

ORIGINAL RESEARCH

Applied Research of Case-based Learning Teaching in Nephrology Medicine for Professional Postgraduate Students in Clinical Medicine

Guang Yang, MD; Kang Liu, MD; Honglei Guo, MD; Suyan Duan, MD;
Huijuan Mao, MD; Changying Xing, MD

ABSTRACT

Objective • To explore the influence of case-based learning (CBL) teaching methods in comparison to the traditional lecture-based learning (LBL) model in clinical teaching of nephrology for master's degree students in clinical medicine.

Methods • Clinical medicine master's degree students who were trained in the Department of Nephrology, The First Affiliated Hospital of Nanjing Medical University from December 2015 to December 2021 were selected as the study objects. The selected students were divided into two groups: the LBL group comprised 16 graduate students who received the traditional LBL model from December 2015 to December 2018, and the CBL group comprised 18 graduate students who received the CBL teaching methods from January 2019 to December 2021. Both groups participated in the professional theoretical knowledge assessment, including objective and subjective questions and calculating the total score); and the examination of clinical skills communication ability, preparation of handling materials, anesthesia techniques, operational skills, aseptic techniques, and postoperative management), at the time of discharge from the department. The independent learning ability (self-management ability, information ability, and learning ability) of students of the two groups after teaching was then assessed, and the satisfaction of the two groups with their respective teaching mode (including satisfaction with the teaching format, teaching effectiveness, interest stimulation, independent learning and the improvement of

teamwork ability) was assessed by the questionnaire on the degree of satisfaction of the two groups.

Results • The assessment scores of professional theoretical knowledge in the CBL group were significantly higher than those in the LBL group in objective questions, subjective questions, and total scores ($P_1 = .028$; $P_2 = .036$; $P_3 = .041$). The CBL group scored higher than the LBL group in the assessment of communication skills, preparation of operative items, anesthesia technique, operative skills, aseptic technique, and postoperative handling skills, but the differences were not statistically significant ($P_1 = .071$; $P_2 = .260$; $P_3 = .184$; $P_4 = .127$; $P_5 = .352$; $P_6 = .584$). The self-management ability, information ability, and learning ability scores of students in the CBL group were significantly higher than those in the LBL group ($P_1 = .006$; $P_2 = .013$; $P_3 = .003$). Students in the CBL group were significantly higher than those in the LBL group in terms of satisfaction with teaching form, teaching effect, interest stimulation, improvement of independent learning ability, and satisfaction with teamwork ability ($P_1 = .015$; $P_2 = .008$; $P_3 = .010$; $P_4 = .024$; $P_5 = .022$).

Conclusions • The CBL teaching model can improve and enhance the clinical thinking ability of clinical medicine master's degree students in nephrology, and stimulate their interest in learning. Professional master's degree students have a high degree of satisfaction with the CBL model. (*Altern Ther Health Med.* 2024;30(1):97-101).

Guang Yang, MD; Kang Liu, MD; Honglei Guo, MD; Suyan Duan, MD; Huijuan Mao MD; Changying Xing, MD; Department of Nephrology, The First Affiliated Hospital of Nanjing Medical University, Nanjing, Jiangsu, China.

Corresponding author: Huijuan Mao, MD

E-mail: wumi2006@163.com

Corresponding author: Changying Xing, MD

E-mail: xingcy2022@163.com

INTRODUCTION

With the rapid development of modern medicine, medical education methods are becoming more and more diversified, and it is the general trend to cultivate medical professionals who can adapt to the development and change requirements of the times. The development of clinical medicine promotes the gradual differentiation of internal medicine into many specialties. The clinical manifestations of renal diseases are complex, and many renal diseases, in addition to primary renal diseases, are secondary to other diseases, so that treatment not only involves the characteristics

of the department, but also takes into account the treatment of other disciplines.^{1,2} This requires nephrologists to have a broad knowledge of internal medicine and more comprehensive clinical skills, and the development of these competencies must be accomplished primarily at the residency level, especially for professional postgraduate residency students in nephrology who are in the early stages of training.³ In the clinical practice process, it is necessary to not only train basic clinical skills, but also learn basic medicine, other internal medicine, and even bioengineering-related knowledge, thus can combine theory with practice to achieve a better understanding of and master the clinical knowledge and skills of nephrology.^{4,5} Still, many hospitals have been emphasizing medical treatment and scientific research but not teaching, also, the teaching teachers have heavy clinical work and scientific research tasks, and limited teaching time and energy. Moreover, the teaching process is mostly mechanical indoctrinated theoretical knowledge, students passively accept the input of knowledge. But, in the long run, it is not conducive to the cultivation of clinical thinking ability and self-learning abilities of clinical medicine master's degree students.^{6,7} Therefore, it is especially important for the teaching of master degree students in nephrology, get rid of the drawbacks of traditional teaching, and improve the new teaching method to improve the direction of continuous exploration by graduate tutors of nephrology.

In recent years, case-based learning (CBL) has been widely used in clinical practice teaching for professional-oriented master's students in dentistry,⁸ oncology,⁹ and ophthalmology.¹⁰ CBL is a group discussion teaching method guided by real cases, based on clinical problems, dominated by medical students, and led by teachers.^{11,12} Compared with the traditional lecture-based learning (LBL) model, CBL can greatly improve students' initiative to acquire knowledge, provide them with a good clinical simulation environment, broaden their knowledge and develop their creative ability, etc. More and more clinical medical educators strongly advocate the use of CBL in medical education.^{13,14} In this study, to further explore the influence and generality of this teaching method, the professional master of clinical medicine in the internal medicine of nephrology selected applied the teaching model of CBL to the clinical practice teaching of the internal medicine of nephrology, expecting to improve the quality and efficiency of professional talent training in the internal medicine of nephrology.

MATERIALS AND METHODS

Research Subjects

Professional postgraduate students in clinical medicine trained in the Department of Nephrology of the First Affiliated Hospital of Nanjing Medical University from December 2015 to December 2021 were selected as the study subjects. From December 2015 to December 2018, 16 graduate students received traditional teaching mode, including 9 male students and 7 female students, with an average age of 24.20 ± 0.86 , were enrolled in the LBL group.

From January 2019 to December 2021, 18 graduate students were enrolled in the CBL group, including 12 male students and 6 female students, with an average age of 24.23 ± 0.88 . Inclusion criteria: (1) The same educational background i.e., undergraduate graduates of relevant majors who have passed the national graduate entrance examination in a unified manner. (2) Be taught by the same group of instructors in the same department and used uniform assessment and grading criteria. (3) Students voluntarily enrolled in the group after giving informed and signed consent. Exclusion criteria: (1) Those who were unable to participate or complete this study due to mental illness or other reasons. (2) Those who could not complete the relevant assessment and scoring according to the regulations.

Teaching methods

According to the teaching syllabus provisions, common clinical diseases in the department of nephrology, such as nephrotic syndrome, acute renal failure, uremia, and other diseases, were selected as teaching contents, in combination with the latest research progress and characteristics of renal internal medicine.

LBL group

Graduate students in the LBL group accept the traditional teaching model and were taught by the doctors of the nephrology department at or above the deputy senior level at the hospital. with academic lectures as the main topic, supplemented by slide show presentations, to explain the basic knowledge of disease etiology, pathology, clinical manifestations, diagnosis and differential diagnosis, treatment principles, etc. They also participated in two teaching visits per week. Teaching faculty were experienced in bedside teaching and were visited at least two times per day on weekdays. Postgraduates participated in the treatment of patients under the guidance of superior doctors, and the relevant basic operation skills were taught by the teachers in the practical clinical work.

CBL group

CBL was adopted to select specific cases that meet the teaching content and purpose, such as "acute kidney failure" as the teaching case, and the case data was distributed in advance. The teacher designed relevant questions for the students, taught them the basics, then provided them with research ideas on determining if a patient has acute renal failure and finding information to analyze the cause and treatment. The postgraduates first studied theoretical clinical knowledge related to the skill operation in small groups, and after discussion, they then formulated, in the context of the case, the following clinical operation project and analyzed whether there were indications and contraindications for the operation, etc. Students looked for consequences based on the causes and collected strong arguments and documents, they were supervised and guided by their teachers to find materials and books related to teaching and cases The students were divided

randomly into two groups of 9 students each. After collecting the arguments related to the case, students discuss in groups to prove whether their ideas and opinions were correct, and finally to find solutions to the problem. The teacher reviewed the results of the case solution and summarized the cause, pathogenesis, and treatment plan. Therefore under the teacher's supervision, students had a better understanding and grasp of knowledge and improved their practical abilities.

Observation index

(1) Theoretical knowledge assessment: The examination of professional theoretical knowledge by written examination was divided into subjective questions and objective questions, each accounting for 50 points, with a total score of 100 points, with higher scores indicating higher mastery of professional theoretical knowledge.

(2) Clinical skills operation assessment: Clinical Operational Skills Assessment (direct observation of procedural skill, DOPS) scale was used for the clinical skills operation of professional master students in the department of nephrology. The evaluation included 11 items: understanding the indications and relevant clinical knowledge, obtaining consent from the patient and his/her family in the form of written notification and signature from a family member or the patient, preparation of items for operation, appropriate choice of anesthesia, hands-on ability, aseptic technique, availability for assistance timely, postoperative management, communication ability, humanistic care, and overall performance. Scoring criteria: The DOPS scale was a 9-point scale, each item was divided into 3 levels, with 1-3 points considered unqualified, 4-6 points considered qualified, and 7-9 points considered excellent. This study mainly focuses on the observation and assessment of core abilities such as communication ability, preparation of handling items, anesthesia technique, operation ability, aseptic technique, and postoperative treatment.

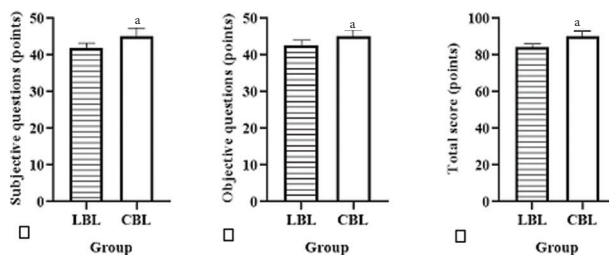
(3) Self-learning ability: It mainly contained three items of self-management ability, information ability, and learning ability. The self-learning ability scale was developed by our institute to compare the self-learning ability of two groups of students.

(4) Satisfaction with the teaching mode: After the training, the questionnaire was issued, and the residents scored satisfaction with the teaching form and teaching effect. From 1 to 10, with 1 indicating very dissatisfied and 10 indicating very satisfied.

Statistical analysis

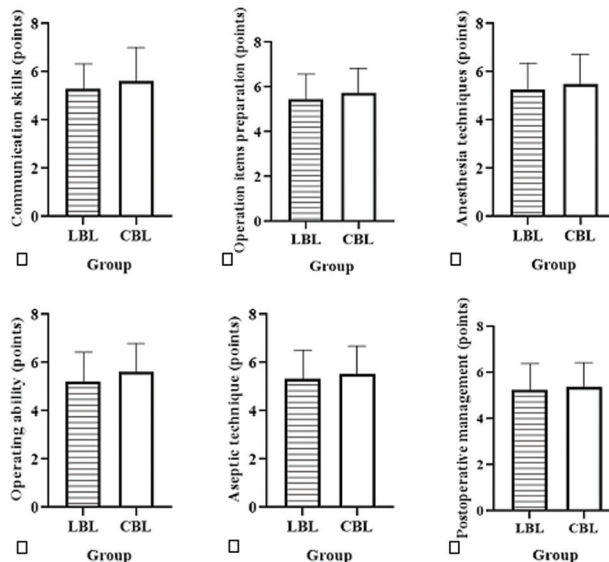
Statistical Product and Service Solutions (SPSS) version 22.0 statistical software (IBM, Armonk, NY, USA) was used for data analysis. The mean standard deviation (Mean SD) was used to express the measurement data conforming to the normal distribution, and independent samples *t* test was used for comparison between two groups; counting data were represented by case number, percentage, and chi-square test. The difference was considered statistically significant at *P* < .05.

Figure 1. Comparison of the results of professional theoretical knowledge assessment between two groups of students. (a) objective question assessment scores, (b) subjective question assessment scores, (c) the total score of professional theoretical knowledge assessment.



^a*P* < .05 compared with the LBL group.

Figure 2. Comparison of clinical skills assessment scores between two groups. (a) communication ability assessment scores, (b) operational items preparation assessment scores, (c) anesthesia technique assessment scores, (d) operational ability assessment scores, (e) aseptic technique assessment scores, (f) postoperative handling ability assessment scores.



RESULTS

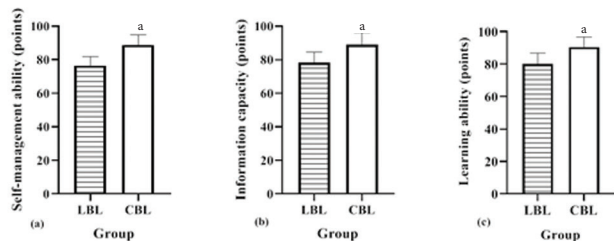
Comparison of the results of professional theoretical knowledge assessment between the two groups

The objective question assessment scores, subjective question assessment scores, and total scores of professional theoretical knowledge assessment of the CBL group were significantly higher than those of the LBL group (*P*₁ = .028; *P*₂ = .036; *P*₃ = .041), as shown in Figure 1.

Comparison of clinical skills assessment scores between the two groups

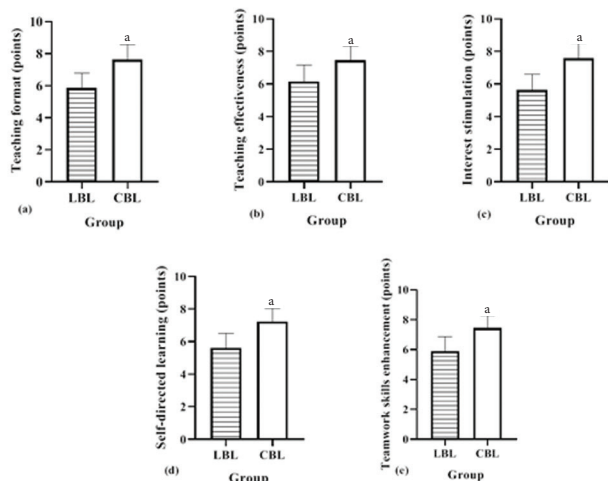
The assessment scores of communication ability, preparation of handling items, anesthesia technique, operation ability, aseptic technique, and postoperative handling ability of the CBL group were all higher than those

Figure 3. Comparison of learning ability after teaching between two groups. (a) represents self-management skills points; (b) represents information management skills points; (c) represents learning ability points.



^a $P < .05$ compared with the LBL group.

Figure 4. Comparison of satisfaction with the teaching mode between two groups. (a) satisfaction with teaching format, (b) satisfaction with teaching effectiveness, (c) satisfaction with interest stimulation, (d) independent learning, (e) improvement of teamwork skills.



^a $P < .05$ compared with the LBL group.

of the LBL group, but the differences were not statistically significant ($P_1 = .071$; $P_2 = .260$; $P_3 = .184$; $P_4 = .127$; $P_5 = .352$; $P_6 = .584$), as shown in Figure 2.

Comparison of learning ability after teaching between two groups

The self-management ability, information ability, and learning ability scores of students in the CBL group were significantly higher than those in the LBL group ($P_1 = .006$; $P_2 = .013$; $P_3 = .003$), as shown in Figure 3.

Comparison of satisfaction with the teaching mode between two groups

The satisfaction of the two groups with their respective teaching modes was assessed by using the exit satisfaction questionnaire. The results show that students in the CBL group were significantly higher than those in the LBL group in terms of their satisfaction with the teaching form, teaching

effect, interest stimulation, independent learning, and improvement of teamwork ability ($P_1 = .015$; $P_2 = .008$; $P_3 = .010$; $P_4 = .024$; $P_5 = .022$), as shown in Figure 4.

DISCUSSION

Nephrology is highly specialized, patients are generally older, and the number of critically ill patients is high. After long-term treatment, patients have a poor emotional state and are resistant to medical and nursing staff, which increases the difficulty of carrying out clinical teaching.¹⁵ In addition, the nephrology environment is complex, which makes the teaching process harder because there are many challenges in teaching. In the LBL teaching method, teachers are in a dominant teaching position, simply passing knowledge to students, while the students are in the passive acceptance position. Consequently, the students’ self-learning ability and flexibly flexibility to apply knowledge are reduced. So students lose enthusiasm for learning, and a gap between theoretical knowledge and clinical practice is created.^{16,17} The key to this problem is the lack of transition from basic theoretical teaching to clinical practice in the current education system, which makes it imperative to explore efficient and feasible clinical medicine education tools.

CBL teaching is a case teaching method that is “case-based, problem-indexed, clinical thinking as the main line, and interaction as the means”.¹⁸ Cultivate students’ ability to discover, explore and solve problems, deepen students’ understanding of disease analysis, diagnosis, and treatment plans, and consolidate students’ knowledge. Compared with traditional classroom and lecture lectures, CBL can greatly improve students’ initiative to acquire knowledge and provide a good clinical simulation environment.^{19,20} However, some scholars believe that there is insufficient evidence that CBL can improve students’ clinical competence, and its teaching methods are complex and time-consuming, and have high requirements for teaching design and teachers, which limit the application of CBL in practical teaching.²¹

The theoretical knowledge of nephrology is the core content of postgraduate training in nephrology, the theory is the basis of practice, and the diagnosis and treatment of diseases should be based on scientific theory. Clinical requirements for medical students’ professional knowledge are high, and students’ theoretical knowledge is not solid enough, which will undoubtedly affect their clinical practice skills.²² The CBL teaching format is to include specific events and situations by selecting typical case materials, which keeps the students interested in active learning and provokes their curiosity. The selected cases are then explained by the instructor and actively discussed by the graduate students to find the diagnosis and treatment methods so that the students can strengthen their relevant knowledge from the specific cases, facilitate their understanding and deepen their memory.^{23,24} According to similar studies,²⁵ it has been found that the field of nephrology is characterized by a complex environment, heavy workload, and numerous challenging teaching points. This aligns with the results of our study,

indicating that nephrology education commonly faces significant challenges. Furthermore, the limitations of traditional teaching methods, such as the LBL approach, have been confirmed in other research as well. This emphasizes the necessity to explore more effective teaching methods. Additionally, some studies have indicated the positive effects of Case-Based Learning (CBL) in other medical specialties (including surgery, paediatrics, internal medicine and obstetrics and gynaecology, etc.), such as improving students' clinical skills and self-directed learning abilities.²⁶ However, there are also studies suggesting that the complexity and time-consuming nature of CBL restrict its application in practical teaching.²⁷ This indicates the need to consider both the adaptability and feasibility of implementing CBL teaching models. Therefore, considering the perspectives of similar studies, we can conclude that the CBL teaching model has shown positive impacts in nephrology clinical education, enhancing students' clinical thinking abilities and fostering their interest in learning. However, when applying this model to actual teaching, it is necessary to adapt it appropriately to specific circumstances, finding the right balance and optimal timing to ensure that nephrology clinical education becomes more scientifically grounded and efficient.

The professional postgraduate students included in this study, specializing in clinical medicine in nephrology, also confirmed the above findings from multiple perspectives. Firstly, after applying the CBL teaching mode to the clinical practice teaching of nephrology, the clinical skills and operation ability of students were positively evaluated from the dimensions of communication ability, preparation of operational items, anesthesia technology, operation ability, aseptic technique, and postoperative treatment. The analysis may be that the complete case study provided by CBL gives students an actual clinical case, attracts them to conduct a scientific and orderly inquiry, and enables learners to improve their understanding of the disease, develop correct diagnosis and treatment ideas, and agile strain capacity in the process.²⁸ Secondly, from the results of the assessment of students' professional theoretical knowledge and the measurement of their learning ability after the teaching, the CBL model not only improved students' clinical operation ability but also made their clinical theoretical knowledge and self-learning ability more efficient.

Finally, the CBL group gave high ratings of satisfaction with all aspects of the teaching model, and the analysis may be because the CBL case teaching model is more in line with the practical requirements, it greatly facilitates flexible one-to-one or one-to-many targeted discussions between students and students, and students and teachers on the corresponding clinical problems, which not only enhances the ease of communication but also greatly improves the efficiency of practical work.²⁹

In summary, the CBL teaching model has positively impacted master's students teaching in clinical medicine in nephrology, significantly improving their clinical thinking skills and stimulating greater interest and exploration in the discipline. It is worth noting that because of the busy and complex clinical work of nephrology in China, the CBL

teaching mode should be moderately improved by the national conditions and explored in practice to find its balance and the best time to apply it, to make the clinical teaching of nephrology in China more scientific and efficient.

CONFLICT OF INTEREST

It is guaranteed that there is no conflict of interest in this study.

AUTHORS' CONTRIBUTIONS

Guang Yang, Kang Liu, Huijuan Mao and Changying Xing designed the study and performed the experiments, Guang Yang, Kang Liu and Honglei Guo collected the data, Huijuan Mao, Changying Xing and Suyan Duan analyzed the data, Guang Yang, Kang Liu, Huijuan Mao and Changying Xing prepared the manuscript. All authors read and approved the final manuscript. Guang Yang and Kang Liu are co-first authors.

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