

Practice of clinical thinking training of resident doctors in standardized training of obstetrics and gynecology ultrasound

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Abstract: *This study aims to analyze the influence of the case teaching method on resident doctors during standardized training in obstetrics and gynecology ultrasound. A total of 40 resident doctors who participated in such training from March 2020 to March 2025 were randomly selected and divided into a control group (20 cases, conventional teaching method) and an observation group (20 cases, case teaching method), and the teaching effects of the two groups were compared. The results showed that the observation group had significantly higher scores in clinical thinking ability (including quality of case analysis reports, performance in objective structured clinical examination, case-based thinking oral test, immediate thinking explicit assessment in the operation process, performance of multi-situational interaction, and teaching feedback) and satisfaction scores (including teacher's teaching attitude, teaching effect, learning efficiency, academic performance, and improvement of learning ability) than the control group ($P < 0.05$). In conclusion, the application of the case teaching method in the standardized training of obstetrics and gynecology ultrasound can improve the clinical thinking ability and satisfaction of resident doctors.*

Keywords: *Obstetrics and Gynecology; Ultrasound; Standardized training; Resident physician; Clinical thinking*

1. Introduction

At present, the diagnosis of many diseases in obstetrics and gynecology depends on gynecological ultrasound, and the accuracy of diagnosis is directly affected by the proficiency of operating and using instruments and clinical thinking ability^[1]. In the standardized training of obstetrics and gynecology ultrasound, emphasis should be placed on training the clinical thinking ability of resident physicians, so that they can have the ability to integrate and analyze the characteristics of dynamic ultrasound images, anatomical and pathophysiological knowledge, and specific clinical information, and ensure that they can infer accurate diagnostic opinions and make reasonable clinical decisions^[2]. Standardized training is the core way to train qualified obstetrics and gynecology ultrasound resident doctors. However, the conventional teaching method focuses on training the ability of resident doctors to obtain standard sections and identify common disease signs, which is difficult to guide resident doctors to establish a complete thinking chain from image observation to clinical diagnosis, and it is easy to cause them to "speak by looking at pictures" and difficult to deal with complex or atypical cases^[3]. Improving their clinical thinking ability can directly improve the comprehensive quality of ultrasound reports and clinical guidance value. Therefore, exploring an effective clinical thinking training path has become the key to improve the competency and medical service quality of obstetrics and gynecology ultrasound resident doctors. Case teaching method is regarded as an effective tool to deal with the shortcomings of conventional teaching method because of its unique advantages of situational authenticity, problem-driven and explicit thinking process. The purpose of this study is to construct a deeply structured and interactive advanced case teaching method, and design a progressive teaching link of "independent inquiry-collaborative debate-thinking visualization review-reflection internalization", forcing students to complete information extraction, hypothesis generation, evidence weighing and decision-making in simulated clinical uncertainty. In order to improve their clinical thinking ability scientifically and orderly, so as to provide empirical reference for optimizing the talent training system of obstetrics and gynecology ultrasound medicine. Elaborated as follows.

2. Data and Methods

2.1 General information

Forty resident doctors who participated in the standardized training of obstetrics and gynecology ultrasound in our hospital from March 2020 to March 2025 were randomly selected and grouped according to different teaching methods. The control group (20 cases) aged 21–28 years, with a mean age of (24.15 ± 2.37) years, had a male/female ratio of 10/10; the observation group (20 cases) aged 22–27 years, with a mean age of (24.38 ± 2.41) years, had a male/female ratio of 8/12. Comparison of general data between the two groups showed no statistically significant difference ($P > 0.05$).

Inclusion criteria: the trainees who were undergoing standardized resident training in the Department of Ultrasound Medicine in our hospital, who had completed a three-month rotation in the Department of Ultrasound Medicine, who had basic ultrasound scanning skills, who voluntarily participated in the study and signed the informed consent; For the first time, he entered the sub-professional group of obstetrics and gynecology ultrasound for rotation training.

Exclusion criteria: residents who have completed previous training in obstetrics and gynecology ultrasound or have completed special training in other institutions; physicians who have been qualified to issue independent obstetrics and gynecology ultrasound clinical reports before enrollment; physicians who have interrupted training for various reasons during the study; Physicians who have previously participated in training programs that are highly similar to the teaching methods or evaluation systems of this program.

2.2 Method

2.2.1 Control group

The control group was taught with conventional teaching method. In the first week of enrollment, the theory (the basis of gynecological ultrasound, the standard of normal ultrasonography, and the key points of diagnosis of common diseases) was taught. Then the teacher led the students to follow the clinical study, and the students observed and imitated the acquisition and measurement of the standard section of the established disease. Teachers supervise and correct students' actual computer operation in time. A weekly case discussion was held around pre-selected typical case images to identify characteristic signs and diagnostic criteria. The teacher corrected the medical records written by the students and focused on the standardization of descriptive terms and the accuracy of diagnostic conclusions.

2.2.2 Observation group

The case teaching method was used in the observation group. (1) Select and establish a digital case database with complete clinical background (chief complaint, medical history, laboratory examination), dynamic ultrasound images, corresponding pathological results and long-term follow-up outcomes of real difficult cases of gynecological ultrasound, such as early pregnancy abnormalities, fetal structural malformations, gynecological tumors, implantable diseases, etc. The included cases were graded based on cognitive load and complexity, and a step-by-step training ladder was developed: from identifying a single typical sign to a complex situation in which multiple system abnormalities coexist or ultrasound findings seem contradictory to clinical history. (2) The case data were sent to the trainees, who were required to independently analyze and complete the pre-analysis report with the core contents of identifying and describing all the key and secondary ultrasound signs, proposing 2 to 3 most likely differential diagnoses based on the signs and ranking them, and explaining each diagnostic support point and unsupported point before the centralized discussion. Students think independently and integrate information to form a preliminary diagnostic hypothesis. (3) Based on the teacher's guidance, the group discussed the presupposed heuristic questions, compared and debated the students' respective analysis paths, cited guidelines or literature evidence to support their views, and analyzed the reasoning logic behind different diagnostic hypotheses, so as to expose the possible anchoring bias, knowledge blind spots and logical jumps in each student's thinking. (4) After the group discussion, the tutor systematically summarizes the performance of each trainee, so as to clearly show how to grasp the key clues from the messy information, how to link the knowledge of anatomy and pathophysiology with the image characteristics, how to make the "thinking map" of differential diagnosis and decision-making under uncertainty, and how to make the "thinking map" of differential diagnosis and decision-making. Review the complete and optimal clinical thinking process from the initial recognition of the case to the

formation of the conclusion. Teachers clearly point out common misunderstandings and provide strategies to avoid them. (5) The trainees are required to revise the personal pre-analysis report based on the "thinking map", write a reflective summary, reflect on the problems existing in their initial analysis, the most important inspiration gained from the discussion between peers and mentors, and the plan to optimize the thinking path when dealing with similar cases in the future.

2.3 Index observation

(1) Scoring of clinical thinking ability: The improved scale of our hospital evaluated the clinical thinking ability of resident doctors from the aspects of case analysis report quality, objective structured clinical examination performance, case-based thinking oral test, immediate thinking explicit assessment in the operation process, multi-situational interaction and teaching feedback performance, each item was converted into a hundred-mark system, and the score was positively correlated with the ability. (2) Satisfaction score: The improved scale of our hospital evaluated the satisfaction of resident doctors from the aspects of teachers' teaching attitude, teaching effect, learning efficiency, academic performance and learning ability improvement. Each item was converted into a hundred-mark system, and the score was positively correlated with the satisfaction.

2.4 Statistical analysis

SPSS26.0 processing data, ($\bar{x} \pm s$) and (%) represented the measurement and enumeration data, which were tested by t value and χ^2 respectively, and ($P < 0.05$) were statistically significant.

3. Results

3.1 Comparison of clinical thinking ability scores

Before the training, the scores of clinical thinking ability of the two groups were compared ($P > 0.05$), and after the training, the observation group was higher than control group ($P < 0.05$), as shown in Table 1.

Table 1 Comparison of clinical thinking ability scores [$\bar{x} \pm s$ (Minutes)]

Grouping	Number of cases	Quality of case analysis report		Objective structured clinical examination performance		Case-based Speculative Oral Test		Explicit assessment of immediate thinking during operation		Multi-Situational Interaction and Teaching Feedback Performance	
		Before training	After training	Before training	After training	Before training	After training	Before training	After training	Before training	After training
Observation group	20	71.56±7.39	89.23±6.47*	70.23±7.56	89.54±6.52*	71.19±7.38	89.37±6.43*	70.42±7.45	89.68±6.54*	71.78±7.62	89.43±6.51*
Control group	20	70.81±7.42	80.64±8.12*	71.28±7.47	80.13±8.35*	70.27±7.43	80.75±8.28*	71.63±7.56	80.42±8.37*	70.41±7.56	80.39±8.17*
T-value	-	0.320	3.700	0.441	3.972	0.392	3.677	0.509	3.898	0.570	3.870
P value	-	0.750	0.000	0.661	0.000	0.696	0.000	0.613	0.000	0.571	0.000

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

3.2 Comparison of satisfaction scores

The satisfaction score of the observation group was higher than that of the control group ($P < 0.05$), as shown in Table 2.

Table 2 Comparison of satisfaction scores [$\bar{x} \pm s$ (Minutes)]

Grouping	Number of cases	Teachers' teaching attitude	Teaching effect	Learning efficiency	Academic performance	Improve learning ability
Observation group	20	91.23±5.47	90.89±5.35	90.71±5.42	91.87±5.51	91.65±5.48
Control group	20	82.46±7.58	82.14±7.43	82.67±7.54	82.56±7.32	82.38±7.46
T-value	-	4.195	4.273	3.872	4.544	4.478
P value	-	0.000	0.000	0.000	0.000	0.000

4. Discussion

The results of this study showed that the score of clinical thinking ability in the observation group was higher than that in the control group after training ($P < 0.05$), indicating that the application of case teaching method in the standardized training of obstetrics and gynecology ultrasound can improve the clinical thinking ability of resident doctors. According to the characteristics of obstetrics and gynecology ultrasound and the actual situation of resident doctors participating in the training, the case teaching method designs a personalized, structured and interactive case teaching scheme to simulate the real clinical decision-making environment (complete clinical background, dynamic ultrasound images and even real cases with contradictory information), so as to systematically improve the clinical thinking ability of trainees^[4]. This method can help students break the limitation of mechanical memory of single typical ultrasound signs in conventional teaching method, but promote them to actively collect, screen and balance various information, and directly improve their ability of information processing and problem building^[5]. Under the guidance of teachers, group discussions are conducted, in which students elaborate their personal diagnostic hypotheses and their basis, which can not only fully expose the potential loopholes or cognitive biases in their thinking, but also promote their critical examination and revision of their reasoning logic through peer collision of views and immediate feedback from teachers, thus strengthening the rigor of differential diagnosis and decision-making argumentation. In the teaching summary, "thinking map" is used to review and reflect, and the recessive and rapid clinical thinking process is externalized into an observable and analyzable path, so that students can identify their own shortcomings in knowledge connection and evidence chain construction. The case teaching method does not simply explain cases, but through "situational immersion-hypothesis generation-debate test-structured review", effectively promotes the efficient transformation of theoretical knowledge to clinical thinking ability, and ultimately realizes the qualitative change of clinical thinking from linear, rigid to non-linear and adaptive development.

The satisfaction score of the observation group was higher than that of the control group ($P < 0.05$), which proved that the application of case teaching method in the standardized training of obstetrics and gynecology ultrasound could improve the satisfaction of resident doctors. Through highly simulating the real clinical situation and deep interaction, the case teaching method can effectively meet the internal needs of resident doctors in terms of cognition, emotion and professional growth, so as to comprehensively enhance their learning experience. This method breaks through the shortcomings of the abstract teaching mode of conventional one-way inculcation, based on real and complex clinical cases, so that resident doctors can feel the relationship between learning content and future post competence in the early stage of training, and this sense of immediate value of "learning is useful" enhances their intrinsic motivation for learning. In the group discussion, the resident doctors changed from passive knowledge receivers to active problem solvers, and tested their views in the pre-analysis report in the interaction with their peers, which not only created a respectful and equal academic atmosphere, but also met their needs for autonomy and identity as prospective doctors. Through the visual review of "thinking map" and personalized feedback from teachers, doctors can clearly perceive the substantive progress of their clinical thinking from vague and scattered to systematic and rigorous, and this "growth visibility" can make them feel a strong sense of achievement and self-efficacy. By constructing a comprehensive learning environment with sense of value, sense of participation, sense of growth and sense of security, the case teaching method fundamentally improves the interactive quality and psychological experience of training, and ultimately improves the subjective satisfaction of resident doctors.

To sum up, the application of case teaching method in the standardized training of obstetrics and gynecology ultrasound can improve the clinical thinking ability and satisfaction of resident doctors.

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