A DECISION SUPPORT SYSTEM FOR BREAST CANCER CHEMOTHERAPY

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Abstract - A system is presented to assist physicians giving post operative adjuvant chemotherapy for breast cancer. This system has been implemented in Visual Basic 4 under Windows 3.x and under Windows 95. Each chemotherapy protocol in the system has been programmed as one code object which includes conditional statements. The system is being tested at the National Cancer Institute in Milan and will be made available to general hospitals in the future.

I. INTRODUCTION

Clinical chemotherapy of cancer has expanded rapidly in the past quarter of century, and the concept that the internist has an increasing responsibility in the treatment of cancer patients has gained wide acceptance. In particular, this view has been well established for adjuvant chemotherapy of operable breast cancer. The long-term results of the initial adjuvant studies on node positive patients, that were first carried out from the Milan NCI and from the National Surgical Adjuvant Breast and Bowel Project (NSABP), can be summarized as follows. The essential findings from the 20-year results of the Milan trial on surgery plus CMF (12 monthly cycles) versus surgery alone indicated a persistent advantage for the CMF treated patients [1]. Moreover, at more than 15 years, there is no significant difference in treatment outcome between 6 and 12 monthly cycles [2]. A long-term relapse-free survival advantage following adjuvant melphalan has also been reported by the NSABP [3] investigators. These results were validated through an international overview, or metanalysis, which tested at 10 years the effects of adjuvant cytotoxic chemotherapy in several randomized trials carried out all over the world that utilized a concomitant control group [4]. Even for some subsets of node negative patients (high risk node negative patients), the results of randomized trials [5] indicated a significantly prolonged relapse-free survival in the treated group. In nearly all the above mentioned studies the benefit from adjuvant chemotherapy was unrelated to menopausal status. The overview estimated that polychemotherapy produces, overall, a highly significant 28% reduction in the annual hazard for recurrence-free survival, and a highly significant 16% reduction in the annual hazard for survival [4]. Individual randomized trials produced even better results.

As a result of this process, at present adjuvant chemotherapy administration, coming out of the narrow research milieu, is widely used in clinical practice, even by physician who are not full-time involved in cancer patient care. This circumstance supports the usefulness of decision support systems for post-operative breast cancer therapy, on the basis of commonly used therapy protocols.

We present a decision support system to help physicians giving post operative adjuvant chemotherapy for breast cancer. The system is being tested at the National Cancer Institute in Milan and will be made available to general hospitals in the future.

II. METHODS

An expert system named BREASTCAN and designed to assist physician giving post operative adjuvant chemotherapy for breast cancer was initially developed in 1984-1986 [6]. This system has now been revised and complemented by a clinical record for chemotherapy. BREASTCAN employed production rules which were grouped into frames and were invoked in a goal-driven fashion. Frames were organized in a tree like structure. Each frames corresponded to one protocol and contained slots with groups of rules. This initial version was implemented in Prolog under UNIX.
Recently, another version of the system has been set-up, based on revised protocols. This version has been implemented in Visual Basic 4 under Windows 3.x and under Windows 95. The choice of the implementation on Pcs follows the trend of the last few years and is particularly appropriate for a system which is meant to be used in everyday clinical practice, mainly in medium size hospitals.

The object programming features of Visual Basic allow to retain the original frame based structure, since each frame can be programmed as one code object which includes rules as conditional statements.

Fig. 1: Initial display

Fig. 2 - Tumor stage and lymph node state
The clinical record present in the system has been developed along the lines of the database implementation used in the information management structure of the CONQUEST project (AC:TION) of the Telematics Applications programme, funded by the European Union. This choice was made in order to easily include the presented system within CONQUEST as its chemotherapy section.

III. RESULTS

The system is at present being tested at the National Cancer Institute in Milan. The test is based on retrospective cases available in the institute above. Subsequently, after testing on a high number of cases, it is intended to test the system within clinical practice. After completion of this phases the system will be made available to general hospitals.

One of the needs that have emerged is user friendly communication. User friendly needs have originated interface design choices as shown below.

A consultation session starts with a display showing: anagraphic data and some initial clinical data of a patient. The clinician consulting the system is also allowed to insert notes, which will be shown afterwards whenever the system is consulted for that patient. In this display, as in all other displays, a menu is also available containing options for: data base management (patient insertion, record modifications, fast retrieval, patient deletion), display of table showing tumor stages and lymph node states (fig. 2), ideal weight table, therapy (this option starts a reasoning section and shows the therapy recommended by the system, fig. 3), follow-up (this option starts a reasoning section and shows the recommendations of the system for the follow-up, fig. 4), exit and help.

IV. CONCLUSION

It has been shown that there are large national differences in the survival rates of cancer patients with similar stages of disease. Even within the same country and with patients treated with common protocols within multicentric clinical trials, treatment outcome is significantly variable from institution to institution. Efforts are being made to reduce these variations in treatment outcome by developing general systems which can be rapidly disseminated to all medical doctors treating oncology patients. Computer decision support system can play a key role in this respect. The present work aims to provide a decision support tool for the improvement of
quality in chemotherapy, offering the possibility to transfer expertise achieved in specialized cancer institutes to general hospitals, in which cancer patients are often treated by doctors who are not specifically trained in oncology. The percentage of cancer patients who are treated outside specialized oncology institutions is particularly high in Mediterranean European countries. At present the decision system relates to breast cancer only, but it is intended to extend it, including other kinds of cancer for which chemotherapy is advisable. Moreover, the system can be easily modified including possible new developments.

![Fig. 4 - Follow-up suggestions](image)

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IV. REFERENCES