

# Application of PBL Teaching Method in Geriatric Cardiovascular Internal Medicine Training

Fang Chen, Wei Xia\*

The First Affiliated Hospital of Yangtze University, Jingzhou 434000, Hubei, China

*\*Author to whom correspondence should be addressed.*

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**Abstract:** *Objective:* To evaluate the teaching effectiveness and practical value of problem-based learning (PBL) in the standardized training of geriatric cardiovascular residents. *Methods:* A total of 80 postgraduates and trainees who participated in the standardized residency training program in the Department of Geriatric Cardiovascular Medicine of our hospital from January 2020 to December 2024 were enrolled and randomly divided into two groups, with 40 cases in each. The control group received traditional lecture-based learning (LBL), while the observation group was taught with PBL combined with LBL, and both groups underwent an 18-month training period. *Results:* The scores of theoretical examination, practical skill assessment, and teaching satisfaction in the observation group were significantly higher than those in the control group ( $P < 0.05$ ). *Conclusion:* The PBL teaching method can effectively enhance the theoretical knowledge, clinical skills, and overall competence of trainees in geriatric cardiovascular medicine, and thus deserves wider application.

**Keywords:** PBL teaching method; Geriatric cardiovascular medicine; Resident standardized training; Clinical skills; Teaching effect

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## 1. Introduction

With the acceleration of population aging in China, the incidence and mortality of cardiovascular diseases in the elderly are increasing year by year, which has become the primary factor threatening the life and health of Chinese residents. As the core discipline of clinical internal medicine, cardiovascular medicine has a wide spectrum of diseases and a highly complex etiology, except for structural heart diseases and vascular diseases. It often involves congenital, acquired, and systemic secondary pathological changes, and has direct and close cross-links with many clinical and basic disciplines, so it puts forward extremely high requirements for specialists' knowledge reserve, clinical judgment ability, and emergency treatment level<sup>[1,2]</sup>. However, there are still many obvious problems in the standardized training of residents in cardiovascular medicine in China, such as the limited number of training bases, the shortage of high-quality teachers, the lack of internal driving force for active learning, and the single training mode, which cannot well meet the personalized training needs of residents at different levels. The traditional one-way indoctrination teaching based on lecturing can no longer meet the urgent needs of modern medical education for innovative and practical personnel training<sup>[3]</sup>. For this reason, the problem-oriented PBL teaching method has become the direction of current medical education reform and

promotion because of its distinct advantages of independent inquiry, cultivating critical thinking, and solving clinical practical problems<sup>[4]</sup>. The purpose of this study was to systematically evaluate the practical application effect of the PBL teaching method in geriatric cardiovascular medicine training, in order to provide an evidence-based basis for optimizing the resident training system.

## **2. Data and methods**

### **2.1. General information**

In this study, from January 2020 to December 2024, a total of 80 postgraduates and trainees who were receiving standardized resident training in the Department of Geriatric Cardiovascular Medicine of our hospital were enrolled, and they were divided into two groups by random number table method, each including 40 trainees. In the control group, there were 15 male students and 25 female students, aged from 19 to 23 years old, with an average of  $(22.05 \pm 1.17)$  years old; in the observation group, there were 17 male students and 23 female students, aged from 19 to 23 years old, with an average of  $(21.72 \pm 1.35)$  years old, and the general data of the two groups were balanced and comparable ( $p > 0.05$ ).

#### **2.1.1. Inclusion criteria**

Having completed the systematic theory study of Internal Medicine; voluntarily participating in the study and signing the informed consent; attendance rate during the training period was no less than 90%.

#### **2.1.2. Exclusion criteria**

Those who quit the training halfway; those who have serious violations of discipline during the training period; Those who have participated in PBL teaching training.

## **2.2. Method**

### **2.2.1. Control group**

The traditional lecture-based learning method (LBL) was used for teaching. According to the training syllabus, the teachers teach the students routine knowledge, carry out routine ward rounds and skills training, select classic cases for teaching ward rounds, supplemented by special lectures and case discussions, and guide the students to carry out clinical analysis and treatment plan formulation. In the teaching process, the teachers are the main body, and the students mainly listen to and record.

### **2.2.2. Observation group**

The mixed teaching mode of PBL combined with LBL was implemented, and the specific scheme was as follows:

#### **(1) Construction of case base**

The teaching team selected typical cases of coronary heart disease, chronic heart failure, hypertensive emergency, atrial fibrillation, and acute myocardial infarction from the characteristics of geriatric cardiovascular diseases, and each case was elaborated from the aspects of diagnostic basis, treatment measures, and prognosis evaluation. The case design strictly follows the three basic principles of authenticity, complexity, and problem-orientedness, and introduces elements of complications, such as heart failure with renal insufficiency, adverse drug reactions, and other situations of discussion value.

#### **(2) Pre-class preparation stage**

The trainees were divided into several groups of 4 to 6 people, and the teaching officer distributed the PBL case data to each group in advance. The trainees were required to consult relevant literature and clinical guidelines extensively through teaching materials, libraries, and the Internet, and take the initiative to raise the existing and potential nursing and diagnosis and treatment problems of patients.

## (3) Classroom implementation stage

Concentrate on group discussion. First, let the members of each group exchange and supplement the retrieved information. Then, a student in the group acts as a recorder to summarize the questions raised by each person in a complete and orderly manner. The teacher participates in the discussion as a guide and promoter, and uses open-ended questions to urge the students to actively put forward hypotheses, analyze evidence, and draw conclusions. Teachers themselves do not give answers directly. Five minutes before the end of the discussion, they affirm the correct views, correct cognitive biases, and give a brief overview of the latest research progress of relevant knowledge.

## (4) Extended stage after class

Let the students write a reflection log, systematically find out the blind areas of knowledge, and then guide them to use the Internet to consult relevant information, actively refine and internalize what they have learned, so as to cultivate the clinical thinking of drawing inferences about other cases from one instance.

## (5) Scenario simulation training

As the simulation teaching can introduce emergencies such as acute chest pain and ventricular fibrillation, the trainees can play the roles of nurses, patients, family members, and doctors in the teaching, and practice the schemes obtained from the PBL discussion, so as to improve the emergency handling ability.

The training period of both groups was 18 months.

### 2.3. Observation index

## (1) Theoretical examination results

The unified proposition group compiles objective test papers for the test. The test questions are randomly selected from the question bank according to the principle of difficulty coefficient. The full score is set at 100. The focus is on the students' mastery of the theoretical knowledge of the etiology, pathophysiology, diagnostic criteria, and treatment principles of cardiovascular diseases in the elderly.

## (2) Examination results of clinical skill operation

A comprehensive evaluation was made from three dimensions of literature retrieval ability, standardization of clinical operation, and comprehensive analysis ability of medical records, with a full score of 100.

## (3) Scoring of teaching satisfaction

With the help of a self-made questionnaire, the five aspects of learning interest and autonomy, improvement of clinical thinking ability, improvement of communication and expression ability, improvement of team cooperation ability, and improvement of analysis and problem-solving ability were scored, with a full score of 10 for a single item and a total score of 50.

### 2.4. Statistical analysis

The data involved in this study were processed by SPSS 23.0 software. The data of  $\chi^2$  and  $t$  test were count and measurement data, and the count and measurement data were also processed by (%) and ( $\bar{x} \pm s$ ) means. When the difference meets the statistical condition,  $p < 0.05$ .

## 3. Results

### 3.1. Comparison of theoretical examination results and skill operation examination results

Table 1 shows that the scores of the theoretical examination and skill operation examination in the observation group were higher ( $p < 0.05$ ).

**Table 1.** Comparison of theoretical examination and skill operation examination results ( $\bar{x} \pm s$ , minutes)

| Group             | Number of cases | Theoretical assessment results | Examination results of skill operation |
|-------------------|-----------------|--------------------------------|----------------------------------------|
| Observation group | 40              | 94.51 $\pm$ 1.92               | 95.63 $\pm$ 1.86                       |
| Control group     | 40              | 85.42 $\pm$ 2.68               | 86.48 $\pm$ 1.25                       |
| <i>t</i>          | -               | 19.635                         | 22.372                                 |
| <i>p</i>          | -               | < 0.05                         | < 0.05                                 |

### 3.2. Comparison of teaching satisfaction scores

Table 2 shows that the dimensions and total scores of teaching satisfaction in the observation group were higher ( $p < 0.05$ ).

**Table 2.** Comparison of teaching satisfaction scores ( $\bar{x} \pm s$ , minutes )

| Group             | Number of cases | Stimulate interest in learning | Clinical thinking ability | Ability of communication and expression | Teamwork ability | Ability to analyze and solve problems | Total score      |
|-------------------|-----------------|--------------------------------|---------------------------|-----------------------------------------|------------------|---------------------------------------|------------------|
| Observation group | 40              | 9.33 $\pm$ 0.61                | 9.48 $\pm$ 0.52           | 9.38 $\pm$ 0.58                         | 9.51 $\pm$ 0.47  | 9.41 $\pm$ 0.55                       | 48.75 $\pm$ 1.94 |
| Control group     | 40              | 7.15 $\pm$ 0.43                | 7.28 $\pm$ 0.37           | 7.05 $\pm$ 0.52                         | 7.37 $\pm$ 0.51  | 7.18 $\pm$ 0.48                       | 43.19 $\pm$ 1.53 |
| <i>t</i>          | -               | 11.724                         | 12.216                    | 11.357                                  | 12.089           | 11.673                                | 12.185           |
| <i>p</i>          | -               | < 0.05                         | < 0.05                    | < 0.05                                  | < 0.05           | < 0.05                                | < 0.05           |

## 4. Discussion

Since PBL was first proposed at McMaster University in Canada in the 1960s, it has been continuously improved for more than half a century, and now it has become one of the most popular and widely used teaching methods in the field of global medical education<sup>[5]</sup>. According to the report of the World Health Organization, there are about 1700 medical schools around the world adopting the PBL teaching method, and there is an obvious growth trend in recent years. More than 90% of medical schools in the United States have formally incorporated PBL into the medical education system, the fundamental idea of which is “problem-based learning”, fully respecting the dominant position of learners, taking real clinical cases as the starting point, guiding students to analyze and solve problems actively. Therefore, it is very helpful to cultivate students’ critical thinking and clinical decision-making ability<sup>[6,7]</sup>. Geriatric cardiovascular medicine itself is an excellent field for PBL teaching method to exert its ideal effect: there are many kinds of diseases in this subject, and the disease changes rapidly, and elderly patients often have a variety of underlying disease, so it is necessary to take into account the liver and kidney function, drug interactions and other factors when using drugs, so there is a very high inherent requirement for the comprehensive quality of residents<sup>[8]</sup>. Traditional LBL teaching is based on one-way teaching by teachers, and students only passively accept knowledge, so it is easy to cause rote memorization and separation of knowledge and practice, and it is difficult to really cultivate students’ ability to analyze clinical problems independently<sup>[9]</sup>. Therefore, the application of the PBL teaching method in geriatric cardiovascular medicine has clear advantages: designing real cases close to clinical practice, allowing students to discuss core issues, mastering the diagnostic ideas and treatment principles of diseases in the process of literature review, group collaboration and summary, and thus establishing a systematic and standardized clinical thinking framework for students. Also learn to make rational and prudent medical decisions in complex clinical situations<sup>[10]</sup>.

In this study, a case library covering common cardiovascular diseases in the elderly, such as coronary heart disease, chronic heart failure, atrial fibrillation, and acute myocardial infarction, was constructed, and each case was carefully designed to include complications and other complex elements to ensure that the discussion was challenging and enlightening enough. Teachers play the role of guide and promoter in the whole teaching process, stimulate students’ thinking through open questions, provide timely feedback and guidance, but do not directly give standard answers; this teaching method

of “teaching people to fish” effectively promotes the improvement of students’ autonomous learning ability.

The results showed that the theoretical examination scores of the observation group were better than those of the control group ( $p < 0.05$ ). Therefore, it can be concluded that PBL teaching method is problem-driven, which is conducive to the mastery of knowledge and the consolidation of knowledge. At the same time, the performance of the observation group was significantly better than that of the control group ( $p < 0.05$ ), indicating that the teaching mode of PBL combined with scenario simulation effectively improved the students’ operational skills and the standardization of clinical operation. What’s more, the dimensions and total scores of teaching satisfaction in the observation group were higher ( $p < 0.05$ ), and the students had a high degree of recognition of PBL teaching mode, believing that it was conducive to stimulating learning interest, cultivating clinical thinking, and improving communication and cooperation ability.

To sum up, the mixed teaching mode of PBL combined with LBL shows significant teaching advantages in the standardized training of geriatric cardiovascular medicine residents, and should be promoted.

## Disclosure statement

The authors declare no conflict of interest.

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