based procedural teaching models such as the briefing-intraprocedure teaching-debriefing model can still be used effectively<sup>13</sup> to provide a structured approach to procedural teaching. In particular, briefing is felt to be particularly important in virtual supervision. This allows not only the ability to discuss the virtual supervision process and appropriate camera positioning, but also the development of a plan should the learner ultimately require in-person assistance.

### CONCLUSION

Based on our experience of this pilot intervention, virtual IBP supervision and teaching may be an appropriate and useful tool in specific situations. Success is felt to be optimized when specific attention is paid to procedural teaching best practices, learner selection, and technological logistics.

**Abbreviations and Acronyms:** **IBP**, invasive bedside procedure; **ICU**, intensive care unit; **PPE**, personal protective equipment

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