

tendency in inoperable recurrences and apparently hopeless cases. It should be given the opportunity to benefit patients when there is a possibility.

The dangers that accompany the employment of the powerful agent have been minimized and can practically be excluded in the hands of competent therapists. The dermatitis produced in therapy is always within limits and is never serious, unless the severity of the condition treated demands severe measures, and the benefit to be derived is proportionately great. Intelligent individuals and physicians in particular should not speak of *x*-ray "burns" as necessary or common in Roentgen treatments. There is a vast difference between the acute necrosis produced by an overdose of powerful *x*-rays in an attempt to take a picture by a novice and the progressive tanning of the skin by carefully adapted dosage in Roentgen therapy; a difference as great as that between the actual cautery and a mustard plaster, both of which have their place and uses in therapy and neither of which should be entrusted to the unskilled.

The increased metabolism which has been demonstrated as a result of Roentgen treatment is not a danger in skilful hands, but a great power for good and a valuable therapeutic force.

The gravest danger from the Roentgen rays lies in their promiscuous employment by those who have not been taught their use or the knowledge of their physiologic action and therapeutic effects.

The production and application of the Roentgen rays as diagnostic and therapeutic agents should be taught to medical students by practical laboratory and clinical courses. Their employment on the human subject for diagnostic or therapeutic purposes should be limited to qualified practitioners, that is to those licensed by state boards to practice medicine and dental surgery.

Action to this effect has been taken by recognized bodies of medical men in Vienna, in Berlin and in Paris, by the German Roentgen Society and by the Academy of Medicine in Paris.

THE ROENTGEN RAYS IN SUPERFICIAL LESIONS.*

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The Roentgen rays, as a therapeutic agent in the treatment of superficial lesions, has attained an important place. The lesions which have been successfully treated are varied. This is accounted for by a careful study of the physical properties and the physiologic action of the rays. No therapeutic agent should ever be employed without first studying its physiologic action and the amount necessary to produce the desired effect. In order to appreciate the value of the agent it is necessary to understand that the rays are not all of uniform energy and that those given off by a low and a high tube have a very different action on tissue. For instance, a light which is most efficient in acne, would be useless in the treatment of tuberculous adenitis.

In a general way the vacuum might be subdivided into five degrees for the treatment of the various diseases, ranging from a point where the tube is so low that the rays have very little penetration, but are very rich chemically, to a vacuum where the rays have great penetration, traveling several hundred feet from the tube, and are not rich chemically. One of the greatest drawbacks

to the progress of radiotherapy in the past has been the careless and inaccurate application of the rays, little attention being given to the degree of vacuum, tube distance and exciting energy. There is not a drug in the Pharmacopeia which is more powerful, more flexible, or more efficient when properly prescribed, nor more dangerous when used carelessly.

One of the frequent remarks heard is: "I always give a small dose to be on the safe side." Now, is there anything more ridiculous than a physician employing an agent about which he knows practically nothing, or is afraid to give the required dose to produce the necessary physiologic action? Then, when the patient does not improve, the agent is deemed inadequate when the operator is merely incompetent. If strychnia or digitalis were employed without producing their full physiologic action, the failure would not be blamed on the drug. Any graduate of medicine can do surgery, but unless he has had experience and judgment he can not secure good results, and yet when he graduates from college he is better prepared to do surgery than to do radiotherapy.

One should understand the action of the rays, know the tissues first affected, what changes take place, and the exact process of repair. Then the operator is able to determine the disease in which the *x*-ray may be expected to be beneficial or harmful. Any haphazard use of the rays should be condemned.

That the Roentgen rays have a selective action on epithelial cells should no longer be questioned. Therefore, the tissues composed of epithelial cells will be acted on long before the surrounding structures are affected, and this explains how a chain of lymphatic glands will undergo a degeneration with almost an entire obliteration without seriously influencing the surrounding tissues. All tissues which have undergone pathologic changes react more quickly and intensely.

The editor of the *Archives of Roentgen Rays* sums up the physiologic action of the rays as follows:

The activity of development of the cellular constituents of a part and the amount of cellular proliferation modify the reaction. The more active the cellular proliferation, the more readily do the cells respond to irradiation.

The stage of maturity to which the cells have attained has a decided influence on the cellular reaction. In the case of epithelial and endothelial cells it has been found both experimentally and clinically that cells that are fully matured react less readily than those still in the process of development. In the case of lymphocytes and leucocytes, degenerative changes are advanced by full maturity, while arrest of development and retrogressive changes are the lot of the immature.

That the nature of the cells produced has a modifying influence on the reaction has been too repeatedly pointed out to be here dwelt on. The only appreciable result of irradiation on the red-blood corpuscles is a decrease in their physical resistance; no alteration in the hemoglobin has yet been established. The white cells, on the other hand, are very susceptible to irradiation; the leucocytes show marked degenerative changes, mainly in the direction of the fragmentation of the nucleus. The protoplasm of the cells, more particularly of the polynuclear variety, undergo a degenerative change, being broken up into small masses, which refuse to stain or stain badly. This plainly shows that their evolution is hastened.

The epithelial cells of the body, both cutaneous and parenchymatous, are affected in proportion to their vitality. . . . The more embryonic forms of cells are more easily affected, a retardation in development preceding degenerative metamorphosis. Where healthy structures are exposed to the action of the rays, the primary changes of degeneration and destruction of the epithelial cells have been found to precede proliferation of the connective tissue, the vascular changes being a late manifesta-

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tation of irradiation. The destruction of the Malpighian corpuscles and cellular elements in the spleen, as noted by Heinecke, is a well-known illustration of the influence of irradiation on the organs built up of lymphatic tissues.

In applying the rays it is hardly necessary to state that the severity of reaction can be varied from a mild erythema to a necrosis, according to the kind and amount of energy absorbed. With a modern apparatus it is possible to regulate the dose to produce the desired effect with a great deal of accuracy and to avoid accidental dermatitis with a degree of certainty.

The biologic action of the Roentgen ray on superficial diseases has been summed up as follows:

1. Stimulation of the tissues in atrophic conditions—affections like alopecia areata. Here caution must be used not to get more than stimulation.

2. Alterations of metabolism, such as eczema, psoriasis or any other of the indurated inflammatory skin diseases in which it is necessary to cause absorption of the inflammatory products.

3. Atrophy of the skin and its appendages—affections like acne, where it is necessary to decrease the size or functional activity of the sebaceous gland or the sweat glands, as in hyperidrosis.

4. Destruction of the microbes in living tissues—lupus vulgaris, etc.

5. Destruction of certain pathologic formations—tuberculous adenitis and overgrowths, as in goiter.

ALOPECIA AREATA.

The most efficient treatment of alopecia has always consisted in the application of slightly irritating drugs, which stimulate the function of the papilla and surrounding tissues. Drugs have a very superficial action and often prove useless. Stimulation can be produced by the Roentgen rays, which penetrate deeply, and have proved efficient when the other remedies have failed. In this connection I will report the following case:

Miss M., referred by Dr. Jackson, had alopecia areata for two years, and was apparently cured by stimulating medication. When it recurred she was referred for x-ray treatment. Ten exposures of the Roentgen rays apparently cured the disease and the good result has persisted.

PSORIASIS.

Many favorable results have been reported, as well as a few failures. The reports of the various operators are not very uniform in this obstinate disease, which is undoubtedly due to the technic, as one will report that only the mildest form of treatment is required, while another will advocate intense radiation. The treatment usually requires a considerable length of time, as it often covers large surfaces and has a great tendency to recur. I have treated four cases with Roentgen ray and the average time in three cases in which an apparent cure was produced covered six months. These were among twelve or more cases treated by various methods. It certainly requires perseverance on the part of the patient and the doctor in order to effect a cure in the chronic cases.

We should not use the Roentgen rays in all the milder cases of psoriasis without first trying the other remedies, not because the rays are not efficient, but because the treatment is not so irksome.

Mr. G., aged 44, had psoriasis for eighteen years, and during this time he had learned that he could treat himself with chrysarobin, as well as could any physician. He had tried almost all the remedies ever used for the treatment of psoriasis. The disease covered the greater portion of the body. Treatment was given three times a week for three months and then irregularly for six months, when all the lesions had disappeared.

During this time, seventy-eight treatments were given. It is now eighteen months since the last treatment was given and there has been no recurrence of the disease. No drugs were used nor was any other treatment taken during this time.

ECZEMA.

Some cases of chronic eczema have responded to the Roentgen rays, while in others the treatment was not efficient. The classes of cases mostly benefited are those in which there was inflammatory exudate and the stimulation of the rays caused the absorption of the exudate. The rays should not be employed when the disease is caused by an irritant or when there is a systemic derangement, until these causes have been remedied. If the treatment will do nothing more it nearly always relieves the itching for the time being. In this connection I will report the following case:

Mr. D., aged 55, had suffered with squamous eczema of the face for ten years. The skin was thickened and the glands under the chin were enlarged. All other treatment had only alleviated the symptoms. Twenty treatments caused a disappearance of the disease.

KELOIDS.

The treatment of keloids by the Roentgen rays has been more successful than any other method up to the present time. At the last meeting of the American Roentgen Ray Society, a paper on keloids was read, and the author and those discussing the subject mentioned thirty-one cases in which the rays had been employed successfully. It has been shown that it requires considerable time to cure keloids, and that rays should be employed of such a character as to stimulate normal tissue processes and to promote absorption. A ray which would be destructive if given in large doses, as in the treatment of carcinoma or tuberculous glands, would not be efficient. This certainly accounts for failures in the past. Several operators have advocated the removal surgically, and then the administration of a course of treatment to prevent recurrence. Usually this does not seem necessary. Among the cases of this condition is the following:

Mr. B., aged 27, was referred by Dr. Morgan for treatment after a keloid of the cheek had been twice removed and each time promptly recurred. X-ray treatment was given three times a week for three months and then a few irregular treatments during the next two months, when the lesion had entirely disappeared.

ACNE.

Radiotherapy is unquestionably a valuable agent in the treatment of acne. Excellent results have been obtained in many obstinate cases which resisted all other methods. Acne vulgaris yields to the treatment much more readily than acne rosacea, but by persistent treatment good results have been secured in the latter condition. Sometimes it is surprising how quickly pustular acne will disappear under the influence of the rays given off by a very low tube. I have had the best results when a mild degree of dermatitis has been produced, but I do not believe that there is any other skin disease in which the operator should be more careful not to produce too severe a dermatitis, for in that case the skin becomes tanned and wrinkled. The dose of the rays in acne depends on the condition of the patient and the severity of the disease. I believe that nearly all the failures are due to faulty technic.

The following case of pustular acne was referred by Dr. Kerr after the patient had been treated with the usual remedies without benefit:

Miss W., aged 23, had pustular acne for twelve years, and had been little benefited by any treatment. X-ray treatment for three months caused a complete disappearance of the disease. It is now two years since the last treatment was given and there has been no recurrence.

Many similar cases would serve to illustrate the same course of recovery.

TINEA AND FAVUS.

In tinea and favus the Roentgen ray has proved a useful epilating agent. By proper radiation more or less complete epilation can be secured, and with this a complete disappearance of the foci of infection. Care must be exercised not to cause permanent alopecia. In many places in Europe sufficient rays are applied at one séance to complete epilation, but I believe that it is safer to give this dose in eight or ten sittings. The hair usually falls out in from fifteen to twenty days after the treatment. The scalp then should be treated by the usual methods, such as washing with naphthol soap, or daily application of a 20 per cent. iodine solution. Regrowth of the hair usually begins in from six to eight weeks.

In the treatment of tinea tonsurans and favus, Sabouraud concludes that both diseases are amenable to the Roentgen treatment, which lasts weeks only, in place of years, as under the old method. Radiotherapy has been successful in this manner in sycosis. The following case will illustrate this group:

Mr. C., referred by Dr. Miller, had sycosis involving the right eyebrow and part of the beard. There were two large infiltrated patches about the size of a dollar, and another somewhat smaller. During this time the disease had been very resistant to treatment. After eight exposures to the Roentgen rays, marked improvement was noticed and in two months the disease was apparently cured.

TUBERCULOUS ADENTITIS.

In the treatment of tuberculous glands, the results obtained by the use of Roentgen rays will compare favorably with those from any other method, as a large proportion of the patients can be apparently cured. The treatment usually requires about three months, at the end of which the glands have undergone a degeneration, leaving a hard fibrous nodule, which, as a rule, never gives any further trouble. The radiation must necessarily be intense with the tube placed at least 12 inches from the surface, in order to influence the whole of the diseased area. The important part of the treatment is to have a tube placed the proper distance, giving off rays, rich chemically, and with the proper degree of penetration.

Miss B., aged 18, referred for x-ray treatment, had been operated on six months previously and when she came a very unfavorable prognosis was given. There was a glandular mass in the right side of the neck extending from the ear almost to the clavicle. There were two masses about the size of a hen's egg. It was with difficulty that the patient could move her neck and she was very much emaciated. After nine treatments she became comfortable and began to improve in general health, while the glands began to reduce in size. Sixty treatments were given in six months, when all the smaller glands had disappeared and the two larger masses were reduced to about the size of a hickory nut, hard and freely movable. Treatment was then discontinued, and two months ago, one year after the last treatment, this patient was in about the same condition.

Now the question arises, in the cases in which these hard nodules are left, whether it is advisable to have them removed or not.

No further attempt should be made with the x-rays, as the epithelial tissue, which is easily influenced by the rays, has undergone a fatty degeneration. The fatty

substance is absorbed, leaving the fibrous stroma. I believe that these should be left alone and watched carefully.

GOITER.

Many cases of goiter have been greatly benefited by the Roentgen rays. This is what should be expected from the structure of the thyroid gland after a careful study of the physiologic action of the rays. A certain few cases of goiter which resisted other forms of treatment have responded readily to the rays. The treatment will usually relieve the annoying symptoms, reduce the size of the gland, and in some instances apparently cure the patient. It can hardly be expected to reduce the size of the gland to normal when there is immense tumor. The rays most likely reduce the gland by fibrous degeneration. This requires intense radiation, with the tube placed at least 12 or 15 inches from the surface of the skin.

Many cases would serve to illustrate the benefit derived from the Roentgen rays after other remedies had proved useless.

Mrs. A., aged 35, had goiter for four years and had taken the usual medicinal treatment without much benefit. Pressure symptoms had developed, and the growth was rapidly increasing in size. Treatment was given three times a week for two months, when all the annoying symptoms had been relieved. Treatment was continued for two months longer when the gland was reduced to about one-third the size than when treatment was begun. It is now two years since she was exposed to the rays and during that time she has had no annoying symptoms.

THE TREATMENT OF MALIGNANT GROWTHS BY THE ROENTGEN RAYS.*

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In the field of Roentgen ray therapy we are still a band of pioneers endeavoring to discover the possibilities of this new and mysterious agent. Its first decade has been productive of much new and valuable knowledge concerning the therapy of those diseased conditions which have heretofore proven most obstinate to all forms of treatment.

We should be slow to condemn the ray because it has not fulfilled the expectations of the early enthusiasts, or because the results and observations of different operators have varied so greatly. It is only natural that the results should differ when we consider how great are the variations in the agent itself and the methods of application. What it has undoubtedly accomplished should be our standard and the beacon light to guide us in establishing its real value.

To determine the value of the ray as a therapeutic agent we have to consider, first, the factors concerned in the production of the ray and the methods of application in treatment; second, the physiologic and histologic changes due to the ray, and third, the nature and location of the growth to be treated.

First of all one must appreciate the great variability in the different qualities of the ray, that is, its penetration and also its intensity and effective energy. This variability is readily exemplified in the taking of radiographs with different machines. Some static machines will require minutes to do what some coils will do in the same number of seconds. Furthermore, the ray being a form of radiant energy conforms to the law of

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