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Treatment of Infected Wounds in the Hamster by Contact Application of Ultraviolet Rays.

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With the hope of improving the methods for the treatment of infected wounds in surgical practice, a series of animal studies was undertaken with the Gosztonyi lamp. This instrument is designed to yield the maximum output of radiation in the range of short ultraviolet waves. It is claimed that 93% of the output of ultraviolet radiation is of a wavelength of 2537 Angstrom units, which is the optimum wavelength for bactericidal action as determined by various investigators. With the Gosztonyi instrument the ultraviolet radiation is delivered through small cold quartz applicators of various shapes and sizes which facilitate the application of the radiation by direct contact. This has an important advantage in the irradiation of infected cavities and wounds, because the efficacy of irradiation varies according to the inverse square law, that is, the quantity of radiation delivered to a given site is inversely proportional to the square of the distance from the target for a point source. Another claim made for this instrument which has been corroborated in these studies is that no heat is generated in the applicator. The instrument was tested repeatedly throughout these studies and its temperature never varied from room temperature more than 3°C.

Before attempting to use this instrument in the treatment of patients, preliminary experimental studies were carried out on animals. As a first step in the investigation, the bactericidal efficacy of the instrument was tested by irradiation of cultures of colon bacillus, *Staphylococcus aureus*, and the Hay bacillus prepared on agar plates. Then the direct application of ultraviolet radiation to infected wounds by means of the Gosztonyi apparatus was carried out on a group of Syrian or golden hamsters. Fifty-five animals were selected for the experiments, and the studies were carried to completion on 44. Eleven animals were sacrificed to the preliminary attempts to determine the proper dosage of anesthetic and the most satisfactory organism for the production of infected wounds. Three died from the anesthetic, one from peritonitis, and 7 had unsatisfactory and irregular abscess formation produced by cultures of *Escherichia coli*. In these preliminary trials it was found that the

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most satisfactory lesions were produced with a virulent strain of *Staphylococcus aureus*, and this organism was used in the 44 animals on which the studies were completed.

The animals were anesthetized with 0.2 cc of a 1% solution of nembutal, injected intraabdominally. A pure culture of the *Staphylococcus aureus* on slant agar in a 10 cc test tube was diluted with broth to a sufficient quantity to inoculate 6 animals at a time. An injection of 0.2 cc of this dilution was made over each scapula of the hamster. Following the inoculation, the left side was incised and sutured. A similar procedure was carried out on the right side, except that the wound was irradiated by direct contact with the ultraviolet applicator for 5 to 15 minutes before it was sutured. With this technic, each animal served as its own control. The time which elapsed from the injection of the culture to irradiation varied from 5 to 90 minutes.

Of the 44 animals inoculated with a virulent culture of *Staphylococcus aureus*, an abscess developed on the left side, which was not irradiated, in 37 animals; in 7 animals there was no abscess on the non-irradiated side. On the right side, which had been irradiated, there was no abscess in 35 animals; 9 showed abscess formation. Seven of the 9 animals in which an abscess developed on the irradiated side were among the first injected, and it was in this group that the irradiation period was shorter and the time between inoculation and irradiation longer.

Ten of the animals in which an abscess developed were selected for another study to test the efficacy of the ultraviolet applicator in the healing of these lesions. The abscess was opened and drained in each instance, and the applicator was inserted directly into the wound, in 5 cases. In the other 5, no radiation was administered. In the 5 animals thus irradiated, the wounds showed evidence of healing in 24 to 48 hours. In the control series, one abscess healed in 5 days; the others did not heal.

Results. The results of these experimental studies, which proved the bactericidal action of the Gosztanyi applicator and its effectiveness both in prophylaxis and treatment of abscesses produced by *Staphylococcus aureus* furnished the experimental basis for clinical studies.