Recognition of emerging cardiac diagnoses by echocardiography in 5th-year medical students — the role of focused e-learning

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INTRODUCTION

Echocardiography has become one of the most widely used diagnostic tests in modern medicine. With the increasing availability of echocardiographic equipment and the advent of miniaturized, portable cardiac-echo technology, the inclusion of echocardiography-derived data in routine physical examinations may soon become common for cardiologists and non-cardiologists [1]. The role of echocardiography in emergency departments has been recently acknowledged [2, 3]. Therefore, providing future physicians with skills on how to acquire and interpret cardiac-echo data is becoming highly expected in medical curricula [4–6]. To meet these expectations the Board of the Faculty of Medicine of the Jagiellonian University Medical College (JUMC), supported by recent literature on online teaching [7–9] and by the experience of successful implementation of ECG e-learning [10, 11], introduced in 2020/2021 academic year a subject entirely dedicated to this field. The subject has been included in the program of the 5th year of the 6-year JUMC Faculty of Medicine curriculum. The 10-hour course, with a synchronous online seminar design, is aimed at improving the students' knowledge of the application of basic echocardiographic projections, their ability to evaluate the morphology and function of heart structures and chambers, and their ability to interpret results in relation to clinical contexts. The online mode of the course was chosen to ensure, equally to all students, synchronous presentation and discussion of essential elements of the echocardiographic examination. In this study, we aimed to evaluate the didactic effectiveness of such an approach.

METHODS

All 5th-year students of the 2020/2021 academic year at the JUMC Faculty of Medicine were eligible to participate in the study. Participation was voluntary. All students were informed about the topic and the purpose of the study. An invitation along with a link to an online questionnaire was disseminated using a university mailbox, discussion groups, and social media on February 26, 2021, with a completion deadline of April 6, 2021.

The specifically designed questionnaire for this study was composed of 2 sections (Supplementary material). The first contained 8 echocardiographic recordings of different cardiovascular pathologies (one major diagnosis per recording), and the second presented 8 real-life descriptions of echocardiographic findings, which included data on the morphology and function of different cardiac elements. The students were asked to answer 16 multiple-choice questions with five distractors (Supplementary material) including one "I don't know" option. There was no time limit for the completion of the questionnaire, but only one attempt was available. Correct answers were published after finishing the survey. The maximum score was 16 points, with 8 points for image recordings (image score) and 8 points for echocardiographic descriptions (description score).

The threshold for a positive result was defined at ≥9 points (>56%) in accordance with the guidance of the Polish Medical Final Examination (LEK). Both the recordings and the descriptions were provided by trained cardiologists and were assessed before the start of the study by two other independent cardiologists.

Statistical analysis

The students, who gave consent to take part in the study and completed the online questionnaire, were divided into 2 groups. The first was comprised of those who had already completed their echocardiography course before the study start (the post-course group), and the second was those who had not (control group). The minimal size of the sample was calculated based on available literature (Supplementary material).

The study groups were compared in terms of the total score (max. 16 points), images score (max. 8 points), descriptions score (max. 8 points), and the number of correct answers to each question. Data were expressed as median and interquartile range or as numbers and percentages. The Mann-Whitney U test was used to compare continuous variables, and the Chi-square test to compare the categorical variables. The significance level was set at $P < 0.05$. Statistical analysis was performed using jamovi 1.2.27 software.

RESULTS AND DISCUSSION

A group of 63 students completed the questionnaires. Twenty-five students were assigned to the post-course group and 25 to the control group. The students who were participating in the course when completing the questionnaire (n = 2) and those who chose only "I don't know" answers to all the questions (n = 11) were excluded from the analysis (7 students from the post-course group and 4 students from the control group). As presented in the supplementary material, the response rate was 25% in both groups.

Students from the post-course group achieved a higher total score (10 [6–12] vs. 5 [3–8]; $P = 0.001$) respectively, image score (5 [4–6] vs. 2 [1–4]; $P = 0.001$) and description score (5 [2–6] vs. 2 [2–4]; $P = 0.01$) than the control group. As few as 5 (20%) students from the control group reached >56% of points (9 or more points) of correct answers, whereas in the experimental group it was 14 (56%) students ($P = 0.008$).

Students of the post-course group, as compared to the control group, more often made a correct diagnosis of images presenting acute aortic dissection (56% vs. 28%; $P = 0.045$, respectively), acute pulmonary embolism (52% vs. 24%; $P = 0.41$, respectively), acute myocardial infarction (68% vs. 12%; $P = 0.001$, respectively) and severe systolic dysfunction of the left ventricle (72% vs. 28%; $P = 0.002$, respectively).

Moreover, the post-course students correctly interpreted the descriptions of high risk of pulmonary hypertension (64% vs. 36%; $P = 0.048$), acute pulmonary embolism (48% vs. 16%; $P = 0.015$), severe systolic dysfunction of the left ventricle (76% vs. 36%; $P = 0.004$), and severe aortic stenosis (56% vs. 12%; $P = 0.001$); they did it more frequently than the students from the control group.

The distribution of correct answers for each question is shown in Figure 1.

The results of this study show that 5th-year medical students have insufficient competencies to interpret cardiac echo data, as the threshold for a positive result was achieved by only 20% of students who had not completed the online echocardiography course. However, this score can be significantly improved with the use of an internet-based course specifically focused on echocardiography (56% of students achieved positive results).

An important strength of our study is its novelty. Although echocardiographic e-learning has been previously assessed as a method of education in several studies (Supplementary material, Discussion and Supplementary references [1]), thus far the scientific question: "Does an online course of transthoracic echocardiography improve recognition of emergency cardiac conditions and understanding of echocardiographic results in medical students?" has not been answered.

This study has some limitations. First, the sample size seems low, although it was predefined based on previous studies. Second, our study has a case-control design, which is prone to a certain bias inherent in such studies [12].

In summary, a routine 10-hour online echocardiographic course allowed the 5th-year medical students to improve their competencies in recognition of acute or severe cardiac diseases with the use of cardiac echo examination.

Supplementary material

Supplementary material is available at https://journals.viamedica.pl/kardiologia_polska.

Article information

Conflict of interest: None declared.

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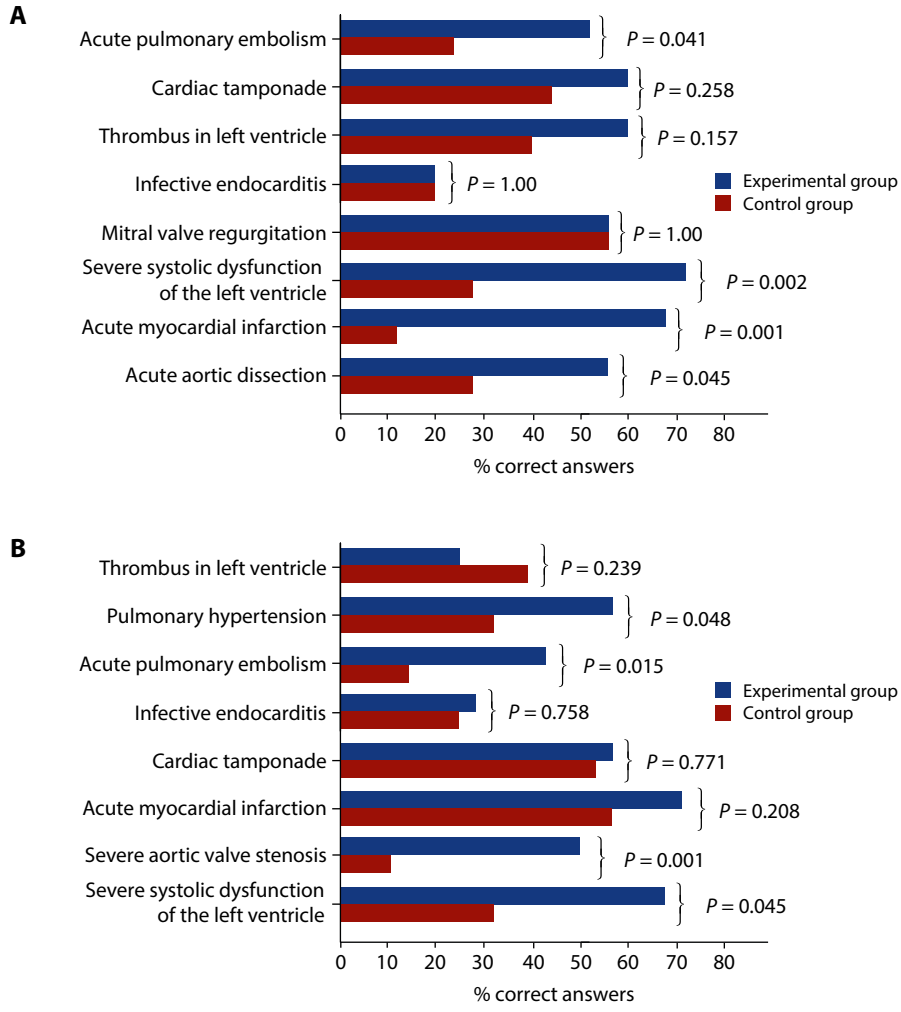

Figure 1. Percentage of correct answers for each question in the control and the experimental groups. **A.** Recognition of echocardiographic images. **B.** Interpretation of echocardiographic description

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