PHOTOTHERAPY IN ERYSIPELAS

BY

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Much has been written, and continues to be written, regarding the treatment of erysipelas, each new remedy enjoying a passing popularity, only to be discarded in favour of the next. The mere multiplicity of methods itself testifies to their inefficacy or their lack of universal applicability, and indicates the need for further experiment. Local applications, used empirically, have largely given place to attempts at specific therapy, mainly in the form of serums and vaccines, but while this would appear to indicate a distinct advance, it is generally admitted that wide variations in the response to antitoxin and vaccine therapy exist.

In these circumstances I feel justified in submitting records of the following cases, and advocating, on deductions drawn from their study, the early employment of ultra-violet radiation as a means by which practically all cases may be advantageously treated. The series consists of fifty-one cases, for the most part consecutive, treated at the Edinburgh City Hospital.

LITERATURE

Although records of the treatment of erysipelas by ultra-violet rays have been published by a few Continental and, later, American writers, workers in this country appear to have altogether neglected the investigation of this line of attack.

Koenig¹ was one of the first to experiment with this mode of treatment, having employed it as early as 1913, using a quartz mercury vapour lamp. While admitting its efficacy in certain cases, he pointed out that in others it failed to attain the desired object. Later, Petenyi² treated fourteen infants suffering from erysipelas in a similar manner, and although two of his cases, in which treatment was commenced at a late stage, died, the remaining twelve recovered. All his cases were under 10 months, three of those surviving being newborn infants with umbilical infection. Considering the usual death rate of erysipelas in infants, these results were remarkably good. He specified dosage simply in terms of time and distance from the lamp used, his commencing dose being less than that necessary to produce an erythema. Czepa³ in 1922 reported a series of one hundred cases treated thus, and "in almost every case the temperature fell promptly after the first irradiation, and the spread of the inflammation ceased." His results, he says, were so constant that they cannot be attributed to chance. Brunauer⁴ attributes the varying results obtained by previous workers in this field to the variable methods in which the treatment was applied. He recorded fifteen cases treated thus, his technique differing from that previously adopted in that he covered the centre part of the lesion and irradiated only the spreading edge. His results were good.

Becker,⁵ also using a mercury vapour lamp, recorded two cases in which actinotherapy had immediate good results, and recommended exposure to one and a half times the erythema dose of an area extending 4 cm. beyond the erysipelatous area in all directions. Later he reported that in eight infants, ranging in age from 18 days to 12 months, with erysipelas, treated by means of ultra-violet radiation, with one and a half times the erythema dose, only one death occurred, and that was in an infant, aged 20 days, in whom erysipelas followed an operation for umbilical hernia.

Ude⁶ of Minneapolis, in an interesting and instructive report, compares the results obtained in treating a large number of cases of erysipelas by various methods, his conclusions being that the various methods used "gave practically the same end-results, with some minor advantage for the ultra-violet series." The dose employed was twice that required to produce a mild erythema on normal skin—less than the vesiculating dose. Later, Ude and Platou⁷ recorded very good results in a long series of cases adequately controlled, employing the same technique and dosage.

RESULTS IN A SERIES OF FIFTY-ONE CASES

In the series of cases to be described the source of ultra-violet light was a standard model air-cooled quartz lamp. The efficiency of the lamp was tested by estimating the erythema dose for a series of patients with the arc at a fixed distance of 12 inches from the skin surface. In practically all the cases following an exposure of two and a half to three minutes at this distance a mild but definite erythema resulted. In a few of the cases under consideration the individual erythema dose was estimated before treatment was commenced, but as individual differences in response at such short range proved to be very slight, and as such a preliminary investigation entailed deferring actual treatment, two and a half to three minutes was assumed to be the universal erythema dose, except in the case of infants. For actual treatment one and a half times to twice the erythema dose was employed. In all cases, before estimating the erythema dose and before commencing treatment, the lamp was allowed to burn for at least five minutes to ensure as far as possible constancy of output.

TECHNIQUE OF TREATMENT

Before treatment was commenced any soothing preparation previously applied to the part, especially if greasy, was carefully removed from the affected area and surrounding skin. All cases, except infants, were exposed for five minutes with the arc at a fixed distance of 12 inches. In the case of infants a slightly shorter exposure was employed, when the actual individual erythema dose was not estimated. In all cases part or all of the inflamed area, according to its extent, was included in the exposure, with a margin of about 1½ inches of healthy skin when this was possible, the rest being protected by some light covering. In facial, and head cases generally, the eyeballs were protected by small pads of cotton-wool fixed by a narrow strip of adhesive plaster, but the eyebrows were left uncovered, and each part of the spreading edge was systematically exposed to rays falling, as far as possible, perpendicularly. When the entire involved area was easily covered by one exposure this completed the treatment, but occasionally part of the lesion, which at the time of admission was assumed to have subsided, was neglected, and had to be treated later. In the few cases in which definite extension occurred through the erythematous area the treatment was repeated one or two days later if a margin of healthy skin could still be included. Following light treatment, the affected part was left uncovered, or at least without dressings, except in two instances in which pain was a prominent feature, and in these lint wrung out in cold water and frequently renewed was sufficient. All other treatment was symptomatic.

The cases treated ranged in age from 7 months to 74 years, and included "primary" cases and cases secondary to accidental wounds, operations, and confinements. As usual there was a marked preponderance of facial cases. "Subacute" cases showing no pyrexia or other constitutional disturbance were not treated, and are not included in the series. Table I shows the age and sex incidence.

TABLE I.—Age and Sex Incidence

Sex	Age Period in Years										Totals
	0-1	1-4	5-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	
Males ...	1	0	0	1	1	5	1	7	3	1	20
Females...	0	2	1	5	7	2	4	8	2	0	31
Totals ...	1	2	1	6	8	7	5	15	5	1	51

The duration of illness before admission to hospital varied from one to eight days, the average for the series being four days.

IMMEDIATE EFFECTS

During the exposure the patient in no instance complained of discomfort. On the contrary, the sensation of warmth produced appeared to be appreciated. In the course of a few hours the healthy skin included in the radiation area showed an intense erythema, with a degree of oedema, the appearance being so similar to that of the erysipelatous area as to render the edge of the latter at times indistinguishable. Existing oedema of the actual lesion was slightly increased. At this stage, as a rule, there was no complaint of pain, even when, as occasionally happened, there was a crop of tiny vesicles on the affected area or an oozing of serum. Local applications were unnecessary. By the end of forty-eight hours the oedema had generally subsided, and the affected skin became dry and wrinkled. By this time also there was a critical fall in temperature in thirty-one of the thirty-nine cases in which the whole edge of the lesion was tackled. In twenty-three of these cases the fall commenced within twenty-four hours. The further course of cases was for the most part uneventful.

With the dosage adopted—up to twice the normal erythema dose—vesiculation following irradiation seldom occurred, and when it did, appeared to cause no additional discomfort or to prolong the course of the illness. In only one case was a severe degree of vesiculation produced, the patient being a case of puerperal septicaemia and pneumonia, profoundly anaemic, who had contracted erysipelas of the face.

ULTIMATE EFFECTS

To gain a true conception of the value or otherwise of radiation therapy it was essential that the cases treated should be adequately controlled. This was done by selecting as a control for each case treated a similar case treated by other means. In allocating "controls" the hospital records for the past five years were searched, special attention being paid to a consideration of age, sex, localization and extent of lesion, duration of illness, and complications present. In all cases it was found possible to allocate a suitable control.

In assessing the therapeutic value of phototherapy employed thus, attention was paid to: (1) the duration of the pyrexia, (2) the extent of spread of the lesion after treatment, (3) the incidence of complications, and (4) the occurrence of relapses. The mortality rate in such a short series of cases is of little value. Of fifty-one cases treated, four died—all complicated cases. The first was a child of 13 months on whom a mastoidectomy was performed after the onset of erysipelas and before phototherapy was commenced; the second death occurred in the case of a female, aged 30, with concurrent pneumonia and nephritis; the third was a case of puerperal septicaemia and pneumonia; and the fourth was a female, aged 55, already under treatment for severe cardiac decompensation, who died suddenly from cardiac failure.

Duration of Pyrexia.—The forty-seven cases treated and ending in recovery were of varying degrees of severity, and in estimating the effect of treatment the temperature chart was taken as the safest single guide, the disease being presumed to have ceased on the day on which the morning or evening temperature was first subnormal and did not subsequently rise except in the presence of an obvious complication. In some of the cases only one section of the spreading edge and neighbouring skin was irradiated, in others a margin of healthy skin all round the inflamed area was included in the exposure, and in the remainder the whole lesion, together with the surrounding skin, was irradiated.

The results of treatment are briefly summarized in Table II.

TABLE II.—Duration of Pyrexia in Cases Ending in Recovery

Series	Duration of Illness before Admission, (Days)	Average Duration of Fever (Days)	Average Duration of Fever after Treatment (Days)
47 cases treated by U-V rays	3.96	7.81	3.85
47 control cases ...	4.10	9.26	5.16
In the 39 cases in which it was found possible to tackle the whole of the spreading edge, the results were as follows:			
39 cases treated by U-V rays	3.72	6.97	3.25
39 control cases ...	3.91	9.03	5.12
In 10 cases in which the whole affected area and a surrounding margin of healthy skin were irradiated the results were even better.			
10 cases treated by U-V rays	3.40	5.50	2.10
10 control cases ...	3.31	7.92	4.61

Similarly, of eight cases in the series in which treatment was commenced early in the disease—on the second day of illness—the average duration of fever was again 5.5 days as against 9.6 days in the corresponding control cases.

Extent of Spread.—Definite spread of the dermatitis through the irradiated area of healthy skin occurred in a few cases, principally in those cases in which treatment was commenced at a comparatively late stage and the lesion was obviously very active. This was noticed particularly in cases of the "wandering" type, when two or more exposures of the spreading edge at intervals of two days were necessary before spread was arrested.

Incidence of Complications.—The sole complication seen in cases treated and surviving was streptococcal abscess, which occurred in two cases.

Incidence of Relapses.—Relapse occurred in one of the forty-seven cases. The inflamed area was promptly re-irradiated, and the condition subsided completely within twenty-four hours, of the onset. In another case, not included in the series, in which the initial attack, in spite of serum therapy, lasted seventeen days, there were four relapses. The first occurred thirteen days after the temperature had reached normal, and the temperature remained elevated for a further six days. Eleven days later another relapse occurred, and it was decided to try actinotherapy. On this occasion the patient ran a mild temperature for only forty-eight hours. Ten days later she again relapsed, and was promptly irradiated, this time without any recorded rise of temperature. After a further ten days a final extensive relapse took place, and under actinotherapy the temperature was again normal within three days.

A brief account of a case in which the erysipelas commenced while the patient was in hospital is interesting. The patient, a female aged 34 years, was convalescent after diphtheria. The erysipelas commenced on the twelfth day in hospital, and on the morning of the thirteenth day involved both cheeks, orbital regions, and glabella. There was considerable oedema, with numerous small vesicles on the affected area, and a rapidly advancing, well-marked edge all round the lesion. The patient was markedly ill, noisy, and confused. The affected parts were subjected to three exposures of ultra-violet light at one sitting—one to each cheek, and one to the glabellar region—on the afternoon of the second day, with gratifying results. No further spread occurred, the common feature in such cases of oedema of the external auricle failed to appear, the mental condition improved forthwith, and there was a critical fall of temperature.

From these results it would appear that if acute cases of erysipelas come under treatment sufficiently early prompt exposure of the affected part to what is customarily considered an overdose of ultra-violet rays would, in a large proportion of cases, abort the lesion. The method also has the advantage of being easily applied, and of effecting a considerable saving of dressings and

linen, as no local applications following treatment are necessary, or, indeed, desirable. A dosimeter is unnecessary. If the operator takes the trouble to estimate at regular intervals the efficiency of the lamp used, the erythema dose for the individual is easily and quickly ascertained, and even when this is not done, but the dose gauged from previous experience with the lamp in use, there is a wide margin of safety.

SUMMARY AND CONCLUSIONS

1. A report is presented on fifty-one cases of erysipelas treated by exposure to an artificial source of ultra-violet light, the exposure being one and a half times to twice that required to produce a definite erythema on normal skin.
2. The treatment of erysipelas, particularly the early case, by ultra-violet light appeared to give better results than other methods in use.
3. The method is easily applied, usually available, devoid of danger, cleanly, and inexpensive.
4. The technique is simple, and can be carried out with any ultra-violet lamp of known efficiency.

The cases detailed are from the records of the Edinburgh City Hospital. The opportunity for, and inception of, this investigation are due to Dr. W. T. Benson, superintendent of that institution, to whom the writer is much indebted.

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CARBON DIOXIDE ABSORPTION METHODS IN ANAESTHESIA

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Nitrous oxide and oxygen is now so universally used that the anaesthetist has to transport an apparatus of considerable bulk and enormous weight. It was in an attempt to find a really portable apparatus that a trial of the carbon dioxide filtration method was decided upon. This method has many advantages, and, as far as can be seen, no disadvantages.

In the past carbon dioxide filtration had fallen into disrepute owing to the large size of the canister and the fact that it was bulky and awkward to hold right up at the face-piece. Nowadays all this is changed by the use of wide-bore Siebe Gorman tubing, with flap valves to ensure the unidirectional flow of expired gases. This enables the absorber unit to be attached to the anaesthetic stand, head of the table, or gas machine itself, while the application of the mask to the face is no longer a wearisome task. By means of this unidirectional method of flow of respired gases the absorber canister need not be the bulky apparatus of the past. Much experimental work has been done on this method in America by Lundy, Heidbrinck Company, and Foregger Company and McKesson, to name a few, so that it is by no means an innovation. Hewer also employed the method some years ago in this country. In the writer's opinion, however, the success of the apparatus lies (1) in the unidirectional method of flow, abolishing dead spaces, (2) in the passing the gases twice through the absorber, and (3) in effecting this with as little resistance as possible to the flow. Accuracy in oxygen supply is another step towards perfection, for a difference of 30 c.cm. of oxygen

per breath will make an enormous difference in percentage composition of the respired gases. For this purpose I have had constructed a special flowmeter for small flows of from 250 c.cm. oxygen upwards.

Briefly the principle, as is well known, lies in the absorption of the patient's carbon dioxide by soda lime. The patient rebreathes the same amount of nitrous oxide continuously, as this is given out from the lungs unchanged. Oxygen is used constantly, of course, and it is necessary to give accurately graded quantities of this latter gas continually. Ether, when employed, can be added to replace what has been used up. By this method one consumes an extremely small quantity of gas. One or two gallons per hour is the usual amount, as opposed to 100 to 150 gallons per hour—a great saving.

APPARATUS

This consists of a "circular rebreather" as compared with the ordinary single-tube to-and-fro method. In the face-piece mount are two very fine flap valves made from thin Paul's tubing. These valves are the most important

Absorber attached to Boyle's machine. The lower part of the drawing depicting the cylinders is diagrammatic, but the upper half is to scale.

part of the apparatus, as they are used to ensure the flow of the gases in a unidirectional manner, and their inertia is so small that breathing is not in any way impeded. From this mount two 30 in. Siebe Gorman tubes run to a Y-piece, which is connected with the absorber. The latter is about 4 in. long and 3 in. wide, and holds 1 lb. of soda lime granules. These are kept in position by two gauzes at each end of the machine, one fine and one coarse. The absorber must be absolutely full of soda lime for successful operation. Breathing is not obstructed, as one might suppose, largely owing to the fact that the soda lime used is not too great in quantity. Attached to the soda lime canister is a bag of one gallon capacity, with a tube for the admission of