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Research Article

Clinical Reasoning as Axis of Teaching

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Abstract

The basis of this methodology process is base on the constructivism theory: all knowledge resulting from previous knowledge and new experiencies, which will contribut to conform a novel knowledge. The work proposal of this Method is based fundamentally on the John Dewey´s learning theory; he believed that teaching experiences should arouse curiosity, enhance personal initiative, and allow free expression of learners' ideas. In explaining the importance of individual experiences on the development of expertise, he wrote, "What [the student] has learned in the way of knowledge and skill in one situation becomes an instrument of understanding and dealing effectively with the situations which follow".

Keywords

Medical reasoning; Clinical; Teaching

Introduction

The formulation of a differential diagnosis is one of the most important and intellectualy challenging aspect of medical reasoning. The clinical reasoning process is helpful as a framework or roadmap to guide students as they begin to understand the elements of reasoning inparticular cases. Thus, they can do it through a method, called "clinical method" or "diagnostic process", is used not only in many medical residency systems but also in academic institutions or resolving medical problemas. In these frame of medical training, the so-called inductive-deductive inference is a mental process that physicians do, supporting by: at first, the information that the patient provides through the medical examination of the patient. In this way, is expected that doctor makes the clinical diagnosis through a mental process of analysis and, in this instance, without the support of the complementary examinations. This process is an intermediate reasoning that allows to establish degree of probablility of adiagnostic hypotheses (at the first moment syndromic diagnoses, then pathological and finally aetiological diagnoses will be obtained). From there, the physician decides an exploratory study establishing the necessary complementary examinations that allow to confront the differential diagnosis or to validate the one of greater probability, completing: "the Art of Diagnosis" [1].

The result of these and their contrast with the hypothesis and the obtaining of new information from the context of the patient itself

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allow to specify, with some certainty, the most probable diagnostic hypothesis that can explain almost all clinical picture findings. As Custer et al. [2], in their review of mental representation about knowledge in medical diagnosis, the first stage of reasoning in students was done with the model called "prototype" represented by prototypes. The theoretical basis of this framework is an abstract process that is used to construct a memory search of two or more episodes experienced in advance (two or more patients/pathologies that have been previously seen). This framework supposes a sum of different models, for example: independent keys, ideal example, synthetic description. In this way are based the books about demostration a prototype of disease or type of patient. Thus, in certain cases, the diagnoses can be made quickly and correctly, according to this theory and the so-called "instance-based" theory, which assumes that clinical reasoning comes from looking at a series of previously stored examples in memory in order to make a new diagnosis. In this framework is not considered an abstract process, only adding new data to to an existing data. While we know that people rely on previous experiences to identify new ones, in medical diagnosis it seems important not only to know the previous experience (disease, skin lesion, radiography, etc.) but also knowing the context in which it is developed or presented the patient. This framework also seems very unlikely, since storing all disease patterns is impossible under normal conditions. The other stage of medical reasoning is framed in the model called "semantic network", scheme and script: in this one it is assumed that the structure and function of medical knowledge is based on a nucleus and a network of nodes that, when it are activated then it active by different networks anothers nucleus. In this context the disease is represented by a network of biomedical and clinical concepts interconnected by links. Making the diagnosis is to find the way in the network of symptoms, signs, and findings that lead to the node that represents the category of diagnosis suspected. This model of semantic network is the one that gives rise to clinical reasoning. This framework is a very usful tool that does not allow the doctor with "empty hands" when a prototype or previous instance failure. The above quotations are based on the modern conception of teaching, with "thinking" following the stages of the Scientific Method, a fundamental contribution of the philosophy of John Dewey [3]. These theoretical bases are important for the design of educational strategies in the Medical Schools that, allow to develop and strengthen some competences which students should have before graduate. In Argentina the competences are included within the framework of Resolution 1314 of the MECyT [4].

The Ministerial Resolution mentioned a lists of 40 competencies that should have medical students. Among which those that would be strengthened by this methodology would be the following:

"... No. 3 to formulate initial diagnostic hypotheses taking into account the data provided in the anamnesis, the findings of the physical examination and the prevalence of the disease..."

"... to No. 4 propose differential diagnoses..."

"... No. 19 Participate in presentations and discussions of "clinical cases " between colleagues.

When we refer to the "Method" as a category we refer to procedures that are concatenated in an orderly and sequential way

to achieve the proposed objectives, which in this case is diagnosis [5]. It is "... the system of successive and conscious actions of the man, which tends to reach an outcome that corresponds to the objetive" [6,7].

The clinical method is the scientific method applied to the medical diagnosis process. It is a system of rules to order the procedures that the doctor uses to obtain the correct information (symptoms and signs), for making the diagnoses. It consists of knowing, naming and cataloging a disease precisely, improving medical practice and improving teaching and professional education.

1. The constructivist postulates about learning are summarized by Carter [8]:

2. Learning is an internal constructive process. The information presented to an individual must be reconstructed by the individual through a previous internal (usually non-spontaneous) experience.

3. The degree of learning depends on the individual's cognitive development.

4. Learning depends on an internal reorganization process.

The most effective strategy to achieve learning is throughout the creation of contradictions or cognitive conflicts (between what I know and what I should know). Learning is favored through social interaction. "The learner thinks, but also acts."

The work proposal of this Method is based fundamentally on the John Dewey´s learning theory [3]; Dewey believed that teaching experiences should arouse curiosity, enhance personal initiative, and allow free expression of learners' ideas. In explaining the importance of individual experiences on the development of expertise, he wrote, "What [the student] has learned in the way of knowledge and skill in one situation becomes an instrument of understanding and dealing effectively with the situations which follow". According to Dewey there would be an order in the didactic process:

1. Knowledge of previous conflicting situation and new situation, which would lead to motivation for solving.

2. Define the problem and put the goal.

3. Application a logical development methodology.

4. Hypothesis verification.

Dewey says: "The responsibility to select rigth objective conditions, carries the responsibility of understanding which are the needs and capacities of individuals who are learning at a given time." Hence, the importance for teacher to know and to understand adequately the student´s internal psychological processes in order to a good management and orientation of the educational goal: Quality learning or significant learning. Therefore, it must be inferred that every teacher who pretends to be a true education professional must have a theoretical framework that guides his activity, which enables him to be able to promote meaningful, creative and innovative learning. The teacher must take into account the caracteristics that the students have. To do it, the teacher will have to be able to create different situations, based on one or several theories of learning that allow the student to "learn".

Objectives

Provide a tool for students to be able for using the clinical method

or diagnostic method along their undergraduate time [9]. The challenge is to put this method into the imaginary of the students, using as objetives:

1. Give a frame of the method to be used along their undergraduate time

2. Determine the integration needs to achieve the goal.

3. Develop a methodology proposed using different scenarios according to the teaching strategy.

4. Develop the proposed methodology according to the resources it would needed (cases, audiovisuals: cinema, real patients)

5. Activities organization (good practices):

The introduction of the clinical method can be included within the fourth year of the medical course. It would be the time in which their are learing Semiology or Introduction to Internal Medicine. The methodology will show the student that they will need to recover contents that have been already learned and incorporate new knowledge.

The proposal´s slogan would be: "You learn what you practice".

The development of this approach takes into account different types of teaching design and strategies such as Problem Based Learning (ABP) [10], Case-Based Learning (ABC) [11], Learning in Small Groups [12]. At the begining of the course the students are distributed into small groups (between 3 and 8) in order to avoid difficulties when the number is small or when it is large. In this meeting, the bases and application of the method are given as a seminar, then the groups are assigned to a coach (each group must have one Coach).

Methodology

The reasoning is developed in five steps:

Collection of information

The case is presented (the film is projected or a real patient is selected) to student´s groups. At this stage the students will approach the case, making the clinical history, and begin with the brainstorm that will allow them to link their previous knowledge (Anatomy, Histology, Microbiology, Chemistry, Physiology, etc.). When possible, clinical material should be organized in the same chronologic sequence as the events unfolded in real life. Although the presentation of material will often start with a patient's age, sex, and chief complaint, it also can begin with the problem for which the patient was referred to a physician or hospital.

Selection of a pivot

In this step, will emerge the "pivot" or "cardinal symptom", it might appear that students should try to identify that could explain or at least be consistent with, all the findings found in the information collected. It will guide the the methodology, this will allow students to approach the case. The pivotal finding may be a symptom (subjective), a sign (objective) or a result of a complementary examination (objective), as well as a syndrome (eg heart failure) or a pathological entity (eg Hyperthyroidism, anemia, cerebral infarction); In general the two latter are diagnoses that will lead students re-start in order to find the etiology. This finding may arise according to the student's

knowledge or to an imprint in his memory, being it attached to some previous experience, etc.; this choice does not usually alter the final result. As an example, it can expose Symptom: Cough, dyspnea, abdominal pain. Sign: Hepatomegaly, murmur, patellar shock. Supplementary test: Hb: 9,7 g / dl; Glucose: 230 mg%.

List of causes

In this step the student will investigate the list of causes that could explain the finding of the chosen pivot. It is also important that students temporarilly ignores all the other details of the case and concentrate on compiling a list of disease that could have caused the pivot. Example: Cardiac diseases, respiratory causes, Psychogenic causes / hyperventilation, Neurologyc causes, Muscle causes, Gastro Gastroesophageal reflux, which causes night dyspnea crisis, or Physical deconditioning.

Thus, if the students take the respiratory causes they will find pathologies like, Asthma, COPD, pleural effusion, PTE, pneumonia, pneumonitis, pulmonary infarction, non-cardiogenic pulmonary edema, pneumothorax, diaphragmatic paresis, etc., As possible explanations of the chosen Pivot.

Contextualization and pruning the cause list

"the main purpose is to put the chosen pivot into patient´s context". In this step the student must use all the findings in the patient's clinical history in order to adjudicate a degree of probability to each cause (from the list previously generated), making the pruning process. The students focus on one posible diagnosis at a time, comparing one by one the patient´s findings with the signs and symptoms that characterize the disease, again taking adventage of the fact that most medical knowledge is stored according the disease. Appropriate skills to interrogate the patient´s findings, will give the student an important tools at the time to prun the causes. In this phase it is very important to have clarity about the different pathologies that are evaluated as most probable, to generate a list of findings that are unknown to encourage their investigation. It is at this stage where the student must sharpen his or her skill in the clinical history, for example, the importance of how to ask about a symptom:

Example: the chosen pivot was: "Dyspnea" then the anamnesis should include questions like:

How and when the symptom started

- Since when do you have difficulty breathing? = More than 5 months: COPD, Heart failure.

- Dyspnea was sudden onset? = Pneumothorax, Pulmonary embolism, acute pulmonary edema, gas inhalation, etc.

- Was it progressive? = CHF, pleural effusion, obesity, pericardial effusion, tumors, Hamman-Rich syndrome, etc.

- Was it months or years? Pulmonary fibrosis, COPD, etc.

Associated symptoms

- Does dyspnea appear during inspiration? = Obstruction of upper airways.

- Does dyspnea appear during expiration? = Obstruction of the lower airways.

- Is dyspnea constant? = COPD, pneumoconiosis, etc.

- Is dyspnea variable? = Asthma, change in secretions, etc.

- Is dyspnea continuous, with paroxysms? Asthma, COPD with exacerbations, etc.

- Paroxysmal with asymptomatic intervals? Asthma, psychogenic.

Aggravating or trigger factors

- Exercise? = Suggestive of organicity; CHF, COPD, anemia, obesity, etc.

- Rest? = Asthma, pneumothorax, pulmonary edema, etc.

- Only at rest, but not in exercise? = Most of the psychogenic.

- ¿Standing? Severe COPD.

- ¿In decubitus? = Orthopnea; CHF.

- Is dyspnea worse with pollution? = All forms of COPD.

Mitigating factors

- Improvement with bronchodilator? = Bronchospasm.

- Improvement with diuretics? = CHF

- Sitting in orthopnea? = CHF.

- Symptoms or accompanying signs:

- Wheezing? = Airway obstruction, asthma, bronchitis, etc.

- Fever? = Pneumonia, tuberculosis, etc.

- Cough, expectoration? = COPD, acute infection, etc.

- Hemoptysis? = Pulmonary tuberculosis, cancer, pulmonary infarction, mitral stenosis, etc.

- Chest pain? = Myocardial ischemia, pneumothorax, etc.

- Palpitations? = Arrhythmia.

- Sighs? = Psychogenic.

- Cyanosis? COPD, CHF, etc.

- Joint pain? = Connective diseases, sarcoidosis, etc.

- Diarrhea? Carcinoid syndrome, parasitic diseases of the lung, etc.

Environmental factors

- Smoker? = COPD.

- Animals like birds? = Psittacosis, etc.

- Has the patient had chest X-rays?, positive skin hypersensitivity tests?, had chest irradiation ever?, had diagnosis or symptoms of DVT?

Family history related to problema

- Does anyone in the family have a lung disease? = Pulmonary tuberculosis, alpha 1 antitrypsin deficiency, mucovisidosis.

Selection the clinical diagnosis: In this step the students have all the information posible. They should have done the research according to the presentation of the case and may arrive at the more likely diagnoses (in general 2 or 3 differncial diagnosis). This diagnosis may be a syndrome or a specific disease.

When talking about probabilities, these are estimated as: high,

moderate or low. As an example, it can be used following the patient with dyspnea: "Patient with dyspnea, which was suddenly at presentation", thus, the probable diagnoses are shown and grouped as follows according to probability in Table 1.

Validation of the clinical diagnosis: In this stage the students must base their hypothesis. They should be able to resort to semiological evaluations, or complementary exams to validate or reject Their hypothesis. In case of validating the hypothesis and that there is still no such diagnosis that can focus the appropriate therapy or rejecting the hypothesis should re-pivot with the last diagnosis and apply the methodological steps again (As an example we can quote: "patient with dyspnea that Hypothesis is pleural effusion, "we can validate it with a chest X-ray. Once the diagnosis is validated, we would be faced with a syndrome, which serves to re-pivot in order to achive the pathophysiological or etiological diagnosis.

The work is developed in different phases, each one has clear objetives (Table 2)

Phase 1: The methodology that will be systematically applied in each case is presented in theoretical form with debate. Then the work is in small groups of 6-8 students with a Coach, and the case is presented. The Coach encourage students to identify the work axes for starting with the methodology. Objectives and probable explanations are outlined and bibliographic research is planned.

Phase 2: Bibliographic search. Independent works of the students that will depend on the objectives to be achieved in each "case". Students are looking for information in different bibliographic sources. The Coach supervises passively, only making intervention on the development of the methodology.

Phase 3: Methodological discussion with the Coach: the case is presented and the group is stimulated for developing, analysing, correcting and interpreting the diagnostic hypotheses achieved. The stimulus is based on reasoning questions.

Phase 4: At this time is the the the moment of the "formal" presentation of the case and its resolution from each group of students, not only to Coachs but also to peers. A debate is being held the conclusions, clarifying methodological doubts, as well as theoretical contents. Evaluation is performed.

As it is noticed the ideal scenario for the development of this methodology is the work in groups, nevertheless, situations can be given where the groups are numerous and therefore not ideal.

The tools used can be cases, cinema or real patients: When we refer to "cases" [13], these should be helpful for a trigger or trigger for student's concerns or brainstorming. Therefore, they must comply with four basic guidelines [14]:

➢ The writing or narrative should be sober and clear

➢ The case must be according to the analytical capacity of the participants.

➢ The cases must be according to the real context in which the students will live in their professional life.

➢ Develop a sheet with objetives for the students' homework.

➢ The case studies shuold offer a scenario enough versatile and flexible in order to serves as a trigger.

The other useful tool to be used is the Cinema or comercial movies [15,16]. Cinema is possibly the most complete artistic manifestation when it comes to creating a disease. Virtually no disease have been escaped to his eyes, his analysis transcends the disease itself, affecting not only its individual and social consequences but also the feelings it provokes. In recent years, teaching is being shaken by the need for adaptation and evolution, both in methods and how to teach them in order to dynamize the teaching act and the educational immobility perpetuated by tradition.

Last but not the least, the use of the "real patient" as a teaching tool, in this situation, which is most similar to the student's professional activity, the student needs knowledge such as the correct notion of the anamnesis and the general patterns of the semiology evaluation in order to approach the patient ("problem"). The advantage over the previous tools is that real patient allows students being the self-creators of the "case". Therefore, students could identify errors or omissions in the anamnesis or semiological examination which could be fundamental to achive a given diagnostic hypothesis.

In this situation the ideal setting is when the students are attending Semiology or have been accredited it. Two strategies can be used,

Table 1: The diagnosis probability based on contextualization and pruning the cause list.

Probability		
High	**Moderate**	**Low**
Pulmonary embolism	Heart failure	Pleural effusion
Neumotórax	Pneumonia	Pneumoconiosis
Pulmonary edema	Pulmonary edema	Pulmonary tuberculosis
Traumatic haemothorax	COPD	Pulmonary vasculitis
Upper airway obstruction	Asthma	Neuropathies
Acute Asthma		Myopathies

Table 2: Activities in each phases for coach and students.

Phases	Coach	students
Phase 1: Case presentation	Present the case Activate groups	Activation of previous knowledge Brainstorming, Hypothesis development
Phase 2: investigation	Provides resourses for searching	They propose learning to guide the search Define the pivot or problem
Phase 3: Discussion - Re-evaluation	It demands evolution of the production Encourage students work within methodology Stimulates the redirection of production	Discuss their production. Redefine problem or reconsider the context if neccesary Propose solutions
Phase 4: Presentation - Group evaluation	Order the presentation Proposes discussion Evaluate competencies	They present the production to teachers and peers Respond to the debate Self-evaluate

one of which is to select a particular patient (this is often used for evaluations where we are going to predict or determine the objectives of the evaluation) and the other (more preferred by us) is to allow the group of students to choose the patient (from an external clinic, external guard, hospitalization room or even intensive care units). Once developed the phases of the method, which develop the groups of students in their assigned teaching units, stipulates a plenary day where each group will expose to their peers their diagnostic proposals. This proposal of work with "the real patient", has as advantages like the following:

- Students are faced with patient that arouse their interest.

- They feel being part of a process where the goal is to arrive at a more probable diagnosis by applying a method and not the mere fact of being evaluated.

- They are encouraged to research.

- They feel involved in the diagnostic and therapeutic exercises.

- They often experience different emotional situations linked to patients' histories or to the evolution of their illnesses.

Each of these points and all of them put the students in real situation they could live in the coming future as a doctors.

This method is likely to contribute with incorporating tools during the undergraduate time to mitigate in the future the two most frequent errors in medical practice:

1. "Do not see what there is", no obvious symptoms or signs are perceived by nonobservance or by not having the methodological tool that we mentioned [17].

2. " To watch what there is not ", is when doctor intends to adapt the patient's findings to the book chapter or to a known prototype without taking into account is really happen [18].

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