SURGICAL PATHOLOGY ACCESSIONING AND MANAGEMENT
ON A MULTI-USER HARD DISK MICROCOMPUTER SYSTEM

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Abstract

With the advent of hard disk microcomputer technology, on-line storage of a large surgical pathology data base is now possible. We have developed an inexpensive, microcomputer-based, multi-user, hard disk system for surgical pathology which utilizes a commercially available word processor and data base management system. System functions include word processing with the generation of preliminary and final surgical reports, on-line access to a large surgical pathology data base, printing of daily secretarial and histology log sheets, and semi-automated SNOMED coding. Successful implementation of this system has already resulted in more efficient file management, both in the storage and retrieval of data.

Introduction

Montefiore hospital is an acute-care adult 500-bed medical-surgical facility affiliated with the University of Pittsburgh Health Center. The department of pathology processes about 7500 surgical specimens and 125 autopsies per year. While advances in the computerization of clinical laboratory data have continued in recent years, similar handling of surgical pathology data has not proceeded at the same rate. Many surgical pathology data base management systems have been described in the literature, but they are most often implemented on large, expensive main frame computers. The recent development of multi-user software and hard disk technology has increased storage capacity and the number of peripheral devices which can be run from the same small, inexpensive microcomputer. For these reasons, we developed a comprehensive microcomputer-based, hard disk, multi-user system for use in our surgical pathology department. The system provides word processing, on-line access to the surgical pathology data base, daily logs, and computer assisted SNOMED coding.

Materials and Methods

The system hardware consists of a NorthStar Horizon central processing unit containing 224k of random access core memory. This memory is divided into four separate parts: each of three peripheral terminals receives 64k of random access memory, with the remaining 32k used for internal purposes by the microcomputer. An 18 megabyte Winchester hard disk drive is also employed, with a tape back-up system for duplication of hard disk data. One letter quality 33 character per second NEC Spinwriter 3510 printer and one DEC LA-36 dot matrix 36 character per second printer are used for the generation of surgical reports and daily log sheets. The system is expandable, and can accommodate up to nine peripheral devices on a multi-user basis. The central processing unit also contains one quad-density disk drive with 380k of storage capacity per 5½ inch floppy diskette. Word processing (Wordstar*), data base management (Condor series 20 +++, and bookkeeping functions are all easily facilitated on this multi-user system. Furthermore, the price range for a system of this type is not excessive (total cost about $18,000), although no professional programming costs were incurred. All programs were written by us, with the exception of the word processor and data base management system. The programming was done in Microsoft Basic and compiled with the Basic Compiler***. The entire system runs under the CP/M disk operating system.

Results

Demographic and specimen information is entered through a cathode ray terminal (CRT) located in the histology laboratory (Fig. 1). Surgical accession numbers are automatically assigned to each specimen, decreasing transcription errors. Each case may also be edited throughout the day, and manual assignment of surgical numbers is also possible. These functions are performed by a Microsoft Basic program which correctly formats the entered data for printing on a five-part surgical pathology report form. The entered data is then stored as an ASCII file, in a format which the commercial word processor can utilize. After entry of this data, the pathologist performs the gross examination of

* NorthStar Computers, San Leandro, Calif. 94577
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*** Microsoft Inc., Bellevue, WA 98004
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+++ Micopro International Corp., San Rafael, Cal.
The specimen and dictates the information for transcription by the secretarial staff. Cross descriptions are appended to the demographic information by the medical secretary through the word processor. When the daily work is completed, numerical and alphabetical log sheets of all entered cases are generated and the individual cases are merged into a large daily file from which the gross dictation is printed. Telephone inquiries regarding individual cases can be easily answered by the use of the word processor.

Following microscopic examination of histologic slides, microscopic descriptions and diagnoses are appended to the surgical report, once again using the word processor. Another compiled program enables computer-assisted diagnostic coding of the English text diagnostic statements using the SNOMED nomenclature for surgical pathology. Diagnostic codes are retrieved and printed by this program, utilizing a SNOMED lexicon stored on the hard disk. The codes and their abbreviated English equivalents are then manually entered into the data base after review by the responsible pathologist. The daily files are kept for twenty working days, constituting a one-month temporary file which resides in its own text area on the hard disk. As these files are stored, they are broken down by a third compiled program which extracts pertinent demographic and diagnostic data and stores it in a form that can be integrated into the main data base. Therefore, all surgical pathology data is available for on-line use at any time. Case study is facilitated by using the data base management system to locate cases by a variety of demographic or diagnostic parameters.

Utility programs allow construction of the original SNOP or SNOMED files by the user, with provisions for the addition, deletion, and editing of the individual codes and their English text equivalents. Each terminal, by virtue of its separate random access memory, can be used by any qualified individual for the performance of any task within the department. Since billing information is already present within the temporary files, future programming will concentrate on utilizing this information for billing and workload recording purposes.

**Discussion**

In a previous report from our institution, the feasibility of an inexpensive microcomputer based system for anatomic pathology was demonstrated. Computer assisted SNOP coding was available with that system, but not the recently developed SNOMED classification. Also, the limitations of storage space with 5¼ inch floppy diskettes severely hampered efficient use of that system on a real time basis. Previously, most computer systems dealing with surgical pathology data base management were implemented on expensive mini- or main frame computers. Computerized coding of final diagnoses using these larger systems has also been described.

The widespread use of microcomputers has led to the description of several diagnostic coding programs in the recent literature. However, many of these systems do not employ hard disk technology, and are therefore severely hampered by the lack of storage space. The use of floppy disk drives often delays system performance due to the relatively slow access speed of these units when compared to the newer Winchester hard disks. Because of these inherent difficulties, we devised a system incorporating our own programming and commercially available software implemented on the latest microcomputer hardware. The word processor allows easy secretarial manipulation of report information, while the data base management system permits rapid retrieval and cross referencing of a large surgical pathology data base. By virtue of its increased storage capability, 60-70,000 cases containing abbreviated demographic and diagnostic information can be kept on-line for immediate use by pathology personnel. Our own programs enable the production of sequential ASCII files which can be used by the word processor and data base system. Generation of daily log sheets prevents repetitive work in both the secretarial and histology divisions of the laboratory.

The system hardware is of utmost importance in the operation of our system. The NorthStar Horizon central processing unit can handle up to nine peripheral devices simultaneously, enabling terminals and printers to be placed in various areas of the laboratory. The system is also password protected, thereby preventing unauthorized access to the surgical pathology files. Because each terminal and printer operates individually from the rest of the system, ongoing program development can take place while the daily workload is being processed.
The Winchester hard disk combines tremendous storage capability plus fast access time when searching for records within a large database. Furthermore, up to four of these drives can be supported by the microcomputer, bringing the total available online storage capacity to 72 megabytes. While this system contains sufficient storage capability equal to that of much larger mainframe systems, its entire cost was about 18,000, well within the reach of any hospital laboratory. To date, use of the system has resulted in greater coding accuracy and more efficient data storage and retrieval within the surgical pathology laboratory. Access to current patient information is greatly enhanced by the word processor, and the database management system will eventually replace the card files which are currently used in our laboratory.

Despite the obvious advantages of this system, heavy use can lead to slightly slower operation. However, each terminal can be given a higher or lower priority to accomplish the work necessary at any given time. Because the system is both efficient and expandable, it is ideal for use in the surgical pathology laboratory. With decreasing microcomputer costs and more refined programming languages, the implementation of this system as described is now feasible for any hospital surgical pathology laboratory. While we also have a mainframe computer in the clinical pathology section of the laboratory, there does not appear to be sufficient technology available at the present time which would allow an interface between the two computer systems. To our knowledge, such technology is presently under development but not currently available for use.

References