(5) System Planning in Clinical Diagnosis

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1. System

Clinical diagnosis is a system which aims analyzing information obtained from patients and choosing the most favorite treatment for them. In system planning of clinical diagnosis, the most effective approach to this aim is to be searched for among those available at the moment. It is not true that none of such a system planning has been found in the current diagnostics. In textbooks of diagnostics, the terminology including complaint, history, family history, present status, differential diagnosis, and prognosis and so on is found and sequence of making diagnosis is described using this terminology. Perhaps the existence of basic form of system can not be denied even in the current diagnostics.

However, the system has not been well analyzed by any means and it is not realistic to expect the past studies on diagnostics to have carried out the analysis without aid from information science and computer. It is believed that medical scientists of these days are obliged to achieve a sophisticated system for medical diagnosis which has been tried but not finished in the past.

2. Hardware and software

In the system for clinical diagnosis, two aspects are observed. One is the system for diagnostic logic and sequence of decision making, which can be called software system. The other is the system for organizing instruments, equipments and room spaces so that the software system can be operated with efficiency, which can be called hardware system.

3. System planning and computer

On planning a system, it is too simple if one insists that computer is indispensable in building any system. The highest efficiency is the prime condition for system planning and, if the aim can be achieved more easily by human work rather than by using computer, the system should not make use of computer.

However, clinical diagnosis consists of processes of memory, calculation and judgement. These are the easiest jobs for computer and thus it is quite reasonable to make full use of computer in building the system for clinical diagnosis.

4. Display system for patients' progress

One of the examples of extensive use of computerized display system to assist doctors in making diagnosis is found in Thoracic Clinics of Karolinska Hospital, Stockholm, Sweden. Respiration rate, heart rate, body temperature, urine volume

and some other parameters of patients in ICU and operation room are fed into computer by hands of nurses continuously. Doctors in charge of these patients can call up from computer the progress curves of these parameters on the display unit at their will.

In this system, computer demonstrates the patients' progress in a well organized form but does not give doctors the diagnosis or suggestion for treatment and these jobs are left over for doctors. However, even this type of help is quite useful when uninterrupted monitoring is required for patients in serious condition.

5. Automated history taking system and automated diagnosis-making system.

If the diagnostic logic possessed by experienced doctors is stored in computer, it should show the "same" ability in making diagnosis as the doctors. In order to materialize this idea, the automated history taking system and the automated diagnosis-making system have been developed by various teams. In the former, patient and computer communicate with each other through the system and in the latter doctor and computer do the same interaction. Routinely, computer displays a question and man in front of the display unit is requested to answer it by pushing buttons of "yes", "no" or "I do not know". The computer located at a distance can be utilized in this system by making use of data communication system, even if in-house computer is not available.

Through these "Question & Answer" interactions, computer will find the most probable diagnosis or diagnoses (two, three or more) and show it or them on a display unit along with the probability. With the history taking system, the process does not proceed to diagnosis making but stops at the demonstration of problems and complaints of the patient.

In these interactively communicating system, the questions following vary depending on the answer to the previous questions so that the area relevant to the patients problems is investigated in detail and non-relevant area is skipped.

6. Automated monitoring and treatment-executing system

The next step of the system for making diagnosis is that where computer not only makes diagnosis and suggestions but also executes the treatment. In Univ. of Alabama's ICU system, computer is in charge of monitoring respiration, heart rate, urine volume, blood loss and so on as well as of controlling the pump for infusion tubes. When computer decides, based on parameters under observation, that an action has to be taken, the pump is switched on and water, blood or drug is administered to the patient through the infusion tube.

However, the procedure is done in a very careful manner. A small amount (e.g.: 20 cc of blood in case of blood transfusion) is given at first to see the reaction to it. If good, another dose in the same amount will be added. In case computer is no longer able to make judgement of patient's condition, the system is immediately switched to operation by doctors hands.

7. Diagnosis-making system and diagnostic logic

As described above, the hardware system for diagnosis making is fairly well

developed which includes the display unit of the patients' courses, pump controlling system for the infusion tube and so on.

However, such systems are not expected to be in general use in the near future. Rather, each system is still in experimental stage. One of the reasons for it is high cost, but the more fundamental one is the lack of reliable diagnostic logic. Reevaluation of current logic and building of new logic by making use of medical data bank is emergently necessary.

8. System for the sequence of examinations and diagnosis-making

So far systems for decision-making in clinical diagnosis by means of diagnostic logic has been discussed. However, planning a system for sequence of examinations and diagnosis is also important.

One of the examples of such system planning is the multiphasic health testing system which is becoming prevalent in these days. So far the examination stations have been scattered around in the hospital and sequence of examination has not been planned well, so that the health testing in various items has taken a considerable length of time. In the new system, the total course is finished in two or three hours. Computer is not indispensable in that system itself but computer plays a major role in booking, scheduling and data collection.

9. Future of clinical diagnosis system

As far as hardware is concerned, fairly good system is available if money can be supplied. Rapid rise of labor cost, shortage of manpower in medical field and, on the other hand, the decrease of relative cost of data processing instruments will make investment of such hardware system easier than now in the near future.

However, building of the so-called software of diagnosis system, i. e., rearrangement of diagnostic logic and establishing medical data bank started just recently and it will take time before materialization.