

COMPUTERS IN THE MANAGEMENT OF DIABETES

Ajay Sood

Great increase in the amount of information in the field of medicine, has prompted one to look for better means of handling the vast store of knowledge. Creation of specialities in response to the above need, has reached its limit of usefulness, as more and more facts accumulate in one speciality itself. Computers seem to be an effective tool for solving this problem. They are now being used increasingly in the management of patients with diabetes mellitus.

Storage of information

Diabetes mellitus is a chronic disease and requires long term care. It generates a large amount of data for each patient. When a physician sees a patient, he needs to know as much as possible about the past history and course of the disease-A computerised registry will be a feasible solution for this problem.^{1,2} New data about the patient can be entered on each follow up visit, while previous information on the patient can be retrieved. Information about the patient can be retrieved in the form of raw data or can be analysed in various ways.

Monitoring of the patient

Self monitoring of blood glucose : Self monitoring of blood glucose (SMBG) has been shown to improve the control of diabetes mellitus. The values of blood glucose obtained by SMBG can be entered into the computer and instant analysis can be obtained. Reflectance glucometers with memory function have been developed. These can store upto 130 values of blood glucose measured in the last few days prior to a visit to a physician. These reflectance meters can be interfaced with a computer and data transferred directly to the computer without the use of clerical or data-entry staff.³ Instant graphical generation of the results of SMBG is possible.

Critical analysis of level of control: Blood glucose values can be accessed in a number of ways. The values can be displayed graphically for various days of the week, or for various times of the day. For example, if the patient has different routine on the week-end, then one may look at the values of the two days of the week-end for closer scrutiny. The blood glucose levels can also be averaged or their frequency distribution presented as histograms. Analysis can be made of the blood glucose values and the insulin received. A program which simultaneously also processes the nutrition data can relate the blood glucose values to the amount of carbohydrate consumed at various times of the day.⁴ All this helps in better understanding of the pattern of the disease in a particular patient.

Department of Endocrinology Diabetes, All India Inst. Med. Sciences, New Delhi. India.

Check on investigations : A computer can provide a reminder to the physician whenever a particular investigation is missed, or provide a cue when the investigation needs to be repeated.

Treatment of the patient

Quick analysis of the data especially of SMBG, not only provides better insight to the physician, but also increases the interest of the patient in their control by helping them understand their disease better^{2,3*}. It has been demonstrated that the control of diabetes is improved when computers are used in its management².

Dose of insulin : The dose of insulin required for the control of diabetes can be quickly and accurately decided, using algorithms made for this purpose—Using previous data about the blood glucose and the requirements of insulin in a particular patient, individual variations regarding sensitivity of the patient to insulin can be taken into account while deciding the dose required. Chanoch *et al*⁵ developed a program for a pocket computer to assist patient in deciding the dose of insulin required while using constant subcutaneous infusion system. In deciding the dose following factors were taken into account : gender of the patient, pre—and postprandial blood glucose values, weight of the patient, time of the day and the carbohydrate content of the food being ingested. They tested this computer program on five patients, and reported better patient participation in the management of the disease accompanied by improvement in diabetic control. The computer also suggested ingestion of carbohydrate when blood glucose values decreased below a certain level. None of the patients developed episode of hypoglycemia which they could not treat themselves with suggested carbohydrate snack.

Other programs developed, accommodate different regimens of intensive conventional therapy, including 2, 3 or 4 injections per day as well as continuous subcutaneous insulin infusion; allow for seven graded levels of control, including that for pregnancy; and use different algorithms for insulin dose adjustment⁶. Physician can run the program to satisfy the need of a particular patient, by adjusting several 'threshold, and 'sensitivity' values to obtain desired level of control, consistent with individual 'brittleness' and willingness to monitor the blood glucose frequently.

Closed loop insulin delivery pump : A pre-programmed computer uses the blood glucose value sensed by a glucose electrode, and decides the dose of insulin to be delivered by the pump. This feedback system can control the blood glucose very effectively.

Drug interactions : Physician can be warned about any adverse drug interaction, likely to occur when a new drug is started.

Patient education

Microcomputers can be effectively used for patient education both at home and in the hospital. It has been seen that patients using microcomputer system in the management of their disease, perform more SMBG determinations than those not using it*.

Programs written in BASIC computer language are available and provide several functions which include electronic notebook for entering data, facilities for graphic display of data, monthly summary with brief statistical analysis and detailed statistical analysis⁶. Number of studies^{1,2,4} demonstrate improved patient and physician compliance and a better diabetic control with the use of computers in management of diabetes mellitus. Development of more user friendly programs will let physicians use computers easily without any formal training in computer science. All this is likely to make the use of computers more popular in the management of diabetic patients.

References

1. Gardner DW, Klachko DM (Nov. 10-Nov. 13, 1985). A microcomputer based diabetic patient registry for patient management and clinical research. Proceedings on the Ninth Annual Symposium on Computer Applications in Medical Care, Baltimore. Ed. Ackerman MJ : 87-91.
2. Niihira S, Inada H, Tei S, Aono S, Isshiki G, (1987). Application of computer programs in management of diabetic children. Acta Paediatr Jpn 29 : 385-392.
3. Kuykendall VG, Michaels DW, Hartmann KG, (Nov. 10-Nov. 13, 1985). Assessment of self-monitored blood glucose results using a reflectance meter with memory and microcomputer. Proceedings on the Ninth Annual Symposium on the Computer Applications in Medical Care, Baltimore. ED. Ackerman MJ : 98-102.
4. Laron Z, Faiman G, Flexer Z. Rapaport M, (1987). Use of computer program in the treatment and education of young diabetics. Acta Paediatr Jpn 29 : 378-84.
5. Chanoch LH, Jovanovic L, Peterson CM, (1985). The evaluation of a pocket computer as an aid to insulin dose determination by patients. Diabetes Care 8 : 172-6.
6. Rodbard D, Penick N, Jaffe ML, (1984). Diabetes data management program available for microcomputers. Diabetes Care 7 : 401-2.