enough to consider only the glycosuria, or even the end-products of metabolism in the urine, the information to be obtained from analysis of the blood and faeces should also be taken into account, and I venture to think that the time is coming, and will come shortly, when a physician who attempts to treat a case of diabetes guided only by examination of the urine for sugar will be held as guilty of negligence as the present-day surgeon would be who failed to employ radiography when treating an injury of the bones or joints.

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THE LOCAL TREATMENT OF MENINGOCOCCUS CARRIERS WITH ANTISEPTICS.

(A REPORT TO THE MEDICAL RESEARCH COMMITTEE.)

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OWING to the measures adopted in the Navy to limit the spread of cerebro-spinal fever a large number of carriers were detected in the Portsmouth depot and isolated in a special camp. It then became necessary to attempt to sterilise the throats of these men, and, although from analogy with other diseases the local application of antiseptics appeared likely to be unprofitable, it was thought desirable to give these a trial. If the antiseptic did not destroy the cocci in the throat, it was possible that it might prevent the cross-infection from one man to another. Further, the use of inhaling rooms in the Army had been said to give encouraging results.

In an experimental treatment of this sort there were three important matters to be considered: (1) The antiseptic to be used; (2) the method of application; and (3) the index of cure.

1. The Antiseptics Used.

The antiseptics most thoroughly tested were chloramine-T and acriflavine. Dakin's new dichloramine compounds came to hand too late in the season to make a satisfactory test. Other antiseptics were boracic acid, carbolic acid, magnesium hypochlorite, formalin, potassium permanganate, guaiacol, and several others. In addition to these, we administered to a few men a placebo in the form of tablets of formalin.

2. The Method of Application.

Chloramine-T was applied in two different ways:—

(a) In an inhaling chamber, the drug being dispersed as a fine cloud by a high-pressure steam-jet. This apparatus differed in design from that proposed by Colonel M. H. Gordon for the Army, but no doubt gave similar results. A 5 per cent. solution of chloramine-T was used in the reservoir of the nebuliser; this strength was found to give as powerful an atmosphere of chlorine as was pleasant. The room accommodated about 10 men and these remained therein for about 15 minutes per diem. They were instructed to breathe strongly through the nose during this time, but there was no way to ensure that these orders were carried out, and in many cases they probably were not.

(b) In a nasopharyngeal spray. This was a glass hand-spray made by one of us, the nozzle of which was readily slipped through the mouth into the nasopharynx. Two or three pumps were given with the bellows and the chloramine-T (2 per cent.) thus came copiously into contact with the whole nasopharynx and often dripped from the anterior nares. This treatment was applied once a day.

Acriflavine (kindly supplied to us by the Medical Research Committee), in a strength of 1 in 500 in salt solution, was applied daily with our nasopharyngeal spray.

The other antiseptics mentioned were used in the earlier stages of the investigation. They were all applied with Parke, Davis, and Co.'s "Glaseptic" nasal spray until the drug could be felt in the nasopharynx. The strength of boracic acid was one drachm to the pint, of carbolic 1 in 200, of formalin 1 in 200, and of potassium permanganate 1 in 1000.

3. The Index of Cure.

The apparent value of these antiseptic treatments depends very largely upon what end it is proposed to achieve and the exact manner in which the process is carried out. In general the technique is to apply the treatment until swabs taken from the nasopharynx fail to reveal the meningococcus. The man is then looked upon as cured. There are, however, a number of fallacies which must be avoided.

(a) The treatment must not be carried on continuously during the whole period of quarantine for two reasons. First, the treatment if applied on the day that the swab is taken will directly vitiate the result. We have therefore always allowed 24 hours to elapse after treatment before the swab is taken. Secondly, the treatment if applied continually will readily diminish the number of meningococci or reduce their vitality so that they will not grow in culture, but when treatment is stopped they will frequently reappear again. It is therefore essential not to apply treatment continually, but to give the man a chance of relapsing before he is said to be cured. In practice the routine has been as follows:—
1. Upon receipt a positive carrier is treated once a day until his next swab is due—that is to say, until six days have elapsed since the first swab. In practice this is usually one or two days' treatment. 2. Treatment is stopped 24 hours before the swab is taken. 3. It is continued after the swab is taken until the report is received. 4. If this is negative treatment is stopped, and if the man remains negative on weekly test, no further treatment is given. 5. If the report is positive, treatment is continued until the next swab is due. More recently, in order to give the "positives" a greater degree of treatment, we have swabbed them while positive every 14 days instead of every week. On a negative swab being obtained, however, we reverted to the weekly tests.

(b) A certain period of time must be allowed to elapse after a negative swab is obtained before a man is said to be cured, in order that the permanency of the cure may be established. It is customary for a certain number of negative swabs at fixed intervals of time to be required before a man in the services is allowed out of quarantine. The precise number of swabs has never, to our knowledge, been accurately worked out. In the Army it was two, while the Navy at one time required six weekly negative swabs. During the past season this number was reduced to four. All our carriers, therefore, have been retained under observation until at least four negative swabs have been obtained, and we are thus able to give more accurate information as to the permanence of cure in these cases.

The following figures show the number of relapses which occurred after various numbers of "negatives" had been obtained. 375 carriers (pure "Gordon" types) were subjected to the "4-negative" standard. Of these—

137 relapsed (185 times) after 2 "negatives" = 36 per cent.
63 " (74 times) " 3 " = 16 "

A small number of men were examined by mistake or for various reasons for more than the necessary 4 "negatives." Of these—

13 carriers relapsed after 4 negative swabs.
5 " " " 5 "
4 " " " 6 "
2 " " " 7 "

The number of carriers who were examined after four "negatives" is so small that no statistical capital can be made out of these latter figures. Nevertheless, it is certainly remarkable that so many relapses were observed in so few cases. From the foregoing figures it is clear that if two negative swabs are taken as the index of cure no less than 36 per cent. of the men will, in fact, not be cured, and will be returned to the community in the same condition as they were before they were isolated. It is also clear that under these conditions of "cure" a form of treatment may readily be supposed to have a value which is quite fictitious.

The number of negative swabs which constitutes a cure is a practical question which has to be decided with due regard both to inconvenience to the Service and to safeguarding the Service. It appears to us that it would be irrational to undertake a very extensive system of control, as in the Navy, and then to stultify that system by prematurely discharging one-third of the proved carriers on two negative tests. Clearly the proved carrier is the man on whom attention should be most concentrated if extensive administrative measures are taken against this disease at all, and thus it would appear that the naval routine of four "negatives" is better than two "negatives." The number of men involved

when the carriers are only derived from contacts is so small relatively to the whole Service that four "negatives" should not entail undue inconvenience. In all our cases, therefore, the index of cure has been four consecutive negative swabs taken at weekly intervals. During the whole of this time no treatment has been applied in order that every opportunity for early relapse might be present.

The Results of Treatment.

Owing to the relatively small number of carriers and to the fact that at first the treatment was often changed, the estimation of the value of these different methods is difficult. On examining the figures, however, it is soon found that there is another factor which enormously increases the difficulty—namely, that one-third of the men become cured immediately upon entry into the isolation camp *whatever the treatment applied to them may be*. Thus of 375 carriers of pure "Gordon" types, 124 registered their four consecutive negative tests immediately upon entry into the isolation camp. The treatment applied to these men was practically nil, since by the time the "doubtful" colonies had been proved to be positive, and the man had been removed to the isolation camp, the greater part of the week had passed and only one, or at the most two, days' treatment remained before it had to be stopped preparatory to the next swab. When it is remembered that this treatment consisted of formalin tablets and boracic nasal sprays, as well as chloramine-T and acriflavine nasopharyngeal sprays, it appears justifiable to us to regard the effect of treatment as nil, and to assume that these men cleared up spontaneously. Since, then, one-third of the men are cured spontaneously, a drug must be very decisive in results before its curative action becomes very obvious.

The effect of the antiseptics has been estimated in two ways: (1) by calculating the ratio of cures to the number of men treated by each antiseptic; and (2) by counting the number of men who obtained 4, 3, 2, 1, or no "negatives" immediately upon starting upon a particular treatment.

TABLE I.—Showing the Cures Effected by Various Treatments.

TABLE II.—Showing the "Immediate Negatives" obtained by Various Treatments.*

Treatment.	Number treated.	Number cured.	Per cent. cured.	TABLE II.					
				Number treated.	Immediate negatives.				
					4	3	2	1	0
Chloramine - T in } inhaling room ... }	85	43	50	91	38	2	15	4	32
Chloramine - T in } spray }	96	60	62	99	40	2	13	10	34
Acriflavine }	101	59	58	101	51	11	9	26	4
Boracic	50	29	58	31	22	0	7	1	1
Carbolic	64	30	46	54	27	0	8	5	14
Magn. hypochlor. ...	59	28	47	52	25	0	5	8	14
Formalin	65	29	44	55	22	0	11	6	16
Pot. permang. ...	63	30	47	47	17	0	5	5	20
Gualacol	35	17	50	26	8	0	4	0	14
Formamint	14	5	35	15	6	0	3	0	6
Average	632	330	52	—	—	—	—	—	—

* In Table II. the cure is credited to that treatment under which the man was last.

Table I. shows that about 50 per cent. of the men treated by any method were cured. Any variation in the percentage is not greater than might be produced by chance and has no significance.

Table II. shows that with each form of treatment 40–50 per cent. of the men are cured immediately; with boracic acid alone is the figure much higher, but here the factor of error due to small numbers comes in acutely. This percentage (40–50) corresponds roughly to that given by all treatments together (33) which, as has been explained, may be assumed to be no treatment. The difference between the 33 per cent. of no treatment and the 40–50 per cent. of treatment is due, not to the efficacy of treatment, but to the fact that the two figures are calculated from two different series of men. The 33 per cent. relates to carriers of meningococci which agglutinate with monovalent sera, while the 40–50 per cent. refers to a series which includes in addition a number of carriers of cocci which agglutinate feebly or not at all

with monovalent sera. These latter often fail to agglutinate, and therefore these carriers are more easily "cured."

It is clear that the therapeutic effect of none of these antiseptics is sufficiently great to class one as better than another.

On examining the figures of those men who remained positive after treatment, it is again observed that the results are fairly similar; about one-third of the men failed to obtain a negative immediately after treatment. Acriflavine and boracic are exceptions to this rule; the former showed only 4 positive in 101 after treatment, and the latter 1 positive out of 31. In the case of acriflavine these positives have passed into the group of "1 immediate negative," and there is some evidence that acriflavine actually does produce a transient inhibition of the bacteria.

Conclusion.

Looking at the results as a whole, we conclude that one-third of the men recover spontaneously, and that none of the methods of treatment tested has any conspicuous merit, nor has one any obvious advantage over another. This result is what might be expected from analogy with work on diphtheria carriers.

We are much indebted to Dr. John Brownlee, statistician to the Medical Research Committee, for opinions upon figures submitted to him.

ON THE CLOSURE OF WAR WOUNDS IN HOME HOSPITALS.

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As the result of experience gained during the last two and a half years it has been found possible to render wounds, the discharges from which have been teeming with pus organisms, surgically clean, so that in a period varying from a very few days to at most a week or two, an infected wound can be stitched up with every prospect of something approaching primary union taking place.

The two surgeons whose names are chiefly associated with these results are, in this country, Rutherford Morison and, in France, Carrel. Through the courtesy of Sir Berkeley Moynihan I was privileged in October, 1916, to see Mr. Rutherford Morison demonstrate his method of treating war wounds with "B.I.P.P.," and also to hear Dr. Sharman, of Pittsburg, who had spent some months in France seeing war surgery, relate his experiences at Carrel's hospital. More recently I heard Colonel C. J. Bond, of Leicester, describe the Carrel-Dakin treatment, and not less useful have been several discussions on the subject with Colonel Moynihan himself.

Between November, 1916, and the end of June, 1917, I have performed well over 300 operations for the closure of war wounds at the Bradford War Hospital and have gradually evolved a technique (which will probably be further modified as my experience grows, but) which already gives me results which I regard as very satisfactory and which I propose to describe in this article. This I shall do at some length, since I consider that the highest percentage of good results can only be obtained by following out the method in detail.

The Carrel, B.I.P.P., and Bradford Methods.

The Carrel method.—The Carrel treatment consists (1) in the sterilising of the wounds, and (2) in the suture of the surgically clean wound. When a case is seen soon after the wound has been inflicted an anæsthetic is given; the skin around the wound is thoroughly cleaned and the wound is freely opened up. foreign bodies, lacerated muscles, damaged skin edges, and loose bone fragments are removed, all bleeding is stopped, and special tubes are inserted, through which is instilled into the wound every two hours a solution containing 4.5 per cent. of active chlorine—the object being to keep an efficient antiseptic constantly in contact with the whole of the wound surface. The discharge is microscopically examined every day or two, and in from 5 to 11 days the wound is usually sterile enough (1 organism to each 4 microscope fields) to enable it to be completely stitched up and for primary union to result. Colonel Moynihan tells us that notices are hung up in Carrel's wards to the effect