Physical Problems of Co⁶⁰ Therapy using a Hyperbaric Oxygen Tank

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The Manitoba Cancer Foundation has been using a Vickers Oxygen Tank for approximately 20 months in conjunction with a commercial fixed field type of Co⁶⁰ beam therapy apparatus for radiotherapy of selected patients. The combination of these two pieces of equipment has necessitated modifications in our beam direction equipment as well as changes in the customary source skin distance.

In addition, the perspex wall of the tank has introduced certain problems. The first of these is connected with the use of light beams for localizing the treated area. Measurements have shown that this may be neglected for all practical cases in radiotherapy. The discolouration of the tank for a total patient (tumour) dose of about a quarter megarad has also been found not to be a serious problem.

A second problem is concerned with the correction of given dose-rates for absorption in the perspex wall of the cylinder. Our investigations have shown that this correction varies with field size from 22% to 14%. Accordingly charts have been prepared for each field size at two different S.S.D.'s, giving the diaphragm setting and the absorbed dose-rate in rads/minute. These dose-rates, of course, refer to the dose-rate on the central axis of the beam for the given S.S.D., at a depth of 0.5 cm in tissue.

The final problem which we have considered relates to the surface ionization ratio and the effect of increased pressure in the tank. Some clinical evidence suggested that there might indeed be an increased surface ionization ratio. Investigations by Howarth [1] also indicated that increased gas pressure might result in an larger surface ionization ratio. Preliminary measurements have been made with a thin-window ionization chamber in a steel pressure vessel which suggest that the surface ionization ratio may be increased by as much as a factor of 2 for small fields if the pressure inside the tank varies from air at atmospheric pressure to air at 30 pounds per square inch. However

the magnitude of the effect would appear to be such that little clinical effect would be expected.