contracture of the tendo Achillis. Marked hyperaesthesia to cotton-wool stimulation on the sole and on the outer side of the foot.

Fifth Operation.—Division of tendo Achillis and forcible extension of the knee with the hope of stretching nerve fibres and diminishing pain. Scar was felt to stretch in the popliteal space. Slight alleviation of pain for two days, but it recurred.

Sixth Operation (May 24th).—Removal of scar, freeing nerve and fascial "sleeve." Both popliteal nerves were found surrounded by large areas of fibrous tissue. Both nerves were freed from scar as much as possible, and this extended for 3 in. above their junction. The nerves felt hard and fibrous, but to such an extent that further treatment seemed contraindicated. Fascial sheaths taken from both thighs 6 in. by 2 in.; invested both popliteals and the sciatic like a pair of trousers. All three nerves injected with 5 c.cm. normal saline above and below the "sleeves." Temporary relief was obtained for a week but the pain afterwards recurred.

June 18th. Pain as before and foot oedematous.

July 4th. As patient continues to lose weight and is very depressed it was decided to sacrifice the "sciatic" nerve. This on account of the length of time the patient has been in bed (fifteen months), although there is voluntary power in extension of the ankle.

Seventh Operation (July 6th).—Excision of sciatic nerve at the junction. Four inches removed, which included repair work of operation No. 6, with fascial covering.

July 10th. All pain gone; anaesthesia in foot.

September 19th. Patient invalided to Canada; boot and iron to prevent drop-foot.

Microscopical Report on Nerve Section.—Several large bundles of nerve separated by much dense—in places hyaline—connective tissue, in which are imbedded groups of inflammatory cells and also foci of endothelial cells laden with brown pigment; old haemorrhage. In all nerve bundles there is considerable destruction of fibrils and their sheaths, often with replacement fibrosis. In parts at the periphery of the section a layer of connective tissue is seen, in some parts separated from, and in other parts attached to, the subjacent connective tissue covering the nerve bundles. The section shows to what extent interstitial fibrosis may occur when the nerve sheath is damaged. Conversely, it shows the uselessness of dissecting the nerve from surrounding scar when on palpation the nerve feels in the least degree hard or nodular. The layer of connective tissue referred to above consists of the fascial flap that had been put in position six weeks previously. It shows that the "sleeve" does not unduly adhere to the nerve sheath.

CASE F.—Tendon Transplantation in a Case where Nerve Suture was Impossible.

Pte. L., Canadian Infantry. Admitted December 24th, 1915, with history of having been hit by a bullet in the left groin on November 16th. The bullet emerged posteriorly in the region of the left sacro-iliac joint. Wounds closed on admission.

The left thigh is markedly atrophic—two inches less in circumference than the right. Cannot extend leg on the thigh, and cannot raise the patella. The quadriceps muscle does not react to faradism, and only sluggishly to galvanism. Matted glands and adhesions causing a marked mass felt on palpation in left pelvis. Thomas's walking knee-splint applied; massage and galvanism.

May 17th, 1916. No voluntary power in quadriceps; no reaction to faradism, and only sluggishly to galvanism. Apparently a complete lesion of the anterior crural. Suture contraindicated for anatomical reasons. Tendon transplantation advised.

Operation (June 16th).—Vertical incision twelve inches long on outer side of popliteal space. Biceps isolated and separated from head of fibula. From a corresponding incision on the inner side the semitendinosus was separated from its insertion. A channel was made between the deep fascia and the aponeurosis of the vasti through a 4-inch vertical incision in the suprapatellar region. The tendons were brought through this opening to the patella from their respective sides. Each tendon was fixed to the patella by means of a tunnelling process, which fixed them subperiosteally on the anterior surface. Sutured with No. 3 chromic catgut; wounds closed.

September 16th. Walking well; full extension possible voluntarily, and 45 degrees flexion of knee permitted.

September 26th. Discharged in England.

THE June issue of the *Edinburgh Medical Journal* is entirely given up to the medical and surgical aspects of child welfare, and forms the second collective report on this subject published by our contemporary. Dr. Claude Ker deals with infectious diseases; Dr. Norman Walker and Dr. R. Cranston Low with dermatology; Mr. J. V. Paterson and Dr. H. M. Traquair with diseases of the eye; Mr. J. S. Fraser with diseases of the ear, nose, and throat; and Mr. J. H. Gibbs, who is an able exponent of the views of Dr. Sim Wallace, with the prevention of dental disease. Each of these subjects is treated from the immediate point of view of child welfare. Dr. J. Hally Meikle contributes a chapter on medical inspection and supervision of school children in Edinburgh; and Dr. and Mrs. Leslie Mackenzie write on administrative institutions and regulations, and certain legal aspects of the subject.

C

OBSERVATIONS ON CHLORAMINES AS NASAL ANTISEPTICS.*

BY

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(Report to the Medical Research Committee.)

THE valuable results obtained by Gordon and Flack¹ on the use of chloramine-T, zinc sulphate, and other antiseptics for the treatment of meningococcus carriers among soldiers, led us to undertake some experiments on the influence of certain antiseptics on the total bacterial count of the nasal secretions of apparently normal individuals. It would appear that such experiments might furnish information which could be utilized in a practical way for the treatment of certain types of carriers. On submitting our results to Colonel Gordon he expressed the opinion that they possessed some interest in relation to the carrier problem, and we are thus led to record a short account of them.

The problem of destroying pathogenic organisms in the nasal cavities and upper air passages by direct disinfection is a difficult one. There are, undoubtedly, many carriers with anatomical abnormalities of the nose, pharyngeal vault, and tonsils, precluding immediate contact with solutions used either as sprays or gargles. In such cases there is little if any prospect of any antiseptic proving effective. On the other hand, the fact that the chloramines do not cause precipitates or coagula in secretions or exudates is favourable to their acting upon micro-organisms contained in these fluids. Experiments made by Gordon and Flack on meningococcus carriers among soldiers, in which they used a solution of chloramine-T² reduced to a very fine spray with a current of superheated steam, have given decidedly encouraging results.

Our first experiments were merely modifications of those of Gordon and Flack, and were made on the normal noses of healthy individuals. A high-pressure jet of air replaced steam, and the fine spray so produced was inhaled from a double cone of celluloid, which obviated the use of a closed chamber. The coarser droplets from the spraying nozzle were caught by diaphragms and returned to the reservoir from which the antiseptic solution was drawn, thus effecting a considerable saving.

With this apparatus, using a 0.5 per cent. solution of chloramine-T and sufficient salt to make it approximately isotonic, we found it possible to secure a very considerable reduction of the bacteria in the nasal secretions, occasionally obtaining sterile agar plates with the swabs used for collection. It was necessary, however, to continue the treatment for half an hour to attain this. Such a protracted treatment militates greatly against the method; it is probable that the concentration of the antiseptic actually present at a given time is insufficient to act promptly. The use of more concentrated solutions seems unwise, because it would be likely to prove irritating in many cases. We therefore turned our attention to other means of prolonging the time of contact without increasing the concentration, and finally had recourse to the use of an oily medium.

Chloramine-T, while freely soluble in water, is practically insoluble in oils. But the corresponding dichloramine (toluene-*p*-sulphodichloramine, $\text{CH}_3\cdot\text{C}_6\text{H}_4\cdot\text{SO}_2\text{NCl}_2$, to which we now propose to assign the abbreviated name of dichloramine-T), though very sparingly soluble in paraffin oil, is quite readily dissolved in eucalyptol. The resulting solution can be subsequently diluted with paraffin. In this way a reasonably bland oil solution, containing as much as 2 per cent. of the dichloramine, can be obtained. It is with such solutions of different strengths that our second series of experiments was made.†

* "Chloramines" are substances containing chlorine linked to nitrogen, almost all of which possess marked germicidal properties. Hitherto the most widely used member of this group is sodium-toluene-*para*-sulphochloramide, $\text{CH}_3\cdot\text{C}_6\text{H}_4\cdot\text{SO}_2\text{Na}\cdot\text{NCl}_2$, which is known under the name of chloramine-T and also a variety of trade names. The related dichloramines contain the NCl_2 group and are mostly sparingly soluble in water, but more readily soluble in organic solvents. A study of the germicidal action of these bodies will be found in the *Proc. Roy. Soc.*, B, 89, p. 232, 1916.

† It may be worth noting that Captain Sweet and Dr. Lee, at our suggestion, have investigated the use of a similar mixture containing 5 per cent. of dichloramine-T as a surgical dressing for infected wounds. The results will be published shortly and are said to be distinctly encouraging.

It should be noted that both of these oils combine with chlorine, and in order to obtain reasonably stable solutions it is important to reduce their avidity for this element by previous chlorination. The manner in which this was done and the mode of preparing the dichloramine solutions used are described below.

When the oil solution of dichloramine comes in contact with aqueous liquids a part of the chloramine passes into the latter. The former, therefore, serves as a reservoir from which the chloramine can be drawn to maintain a certain concentration of active antiseptic in the watery medium with which it is in contact. Experience showed that the active chlorine contained in the antiseptic was not exhausted after two hours, when a 2 per cent. oil solution was sprayed into the nose. By the use of this method, therefore, the action of the chloramine could be maintained without discomfort for a much longer time than when aqueous solutions alone were used. There is, however, one disadvantage in the use of oil alone. It is not as efficient in removing inspissated secretions as are watery solutions. Our choice has therefore been to cleanse the nose with an aqueous spray or irrigation, and then to apply the oil with a spray as thoroughly as possible.

The main results of our experiments with aqueous and oil solutions are summarized below.

I. EXPERIMENTS WITH AQUEOUS CHLORAMINE-T.

Experiments were made with a 0.5 per cent. solution of chloramine-T, inhaled through the nose as a fine power spray. Inhalation of this mist is not irritating, but causes a prompt increase in nasal secretion. For this reason, a control sample of the secretion was not taken until one minute after beginning treatment. All the samples for bacteriological examination were collected with sterile swabs of absorbent cotton, which were immediately immersed in a small quantity of a sterile solution of sodium thiosulphate to arrest any further action of the antiseptic. The whole swab, together with the thio-sulphate solution, was then used in making agar plate cultures. After from two to four days' incubation, the number of colonies appearing on these was counted.

In Table I the average of the six experiments in which the periods and mode of treatment were the same is given, and, for comparison, a similar experiment in which normal salt solution replaced that of chloramine-T.

The treatment included two periods of fifteen minutes each, with a pause of from thirty to forty minutes between. Samples for bacteriological examination were taken at intervals of five minutes, necessitating an interruption of about one minute in the application of the spray. This lost time is excluded from the table.

TABLE I.—Aqueous Chloramine-T and Neutral Salt Solution.

Time of treatment:	Number of Colonies Derived from Sample.					
	First Period.			Second Period.		
	5 min.	10 min.	15 min.	5 min.	10 min.	15 min.
0.5 % chloramine - T (control, 43,240)	1,331	707	526	439	153	17
Normal salt solution (control, 53,738)	12,352	121,620	13,587	2,137	10,055	34,339

II. EXPERIMENTS WITH OIL SOLUTIONS OF DICHLORAMINE.

Applications of the oil solution of dichloramine-T to the nose were made with an atomizer designed for paraffin oil, and from ten to twenty vigorous compressions of the bulb used for each nostril. The strength of solution and intervals of time between applications varied considerably. A brief preliminary treatment with an aqueous solution of chloramine-T was frequently employed to cleanse the nasal passages, and the oil was then not applied until the augmented secretion had subsided. The manner of collecting and examining samples of the secretion was identical with that already described, save that no sample bacteriological test was made less than half an hour after the application of the antiseptic, and the interval is usually an hour or longer.

While these experiments were in process there were no

TABLE II.—A Few Representative Results with Oil Solutions.

Treatment Employed.	Appli- cations of Oil between Tests.	Time of Test, from Beginning of Treatment.	Number of Colonies on Agar Plate.
I. 0.5 % aq. chloramine-T followed by 2 % di- chloramine-T in oil	0 1 0	0 30 min. 60 "	42,240 9 0
II. 1 % dichloramine-T in oil	0 1 0 0 0 0 0	0 1 hour 1.5 hours 2 " 3 " 5 " 7 "	1,150 590 1,750 140 145 39 135
III. 0.25 % dichloramine-T in oil	0 1 0 0 0	0 0.5 hour 1.5 hours 3 " 3.5 "	625 860 155 150 25
IV. 1.5 % dichloramine-T in oil	0 1 1 0	0 1 hour 3.5 hours 6 "	16,104 175 7 9
V. 0.1 % aq. chloramine-T followed by 1.5 % di- chloramine-T in oil	0 2 1 1 0	0 1 hour 2 hours 3 " 4 "	105,600 10 12 3 10
VI. 0.5 % aq. chloramine-T followed by 1.3 % di- chloramine-T in oil	0 2 2 0	0 1 hour 4 hours 5 "	1,800 0 0 20
VII. 1.25 % dichloramine-T in oil	4 0 0 3	1 hour 1.5 hours 2.5 " 17 "	15 370 665 0
VIII. 0.5 % aq. chloramine-T followed by 1.3 % di- chloramine-T in oil	0 1 4 0 1 1 1 1	0 1 hour 4 hours 20 " 22 " 24 " 26 " 27.5 "	6,129 8,960 87 1,980 59 3 1 20

precautions taken to exclude intercurrent access of bacteria to the nose from the air, and in those of longer duration the subject of the experiment frequently went out of doors and was exposed to the dust of the streets. On three occasions, oil sprays taken just before retiring at night resulted in sterile swabs on rising the next morning, without further treatment. In these cases the nose was normal and perfectly free, and there is good reason to believe that the oil had reached all parts of the nasal passages.

The weight of oil ejected from the spray with one vigorous compression of the bulb was approximately 18 mg. The total amount of antiseptic solution introduced into and finding lodgement in the nose was therefore very small—never over 15 mg., usually very much less. Bearing in mind the extent of surface treated, and that the presence of the oil precludes immediate action of all the antiseptic, it is evident that the germicidal efficiency of the dichloramine-T is of a high order.

As already stated, the incentive to these studies was to learn the adaptability of the chloramines used to the treatment of carriers. The results briefly summarized in Tables I and II warranted the belief that this application was worthy of trial.

Not ourselves having opportunity to treat carriers, this undertaking has been assumed by others, and is now in progress. There were no available meningococcus carriers in the neighbourhood of our work, but some observations have been made upon those carrying pneumococci or diphtheria bacilli, the latter mostly young children or infants and difficult to treat. The results obtained up to the present time are decidedly encouraging, but too few in number to warrant definite conclusions. We venture however, to append an outline of the treatment suggested, although fully aware that clinical experience may indicate that it might well be modified in certain particulars.

USE OF CHLORAMINE-T AND DICHLORAMINE-T IN THE DIS- INFECTION OF THE NASOPHARYNX OF CARRIERS.

In the light of the experience hitherto gained, it seems important to follow as closely as possible, the following procedure:

1. Cleanse the nose with salt solution or with 0.25 per cent. aqueous chloramine-T solution, either by spraying several times, using the handkerchief between applications, or by irrigation. The same chloramine-T solution should also be used as thoroughly as possible as a gargle.

2. After this preliminary cleansing, and when the augmentation of nasal secretion has subsided, apply the oil solution of dichloramine-T with an oil atomizer, endeavouring to reach all parts with an abundant supply of the oil. It is not certain that the oil introduced in this way continues active for more than two hours. For intensive treatment it should be renewed at the end of that time. In any case, it would seem important to repeat spraying with the oil at such intervals as to make at least four oil treatments daily at about equal intervals of time.

The first few applications of the oil sometimes occasion sneezing, but the nose appears to acquire a tolerance of the treatment, and subsequent applications cause no inconvenience.

As with all antiseptics, there are three factors governing success which must be constantly borne in mind: (1) There must be good contact with the parts to be acted upon; (2) there must be an adequate concentration of the antiseptic; (3) this must be maintained an adequate length of time. When the concentration is of necessity restricted, the time of action must be correspondingly prolonged. It is to attain this last desideratum that the treatment with an oil solution is recommended, but even so the actual amount of antiseptic applied to the nasal mucosa is not very considerable, although larger in quantity and in a more persistent form than could be tolerated in aqueous solution.

METHOD OF PREPARATION.

The preparation of the substances employed in these experiments is as follows:

Dichloramine-T, $\text{CH}_3\text{C}_6\text{H}_4\text{SO}_2\text{NCl}_2$. This substance was first prepared by Chattaway,³ and the following details are based on the method employed by him.

Bleaching powder (350 to 400 grams) of good quality is shaken with two litres of water on a shaker for an hour, and then the mixture allowed to settle. The supernatant fluid is siphoned off and the remainder filtered. Powdered toluene-para-sulphonamide, 75 grams, is then added to the whole of the hypochlorite solution and shaken till dissolved. The solution is filtered if necessary, placed in a large separating funnel, and acidified with acetic acid (100 c.cm.) added in portions. About 100 c.cm. of chloroform is then added to extract the dichloramine, and the whole well shaken. The chloroform layer is tapped off, dried over calcium chloride, filtered, and allowed to evaporate in the air. The residue is powdered and dried *in vacuo*. It is sufficiently pure for most purposes without recrystallization, and it is not necessary to use a pure toluene-para-sulphonamide in its preparation, as objectionable impurities likely to be present are removed in the preparation of the dichloramine.

An alternate method of preparation is as follows:—Toluene-para-sulphonamide (50 grams), water (500 c.cm.), crystallized sodium acetate (100 grams), and chloroform (100 c.cm.) are placed in a flask, which is immersed in cold water, and the contents treated with chlorine gas to saturation. If necessary, more chloroform is added to dissolve the dichloramine completely. The chloroform is separated in a funnel, washed with a little water, dried over calcium chloride, filtered, and allowed to evaporate. The crystalline residue of pure toluene-para-sulphon-dichloramine is powdered and dried *in vacuo*. The yield is practically the theoretical.

Preparation of Chlorinated Eucalyptol for Use as Solvent.

Eucalyptol (*British Pharmacopoeia* or *United States Pharmacopoeia*), and not eucalyptus oil, must be used. Five hundred c.cm. is treated with 15 grams of potassium chlorate and 50 c.cm. concentrated hydrochloric acid for twelve hours or longer; it is then well washed with water and with sodium carbonate solution. After this the water is tapped off and 15 grams of dry sodium carbonate is added to the oil and the whole allowed to stand for twenty-four hours. It is then filtered, dried with a little solid calcium chloride, and is then ready for use.

Preparation of Chlorinated Paraffin Oil for Use as a Diluent.

To 500 c.cm. of commercial liquid paraffin oil 15 grams of potassium chlorate and 50 c.cm. of concentrated hydrochloric acid are added and the mixture exposed to light, preferably sunlight, for several hours. It is then transferred to a separating funnel and washed successively with water, a solution of sodium carbonate, and again with water. The opalescent oil is then tapped off, solid calcium chloride added in small quantity, and about 5 grams of animal charcoal. On subsequently filtering through paper a clear, slightly yellowish oil is obtained, which is ready for use.

Preparation of the Oil Solution of Dichloramine-T.

Dissolve 0.2 gram of the dichloramine-T in 2 c.cm. of the chlorinated eucalyptol without heating. When solution is complete, add 8 c.cm. of the chlorinated paraffin oil. Mix well, and the solution is ready for use. This solution contains 2 per cent. of the dichloramine-T. It is relatively unstable, and should be discarded as inefficient as soon as a distinct precipitate makes its appearance (toluene-para-sulphonamide). An opalescence or moderate cloudiness is not evidence of material deterioration. It is a safe rule not to use the completed oil mixture more than three or four days after its preparation. Strong light and heat undoubtedly hasten the rate of deterioration.

An alternate method, when considerable quantities are required, is to prepare a stock solution, 10 per cent. of the dichloramine-T in chlorinated eucalyptol, and to dilute this with chlorinated paraffin oil, 1:4, as needed for immediate use. The eucalyptol solution should be kept in a cool, dark place, and under these conditions will suffer little deterioration within a month.

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- ¹ Lieutenant-Colonel M. H. Gordon: Disinfection of the Nasopharynx of Meningococcus Carriers, *BRITISH MEDICAL JOURNAL*, July 1st, 1916. Also a later article by the same author and Captain Martin Flack, published in the same JOURNAL.
- ² H. D. Dakin, J. B. Cohen, and J. Kenyon: On Chloramine, its Preparation, Properties, and Use, *BRITISH MEDICAL JOURNAL*, January 29th, 1916.
- ³ *Trans. Chem. Soc.*, 1905, vol. lxxxvii, p. 145.

CLINICAL NOTES ON A CASE OF FIBROID DISEASE OF BURSAE.

BY

CAPTAIN MANFRED MORRIS, R.A.M.C.(T.F.).

FIBROID HYPERPLASIA occurring in bursae and false bursae is of interest rather from the point of view of etiology than of treatment. My attention was lately drawn to this condition by a case of widespread fibrosis occurring in many bursal sites.

In January last there was admitted to the Surgical Division of No. 1 General Hospital a patient, aged 53, an engine-room artificer in the Royal Navy. He complained of piles and inability to sit down owing to the pain caused by tumours in his buttocks. On examination the patient had four external hæmorrhoids and large solid masses over the tuberosities of both ischia. These masses were as large as fetal heads, the right one being somewhat larger than the left. The tumours were irregular in outline, adherent to skin, and felt fixed to deeper structures.

On palpation they gave a non-fluctuant, hard, almost cartilaginous sensation to the hand. The skin over these masses was red, tender, and beginning to be inflamed. Further examination of this patient showed smaller tumours of similar consistence and physical signs occupying situations over the olecrana, the tubercles of both tibiae, the third piece of the sacrum, and one small mass as large as a walnut on the ulnar aspect of the base of the left thumb. The patient complained chiefly about his piles, and at a preliminary operation I ligated these. Convalescence was normal, the patient being encouraged to lie in the prone posture as much as possible to give the skin over the buttocks a chance to recover. Fourteen days later I decided to operate on the masses in the buttocks. The disability caused by these was purely mechanical. X-ray examination showed no bony changes in the pelvis and hip-joints. The tumours were represented by dim shadows mapping out their outline, which appeared to be continuous with the tuberosities of the ischia. The patient was placed in the prone position, with sandbags across the sterno-clavicular articulation and pelvis, so as not to embarrass respiration, and given chloroform. Curved incisions were made over the masses, which were found to be extremely dense and adherent. Their capsule was very vascular, and adherent to surrounding tissues. It was soon obvious that it was impossible to shell out these tumours, so they were removed by morcellation, triangular wedges being cut out till the masses