Table 1. Readings of Weil-Felix test in Case 2

<table>
<thead>
<tr>
<th>Date</th>
<th>Titres at which agglutination obtained with suspensions of:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proteus OX 2</td>
</tr>
<tr>
<td>15 10 56</td>
<td>60</td>
</tr>
<tr>
<td>25 10 56</td>
<td>60</td>
</tr>
<tr>
<td>16 11 56</td>
<td>30</td>
</tr>
</tbody>
</table>

Note.—Titres are expressed as the reciprocals of the highest dilution of the patient’s serum at which agglutination was observed.

The patient was seen again on 17th May, 1957, when he was fit and well. Blood taken for Wassermann reaction on that date was negative.

SUMMARY

Two cases of scrub typhus are described. In both, the existence of a genital eschar with regional adenitis pointed to venereal infection. Although only two cases have been recorded during the previous two years at the Venereal Disease Department of the British Military Hospital, Singapore, it is possible that others have been missed and it is considered that scrub typhus should enter into the differential diagnosis of certain types of genital ulcers, particularly those occurring in soldiers serving in areas where scrub typhus is endemic.

Thanks are due to Colonel R. J. G. Morrison, Consultant Physician, Far East Land Forces, for his encouragement.

A TRIAL OF METHODS FOR MASS INOCULATION

BY

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PROVISION of a safe technique for mass inoculation has demanded much thought, particularly in the Army, as the possibility of the transfer of infection on a serious scale is well established. The ideal procedure to minimise this hazard is to provide a sterile syringe and needle for each inoculation, but this would in practice prove too costly and time consuming. It has been shown by Hughes...
(1946) that when he removed the needle after intramuscular injection, red blood corpuscles could be demonstrated in the fluid in the syringe nozzle. Evans & Spooner (1950) demonstrated that when they injected a heavily infected animal and then removed the needle the residual fluid in the syringe became infected. These observers considered that the contamination was due to a negative pressure, induced by removal of the needle, causing fluid from the distal end to be sucked up into the syringe nozzle. This was confirmed by Fleming & Ogilvie (1951), and they proposed as a safe mass inoculation technique a modification of the hot-oil sterilisation method used by Sir Almroth Wright.

THE FLEMING AND OGILVIE TECHNIQUE

Liquid paraffin in a metal beaker supported by a metal retort stand is heated to a temperature of 130° to 140° C. by a bunsen burner. Sterilisation is effected by dipping the syringe in the oil to a level half-way up the needle mount for 10 seconds. The thumb must control the plunger during the injection, while the syringe is withdrawn from the patient and during sterilisation.

The hot-oil method of sterilisation has, according to Fleming & Ogilvie (1951), three main mechanisms:

(a) The actual temperature of the oil.
(b) The sterilising effect of the steam produced by the boiling of fluid inside the needle.
(c) The mechanical effect of the jet of steam forcing out potentially infective material.

Experiments performed in these laboratories adhering strictly to this technique gave very satisfactory results. In fact, it was found possible using this method to give a large number (100) of injections into an infected "artificial mouse" as described by Evans & Spooner (1950), and still maintain the sterility of the syringe and needle when the pressure inside the "artificial mouse" had been raised by an additional 2.5 cm. of mercury, i.e. a pressure much greater than that likely to occur in the subcutaneous tissues of the body.

This technique was adopted by the Army in 1953 and has been thought to be both convenient and safe for mass inoculation procedures. There are, however, two disadvantages, not generally appreciated:

(a) The syringe piston must be controlled firmly and continuously by holding the thumb or finger over the end of the plunger while injecting and thereafter. It has been observed that the majority of medical officers do not adhere to this technique, as it is uncomfortable and appreciable amounts of the inoculum tend to be discharged before or during the actual injection. Usually the injection is performed using the syringe as a "dart"—where the syringe is held by the thumb and forefinger from beneath the barrel, or as a "billiard cue"—where the syringe is held by the thumb, forefinger and the middle finger above the barrel.
(b) The sterilisation in the hot oil must be performed by the operator himself, because he must not move his finger from the end of the plunger between completing the injection and the end of the immersion in hot oil. He therefore loses the advantage of team work when large-scale inoculations are required so that the time taken may be considerably increased.

This paper describes the results of experiments undertaken to assess whether modifications of this technique could be safely adopted to save time in mass inoculation.

**METHOD**

A syringe containing 0.2 ml. of sterile broth, drawn from a standard rubber-capped vaccine bottle, was used to inject into an "artificial mouse" filled with a broth culture of *Staphylococcus aureus* at a pressure, except where otherwise stated, of approximately 20 ml. of nutrient broth. Sterilisation was then carried out by immersion of the needle half-way up the butt in hot oil at 130° C. for 10 seconds with the thumb pressing firmly on the plunger. The sterility of the syringe was then checked by flushing 0.5 ml. broth from a second rubber-topped vaccine bottle into tubes of sterile broth and incubating at 37° C. for 48 hours. The sterility of the syringe and needle was tested before commencing each series of injections, and a check on the broth culture was made at the end of each experiment. The vaccine bottle containing the inoculum was also incubated for 48 hours. Usually 25 or 50 consecutive injections were made.

The standard 5 ml. all-glass syringe fitted with 1-inch needles (No. 23 S.W.G.) was used.

**MODIFIED TECHNIQUES**

In one series of experiments, the syringe was not sterilised immediately by the operator himself but was laid on the bench (thus interrupting the continuous pressure on the plunger), and then immediately sterilised in hot oil by the operator. The results showed that both the syringe and the vaccine bottle were invariably infected when tested after the first 25 injections. Repetition of this experiment, but examining the syringe for sterility after each injection, showed that the syringe was infected after a maximum of three injections.

A second series of experiments in which after each injection the syringe was handed, needle down, to an assistant for sterilisation showed that, although this was more effective, it was not safe and infection of 20 per cent of the tubes occurred. (It was evident that in this series infection was sporadic, and it is assumed that where the syringe was subsequently found to be sterile after having previously been contaminated, infection was minimal and overcome by dilution and the hot-oil treatment).

Subsequently, injections were made with the thumb not controlling the plunger during inoculation using the "billiard cue" technique described above, followed by sterilisation by the operator who firmly controlled the plunger. These experiments were first performed at pressures of 5 cm. of mercury,
but the syringe was heavily infected after the fourth injection, and even at atmospheric pressure 20 per cent of tubes were not sterile.

It was therefore realised that, especially in well-used and lubricated syringes, the plunger was not sufficiently stable to prevent small movements when not controlled by the thumb and when an assistant performed the sterilisation.

THE "SPRING CLIP" SYRINGE

It had been proposed that a metal spring clip which would grip the syringe piston firmly and thereby prevent reflux might obviate the inconvenience and delay involved in the operator having to maintain a constant firm pressure on the plunger after injection and during sterilisation. The experiments were repeated, using two syringes fitted with such a device. The results, however, proved disappointing, and it was clearly shown that the addition of the metal clip had no advantage over an ordinary syringe, and that any departure from the technique of Fleming & Ogilvie soon resulted in contamination of the syringe.

THE GROSS SYRINGE

In 1954 W. O. Gross (1954) described a syringe which seemed to offer a safe and rapid method for mass inoculation. The essential feature of this syringe is the design of the needle-to-syringe connection. The needle is attached by means of a flat plate fixed to its base which is pressed against a similarly shaped flat plate on the nozzle. In the course of removal of the needle these two flat surfaces are made to slide apart very rapidly. The needle can be removed without any suction whatsoever, thus eliminating the danger of reflux from the needle. A circular magazine to hold 50 needles is part of the apparatus, and changing of the needles can be effected with ease and rapidity.

In two series of experiments it was found possible to give up to 100 injections into an "artificial mouse," the internal pressure of which was as high as 6.4 cm. (2.5 in.) of mercury, and still maintain the sterility of the syringe when the plunger was firmly controlled during injection and withdrawal. When injections were given using the "billiard cue" technique, maintenance of sterility in several series of 25 injections was not possible when the pressure in the "artificial mouse" was at or above 1.3 cm. (0.5 in.) of mercury, although it proved effective on three occasions at atmospheric pressure.

CONCLUSION

The findings of Fleming & Ogilvie (1951) are confirmed and attention is drawn to the often neglected essential feature of this hot-oil sterilisation technique, namely that the thumb or finger must control the plunger during injection, withdrawal and sterilisation.

Several modifications of this technique were tried but resulted in contamination of the syringe.

A syringe incorporating a spring clip to stabilise the plunger and thus
obviate the necessity for the operator to maintain pressure on the plunger was found to be ineffective after repeated trials.

The syringe described by W. O. Gross (1954) seems to offer an advance in mass inoculation technique in that it provides a more rapid method than others described. Again, however, with this syringe the thumb must control the plunger carefully during injection and withdrawal from the patient. Whether such control with a syringe of this bulk is practicable will have to be determined in a series of field trials by regimental medical officers. In our hands it proved possible to use the syringe in this fashion, and it may well prove to be a step forward in the provision of a safe mass inoculation technique.

REFERENCES


SCHISTOSOMIASIS AMONGST RHODESIAN TROOPS

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The marked increase in the incidence of schistosomiasis in Central and Southern Africa in recent years amongst all sections of the community is well known. Public Health authorities are faced with a formidable task when considering the preventive aspects of the disease on a nation-wide scale.

To approach the task by directing the attack mainly against the intermediate host, the snail, is inadequate because it would be impossible to cover all the rivers, streams and dams in such an immense area, although the value of these measures, however limited, cannot be disputed.

It would appear, then, that the maximum effort should be expended in dealing with the problem as it appears in the case of the definitive host, man. Here it is not sufficient to wait for symptoms to appear before dealing with them, but rather to look for evidence of the disease before it becomes clinically obvious. Under such circumstances treatment would be far more efficacious than when the lesions are well established.

This object was held in view by the writer when he was appointed in February, 1956, to be regimental medical officer to an infantry battalion of Rhodesian troops who were destined to do a tour of duty in the Far East commencing in April, 1956. The battalion consisted of 56 European officers and other ranks