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## **FORMATION AND IMPROVEMENT OF CLINICAL THINKING IN MEDICAL STUDENTS**

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**Ключевые слова:** *кейс-метод, клиническое мышление, высшее медицинское образование*

**Abstract.** *Formation and improvement of clinical thinking in medical students. Khaniukov O., Kozlov S., Yehudina Y., Sapozhnychenko L., Kozlova Yu., Somilo O. Introduction and purpose of the study: high requirements for graduates of higher medical establishments facilitate the search, implementation and improvement of modern teaching methods in order to optimize the development of clinical thinking in medical students. In the the course of the work, a big volume of information was used, which was worked out using such methods as historical and literary synthesis, structural and logical analysis, abstract thinking and personal experience taking into account the principles of systemic approach and analysis. To improve the quality of medical students' training it is necessary to use the innovative teaching methods. Presence of the personal clinical archive, with allow to use archival material in the training process (for example, to use case-method), in the analysis of a clinical case and the use of data in the scientific work. The article presents an example of a clinical problem and emphasizes the importance of the case-method in teaching students in higher educational institutions. Formation of clinical thinking takes place over the course of direct work with the patient, with an independent attempt to resolve a specific clinical situation in real conditions. Case method allows to reveal and form the necessary personal qualities and abilities of medical students, necessary for the further work. Modern methods and means of information technology must be purposefully implemented into clinical practice and educational process for the development of professional skills, formation of clinical thinking, accumulation of clinical experience.*

**Реферат.** *Формування та удосконалення клінічного мислення у студентів-медиків. Ханюков О.О., Козлов С.В., Єгудіна Є.Д., Сапожниченко Л.В., Козлова Ю.В., Соміло О.В. Високі вимоги до випускників вищих начальних закладів медичного профілю сприяють пошуку, впровадженню та удосконаленню сучасних методів навчання з метою оптимізації розвитку клінічного мислення у студентів-медиків. У процесі роботи було використано об'ємний інформаційний матеріал, який опрацьований з використанням таких методів, як історико-літературний синтез, структурно-логічний аналіз, абстрактне мислення та особистий досвід з урахуванням принципів системного підходу та аналізу. Для підвищення якості підготовки студентів-медиків, формування та вдосконалення клінічного мислення необхідно використання інноваційних методів навчання. Наявність персонального клінічного архіву дозволить мати архівний матеріал для використання в навчальному процесі (наприклад, для використання кейс-метода), при аналізі клінічного випадку та використанні даних у науковій роботі. У статті представлений приклад клінічної задачі та підкреслюється значення кейс-метода в навчанні студентів у вищих навчальних медичних закладах. Формування клінічного мислення відбувається в процесі безпосередньої роботи із хворим, при самостійній спробі розв'язування конкретної клінічної ситуації в реальних умовах. Кейс-метод, як метод аналізу конкретного клінічного випадку, дозволяє розкрити та сформувані необхідні для подальшої трудової діяльності якості та здібності студентів-медиків, формує клінічне мислення, аналітичні здібності, самостійність у прийнятті рішення, комунікативність, навички роботи з достатньо великим об'ємом інформації. Сучасні методи та засоби інформаційних технологій необхідно цілеспрямовано впроваджувати в клінічну практику та навчальний процес для розвитку професійних навичок, формування клінічного мислення, накопичення клінічного досвіду.*

According to the Concept of development of Public Health Care of the population of Ukraine approved by the Presidential Decree, ensuring the right of citizens to qualitative medical care in accordance with the requirements of the European Community has become a priority area in the reform of the system. The modern Ministry of Healthcare of Ukraine puts high requirements to the graduates of high medical schools. The following professional qualities of future specialists are of great importance: self-analysis of emerging situations and prompt decision-making, ability to work in a team and collective, to quickly focus on the changes in the situation. Therefore, the 6th year student of the higher educational institution should be able to:

1. Conduct and interpret survey, physical examination, clinical examination, results of modern laboratory and instrumental research, morphological analysis of biopsy, operative and sectional material;

2. Identify the main pathological symptoms and syndromes of the disease in a patient, using the knowledge of professionally-oriented and clinical disciplines;

3. Conduct differential diagnostics, formulate the preliminary diagnosis;

4. To Justify methods of diagnostics, treatment, rehabilitation and prevention basing on the pathogenesis;

5. Use algorithm for diagnosis making (clinical: main, complication, concomitant);

6. Carry out life prognosis, work capacity and recovery of a particular patient;

7. Diagnose and provide emergency care;

8. Demonstrate the possession of moral and deontological principles of a health care professional and the principles of professional subordination;

9. Analyze medical information based on the principles of evidence-based medicine.

As can be seen from the skills presented, they are based on the ability to analyze detected symptoms and syndromes and integrate them into the nosological unit. This skill is based on theoretical and empirical knowledge and has the term "clinical thinking" [11]. In general terms, under clinical thinking, one can understand the cognitive ability to solve professional problems on the basis of knowledge, experience and intuition. Improving its formation in medical students increases the level of clinical practice. So, optimizing the formation of clinical thinking among medical students remains an urgent problem.

The purpose of the work is to increase the level of practical training and clinical judgement of medical students by introducing a case-method into the educational process in higher educational institutions.

## MATERIALS AND METHODS

In the process of the work, a big volume of information material was used, which was worked out using such methods as historical and literary synthesis, structural and logical analysis, abstract thinking and personal experience, taking into account the principles of systemic approach and systemic analysis.

## RESULTS AND DISCUSSION

A training program of a doctor in a higher educational institution, developed by the founders of clinical medicine M.Ya. Mudrov and P.O. Charukovskii is currently optimal [7]. Fundamentalism and consecutive order is traced in it. During their 1st and 2nd year students are trained to work with a patient, during their 3rd year they master propaedeutics of internal medicine, during 4, 5 and 6 years of study internal medicine is being studied - students learn to interview patients, to take present history and past history, to carry out medical examination of a patient, to formulate a preliminary diagnosis, to make a plan of examination and treatment, to determine prophylaxis and prognosis. Dynamism in the formation of clinical thinking must be ensured by the study of clinical theory, starting with the 3rd year and the transition to clinical practical disciplines. One of the most important disciplines that immerses students into the clinic is pathological physiology, the main tasks of which are the formation of a certain amount of knowledge on the emergence and development of typical pathological processes and their modeling, understanding of the ways of pharmacotherapy of the major human diseases and the creation of a basis, which defines professional competence and comprehensive knowledge of a doctor [10]. Such "competent" approach to teaching discipline is created in accordance with the modern requirements, which are stipulated by the European and world integration of education, which promotes professionalism of the future specialists [12]. Drilling of the obtained theoretical knowledge in classes with the experienced physician-instructor, when doing cycle in internal medicine in a small group of students with compulsory bed-side instructions, creates the best condition for the formation of clinical thinking. Independent attempts to resolve the clinical situation in real conditions form logical thinking, responsibility, interest and understanding of the need for a constant upgrading of knowledge and skills.

Acquisition of skills for communication with patients and colleagues begins at the stage of studying in the university and is improved during all further practical work.

One of the effective methods of forming clinical thinking is the case-method [1]. Case - is a research approach that is used for an in-depth and multilateral understanding of a complex problem in the context of the real life. This method allows to consider a specific situation that has occurred in life and the possibility of its occurrence in the professional activity of the doctor is high enough. Realizing the possibility of occurrence of this situation in practice, students actively participate in the discussion, independently looking for ways to solve this problem, using already acquired knowledge and understand the need for further education. There are three concepts of learning by the case-method:

- case-bedside teaching (classroom training and bedside instruction);
- case-didactic teaching (training cases are minimized, in the foreground - lectures on topics that were in the case);
- case-interactive teaching (in-depth study of the complicated clinical cases "step by step" [6].

The case varies according to the format and degree of difficulty. According to the format of using it is distinguished:

1. Mini-cases (1-2 pages or less). Students get acquainted with the case at the lesson and solve it on his/her own, after which they discuss it with the lecturer and defend their opinion. In this case, it is necessary to demonstrate not only knowledge, skills and abilities within the discipline, but also to demonstrate autonomy, clinical thinking and the possibility of self-presentation. Used on seminars and workshops.

2. Medium (concised) cases (3-5 pages). Intended for handling in practical classes and general discussion, they sometimes need short training.

3. Bulky cases (20-25 pages on average). Analysis of one particular situation is carried out by the whole group, but preparation is on his/her own out of class, and then discussed at the lesson or in groups of 2-3 students at the lesson. After that all variants of solution of the question are presented, a discussion is held, during which students are advised to defend their point of view through the argumentation of the data. This kind of work contributes to the formation of communicative abilities, provides an opportunity to defend their position and view, as well as learn to listen and understand the interlocutor.

Also, cases are divided according to the level of complexity: structured and unstructured, which depends on the existence of a model of solution and the existence of an optimal solution; according to the variation of tasks (case-task, case-question), according to the presence of supplements, the manner of presentation (multi-genre).

The use of the case-method allows the teacher to assess a student's ability: to clinical thinking, to justify own decisions and actions, ethical communication with colleagues, to express own thoughts and not only to determine the level of knowledge of the new material but the ability to use existing knowledge [1].

Formation of clinical thinking is a comprehensive, multifactorial, long and continuous process. Modern computer technologies allow to increase the efficiency of formation of clinical thinking at all stages of the latter. Methods and tools of information technology expand the educational opportunities of studying a complex, insufficiently formal information such as symptoms, syndromes and nosological forms. Computer technologies on archiving and searching for the necessary information can increase the efficiency of the acquisition and use of clinical experience. Possibilities of modern information technologies can be realized on the basis of databases in the form of a personal clinical archive (case-histories with laboratory and instrumental research methods). Its effective leveraging using in educational process will allow the user to collect and process large volumes of their own clinical observations [4]. The purpose of the personal clinical archive is to preserve the results of patient's supervision, to find the necessary information on the symptom, syndrome, diagnosis, and possibility of restoring the clinical case by its clinical data. This allows to use archival material for optimization and evaluation of the effectiveness of diagnostic and treatment measures at the following visiting a doctor, to return to previous materials to use them in the training process (for example, to use a case-method), in the analysis of a clinical case and the use of data in the scientific work [1].

For example: for the preparation of material for case-interactive teaching, students of the 6th year can use a clinical archive. The students are provided with a small amount of information about the patient in the order in which it was available to the doctor - demographic data, complaints, past history, present history. After that the students ask questions and discuss the data, what does this information give. Subsequently, gradually the results of an objective survey are provided. Students discuss the findings, reveal the main symptoms, the key syndrome, formulate a preliminary diagnosis. During the discussion, several possible diagnoses are considered, among which differential diagnostics is carried out, an examination plan is formed. Further, the students receive the results of the laboratory and instrumental examination methods in accordance with the clinical guidelines for the diagnosis and treatment of the

disease under consideration. They formulate a clinical diagnosis (the main, complications of the main and concomitant one), prescribe treatment: drug therapy and drug-free. Prophylactic methods, prognosis of the disease, prognosis for life and work are considered.

Thus, the analysis of the situation is carried out in three stages:

1. At the first stage, students study received information independently, find a problem and solve it.

2. At the second stage they work in a small group, discussing the information received and expressing their opinion as for the diagnosis, the plan of examination and treatment.

3. At the third stage – group discussion is conducted with a doctor-instructor.

An example of case-iterative teaching for the 6-year students:

Male patient, aged 36, complains of dyspnea and periodic pain behind the chest, which arise during normal physical activity and disappear at the rest state, elevation of blood pressure (BP) to maximum values up to 160/90 mmHg

*Anamnesis morbi.* For about 5 years suffers from hypertension, the maximum values of blood pressure reach 170/100 mmHg. The prescribed medication (angiotensin converting enzyme (ACE) inhibitors, statins, aspirin) was taken from time to time. Since 2016 he began to experience constricting pressure in the area of the heart and shortness of breath that occurs during normal physical activity. Consulted by a physician, established: IHD: stable angina II FC. Arterial hypertension 2 degree. Heart failure with preserved ejection fraction (65%), II NYHA. Administered: nitrates, ACE inhibitors, beta blockers, aspirin. Patient's condition did not improved.

*Anamnesis vitae.* Denies harmful habits. There is no evidence of sudden cardiac death cases in relatives.

*Physical examination:* The general condition is satisfactory. Skin and visible mucous membranes are clear. Breathing rate (BR) is 16 per minute. Percussion over the lungs – sound is clear, pulmonary. Auscultation over the borders of the lungs – vesicular respiration, no rales in the lungs. Heart rate – 60 per minute. BP – 150/80 mm Hg. On palpation of the heart area – pathological changes are absent. The borders of relative cardiac dullness: right - on the right side of the sternum, upper – at the level of the 3d intercostal space along the left parasternal line, left – along the left mediastinal-clavicular line. Heart tones are muffled. The rhythm is correct. Systolic murmur over the whole heart area, with a maximum at the apex. The liver is palpated near the edge of the costal arch. Mild edema of the lower limbs.

Data of laboratory and instrumental research methods

*Complete blood count and common urine analysis* – without pathology. *Biochemical blood test:* cholesterol – 6.0 mmol / l, triglycerides – 2.5 mmol / l, high density lipoproteins – 1.01 mmol / l, potassium – 4.0 mmol / l, sodium – 140 mmol / liter.

*On the electrocardiogram (ECG)* is recorded - left bundle branch block. Signs of left ventricular myocardial hypertrophy.

*ECG monitoring:* sinus rhythm with episodes of sinus arrhythmia, heart rate in the daytime – 54-65-80 bpm., rarely increases gradually to 90-98 bpm., at night HR – 50-60 bpm., in sinus arrhythmia – 45 bpm (rarely). Rare single multifocal (in morphology) ventricular extrasystoles, separate complexes are interpolated. On recording – constant intraventricular block of various degree. Transitional AV block II degree, 1 type with pause 2.5 sec (03:31).

According to the received data on *transthoracic echocardiography* revealed: Maximum LV wall thickness 15 mm. Hypertrophic cardiomyopathy (HCM). Concentric hypertrophy of the LV walls with moderate obstruction of left ventricular outflow tract (LVOT): maximum gradient in LVOT – 38 mmHg, mean – 20 mmHg.

*Magnetic resonance imaging (MRI) of the heart:* signs of a concentric hypertrophic cardiomyopathy of the LV.

*X-ray of the thoracic cavity:* Lung fields without infiltrates and focal changes. The roots are strengthened. The dome of the diaphragm is clear. Sinuses are free. Heart - dilatation of the LV.

*Coronary angiography and sounding of cavities of the heart* was performed. Conclusion: HCM with elements of obstruction (maximum gradient – 40 mmHg.). Hemodynamically significant changes in coronary arteries were not detected.

*Angiography of the renal arteries:* Pathology of renal arteries is not detected.

To exclude the diagnosis of Fabry's disease, the *definition of alpha-galactosidase (α-Galactosidase)* and lyso-GL-3 was performed in a patient. Indicators are within normal limits.

When calculating the risk of sudden death and indications for the administration of an implanted cardioverter defibrillator (ICD) in HCM, HCM SCD risk calculator is used, in the patient a 5-year risk of sudden cardiac death makes up 1.56%.

Discussion, interviewing, justification and interpretation continue until all the relevant information is considered or until all important issues of diagnosis, treatment, prognosis and prevention are considered. Using the case-method allows to actively involve and solve various needs of team work,

contributes to individual training as well. The theory of this method of learning is that it encourages students to use and evaluate their personal experience, work in a team, taking into account the views of each participant [2].

It should be emphasized that whatever form of the case-method is used, it should have the following main general characteristics that influence the empirical training in clinical conditions: the presence of a clear consecutive structure, active involvement of students, modeling of clinical thinking and action, providing feedback, creating a common learning environment and meeting the requirements of the National Center for Case Study Teaching [1]:

1. To be compared with the purpose and tasks of education;
2. To show the real clinical situation;
3. To have enough data as for disease, needed to answer specific questions;
4. Stimulate interest in a clinical case
5. To encourage students to logical thinking and responsibility for their decision.

With the help of the case-method, the teacher develops his pedagogical potential, has the opportunity to grow professionally together with students, to be a supporter of innovative approaches in the educational process. The case method is gaining more recognition from both students and teachers. It promotes the development of non-standard thinking, initiative and deeper mastery of practical skills in medicine. At present, the use of Web-technologies is one of the most important means of medical education [5], which allows transferring the learning process to a qualitatively higher level. This method has several advantages: the possibility of distance

learning, the ease of updating the course and information, the individualization of education, innovative methods of study and automation of the training record keeping [9]. The teaching of medical students through Web-technologies depends on the timeliness of obtaining knowledge, the effectiveness of using simulation and integration within and between institutions [8]. The use of the case-method by means of Web-technologies is the next step in students' training [3].

### CONCLUSIONS

1. Formation of clinical thinking in medical students takes place in the course of a direct work with the patient, with an independent attempt to resolve a specific clinical situation in real conditions.
2. Case method as a method of analysis of a real clinical case allows to reveal and form qualities and abilities of medical students which will be necessary in the further work, to form clinical thinking, analytical skills, autonomy in decision-making, abilities of communication, skills to work with a sufficiently large volume of information.
3. Modern methods and means of information technology need to be purposefully implemented into clinical practice and educational process for the development of professional skills, formation of clinical thinking, accumulation of clinical experience.

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