

Original Article

The effect of PBL combined with comparative nursing rounds on the teaching of nursing for traumatology

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Abstract: Objective: To investigate the effect of problem-based learning (PBL) combined with comparative nursing rounds on the teaching of nursing for traumatology. Methods: This prospective study was performed in 186 nursing student interns. According to a random number table, these interns were assigned to the control group (n=93) and the experimental group (n=93). In the control group, the interns received traditional teaching methods. Meanwhile, interns in the experimental group received PBL combined with comparative nursing rounds teaching. The level of teaching approval, excellent and good rate of theoretical knowledge, operational ability, medical record writing, and critical thinking disposition inventory-Chinese version scores were compared between the two groups. Results: Teaching approval in learning initiative, problem solving ability, critical thinking, clinical work ability, independent information acquisition ability, and teamwork spirit in the experimental group were improved compared with the control group (all $P < 0.05$). The excellent and good rate of theoretical knowledge, operational ability, and medical record writing in the experimental group were all higher than those in the control group (all $P < 0.05$). Compared with the control group, critical thinking disposition inventory-Chinese version scores in all aspects in the experimental group after training were improved (all $P < 0.05$). Conclusion: The application of PBL combined comparative nursing rounds in the teaching of nursing for traumatology is beneficial for a significant improvement in the grasp of theoretical knowledge, operational ability, critical thinking ability, and teaching approval.

Keywords: Problem-based learning, comparative nursing rounds model, traumatology, critical thinking

Introduction

In surgical nursing, clinical practice and theoretical knowledge are closely related. To a certain extent, the quality of surgical nursing can affect the therapeutic effect [1]. In the past, classroom teaching was predominately applied in teaching surgical nursing. In classroom teaching, the development of nursing student interns' subjective initiative and critical thinking are constrained, and the combination of clinical practice and theoretical knowledge is ignored. As a result, the teaching effect is not always good [2, 3]. As a reasonable and reflective way of thinking, critical thinking is a thinking skill that is generally regarded as one of the main goals of modern higher education. Problem-based learning (PBL) is a novel teaching method, where problem-oriented and intern-centered practical teaching is carried out [4, 5]. The comparative nursing round module

is a new learner-oriented teaching model. In this model, differential analysis on the pathogenesis, clinical manifestations, etc. are performed in patients with the same disease. It can help to improve the interns' operational ability, enrich their theoretical knowledge, and open up their thinking ability [6].

At present, PBL and comparative nursing rounds are commonly observed in teaching clinical nursing worldwide. To be specific, they have been widely applied in the clinical teaching in departments like orthopedics and surgery. When PBL and comparative nursing rounds are combined, the deficiencies each type are made up for, and the consolidation of clinical practice and theoretical knowledge is improved. The quality of clinical nursing teaching is thus enhanced [7]. Traumatology is a comprehensive department that integrates urology, general surgery, neurosurgery, cardio-

thoracic surgery, hepatobiliary surgery, and orthopedics. In traumatology, the scope of the diagnosis and treatment includes organ rupture, brain injury, burns, and other combined surgical diseases. This means that increased professional quality is required. Accordingly, training requirements for nursing student interns are higher. Here, different nursing teaching methods were applied in 186 nursing student interns to study the effect of PBL combined with comparative nursing rounds on the teaching of nursing for traumatology.

Materials and methods

General information

This prospective study was conducted in 186 nursing student interns who were studying in the Traumatology Department of the Affiliated Hospital of Beihua University between September 2018 and September 2019. According to a random number table, the interns were divided into the control group (n=93) and the experimental group (n=93). Inclusion criteria: The internship period lasted 6 months or more; the participants were informed in advance of the content of this study, and informed consent was voluntarily given; the interns studied in our hospital; the interns were able to grasp basic nursing knowledge; the interns were in an internship period after the training. Exclusion criteria: Time off during the internship period was more than 1 month; the intern nurses were enrolled in informal universities and colleges; the interns were participating or participated in similar nursing teaching research at another institution. As for the teachers teaching both groups, they (1) had been working in traumatology for more than 5 years; (2) had a junior college degree or above; (3) had teaching qualifications; (4) were head nurses with a rich history of clinical experience. In order to eliminate the influence of subjective factors on the effect of practical teaching, the teachers of both groups were rotated every month. This study was approved by the Ethics Committee of Affiliated Hospital of Beihua University.

Teaching methods

In the control group, nursing student interns received traditional teaching: interns were allocated into multiple groups, each with 5-6 interns; interns in each group learned the theo-

retical knowledge of nursing in traumatology, independently; to ensure interns in each group obtained a detailed theoretical knowledge, teachers guided them to master literature retrieval methods and know the sources for clinical research evidence; demonstrations of skills and general operations were regularly demonstrated by the teachers; the diagnosis and treatment process, focus of nursing, and other content were demonstrated by the teachers for the students one on one.

In the experimental group, nursing student interns received PBL combined with comparative nursing rounds teaching, which is described as follows. (1) Preparation: teachers chose cases one week in advance. Most of these cases, such as limb fractures, liver and spleen ruptures, kidney rupture, and skin burns, are commonly and frequently observed in traumatology. According to the textbooks, related questions were proposed and 2 thinking questions were assigned. A literature search was also performed so as to be well prepared for ward rounds. The interns were asked to preview the textbook material and read the lessons with the purpose of solving the questions assigned by the teachers. They were allowed to discuss the cases freely. The collection of medical history was completed. In addition, solutions to the questions raised by the teachers were well prepared in advance [8]. (2) Ward rounds: nursing student interns reported the condition of patients that they were in charge of, separately. Thereafter, the teachers summarized the reports and pointed out any differences and similarities in clinical manifestations and onset characteristics among the cases. In order to explore the learning situation, they asked the interns to answer the thinking questions assigned in advance on the spot. Subsequently, the teachers checked the patients' condition and pointed out current nursing problems. What's more, they guided the interns to find reasonable nursing measures. The main duty of the teachers was combining actual clinical cases with theoretical knowledge, and extending any relative special knowledge [9]. (3) Summary: the teachers made comments on the performance of the nursing student interns during ward rounds. They explained and sorted out the conditions and key points and difficulties in nursing. Questions were raised to guide the interns to discuss things on-site and speak actively. (4)

After ward rounds: research questions were raised. To solve these questions, nursing student interns consulted the relevant literature. In this way, their thinking ability and scientific research awareness were improved [10].

Outcome measures

Teaching approval: A self-made teaching approval questionnaire was applied to assess the approbation of teaching. The questionnaire was composed of 6 aspects, including learning initiative, problem solving ability, critical thinking, clinical work ability, independent information acquisition ability, and teamwork spirit. Approval and disapproval were the answers.

Excellent and good rate of theoretical knowledge: A test of theoretical knowledge was performed on the next day after training. The test consisted of noun explanation questions, analysis of cases on nursing, and fill-in-the-blank questions. The total score was 100 points: excellent (above 90 points), good (80-90 points), fine (60-80), and poor (below points). The excellent and good rate = (excellent + good)/the total number of patients * 100%.

Excellent and good rate of operational ability: After training, the test of theoretical knowledge was completed. Nursing simulation and comprehensive ward rounds were the main content of the test. The total score was 100 points: excellent (above 90 points), good (80-90 points), fine (60-80), and poor (below points). Excellent and good rate = (excellent + good)/the total number of patients * 100%.

Excellent and good rate of medical record writing: The assessment of medical record writing was carried out after training [11]. The content of the assessment included chief complaint (5 points), physical examination (10 points), auxiliary examination (5 points), medical history (25 points), an abstract of the medical history (5 points), diagnosis (10 points), diagnostic analysis (13 points), diagnosis and treatment plan (7 points), course records (10 points), discharge records (5 points), and others (5 points). The total score was 100 points: excellent (above 90 points), good (80-90 points), fine (60-80), and poor (below points). Excellent and good rate = (excellent + good)/the total number of patients * 100%.

Critical thinking: Critical thinking disposition inventory-Chinese version (CTDI-CV) was applied to assess the critical thinking of nursing student interns in both groups before and after training [12]. It consisted of 5 aspects, including open thinking, cognitive maturity, analytical ability, systematization ability, and critical thinking. Each aspect was composed of 10 items, with each item scoring 0-6 points. Namely, the total score of each aspect was 0-60 points. The score was positively correlated with the level of critical thinking.

Statistical methods

The whole data were analyzed using SPSS statistical software version 25.0. Normality Kolmogorov-Smirnov test (KS) was used as the normality of the data. The normally distributed measurement data were calculated as mean \pm standard deviation ($\bar{x} \pm sd$); independent sample t test was used for inter-group comparison, while paired t-test was applied for before-after comparison within the same group. The enumeration data were expressed as number/percentage (n/%); comparison was conducted with chi-square test. The difference was statistically significant when *P* value was less than 0.05.

Results

Baseline data

There were no significant differences concerning nursing student interns' general information like gender, age, and education background, and the education background of the teachers between the two groups (all *P*>0.05, **Table 1**).

Teaching approval

Teaching approval in learning initiative, problem solving ability, critical thinking, clinical work ability, independent information acquisition ability, and teamwork spirit in the experimental group were higher than those in the control group (all *P*<0.05, **Table 2**). These results indicate that teaching with PBL combined with comparative nursing round can effectively improve the approbation of teaching.

Excellent and good rate of theoretical knowledge

The excellent and good rate of theoretical knowledge in the experimental was higher than that in the control group (81.72% vs 68.82%, *P*<0.05, **Table 3**), suggesting that PBL com-

PBL combined with comparative nursing

Table 1. Baseline data

Group	Control group (n=93)	Experimental group (n=93)	t/ χ^2	P
Age (years)	24.7±3.4	24.9±3.5	0.395	0.693
Teaching teachers (n)	10	10	0.000	1.000
Gender			0.148	0.700
Female	90	89		
Male	3	4		
Education background			0.170	0.919
Secondary schools	13 (13.98)	15 (16.13)		
Junior college	30 (32.26)	29 (31.18)		
Undergraduate college and above	50 (53.76)	49 (52.69)		
Internship period (months)	3.5±1.2	3.4±1.2	0.568	0.571
Education background of teaching teachers			0.000	1.000
Junior college	4 (40.00)	3 (30.00)		
Undergraduate college and above	6 (60.00)	7 (70.00)		

Table 2. Teaching approval (n, %)

Group	Control group (n=93)	Experimental group (n=93)	χ^2	P
Learning initiative	75 (80.65)	86 (92.47)	5.592	0.018
Problem solving ability	72 (77.42)	83 (89.25)	4.684	0.030
Critical thinking	77 (82.80)	86 (92.47)	4.019	0.045
Clinical work ability	74 (79.57)	85 (91.40)	5.242	0.022
Independent information acquisition ability	78 (83.87)	89 (95.70)	7.093	0.008
Teamwork spirit	80 (86.02)	90 (96.77)	6.838	0.009

Table 3. Excellent and good rate of theoretical knowledge (n, %)

Group	Excellent	Good	Fine	Poor	Excellent and good rate
Control group (n=93)	15 (16.13)	49 (52.69)	20 (21.51)	9 (9.68)	64 (68.82)
Experimental group (n=93)	31 (33.33)	45 (48.39)	11 (11.83)	6 (6.45)	76 (81.72)
Z/ χ^2		8.948			4.159
P		0.030			0.041

Table 4. Excellent and good rate of operational ability (n, %)

Group	Excellent	Good	Fine	Poor	Excellent and good rate
Control group (n=93)	22 (23.66)	46 (49.46)	17 (18.28)	8 (8.60)	68 (73.12)
Experimental group (n=93)	34 (36.56)	48 (51.62)	9 (9.68)	2 (2.15)	82 (88.17)
Z/ χ^2		8.676			6.751
P		0.034			0.009

combined with comparative nursing rounds teaching can effectively improve the theoretical knowledge.

Excellent and good rate of operational ability

The excellent and good rate of operational ability in the experimental was improved when compared with the control group (88.17% vs 73.12%, $P < 0.01$, **Table 4**). This result denotes

that PBL combined with comparative nursing round teaching can effectively improve operational ability.

Excellent and good rate of medical record writing

Compared with the control group, the excellent and good rate of medical record writing in the experimental was increased (89.25% vs

Table 5. Excellent and good rate of medical record writing (n, %)

Group	Excellent	Good	Fine	Poor	Excellent and good rate
Control group (n=93)	19 (20.43)	52 (55.91)	15 (16.13)	7 (7.53)	71 (76.34)
Experimental group (n=93)	33 (35.48)	50 (53.76)	7 (7.53)	3 (3.23)	83 (89.25)
Z/ χ^2		8.318			5.435
P		0.040			0.020

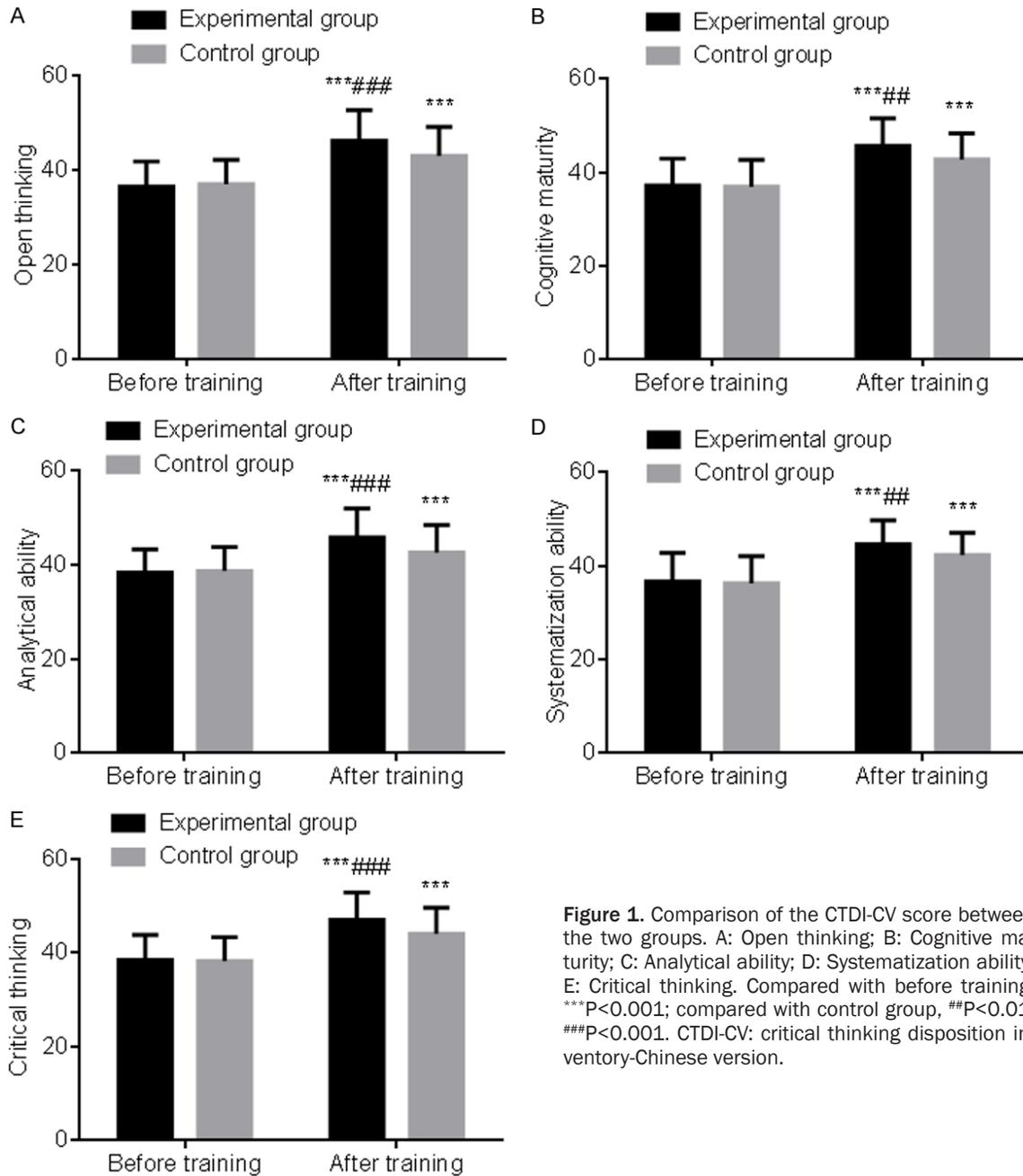


Figure 1. Comparison of the CTDI-CV score between the two groups. A: Open thinking; B: Cognitive maturity; C: Analytical ability; D: Systematization ability; E: Critical thinking. Compared with before training, ***P<0.001; compared with control group, ##P<0.01, ###P<0.001. CTDI-CV: critical thinking disposition inventory-Chinese version.

76.34%, P<0.05, **Table 5**), indicating that PBL combined with comparative nursing round teaching can effectively improve medical record writing.

CTDI-CV score

As shown in **Figure 1**, there were no significant differences concerning the CTDI-CV scores in

all aspects between the two groups before training (all $P > 0.05$); the CTDI-CV scores in all aspects in both groups after training were increased when compared with before training (all $P < 0.01$); the CTDI-CV scores in all aspects in the experimental after training were higher than those in the control group (all $P < 0.01$). These results suggest that PBL combined with comparative nursing round teaching can effectively improve critical thinking.

Discussion

The treatment of injuries caused by trauma is the main mission of doctors in traumatology. High demands for nursing are thus required. How to better teach nursing student interns and help them meet the needs of nursing through effectively improving the quality of clinical teaching is the focus of clinical work. Our results showed that teaching approval in all aspects (learning initiative, problem solving ability, critical thinking, clinical work ability, independent information acquisition ability, and teamwork spirit) in the experimental group were higher than those in the control group; compared with the control group, the excellent and good rate of theoretical knowledge, operational ability, and medical record writing were all improved. Xie et al. applied PBL combined with a comparative ward round model in the surgical teaching of nursing undergraduates; the result showed that the score in theoretical knowledge assessment in the PBL combined with comparative ward round teaching group was higher than that in the routine teaching group, which was consistent with our results [13]. These results suggest that the application of PBL combined comparative nursing rounds in the teaching of nursing for traumatology can help nursing student interns improve their excellent and good rate of theoretical knowledge, operational ability, and medical record writing. Moreover, teaching approval is improved.

The core of PBL combined with comparative nursing rounds is a problem-oriented method, being intern-centered, and with a differential analysis of various cases of the same disease being studied during ward rounds. Interns are guided to find similarities and differences among different cases. In addition, they are instructed to discover problems in nursing and find reasonable solutions [14]. PBL combined

with comparative nursing rounds have the following advantages. (1) Improvement of learning efficiency: Before ward rounds, interns previewed and studied to solve the questions raised by the teachers. The learning efficiency is therefore high. Additionally, the theoretical knowledge in textbooks was confirmed in clinical practice, consolidating the learning content [15]. (2) Enhancement of self-confidence: The interns' oral expression skills and language organization skills were practiced through participating in the whole process of ward rounds. Interns could fully show their knowledge, improving their self-confidence [16]. (3) Development of thinking ability: During ward rounds, the teaching was problem-oriented. The interns studied and discussed problems independently. Also, they were required to consult relevant literature by themselves. Not only the content in textbooks was consolidated, but also special knowledge outside the textbooks was grasped. As a result, the intern's horizons and thinking were broadened [17, 18]. (4) Enhancement of teamwork spirit: In the PBL combined with comparative nursing round teaching group, the interns were assigned to multiple groups. Before ward rounds, interns discussed questions on their own. This helped to improve their ability to communicate with each other. Hence, their teamwork was improved [19]. (5) Benefit of both teaching and learning: In the PBL combined with comparative nursing rounds model, requirements for the teachers were increased. Teaching ability can influence the learning enthusiasm of interns to a large extent. In this model, not only the interns but the teachers also kept learning. This benefited everyone, improving the quality of teaching [20, 21].

Critical thinking is considered to be one of the goals of modern higher education [22]. In this study, the CTDI-CV scores in all aspect in the experimental group after training were higher than those in the control group. Cui et al. applied PBL combined with comparative ward round teaching in the surgical teaching of nursing undergraduate. These results showed that these undergraduates' critical thinking was significantly improved [23]. This indicates that PBL combined with comparative nursing rounds can help to improve the critical thinking of nursing student interns in traumatology. In PBL combined with comparative nursing round teaching, the interns were required to

learn and think independently. Their enthusiasm for learning was inspired in the process of presenting, analyzing, solving, and summarizing questions. Accordingly, the interns' teamwork spirit and problem-solving ability were improved. Their critical thinking was also enhanced, which in turn promoted the improvement of the ability and quality of nursing [24, 25]. In addition, clinical practice and theoretical knowledge were combined in the PBL combined with comparative nursing rounds teaching model, breaking the traditional rote learning. During ward rounds, theoretical knowledge was strengthened and consolidated. Furthermore, independent learning and critical thinking were cultivated [26].

However, the sample size of our study is small, which may have an impact on the results. Subsequent future study will perform in an amplified sample to verify our conclusion.

In summary, the application of PBL combined comparative nursing rounds in the teaching of nursing for traumatology is beneficial for a significant improvement of theoretical knowledge, operational ability, critical thinking ability, and teaching approval of nursing students.

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Disclosure of conflict of interest

None.

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