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On-line education in anaesthesiology: Perioperative echocardiography for Latin America

Educación on-line en anestesiología: Ecocardiografía perioperatoria para América Latina

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ABSTRACT

Background: Echocardiography is a versatile tool for anaesthesiologists. There was a lack of availability in Latin America. For those reasons starting in 2011, the Chilean Society of Anesthesiology had sponsored an online program with pre-recorded echocardiography lessons, bibliography, homework, and forums. **Methods:** An observational, descriptive, and transversal study was carried out, analyzing this online course from 2011 to 2020 led by certified Chilean echocardiographers. In 2023, a survey was emailed to formal students. Specifically, students were asked if they were teaching echocardiography before and then after the program. **Results:** A total of 211 completed questionnaires were received. The results showed that before training, 89.1% of anesthesiologists did not use echocardiography. However, after training, 81.5% responded that they use echocardiography. Also 100% of the anaesthesiologists that responded used echocardiography in clinical practice, 51.2% do it weekly, 15.2% monthly and 2.8 quarterly. The main responders were from Chile, Argentina, and Uruguay. Students were teaching echocardiography in 10.9% before their echo program after 45.5% their echo program comparing ($p < 0.001$). **Conclusions:** After participating in these 8month online echo course a high and significantly number of former students were teaching echo. Probably this can be a pivotal element in disseminating this image technique. This report shows that online education can overcome many limitations thus expanding promising alternatives to education in anaesthesiology in a developing region such as Latin America. And remarkable it was a pioneering online teaching way starting in 2011, about 10 years before SARS-CoV-2 pandemic and the reconversion of all teaching system into online.

Key words: Echocardiography transoesophageal, transthoracic echocardiography, continuing medical education.

RESUMEN

Introducción: La ecocardiografía es una herramienta versátil para los anestesiólogos, que aún no está disponible en toda América Latina. Por estas razones, la Sociedad Chilena de Anestesiología ha patrocinado un programa en línea desde 2011 con lecciones de ecocardiografía pregrabadas, bibliografías, tareas y foros. **Métodos:** Se realizó un estudio observacional, descriptivo y transversal, analizando este curso en línea desde 2011 hasta 2020, dirigido por ecocardiografistas chilenos certificados. En 2023, se envió una encuesta por correo electrónico a los estudiantes formales. Específicamente, se les preguntó a los estudiantes si se les enseñó ecocardiografía antes y después del programa. **Resultados:** Se recibieron un total de 211 cuestionarios completados. Los resultados mostraron que el 89,1% de los anestesiólogos no utilizaban ecocardiografía antes de la capacitación. Sin embargo, después de la capacitación, el 81,5% indicó usar ecocardiografía. Además, el 100% de los anestesiólogos que respondieron utilizan ecocardiografía en la práctica clínica, el 51,2% lo hace semanalmente, el 15,2% mensualmente y el 2,8% trimestralmente. Los principales encuestados provinieron de Chile, Argentina y Uruguay. Los estudiantes realizaron ecocardiografías en 10,9% antes de su programa de ecocardiografía y en 45,5% después de su programa de ecocardiografía, comparado ($p < 0,001$). **Conclusiones:** Después de participar en este curso en línea de ecografía de 8 meses, un número alto y significativo de exalumnos impartió clases de ecografía. Probablemente, esto podría ser un elemento crucial para la difusión de esta técnica de imagen. Este informe muestra que la educación en línea puede superar muchas

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limitaciones, ampliando así alternativas prometedoras para la educación en anestesiología en una región en desarrollo como América Latina. Y notablemente, fue un método de enseñanza en línea innovador que comenzó en 2011, aproximadamente 10 años antes de la pandemia de SARS-CoV-2 y la transformación de todo el sistema educativo hacia lo en línea.

Palabras clave: Ecocardiografía transesofágica, ecocardiografía transtorácica, educación médica continua.

Introduction

Echocardiography is an important perioperative device for anesthesiologists[1],[2].

Clinical experience allows physicians to explore by auscultation, electrocardiographic tracing, among other techniques, to find pathologies in patients. Since the emergence of echocardiography, this diagnostic and monitoring tool allows the visualization and direct recognition of the heart and great vessels[3]. Thus, allowing for evaluation, determining a more specific diagnosis and individualized treatment. Its growth and acceptance have become an opportunity to improve the cardiac clinical evaluation, optimization, and management planning of patient perioperative care, as well as a goal-based control tool for therapeutic[4],[5]. Echocardiogram diagnostics through the gradual use of portable equipment, allowed the ability to transfer echocardiography to the cardiac operating room to the non - cardiac operating, intensive care unit and emergency department, expanding the detection of pathologies not only to the preoperative period. It becomes a cardiovascular assessment for the anesthesiologists. It motivates them to improve its correct clinical indications, use and interpretation[6]. At present, it is common to recognize the presence of the ultrasound machine as necessary input in any hospital of tertiary complexity. Significant gaps persist however, particularly of the economic nature, which limits its availability in the most impoverished countries of Latin America. Echocardiography, being an imaging technique, highlights its feasibility to transmit images and videos of different pathologies, which makes its education very visual and therefore friendly.

Digital education can be developed remotely, online, or deferred, with the possibility of repeating, going back or omitting content[7],[8]. Expanding the range of offerings for the student and edited to fit the needs of the moment[9],[10]. With the current growth of digital platforms as training tools, a group of leading anesthesiologists in echocardiography, working together with the Chilean Society of Anesthesiology, created a digital course on echocardiography for Latin American anesthesiologists. Since its inception in 2011 it has allowed students to learn the new technology online from 2011-2020. The course was discontinued because of pandemic. The main novelty of this pedagogical strategy lies in the visionary use of distance learning, e-learning, as it is popularly known. The scope of the program covered various countries, being a pilot model in the dissemination of knowledge of echocardiography through digital media in Latin America.

The main objective was to determine if the student was able to teach echocardiography after finishing the course. With the clear purpose of disseminating the technique.

Secondary objectives were the assessment of the clinical use of this tool in a continent historically marked by postponement and economic inequality, which also includes marginalization in access and quality of education and medical devices, before and after the training.

Methods

Study design

This study was designed as a pre and post intervention study conducted in Latin America from April 2011 to April 2020 and approved by the ethical committee of Hospital Clínico FACH, Santiago, Chile (Nº1266*1).

The number of participants included in this study was 211 of both sex and any age who responded an anonymized questionnaire with informed written consent. Participation was allowed only after signing the consent form and agreement to adhere to the study requirements.

Intervention

The echo program was structured into six theoretical modules the given video classes. In addition, there was also the possibility of downloading complementary bibliographic material and relevant scientific articles in each session.

The 6 modules were structured around the following themes, physics of ultrasound (Doppler, M-mode, continuous, pulsed, tissue), Setting the ultrasound machine, Artifacts Transesophageal echocardiography (TEE), transthoracic echocardiography (TTE), Systolic and diastolic function, Perioperative ischemia, Hemodynamics, TEE in non-cardiac surgery, Echocardiography in the catheterization laboratory, Basic lung ultrasound, Vascular access under ultrasound.

At the end of the eight months of training, a final exam with a minimum of 70% approval was given.

Only students who had successfully completed the training process during the indicated period were invited to participate in this study. For the collection of information, a survey was prepared which was sent via email to the entire cohort of students. Those who answered the survey did so voluntarily without receiving any type of economic, academic, or other associated benefit. All the responses were used to create a database, where a percentage analysis of the responses to each question could be formulated.

Statistical analysis

Results were collected, tabulated, and statistically analyzed by an IBM-compatible personal computer with SPSS statistical

package version 27. Data were shown as mean, interquartile range or value, and frequency and percent. Descriptive statistics, e.g., number (no), percentage (%), mean (x), and standard deviation (SD). Test of normality distribution was done by Kolmogorov-Smirnov test for quantitative data. McNemar test was used to study the association between paired qualitative variables (Yes/No), and a p value of < 0.05 was considered statistically significant.

Results

A total of 211 surveys were received, from seven Latin America countries. Of those 52.6% from Chile, followed by Argentina 17.5%. Male students represented 58.3%. The average age was 44.2 ± 10.5 years (Table 1).

The results showed that before training, 89.1% of anesthesiologists did not teach echocardiography. However, after training, 81.5% responded that they teach echocardiography at their workplace.

Also 100% of the anesthesiologists that responded used echocardiography in clinical practice, 51.2% do it weekly, 15.2% monthly and 2.8 quarterly.

There were more responses from students who completed the program in 2019 (18.75%), than 2018 (17.61%) and 2015 (17.04%). Regarding years working as anesthesiologist: 21% had less than 5 years, 55% had more than 5 years but less than 20%, 24% had more than 20 years. Regarding the questions asked to the cohort, the results were broken down by consultation, finding that close to half of the respondents had not taken other training courses in echocardiography in addition to this program (47.73% vs 52.27%). The high presence of anesthesiologists trained in echocardiography in their respective work centers was also obtained as information. In 60.8% of the cases, the student trained in this program was the first specialist trained in echocardiography present in their surgical suite. With respect to the performance of echocardiography, the most prevalent was weekly use (51.2% of cases), followed by hardly ever use (30.8% of cases). Regarding tutoring other colleagues in their workplace, a vast majority (89.1%) of the respondents reported having played the role as an echo- teacher instructing other colleagues in echocardiography after completing the course. Finally, 39 students (18.5%) stated that they did not have ultrasound equipment (ETT) while 108 students (51.2%) stated that, so they could not perform echocardiography. When asked about the limitations in this regard, sadly, this emerged as the first and most recurrent reason for abandoning the practice of echocardiography (Table 2).

Regarding the evaluation of the course, on a scale from 1 (very useless) to 5 (very useful), it was found that more than half of the students (58.52%) rated the program with the highest grade, while none awarded the minimum grade (Table 3).

Table 1. General characteristics

General characteristics of the respondents	n (%)
Sex	
Male	123 (58.3)
Female	88 (41.7)
Age	
Up 50 years old	148 (70.1)
Over 50 years old	63 (29.9)
Place of professional practice	
Chile	111 (52.6)
Argentina	37 (17.5)
Other	32 (15.2)
Uruguay	8 (3.8)
Perú	8 (3.8)
Colombia	7 (3.3)
Bolivia	7 (3.3)
Paraguay	1 (0.5)

Table 2. Training, teaching and work characteristics

Training, teaching, and work characteristics of the respondents	n (%)
Before course, teaching other professionals	
No	188 (89.1)
Yes	23 (10.9)
After course, teaching other professionals	
No	115 (54.5)
Yes	96 (45.5)
ETT availability	
Yes	172 (81.5)
No	39 (18.5)
ETE availability	
No	108 (51.2)
Yes	103 (48.8)
What is the frequency of echocardiographic use in your practice?	
Hardly ever	65 (30.8)
Weekly	108 (51.2)
Monthly	32 (15.2)
Quarterly	6 (2.8)

Table 3. Contingency table

		After teaching	
Before teaching	Yes	No	Total
Yes	23	0	23
No	73	115	188
Total	96	115	211
McNemar Test	Value	gl	p
χ^2	73.0	1	< .001
N	211		

Discussion

On-line Echocardiography teaching for anesthesiologists is possible.

The results showed that before training, 89.1% of anesthesiologists did not teach echocardiography. However, after training, 81.5% responded that they teach echocardiography at their workplace, so after participating in these 8 month online echo course a high and significantly students were teaching echo. Probably this can be a pivotal element in disseminating this image technique.

Online teaching stands as a reasonable access to education, with self-management of the training process as a rule. Among the identifiable advantages of an online teaching mode, is the loss of the face-to-face teaching paradigm[11]. In addition, digital education allows different modes of student participation, in the form of question-and-answer forums, as well as group videoconference sessions[12]. It also creates ties between people of different nationalities and enrich intercultural exchange. By opening their classrooms digitally prestigious institutions increase their connection with other learning environments[13],[14]. Finally, digital assistance or intraoperative consultation with expert tutors is also feasible, when the necessary equipment and regulations are available[15].

On the other hand, the disadvantages of an online teaching modality are the peremptory requirement of Internet access. Also, the perception of a lower quality certification of the programs, less personalized way of educating, and scarce legal regulation that persists in digital educational matters[16]. Since the echocardiogram is a procedure, theoretical learning in classes could not be accompanied by practical sessions in this program. In fact, the non-availability of an ultrasound machine emerged as the main limitation for practicing what was learned. If it was strictly necessary, the costs associated with the course would increase significantly.

Regarding the study, its strengths are the international scope, the high participation of the students and based on an educational program certified by a national anesthesiology society. It is important to note that 60.8% of the cases of students reported are the first specialists trained in echocardiography at their health center. It reflects a powerful impact of the educational model, bringing new study tools to various nationalities. Along with this, it was reported, that students trained in echocardiography thanks to the program, were able to teach other colleagues in their workplace, and expand the scope and impact of what was taught. Finally, the current validity of the course makes it feasible to broaden the base of data and repeat the analysis with students of the courses.

Study limitations include the fact that it did not investigate the demographic aspects of the students, although this was not the initial intention of the researchers. It may in a subsequent analysis by subgroups. An important issue was that the course was discontinued during pandemic, because of lack of budgets. Education is challenging, especially in health care. It represents a field in constant change analysis, and reassessment. Education itself has learned and will continue to learn from the changes. It began with the advent of internet, followed by artificial intelligence, virtual reality, and the boom in computer development, technological hardware, among others, that we can´t even imagine. Since its nadir, it has echoed the changes and experienced a virtuous and intricate path in search of new, safe, advanced, and personalized ways of teaching, with the sole purpose of captivating the attention of its students. This inspiration collected by the Chilean Society of Anesthesia make possible to bring to Latin America the worlds of education and health closer together, for the benefit of the students and patients, reconciling their respective rights and safeguarding safety in learning, which is also a hallmark of anesthesiology.

In conclusion the design, implementation, and evaluation of remote academic strategies for training in echocardiography is feasible, reproducible, and a successful modality of education for anesthesiologists in Latin America. Its future development complemented by new digital teaching strategies, artificial intelligence and virtual reality are the subject of future analysis.

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