ISSN 2618-1584 Vol. 7, Issue 2: 24-28, DOI: 10.25236/FMSR.2025.070205

Application progress of bedside ultrasound teaching in residential training practice teaching activities

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Abstract: *To analyze the effect of bedside ultrasound teaching applied in residential training practice teaching. In this study, 80 people who studied in the resident training base of emergency medicine in our hospital from January 2022 to June 2024 were selected as the research target, and they were randomly divided into the experimental group (n = 40) and the control group (n = 40) by computer. The control group was given conventional teaching training program, and the experimental group was given bedside ultrasound visualization teaching training program. The evaluation scores of the two groups for the relevant content of the teaching process, the time spent in the practice of thoracentesis, the results achieved in the assessment, and the satisfaction ratio of the two groups for the teaching effect were compared. Results: The evaluation scores of case selection in the two groups were similar (P > 0.05). The evaluation scores of explanation and demonstration in the experimental group were significantly higher than those in the control group (P < 0.05); The time spent on thoracentesis in the experimental group was significantly shorter than that in the control group (P < 0.05).The scores of theoretical knowledge in the two groups were similar (P > 0.05), while the scores of puncture operation and adaptability in the experimental group were higher than those in the control group (P < 0.05); The satisfaction rate of the experimental group reached 95. 00%, which was higher than that of the control group (75. 00%) (P < 0.05). The visual teaching of bedside ultrasound in residential training practice teaching has achieved good results, which can strengthen the residents' understanding of clinical operation, enhance the residents' puncture operation ability, improve the ability to deal with emergencies, and further promote the overall teaching level.*

Keywords: *Bedside ultrasound teaching; Residential training practice; Teaching activities;Visual teaching; Clinical operation*

The implementation of standardized education and training for residents in the ultrasound department can ensure the high-quality development of medical services, which is one of the main tasks of the hospital [1] . When conducting standardized resident training, residents need to master the techniques of thoracic, lumbar, abdominal and bone marrow puncture. However, since the patients received at the training base may not be able to meet the training requirements at the same time, it is relatively difficult to perform the above tasks at the same base [2] . With the rapid development of research in the field of emergency medicine, the types of diseases of patients receiving treatment have become more and more diverse, and the number of patients has also increased dramatically. Education and training in these technologies can be achieved after the rotation of emergency care centers [3] . However, how to effectively explain and impart operational technical standards to residents has become a new challenge to be solved urgently. The purpose of this study is to explore the actual effect of bedside ultrasound visualization teaching in the basic operation education of emergency residents, and the relevant information is reported as follows.

1. Data and Methods

1.1 General information

In this study, 80 people who studied in the resident training base of emergency medicine in our hospital from January 2022 to June 2024 were selected as the research target, and they were randomly divided into the experimental group (n = 40) and the control group (n = 40) by computer. In the control group, there were 18 male doctors and 22 female doctors, ranging from 22 to 28 years old, with an average age of (24.37 ± 5.38) years old. According to different departments, there were 20 internal medicine doctors, 5 imaging doctors, 11 surgical doctors and 4 other doctors. There were 17 male

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doctors and 23 female doctors in the experimental group, ranging from 23 to 28 years old, with an average age of (24.25 ± 6.27) years old. According to different departments, 21 doctors were in internal medicine, 4 in imaging, 9 in surgery and 6 in other departments. There was no significant difference in the general data between the two groups ($P > 0.05$), and there was comparability between the two groups. Inclusion criteria: standardized training in the unit; rotation study of resident doctors in the ultrasound department; participation in pleural effusion puncture training. Exclusion criteria: Practicing without residency training.

1.2 Research methods

The control group was given the conventional training program. The relevant operations are mainly carried out by the teaching doctors, and the operation process is explained in detail, and the residents participating in the training are observed and made relevant records under the guidance of the teaching doctors.

The teaching and training program of bedside ultrasound visualization teaching was implemented in the experimental group. The main contents include: (1) The primary procedure of the instructor is to select cases. Generally speaking, priority will be given to those emergency patients with relatively single disease status, relatively mild symptoms and stable vital indicators. Once a case has been identified, adequate notification and communication is required for the patient and their family, and teaching activities can only be carried out with their approval and consent. (2) Explain the key points of the operation in detail, including ultrasonic operation and thoracentesis technology, so that residents can understand the theoretical knowledge of the operation in depth and avoid seeing only superficial phenomena without in-depth understanding of the actual situation. (3) Carry out ultrasonic positioning for the patient to ensure the accuracy of the operation, and mark the positioning position. The patient is instructed to sit with his back toward the examiner, with his hands folded close to his shoulders, his head slightly lowered, and his upper body tilted forward, maintaining a stable position during the procedure. To keep the section of the probe beam parallel and horizontal to the intercostal space, the direction of the beam should be perpendicular to the skin surface, and each intercostal space should be scanned from bottom to top. If an anechoic area is observed somewhere, there may be a pleural effusion in that place. The location of the puncture point should be the deepest part of the pleural effusion, and then the thickness of the chest wall and the maximum depth of the needle perpendicular to the chest wall should be measured. At the same time, the depth of the pleural effusion should be measured, and the maximum depth of the other needles should be measured. While performing the procedure, the physician needs to interpret the ultrasound image in terms of anatomy to improve the resident's knowledge and understanding of the space in which the puncture is performed. And (4) performing operations related to the puncture for the patient. The puncture operation is carried out according to a standard method, the ultrasonic dynamic guidance can be adopted according to the personal condition of the patient, and the puncture state of the puncture needle is monitored in real time, so that the puncture task can be completed in an intuitive visual environment.

1.3 Observation index

(1) Compare the evaluation scores of relevant contents in the teaching process. The total score of the project is 10 points. Through the evaluation of relevant indicators such as case preparation, explanation process and demonstration process, the higher the score, the better the evaluation level. (2) To compare the time spent in the practice of thoracentesis. Observe and record the time for thoracentesis. (3) Compare the results achieved in the assessment. The content of the assessment mainly includes theoretical knowledge, puncture operation, adaptability, analysis and problem-solving ability and other indicators. The full score of each item is 100 points. The higher the evaluation score, the better the results achieved. (4) Comparing the satisfaction rate of teaching effect. The evaluation was carried out through self-made questionnaires, which were mainly divided into three criteria: very satisfied, satisfied and dissatisfied.

1.4 Statistical methods

In this study, the collected data were analyzed and processed by SPSS21.0 tool, in which the count data were displayed in%, the measurement data were displayed in $X \pm s$, and $\chi 2$ and t tests were performed respectively, indicating that the difference was statistically significant in the case of $P < 0.05$.

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2 Results

2.1 Compare the evaluation scores of the two groups on the relevant contents of the teaching process

The evaluation scores of the two groups in the case selection index in the teaching process were similar (P > 0.05), and the evaluation scores of the experimental group in the explanation process and demonstration process in the teaching process were significantly higher than those of the control group (P < 0.05). See Table 1.

Table 1 Comparison of the evaluation scores of the two groups on the relevant contents of the teaching process (X ± s, points)

Group	Number of cases	Case selection	Explain the process	Teaching process
Control group	40	9.55±0.13	7.68±1.21	7.88±0.85
Experimental group	40	9.58±0.16	8.91±1.25	8.69±0.70
t		1.127	5.477	5.698
P		0.262	0.001	0.001

2.2 Comparison of the time spent on thoracentesis between the two groups

The time of thoracentesis in the experimental group was significantly shorter than that in the control group (P < 0.05). See Table 2.

Table 2 Comparison of the time (X ± s, min) spent on thoracentesis between the two groups

Group	Number of cases	Puncture completion time
Control group	40	20.20±2.68
Experimental group	40	17.21±1.87
t		7.087
P		＜0.05

2.3 Compare the achievements of the two groups in the assessment.

The scores of theoretical knowledge were similar in the two groups (P > 0.05), while the scores of puncture operation, adaptability, analysis and problem-solving ability in the experimental group were higher than those in the control group (P < 0.05). See Table 3.

Table 3 Comparison of the results of the two groups in the assessment (X ± s, points)

Group	Number of cases	Theoretical knowledge	Puncture operation	Resilience	Ability to analyze and solve problems
Control group	40	82.68±7.22	71.03±4.71	60.32±5.64	4.46+0.33
Experimental group	40	85.16±7.98	80.32±4.58	72.31±5.84	3.51±0.74
t		1.785	7.766	11.439	7.001
P		0.077	0.001	0.001	0.001

2.4 Compare the satisfaction ratio of the two groups to the teaching effect

The satisfaction rate of the experimental group for the teaching effect reached 95.00%, which was higher than that of the control group (75.00%), as shown in Table 4.

Table 4 Comparison of the satisfaction rate of the two groups on the teaching effect (n,%)

Group	Number of cases	Very satisfied	Satisfied	Not satisfied	Satisfaction rate
Control group	40	12(30.00)	18(45.00)	10(25.00)	30(75.00)
Experimental group	40	22(55.00)	16(40.00)	2(5.00)	38(95.00)
X2					2.960
P					0.003

3. Discussion

In clinical practice, the main target of thoracentesis is the people with pleural effusion. Patients with pneumothorax are usually treated with closed drainage. Therefore, this study will focus on the

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operation of pleural effusion puncture. According to the contents of relevant standardized training materials, it can be seen that when carrying out thoracentesis, it should be judged according to the specific conditions of patients, and decide whether to use X-ray or ultrasound examination as an auxiliary puncture method [4] . However, in actual clinical practice, we must first perform ultrasound to determine whether there is effusion, and then perform thoracentesis, rather than relying solely on experience such as auscultation or percussion to perform blind puncture. Relevant data show that the use of ultrasound guidance can reduce the possible complications of thoracic puncture, thereby improving the success rate of puncture [5]. Typically, however, the sonographer performs the localizations, while the emergency physician performs the thoracentesis. Therefore, when performing the puncture, the thoracentesis operator can only determine the position of the puncture point through the ultrasound image, and does not know the internal condition of the thoracic cavity [6] . In the current situation, there are sometimes some contradictions between medical institutions and patients in our country. In the process of teaching, many residents who receive standardized training are not willing to choose residents to carry out relevant treatment operations [7] because they are worried about possible disputes and complaints and doubt the ability of residents to operate. Due to the short clinical working years of residents and their lack of understanding of ultrasound images, they often feel afraid in the process of performing the operation and will not actively participate in the operation, which leads to the effectiveness of standardized training activities being affected.

Visualization training has been effectively adopted in medical education. Researchers have reported that the application of this technique to anesthesia teaching can produce good results. In the teaching of emergency clinical operation, the following methods can be used to improve the training effect. Standardized training by a resident who performed ultrasound mapping and thoracentesis allowed the thoracentesis operator to gain insight into intercostal anatomy and pleural effusion, and to more accurately assess anatomic injury after needle insertion [8] . Ultrasound can be used to determine the exact location of the intercostal arteries and veins when studying the anatomy, thus reducing the injury to the intercostal arteries from the puncture. This study showed that the evaluation scores of the experimental group in the process of explanation and demonstration were significantly higher than those of the control group ($P < 0.05$). The time spent on thoracentesis in the experimental group was significantly less than that in the control group ($P < 0.05$), indicating that the implementation of bedside ultrasound visualization teaching can improve the explanation process and demonstration process of residents in standardized training, and shorten the time of thoracentesis in residents [9] . At the same time, the implementation of bedside ultrasound visualization teaching enables residents to determine the puncture location according to the specific situation of patients, so as to improve the safety of puncture, enhance the confidence of residents in thoracic puncture, and enhance their practical operation ability [10] . The results of this study showed that the evaluation scores of puncture operation and adaptability in the experimental group were higher than those in the control group ($P < 0.05$), and the satisfaction rate of the experimental group was higher than that in the control group ($P < 0.05$). The results showed that the visual teaching of bedside ultrasound could improve the residents' puncture operation skills and enhance their adaptability in the process of operation.

To sum up, the visual teaching of bedside ultrasound can enhance the cognitive and operational ability of residents, improve the level of puncture operation, and achieve satisfactory teaching results.

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