

## EFFECT OF X-RAY IRRADIATION ON EXCISED EARLOBE SPECIMENS FROM CASES OF LEPROMATOUS LEPROSY

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A certain amount of work has been done on the effect of x-rays in lepromatous leprosy. As early as 1901 Sequeira used x-rays in leprosy, and this was reported for the first time by Bellot (1) in 1904. Heiser in the Philippines (2), and Matthews in India (5), favored the use of x-rays for treatment of lepromatous leprosy. More recently, Kirwan (3) advocated the use of Grenz rays for the treatment of leprous lesions in the eyes. All these workers used very high doses of the radiations. They saw improvement of the lesions, but there was neither a permanent cure nor any change in the bacteriological picture. This has been especially worked out by Lutterback *et al.* (4) quite recently.

On the other hand, Rogers and Muir (7) state that x-rays have little curative effect in leprosy, and may produce blisters and ulcerations in nerve cases. In my work on the differentiation of human and rat leprosy bacilli (6) I clearly found that x-rays bring about definite destructive changes in *Mycobacterium leprae*. The fundamental difference between my work and that of others has been the duration and dose of irradiation. I gave small doses, 63r to 84r, over periods of 45 to 60 minutes, while others irradiated with very high doses for only a few seconds.

In the present work an attempt was made to find out the effect of x-rays with prolonged irradiations on the tissues and bacilli in lesions of lepromatous leprosy that had been removed from the patient.

### EXPERIMENTAL

Pieces of aseptically removed earlobes from cases of lepromatous leprosy were obtained from the Skin Diseases Hospital, Lucknow. Each of the specimens was subdivided into three portions. One piece was put directly into 10 per cent formol-saline and the other two were put into small petri dishes, one in each. One of these two pieces was kept in a frozen condition in a refrigerator. The other was subjected to a series of exposures to x-rays, being also kept frozen when not being irradiated.

A deep x-ray therapy plant working at 150 KVP was used, with a 0.5 mm. copper filter. The materials were placed at a distance of 150 cm. from the source of rays and were irradiated for 15 minutes on each occasion. This was done for three successive days with one series of specimens, and for four days with another series.

After each exposure to x-rays, a smear was made from each specimen for determination of the numbers of bacilli that were present. When the irradiations were completed, all of the tissues were put into 10 per cent neutral formol-saline, and paraffin sections were prepared. These were stained by a Ziehl-Neelsen technique, and with hematoxylin and eosin.

The numbers of bacilli found in the smears at the different intervals are shown in Table 1. The numbers are presented in a rough, semi-quantitative

tative manner, 1+ denoting few bacilli and 4+ denoting many; "trace" signifies only 1 or 2 bacilli in the smear. It will be seen that there was no reduction in the numbers after the first 15-minute x-ray treatment, slight reduction after the second one, but marked reduction after the third.

The findings in sections, comparing the nonirradiated control specimens with those that had received the full x-ray treatments, were in agree-

TABLE 1.—Numbers of bacilli in smears before and after various periods of x-ray treatment of the specimens.

Specimen No.	Cumulative periods of treatment				
	None <sup>a</sup> (control)	15 min. (21r)	30 min. (42r)	45 min. (63r)	60 min. (84r)
1	4+	4+	3+	Trace	—
2	4+	4+	3+	2+	—
3	3+	3+	3+	2+	—
4	4+	4+	3+	1+	—
5	3+	3+	2+	1+	—
6	4+	4+	3+	1+	Trace
7	4+	4+	3+	2+	Trace
8	4+	4+	3+	2+	Trace
9	4+	4+	3+	2+	Trace

<sup>a</sup> Before-treatment control smears.

ment with the findings in smears so far as concerns the numbers of bacilli. The tissue cells of the irradiated lesions showed no damage from that treatment.

#### DISCUSSION

As a result of x-ray treatment for 45 minutes (63r), the bacilli were greatly reduced in numbers, most of them being disintegrated beyond the stage of recognizability, and those that remained had a beaded appearance. In none of the sections were large clumps of bacilli seen, as in sections of the control pieces of the specimens. In no case did the tissue cells appear to have been damaged by the irradiation.

This finding is in contrast with those of the previous investigators cited. They applied irradiation for very short periods, in very high dosage, sometimes in the earlier work producing burns. They got some resolution of the lepromatous lesions, but without affecting the bacilli. From the results of the present work it would seem that they had obtained destruction of both the tissue cells and the bacilli to a certain depth of the tissue.

With the low dosage applied over a long period in this study there was destruction of bacilli without destructive changes in the tissue cells, the

bacilli appearing to have been the more sensitive. There was thus obtained a differential effect. On this basis, with small doses of irradiation bringing about changes in the bacilli situated at depth, it may be possible to rid lepromatous nodules of their bacilli and bring about a natural healing in patients.

#### SUMMARY

Pieces of earlobes from lepromatous leprosy patients were subjected to x-ray irradiations, some 63r and others 84r, over periods of 45 and 60 minutes respectively. Smears and histological preparations from these irradiated materials were stained by the Ziehl-Neelsen technique, and sections were also stained with hematoxylin and eosin. It was found that the leprosy bacilli were either beaded or disintegrated, but no damage to the tissue cells was detected. This would suggest that, at this dose level, patients with local lesions can be treated, or even generalized lesions can be treated.

#### RESUMEN

Trozos de lóbulos de orejas procedentes de enfermos que tenían lepra lepromatosa fueron sometidos a irradiaciones de rayos X, algunas de 63 r y otras de 84 r, durante períodos de 45 y 60 minutos, respectivamente. Frotos y preparaciones histológicas de estas substancias irradiadas fueron coloreados por la técnica de Ziehl-Neelsen, tiñéndose además cortes con hematoxilina y eosina. Observóse que los bacilos leproso eran moniliformes o estaban desintegrados, pero sin que pudiera distinguirse lesión alguna de las células de los tejidos. Esto sugiere que, con dosis del tenor mencionado, puede tratarse a enfermos con lesiones locales, o hasta con lesiones generalizadas.

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