Rev. Spirat. 2025;3(SN1): e5543
DOI: 10.20453/spirat.v3iNE1.5543

Attribution 4.0

ICU-focused bronchoscopy training: advancing skills through simulation

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Abstract

Bronchoscopy is essential in managing conditions in the ICU, such as acute respiratory failure. Traditionally performed by pulmonologists, there is a growing need to train intensivists in bronchoscopy due to the increasing complexity of ICU patients. While existing simulationbased programs focus on complex procedures, there is a gap in training intensivists for basic bronchoscopic tasks crucial in critical care. This study details the implementation of a focused bronchoscopy training course for intensivists.

The course, conducted over two days, combined theoretical instruction and hands-on practice using simulators and realistic ICU scenarios. Trainees received comprehensive guidance on bronchoscope handling, airway anatomy, and basic maneuvers. The course utilized single-use bronchoscopes, 3D-printed bronchial tree simulators, and other ICU-specific equipment to enhance realism and interactivity. The training was held in multiple LATAM locations, with approximately 30 intensivists per session, showing significant improvements in theoretical knowledge and practical skills. Participants exhibited high proficiency in basic bronchoscopy maneuvers and airway anatomy identification.

The program's success underscores the importance of specialized bronchoscopy training for intensivists, addressing a critical need in ICU settings. The course's structure, combining brief theoretical presentations with extensive practical sessions, facilitated effective learning and confidence building. The use of realistic simulators was pivotal in enhancing the learning experience.

Future research should focus on long-term assessments of skill retention and clinical impact. Additionally, exploring diverse evaluation methods may provide a more comprehensive measure of bronchoscopy proficiency. This training model offers a valuable addition to ICU education, ultimately aiming to improve patient outcomes in critical care.

Keywords: simulation; small group instruction; role-playing

Introduction

Medical practices evolve quickly with the discovery of new pathologies and the development of more effective approaches for existing conditions. This presents a challenge for the training of professionals, often necessitating new strategies for ongoing education and skill development.

For instance, bronchoscopy is a valuable tool for managing various conditions in the intensive care unit (ICU). Bronchoscopy can be quickly performed at the bedside at any time, and requires minimal assistance, without the risk of potentially dangerous transfers outside the ICU (Bauer & Midthun, 2023). While historically performed by pulmonologists, the growing complexity of critically ill patients and the continuous demand for respiratory care necessitate training intensivists in bronchoscopy skills.

Simulation-based training programs have consistently shown improved learning outcomes, enhancing technique and efficiency (Kennedy et al., 2013). However, these programs primarily focus on complex procedures typically handled by highly specialized proceduralists in specialized suites. Unfortunately, these programs do not address the primary clinical uses of bronchoscopy in critical care settings.

Developing specific training programs for intensivists can improve their competence and confidence in performing bronchoscopy, potentially enhancing clinical outcomes. This work details the experience of implementing a critical care-focused bronchoscopy training course.

Theoretical framework

Simulation is a widely used teaching strategy in the health field because it allows the practice of skills in advance, increasing confidence and reducing stress for the practitioner before they face real critical situations. In this way, we choose to perform a simulation-based course for learners to have the opportunity to participate in realistic, protected, and supervised scenarios without compromising the safety of their patients (Dávila-Cervantes, 2014). The trainees received instruction from two bronchoscopy educators in a two-day, time-compressed simulation course. This decision was based on a previous report indicating no discernible differences in skills acquisition between one-day and weekly distributed bronchoscopy simulation practices (Bjerrum et al., 2016). This aimed to complement practical training on simulators with brief presentations focusing on technical and theoretical aspects deserving emphasis (Soto & Miguel, 2001).

The course followed the structure outlined by Perkins for learning workshops (Perkins, 2010). The structure of the course was divided into three parts: initial demonstration-explanation stage, full simulation work, and critique stage.

Method

At the beginning of the course, the students received an initial demonstration-explanation about the use of the bronchoscope, which included a brief overview of its components and accessories, as well as instructions on proper grip, basic maneuvering, and setup. This stage focused on explanation and modeling, aiming not only to introduce concepts but also to demonstrate how they were applied with the bronchoscope.

Subsequently, students immersed themselves in full simulation work, with instructors tasked with both recalling the general ideas and techniques presented earlier and guiding the individual development of students. Instructors provided personalized and individualized tutoring and feedback regarding each student's ongoing work. Additionally, students had the opportunity to practice alongside peers in small groups ranging from two to four students, fostering collaborative learning and encouraging them to brainstorm and resolve problems and challenges together (Perkins, 2008). Finally, the third structure involved a critique stage, where students discussed and commented on each other's work. The instructors offered observations and provided an overall assessment of the process's development. The Bronchoscopy step-by-step approach was applied, which are time-tested exercises to teach muscle memory and airway anatomy (Bronchoscopy Step-by-Step©, Bronchos-

copy International). This method breaks down complex tasks into smaller elements, fostering motor learning and spatial awareness. It aims for trainees to develop efficient movements and accurately identify airway anatomy through repeated, deliberate practice (Singh & Restivo, 2023).

The instruments used in the course were the same as those used with patients and included single-use bronchoscopes and video screens (aScope™ 4 Broncho and aView™, Ambu®). 3D-printed low-fidelity bronchial tree simulators with a high degree of anatomical realism were utilized (Leong & Li, 2020). Alongside the course, endotracheal tubes, mechanical ventilation connectors and other specific ICU supplies were used to simulate realistic intensive care scenarios. Furthermore, a percutaneous tracheostomy simulator was utilized. Percutaneous tracheostomy is a surgical procedure usually performed collaboratively between surgeons and bronchoscopists in clinical settings. Hence, the utility of the role-playing scenario in both roles was emphasized. Additionally, within the same simulator and simultaneously, it encouraged interaction among students to successfully complete the task (Kattan et al., 2019). The training course concluded with an individual performance test based on a validated training assessment tool through direct observation of the learner's performance on the simulator (Davoudi et al., 2008).

Results

The bronchoscopy training course was conducted six times in Buenos Aires (Argentina), and once in Paysandú (Uruguay), Antofagasta (Chile), Asunción (Paraguay) and Puerto Vallarta (México).

The bronchoscopy training course was attended by a maximum of 30 intensivists each, all of whom had varying levels of prior experience with bronchoscopy. Upon completion, participants demonstrated significant improvement in both theoretical knowledge and practical skills. Trainees achieved high proficiency in basic bronchoscopy maneuvers and airway anatomy identification by the end of the course.

Discussion

The implementation of ICU-focused bronchoscopy training courses across multiple LATAM locations has demonstrated significant improvements in intensivists' bronchoscopy skills and confidence.

The combination of brief theoretical presentations and extensive practical sessions allowed for efficient learning without overwhelming the participants. Small group practices promoted a collaborative learning environment tailored to tackle challenging aspects, which significantly enhanced skill refinement and confidence building. The role-playing scenario provided students with the opportunity to practice percutaneous tracheostomy skills in a setting that emphasized the crucial dynamic interaction between the surgeon and bronchoscopist, ensuring the procedure is performed safely and effectively.

The use of the 3D-printed simulators, with high anatomical realism and interactivity, was a crucial factor that enhanced their learning experience. Furthermore, the affordability of these low-cost tools improves accessibility, allowing students to continue their education on the simulator after completing the course. The final performance test, based on a validated training assessment tool, confirmed the overall improvement in the participants' bronchoscopy skills. The direct observation of learners' performances provided a robust measure of their competency. Finally, feedback from the participants was overwhelmingly positive. They expressed increased confidence in performing bronchoscopies in critical care settings and appreciated the practical, handson nature of the course.

Conclusion

The ICU-focused bronchoscopy training courses are a valuable addition in critical care education. The success of this program highlights the substantial benefits of incorporating such specialized training into ICU practice, which can ultimately improve clinical outcomes for critically ill patients. Bronchoscopy simulation offers a safe environment where learners can repeatedly practice various clinical skills, ensuring patient safety is not compromised.

Educators in related fields can draw upon these principles to innovate their training methodologies. Emerging critical care practices like ultrasound or transcranial Doppler could benefit from similar structured training programs, ensuring proficiency and application in clinical settings. Additionally, other mainly endoscopic procedures used outside the ICU such as cystoscopy or hysteroscopy, could also benefit from adopting a similar training format.

Limitations and Future Research

We identified several limitations in our work: Firstly, while the training program was implemented in various centers in LATAM, we did not explore its adaptability to different contexts. Secondly, the evaluation of participants' bronchoscopy skills and confidence was conducted immediately after the training course. Longerterm follow-up assessments are needed to understand the sustainability of acquired skills and their impact on clinical practice over time. Additionally, there is currently no evaluation of the transition from simulator to real clinical scenarios. Lastly, while the final performance test was based on a validated training assessment tool, it may have limitations in capturing all aspects of bronchoscopy proficiency. Exploring alternative evaluation methods could offer a more comprehensive assessment.

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