THE TREATMENT OF SCABIES BY CHLORINE GAS.

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WHILST one of us was carrying out the training of troops in the use of anti-gas measures involving exposure of the men to chlorine gas, the officer commanding one of the battalions made the remark that, "If the gas had done nothing else, it had cleared the camp of scabies." Subsequent interrogations of the medical officer confirmed the observation to a great extent.

Scabies being a parasitic disease, it did not seem unreasonable to suppose that the "gassing" to which the men had been subjected had proved fatal to the acarus. It might reasonably be expected, however, that cases of scabies in the camp would not be very severe or they would have been sent into hospital. Also other common parasitic conditions, such as pediculosis, might easily have been confused with scabies in the observations mentioned above.

At any rate, a careful investigation appeared to be worth while, in which the concentration of the gas to which the patients were exposed and the duration of the exposures were carefully controlled. Cases of indubitable scabies were therefore used in the investigation.

Through the kindness of the D.D.M.S., London District, about sixty cases of scabies in non-commissioned officers and men and fourteen cases in officers have been treated by exposure to chlorine. The details of the treatment differed in the two cases.

The non-commissioned officers and men were exposed to a concentration of one to two parts of chlorine per thousand of air (by volume), the service gas helmet being worn as a protection. The exposures were of five minutes' duration and occurred on successive days. Usually four exposures were given, but in some instances this number was exceeded.

The patients had a hot bath before their first treatment and wore ordinary hospital-clothing. At the first exposure the bedding was placed in the "gassing" chamber. The officers wore a box respirator as protector, and were exposed to a concentration of between two and three parts of chlorine per thousand of air. The exposure lasted twenty minutes.

A bath was taken on the morning of the first day of treatment and not again, except in one case, until the day after the last exposure of gas. The number of exposures given and the intervals between them were varied in order to find out the best conditions of treatment.

A few of the cases were given four exposures on successive days, and then, after two days' interval, two more exposures on successive days. Others received two exposures on the first two days, then, after two days' interval, two further exposures on successive days. Three of the officers were given two exposures on the first two days, and then, after three days' interval, one more exposure only. On the first day of treatment the officers' underclothing, sleeping garments, and gloves were exposed to the gas, and clean bed linen was ordered the same night. The clothing was exposed for twenty minutes. The treatment of both officers and men was carried out in rooms with about a thousand cubic feet of air space. Chlorine was delivered into this from a cylinder, and it was found, after very little practice, that an approximation to the concentration desired could easily be obtained. The concentration in all cases was determined more exactly by drawing with a siphon a measured volume of the air through 5 per cent. sodium iodide solution, and titrating the iodine liberated with sodium thiosulphate.

If 1,100 c.cm. of air are drawn through the iodide solution, and decinormal sodium thiosulphate be used in the titration, then each cubic centimetre of thiosulphate used is equal to one volume of chlorine per 1,000 volumes of air.

The point of the delivery tube of the burette was pushed through the cork of the wash-bottle containing the sodium iodide, so that the titration could be carried out in the gas chamber. If the iodine is not over-titrated, then several determinations of the concentration can be made by refilling the siphon bottle and again drawing through the wash-bottle a known volume of air.

Results of the Treatment.

Non-commissioned Officers and Men.—Nearly sixty non-commissioned officers and men were treated under somewhat unsatisfactory conditions at a military hospital in the London district, the mode of treatment being that described above. Of the whole number, the medical officer of the hospital reported not more than 25 per cent. as cured. Many of the cases not definitely cured showed much improvement.

In view of the much more favourable results obtained in the treatment of officers, which will be referred to presently, the comparative failure of the treatment of the non-commissioned officers and men may be ascribed to the exposure to chlorine being of too short a duration, and also to the fact that the concentration of the gas used was on the average not more than one per thousand of air.

Officers.—Of the fourteen officers treated, eleven were cured and three much improved. Eleven of the officers received four or more exposures, and of these nine were cured. The two who still had apparently active lesions had received six exposures. Two officers were given four exposures on six days, the two middle days forming an interval. Both were cured; one, however, was a mild case. Three officers received three exposures only, one on each of the first two days, and the third on the sixth day. Of these, two were cured, and the third was almost free of scabies a week after the last exposure.

These figures make it appear that usually four exposures are sufficient when given on the first, second, fifth, and sixth days.

One feature of the treatment which was noted in officers, non-commissioned officers, and men was the production of a very irritable condition of the skin, especially about the scrotum and axillae, in some of the cases. It was most marked in cases which may be termed chronic, and which had been treated by sulphur in one form or another for varying periods without cure, and also more noticeable in the cases which were given more than four exposures. We have noted the same condition in ourselves whilst working in chlorine gas for various purposes. It passes away completely as a rule in the course of one or two weeks and is relieved to some extent by adding a little washing soda to the daily bath.

Details of the officers' cases are given below:

Case 1.—Severe scabies on wrists, thighs, and neck; fourteen days' history. Had been treated by sulphur baths and ointment, but made only slow progress. Was treated by chlorine gas on October 13th, 14th, and 18th, 1916. On October 18th the patient was free of scabies. Wrote a month later to say he was still free.

Case 2.—Legs and arms chiefly affected. Patient had had three months' previous treatment with sulphur in various media. He received nine treatments by chlorine gas in November, 1916—namely, on the 10th, 13th, 17th, 18th, 19th, 20th, 27th, 28th, and 29th. On the 30th he was cured.

Case 3.—Arms chiefly affected; one week's history. The disease was accompanied by dermatitis of obscure origin. Treated by chlorine gas on November 10th, 13th, 17th, 18th, 19th, and 20th, 1916. On the 23rd the condition was very much improved, but not quite cured.

Case 4.—Patient had suffered from scabies and eczema for three months, the feet, hands, arms, and back being affected. Had been treated previously with sulphur. Was treated by exposure to chlorine gas on November 14th, 16th, 20th, 21st, and 22nd, 1916. On December 1st he was free of scabies.

Case 5.—Patient's second attack during the year; one month's history. Had had no treatment. Exposed to chlorine gas on November 16th, 20th, 21st, 22nd, 23rd, 28th, and 29th, 1916; and was free of the disease on December 1st.

Case 6.—Patient's hands, arms, trunk, and legs were affected; six weeks' history. No previous treatment. Received five treatments by chlorine gas—November 16th, 18th, 20th, 21st, and 22nd, 1916—and on December 1st was cured.

Case 7.—Patient had a two months' history of scabies and furunculosis; he had undergone no special treatment for scabies. Treated by chlorine gas on November 16th, 20th, 21st, 22nd, and 23rd. Was free of the disease on December 13th.

Case 8.—Groin and thighs chiefly affected; ten days' history. Had had sulphur treatment for three days. Was treated by chlorine gas on November 18th, 1916, and three following days, and again on the 25th and 26th. Free of scabies on November 30th. Wrote from France on December 27th to say that he was still free.

Case 9.—Patient had five months' history of the disease, and had received many treatments with calcium sulphide, without effect. Treated by chlorine gas on November 20th, 21st, 22nd, 23rd, 28th, and 29th, 1916. When seen on December 14th was cured.

Case 10.—Patient had ten weeks' history of scabies. Was treated by chlorine gas on November 23rd, 24th, 25th, 29th, and 30th, 1916, and when seen on December 14th was apparently cured; later, however (December 19th), scabies had recurred.

Case 11.—A moderately severe case; three weeks' history. No previous treatment. Exposed to chlorine gas on November 25th, 26th, 29th, and 30th, 1916. Cured on December 13th.

Case 12.—A mild case, with six weeks' history. Sulphur bath treatment for two weeks. Treated by chlorine gas on November 28th and 29th, 1916, and again on December 2nd and 3rd. Cured on December 7th. Wrote on December 21st saying he was still free of disease.

Case 13.—Hands, arms, trunk, and legs affected. One week's history with rapid spread of the infection. Treated by chlorine gas on December 7th, 8th, and 12th. On December 16th the patient was free of scabies.

Case 14.—Hands, arms, trunk, and legs affected. Ten weeks' history. No previous treatment. Treated by chlorine gas in December, 1916. On December 27th there was no irritation, but apparently scabies lesions were still present.

It is only possible to surmise as to the active agent in the cure. The toxic properties of chlorine are well known, and no doubt the acarus is affected by the gas diffusing into the burrows.

It seems possible, however, that the action may be prolonged by the combination of the chlorine with the outer layer of the skin and its gradual liberation as hydrochloric acid, since it is well known that proteins form such unstable compounds. In addition to the chlorine the hydrochloric acid may thus play a part in killing the acarus or its eggs.

It is generally held that the efficacy of the sulphur bath treatment is due to the formation of sulphuric acid and by oxidation of the sulphur; and this view would be in accord with the above supposition.

The treatment is perhaps a little too difficult to carry out in civilian life without special apparatus and a "gassing" room. For army purposes, however, where respirators are supplied which protect against the concentration of chlorine used it may be valuable because it is ambulatory, no special hospital accommodation being required as in the treatment of sulphur ointment.

We should like to express our thanks to Major J. S. Morrow, R.A.M.C., of the Queen Alexandra Military Hospital, for making an independent examination of the officers, and to Drs. Shelswell and Harrison, of Holborn Military Hospital, Mitcham, for examining and reporting on the non-commissioned officers and men.

Since writing the above, our attention has been drawn to a striking instance showing the efficacy of the method for preventing the spread of scabies in a unit. Numerous cases of scabies were occurring in a mounted section which was sleeping in temporary barracks. They were all passed through a considerable concentration of gas in a state of nudity, helmets being fastened round their necks with towels. The gassing was carried out in their sleeping quarters, all their clothes and bedding being treated at the same time. The medical officer has reported that no further case of scabies occurred for more than two months thereafter.

ANAPHYLACTIC SHOCK AFTER INJECTION OF SERUM INTRAVENOUSLY.

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THE intravenous method of injecting serum causes the patient so much less discomfort than injection into the subcutaneous tissues, and has so many other advantages, that the record of three cases in which anaphylactic shock occurred may be of interest. After a rabbit or a guinea-pig has been sensitized by an injection of serum, it is sometimes possible to kill it within a few minutes by giving it a second subcutaneous dose. In man, however, the anaphylactic symptoms which may follow a second injection of serum under the skin are rarely dangerous, and consist usually in an accelerated and exaggerated attack of serum sickness; but intravenous injection may have alarming consequences. The following are notes of three such in a series of cases of dysentery.

CASE I.

W. P., aged 24. Admitted to hospital on July 24th, 1916, with symptoms of dysentery—frequent stools of blood and mucus. Temperature 100°–102° F. *B. dysenteriae* (Shiga) was grown from faeces on the day of admission. He did not improve on the treatment he was receiving, so antidysentery serum was injected intravenously as follows: On July 30th, 25 c.cm.; on July 31st, 20 c.cm. (patient rather better); on August 1st, 20 c.cm.; on August 2nd, 20 c.cm. (patient considerably improved); on August 5th, 20 c.cm.

About one and a half minutes after the last injection the patient experienced sudden pain over the heart; went pale, and felt faint. This gave him a great fright, but he felt all right again within a few minutes. A serum rash was out all over the body by the following day. His convalescence was rapid.

CASE II.

A. D. J., aged 25. Admitted to hospital on September 15th, 1916, and died on September 17th. The patient was very ill and thin. His illness had begun on August 14th, and in the course of treatment he had received one injection of anti-dysentery serum on August 22nd. Diarrhoea had rather diminished before admission, but became severe again on the 16th, when the stools consisted chiefly of mucus. Bacteriological examination was negative. As he was very ill indeed on the night of the 16th, it was decided to give him intravenous saline, and the opportunity was taken to give serum along with it. The sequence of events is here tabulated:

11.20 p.m. Injection of normal saline begun.

11.25. Antidysentery serum 25 c.cm. added to saline in container after about 250 c.cm. of normal saline had been run in. The injection meanwhile was going on.

11.28. Patient complained of pain across the front of the chest, then became restless, stretched out his arms, and had wide-staring eyes. He probably lost consciousness for a few seconds. The heart sounds remained steady, and there was no sign of cardiac dilatation. Injection stopped.

11.33. The whole condition had passed off. Injection of saline containing serum resumed.

11.40. An urticarial rash began to appear on the arm, apparently along the line of the vein into which the fluid was being injected. Within a few minutes urticarial patches had appeared also on the forearms, hands, and the upper part of the trunk. They were not observed elsewhere.

11.55. Injection stopped, the patient having had 1,200 c.cm. and being distinctly improved.

12 midnight. All traces of urticaria had disappeared.

The improvement was temporary. The patient vomited a good deal during the night, and died the next day.

Post mortem, there was found acute dysenteric inflammation of the great intestine, with much thickening, and haemorrhage into the mucous membrane. Only two inconsiderable ulcers were present. The stomach was much distended, and contained a large amount of greenish-brown fluid. There was great dilatation of the duodenum, which had a diameter equal to that of a normal stomach.

CASE III.

B. G., aged 28. Admitted to hospital on September 23rd, 1916, with gunshot wounds of the right thigh and a deep gunshot wound of the right ankle. The notes of his case had been lost in transit. After admission he was found to be suffering also from dysenteric symptoms, and *B. dysenteriae* (Shiga) was grown from a stool on September 25th. The temperature was high (103°), and he had very frequent motions. Within the next few days he became very thin, had a dry brown tongue, and spoke with difficulty. The condition of his wounds was unsatisfactory. On September 3rd intravenous saline was given at 2 p.m.; 50 c.cm. of antidysentery serum was put in the container along with the saline before the injection was begun. When not more than 50 c.cm. of the mixed fluid had been run into the vein the patient suddenly became very ill, with eyes staring and arms stretched out. His face was pale, and he had become unconscious. Breathing stopped for about thirty seconds. Within a few minutes he looked quieter, but he remained unconscious for about two hours, with a rapid pulse. In the evening he improved, and was able to answer questions. No rash was seen. He had a restless night, but was rather better in the morning. At 11 a.m. 1,100 c.cm. of saline solution, without serum, was given, without abnormal symptoms. There was a transient improvement, but he died next morning. *Post mortem*, there was a well marked dysenteric condition of the colon, with a few shallow ulcers.

These three were the only cases to show unusual symptoms among a large number, not all cases of dysentery, in which either serum, or saline solution, or both together, were injected intravenously. The possibility of the entrance of air along with the fluid can be excluded. In Case I no serum injections had ever been given previously, and though it is unusual for sensitization to occur while the injections are being continued, and especially within six days of the first, I do not see how the symptoms can be explained otherwise than as due to anaphylactic shock, especially in view of the two other cases. In Case II antidysentery serum had been given subcutaneously twenty-six days before. The rapid appearance and disappearance of urticaria is of interest, and especially its appearing first near the site of injection. This corresponds to what is found in cases of serum sickness, where frequently the rash is first seen round the site of puncture. The absence of further symptoms when the injection was resumed is what one would have expected. The dilatation of stomach and duodenum was probably not due to anaphylaxis. In Case III there can be no doubt that the patient