Physical Aspects of Radiotherapy with Hyperbaric Oxygen

E.E.

Stickley

From the College of Physicians and Surgeons, Columbia University, New York, N. Y.

At the Columbia Presbyterian Medical Center, practical work on radiotherapy under high pressure oxygen has included two series of patient treatments, a variety of animal experiments and ancillary studies in the determination of oxygen concentration in tissues. The first treatments carried out here were done with a steel chamber of local manufacture, using pure oxygen at four atmospheres pressure and X-rays from the 24 million volt betatron. Currently treatments are carried out in the (Vickers) plastic chamber at three atmospheres with Cobalt-60 gamma rays. At the higher pressure, anesthesia and myringotomy was used; at three atmospheres, sedation is employed when indicated for patient comfort and incidentally to assist in maintaining alignment with the radiation. Omitting anesthesia is an advantage in the clinical management, permits finer fractionation, and effects a considerable reduction in the requirements for physical monitoring systems.

Special facilities provided for the clinical work have included a mobile or fixed oxygen supply, exhaust system for rooms where the oxygen is stored and used, modification of devices used in localizing and fixing the radiation pattern, and supplementary means for monitoring the patient throughout the entire procedure. Within limits imposed by the geometry of the patient enclosure, any standard method of applying radiation can be accommodated through the exercise of ingenuity.

Based on the earlier experience, current construction and future planning for hyperbaric oxygen in radiation therapy comprise separate planning and preparation areas, a simulator facility for pre-alignment, space for oxygenation build-up, with electronic monitoring and surveillance available at these sites as well as in the several irradiation rooms. Safety and the compliance with municipal regulations are based on certification of the pressure vessel (patient enclosure), approved oxygen storage and supply line, direct exhaust systems, and explosion-proof electrical equipment.

An essential aim in this work is to reach a definite answer as to the relative worth of the procedure. The malignancies to be treated the criteria of therapeutic success and the plan for carrying out the series of comparative treatments have all been selected to reinforce the validity of the eventual conclusions. To generate a more homogeneous comparison population primary interest now centers on glioblastoma multiforme and head and neck cancers. With glioblastoma as the subject of study about 50 cases per year are to be expected. Comparative analysis of the results will require criteria and analysis somewhat more sophisticated than a simple survival table. With the aid of the statisticians a confidence level system and a schedule to enforce randomness have been prepared

predicated on a two-year follow up on a three year series. Material to be presented will serve to illustrate these several aspects of the facilities management and analysis of the work completed and projected.