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The role of scenario simulation teaching in the standardized training of anesthesiology resident

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Abstract: *In order to analyze the application effect of scenario simulation teaching in the standardized training of anesthesiologists, 50 cases were randomly selected from the anesthesiologists in our hospital from March 2021 to March 2022, and were divided into the control group (25 cases, conventional teaching method) and the observation group (25 cases, scenario simulation teaching method) by double-blind method, and the effects of the two groups were compared. The scores of theoretical knowledge, operation skills and clinical thinking ability after teaching in the observation group were higher than those in the control group ($P < 0.05$). Situational simulation teaching is used in the standardized training of resident physicians in the Department of Anesthesiology, which is conducive to improving their examination results and cultivating their clinical thinking ability.*

Keywords: *Scenario simulation teaching; Department of Anesthesiology; Resident; Standardized training; Examination*

1. Introduction

Anesthesiology involves surgical anesthesia, pain treatment and critical patient treatment, and the professional quality and clinical thinking ability of residents directly affect the safety and prognosis of patients[1]. Standardized training is the core way to improve the core quality and clinical competence of anesthesiologists and cultivate their clinical thinking ability.Through training, residents can not only consolidate their theoretical knowledge of anesthesiology and improve their anesthesia skills, but also improve their ability to make decisions and operate quickly in a complex and risky clinical environment[2]. The conventional teaching method of "theory teaching + bedside teaching" is often used in the standardized training of anesthesiology residents.Residents passively accept relevant knowledge in the one-way inculcation of teachers, which can not effectively cultivate the ability of residents to deal with clinical emergencies[3]. The theoretical basis of scenario simulation teaching is constructivist learning theory, which allows students to practice and deal with emergencies in controllable simulated clinical real scenes, aiming at improving their ability to combine theory with practice[4]. Scenario simulation teaching is applied in the training of anesthesiology department to simulate clinical scenarios such as perioperative routine anesthesia operation and emergency treatment of critical and severe cases, so that residents can accumulate clinical experience in a safe environment and improve their ability to deal with emergencies (intraoperative anaphylactic shock, tension pneumothorax, difficult airway, etc.[5]. This study analyzed the effect of scenario simulation teaching in the standardized training of residents in the Department of Anesthesiology, as described below.

2. Data and Methods

2.1 General information

Fifty cases were randomly selected from the inpatients in the Department of Anesthesiology of our hospital from March 2021 to March 2022, and were grouped by double-blind method. In the control group (25 cases), the age ranged from 22 to 28 years old, with an average of (25.32 ± 1.56) years old, including 17 undergraduate students and 8 master students, male/female (15/10); in the observation group (25 cases), the age ranged from 22 to 29 years old, with an average of (25.68 ± 1.61) years old, including 16 undergraduate students and 9 master students, male/female (14/11).

Inclusion criteria: medical bachelor degree or above, in line with the admission criteria of

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standardized resident training in anesthesiology department, no anesthesia-related work experience, voluntary participation in this study and signing informed consent, no long-term leave, absenteeism during the training period.

Exclusion criteria: those who terminated the training for personal reasons during the training period, those who had clinical experience related to anesthesia, and those who participated in scenario simulation teaching and training.

2.2 Method

2.2.1 Control group

The control group was taught with conventional teaching method. A special lecture is organized once a week around the rotation outline of the Department of Anesthesiology, using multimedia courseware combined with typical cases to explain the basic knowledge of anesthesia pharmacology, airway management, perioperative monitoring, etc. Teachers in the operating room lead residents to discuss the patient's medical history, anesthesia risk assessment and program before anesthesia operation. Teachers demonstrate key skills such as tracheal intubation, intraspinal puncture and arteriovenous catheterization step by step in real anesthesia operation, and residents observe them. After the operation, under the guidance of the teacher, the resident recorded the main points of the abnormal conditions or complications in the process of anesthesia. At the end of the rotation, teachers pointed out the shortcomings one by one and put forward suggestions for improvement according to the results of residents'theoretical written examination and operational skills examination.

2.2.2 Observation group

The teaching method of scene simulation was used in the observation group. (1) Based on the characteristics of the Department of Anesthesiology, high incidence or high-risk situations such as no intubation, no oxygenation and anaphylactic shock were selected, and the learning objectives of each simulation were defined. (2) Write a detailed simulation script based on the initial vital signs, disease evolution nodes, expected anesthesia treatment actions, teacher intervention prompts, etc. For the selected participants, a real operating room environment is established, equipped with high-fidelity simulators or hybrid simulation devices, corresponding medications, airway instruments and monitoring equipment. (3) The trainees were divided into the roles of anesthesia main class, assistant and itinerant nurse, and observers were appointed. The teacher briefly explains the rules and emphasizes the security boundary and confidentiality principles in the simulation. An informal walkthrough can be scheduled to test equipment and script fluency. (4) Teachers dynamically adjust the physiological parameters and clinical signs of patients in the simulation scene through the central control system, and require students to complete the evaluation, diagnosis and operation within the prescribed time. If the student deviates from the key step, the teacher can throw out the preset clues at the right time (such as "blood pressure drops to 50/30 mmHg") to create moderate time pressure and cognitive load. (5) Resume immediately after the simulation, and the trainees point out "what is effective and what is inadequate" through the video of key clips. Teachers use the "plus one minute" questioning method to guide students to analyze the thinking process behind decision-making, and to find out the knowledge blind spots or communication faults according to the standard process. (6) For the common problems found in the review, the teacher shall explain them directionally or demonstrate them again. Then the teacher adjusts the difficulty or variables of the scenario (such as changing the age of the case and complications), and lets the same group of students rehearse again to test the effect of knowledge transfer. Finally, the evaluation of the students on the reality, difficulty and teaching gains of the simulation is collected for the subsequent course iteration.

2.3 Index observation

(1) Examination results: statistics of theoretical knowledge and operational skills, 20 points for each item. (2) Score of clinical thinking ability: The score of self-made scale in our hospital was positively correlated with the ability, with 100 points for each item.

2.4 Statistical analysis

The data were processed by SPSS 26.0 software, and the enumeration data were expressed as [n (%)], and the 2 test was adopted. The measurement data shall be ($\bar{x} \pm s$), and t-test is adopted. $P < 0.05$

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indicates a statistically significant difference.

3. Results

3.1 Comparison of assessment results

The scores of theoretical knowledge and operational skills in the observation group were higher than those in the control group (P < 0.05), as shown in Table 1.

Table 1 Comparison of assessment results [$\bar{x} \pm s$ (Minutes)]

Grouping	Number of cases	Theoretical knowledge assessment				Operation skill assessment					
		Basic theory of anesthesiology	Rational use of anesthetic	Methods of anesthesia for common diseases	Prevention and treatment of anesthesia complications	Critical patient treatment	Tracheal intubation	Intraspinal anesthesia	Venipuncture catheterization	Anesthesia machine operation	First aid skills
Observation group	25	16.23±2.14	16.48±2.23	16.67±2.16	16.54±2.12	16.38±2.25	15.51±2.15	15.29±2.27	15.67±2.21	15.34±2.13	15.16±2.24
Control group	25	12.48±1.67	12.52±1.56	12.71±1.53	12.46±1.64	12.65±1.61	11.34±1.38	11.65±1.43	11.72±1.58	11.51±1.39	11.47±1.35
T-value	-	6.907	7.275	7.480	7.629	6.740	8.161	6.783	7.269	7.529	7.054
P value	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.2 Comparison of clinical thinking ability scores

The scores of clinical thinking ability of the two groups were compared before teaching (P > 0.05), and the scores of the observation group were higher than those of the control group after teaching (P < 0.05), as shown in Table 2.

Table 2 compares the scores of clinical thinking ability [$\bar{x} \pm s$ (Minutes)]

Grouping	Number of cases	Case analysis ability		Diagnostic decision making ability		Ability to recognize complications		Emergency response capability		Ability to communicate and cooperate	
		Before teaching	After teaching	Before teaching	After teaching	Before teaching	After teaching	Before teaching	After teaching	Before teaching	After teaching
Observation group	25	64.35±6.81	86.53±6.21*	63.59±6.63	86.15±6.42*	63.18±6.32	86.89±6.54*	64.53±6.49	86.26±6.35*	63.37±6.42	86.49±6.26*
Control group	25	63.62±6.75	75.81±7.62*	63.94±6.67	75.58±7.51*	64.45±6.54	75.26±7.48*	63.62±6.53	75.43±7.64*	64.48±6.50	75.75±7.53*
T-value	-	0.380	5.452	0.186	5.349	0.698	5.852	0.494	5.450	0.607	5.483
P value	-	0.705	0.000	0.853	0.000	0.488	0.000	0.623	0.000	0.546	0.000

Note: Compared with the group before teaching*, P < 0.05.

4. Discussion

The results of this study showed that the scores of theoretical knowledge and operational skills in the observation group were higher than those in the control group (P < 0.05), which confirmed that the use of scenario simulation teaching in the standardized training of residents in the Department of Anesthesiology was conducive to improving their examination results. Scenario simulation teaching is conducive to improving the performance of anesthesiology residents by reconstructing the transformation path from knowledge input to clinical output[6]. By constructing a highly simulated clinical situation in the Department of Anesthesiology, this teaching method designs a complete script of "problem-decision-action", in which the preset disease evolution nodes and expected operation clues enable residents to integrate anatomical, pharmacological, physiological and operational skills[7]in a limited time. In the simulation, the teacher dynamically adjusts the patient's physiological parameters and throws out preset clues through the central control system, and the resident's cognition will experience a controllable disorder: the simulation deliberately amplifies the critical signals that are difficult to repeat in the real operating room, and the resident completes the anesthesia assessment and operation under the information gap, which can expose the speed of knowledge retrieval and the priority of differential diagnosis. Teachers can avoid overestimating the accuracy of their reasoning and reduce the common hindsight bias[8]in real clinical practice through the "plus one minute" questioning

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method. By looking back at the key segments, residents can intuitively observe the gap between the expected operation and the actual action, and this metacognitive feedback based on their own mistakes has a stronger effect of behavior modification than one-way teaching of teachers. Finally, by adjusting the difficulty variables and rehearsing again, the transfer from the simulated scenario to the real scenario was completed: the resident's wrong path in the first simulation was corrected, and in the second highly similar but different details of the situation, he could actively avoid it, which could strengthen his habit of correct prediction. This progressive training of "exposure-reflection-re-exposure" is conducive to improving the assessment results of residents when they leave the department.

5. Conclusion

After teaching, the score of clinical thinking ability in the observation group was higher than that in the control group ($P < 0.05$), indicating that the use of scenario simulation teaching in the standardized training of residents in the Department of Anesthesiology is conducive to the cultivation of their clinical thinking ability. The essence of scenario simulation teaching is to make the implicit thinking process explicit, and to deliberately train residents in dynamic, vague and incomplete clinical situations, so as to enhance their clinical thinking ability[9]. By designing clinical scenarios with inherent logical conflicts or atypical manifestations of anesthesia events, residents are prompted to initiate a two-way reasoning mechanism to quickly identify common causes while using analytical reasoning to investigate rare but fatal causes one by one, so as to break the anchoring bias of solidification and prompt them to take the initiative in the face of assessment or real cases. The key information in the simulation scenario is not given at one time but gradually exposed, and residents need to make immediate treatment decisions under the information gap, which is in line with the essence of "action under uncertainty" in clinical thinking[10]. Under the guidance of teachers, the review directly affects the metacognitive level of clinical reasoning, and urges residents to reflect on whether their hypothesis chain and evidence weight distribution are reasonable. By adjusting the physiological parameter information and clinical signs of patients in the script, the teacher made the residents gradually internalize the thinking habit of "hypothesis-driven-active verification-dynamic correction" through multiple simulations. Residents can experience the adverse outcome of simulation caused by thinking errors without medical risk, and this emotional and cognitive conflict can strengthen their memory of key reasoning nodes, so that they can quickly choose the right thinking path in similar situations, and ultimately promote the improvement of clinical thinking ability from multiple cognitive levels.

To sum up, the application of scenario simulation teaching in the standardized training of residents in the Department of Anesthesiology is conducive to improving their assessment results and cultivating their clinical thinking ability.

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References

[1] Bao Yin, Xin Yan, Li Xiuhua, et al. Application of Flipped Classroom Combined Simulation Training in Laryngeal Ultrasound Teaching for Anesthesiology Residents [J]. China Medical Guide, 2024, 26 (12): 1211-1215.

[2] Tan Yiwen, Huang Yanqing, Tian Yi, et al.Application of PBL teaching method combined with simulation training in skill operation teaching of anesthesiology residents [J].China Journal of Continuing Medical Education, 2023,15 (11): 92-96.

[3] Xin Xianfeng, Han Xi, Zeng Fanrong, et al. Effect of flipped classroom combined with TBL teaching method on anesthesiology resident training teaching [J]. Journal of Qiqihar Medical College, 2024, 45 (21): 2081-2085.

[4] Zhang Yuguan, Li Xu, Xu Li. Application effect of scenario simulation teaching in hospital infection knowledge training for anesthesiology residents [J]. China Medical Herald, 2022, 19 (13): 87-91.

[5] Duan Caiping. Application of scenario simulation combined with case teaching method in resident training of anesthesiology [J].Chinese Journal of Continuing Medical Education, 2023,15 (1): 78-82.

[6] Wang Ruijuan. Application of scenario simulation teaching and CBL in anesthesiology resident

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training [J]. China Continuing Medical Education, 2024, 16 (9): 96-100.
[7] Sun Qi, Liu Su, Liu Chang, et al. Application of SimMan3G scenario simulation training in pneumothorax teaching for anesthesiology residents [J]. China Postgraduate Medical Education, 2024, 8 (6): 473-476 + 480.
[8] Song Yun, Lu Feng, Lei Xiaofeng, et al. Application of scenario simulation teaching method in standardized training of anesthesiology residents [J]. Continuing Medical Education, 2024, 38 (6): 59-62.
[9] Lin Yuwei, Weng Digui, Wang Jianling. Application of scenario simulation teaching combined with problem-based learning during standardized training of anesthesiology residents [J]. Journal of Qiqihar Medical College, 2024, 45 (14): 1387-1391.
[10] Yang Rui, Lu Jinfang, Li Yonghua, et al. Application of scenario simulation teaching based on virtual reality in combined spinal-epidural anesthesia teaching for standardized training of anesthesia residents [J]. Chinese Journal of Multimedia and Network Teaching (First Issue), 2024, (9): 9-12.