HyperOncology: Demonstration of an Evolving Comprehensive Hypermedia-Based Workstation for the Radiation Oncologist

Patricia A. Michael, Ph.D., M.D.
HIS Clinical Systems Research
Rex Hospital
Raleigh, NC 27607
Internet: pmichael@med.unc.edu

R. Heath Foxlee, M.D.
Department of Radiation Oncology
Virginia Mason Clinic
Seattle, WA 98111
CompuServe: 75430,3564

ABSTRACT

HyperOncology is a prototype hypermedia-based workstation designed for the practicing radiation oncologist. Individual patient records consist of linked demographic, clinical history, presentation, staging, course, laboratory and treatment data. Searching and sorting capabilities, navigational aids, information printing and archiving, plotting capability, and graphics and updating tools are available. Upon integration with an evolving knowledge base, HyperOncology will eventually become a comprehensive clinical database and information retrieval system in the specialty of radiation oncology.

INTRODUCTION

Integrated access to basic science material, standard clinical specialty knowledge, individual patient data, and clinical databases would be a useful and efficient approach to information management for patient care in a busy clinical setting. RadOnc, a prototype hypermedia program featuring a dictionary, navigational aids, information printing and archiving, and graphics and updating tools, was developed for the resident physician in the specialty of radiation oncology in an initial attempt to fulfill this goal [1]. A relational database containing drug information called MacPharmacy was subsequently built as an adjunct to RadOnc [2]. Users could retrieve, insert, update, delete and print drug entries and freely navigate between MacPharmacy and RadOnc. Upon reviewing the status of RadOnc, the authors decided to expand and modularize the patient management capabilities. The first step in this process was the inclusion of demographic data and management notes [3]. The second step was the incorporation of individual patient laboratory data and plotting capability. This patient management module,

HyperOncology, will eventually become the core of a larger integrated system.

PROGRAM DESCRIPTION

The design guidelines for the system were as follows: 1) the interface should be user-friendly, facilitating task execution through the use of menu selection and buttons, 2) the user should be able to navigate freely between demographic, clinical history, presentation, course, management and treatment data, 3) the user should have the capability to add, modify or delete information, 4) graphics tools should be available due to the pictorial nature of the specialty, and 5) the user should be able to archive and retrieve data on past patients. These requirements are readily accommodated by a hypermedia-based system. The choice of radiation oncology as the system domain was based on the medical practice specialty of one of the authors.

Interactive hypermedia systems consist of nonlinear text, graphics and audiovisual media with navigation, linkage and data entry capabilities [4,5]. HyperCard, a hypermedia authoring tool for the Macintosh computer, was chosen as the application design tool for HyperOncology because of its user-friendly text and graphics tools and linkage capabilities and its role in successful implementation of medical record systems [6,7,8]. HyperOncology was developed using HyperCard 2.0 and is demonstrated on a Macintosh SE 2/40 but is usable on any Macintosh computer with at least two megabytes of internal memory.

The Demographics, Management, Patient, and Treatment stacks comprise the central patient management stacks. The data stacks consist of pharmacy, chemistry, hematology and urinalysis, microbiology, drug level, blood bank, ABG and radiology data organized by patient. Nontextual

laboratory data on individual patients in the data stacks can be plotted and viewed on the Display card in the Authors stack. The Diagrams stack contains scanned anatomical images which can be imported to the Treatment stack. Installation and stack version upgrading can be performed from the Toolbox card in the Authors stack. From any stack, the user can start up HyperOncology, obtain help information, and navigate to any other stack.

There is one card per patient in each of the patient management stacks (four cards total per patient) except for the data stacks which have one card per patient per laboratory test. The information fields on each card are organized in a manner that facilitates data review and evaluation. The Demographics and Management cards have been previously described and illustrated [3]. The Patient card contains ICD-9 codes, attending and referring physicians, age, race, sex, tumor site, histology, staging, Karnofsky Performance Status, significant dates, history, course, follow-up and a "to do" list. The Treatment card contains managing physicians, tumor site, treatment detail and adverse effects. The data card is common to all data stacks and contains managing physicians, test name and date, and results. The user can click on any test item (e.g. Na) and obtain a plot of all previous and current results of that item for that patient.

From any of the patient management stacks, the user can search for a patient, sort cards by patient name, create new patient cards in each stack, print selected stacks, and archive and retrieve patient cards. Text can be freely added to individual cards in the patient management stacks. Treatment diagrams can be drawn on the white space on the left side of the Treatment card using HyperCard's graphics tools, or they can be imported from the Diagrams stack.

DISCUSSION

HyperOncology provides integrated access to demographic, clinical history, presentation, staging, course, laboratory and treatment data. Searching, sorting, diagram importing and data plotting functions are available. Template cards facilitate expansion of the database and can be customized to adapt to any medical specialty. For example, a chemotherapy-oriented treatment card could be substituted for the radiotherapy-oriented treatment card to make the software more useful

for a medical oncologist. Continuing development will focus in the short term on statistical analysis of patient data and quality assurance monitoring and in the long term on linkage to upgraded dictionary and disease description stacks from RadOnc to create a comprehensive workstation for the practicing radiation oncologist.

References

1. Michael PA and Foxlee RH. "RadOnc: An Integrated Clinical Database and Information Retrieval System Implemented by HyperCard." *Proceedings, The Thirteenth Annual Symposium on Computer Applications in Medical Care*, 1989, pp. 966-967.
2. Michael PA and Foxlee RH. "MacPharmacy: A Relational Database Adjunct to a Hypermedia-Based Physician Workstation." *Proceedings, The Fourteenth Annual Symposium on Computer Applications in Medical Care*, 1990, pp. 984-985.
3. Michael PA and Foxlee RH. "HyperOncology: A Hypermedia-Based Workstation for the Radiation Oncologist." *Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, Vol. 13, No. 3., 1991, pp. 1355-1356.
4. Conklin EJ. "Hypertext: An Introduction and Survey." *Computer*, September 1987, pp. 17-41.
5. Lynch PJ and Jaffe CC. "An Introduction to Interactive Hypermedia." *J Biocommun* 1990, 17(1): 2-8.
6. Dambro MR and Jennings DP. "HyperMed: Medical Records Implemented with HyperCard." *Demonstrations Digest, The Twelfth Annual Symposium on Computer Applications in Medical Care*, 1988, pp. 49-50.
7. Jennings DP and Dambro MR. "Using a HyperCard Workstation to Interface with a COSTAR Data Base." *Proceedings, The Twelfth Annual Symposium on Computer Applications in Medical Care*, 1988, pp. 445-447.
8. Shultz EK and Brown RW. "The Interactive Medical Record: A Hypermedia Prototype." *Demonstrations Digest, The Twelfth Annual Symposium on Computer Applications in Medical Care*, 1988, pp. 15-17.