Original Research Article

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Comparison of problem/case-based learning with lecture-based learning in the clinical teaching of ophthalmology

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ABSTRACT

Background: Few researches have focused on the effectiveness of problem/case-based learning (PCBL) method in clinical teaching of ophthalmology among undergraduate students and their evaluation feedbacks to this method. Knowledge of current different approaches of teaching clinical ophthalmology might help to achieve better learning effect. So, our aim was to compare problem/case-based learning (PCBL) with lecture-based learning (LBL) in the education of medical students and investigate the student perceptions of teaching ophthalmology by the PCBL approach.

Methods: Two classes of fourth-year medical students were divided into two groups by class-based randomly and were taught the ocular trauma course. A total of 76 students studied in lectures and 87 students learned in a problem/case -based learning discussion session. Five questions were designed on ocular trauma in the final examination to evaluate the effectiveness of these two teaching methods. Students with the PCBL perceptions were collected to analyse the effectiveness of the PCBL.

Results: Comparing with LBL, a significantly higher overall examination score occurred in the PCBL group. Most students in the PCBL class agreed that PCBL performed better in improving their understanding of the subject materials, promoting learning motivation, and enhancing the communication skill and clinical thinking method.

Conclusions: The PCBL is an effective approach to assist students in understanding the clinical diagnosis and treatment of ocular diseases. This teaching method helps students increase the motivation of improving learning and problem-handling skills.

Keywords: Problem-based learning, Lecture-based learning, Undergraduate, Clinical ophthalmology

INTRODUCTION

Medical courses used to implement through traditional teaching strategies, such as tutorials, didactic lectures and practical classes. LBL, a teacher-centered pedagogy that mainly depends on the passive transfer of knowledge from the lecturer to the learner, is the historical primary teaching modality in medical education. However, the traditional lecture may not be the optimal teaching pattern

in guiding students to learn and apply therapeutic or scientific content to real clinical scenarios.

PBL is a student-centered approach that relies on solving listed problems by students. The PBL can contribute to dialectical thinking, independent learning style, sharing knowledge, and information acquisition with combining the basic science knowledge and clinical scenarios.^{2,3} The PBL was introduced in China in the 1980s, however, the practice of this method is rare in the beginning. With the implementation of the educational revolution in the 21st

century in China, PBL began to spread as a useful learning tool.⁴ Case-based learning (CBL) is usually composed of an engaging and/or controversial story based on scientific principles, which is currently used in multiple health-care settings around the world.⁵ Presently, CBL has gradually been applied as practical teaching method in medical education in china.⁶

Problem/case-based learning (PCBL), a combination of CBL and PBL, has both of their advantages of helping in developing teamwork and promoting foster self-study and analytical ability. In the process of PCBL implementation, selection of representative clinical cases in CBL and guiding questions in PBL based on same course. A case-based and problem-driven teaching strategy plays a vital role in cultivating clinical thinking and developing a broader sight of case scenarios. In previous research, students in some studies didn't show preference for PCBL compared to LBL; while students in many studies got higher scores in PCBL.

Ophthalmology is a highly specialized profession that requires lifelong ability to solve unique and challenging case problems. However, the allocation of time, teacher availability, funding, and resources in ophthalmic the ophthalmology education made clerkship marginalized in medical schools worldwide gradually. Few researches are focusing on the practical academic performance of undergraduate students in ophthalmology PCBL course. 11,12 Based on the considerations of the above problems, we introduced PCBL in ocular trauma teaching for better learning effect. This study aimed to compare the academic and clinical performance between PCBL strategy and traditional LBL method.

METHODS

A total of 163 students were recruited from two classes of same clinical courses, who had received the previous chapters of clinical ophthalmology teaching through the LBL method from February 2018 to June 2018 in Wannan Medical College (WNMC). The students were divided into study group and control group by simple class-based randomization to learn ocular trauma course. The study group (n=87) was divided into eight teams and attended in the PCBL class, and the control group (n=76) was educated in the regular LBL way. All the students were unaware of the grouping situation before the research.

Ocular trauma cases include multiple eyeball wounds. Students need to have a comprehensive knowledge of clinical signs and symptoms of ophthalmic diseases. Additionally, students are required a solid talent for ocular trauma, containing endophthalmitis, glaucoma, cataract, iris concussion, vitreous hemorrhage, and retinal detachment. Therefore, we selected the ocular trauma module as the target course to apply the PCBL approach, and the lecturer designed the study procedure based on the learning goals and requirements of this chapter.

The control group was taught by regular LBL method following the usual procedure, which is a one-hour academic lecture followed by a ten-minute question and answer session. On another hand, the PCBL group was given a case and two problems based on clinical patients diagnosed and treated recently. The scenario should have essential information, including medical history, symptoms, auxiliary examinations, along with diagnoses and treatment plans. The two problems should arise about etiological diagnoses and prognosis of ocular trauma complications. During this class divided into 8 teams, one student in each team consisting of 10-11 students described the case and problems and students carried out the discussion within teams. The same lecturer implemented and controlled the process of the course, corrected deviations in time, and summarized the achievement of the class.

There was a final exam at the end of the ocular trauma courses to evaluate the level of grasping the knowledge of students. The examination was consisting of five questions which were the single best answer format of multiple choice questions, and the total mark is 5. In detail, we carefully selected the questions from the standard question pool at WNMC to test the understanding of the fundamental knowledge, causes, characteristics, diagnosis, and treatment of the ocular trauma cases.

In addition, students in the PCBL class were asked to self-evaluate their interest and skills in ocular trauma after the course. The self-evaluate questionnaires are composed of 10 questions about learning quality, knowledge retention, practical usefulness, class attractiveness, and performance in exam, motivation to study, and preferences to collect students' opinions. The evaluation had four scales for each aspect: excellent, good, fair, and poor respectively.

We used statistical analyses to calculate the total scores of ocular trauma-related questions from final examination of each student. An independent samples t-test compared the performances of the final exam of two groups. The Mann-Whitney U test was used to analyze the level of students' interest and preference. All preliminary statistical analyses were achieved by SPSS 16.0 version, and the theoretical p-values with statistical significance is lower than 0.05. The ethics committee of the first affiliated hospital of Wannan Medical College has approved this study.

RESULTS

A total of 163 students are involved in the study, 87 students assigned to the PCBL group and 76 students assigned into the LBL group. There was no statistical difference between the two groups in gender ratio and ages (Table 1). All students in the PCBL group participated in the discussion of case and questions and fulfilled the questionnaires, and all students in the LBL group accomplished the course. Students in both groups

submitted the written examination on time. Table 2 depicted the comparison of the written examination scores between the LBL group and the PBL group. Comparing with the LBL group, the mean examination

scores of the PCBL group were significantly higher (4.91) than the LBL group (4.73), the results of t-test illustrated that these two groups have statistically significant difference (p=0.01).

Table 1: Demographic information of medical students.

	PCBL	LBL	Statistics	df	P value
Number of students	87	76			
Gender					0.564 ^a
Male	37	50	$x^2 = 0.334$	1	
Female	28	48			
Age (in years)	21.43±099	21.33±098	t=0.62	161	0.536 ^b

PCBL: Problem/case-based learning, LBL: Lecture-based learning, df=degrees of freedom. (a) The two groups were compared using the Pearson chi-square test. (b) The two groups were compared using independent samples t test.

Table 2: Comparison of total score of examination (x±s).

Group	N	Score	t-value	P value
Group with PCBL method	87	4.91	2.43	0.01
Group with LBL method	76	4.73		

PCBL: Problem/case-based learning, LBL: Lecture-based learning.

Table 3: Comparison of students' perspectives between PCBL and LBL in PCBL-classroom.

Items	Ways	Excellent	Good	Fair	Poor	Z	P value
							0.001
Improving interest to learn	DCDI		- 25		- 0	-6.86	< 0.001
	PCBL	56	27	4	0		
	LBL	17	33	37	0	=	
Making highly concentrated			• •			-4.97	< 0.001
	PCBL	40	38	9	0		
	LBL	14	42	30	1		0.001
Sharping analytical skill	DCDI				- 0	-5.35	< 0.001
	PCBL	35	46	6	0		
D 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	LBL	16	31	37	3	6.10	0.001
Developing Independent thinking ability	DCDI	. ~	25	4		-6.18	< 0.001
	PCBL	45	37	4	1 -		
	LBL	13	40	29	5	1 41	0.16
Understanding the important and difficult points	DCDI	20	10	1.77	0	-1.41	0.16
	PCBL	28	42	17	0		
7 10 / 1 100	LBL	22	41	22	2	2.07	0.001
Improving self-study ability	DCDI	26	26	1.5	0	-3.97	< 0.001
	PCBL	36	36	15	0	-	
	LBL	18	32	32	5	7.40	0.001
Promoting expression and communication	DCDI		20		0	-7.49	< 0.001
	PCBL	54	28	5	0		
	LBL	14	26	38	9		0.001
Increasing collaboration and teamwork	DCDI	40	22	1.4	0	-6.56	< 0.001
	PCBL	40	33	14	0	-	·
	LBL	7	31	44	5	4.71	.0.001
Evaluate this method of teaching		40	20	4	1	-4.71	< 0.001
	PCBL	43	39	4	1		
T 11 1 1 1	LBL	17	48	22	0	1.01	0.21
Increased learning burden		1.1	1.7			-1.01	0.31
	PCBL	11	17	55	4	-	
PCRI - Problem/case based learning I RI - Lecture based lea	LBL	5	19	57	6		

PCBL: Problem/case-based learning, LBL: Lecture-based learning.

As presented in Table 3, students in the PCBL-classroom hold the opinion that the PCBL strategy is superior to the LBL in helping improve their skills, including: promoting interest to learn (p<0.001), making highly concentrated (p<0.001), sharping analytical skill (p<0.001), developing independent thinking ability (p<0.001), improving self-study ability (p<0.001), promoting expression and communication (p<0.001), increasing collaboration and teamwork (p<0.001) and evaluating this method of teaching (p<0.001). However, PCBL students did not agree that the PCBL could help in understanding the essential and challenging points (p=0.16) and increasing learning burden (p=0.31) in ocular trauma learning.

DISCUSSION

This study was a further exploration of the effectiveness and suitability of the PCBL in the process of ocular trauma teaching. A significantly higher overall examination score occurred in the PCBL group as compared to LBL. In addition, participators considered that PCBL could aid in highly concentrating the course materials. Moreover, students reflected that they improved communication, collaboration, independent thinking, and analytical skills during the PCBL class. These findings provided an excellent precedent and should encourage the educators to consider using the PCBL in ophthalmology teaching.

In our study, we found students in the PCBL group obtained significantly higher scores compared to LBL approach for ocular trauma topic. Consistent with our findings, previous studies have shown that the PCBLclassroom approach improves students' performance. 7,9 A study conducted by Lei illustrated that the students educated by PCBL with competition mode were more likely to refer case-related articles and attend group consultation; they also performed better in the final written examination on the clinical diagnoses and treatment of severe infection. ⁷ Carrero carried out a study on teaching pre-anesthetic assessment in a resident medical training program in Spain, which concluded that the PCBL appeared to be more effective than the LBL in reasoning choice of anesthetic technique. However, the performances of lecture-based and case/problem-based learning mode had little differences in improving residents' immediate pre-anaesthetic assessment knowledge.9

This study noted that PCBL was able to enhance the students' learning abilities and that there was an improvement in the analytic, collaborative, and communication skills of students. Previous data regarding learning outcomes comparing PCBL to lecture format show either similar or improved outcomes with LBL format.^{7,8} In the study of Aljarallah and Hassan, PCBL showed some other benefits, including improving learning abilities, promoting self-assessment and logical thinking, integrating theory with practice, and encouraging students' personalized learning.⁸ Certainly,

several studies had different results when comparing these two methods, which may because of the bias between the intervention and control groups, as well as the lecturer and tutor were not identical. ^{13,14} Meanwhile, the way to carry out PCBL and the interval time to the examination may also influence the effectiveness. Despite more interest shown in PCBL study, there is no consistent evidence verifying that this strategy is superior to the LBL in understanding the essential and challenging key points and increasing learning burden.

The effectiveness of using PCBL-classroom method in ophthalmology teaching may come from various factors. 15,16 Problem/case-based learning sessions were designed to help students to narrow the gap between theory and practice and improve learning interest; to minimize possible negative impact of the hidden curriculum and enhance concentrate; to develop clinical information gathering skills and analytical skills; to apply basic science knowledge to real-life clinical scenarios; and to develop case presentation and independent thinking skills. Students have appreciated the focus on breadth of expression and communication rather than diagnosis alone, strengthening collaboration and team work. The PCBL class group is more freedom to selfstudy, allowing students to arrange their time more reasonably and effectively. PCBL-classroom approach emphasizes the output of knowledge from students and improves application of student's medical knowledge.

Several limitations need to be considered. Firstly, we evaluated the learning effects after the course immediately. However, the delayed testing and follow-up investigation were necessary for the long-term evaluation of a new teaching methodology. This study is of sufficient interest and needs further research with a larger sample size and delayed tests. Secondly, these assessments in this study came from students' selfassessment in PCBL class, containing presentation skills and clinical thinking method. As the discussion above, the evaluation process needs to be updated to meet the requirements of measuring core competencies and analyzing the results quantitatively to provide a more effective result. Thirdly, in the study, we just selected the chapter of ocular trauma to compare the teaching effect of PCBL, but the characteristics of each chapter are not completely consistent, and further research is still needed to apply the PCBL method in other chapters of clinical ophthalmology teaching.

CONCLUSION

The PCBL strategy is a better option rather than LBL in the ocular trauma module teaching. In ophthalmology learning, PCBL promotes the motivation of studying, enhance clinical communication and thinking skills, as well as improves the performance in the final written examination. The PCBL approach needs optimization in specific courses, students' burden and workload, and the evaluation system in further study.

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