

Application of CBL Combined with PBL Teaching Model in Standardized Training for Cerebrospinal Fluid External Drainage: Postprint

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Abstract

Objective To investigate the effectiveness of case-based learning (CBL) combined with problem-based learning (PBL) teaching model in standardized training for cerebrospinal fluid drainage. **Methods** According to the order of training, nurses participating in the department's training program were divided into a control group (n=10) receiving traditional teaching model and a study group (n=17) receiving CBL combined with PBL teaching model. Training effectiveness was evaluated through operational assessment, theoretical assessment, etc. **Results** The theoretical assessment, operational skills, and patient health education scores of nurses in the observation group were higher than those in the control group, and the difference was statistically significant ($P < 0.01$). **Conclusion** Applying the CBL combined with PBL teaching model to standardized training for cerebrospinal fluid drainage can effectively improve the quality of teaching and training, and stimulate nurses' initiative, participation, and interactivity in teaching and training.

Full Text

Application of Case-Based Learning Combined with Problem-Based Learning in Standardized Training of Cerebrospinal Fluid Drainage

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Abstract

Objective To investigate the effect of case-based learning (CBL) combined with problem-based learning (PBL) in standardized training for cerebrospinal fluid drainage nursing.

Methods According to the training sequence, nurses participating in the standardized training were divided into a control group and a study group. The control group received traditional teaching methods, while the study group received CBL combined with PBL training. Training effectiveness was evaluated through theoretical and practical assessments.

Results Nurses in the study group achieved higher scores in theoretical knowledge, practical skills, and patient health education compared with the control group, with statistically significant differences ($P < 0.05$).

Conclusion The combination of CBL and PBL teaching methods effectively improves the quality of standardized training for cerebrospinal fluid drainage, enhancing nurses' initiative, participation, and interaction in the learning process.

Keywords: external ventricular drainage; lumbar drainage; case-based learning; problem-based learning; standardized training

Introduction

Cerebrospinal fluid (CSF) external drainage refers to the closed-system drainage of CSF from the ventricles or lumbar cistern to the exterior, including external ventricular drainage (EVD) and lumbar drainage (LD). The primary purpose is to drain bloody or contaminated CSF outside the cranium, sometimes also used for intracranial pressure monitoring and control, as well as for medication administration via the drainage catheter. As a commonly used therapeutic nursing technique in neurosurgery, the nursing management of EVD and LD has received considerable attention, making specialized nursing training for this technique particularly important.

In recent years, problem-based learning (PBL) and case-based learning (CBL) have been gradually introduced into medical education and have gained widespread recognition. Neurosurgery departments typically manage many critically ill patients with complex conditions that progress rapidly, requiring frequent emergency interventions and advanced nursing techniques, making them high-risk clinical settings that demand relatively high levels of professional competence and core capabilities from nurses. How to make nursing work better align with actual clinical needs and enable nurses to adapt to disciplinary development while maximizing their intelligence and potential has become an increasingly important concern in nursing education.

The neurosurgery department at our hospital employs numerous nurses, but few have specialized neurosurgical nursing experience, and their mastery of CSF

drainage-related specialized knowledge and skills needs further strengthening. To stimulate nurses' learning enthusiasm within a short timeframe and improve the quality standards of CSF drainage nursing, this study applied a combined CBL and PBL teaching method to CSF drainage-related training. Post-training nursing quality showed significant improvement, achieving satisfactory training outcomes, which we now report.

Methods

Study Design and Participants

This study was conducted in the neurosurgery department of a tertiary Grade A hospital in Shanghai. According to the training sequence, nurses who participated in the standardized CSF drainage training were divided into two groups: a control group and a study group. The control group consisted of nurses who received traditional teaching methods, while the study group comprised nurses who received the combined CBL and PBL teaching approach.

All participants were female, with ages ranging from to years (mean years). Educational backgrounds included with bachelor' s degrees and with associate degrees. Professional titles included head nurses, nurse practitioners, and rotating nurses. Years of work experience ranged from to years (mean years), with having more than 3 years of neurosurgical nursing experience and having more than 5 years.

Training Implementation

To ensure consistency in teaching quality, the same trainer with over 5 years of neurosurgical nursing experience conducted both training methods.

Control Group: Received traditional teaching methods centered on the instructor delivering non-targeted theoretical knowledge. Training was conducted twice weekly for a period of 4 weeks.

Study Group: Received CBL combined with PBL teaching methods, with fixed weekly training sessions lasting 2 hours each, conducted twice weekly for 4 weeks.

Training Plan and Objective Setting: Following PBL methodology, training objectives were established, including knowledge of cranial anatomy, CSF circulation pathways, patient consciousness assessment, and Glasgow Coma Scale (GCS) scoring. Following CBL methodology, relevant classic cases were selected, such as postoperative EVD cases in patients with hypertensive intracerebral hemorrhage, postoperative LD cases in hydrocephalus patients, and postoperative EVD plus ICP monitoring cases in traumatic brain hemorrhage patients. All selected cases were inpatients during the training period, enabling trainees to apply knowledge immediately.

Training Process: The trainer distributed the weekly case histories via

WeChat work groups in advance. Trainees familiarized themselves with the cases by reviewing medical records and literature before the training session. During training, the trainer designed different questions for each case, progressing from simple to complex and maintaining continuity consistent with disease progression. This approach encouraged trainees to think actively and solve problems with a questioning mindset. Through group discussions, exchanges, and hands-on practice at the bedside, nurses deepened their understanding of relevant knowledge and skills. Based on each trainee's learning outcomes, the trainer provided specific evaluations and proposed solutions for improving knowledge points until trainees achieved proficiency in CSF external drainage standardized procedures and protocols.

Assessment Methods

Post-training effectiveness was evaluated through theoretical examinations and practical assessments:

1. **Practical Skills Assessment:** Each nurse managed 2 patients with CSF drainage catheters. On-site evaluation was conducted using the “CSF Drainage Assessment Scoring Criteria” , assessing trainees' mastery of patient consciousness status, GCS scoring, dressing cleanliness, drainage speed control, drainage bottle positioning, drainage fluid characteristics observation, and postoperative patient positioning.
2. **Health Education Evaluation:** Patient and family interviews were conducted to assess their mastery of health education knowledge and the quality of nurses' health education implementation.
3. **Theoretical Knowledge Assessment:** Theoretical test questions were used to evaluate the effectiveness of both teaching methods.

Statistical Analysis

SPSS software was used for data analysis. Measurement data were expressed as mean \pm standard deviation ($\bar{x} \pm s$) and compared between groups using t-test. The significance level was set at $\alpha = 0.05$, with $P < 0.05$ considered statistically significant.

Results

Nurses in the study group achieved significantly higher scores in theoretical assessment, practical skills, and patient health education compared with the control group ($P < 0.05$) .

Discussion

PBL is a discussion-based and heuristic teaching method widely applied in international education. This approach involves instructors pre-designing and

presenting questions to trainees, who attempt to solve problems through active learning and critical thinking, while being encouraged to propose new questions, with instructors providing final summaries to enhance knowledge acquisition through problem-solving. However, PBL has limitations, including potentially low guidance efficiency and poor clinical relevance. Trainees may develop incorrect learning directions due to incomplete knowledge, adversely affecting learning outcomes and enthusiasm.

CBL is a teaching model that selects actual clinical cases for trainees to solve clinical problems independently, thereby acquiring clinical knowledge and practical skills. It is a heuristic, interactive, and discussion-based teaching method. Instructors prepare representative cases based on theoretical and practical integration objectives, organize and guide trainees to analyze cases targeted discussions, and enhance theoretical understanding through specific cases. For trainees with clinical work experience but incomplete specialized knowledge, CBL can compensate for PBL limitations to some extent. However, CBL lacks systematic exposition of basic concepts and disciplinary theories, and learning through only a few cases may be incomplete. It also demands high-quality case selection and instructor competence, and individual trainees may lack interaction during discussions if they fail to complete preparatory self-study, preventing expected teaching outcomes. Therefore, combining CBL and PBL effectively compensates for the drawbacks of each method when used independently.

CSF external drainage nursing is one of the specialized and high-risk nursing procedures in neurosurgery. CSF exists in a constant state of production, circulation, and reabsorption balance, with normal daily secretion of 400-500 mL. Daily drainage volume should be controlled at approximately 200-300 mL or adjusted according to the patient's intracranial pressure. Drainage speed and volume control are the core and most challenging aspects of nursing care, and are key to preventing complications related to insufficient or excessive drainage. Insufficient drainage can lead to increased intracranial pressure, causing headaches, altered consciousness, or even brain herniation. Conversely, excessive drainage speed or volume can cause low-pressure headaches, subdural hematoma, subdural effusion, or aneurysm re-rupture. Therefore, standardized training for neurosurgery nurses in CSF drainage is particularly important.

Our study results demonstrate that the study group achieved significantly higher scores in theoretical knowledge, practical skills, and patient health education compared with the control group ($P < 0.05$), indicating that the CBL combined with PBL teaching format significantly improved trainees' mastery of relevant theoretical knowledge, enhanced standardized operational standards for CSF drainage, and improved the implementation rate of health education for patients and families. The application of CBL combined with PBL effectively improved the quality of specialized teaching, enhanced clinical nursing safety, rapidly elevated nurses' specialized competence, and positively reduced the risk of adverse events.

In summary, the CBL combined with PBL teaching format achieved favorable

application outcomes in standardized CSF drainage training, strengthened clinical practicality, improved teaching quality, and stimulated trainees' initiative, participation, and interaction in the learning process.

Conflict of Interest Statement: The authors declare no conflict of interest.

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