Effect of X-Ray and $^{131}\text{I}$ Irradiation on Iodine Uptake by Cultured Human Thyroid Cells

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The effect of X-ray and $^{131}\text{I}$ irradiation upon the iodine uptake by culture human thyroid cells was studied in comparison with the cell survival. After trypsinization of minced thyroid, surgically removed from a patient with hyperthyroidism, cells were washed and suspended in 10 ml of 80% medium 199 and 20% bovine serum. Monolayer sheet of thyroid cells was formed after 24 hour incubation at 37°C without disturbance.

On the 3rd day of culture, $^{131}\text{I}$ (5 $\mu$Ci per ml of medium) was added to the medium and after 3, 5, 10, 24, and 48-hour incubation, cells were collected by centrifugation. $^{131}\text{I}$-uptake expressed as cpm per $10^6$ cells, reached maximum at 5 or 10 hours. Paperchromatographic analysis revealed that about 40% of incorporated $^{131}\text{I}$ was in organic form at 5 hours. Addition of the thyrotropic hormone (0.17 $\mu$/ml) at the start of culture enhanced the 5 hr.-uptake 1.5 to 3 times on the 3rd day, and the stimulating effect was observed until the 5th day. Percentage of organic $^{131}\text{I}$ was a little higher in TSH group than in control group, but the iodoaminoacid composition showed no remarkable difference between these two groups. Five-hr. $^{131}\text{I}$ uptake by the cells varied considerably among thyroid specimens, in part because of preoperative treatment, and decreased sharply from the first to 5th day and thereafter continued to decrease to 15th day, though less steeply.

The group of X-irradiation was consisted of the culture in control and 200 R, 400 R, 600 R, 800 R and 1000 R irradiation. Five days after irradiation, no change in cell number and also in cellular uptake of $^{131}\text{I}$ were found compared to the control. Ten days after, the mean survival ratio in 1000 R group, expressed as a percentage of corresponding value in control, was 63.7%, but 5 hr.-$^{131}\text{I}$ uptake was 93% of non-irradiated control. Therefore, the uptake per surviving cell was rather higher than control. In percentage of protein bound $^{131}\text{I}$ in cells, there was no significant difference among irradiated groups with various doses at 5 and 10 days, although in a few series there was some decrease in higher dose groups after 10 days.

The group of $^{131}\text{I}$-irradiation was incubated for 2 days in medium containing 103, 207, 310, 413 and 516 $\mu$Ci of $^{131}\text{I}$ per 10 ml, which corresponded to each of the radiation dose in X-ray group on calculation. Two days after, the medium was discarded and changed 2 times thereafter. In this experiment 5-hr. $^{131}\text{I}$ uptake was measured by subtraction of retention count, determined from duplicate bottle, from net count of each cell group. At ten days the mean survival ratio from dose growth curve was 60% in 516 $\mu$Ci group but no significant decrease in $^{131}\text{I}$ uptake by these cells was observed.

No significant change both in cell number and $^{131}\text{I}$ uptake was shown at 5 days as in X-ray group.

These data indicate that iodine uptake capacity of thyroid cells is radioresistant and the radiation dose is not enough to exert any deteriorating effect on the capacity in both 2 types of irradiation, at which the cell survival decrease to 60%.