

## Original Article

# Efficacy of case-based teaching combined with a clinical pathway for nursing interns

Hongyu Lin<sup>1</sup>, Xiujuan Gao<sup>2</sup>, Yunxia Lv<sup>3</sup>, Xiudong Li<sup>4</sup>

<sup>1</sup>Department of Operating Room, The 3rd Affiliated Teaching Hospital of Xinjiang Medical University (Affiliated Cancer Hospital), Urumqi, Xinjiang Uygur Autonomous Region, China; Departments of <sup>2</sup>Conduit Room, <sup>3</sup>Cardiology, Ji'nan Jigang Hospital, Ji'nan, Shandong Province, China; <sup>4</sup>Department of Radiation Therapy Center, Liaocheng Infectious Disease Hospital, Liaocheng, Shandong Province, China

Received April 29, 2019; Accepted July 10, 2019; Epub August 15, 2019; Published August 30, 2019

**Abstract:** Objective: To explore the application efficacy of case-based teaching combined with a clinical pathway for nursing internships in a pediatric cardiac surgery intensive care unit. Methods: A total of 200 student nurses undergoing nursing training in The 3rd Affiliated Teaching Hospital of Xinjiang Medical University (Affiliated Cancer Hospital) from February 2016 to October 2017 were included, and assigned into an observation group and a control group according to a random number table method, with 100 in each group. The observation group was given case-based teaching combined with a clinical pathway; the control group was taught by the traditional one-way mode. The theoretical knowledge, practice performance, comprehensive abilities, and self-learning abilities were recorded and compared between the two groups. Results: The theoretical knowledge and practical skills in both groups were significantly higher after the nursing internship than those before internship (all  $P < 0.001$ ). The scores of moral ethics, work attitude, labor discipline, professional ability, medical ethics, style of study, cooperation ability, learning motivation, self-management ability, and information literacy were also significantly higher after the internship than those before the internship (all  $P < 0.05$ ). The above results in the observation group were significantly higher than those of control group (all  $P < 0.05$ ). In addition, the satisfaction degree of the student nurses in the observation group (95.45%) was significantly higher than that in control group (81.82%,  $P = 0.044$ ). Conclusion: The implementation of case-based teaching combined with a clinical pathway can significantly improve student nurses' self-learning abilities, learning initiative, theoretical knowledge, and practical skills, also, the combination method lays a foundation for later clinical work.

**Keywords:** Case-based teaching, clinical pathway, student nurse, pediatrics, cardiac surgery, intensive care, teaching

## Introduction

A pediatric cardiac surgery intensive care unit is one of the departments that needs strong clinical expertise, as it provides active treatment for neonates with severe heart disease and children with congenital or acquired severe heart disease in order to save lives [1-3]. At present, the gradual improvement of medical skills provides safer and more reasonable treatment for patients, who are subsequently taken care of by nurses. However, student nurses are prone to have mental stress because they are unfamiliar with the work, due to the lack of practical experience, their young age, and severe condition of patients. Thus, student nurses have a difficult start when it comes to children in need of urgent treatment. Particularly in

recent years, the ever-increasing demands from children and their families for the quality of nursing care can give great challenges to nurses in cardiac surgery intensive care units [4-6]. The traditional one-way teaching method was usually adopted for nursing training in the past, but this method was not good enough for passing on clinical experience to student nurses. Case-based teaching is founded in using typical cases as the basis to enable students to effectively master the required knowledge according to the teaching and training goals. In addition, teachers are cultivating student nurses for the abilities of finding, analyzing and solving problems through their own study experience of constructing a knowledge based structure. Clinical pathway teaching is a method which reduces both the delay of rehabilitation

and the waste of resources. Case-based teaching plus using a clinical pathway can vividly and truly combine theory with practice. It is of great significance to improve student nurses' skills in pediatric cardiac surgery intensive care units. However, there are few reports about this teaching method. So here we carry out a planned and purposeful study of combining case-based teaching with a clinical pathway for student nurses in The 3rd Affiliated Teaching Hospital of Xinjiang Medical University (Affiliated Cancer Hospital) from February 2016 to October 2017, in order to improve their practical skills in order to better nurse patients.

### Materials and methods

#### *General data*

A total of 200 student nurses undergoing nursing training in the Pediatric Cardiac Surgery Intensive Care Unit of The 3rd Affiliated Teaching Hospital of Xinjiang Medical University (Affiliated Cancer Hospital) from February 2016 to October 2017 were selected as study subjects. All the participants were female, aged 18-25 years old, and were divided into two groups (observation group and control group) according to a random number table method, with 100 cases in each group. All teachers had professional titles as nurse or supervisor nurse. All the student nurses had a 4-week internship. The present study was approved by the Ethics Committee of The 3rd Affiliated Teaching Hospital of Xinjiang Medical University (Affiliated Cancer Hospital). Written informed consent was obtained from all subjects.

Inclusion criteria: Full-time students majoring in nursing; student nurses who comply with the rules and regulations. Exclusion criteria: Those who could not participate in assessments on time, did not have the required skills for this study.

#### *Methods*

In the control group, a traditional one-way teaching method was applied. At first, two clinical teachers introduced the basic circumstances, nursing procedures, rules, regulations, and norms of pediatric cardiac surgery intensive care units to student nurses, and taught them about the name, application and operational procedures of all equipment in the unit. Then,

theoretical knowledge about the internship requirements and goals within the unit was taught along with the use of slides, videos and other multimedia methods in a classroom. Meanwhile, models and related teaching tools were used for proper demonstration. After that, student nurses studied independently, combined with practice.

In the observation group, case-based teaching combined with a clinical pathway was carried out. The specific training contents were as follows: phase one, start and familiarity. The clinical teachers systematically and comprehensively showed student nurses basic layout and facilities of cardiac surgery intensive care unit and clarified all working systems, such as regulations for shifting of duty, ward visits, ward access, ward disinfection and isolation. So that they were familiar and skillful with the use of equipment, knowledge of the maintenance methods of common equipment and its faults, as well as understanding the mental status of child patients. Phase two, initial practice. Student nurses needed to master the writing standards for paperwork and the technical requirements of pediatric cardiac surgery intensive care, including the operating procedures and using requirements of a micro-injection pump as well as the correct input dose calculations, the proper use of the breathing machine, the nursing methods for children who had endotracheal intubation and tracheotomy, the proper use of a temporary pacemaker and a blood gas analyzer. In addition to being familiar with the use of bedside monitors and common troubleshooting measures, correctly writing patient care record sheets, the proper and scientific care for children after extracorporeal circulation and cardiopulmonary resuscitation, being familiar with the operation methods and precautions of a defibrillator, and being able to observe and manage the pericardial and mediastinal drainage. Phase three, intensive learning. The aim of this phase was that the student nurses were able to master the care methods of common diseases in a cardiac surgery intensive care unit, including the postoperative care of heart tumor, aortic sinus aneurysm, congenital heart disease (simple and complex), coronary artery bypass grafting, and surgery combined with valve replacement. Phase four, quantitative assessment. The comprehensive assessment in nursing work was performed by

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**Table 1.** Comparison of the general data

| Group             | Cases | Age (year old) | Education (n, %) |            |                            |
|-------------------|-------|----------------|------------------|------------|----------------------------|
|                   |       |                | Undergraduate    | College    | Technical secondary school |
| Observation group | 100   | 22.31±1.09     | 13 (13.00)       | 26 (26.00) | 61 (61.00)                 |
| Control group     | 100   | 22.28±1.12     | 12 (12.00)       | 23 (23.00) | 65 (65.00)                 |
| t/x <sup>2</sup>  |       | 0.192          |                  | 0.351      |                            |
| P                 |       | 0.848          |                  | 0.839      |                            |

relevant clinical teachers according to their concrete performance, practical operative ability and work style. The operation of nasal high-flow oxygen in pediatric cardiac surgery intensive care was used as an example, and case-based teaching was applied to explain the basic theory of nasal high-flow oxygen and the operations of an oxygen therapy device, so that student nurses could use the device proficiently, and understand the indications and alarm elimination of the device in a detailed manner. Student nurses analyzed the causes of hypoxemia with the assistance of clinical teachers, also, they designed and completed the treatment measures for hypoxemia by group discussion.

### *Outcome measures*

First, a test paper was written for assessing theoretical knowledge and practical skill after the student nurses finished the internship in the pediatric cardiac surgery intensive care unit. Test questions of theoretical knowledge were all taken from an item bank, and there were two test papers, A and B (both of them had a total of 50 objective questions with full score of 100 points). The exam paper was randomly selected from one of them. There were 12 items in practical skills, and 5 of them were selected for examination (also 100 points in total). Second, their comprehensive abilities (including 5 items: moral ethics, work attitude, labor discipline, professional ability, medical ethics and style of study, 20 points for each item) were evaluated by two related clinical teachers. The total score was 100 points, higher score indicating higher comprehensive abilities. Third, the self-learning abilities of student nurses in the two groups were evaluated by a Self-learning ability scale for nursing students [7]. The scale included four parts: cooperation ability (5 questions), learning motivation (10 questions), self-management ability (5 questions) and information literacy (10 questions), with total score of 150 points, higher score suggesting better self-learning abilities. Lastly,

a satisfaction rating scale was self-developed to evaluate the satisfaction degree of the student nurses to their clinical teachers. The total score of the scale was 100 points, greater than 85 points as satisfied, 70-84 points as generally satisfied, less than 70 points as not satisfied, satisfaction degree = (satisfied + generally satisfied) cases/total cases \* 100%.

### *Statistical analysis*

The statistical data were analyzed by SPSS 19.0 software. The measurement data were expressed as mean ± standard deviation ( $\bar{x} \pm sd$ ); paired t-test was used for comparison before and after internship within groups; independent t-test was used for comparison between the two groups. Enumeration data were expressed as rate (%), and tested by  $\chi^2$ .  $P < 0.05$  was considered statistically significant.

## **Results**

### *General data*

There were no significant differences between the two groups in general data such as age and education background (both  $P > 0.05$ ). As a result, comparative analysis between the two groups was carrying out. See **Table 1**.

### *Comparison of theoretical knowledge and practical skill results*

Difference in theoretical knowledge and practical skill scores between the two groups was not significant before the internship (both  $P > 0.05$ ), and were both increased after the nursing internship, in the two groups (all  $P < 0.01$ ). The increases in observation group were significantly higher than those of the control group (both  $P < 0.05$ ). See **Table 2**.

### *Comparison of comprehensive ability*

Difference in comprehensive abilities were not significant between the two groups before in-

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**Table 2.** Comparison of theoretical knowledge and practical skills ( $\bar{x} \pm sd$ , points)

| Group                                     | Time              | Theoretical knowledge | Practical skills |
|---|-------------------|-----------------------|------------------|
| Observation group (n=100)                 | Before internship | 67.88±9.41            | 53.19±10.18      |
|   | After internship  | 91.35±8.14**          | 89.47±9.36**     |
| Control group (n=100)                     | Before internship | 68.15±9.39            | 53.22±9.86       |
|   | After internship  | 83.52±7.62**          | 85.15±8.73**     |
| Comparison of two groups after internship |                   | t                     | 7.022            |
|   |                   | P                     | 0.000            |

Note: Compared with before internship, \*\*P<0.01.

**Table 3.** Comparison of comprehensive ability ( $\bar{x} \pm sd$ , points)

| Group                                     | Time              | Moral ethics | Work attitude | Labor discipline | Medical ethics and style of study | Professional ability |
|---|-------------------|--------------|---------------|------------------|-----------------------------------|----------------------|
| Observation group (n=100)                 | Before internship | 11.37±1.85   | 10.54±2.36    | 11.28±2.12       | 10.26±1.42                        | 12.51±1.42           |
|   | After internship  | 15.44±2.59** | 17.63±2.14**  | 17.75±1.09**     | 17.97±1.11**                      | 18.53±1.01**         |
| Control group (n=100)                     | Before internship | 11.40±1.78   | 10.48±2.41    | 11.33±1.85       | 10.34±1.15                        | 12.52±1.16           |
|   | After internship  | 14.12±2.31** | 11.85±1.76**  | 15.94±1.17**     | 15.82±1.09**                      | 13.12±1.29**         |
| Comparison of two groups after internship |                   | t            | 3.804         | 20.861           | 11.319                            | 13.820               |
|   |                   | P            | 0.000         | 0.000            | 0.000                             | 0.000                |

Note: Compared with before internship, \*\*P<0.01.

**Table 4.** Comparison of self-learning ability ( $\bar{x} \pm sd$ , points)

| Group                                     | Time              | Cooperation ability | Learning motivation | self-management ability | Information literacy |
|---|-------------------|---------------------|---------------------|-------------------------|----------------------|
| Observation group (n=100)                 | Before internship | 27.65±5.20          | 28.11±4.72          | 26.87±4.51              | 19.81±3.09           |
|   | After internship  | 33.21±4.67**        | 34.60±3.61**        | 35.19±3.64**            | 26.52±2.43**         |
| Control group (n=100)                     | Before internship | 27.67±5.18          | 28.09±4.88          | 26.84±4.73              | 19.82±3.06           |
|   | After internship  | 31.31±3.64**        | 31.14±2.92**        | 31.07±2.87**            | 21.35±2.51**         |
| Comparison of two groups after internship |                   | t                   | 3.209               | 7.452                   | 8.888                |
|   |                   | P                   | 0.002               | 0.000                   | 0.000                |

Note: Compared with before internship, \*\*P<0.01.

ternship (all P>0.05). While the scores of all the 5 aspects: moral ethics, work attitude, labor discipline, professional ability, medical ethics and style of study were significantly improved after internship in both groups than those before internship (all P<0.01), and scores in the observation group were significantly higher than those in control group (all P<0.001). See **Table 3**.

### Comparison of self-learning ability

Difference in self-learning abilities was not significant between the two groups before internship (all P>0.05). While the scores of all four parts: cooperation ability, learning motivation, self-management ability and information literacy in both groups were significantly higher after internship than those before internship (all P<0.01), and the scores in the observation

group were significantly higher than those in control group (all P<0.001). See **Table 4**.

### Comparison of satisfaction rate

The satisfaction rate of student nurses in the observation group (90.00%) was significantly higher than that of control group (78.00%, P=0.021). See **Table 5**.

### Discussion

Modern intensive care medicine as a newly emerging comprehensive discipline in the medical field, gives diagnosis and treatment relying on modern medical technology, and analyzes the condition of children according to their overall condition. The key piece of intensive care is the intensive care unit [8-10]. A pediatric cardiac surgery intensive care unit is an interdisci-

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**Table 5.** Comparison of satisfaction rate (n, %)

| Time                      | Satisfied | Generally satisfied | Not satisfied | Satisfaction rate |
|---------------------------|-----------|---------------------|---------------|-------------------|
| Observation group (n=100) | 65        | 25                  | 10            | 90 (90.00)        |
| Control group (n=100)     | 56        | 22                  | 22            | 78 (78.00)        |
| $\chi^2$                  |           |                     |               | 5.357             |
| P                         |           |                     |               | 0.021             |

plinary department of intensive care and cardiac surgery, an important branch in modern intensive care medicine, and an independent branch from other intensive care branches. The pediatric cardiac surgery intensive care unit has become an important place for maintaining patients' stable conditions after operations, due to the high risk index, large amount of body trauma, and complex postoperative conditions of cardiac surgery, especially 24 h to 48 h after surgery when changes of state of illness are more intense. Additionally, rapid development of pediatric cardiac surgery greatly increases the proportion of complex congenital heart diseases, and the age of children tends to be younger than ever. As well, the equipment in this type of unit is certainly advanced and complicated, so the nurses have to bear this obligatory and significant responsibility, which makes their work more challenging [11-14]. However, pediatric cardiac surgery intensive care units are a relatively unfamiliar environment for most student nurses, and children's various conditions and ages require diverse nursing care. Moreover, the work in intensive care units is very closely coupled with rapid changes in children's conditions, with urgent rescue procedures and numerous tools and equipment, so student nurses are more likely to have a difficult start.

The nursing method in pediatric cardiac surgery intensive care unit has mostly been taught by the traditional one-way method in the past, but this method was obscure, resulting in an unclear understanding about what students learned. Some scholars have proposed that case-based teaching combined with a clinical pathway can help student nurses in pediatric cardiac surgery intensive care units better understand the knowledge and mental status of children, and it is of great significance that they can better serve in clinical practice [15-17]. The case-based teaching method begins with teachers telling classic case stories and ex-

plaining their treatment experiences, then gradually guiding students to become more interested, so that students can create their own way to solve other clinical problems. This teaching method requires good interaction between teachers and students to cul-

tivate the students' logical thinking, analysis and the ability of solving problems [18]. With the combination of a clinical pathway, precise theoretical knowledge is easier to understand and remember. The combined method is a purposeful, planned and targeted teaching mode. On the one hand, it regulates teaching behavior, on the other hand, it avoids missing lectures or repeat lectures [19, 20].

The results of this study showed that, theoretical knowledge, practical skills, comprehensive abilities (moral ethics, work attitude, labor discipline, professional ability, medical ethics and style of study), self-learning abilities (cooperation ability, learning motivation, self-management ability and information literacy) scores all increased significantly after internship compared with those of before internship, and the scores were higher in observation group than in control group with significant differences. In addition, the observation group had a significantly higher satisfaction degree than control group. These results indicated that combined case-based teaching with a clinical pathway can significantly improve the theoretical knowledge and professional practice skills of student nurses compared with the traditional one-way teaching method, and can further stimulate their self-learning abilities with a higher satisfaction degree, which are consistent with related reports [21]. The reason might be that the traditional one-way teaching method just simply trains student nurses, and that theoretical knowledge can be difficult to understand, so students' learning ability is seriously reduced. However, case-based teaching combined with a clinical pathway can train student nurses' comprehensive thinking ability in pediatric cardiac surgery intensive care units from all aspects, promoting their ability of reasoning, questioning and discussion on the basis of theoretical knowledge, mobilize their enthusiasm for learning, and provides the maximum possibility to enhance their ability of combining theoretical knowledge with practice [22].

In summary, combined case-based teaching with a clinical pathway for student nurses in pediatric cardiac surgery intensive care units can significantly improve their theoretical knowledge, practical skills, comprehensive abilities, and is conducive to the cultivation of self-learning abilities with exact effect. But the sample size in this study is small, and the research time is short, so further study with the larger sample size is still needed.

### Disclosure of conflict of interest

None.

**Address correspondence to:** Xiudong Li, Department of Radiation Therapy Center, Liaocheng Infectious Disease Hospital, No.45 Jianshe East Road, Liaocheng 252000, Shandong Province, China. Tel: +86-0635-6979023; E-mail: lixiudong59c@163.com

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