Increased Radiosensitivity of Skin in Humans Irradiated in 4 ATA Oxygen Pressure

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Several experimental animal studies have clearly shown that in rats and mice exposed to several atmospheres of oxygen during irradiation, skin and certain other tissues (e.g., growing bone) appear more sensitive than in air at ambient pressure.

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Certain clinical experiences using HP02 have also indicated that normal human tissues (e.g., mucous membranes and cartilage) may be somewhat more radiosensitive in HP02.

If, indeed, radiosensitivity of normal human tissues is increased in HP02, this becomes an important factor in its clinical use and in designing clinical trials which attempt to evaluate this modality. Such clinical trials require an analysis of both tumour and normal tissue reactions and damage to determine therapeutic ratios and the doses, with appropriate corrections, to be used in HP02 and air respectively.

A clinical experiment was performed in patients treated in HP02, in which a series of hydraulically operated ⁹⁰Sr applicators mounted on a perspex jig were used to expose the skin of the femoral region to a gradation of single doses in the range 250–1250 rads. Eight areas were irradiated per patient, 4 in air and 4 after 10 minutes in HP02 at 4 ATA. The reactions which developed subsequently were charted and scored on a quantitative basis.

A comparison of these results showed that reactions in HP02 were significantly greater, and that doses in air were 20–30% higher than in HP02 for comparable effects. The dose reduction factor (DRF) for HP02 appeared dose dependent being smaller for small doses (250–500 rads) than for high doses (750–1250 rads).

These results appear to indicate that under ambient air conditions a small moiety of anoxic or poorly oxygenated cells are present in skin which increase radio-resistance, and which are fully oxygenated in respect to radiosensitivity by hyperbaric oxygen according to the Alper-Flanders equation for oxygen effect.

Recent experiments performed with rat skin further support the clinical results, both in respect to acute reactions and certain delayed tissue sequelae produced by irradiation.

From the St. Thomas' Hospital, London

Hyperbaric Oxygen and Radiotherapy: Clinical Experiences By I. Churchill-Davidson

From June

1955 to April

1965

a total of 235 patients whose tumours were so locally advanced that they were considered to have little

or no chance of cure by conventional radiotherapy
have been irradiated while they breathed oxygen at 3–4 atmospheres absolute pressure (29.4–
44.1 lb/sq.in. gauge pressure). Although a fully randomised control series has not been possible
81 patients with equally advanced disease
who for various reasons were unsuitable for treatment in the pressure chamber have
since July
1957
been treated with the same dosage and fractionation while breathing air at atmospheric pressure.
Comparable evaluation of both series shows the survival is twice as great among those patients
treated in high pressure oxygen as it is in those treated in air. Also,