Contemporary Issue

APPLICATION OF COMPUTER TECHNIQUES IN MEDICINE

**Lt Col VK MEHTA*, Dr PS DEB+,
D SUBBA RAO#**

ABSTRACT

Computers are being increasingly used in medical profession. There are different levels of interface of medicine and computer technology. This article has been written to create computer awareness in medical professionals and impress upon them the necessity and benefits of various computer techniques in medicine, health and hospital services.

MJAFI 1994; 50 : 215-218

KEY WORDS : Computer, Medical informatics

Introduction

Computers are becoming increasingly popular every passing day amongst a wide section of people. With the advent of microcomputers in late seventies and their subsequent performance enhancement in eighties, computers have reached our homes. Computers have undoubtedly revolutionized our whole life style. Computer techniques have tremendous applications in medical field, where it has the largest amount of social impact. Computers are playing an important role in the running of large hospitals.

Computer facilities are now regarded as integral to much diagnostic equipment. Major uses of computers in medicine include hospital information system, data analysis in medicine, medical imaging laboratory computing, computer assisted medical decision making, care of critically ill patients, computer assisted therapy and so on.

The word computer comes from the word "compute", which means to calculate. Computer can be defined as an electronic device that is designed to automatically accept data, store and process then producing output re-

sults. Computers are used to store and process large amount of data and provide information to the user and to perform large number of calculations rapidly and accurately. Charles Babbage is considered to be father of modern computer [1].

Components of computers : Hardware, Software

Hardware is the term given to the physical components of the computer system. Hardware is basically divided into three units :

1. **Input devices :** Input devices convert the data to be processed into a format acceptable to the computer. The data is then passed on to the central processing unit of the computer. The input devices include punch cards, magnetic tapes, key board and so on.
2. **The central processing unit (CPU) :** The CPU is the brain of the computer. All major calculations and comparisons are made here. It has three constituents, the memory units, the control unit and the arithmetical logic unit.
3. **The output devices :** The output devices accept the result produced by CPU and

* Classified Specialist (PSM) and OC SHO Golconda, Hyderabad 500 008. + Consultant Neurologist, Apollo Hospital, Jubilee Hills; # Sr Manager System, Apollo Hospital; Hyderabad 500 033.

supply the results to users. Printers and visual display units are the popular output devices of computers.

Software are the set of programs that control the activity of processing by the computer. There are two types of software, system software and application software. System software are collection of programs which allow the user to interact with the computer hardware, e.g. operating system like DOS, UNIX and compilers like C, FORTRAN, COBOL and BASIC. Application software consists of programs which perform special functions for the user such as word processing, data processing and spreadsheet programs.

Computer Techniques in Medicine

The application of computer techniques in various fields of medicine is briefly discussed below :

Hospital information system

Medical informatics is a rapidly growing discipline. It seeks to organize and manage information in support of patient care, biomedical research and education through the aid of computer and information networks [2]. A computerized hospital information system can establish consistent standards in the transmission and storage of data and continuously monitor all transactions. It provides easy access to valuable patient care information. The physicians can have direct access to all the information of his/her patient through the use of computer. A hospital information system generally covers areas like registration, admission/transfer/discharge, billing, medical record, index, wards, operation theater scheduling, stores/inventory, pharmacy, diet, CSSD, bio-medical maintenance, payroll, accounts, etc.

To date, several software vendors have developed hospital systems relating to managing hospitals [3]. Generally hospital administrators prefer to buy ready made package and customize the same to suit their needs.

Data Analysis in Medicine

In medical research large number of data is

collected. This data is to be compiled, analyzed and interpreted. For this purpose, certain statistical methods are to be applied, these include calculation of standard deviation, standard error, application of tests of statistical significance like Z Test, unpaired and paired t test and chi-square test. Statistical methods are time consuming. With the help of computer, large number of statistical calculations can be performed in a very short time.

Several good quality statistical packages are available, which allow the use of many more methods than is practical using traditional paper calculations [4]. These statistical packages include the following :

1. The biomedical computer package (BMD) : This was the first package developed and provides a standard set of advanced statistical programs.
2. Statistical package for the social sciences (SPSS) : It is used for wide range of medical problems. Many statistical options are available in SPSS varying from simple statistics to multivariate analysis.
3. Genstat : This is a powerful package with special emphasis on analysis of variance.
4. Epi-Info : This package is developed by WHO for epidemiological studies. This package has word processing, data analysis and graphical abilities. Questionnaire can be made directly by text editor. Data analysis is very simple and serves the need of most of investigators. The program is made available by WHO and CDC (Centre for Disease Control) and are not copyrighted. Making copies for others is permitted and encouraged.

Laboratory Computing

The primary objective of a clinical laboratory is to provide accurate results in short time. Laboratory analysis includes blood chemistry, photometry, microbiology, etc. Results must match with patient identification details and should be valid. Quick access to laboratory system can contribute to efficient patient care system.

Computer Assisted Decision making (CMD)

It is an interactive computer system that directly assists doctors with clinical decision making task. The system is intended to support doctors, complementing their natural abilities to make judgment with computer's vast memory, reliability and processing capabilities. A general model of computer assisted medical decision making has been developed [5].

Care of critically ill patients

Critically ill patients require large number of therapeutic interventions to optimize their chances of survival. For this, the variables must be collected frequently and the data derived therefrom made available to the clinicians and nursing staff. This results in a large quantity of information, which may lose its significance unless the data recorded is presented in a clear manner. In the intensive care unit it is now possible to computerise the total management of data recorded on the patients. Data management includes the entry, integration and reporting of all vital signs, medications, intake and output volumes and laboratory values.

Closed loop system for the direct computer control of the infusions of vasodilator has been developed [6]. An intraarterial canula connected to a suitable cardiovascular monitor provides the input signal to the computer. A pump which infuses the vasodilator drug to the patient is controlled by computer to maintain the arterial pressure within predetermined units.

Computer assisted therapy

Methods for planning, monitoring and ad-

justing dosages regimens of powerful and potentially toxic drugs, e.g. digitalis and antibiotics like gentamicin have been developed. The physician can plan dosage regimens by selecting a target peak total body concentration of a drug.

Medical imaging

During last decade computers were commonly used for high resolution image generation. Dedicated hardware and software is required to generate such images in CT scan, MRI, ultrasound, and gamma cameras. It is possible to integrate these workstations to the main hospital information system. Three dimensional images of living human anatomy, regional physiology and biochemistry in health and diseases are in use.

Other applications of computer

In addition computers are being used in primary health care, psychiatry, physiological measurements, medical education, literature search, and as an aid to the handicapped.

Limitations

Although computers can store and retrieve large amount of data and perform complicated analysis in very short period, their major limitation is that they lack decision making power and are not sensitive like human brain. Data entry is major hindrance for using computers by medical professional.

Computer virus is a generic term used to describe any of a group of willfully destructive computer programs. Viruses can multiply with repeated use of a program and can be transmitted with executable programs. They can destroy program files, data files or erase all data from hard disk. Commonly found viruses in our country are Joshi, Michael Angelo, DirII, India etc. There are anti-virus programs available to remove a virus from a file. Due to newer introduction of viruses it is difficult to completely eradicate viruses. Some of antivirus programs are Scan, CPAV (Central Point Anti Virus), and Norton anti virus.

Faculty of Computers, Military College of

Telecommunications, Mhow is running regular courses for all ranks on applications of computers in different fields. In many garrisons, computer courses are being organized at station level. Although computers have tremendous scope in different field of medicine, the contrast between the apparent need for clinical computing systems and their slow establishment is well recognised. The ability of such systems to solve some of the problems associated with the traditional medical records is also well recognized. Yet after almost 30 years of endeavor and the development of many different systems the number in daily use is relatively small [7]. There is urgent need to create computer awareness among medical professionals. They need to familiarize themselves with application of computer in medicine and make best use of it.

REFERENCES

1. Malni AK, Bhatnagar P. *Computer Science made easy*. Delhi, Pustak Mahal, 1991; 41-3.
2. Formica PE, Scott WC, *et al*. Medical Informatics : An emerging Medical Discipline. *Journal of Medical Systems* 1990; 14 : 161-79.
3. Lele RD. *Computer in Medicine*. New Delhi, Tata McGraw - Hill Publishing company Limited, 1989; 30-2.
4. Brown RA, Swanson BJ. *Medical Statistics on Micro Computers*. Plymouth, Latimer Trend and Company Limited. 1992; 6-7.
5. Reggia J, Nua D, *et al*. Diagnostic Expert Systems based on a set covering model. *International Journal of Man Machine Studies* 1983; 19 : 437-60.
6. Hammard JJ, Kirkendall WM, *et al*. Hypertensive crisis managed by computer controlled infusion of sodium nitroprusside, a model for the dosed loop administration of short acting vasoactive drugs. *Computer and Biochemical Research* 1979; 12 : 97-108.
7. Young DW. Clinical computing systems : Their slow introduction. *Postgrad Med J* 1990; 66 : 333-5.