

Current Directions in Computer-Enhanced Radiology

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ABSTRACT—

A review of the current on-line systems and developmental research in applications of computers to clinical radiology indicates considerable use in therapeutic and nuclear radiology today. The most discussed new use in diagnostic radiology is computer-generated reports, with advantages including time-saving and retrievability and disadvantages including cost and potential difficulty in teaching.

Key Words: Computers/Reporting Systems/Retrieval/Research.

The Third Conference on Computer Applications in Radiology (1) provides an opportunity to assess the role of computers in today's practice of radiology, and suggests some of the more promising areas for new developments.

An opening session for radiologists introduced in detail many basic technical computer concepts. A physician should be able to consider the differences between time sharing on large computers and using dedicated small computers; and to evaluate availability, pertinence, and adaptability of software (computer language and programming systems) for his needs. An understanding of input and output devices and types of data storage will also be helpful in selecting a system. More specific technical matters about hardware and software systems need not be mastered by the clinical radiologist in order for him to have effective dialogue with his computer personnel. Indeed, once a system is designed or selected, communication as close as possible to the user's natural language is appropriate.

An active area of research in diagnostic radiology is radiographic image processing or analysis by computer. In the future, screening and second-look techniques could develop from such projects. Computer-assisted instruction for individual students has met with some early enthusiasm in radiology education.

Computer systems are well known to departments of radiotherapy today, especially in the developing of dose distributions for patients, contributing to more effective use of radiologists' and physicists' professional time. As workers in pattern-recognition, we are impressed with the developments in pattern-production, which included prototype film strips which demonstrate computer-produced animation images of three-dimensional body volumes (2). The fuller consideration of three-dimensional structure of tumours and host tissues should be important in future refinements of radiation planning and evaluation.

Computers have also become an important part of research nuclear medicine facilities in daily clinical practice. A significant number of papers at this year's annual meeting of the Society for Nuclear Medicine were based on computer applications.

In diagnostic radiology, the use of computers in generating, analysing and retrieving radiologists' reports was the field of greatest current interest at the conference. It was the predominant subject discussed by the Round Table Panel "Computers in Radiology—Usefulness for Present and Future Practice."

Diverse ways to use computers for report generation and retrieval were mentioned and it was agreed that at this stage such diversity of effort was welcome. However, whenever possible, programming should be done in a well-known computer language such as FORTRAN or MUMPS in order to be adaptable to other centres. Methods of input include a cathode-ray display with the radiologist typing responses to questions on the screen or using a light pen to select items in communication with the display, the checking of slots on a mark-sense card with transcribing by voice as needed, and key-punching the contents of conventionally dictated typed reports. In general, the objective is a quickly and efficiently generated hard-

copy report by a system capable of effective retrieval of the significant content.

A significant decrease of the time between generation and delivery of the radiologist's consultation is recognised as a prime advantage of computer-generated reports. Each of the systems attempts to require less of the radiologist's professional time than conventional reporting. None is now less time-consuming except for those cases needing only simple standardised reports. Efficient retrieval of reports for teaching, research, or clinical availability is almost universal in the projects. Indeed, this is the major thrust of systems which begin with already-typed conventional reports.

The input of a report into several of the systems requires a limitation of text to a pre-set structure. Potential benefit of this requirement may lie in imposition of a new logical thinking, avoidance of unnecessary words, and automatic presentation of related items of information to insure completeness of content. The standardisation of terminology in reports is a goal of modern radiology which might concurrently be abetted. A thoughtful consideration of disadvantages and problems in modes of computerised reporting arose at the meeting. The expense of equipment involved, although less than only a few years ago, is still considerable, and the need for cost-effectiveness must be considered. On the positive side there are many other departmental uses to which a dedicated computer can be put, such as patient scheduling, file room organisation, utilisation monitoring, and billing. Other expenses mentioned were the expenditure of electrical

energy and possible demand upon forest products. As opposed to advantages of having rapid retrieval for teaching, it was warned that the instruction of young radiologists to report their findings and impressions solely in a highly stylised form may have the effect of impairing the full range of teaching and learning during training. Finally, we can mention the frustrations of "down-time" during the development of a system—in which hardware or software problems make the machine unavailable for varying periods of time. Once really working, however, a computer system can be on-line virtually all day and night, and is not subject to fatigue, forgetfulness, or whim.

The interchange of ideas of design, clinical experience, and evaluation of computer dictating systems may help lead to fruitful development as a worthwhile improvement in clinical radiology.

REFERENCES

- (1) Presented September 12-15, 1972, by the University of Missouri—Columbia Medical Center and Extension Division in co-operation with the American College of Radiology and the International Committee on Computer Applications in Radiology. Gwilym S. Lodwick, Chairman, Alan E. Oestreich, Secretary of the Conference.
- (2) Sterling, T. D., Weinkam, J. J., Knowlton, K. C.: Representations of Three-Dimensional Body Volumes of Interest Through Computer-Produced Animation. Presented at the Third Conference on Computer Applications in Radiology, September, 1972.

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NOTICE

DIPLOMA OF COLLEGE IN RADIOTHERAPY

Council has approved the introduction of certain changes in the Syllabus and examinations for the Diploma of the College in Radiotherapy. All courses of training approved on or after 1st July, 1974, must conform to the new requirements. Any candidate whose course was approved before this date must have passed his Part II examination by 1st July, 1977, or else submit to the new provisions. Full details are available from the Honorary Secretary of the College at 45 Macquarie Street, Sydney, N.S.W. 2000.