Evaluation of Algorithmic Training Efficacy in Neurosurgical Emergencies for Medical Students

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Abstract

Background: Nowadays the question of separation between training and clinics in many clinical fields is extensively debated, and all universities endeavor to present their theoretical education in a manner close to clinics. Medical students require novel educational approaches that will enable them to function efficiently in clinical conditions. In the present study, we evaluated the efficacy of algorithmic and lecture-based training on learning of interns.

Methods: In this experimental study, we assessed scores obtained by two groups of interns, each comprising 30 interns as case and control groups, on a multiple-choice questionnaire with confirmed validity and reliability. The scores were compared before training and after two weeks of training, which was presented using the algorithmic method for the case group and lectures for the control group. Data were analyzed on SPSS software using independent t-test, paired t-test and ANOVA.

Findings: In the case group, the mean scores of interns increased from 10.034 ± 1.56 before training to 15.23 ± 1.57 after algorithmic training, indicating a significant difference. In the control group, the mean scores of interns increased from 10.47 ± 2.43 before training to 12.33 ± 1.54 after lecture-based training, indicating a significant difference. Analysis of variance indicated that the mean score of interns after training in the case group was significantly higher compared to those of the control group.

Conclusion: Training improves learning, and as medical students are more active in clinical fields, using novel methods of education such as algorithmic training may be more efficient compared to other methods.

Keywords: training, algorithmic, students, medicine, intern.

Introduction

Medical universities are responsible for education of physicians who, after graduation, will have to improve health in their societies through fulfilling professional responsibilities and commitment to principles of medicine. Nowadays, medical education is in the center of great attention. Diagnosis and treatment of many diseases which the physicians will face in the future are taught in clinics and emergency departments, and a variety of methods are used to teach the activities that a medical student needs to learn , hence reconsiderations should be given to methods of teaching clinical techniques during the medical student training . Therefore, novel strategies must be implemented for education to yield better learning as well as longer durability of the subject matter.

Currently, medical centers try to use new and specific framework for diagnosis and treatment which assumes the form of an algorithm to be used by medical students (1).

An algorithm is a finite set of commands which are followed in a specific order to solve a problem. In other words, algorithms provide a step-by-step solution to a problem to find an output from a specific input (2). In an algorithmic model, the solution is presented in a stepwise manner and with accomplishment of each step, the student will move on to the next until the problem is solved. In this model, it is recommended that instead of emphasizing acquisition of skills for performing the command perfect, emphasis should be put on understanding concepts and the student must be provided with sufficient time to experiment and to focus on a single problem at a single time (2,3). Algorithms are being used increasingly in mathematics, computer science and clinical activities to ensure that activities are performed correctly, completely and with high accuracy (2).

Pool and McMohen (2005) used this method for training geriatric healthcare providers and achieved acceptable results in terms of improving knowledge as well as the quality of care (4).

Macginn et al. reported that using algorithms in clinical fields not only improves quality of patient care and comfort, but also helps physicians and other healthcare personnel in making clinical decisions. It also benefits programs of clinical service evaluation and renders clinical training easier and more efficient (5).

Benefits of using algorithms in medical sciences are shown in different fields such as dermatologic patients' management, diabetes management and geriatric therapy in improving function and efficacy, reducing errors, clinical evaluation and monitoring clinical care(6,4 ,7).

Trauma is one of the most common causes of death in a mortality survey(8) and head trauma is a major cause of death compared to other sites of trauma , highlighting the need for appropriate treatment. In the present study, we used algorithmic training and lecture-based training to educate medical students for neurosurgery emergencies. These two methods of training were compared for their efficacy so that the results may contribute to adoption of an optimal teaching method to reduce or fill the gap between training and clinical conditions.

Methods and Materials

This is an experimental study on 60 medical students who had finished their clerkship and entered their internship. The students were randomly assigned to equal case and control groups. Prior to training interns for approach to emergencies of neurosurgery, the interns took a multiple-choice questionnaire developed by the authors with its reliability confirmed by test retest (R=0.87) and its content validity confirmed by 4 assistant professors (two neurosurgeons and two neurologists). Subsequently, the case group received a two-hour session on approach to emergency patients using the algorithmic method, while the control group attended a two-hour lecture on the same subject. After training, the case group experienced algorithmic approach to patients in emergency departments of Taleghani and Emam Reza Hospitals, and then both groups took the same examination again. Data were collected and analyzed on SPSS software.

The case and control groups were homogenized for confounding variables of age, sex, marital status and residence and subjects in both groups were required not to exchange information about their respective method of training. Data were analyzed using appropriate descriptive and analytic statistics on SPSS software. In this study, we used independent t-test, paired t-test, Kolmogrov-Smirnov, and analysis of variance.

Findings

Out of 60 students, who participated in our study, 30 were assigned to the case group and 30 were assigned to the control group. 58.3% of study group were women and 41.7% were men. Chi-square test did not indicate a significant difference between the two groups in terms of sex (χ^2=0.617, sig=0.43). The mean age of study group was 28.35 ± 10.55 years, ranging from 24 to 40 years. The mean age of students in the case and control groups was 28.37 ± 3.89 and 28.33 ± 3.8 years, respectively. T-test did not indicate any significant difference between two groups (t=0.034, df=57.97, sig=0.97). 86.7% of all students were single and 13.3% were married. 80% of study group aged less than 30 years and 20% aged 30-40 years, which was the same for case and control groups. Chi-square did not indicate a significant difference between the groups (χ^2=0.00, sig=1.00).

Prior to statistical analysis, we used Kolmogrov-Smirnov test and plot box graph to find out that data before and after the examination were normally distributed. The mean scores of the multiple-choice questionnaire before training for the case and control groups were 10.034 ± 1.56 and 10.47 ± 2.43, respectively. After Levene's test of equality of variances, t-test did not indicate a significant difference between the groups (p=0.0416). Moreover, the mean scores of the multiple-choice questionnaire after training for the case and control groups were 15.23 ± 1.57 and 12.33 ± 1.54, respectively. After Lowin's test for equality of variances, t-test indicated a significant difference between the groups at a confidence interval of 99% (p=0.00) . Comparing the scores of each group before and after training reveals that with algorithmic training, the mean score increased from 10.034 ± 1.56 to 15.23 ± 1.57, indicating a significant difference at 99% confidence interval according to paired t-test (p=0.00). On the other hand, the score of the control group rose from 10.47 ± 2.43 before lecture to 12.33 ± 1.54 after lecture, again indicating a significant difference at 99% confidence interval according to paired t-test (p=0.001).

Analysis of variance indicated that the means scores of the two groups were not significantly different prior to training (f=0.051, sig=0.823), while after training, the mean score of the case group was significantly higher compared to the control group (f=76.128, sig=0.00).

Discussion

The findings of the present study indicate that algorithmic training improves learning in students. In this study, the mean scores of students in the case and control groups were significantly different after training. Robak et al. reported that novel methods of education for cardiopulmonary resuscitation (CPR) improve the knowledge and skills of medical students (9)Our findings indicate that lecture-based training also improved the mean score of students significantly; yet there is no argument against the use of algorithmic training, as all previous studies have indicated that all methods of education affect students' learning. Nevertheless, we found that students who had received algorithmic training learned better compared to those who attended lecture, as the former had achieved significantly higher scores on the examination. The present study indicates that novel methods of education may be efficient in improving the scientific abilities of students. Many studies conducted on clinical fields have obtained similar results and all emphasize the need for modifying educational methods and enabling students for clinical activities.

Poole and McMahon (2005) conducted a study in Australia to conclude that algorithmic education improves the knowledge as well as activities and care provided by geriatric healthcare personnel (4) which is in line with our findings. Sriram et al stated that the aims of medical algorithms are to improve the delivery of medical care (10). Macginn et al. reported that using algorithms in clinical fields not only improves quality of patient care and comfort, but also helps physicians and other healthcare personnel in making clinical decisions. It also benefits programs of clinical service evaluation and renders clinical training easier and more efficient (5).

Conclusion

Since correct and quick approach to patient is vital in most trauma emergencies, we used algorithmic training in the present study and our findings indicate that it has an explicit effect on students' learning, as well as improving their clinical decision-making while rendering the teaching process easier and more convenient. In conclusion, since the present study was conducted in the small environment of one ward, we recommend future studies to address the issue in different clinical fields and on larger populations so that the results will be universalized with greater certainty in all branches of clinical sciences.

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As the student needs to refer to the basic concepts to solve the problems, he/she will gradually perceive the need for the instructions and will be driven towards creating algorithms(4)