

# Evaluation of the Effectiveness of the “1 + 1 + 1” Method in Theoretical Teaching of Emergency Pericardiocentesis

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## Abstract

**Background:** Pericardial effusion may progress to cardiac tamponade when pressure around the heart increases to a level comparable to that of the right and left atria. Patients with cardiac tamponade need timely completion of emergency pericardiocentesis to relieve the threat to the patient’s life, and to save valuable time for patients who need emergency thoracotomy and pericardial window drainage. Pericardiocentesis is a necessary clinical skill for residents in standardized training. In addition, nurses who are familiar with this technology can better assist clinicians to perform this operation. In order to make the medical staff quickly master the theoretical knowledge of emergency pericardiocentesis, we designed a “1 + 1 + 1” teaching method for the theoretical teaching of emergency pericardiocentesis. **Objective:** This study aims to explore the effectiveness of the “1 + 1 + 1” teaching method in the theoretical teaching of emergency pericardiocentesis. **Methods:** We used an English teaching video of emergency pericardiocentesis and applied the “1 + 1 + 1” teaching method for theoretical teaching. A questionnaire survey was conducted before and after the lecture among 19 medical staff of different years of service to understand their mastery of the theoretical content of emergency pericardiocentesis before and after the lecture. According to the years of service, the medical staff were divided into three groups: 1 - 3 years (Group A), 4 - 10 years (Group B), and over 10 years (Group C), and the changes in the mastery of various contents by the overall medical staff and each group were statistically analyzed. **Results:** Before the lecture, the number of people who mastered the indications, contraindications, most commonly used methods, and common complications of emergency pericardiocentesis

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were 15, 12, 16, and 17, respectively, whereas after the lecture, these numbers increased to 17, 19, 19, and 19, respectively. The overall mastery before and after the lecture was statistically significant ( $p < 0.05$ ), especially after the lecture, the medical staff's mastery of the contraindications of emergency pericardiocentesis significantly improved. The overall mastery of Group A and Group B before and after the lecture was statistically significant ( $p < 0.05$ ), while there was no statistical difference in Group C before and after the lecture. **Conclusion:** The “1 + 1 + 1” teaching method can effectively improve the overall mastery level of medical staff's theoretical knowledge of emergency pericardiocentesis, especially in improving the mastery of contraindications of this operation.

## Keywords

Cardiac Tamponade, Emergency Pericardiocentesis, Theoretical Teaching

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## 1. Introduction

Pericardial effusion may lead to increased pressure around the heart. When this pressure increases to a level comparable to that of the right and left atria, restricted cardiac filling and reduced cardiac output may be triggered. In severe cases, this may lead to pulseless electrical activity in the heart, at which point a diagnosis of cardiac tamponade can be made. The classic presentation of cardiac tamponade, known as Beck's triad, is a distend of the jugular vein, distant heart sounds, and hypotension. Patients with cardiac tamponade may present with severe respiratory distress, agitation, tachycardia, and hypotension, followed by rapid progression to occlusion, bradycardia, and pulseless electrical activity [1]. Emergency pericardiocentesis is a lifesaving clinical procedure that can quickly extract pericardial fluid, thereby rapidly restoring normal cardiac function and peripheral blood flow [2]. In clinical work, for patients with cardiac tamponade who need emergency treatment, timely completion of emergency pericardiocentesis can relieve the threat to the patient's life, and save valuable time for patients who need emergency thoracotomy and pericardial window drainage [3] [4].

Pericardiocentesis is a necessary clinical skill for residents in standardized training. According to the “Management Measures for Standardized Training of Residents (Trial)”, the standardized training students should master the basic knowledge and skills commonly used in clinical general medicine, such as the principle of clinical rational use of blood, cardiopulmonary resuscitation technology, pre-hospital emergency care for sudden diseases, palliative care, prevention and treatment knowledge of key and regional infectious diseases and the correct treatment process. In the first year of training, the basic clinical knowledge and skills of students should meet the requirements of medical licensing examination. In addition, “The Contents and Standards of Standardized Training for Residents (2022 Edition)” issued by the Chinese Medical Doctor Associa-

tion in 2022 stipulates that surgical residents should be proficient in the operation points of pericardiocentesis after the standardized training, and complete pericardiocentesis under the guidance of superior doctors. Emergency pericardiocentesis techniques also require frequent review for clinicians who have practiced for many years, as pericardiocentesis is usually performed by sonographers. Emergency pericardiocentesis can be performed in patients with cardiac tamponade if clinicians are skilled in this technique [5]. In addition, the preliminary survey showed that most of the nursing staff had not received relevant teaching and training on emergency pericardiocentesis. Therefore, if nurses are familiar with this technology, they can better assist clinicians to perform this operation [6].

In order to make the trainees in the standardized training of residents quickly master the theoretical knowledge of emergency pericardiocentesis, make the clinicians who have been working in medicine for many years more familiar with this technology, and make the nursing staff assist doctors to implement this technology more smoothly, we designed a “1 + 1 + 1” teaching method for the theoretical teaching of emergency pericardiocentesis. Briefly, that method is one English video overview, one English video detailed explanation and one summary extension. This method is based on problem-based learning theory. The problem-based learning theory was developed to address the problem of undergraduate medical students perceiving the first few years of the curriculum as impractical because of the difficulty of seeing the relevance of topics such as anatomy and physiology to their future careers as clinicians, and this approach, which seeks to demonstrate the topics’ Relevance. Most studies indicate that problem-based learning is generally well received and confers more confidence in graduates’ social and communication skills. After careful consideration of the thought processes developed by problem-based learning, there has been an increase in the number of people adopting this approach, thus making it a mainstay of medical education. Its effectiveness is also increasingly recognized [7]. The overall effect of this teaching method was evaluated by comparing the mastery of medical staff with different levels before and after the teaching.

Specifically, the “1 + 1 + 1” teaching method is as follows: 1) One English video overview. Before watching the English video, the key English words in the video are briefly explained, and then watch the video. 2) One English video detailed explanation. After playing a short part of the English video, the content of the part was accurately explained in detail. 3) One summary extension. Summarizes the content of the video, highlights the key and difficult points, and extends appropriately according to the content of the video.

## 2. Study Subjects and Methods

### 2.1. Study Subjects

Nineteen medical staff with different seniority were selected randomly. The medical staff who attended the lectures themselves were used as controls to ex-

clude statistical differences. All the staff were used as control groups before the lecture, while as experimental groups after the lecture.

## 2.2. Methods

The English video of emergency pericardiocentesis provided by the website of the New England Journal of Medicine was used for theoretical teaching, and the medical staff was taught according to the “1 + 1 + 1” method. The questionnaire was designed by Yudi Liu and Wei Hu; and it was demonstrated efficiently and reliably by Pei Wang. The questionnaire contains the indications, contraindications, most commonly used methods and common complications of emergency pericardiocentesis. Questionnaires were sent out before the class, and all questionnaires completed by all personnel were collected within 5 minutes. At the end of the class, we issued and collected questionnaires in the same way. According to the results of the questionnaire, we comprehensively analyzed the composition of the medical staff, and divided the medical staff into A, B and C groups which were made according to the rank of the medical workers: Group A is for beginners, Group B is for intermediates, and Group C is for associate seniors and above.

## 2.3. Evaluation Indicators

We calculated the overall and each group’s grasp of the theoretical knowledge of emergency pericardiocentesis before and after teaching, such as the number of correct answers to the indications, contraindications, most commonly used methods and common complications of emergency pericardiocentesis.

## 2.4. Statistical Processing

In this study, SPSS 26 software was used for data analysis and statistics. The statistical data were expressed as mean  $\pm$  standard deviation, and the differences were compared by fisher Chi-square test.  $p < 0.05$  was considered statistically significant.

## 3. Evaluation Indicators

### 3.1. Evaluation of Overall Teaching Effect

In this study, a total of 38 questionnaires were distributed and 38 valid questionnaires were recovered, with an effective recovery rate of 100%. The overall results were as follows: there were differences in the mastery of indications, common methods and common complications before and after the course, but the difference was not statistically significant. After the course, the contraindications and overall mastery were significantly better than those before the course, and the difference was statistically significant (**Table 1**).

### 3.2. Evaluation of Teaching Effect in Each Group

1) Evaluation of teaching effect in group A. A total of 8 medical staff were in-

cluded in group A, and the results were as follows: there was no difference in the mastery of indications before and after the course; the mastery of contraindications, common methods and common complications were different, but the difference was not statistically significant. The overall mastery after the course was significantly better than that before the course, and the difference was statistically significant (**Table 2**).

2) Evaluation of teaching effect in group B. A total of 7 medical staff were included in Group B, and the results were as follows: there was no difference in the mastery of common complications before and after teaching; there were differences in the mastery of indications, contraindications and common methods, but the differences were not statistically significant. The overall mastery after the course was significantly better than that before the course, and the difference was statistically significant (**Table 3**).

**Table 1.** Overall teaching effectiveness evaluation.

Evaluation indicators	Control group (n = 19)	Experimental group (n = 19)	p
Indications	15	17	p > 0.05
Contraindications	12	19	p < 0.05
Commonly Used Methods	16	19	p > 0.05
Complications	17	19	p > 0.05
Total	60	74	p < 0.05

**Table 2.** Teaching effectiveness evaluation of group A.

Evaluation indicators	Control group (n = 8)	Experimental group (n = 8)	p
Indications	7	7	p > 0.05
Contraindications	5	8	p > 0.05
Commonly Used Methods	6	8	p > 0.05
Complications	6	8	p > 0.05
Total	24	31	p < 0.05

**Table 3.** Teaching effectiveness evaluation of group B.

Evaluation indicators	Control group (n = 7)	Experimental group (n = 7)	p
Indications	4	6	p > 0.05
Contraindications	3	7	p > 0.05
Commonly Used Methods	6	7	p > 0.05
Complications	7	7	p > 0.05
Total	20	27	p < 0.05

3) Evaluation of teaching effect in group C. A total of 4 medical staff were included in group C, and the results were as follows: there was no difference in the mastery of indications, contraindications, common methods and common complications before and after the course (**Table 4**).

**Table 4.** Teaching effectiveness evaluation of group C.

Evaluation indicators	Control group (n = 4)	Experimental group (n = 4)	P
Indications	4	4	p > 0.05
Contraindications	4	4	p > 0.05
Commonly Used Methods	4	4	p > 0.05
Complications	4	4	p > 0.05
Total	16	16	p > 0.05

#### 4. Discussion

Post-graduation medical education is an important part of medical education, and it is a key stage for medical students and doctors to further integrate theory with clinical practice. The main task of medical education is to select scientific and effective teaching methods so that residents can learn more clinical knowledge and become proficient in a variety of clinical skills within a limited period of time [8].

In this theoretical teaching, we innovatively used the teaching method of “1 + 1 + 1”, which is a specific application of problem-based learning (PBL) in the teaching of clinical operation skills, and is the expansion and supplementation of previous teaching methods [9] [10]. At the same time, we chose English videos as teaching materials, which is similar to microclass material teaching [11] [12], and is also an attempt and exploration in the bilingual teaching of clinical operation skills. This lays a certain foundation for further improving clinicians’ English application ability in medical specialties, expanding a wider scope of selecting bilingual teaching materials, as well as strict selection criteria for bilingual teaching materials, which is of certain reference significance [13]. The results of this study suggest that this teaching method is applicable to the population attending the lectures and is more effective within less senior medical staff. This may be due to the fact that the less senior medical staff themselves did not have as much theoretical knowledge of emergency pericardiocentesis as the more senior medical staff, and that. The method used in this instance was different from that used in undergraduate medical education, which may have been more appealing to the less senior medical staff and allowed them to concentrate more on their theoretical knowledge [14]. At the same time, this allows residents to form their own logical thinking with proficient theoretical knowledge, deepen their understanding of the nature of diseases and corresponding clinical dispositions, and fully utilize their knowledge to accurately identify and rationally solve clinical

cal problems [15]. In addition, the “1 + 1 + 1” teaching method is also applicable to the theoretical teaching of other clinical operation skills.

However, this study only evaluated the effectiveness of the “1 + 1 + 1” teaching method and did not compare it with current widely used teaching methods, so it can only show that this method has a certain degree of teaching effectiveness, and cannot judge the superiority or inferiority of this method compared with other teaching methods. In addition, due to the small number of participants, although the lectures were effective, the differences in most of the statistical results were not statistically significant. In addition, due to the limitation of time and space, this teaching method only covers the theoretical knowledge of emergency pericardiocentesis, and only evaluates the degree of mastery of theoretical knowledge, and the effectiveness of practical skill was not evaluated.

In general, in post-graduation medical education, there is no single teaching method that can fully meet the needs of clinical education [16] [17]. We must adopt a reasonable and comprehensive teaching method based on the combination of key points of clinical knowledge, characteristics of diseases, and patients' realities in order to enable trainees in standardized residency training to accurately, proficiently, and rapidly master clinical knowledge and clinical skills, and to rapidly grow up to be a qualified clinician [18]-[20].

## 5. Conclusion

The “1 + 1 + 1” teaching method is effective in improving the mastery level of medical staff's theoretical knowledge of emergency pericardiocentesis, and is also likely to improve its practical skills.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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### Appendix: Questionnaire of Emergency Pericardiocentesis

Medical rank:  Beginner     Intermediate     Associate seniors and above

The answers to the following question has four alternatives, of which only one is the most suitable.

- 1) Indications for emergency pericardiocentesis
  - A) Cardiac tamponade
  - B) Pericardial effusion
  - C) Pleural effusion
  - D) Pneumothorax
- 2) Contraindications to emergency pericardiocentesis
  - A) Traumatic pericardial effusion
  - B) Pleural effusion
  - C) Acute myocardial infarction (AMI)
  - D) Rib fracture
- 3) The most commonly used method of emergency pericardiocentesis
  - A) Ultrasound-guided
  - B) Blind puncture
  - C) Cardiac monitoring-guided
  - D) Others
- 4) Common complications of emergency pericardiocentesis
  - A) Arrhythmia
  - B) Diaphragmatic injury
  - C) Peritoneal perforation
  - D) Death