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IMPROVEMENT OF THE METHODOLOGY OF PROBLEM-BASED TEACHING OF ULTRASOUND DIAGNOSTICS IN THE DEVELOPMENT OF CLINICAL THINKING IN MEDICAL STUDENTS

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Abstract
The article analyzes the methodology of problem-based teaching of ultrasound diagnostics aimed at forming clinical thinking in medical education. The research presents a pedagogical approach that develops differential diagnostic skills. Educational sessions structured on problem situations enhance students' independent analytical abilities. The methodology was practically tested in teaching medical radiology and yielded positive results demonstrating improved reasoning capacity among learners.

Keywords: ultrasound, diagnostics, methodology, thinking, pedagogy, radiology, problem, student, development, skill, differentiation, analysis, teaching, session, competence.

Introduction

The issue of forming clinical thinking in contemporary medical education continues to maintain its relevance. The foundation of physician practice consists of logical analysis, differential diagnosis, and the ability to make decisions in complex clinical situations. Ultrasound examination has become an integral part of clinical practice today, occupying an important place in the diagnostic process. However, traditional teaching methods are often focused on conveying theoretical knowledge and do not give sufficient attention to developing practical thinking skills. The problem-based learning approach encourages students toward active inquiry and forms the skill of drawing independent conclusions. This method proves particularly effective when teaching ultrasound diagnostics, as each examination result requires analysis within a clinical context. The use of problem situations in teaching radiology develops in students the necessary components of clinical thinking, including the skills to establish connections between patient complaints and screening results, conduct differential diagnosis, and substantiate conclusions.

Literature Review

The issue of developing clinical thinking is widely discussed in medical pedagogy. Khudoyorov demonstrated the high effectiveness of problem-based teaching methods in his research and emphasized the importance of this approach in forming students' independent decision-making skills. Mamatkulov analyzed didactic methods aimed at developing practical skills in teaching radiology. Nazarova examined the pedagogical possibilities of using visual information in the process of forming differential diagnostic skills.

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Among representatives of Russian medical pedagogy, Grigoriev analyzed forms of interaction with students in teaching ultrasound diagnostics and their influence on the thinking process. Smirnova developed principles for constructing educational situations that develop clinical thinking. These studies confirm the direct connection between the problem-based approach and the formation of clinical competencies.

Main Section

The problem-based approach in teaching ultrasound diagnostics is constructed based on specific clinical situations. Students are directed not toward ready-made conclusions but toward independently carrying out the diagnostic process. Each educational session begins with anamnestic data, laboratory indicators, and clinical signs, after which students are required to interpret ultrasound examination results and construct a differential diagnostic sequence. In this process, the educator fulfills a guiding function, managing the direction of students' thinking through questions but not providing ready answers. Students themselves analyze changes in echograms, substantiate probable diagnoses, and explain the necessity of additional examinations with logical arguments. Such an approach stimulates an active cognitive process instead of passive knowledge acquisition.

Clinical thinking encompasses several interrelated elements. First, the ability to correctly evaluate patient complaints and medical history is necessary. Second, the skill to interpret ultrasound examination results in the context of the overall clinical picture must be formed. Third, the skill to conduct differential diagnosis and distinguish echographic signs of various diseases is required. During problem-based sessions, when studying liver pathology, students do not limit themselves to merely identifying diffuse changes but learn to differentiate between hepatitis, cirrhosis, or fatty degeneration based on clinical and laboratory data. In kidney pathology, they learn to comprehensively evaluate the causes of hydronephrosis, changes in stones, and parenchymal condition. For each case, students must substantiate their conclusions with clinical evidence.

The effectiveness of the methodology is determined through students' ability to apply theoretical knowledge in practical situations. While at the initial stage most students could only describe ultrasound images, after problem-based sessions they begin to interpret results in a clinical context. The development of differential diagnostic skills manifests through reviewing several probable diagnoses based on information about the patient's condition and providing logical substantiation for them. Independent thinking skills are clearly observed in analyzing new, previously unencountered clinical situations. Students not only recognize familiar conditions but also logically analyze combinations of unusual signs, express opinions about the necessity of additional examinations, and compare their conclusions with scientific literature. They no longer seek ready answers but instead critically evaluate available information.

Results and Discussion

As a result of applying the problem-based teaching methodology, the quality of students' clinical thinking improved noticeably. In the group taught using traditional methods, students mainly strove to memorize ultrasound signs, whereas in the group where the problem-based approach was applied, they began to fully understand the diagnostic process. While most representatives of the first group solved standard situations well, they encountered difficulties with unusual cases. The second group

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demonstrated independent analysis and substantiated conclusions even in complex clinical situations. Pedagogical observations showed that students who participated in problem-based sessions not only describe ultrasound examination results but also connect them with the overall clinical picture of the patient's condition. When liver dimensions are increased, they do not merely note this fact but analyze etiological factors, inquire about necessary anamnestic information, and take laboratory indicators into account. In kidney pathology, students understood the necessity of jointly evaluating changes in stones together with parenchymal condition. A positive trend was also noted in the development of differential diagnostic skills. Students learned to differentiate diseases with similar echographic signs. For example, when diffuse changes are observed in liver parenchyma, they use clinical and laboratory data to distinguish between viral hepatitis, fatty degeneration, or cirrhosis. Such an approach encompasses not merely identifying visual images but understanding their clinical significance.

The problem-based teaching methodology for ultrasound diagnostics represents an effective tool for developing clinical thinking in medical education. Sessions constructed based on clinical situations form students' abilities to independently analyze, conduct differential diagnosis, and draw substantiated conclusions. The methodology has undergone practical testing in teaching radiology and has demonstrated higher effectiveness compared to traditional approaches. In the future, it would be expedient to apply this approach in teaching other radiological examination methods as well.

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