



Advanced Cardiac Life Support Training by Problem-Based Method: Effect on the Trainee's Skills, Knowledge and Evaluation of Trainers

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Abstract

Background: Cardiopulmonary-cerebral resuscitation (CPCR) training is essential for all hospital workers, especially junior residents who might become the manager of the resuscitation team. In our center, the traditional CPCR knowledge training curriculum for junior residents up to 5 years ago was lecture-based and had some faults. This study aimed to evaluate the effect of a problem-based method on residents' CPCR knowledge and skills as well as their evaluation of their CPCR trainers.

Methods: This study, conducted at Tehran University of Medical Sciences, included 290 first-year residents in 2009-2010 - who were trained via a problem-based method (the problem-based group) - and 160 first-year residents in 2003-2004 - who were trained via a lecture-based method (the lecture-based group). Other educational techniques and facilities were similar. The participants self-evaluated their own CPCR knowledge and skills pre and post workshop and also assessed their trainers' efficacy post workshop by completing special questionnaires.

Results: The problem-based group, trained via the problem-based method, had higher self-assessment scores of CPCR knowledge and skills post workshop: the difference as regards the mean scores between the problem-based and lecture-based groups was 32.36 ± 19.23 vs. 22.33 ± 20.35 for knowledge (p value = 0.003) and 10.13 ± 7.17 vs. 8.19 ± 8.45 for skills (p value = 0.043). The residents' evaluation of their trainers was similar between the two study groups (p value = 0.193), with the mean scores being 15.90 ± 2.59 and 15.46 ± 2.90 in the problem-based and lecture-based groups - respectively.

Conclusion: The problem-based method increased our residents' self-evaluation score of their own CPCR knowledge and skills.

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Introduction

Cardiopulmonary-cerebral resuscitation (CPCR) training is essential for all hospital workers, not least for junior residents who might be tasked with managing the resuscitation team.^{1, 2} In recent years, a large number of studies that have focused on the efficacy of the different methods of CPCR training - especially advanced cardiac life support (ACLS) - have underscored the drawbacks of the common training methods such as the lecture-based method.^{3, 4} For instance, in this method - a great volume of theoretical content should be presented during a limited lecture time, which may tire trainees and lessen the workshop efficacy.⁵⁻⁷ On the other hand, some new CPCR training methods have been developed recently, which are believed to improve the resuscitation knowledge and skills of trainees.⁸⁻¹⁰ Some studies have revealed that a novel training technique - namely the problem-based method - which is learner-oriented and centered on the knowledge and skills of trainees, can augment resuscitation skills.¹¹⁻¹⁵

There is no doubt as to the significance of determining the most optimal method for CPCR training programs for medical students and other hospital staff.^{16, 17} In the Clinical Skill Lab. of the Medical School in Tehran University of Medical Sciences, the CPCR training curriculum for junior residents was lecture-based up to 5 years ago. Since then, the problem-based method has gradually replaced the said method for CPCR training. The present study aimed at assessing the effect of the problem-based method on the junior residents' self-evaluation of their own CPCR skills and knowledge and their evaluation of their CPCR trainers.

Method

This study was performed in the Clinical Skill Lab. of the Medical School in Tehran University of Medical Sciences. The CPCR training for clinical residents in this center is carried out in a two-day workshop during the first six months of residency and is a combination of theoretical sessions for groups of 20 residents, receiving lectures on the recent advances in CPCR, and practical sessions for groups of 5-6 residents, receiving training in advanced CPCR equipment such as mannequins and arrhythmia simulators.

Our problem-based group consisted of first-year clinical residents who participated in a two-day problem-based CPCR workshop in 2009-2010. All the participants were already medical doctors and had some knowledge and/or expertise in CPCR; therefore, the problem-based workshop was tailor-made to suit the educational needs of the trainees. These educational needs were determined by inducing a free discussion at the beginning of the course and following it up with idea presentations and questions during the course. The duration of the problem-based workshop was also determined

according to the participants' educational needs. Our study group was comprised of 290 participants, who filled in a questionnaire pre and post workshop, and those who failed to answer all the questions were excluded. The questionnaire consisted of 12 questions on the participants' self-evaluation of their own CPCR knowledge and 12 questions on their own CPCR skills once before and once after the workshop. The trainees were asked to answer each question with one score ranging from 1 to 10.

Our lecture-based group comprised 160 first-year clinical residents who participated in an ACLS workshop in 2003-2004. Data were extracted from the official archives of the Clinical Skill Lab. To that end, all the relevant questionnaires stored in the Clinical Skill Lab. database of Tehran University of Medical Sciences were reviewed. Forms containing incomplete answers were excluded from the analysis. This workshop was based on the lecture-based method without using a simulator. Education in both groups was otherwise similar and was performed by the application of advanced educational techniques and equipment - including slides, multimedia, mannequins, and simulators - if indicated. The lecture-based group completed the same questionnaire as the problem-based group.

The content of the questionnaire was based on the official forms of the Education Office of Tehran University of Medical Sciences. The validity of the questionnaire was assessed by the experts at the Clinical Skill Lab. in collaboration with anesthesiologists and cardiologists.

The difference between the questionnaire scores as regards the residents' self-assessment of their own CPCR knowledge and skills - before and immediately after the workshop - was analyzed using the independent t-test and univariate analysis of variance and the final difference scores were compared between the problem-based and lecture-based groups.

The CPCR workshop trainers were different in each group. In order to eliminate the effect of the trainers' educational skills as a confounding factor, the participants were given a trainer evaluation questionnaire immediately after the workshop. The respondents assessed and scored (1-20) the quality of the trainers' lectures and skills. It was, therefore, possible to find out whether or not the difference between our two groups in terms of the workshop trainers could affect our study results.

The data are presented as mean \pm standard deviation. The problem-based and lecture-based groups were compared using the Student t-test. The paired-samples t-test was used for comparing the differences between the mean scores pre and post workshop in the participants' knowledge and skills. The analysis of covariance (ANCOVA) test for multivariate analysis was employed to adjust the baseline measurement. The statistical analyses were conducted with SPSS 18.0 (SPSS Inc. Chicago, IL, USA). A p value less than 0.05 was considered statistically significant.



Results

Two hundred ninety junior residents of Tehran University of Medical Sciences in 2009-2010 and 160 junior residents of the same university in 2003-2004 were included in the present study. In each analysis, trainees who failed to provide answers to all the questions in the questionnaire were excluded (Tables 1 and 2).

The mean scores of the residents' self-evaluation of their own CPR skills and knowledge are depicted in Tables 1 and 2.

Table 1. Participants' self-evaluation of their own cardiopulmonary-cerebral resuscitation knowledge (mean scores from 120)*

	Problem-based group	Lecture-based group	P value**
Number	195	125	
Pre workshop	60.32±21.60	66.68±17.93	0.003
Post workshop	91.70±16.89	87.95±14.85	0.032
P value***	< 0.001	< 0.001	

*Data are presented as mean±SD

**A p value < 0.05 was considered statistically significant; the independent t-test was used.

***The paired t-test was employed

Table 2. The participants' self-evaluation of their own cardiopulmonary-cerebral resuscitation skills (mean scores from 60)*

	Problem based group	Lecture-based group	P value**
Number	167	121	
Pre workshop	34.79±7.03	35.93±6.56	0.149
Post workshop	45.34±7.57	43.78±6.47	0.036
P value***	< 0.001	< 0.001	

*Data are presented as mean±SD

**A p value < 0.05 was considered statistically significant; the independent t-test was used.

***The paired t-test was utilized

The average scores - in both CPR skills and knowledge - were higher post workshop than pre workshop in both groups: 91.71 ± 16.89 versus 60.32 ± 21.60 in knowledge and 45.34 ± 7.57 versus 34.79 ± 7.03 in skills in the problem-based group and 87.96 ± 14.85 versus 66.68 ± 17.93 in knowledge and 43.78 ± 6.47 versus 35.93 ± 6.56 in skills in the lecture-based group. The difference constituted statistical significance (p value < 0.001).

In addition, the mean scores of both CPR skills and knowledge after the workshop in the problem-based group were significantly higher than those of the lecture-based group: 91.71 ± 16.89 versus 87.96 ± 14.85 for knowledge (p value = 0.032) and 45.34 ± 7.57 versus 43.78 ± 6.47 for skills (p value = 0.041). After adjustment for baseline measurement using the ANCOVA, there was still a significant difference between the two groups.

The difference between the mean scores of knowledge pre and post workshop was 32.36 ± 19.23 in the problem-based group and 22.33 ± 20.35 in the lecture-based group (p value < 0.001). The difference between the mean scores of skills after and before the workshop was 10.13 ± 7.17 in the problem-based group and 8.19 ± 8.45 in the lecture-based group (p value = 0.042).

Figures 1 & 2 illustrates that the difference between the mean scores before and after the workshop was significantly higher in the problem-based group than in the lecture-based group.

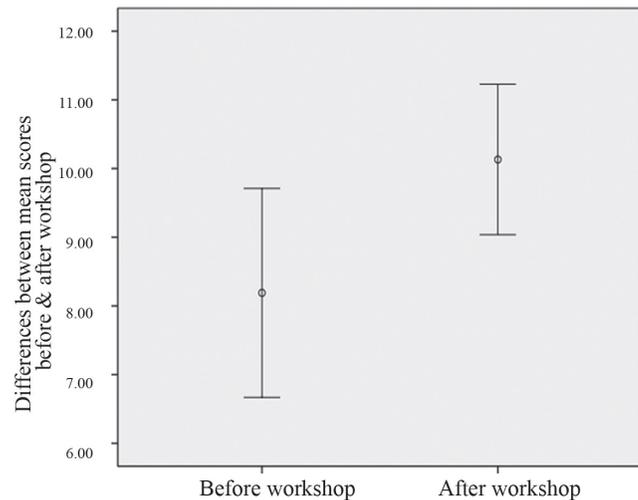


Figure 1. Difference between the mean scores (by scoring range from 0 to 60) pre and post workshop in the participants' skills

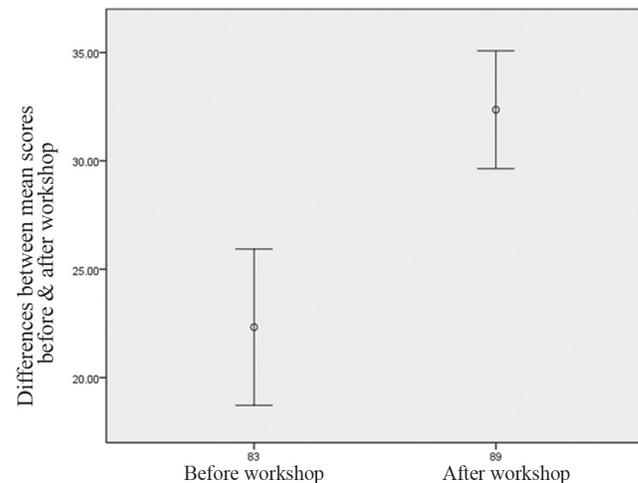


Figure 2. Difference between the mean scores (by scoring range from 0 to 120) pre and post workshop in the participants' knowledge

The trainees evaluated the workshop trainers immediately after the workshop. The number of the residents who answered the questionnaires completely was 203 in the problem-based group and 125 in the lecture-based group.

The mean score of the trainers' lecture quality was 16.05 ± 2.56 in the problem-based group and 16.27 ± 2.17 in the lecture-based group (p value = 0.418). In regard to the quality of the trainers' CPR skills, the mean score was 15.90 ± 2.59 in the problem-based group and 15.46 ± 2.90 in the lecture-based group (p value = 0.193). Accordingly, the quality of the trainers' work demonstrated no statistically significant difference between the two groups (p value > 0.05), and the probable confounding effect of the different trainers and dissimilarities in their educational skills between the two groups was - thus - ruled out.

Discussion

This study appraised a new educational method for CPR training, i.e. the problem-based method, by comparing it with the traditional lecture-based method. As was discussed above, the post-workshop scores were significantly higher than the pre-workshop ones in our two groups of problem-based and lecture-based CPR training. This demonstrates that the CPR workshop of either training method is useful for all participants based on the participants' self-assessment of their own knowledge and skills. The difference between the post and pre-workshop scores was significantly higher in the problem-based group, indicating the higher efficacy of the problem-based method.

Our findings chime in with those reported by some previous studies. Szogedij¹⁸ conducted a retrospective study to assess the effect of the problem-based method on CPR training among 1,775 nurses in Germany. The results demonstrated that those trained via the problem-based method had better resuscitation skills and knowledge. Wang Xp.¹¹ evaluated the efficacy of the problem-based method versus the use of resuscitation simulators vis-à-vis CPR skills and knowledge by recruiting 42 medical students. The results of written and practical tests showed that the group trained via the problem-based method as well as the group trained via the CPR simulators had better outcomes than the group trained via the lecture-based method; there was no significant difference between the problem-based method group and the simulator-based group. The author, accordingly, concluded that the problem-based method could facilitate CPR training. It is noteworthy that in our study, the trainees' skills were not assessed practically; nevertheless, our sample size was larger than that of the above-mentioned study. Moreover, our study population was comprised of the residents of different medical disciplines, who were evaluated as a randomized sample of physicians.

Whereas the present study only focused on the assessment of the immediate impact of the problem-based method, there are a large number of studies that have assessed the efficacy of different training methods on participants' knowledge retention. For instance, Duchy F.¹² - in a review article -

reported that training through the problem-based method exerted less effect on knowledge scores immediately after the workshop but improved knowledge retention significantly.

The present study has some limitations, first and foremost among which is the fact that our study population was composed of trainers with dissimilar specialties and junior residents at various training levels and different levels of exposure to a real CPR situation - which may have affected their CPR skills and knowledge. We sought to minimize the effect of these probable confounders by taking into account the residents' assessment of their trainers as well as their self-assessment of their own CPR skills and knowledge pre and post workshop. Another drawback of significance was the sizable percentage of incomplete questionnaires (low response rate) - handed in by the workshop participants. Furthermore, our two study groups were compared only via the participants' written self-assessment of their own CPR skills and knowledge. Be that as it may, although the trainees' CPR skills were not practically tested post workshop, our problem-based and lecture-based groups consisted of 290 and 160 participants; these group sizes are larger than those in almost all the other available case-control studies.

Conclusion

The problem-based method, as a novel routine for CPR training, improved the quality of resuscitation training in our study population. We would, therefore, suggest that the problem-based CPR training method be employed as an alternative method to the traditional lecture-based method for the ACLS training of junior clinical residents.

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