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# Experimental Computer-Based Management System of Patients in Radiation Oncology

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**Currently, many computer systems are used in many areas of medicine including radiation oncology. For the most part, the computer system has proved to be useful in radiotherapeutic planning and dose calculation. There has been attempts to develop computer system including information management of patients, patient tracing, and office automation in radiation oncology department. But some of these available commercial systems have shortcomings.**

**We developed a management system of patients in our radiation oncology department that integrated most of items for the evaluation of patents. In particular, the data were stored in a natural language (noncoded) and made themselves easily understandable by all clinical groups. In addition , the data could be isolated in files from which the computer could generate graphs and static data by the use of some simple commands. The system provided us with not only the functions of case review but funtions of preparation of conferences, lectures and resident teaching.**

**Key Words:** Computer, Management system, Data, Commands

## INTRODUCTION

During the last decade, many computer systems have been developed and implemented in a number of radiation oncology departments mainly in academic centers and clinics. For the most part, these systems have proved to be effective in radiotherapeutic planning and dose calculation. During the same period, there have been numerous attempts by many programmers or system designers to develop managements systems for radiation oncology departments. These developing systems have functions including radiotherapeutic planning and dose calculation. However the attempts to develop management system including registration, scheduling, patient tracing, file management and providing office automation in radiation oncology departments have been limited and not quite successful[1], at least in part, because of the lack of understanding by programmers or system designers of how radiology departments really functions. Another major reason for such a failure is high cost of software and hardware.

We are reporting the results of our experimental computer program of patients management system developed in our radiation oncology department.

## MATERIALS AND METHODS

### 1. Hardware and Software

The computer system we used was a 16 BIT PC TURBO XT (GULBANG CO. SEOUL KOREA). This was a 16-BIT machine with 640-kilobyte internal memory connected to two floppy disk drivers with 720-kilobyte total capacity. This computer had the card of korean. We used two types of the printer namely Epson RP80 printer (EPSON CO. JAPAN) and GOLDSTAR printer of typewriter type (GOLDSTAR CO. KOREA).

We made the program of data managment using one of the popular operating program. By integrating spreadsheet analysis, information management, and graphics into a single program, the user was readily accessible to programs, directories, and files; it also provided interactive access to the data base. Most of the data base programs were written in the language "c". This was a fully transportable software that ranges among D-BASE II, D-BASE III+, and other programs-data base system including PFS file system. These data base systems were accessible by users without special interface.

## 2. Input Design

We designed data field as shown in Figure 1, which included fields of hospital number, chart number of radiation oncology department, name, sex, age, diagnosis, planned total dose, memo for describing of complication or physician's order, inpatient outpatient(I/O), room number of patients in the ward, and date of treatment. Also the total number of patients, number of inpatients and outpatients, the number of discharged patients could be described automatically (Fig. 1).

## 3. Data Entry

After the initial entry of data base, the patient's medical record including the hospital number and the chart number of radiation oncology department, name, age, sex, memo including complication or physician's order, schedules, radiation dose, and room number were entered (Fig. 2). The number of total patients and discharged patients could be calculated by a function key at the three lines above field names automatically. We were able to use not only English but also korean words by using computer card of korean word. We could edited the letter and number by using edit key.

## 4. Output Design

The data base was too large to watch entirely through single screen of a computer monitor, so we used the screen as a window, through which we could view the entire data base at a glance. Using the vertical window function between the field of total dose and date, the transient abbreviation of the data field was accomplished for viewing the entire data base at once. Data exploring was performed without programmer's support and could be made as specific as the user proposed. The output of the data exploring was independent of the exploring pattern and the exploring output went to a printer, terminals, or into a file for further investigation by the computer (Fig. 3). These files were transportable among Symphony, Jazz, Visicalc, and dBase without a special program of utility. It was remarkably easy to express data base in graphic forms. Charts with a professional appear-

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          Total                Ward    OPD  Discharge  Whole  No. of TX  No. of TX  No. of TX  No. of TX  No.of TX
-------------------------------------------------------------------------------------------------------------
Chart No.No. Name  sex/age  Diagnosis  TD      memo     I and O  date       date       date       date       date
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**Fig. 1.** The input design of data fields.

| | | TOTAL | | WARD | OPD | DISCHARGE | WHOLE | NO. OF TX | NO. OF TX | NO. OF TX | NO. OF TX | NO. OF TX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 18 | | 9 | 9 | 42 | 60 | 14 | 13 | 13 | 14 | 13 |
| CHART NO. | NO. | NAME | SEX/AGE | DIAGNOSIS | TD | NEMO | I AND O | 5-10-87 | 6-10-87 | 7-10-87 | 8-10-87 | 9-10-87 |
| 12345 | 27 | 김철수 | M/45 | LUNG CA | 6000 | CHEST PA | | 5040 | 5220 | 5400 | 5500 | 5760 |
| 12345 | 30 | 이영희 | F/57 | LUNG CA | 6000 | | | 5220 | 5400 | 5500 | 5760 | 5940 |
| 12345 | 32 | 김철수 | M/13 | ALL | 2400 | CBS | 1318 | | | | 1500 | 1650 |
| 12345 | 34 | 김철수 | M/65 | RECTAL CA | 5500 | ELECTRON | | 3600 | 3780 | 3960 | 4140 | 4320 |
| 12345 | 37 | 이영희 | F/45 | CX CA | 5000 | | | 3200 | 3400 | 3600 | 3800 | 4000 |
| 12345 | 39 | 김철수 | M/55 | LUNG CA | 6000 | BONE META | | 2700 | 2880 | 3060 | 3240 | 3420 |
| 12345 | 40 | 이영희 | F/32 | CML | 400 | BACK PAIN | 1317 | | | | 210 | 240 |
| 12345 | 42 | 김철수 | M/57 | LUNG CA | 5500 | WOUND | 1002 | 1080 | 1260 | 1440 | 1620 | 2520 |
| 12345 | 43 | 이영희 | F/18 | ALL | 1800 | | | 1800 | | | | |
| 12345 | 44 | 이영희 | F/59 | CERVIX CA | 5000 | S TOOL 7 | | 2340 | 2520 | 2700 | 2880 | 3060 |
| 12345 | 46 | 김철수 | M/57 | BONE META | 3000 | | 1306 | 2100 | 2400 | 2700 | 3000 | |
| 12345 | 47 | 김철수 | M/47 | LUNG CA | 5500 | OXYGEN | 1307 | | | | | |
| 12345 | 48 | 김철수 | M/15 | ALL | 1800 | | | 1440 | 1620 | 1800 | | |
| 12345 | 49 | 김철수 | M/65 | LUNG CA | 6000 | EFFUSION | 911 | 360 | 540 | 720 | 900 | 1080 |
| 12345 | 50 | 김철수 | M/60 | LARYNX CA | 6600 | | | 1440 | 1620 | 1800 | 1980 | 2160 |
| 12345 | 51 | 이영희 | F/49 | LUNG CA | 6000 | | 1318 | 1260 | 1440 | 1620 | 1800 | 1980 |
| 12345 | 53 | 김철수 | M/57 | LUNG CA | 4500 | | 1318 | 900 | 1080 | 1260 | 1440 | 1620 |
| 12345 | 54 | 김철수 | M/58 | BONE META | 3000 | | 805 | 1200 | 1500 | 1800 | 2100 | 2400 |

**Fig. 2.** The input field showing management data of patients in radiation oncology.

| NAME | DIAGNOSIS | 21-9-87 | 22-9-87 | 23-9-87 | 24-9-87 | 25-9-87 |
|---|---|---|---|---|---|---|
| 김○주 | MEDIASTINA | 750 | 1000 | 1250 | 1500 | 1750 |
| 정○동 | LUNG CA | 3960 | 4140 | 4320 | 4500 | 4680 |
| 임○렬 | LUNG CA | 3600 | 3780 | 3960 | 4140 | 4320 |
| 김○자 | CX CA | 3600 | 3780 | 3960 | 4140 | 4320 |
| 우○자 | ALL | 1500 | 1650 | 1800 | 1950 | 2100 |
| 최○자 | BREAST CA | 2520 | 2700 | 2880 | 3060 | 3240 |
| 이○빈 | RETINOBLAS | 2200 | 2400 | 2600 | 2800 | 3000 |
| 전○화 | LUNG CA | 2160 | 2340 | 2520 | 2700 | 2880 |
| 김○원 | LUNG CA | 1440 | 1620 | 1800 | 1980 | 2160 |
| 이○대 | CML | 210 | 240 | 270 | 300 | 330 |
| 이○명 | CML | 175 | 200 | 225 | 250 | 275 |
| 이○형 | LUNG CA | | | | | |
| 이○주 | ALL | 720 | 900 | 1080 | 1260 | 1440 |
| 조○필 | CERVIX CA | 720 | 900 | 1080 | 1260 | 1440 |
| 구○환 | LUNG CA | 720 | 900 | 1080 | 1260 | 1440 |
| 이○상 | BONE META | 900 | 1200 | 1500 | 1800 | 2100 |
| 성○희 | LUNG CA | 720 | 900 | 1080 | 1260 | 1440 |
| 박○수 | ALL | 360 | 540 | 720 | 900 | 1080 |
| 김○석 | LUNG CA | | | | | |

**Fig. 3.** The output design for printer.

ance could be generated on the screen in a few minutes. We displayed line graph for the daily number of treated patients in radiation oncology department.

## DISCUSSION

There are many computer systems developed and developing for the using in the medical field including radiation oncology. Some of the systems have functions covering radiotherapeutic planning and dose calculation. A few attmepts have been made to develop computer system including information management of patients, patient tracing, and office automation in radiation oncology departments.

But most of these commercial systems so far developed was unsatisfactory[1]. Many computer applications in radiation oncology were used independent small systems without internal online system. The available systems rarely communicated with each other or with computer systems outside the department, in spite of needs of communicaiton. Consequently, the future radiology department shall be designed with a network of interconnecting computers transferring informations to each other. The idea of a standard radiology computer-system has not been well recognized by many people of the hospital data processing departments who have a vested interest in large main frame systems with a centralized control also. This resulted in the creation of high cost of hardware[2].

Currently, many computer applications used in radiology were independent small systems without integrated support of de partment. In general, the software which was written by the outside personnel was unsatisfactory, because (of the lack of understanding by) programmers or system designers had the lack of knowkdge about real functions of radiology departments, and both data analysis and input cannot be accomplished without programming knowledge. As a result, considerable time and money were wasted by improperly designed computer systems[3].

For solving these problems, there were several requirements[4]. The input of data must: (a) interact in a procedures of large volumes. Data storage must be in a format that is readily accessible so that the system can be performed on line and in a comprehensible and natural language style to aid in communication. Data output must: (a) be relatively rapid because of the size of data base: (b) be easily performed without a programmer's support: (c) allow for intercorrelative studies between procedures: and (d) have the capabilities of computer statistical analysis of date.

It is now possible to purchase powerful personal computers at reasonable prices[4], and there are

many operating systems for personal computer. Many individuals and departments have had experienced with commercial or home made software and some of then were useful but unpublished. We have developed experimental program for personal computer by integrating spreadsheet analysis, information management, and graphics into a single program. It takes a few keystrokes to generate it, and produce a hard copy on any of a variety of plotters and printers. This operating system can be used, in the minimum, 256 k internal memory.

We developed data base system to integrate most of items for evaluation of patients in radiation oncology fields. Data were stored in a natural language (noncoded), making them easily understandable by all clinical groups. Data can be isolated in files, from which the computer can generate graph and static data by the use of some simple commands. Not only functions of case review were served by the system, but functions such as preparation of conferences and lectures, resident teaching through follow up were served.

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**═ 국문초록 ═**

## 방사선치료 환자관리를 위한 컴퓨터 프로그램의 실험적 제작


**최일봉 · 김춘열 · 박용휘**

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근래에와서 치료방사선학 영역에서의 전산화가 급속히 이루어지고 있으나 그 전산화의 대부분은 치료계획용 계산에 치우쳐져 있고 환자정보관리, 퇴원환자의 추적검사, 환자관리사무에 있어서의 전산화에 필요한 프로그램등 환자관리에 필요한 프로그램은 매우 적으며, 상업적으로 개발된 프로그램은 일반화하기에는 많은 문제점을 갖고 있다.

이에 저자들은 16비트 개인용 컴퓨터를 이용하여 환자 현황 관리 프로그램을 시험 제작하였다.

1. 환자정보의 입력은 특별한 부호나 숫자를 사용하지 않고 현재 우리가 사용하는 영어나 한글을 그대로 쓸 수 있었다.

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