given. Their toxicities are about the same as those of the corresponding quinine salts, while they are highly soluble, so appear to be suitable and well worth trying intravenously in the treatment of malaria. The acid hydrobromide salt is considerably the less toxic, but whether this combination will lessen the well known tendency of cinchonine salts to produce sickness remains to be tested. I am deeply indebted to Mr. Shaw for making these salts and also some hydroquinine hydrochloride (see (1) in Table III) for me at a time he was very short-handed.

Much of the experimental work in this paper was carried out at the Pasteur Institute, Shillong, thanks to the kindness of the director, Captain R. Knowles, I.M.S., and of Colonel H. E. Banatvala, C.S.I., I.M.S.

Suggestions for the Treatment of Malaria.

Owing to the lack of clinical material under my control at the present time I have only been able to try quinine intravenously in a very few cases of malaria, thanks once more to my friend Captain N. H. Hume, I.M.S. So far we have only given the bi-hydrochloride and the acid hydrobromide in $\frac{1}{2}$ -gram doses once a day for three or four days, but without observing more rapid disappearance of the fever and of the parasites than after quinine by the mouth, so larger doses will evidently be necessary if all the parasites are to be rapidly destroyed. As three grains of the bi-hydrochloride contain as much quinine as four of the acid hydrobromide, after commencing with $\frac{1}{2}$ -gram doses to ascertain whether the patient has any idiosyncrasy towards the drug, up to 12 grains of the bi-hydrochloride or 16 grains (approximately 1 gram) of the acid hydrobromide, in $7\frac{1}{2}$ and 10 c.cm. respectively of normal saline (making practically 10 per cent. solutions), may be given once daily for at least four days. It will probably be advisable to supplement the intravenous doses with quinine by the mouth, as the former is likely to be rapidly excreted through the kidneys—a point I am now investigating. In any case prolonged oral administration should follow the more active intravenous medication. Once the resistant relapse producing stages of the malarial parasite have been produced intravenous quinine is not so likely to be so effective, but the vigorous treatment of primary attacks of malaria by intravenous quinine appears to be worthy of careful trial to ascertain if the frequency of subsequent relapses can be reduced. Military hospitals in malarial areas should afford much more favourable opportunities for following up cases sufficiently long to enable this suggestion to be tested than civil practice. A further material advantage of such early intravenous administration is likely to be that dangerously large infections, which may terminate at any moment in fatal coma under oral administration of quinine, are likely to be rapidly controlled, and the present mortality from malaria to be reduced to practically nil.

The following is a very recent successful example of this line of treatment in the most intense malarial infection I have ever seen recovered from:

The patient was admitted at 4 p.m. in a collapsed and semi-conscious state for suspected cholera, but a low specific gravity of the blood, together with an axillary temperature of 99.4° and a rectal one of 105.6° , led to a blood examination, which revealed a malignant tertian infection of such extreme severity that a count actually showed the proportion of parasites to red corpuscles to be 46 per cent.—that is, almost one-half of them were infected. One gram of acid quinine hydrobromide in 10 c.cm. normal saline was at once injected intravenously. On the following morning the patient was conscious and much better, but the infection still amounted to 19 per cent. of the red corpuscles, so the gram dose was repeated morning and evening, and from the next morning no parasites could be found, and the patient is doing well three days later although deeply jaundiced.

Such a case speaks for itself.

Once repeated relapses have become established the only method of treatment which has given me satisfactory results is the daily administration of ten grains of quinine in one or two doses for at least three, and preferably six, months, always continuing until the end of the malarial season if in an endemic area. During the last seventeen years a number of malarial patients so treated by me have apparently lost their infections and remained free for long periods after omitting the quinine. For example, a medical man had suffered from repeated attacks of benign tertian malaria for several years, when I advised him to take ten grains of quinine a day for six months.

I saw him recently, and learnt that subsequently to that course he had remained free from fever for three years. By this plan, whenever resistant forms reproduce the fever-exciting cycle of the parasite, they will be destroyed by the continual dosage of quinine before they can multiply sufficiently to cause an actual attack of fever, and probably before they can form further resisting stages, which may thus be gradually eliminated from the system. However that may be, I believe this plan is at present the best method we have of checking malarial relapses, while it is one which should be feasible even on active service, if an abundant supply of readily-soluble quinine tabloids are at hand.

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THE SCABIES PROBLEM ON ACTIVE SERVICE.

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EVERY man incapacitated from duty—it matters not by what means—is a gain to the enemy. From the point of view of the army, and of military efficiency, those diseases ought to rank highest in importance which cause most “casualties.” Judged from this aspect, diseases of the skin occupy one of the premier positions, for under the conditions of trench warfare it is inevitable that they are met with in large numbers. The exact extent of the wastage for which they are responsible is known only to the authorities, but it is apparent to all that, since many are contagious, successful efforts directed towards prevention and cure will amply repay by a very large gain of fighting men.

Of the skin diseases found amongst soldiers—excluding pediculosis—scabies is by far the commonest. When uncomplicated its effects incapacitate a man but little; but in consequence of the hard conditions of active service, secondary pyodermic complications are frequent and severe, and these are a very real cause of prolonged sickness. In contrast to the three or four days required for the complete cure of a simple case we have found that when pyodermic complications are established the period necessary is greatly prolonged—the average stay in hospital over a large number of cases being 31.67 days. It should be explained that this figure does not include either treatment elsewhere—which sometimes amounted to many weeks—or the days spent in journeying to the base.

CHARACTER AND DISTRIBUTION OF LESIONS.

Scabies as seen amongst soldiers differs in type from that usually met with in civil practice, and unless the differences are appreciated many cases will not be recognized, leading to dissemination by undetected carriers. The eruption is distributed much in the usual fashion, the sites of election being the wrists, hands, penis, lower abdomen, anterior axillary borders, elbows, and buttocks. The characteristic interdigital burrows, however, are rarely seen; they were present typically in only 13 per cent.* of our cases. Vesicles are much more common, though in quite a number of cases the hands are entirely free from lesions of any sort. A correct diagnosis can only be made after inspection of the whole body. In the majority of cases the penis is involved, and the discovery of papules or crusts on either skin or mucous membrane is almost pathognomonic. This serves in doubtful cases to distinguish scabies from the acute pediculosis so frequently seen, and is for this reason an extremely useful diagnostic sign.

Besides the primary lesions of scabies, others due to secondary coccal infection are common and important. They may be so severe as to mask the primary disease

* This figure does not include cases in which one or two indefinite lesions could be found after prolonged search; including these, the percentage would be about 45. It is our impression that lately burrows have been observed with more frequency than some months ago.

and render it liable to be overlooked. Most common is a variety of impetigo distributed in a characteristic manner on the lower buttocks, elbows, and knees. The presence of pustules or crusting on one or all of these regions should at once suggest scabies and lead to search for the more primary lesions elsewhere.

Occasionally the impetigo becomes very widely spread, but even in such cases a correct diagnosis can be made by observing the characteristic grouping on the regions indicated. In numerous cases the impetigo lesion extends more deeply into the dermis and takes the form of an ecthyma. Occasionally a linear variety of impetigo is present.

Boils and other follicular infections of the skin are frequent and tend to recur indefinitely so long as the primary scabies remains uncured. No case should be considered as one of simple furunculosis until itch has been carefully sought for and excluded, or, if found, until the patient has had a thorough course of sulphur treatment.

Some degree of adenitis is the rule in all cases of scabies which have developed any form of coccal infection. The glands of the groin are those most frequently involved, and suppuration in this situation forms a not uncommon and often troublesome complication. In the upper limb severe lymphangitis with foci of suppuration seems to constitute the corresponding lesion. These septic foci usually occur in the upper third of the limb and on its inner aspect.

Dermatitis as a complication of scabies is most frequently the result of unsuitable, misapplied, or too long continued treatment. In these instances the abdomen, thighs, and arms are the commonest sites, and all degrees, from simple erythema to moist weeping or exfoliating eczema, may be observed. Subjects of the seborrhoeic diathesis seem particularly liable to this complication.

Localized dermatitis may originate in a group of vesicles or other scabid lesions, which, together with the intervening skin, have become irritated by scratching; considerable local thickening of the skin becomes superadded, and the result is an area of chronic infiltrative dermatitis, in part scabid and partly artefact. This is most commonly seen in the flexure behind the knee or on the outer aspect of the thigh.

DIAGNOSIS.

Scabies must not only be distinguished from the pyodermic conditions apt to be associated with it, but also from pediculosis, pompholyx, syphilis, and an unusual papular urticaria.

Pediculosis.

From pediculosis the diagnosis is chiefly made by the difference in distribution, and the absence of infection of hands, wrists, and penis. Not only may the two conditions be associated, but the papule* common to both can only be distinguished with extreme difficulty.

Pompholyx.

The vesicular lesions of pompholyx are much more deeply seated, more numerous, and more difficult to rupture than those of scabies, and are chiefly limited to the hands and feet.

Venereal Disease.

A single large scabid lesion on the penis may give rise to question as to whether or not the patient is suffering from venereal disease, and the eruption on the body may be mistaken for a secondary rash. The diagnosis is not always so easy as might be supposed, particularly if risks of venereal infection have recently been incurred. Here also the two conditions may occur together.

Papular Urticaria.

A type of papular urticaria which we have not observed in civilian practice may simulate scabies very closely. In this condition small red papules occur over the body generally, but particularly on the abdomen and anterior axillary folds. Wheals, or some degree of dermatographia, may often be found or induced. Again, the wrists, hands, or penis are not involved, and the disease tends to disappear suddenly, while relapse is frequent.

* Pediculosis as usually seen in France occurs in an acute form, and characteristically presents a papular type of eruption.

PREVENTIVE MEASURES.

Scabies, it is generally accepted, is rarely contracted excepting after prolonged and intimate contact with infected material, for the acarus does not wander afield like the louse. This being so it is difficult at first sight to explain how the soldier gets the disease. His opportunities for removing clothing and coming into contact with an infected medium are few and are only fully possible when in rest. All the evidence, particularly the occurrence of epidemics amongst officers sleeping in the same dug-out, or amongst groups of men quartered together, points to blankets as the chief means of disseminating infection. Prevention, then, should include frequent disinfection of blankets by such a method as the Clayton sulphur vapour apparatus, or some other accepted form of sterilization. A few cases seem to be contracted from horses, and the protection of the soldier therefore includes efficient treatment of the horse. Great stress is laid by French writers¹ upon the venereal origin of scabies, and this possible source of infection requires to be kept in mind.

Of the greatest importance is the early detection of every case of scabies. Each case undetected acts as a "carrier," and is the potential starting-point of an epidemic. Frequent and thorough inspection of the individual soldier is the only means whereby early diagnosis can be assured. Infected men should be segregated and treated as speedily as possible, for, in addition to preventing dissemination, early diagnosis enables treatment to be instituted while the disease is still uncomplicated, and renders its course short, correspondingly conserving man-power.

CURATIVE MEASURES.

Curative measures should include exposure of the parasite and its ova and their destruction by remedies, short of producing dermatitis. The subsequent disinfection of clothing and bedding to prevent reinfection must never be omitted.

Sulphur, it is generally acknowledged, is the most efficient remedy for the treatment of scabies, and certainly, by reason of its procurability and cheapness, it is that most suited for the extensive requirements of an army. It is a remedy, however, which requires careful and intelligent application, and care must be taken that the patient receives neither too little nor too much treatment, the former leaving him uncured, the latter producing dermatitis, and so increasing his period of unfitness.

How this remedy should be employed is already so well known that a repetition of the details would seem unnecessary had it not been for the recent reintroduction of the sulphur vapour method. This form of treatment, so scathingly condemned by Hebra² in the first half of the last century, seems to have again obtained a certain vogue, in spite of the fact that it was so completely discredited nearly a hundred years ago. Indeed, it has so long been regarded as one of the barbarities of the dark ages that it is rarely mentioned in modern textbooks. We have had opportunity of observing a number of cases treated by this method. Some have suffered from severe dermatitis; numerous others have been uncured. The history given by some of these latter is instructive. After the vapour treatment the itching was relieved, and improvement appeared to take place in the eruption. The patient seemed cured, but after a period of about two weeks the disease again became active, so that it would appear that a false sense of security had here been obtained and a "carrier" discharged to disseminate the infection. That a certain number of cases may be cured by this method is probably correct, but its uncertainty and the special danger of dermatitis, from which it is inseparable, give us no option but to emphatically condemn its use.

Liquid preparations of sulphur, such as Vlemingx's solution (liquor calcis sulphurata) are undoubtedly efficient agents for the cure of scabies, but they also are particularly liable to cause dermatitis, and considerable experience is necessary for their satisfactory employment.

Sulphur Ointment.

For its simplicity and certainty, no method is so suited for general use as that of simple inunction with sulphur ointment (*B.P.*), and admirable results will invariably be obtained, *if the treatment is conscientiously carried out and with due regard to the necessary details.* It must, however, be insisted that the method of application is of

paramount importance. This may be briefly outlined as follows:

I.

On the first day of treatment the patient is given a hot bath and provided with plenty of soft soap and a large, moderately stiff nail-brush.

(a) Before entering the bath, he rubs himself thoroughly all over with the soap, massaging it into the skin, and paying particular attention to the fingers, toes, wrists, penis, and axillae. This should be continued for at least ten minutes.

(b) He then enters the bath, which should be both long enough and contain a sufficiency of water to permit of immersion to the neck. After first steeping for fifteen minutes, he scrubs himself vigorously all over with the nail-brush for the purpose of opening burrows and vesicles. If the eruption is particularly severe or painful this part of the procedure may be correspondingly modified. After the bath a final inspection should be made, when any unruptured vesicles can be opened with a surgical needle.

The bath is given with the sole object of opening up the haunts of the acarus and exposing it to the action of the parasiticide to follow. It is obvious that shower or steam baths cannot fulfil this purpose, and examination of a patient so treated will reveal the burrows and vesicles still intact.

II.

After removing the soap and drying, a liberal quantity of sulphur ointment (*B.P.*) is provided, with which the patient rubs himself vigorously all over, from the neck downwards, special attention being paid to the affected parts and to the fingers, wrists, genitals, axillae, toes, and ankles. The ointment must be liberally applied and thoroughly rubbed in, so that when finished he should be literally "soaking" in it.

The inunction is to be repeated in this manner twice daily for three days—that is, until the patient has had in all six applications. Each must be complete, and for this it is obvious that all clothing must first be removed. The treatment of limited parts of the body is useless.

III.

Finally, on the fourth day, but not before, a second bath is given, and all the patient's clothing and bedding sterilized to prevent reinfection. Even such articles as wrist-straps, strings of identity discs, gloves, etc., should be included.

The vast majority of cases, unless there be secondary complications, will be found cured after three such days of treatment. Should any doubt exist, 2 per cent. beta-naphthol in vaseline may be used daily for four more days. Only under exceptional circumstances should sulphur ointment be applied for more than three days, since its continued use is liable to cause severe dermatitis. Indeed, in susceptible persons a mild degree may be occasioned by the three-day treatment. This is usually easily cured by zinc ointment or Lassar's paste. At the completion of treatment the existence of some degree of itching is not uncommon; this is due to the remedy, and does not indicate failure of cure; it will rapidly pass off, and should be disregarded. Some days also will probably elapse before all the lesions of scabies have disappeared, although the man is no longer infective. A certain degree of pigmentation may persist indefinitely.

SUMMARY.

1. Scabies in soldiers differs in type from the ordinary form seen in civil practice, particularly in the frequent absence of burrows or other lesions upon the hands, and in the great liability to pyodermic complications.

2. The primary disease is often masked by complications. In every case of impetigo, boils, dermatitis, or inguinal adenitis, scabies must be carefully excluded before the diagnosis is considered complete.

3. Cases of scabies complicated by any of the above necessitate about ten times as long a period in hospital as simple cases, therefore early diagnosis and treatment, before secondary diseases have become established, are of the greatest importance.

4. Regular medical inspection is essential for the detection of "carriers." Infected men should be segregated and treated at the earliest opportunity; horses may also require inspection. Blankets being the chief source of spread should be sterilized as often as possible.

5. Treatment by means of sulphur vapour is a method harmful often to the patient, and at all times dangerous to the community in that it manufactures a class of scabies "carrier." In the interests of the army it should be discontinued.

6. The method of treatment most suitable to service conditions on account of efficiency, simplicity, and cheapness is inunction with sulphur ointment, but this must be carried out in a methodical and thorough manner, and with careful attention to the necessary details.

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ON A CONVENIENT METHOD OF PREPARING EUSOL.

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Eusol may be prepared in the following way:

Take 135 c.cm. of the *B.P.* liquor calcis chlorinatae; dilute with water to 1 litre, add 10 grams of boric acid, and shake up till dissolved. The solution remains clear, and without further treatment is ready for use. If preferred, a saturated solution of boric acid may be stocked at room temperature; this contains 4 per cent. boric acid, therefore 250 c.cm. gives the amount required for 1 litre eusol. In making eusol in this way the 135 c.cm. of liquor calcis chlorinatae should be diluted to 750 c.cm. and the 250 c.cm. of boric acid solution added. This prevents the formation of the precipitate which occurs if boric acid be added to undiluted liquor calcis chlorinatae.

By this method eusol can be prepared at a moment's notice simply by diluting and mixing two stock solutions, both of which are stable.

Should eusol be required for intravenous injection in cases of septicæmia, it is necessary to add sodium chloride in the proportion of 8.5 grams to the litre. In this case, therefore, the 135 c.cm. of liquor calcis chlorinatae would be diluted to 500 c.cm. with distilled water, the 250 c.cm. boric acid solution added, and also a solution containing 8.5 grams of sodium chloride dissolved in 250 c.cm. of distilled water.

The quantities here given are calculated on a chloride of lime assaying 25 per cent. available chlorine, which is about the average obtained from commercial samples at the present time.

In our original paper¹ on the preparation of eusol we described the method of making the solution from dry bleaching powder and boric acid, and this method has been found serviceable where large quantities of the antiseptic are used and the supply has to be constantly renewed. It is less suitable where eusol is required in smaller quantities and at irregular intervals. Since liquor calcis chlorinatae keeps well, the method described above has suggested itself as a simple and convenient way of preparing eusol in any quantity desired.

Liquor calcis chlorinatae is a 10 per cent. solution of bleaching powder in water. It is therefore easily prepared, and its keeping power when tested has given the following results: In April, 1915, a bottle of the solution was made by shaking up 100 grams bleaching powder in 1 litre of water. The mixture was allowed to stand overnight and then filtered. At the time it was made it assayed 2.92 per cent. available chlorine. It was kept in a clear glass-stoppered bottle in a cupboard in the laboratory, with temperature rising in warm weather to 18° or 20° C. Over two years later, on the last day of July, 1917, the solution assayed 2.62 per cent. available chlorine; deterioration had thus taken place very slowly. A similar solution, prepared on July 1st, 1917, stored in the same cupboard during the hot weather of July, has remained at constant assay during the month—namely, 2.57 per cent. available chlorine. This solution, it may be remarked, represents a very poor chloride of lime. Generally speaking, the quality of the chloride of lime manufactured has deteriorated very much during the war.