ABSTRACT

Radiotherapy for cancer aims to initiate a healing process. An optimal dose is delivered to the site of tumor so that it is cancericidal at the same time the normal function of the surrounding tissue is not impaired. Some of the problems in clinical dosimetric requirements have been solved with the introduction of computers in radiotherapy. Despite this, new problems arise with the introduction of remote afterloading devices and the use of new radioactive sources especially in the intracavitary treatment of cancer of the uterine cervix.

In this thesis some physical and clinical studies associated with the intracavitary treatment of cancer of the uterine cervix have been dealt with. Selectron (LDR) is a remote afterloading system used for the intracavitary treatment of cancer of the uterine cervix. Generally in the remote afterloading systems, the activity of the sources used is higher than that used in manual afterloading technique. Unless the activity of each individual source is checked and verified with the certificate of calibration provided by the supplier, it is not desirable to use the system. The Selectron is provided with 36 caesium 137 sources, each of 40 mCi. All these sources are brought one after another and the exposure rate is
measured. The measured values are checked with the quoted values. The variation of the maximum and minimum quoted values from the weighted average is $\pm 3.08\%$, whereas the measured maximum and minimum values vary within $\pm 3.29\%$ from the mean value.

To calculate a dose at a point inverse square law is made use of. Tissue attenuation is not taken into account as the calculation of attenuation is a tedious procedure. In this study attenuation of gamma rays of caesium 137 in tissue equivalent materials, like water, paraffin wax, perspex, pressd-wood and tissue equivalent rubber are measured and compared with the calculated values.

As has been mentioned, calculation of tissue attenuation is a tedious procedure, especially when a number of sources are used and dose calculation is required at a number of points. To make the calculations fast and easy for Selectron afterloader, a software in Fortran has been developed. Using the dose distribution (point dose) in any of three planes are obtained, by inputting the data from anteroposterior film. The computed values are checked by direct measurements in a wax phantom to confirm the reliability of the computed values. The results are in good agreement.
For intracavitary treatment direct measurements cannot be performed within patients and also there is no way of checking the computed dose distributions, except film dosimetry. Films are thin and also available in large areas, hence the dose distribution in a plane could be obtained on a single sheet of film. Also films have high spatial resolution. This makes the films useful for intracavitary dosimetry, as the fall-off of the dose is rapid.

Constructing a wax phantom embedding Selectron applicators, the films are irradiated. The radiation dose distribution obtained are analysed by a densitometer to get isodensity lines. The isodensity lines are compared with the corresponding isodose lines. Both the distributions match well, except for the discrepancy around the vaginal applicators. The reason that may be assigned for the discrepancy in the isodensity lines is interpellet shielding. No correction factor is included in the software, for the interpellet shielding. In any case film dosimetry provides a permanent visual record of dose distribution (around the applicators) that can be expected within the patient.

Mayneord's contour projector is generally used for finding the dose to specific points, from intracavitary insertions using cobalt and radium tubes. This is extended to Selectron also. To check the reliability of using this