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APPLICATION OF THE PROBLEM-BASED LEARNING (PBL) METHODOLOGY IN THE STUDY OF PATHOPHYSIOLOGY AS A THEORETICAL BASIS FOR THE FORMATION OF CLINICAL THINKING

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Abstract: Clinical thinking is an important aspect of medical education that reflects a doctor's ability to make decisions and diagnoses. Clinical thinking allows you to make both logical and non-standard decisions in clinical practice and look at the diagnosis from different angles, that is, to make decisions under conditions of uncertainty.

Keywords: pathophysiology, clinical thinking, treatment tactics, basic link, simulation-based education, pharmacotherapy, disease prevention, small groups of students

An important element of effective clinical practice is the mechanism of thinking and decision-making that doctors demonstrate when facing a particular clinical situation. Analyzing it, they rely on their own competence, a key component of which is the level of clinical thinking [1].

Clinical thinking is an important aspect of medical education that reflects a doctor's ability to make decisions and diagnoses. Clinical thinking allows you to make both logical and non-standard decisions in clinical practice and look at the diagnosis from different angles, that is, to make decisions under conditions of uncertainty. Clinical reasoning and, as a result, professional judgment should not be based solely on blind adherence to rules and ignore the most complete information available [2].

An adequate level of clinical reasoning is closely related to diagnostic insight,

understanding of the possible risks and benefits of certain tests and careful analysis of the results of the diagnostic search [3]. The article by Levin M. et al. (2016) highlights the results of applying the case-based "disease scenario" methodology to form the basis of clinical thinking of medical students. The methodology included a brief description of the clinical component with a list of questions, the structure of which realistically combined fundamental knowledge of theoretical medicine and clinical (propedeutic) subjects. The use of this method elicited the following responses from students: "teaches you to reason through differential diagnosis" and "I felt like it made us think like doctors" [4].

The term "clinical thinking" does not yet have an unambiguous definition. The analysis of the literature revealed the following approaches to its definition: a) medical art, consisting of the amount of knowledge necessary to understand the causes and pathological mechanisms of diseases, as well as clinical experience and professional intuition; b) intellectual activity, thanks to which the doctor finds the features characteristic of a given pathological process in a particular person [5].

Some students do not pay due attention to the development of clinical thinking skills. They believe that by mastering sufficiently modern equipment and tools, they will be able to effectively diagnose and treat diseases [6], forgetting that the interpretation of only the results of clinical laboratory and instrumental examination can lead to diagnostic errors [7], and thus to certain errors in the choice of further treatment tactics [8]. The study conducted by Braun, L.T. et al. (2017) showed that the main reason for diagnostic errors in young doctors is the lack of ability to correctly compare the mechanisms of disease development and symptoms, which leads to errors in creating a further therapeutic circuit [9]. Elstein et al. (1978) described two main types of mistakes made by medical students when analyzing and interpreting the results of clinical and laboratory tests in the context of forming a preliminary diagnosis and a scheme of pharmacocorrection of a pathological condition: 1) overinterpretation or underinterpretation and 2) misinterpretation [10].

Thus, the understanding of the basic principles of disease development and the ability to apply them in practical medicine is formed due to studying fundamental

subjects, particularly pathophysiology [11].

Pathophysiology combines the knowledge of various biomedical sciences, which provides a basic link between basic and clinical medical sciences and their application in clinical practice. An important part of this is the teaching of pathophysiology, when students can master the basic concepts of the process of disease onset and development, and deeply understand the pathogenesis of the disease. The task of pathophysiology is to identify and describe [12]:

1. causes and patterns of diseases and pathological processes (i.e. etiology).

2. mechanisms of their development as a complex of pathogenic and adaptive processes (i.e. their pathogenesis).

3. principles of diagnosis and algorithms for their treatment and prevention.

Theoretical training in pathophysiology is necessary to develop students' ability to transform theoretical knowledge into solving practical clinical problems, thus acquiring the ability to make clinical correlations. Clinical correlation in basic medical education can be considered as a learning tool that allows to explore the relationship between a basic science concept and its applicability to medical practice or disease [13].

Thus, linking clinical practice with theoretical education also improves students' decision-making ability, deepens their education, and broadens the knowledge of students and teachers. Teaching pathophysiology by performing situational tasks based on pathophysiological analysis of data on a pathological process or disease is one of the effective teaching methods in medical education that contributes to the formation of clinical thinking.

The most reasonable method in the implementation of pathophysiology tasks can be the use of hybrid teaching, which involves combining traditional lectures and the study of specific cases or problems, group discussion, that is, problem-based learning (PBL) [14]. Problem-based learning (PBL) is based primarily on the integration of existing knowledge and skills [15] and promotes the development of students' critical thinking skills for independent solving of practical problems [16].

Barrett et al. (2005) defines PBL as learning that results from the process of

working toward an understanding of the solution to a problem [17]. The problem arises primarily in the learning process. At the same time, Chasman et al. define PBL as a learning strategy that simultaneously develops problem-solving strategies, disciplinary knowledge and skills by placing students in the role of individuals facing a problem that reflects real-world problems.

Thus, PBL is an approach to learning that uses real-world problems as a context in which students learn critical thinking and problem-solving skills, as well as acquire the necessary knowledge and concepts from the educational material or subject.

With this in mind, the use of multilevel situational tasks in the form of cases that combine analysis, synthesis, generalization and comparison will help students to systematize information around a particular pathophysiological manifestation, for example, the peculiarities of the development of a typical pathological process, such as inflammation, in relation to a "conditional" patient. This will create conditions for the search, systematization and independent interpretation of information on a specific topic from various information sources, i.e., the formation of the ability to make theoretical generalizations [18].

To implement Problem-based learning (PBL) in pathophysiology, the methodology "case-based learning" (CBL) can be used. The essence of the "case-based learning" methodology is the use of a methodological approach based on specific cases, which involves students in the discussion of specific scenarios taken from real medical practice. One of these teaching methods is the "case study" method, which focuses on developing the ability to act in situations where there is no clear answer to a question, but several answers that can compete in terms of truth. It is advisable to use situational tasks in the form of structured (brief and accurate presentation of the situation with the necessary data) mini-cases (a mini-case is formulated in the form of one or two paragraphs, with questions to be answered), with the gradual use of such components as "analysis", "evaluation", "problem solving" and "decision making" [19].

The essence of the case method for learning pathophysiology is that students

are asked to comprehend the information presented in the described situational task, which can be from several sentences on one page (short European case) to many pages (extensive American case). The description of such a situation actualizes a certain set of already acquired knowledge in other fundamental disciplines (human physiology, biochemistry, anatomy and histology, etc.) [20]. Thus, the main outcome of the case discussion should be the identification of thematic semantic keywords, phrases or instrumental and laboratory indicators that have a certain semantic load and serve as an "algorithm for finding the right answer". The use of such a methodological approach in the study of pathophysiology additionally creates the basis for the implementation of Simulation-based education (SBE), which can improve the transfer of theoretical knowledge to future clinical practice [21].

The case-study method is a tool that allows applying theoretical knowledge to solving practical problems [22]. The method promotes the development of students' independent thinking, the ability to listen and take into account an alternative point of view, and to express their own reasonably. With the help of this method, students have the opportunity to demonstrate and improve analytical and evaluative skills, learn to work in a team, and find the most rational solution to the problem.

Working with pathophysiological cases should have its own peculiarities that distinguish it from other teaching strategies. First of all, classes using this methodology in teaching pathophysiology to study clinical correlations should be conducted in small groups of students, which makes it possible to participate in discussions on specific topics of clinical importance. [23].Students should work in small groups, receiving the material directly in class [24]. Situational tasks are based on conditional clinical case histories. A case study consists of a condition in which a pathological condition is indicated with a description of the general condition of the conditional patient, characteristic symptoms, laboratory or instrumental examination data. To answer the questions of the case study, students can use not only the available resources (textbooks, pathophysiology manual), but also external sources (Internet resources).

The following chronological structure of the case may be the most effective:

- Students are divided into small groups (3 - 4 people each)

- Time to complete the task is 90 minutes (academic class time)

- Familiarization with the terms of the case and discussion of answers to the questions (30 minutes)

- Answers to the case study questions from each small group (60 min.)

- Summarizing and evaluation.

In summarizing the results of students' work with situational tasks, an important role is assigned to the teacher, who: 1. Makes a generalized conclusion about the work of each group of students. 2. Highlights incorrect answers and, most importantly, discusses with the group of students the controversial opinions that have arisen and justifies the error of certain judgments of the group in answering.

When discussing case studies, students should not be required to provide ready-made solutions. The purpose of the team's work is to put forward theoretical considerations and, as a result, form a preliminary conclusion about the case study [25]. In the process of discussing the results with students, the teacher must focus their attention on the importance of linking the pathophysiological mechanisms of the development of certain organ (tissue) dysfunctions with reference to symptoms (syndromes). In this case, it is advisable to use the strategy of Unfolding case studies (UCS) [26].

The main goal of this strategy is to develop skills and reasoning for a deeper understanding of pathophysiology. The use of UCS has been shown to increase student engagement, encourage teamwork, and promote clinical judgment [27]. Thus, students already in the initial courses develop the ability to use the method of pathophysiological analysis in the diagnostic search, determination of pharmacotherapy and disease prevention [28].

Thus, the use of the case study method in small teams in the study of pathophysiology contributes to the transformation of individual student knowledge into a single system and will certainly contribute to the formation of the foundations of clinical thinking.

The thematic structure of this discipline allows us to consider its educational

topics as separate "nodes" of systematized knowledge that are logically related to each other. In addition, knowledge of the basic concepts of pathophysiology, mechanisms of development of typical pathological processes, mechanisms of cell damage will contribute to a more thorough study of clinical subjects.

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