varieties of gas infection of wounds as gas gangrene has been responsible for considerable diversity of opinion on the value of different methods of treatment.

The differentiation is essentially a clinical one, and the importance of odour as a sign of gas gangrene is stressed.

The histories are given of three cases of anaerobic cellulitis and four cases of gas gangrene.

My thanks are due to Mr. Cecil Joll and Mr. Charles Gray for advice, and to the honorary staff of the Royal Free Hospital for permission to publish these cases.

REFERENCES

- Ashurst, A. P. C. (1929). *Ann. Surg.*, **90**, 612.
Bates, M. T. (1937). *Ibid.*, **105**, 257.
Bohman, H. R. (1937). *J. Amer. med. Ass.*, **109**, 254.
Edwards, A. Tudor (1940). Quoted in *Surgery of Modern Warfare*, edited by Hamilton Bailey, Part I, p. 121, Edinburgh.
Eliaeson, E. L., Erb, W. H., and Gilbert, P. D. (1937). *Surg. Gynec. Obstet.*, **64**, 1005.
Fleming, A. (1915). *Lancet*, **2**, 638.
Fraser, J. (1919). *Med. Rec. Cttee. Sp. Res. Ser.*, No. 39, p. 8.
Ghormley, R. K. (1935). *J. Bone Jt. Surg.*, **17**, 907.
Hawking, F. (1941). *British Medical Journal*, **1**, 263.
Henderson, D. W., and Gorer, P. A. (1940). *J. Hyg., Camb.*, **40**, 345.
Hosford, J. (1940). *British Medical Journal*, **1**, 1068.
Keen, W. W. (1918). *Treatment of War Wounds*, 2nd ed., p. 166, Saunders.
Kelly, J. F., and Dowell, D. A. (1936). *J. Amer. med. Ass.*, **107**, 1114.
Larson, E. E., and Clifford, S. (1930). *Ibid.*, **94**, 612.
Matson, M. H. (1932). *Arch. Surg.*, **24**, 75.
Ogilvie, W. H. (1940). *Wound Infection*, *Lancet War Primer*, pp. 69, 84.
Roberts, K., Johnson, W. W., and Bruckner, H. S. (1933). *Surg. Gynec. Obstet.*, **57**, 752.
Robertson, Muriel (1941). *Bulletin of War Medicine*, M.R.C., **1**, 130.
Stephenson, D., and Ross, H. E. (1940). *British Medical Journal*, **1**, 471.
Swan, H. Jocelyn (1940). *Ibid.*, **2**, 97.

FURTHER OBSERVATIONS ON ANTI-SEPTIC SNUFFS

BY

M. E. DELAFIELD, M.B., B.Ch.

AND

EDITH STRAKER, M.B., B.S.

*Emergency Public Health Laboratory Service, London School
of Hygiene and Tropical Medicine*

In continuation of the work previously described (Delafield *et al.*, 1941) some further observations on the effect of antiseptic snuffs on nasal carriers of staphylococci and other organisms are now presented. Seventeen of the subjects who provided the material for the earlier report have been further examined for twenty weeks—from early January to the middle of May. Nasal swabs, one from each nostril, were taken as before on three consecutive days each week and the technique of examination was in every respect identical with that previously described.

The Antiseptic Snuffs Tested

The snuffs which were the chief subjects of study had the following composition:

Sulphathiazole Snuffs:

- (a) 10 parts by weight of sulphathiazole
90 " " " " magnesium carbonate
- (b) 33.3 parts " " weight of sulphathiazole
66.6 " " " " magnesium carbonate
- (c) 50 parts " by weight of sulphathiazole
50 " " " " sulphapyridine

Control Snuff:

- (d) Light magnesium carbonate.

To these 1% of menthol may be added according to individual taste. If children are to be treated it would probably be best to omit the menthol. The general impression obtained is that (b) and (c) are better than (a), but that (b) and (c) are equally effective.

The use of lycopodium powder was discontinued, as two of the subjects showed signs of apparent sensitization after a week or two. These signs—profuse rhinorrhoea and headache—disappeared when magnesium carbonate was substituted for the lycopodium. Dr. M. H. V. Cameron

(1941) directed attention to the possible danger of the lycopodium producing granulomata, and cited papers on this subject by Erb (1935) and McCormick and Ramsey (1941). Dr. Cameron is also of the opinion that magnesium carbonate might be a danger, as granulomata apparently due to the use of magnesium silicate have been described. It is probable, however, that when this reaction occurs it is not due to the magnesium ion but to the silicate ion.

Penicillin (1% in lycopodium powder), which had previously proved effective with the few subjects on whom it had been tried, was again tested at the same concentration but with magnesium carbonate powder as a diluent. In this form the penicillin was much less effective than it had previously been, and *in vitro* tests showed that in a few days the snuff lost its power to inhibit the growth of staphylococci. Prof. Florey states that penicillin is rapidly destroyed in an alkaline medium, and it is probable that there is a sufficiently destructive alkalinity on the surface of the particles of magnesium carbonate. Before the use of lycopodium was discontinued penicillin (1%) associated with sulphathiazole (33.3%) and lycopodium was tested on a few subjects, but was found to be no more effective than the sulphathiazole snuff alone.

Method of Taking the Snuff

The subjects have taken the snuff six times a day, either by the classic method or by sniffing it from one corner of a small folded triangular piece of paper. The amounts thus taken per day have been weighed. Twelve pinches or a day's supply of the sulphathiazole (33.3%) in magnesium carbonate weigh 0.075 gramme, representing an intake of less than 0.6 gramme of sulphathiazole a week. Similarly a week's intake of the sulphathiazole - sulphapyridine snuff weighs about 1.6 grammes. No toxic symptoms were ever observed, even after many weeks of snuff-taking.

Persistence of Snuff in the Nose

Study was made of the amount of sulphathiazole taken up by a nasal swab. Swabs from both nostrils of the 17 subjects were examined chemically about two hours after the last snuff-taking. In 11 out of 34 swabs sulphathiazole was demonstrated in amounts ranging from 0.03 to 0.39 mg. As the presence of the drug on the nasal swab might affect the bacteriological findings, all subjects were directed not to take any snuff during the twelve hours preceding swabbing, which was carried out at 10.30 a.m. After this instruction no sulphathiazole was demonstrated on the nasal swabs.

Results with Nasal Carriers of Staphylococci

All the 17 subjects under test were carriers of staphylococci: 3 were light but persistent carriers, whereas swabs from 14 yielded heavy growths of *Staph. aureus* or a coagulase-positive *Staph. albus*. These organisms were sometimes found together on the same plate.

In all cases except one the staphylococci were very greatly reduced as a result of treatment with sulphathiazole snuff, but they never entirely disappeared. Only one carrier was relatively resistant to the snuff in that the number of organisms found was but slightly reduced. In general, when the number of colonies found was small as a result of treatment the staphylococci were white and coagulase-negative, although small numbers of coagulase-positive white staphylococci and of *Staph. aureus* tended to persist in a few carriers. No carrier was definitely "cured." Two to three weeks after treatment was stopped heavy growths of *Staph. aureus* and coagulase-positive *Staph. albus* were again obtained. In a few instances the organism did not appear in profusion until between four and six weeks had elapsed.

Chart I illustrates the progress of one of these staphylococcus carriers. In all charts the counts from the right nasal cavity are represented by a continuous line, those from the left nasal cavity by an interrupted line. The ordinates represent the average of the weekly number of

remained clear till the investigation ceased four weeks later. In the remaining carrier, in spite of treatments with one or other form of sulphathiazole snuff for thirteen consecutive weeks, the bacillus returned four weeks after he ceased to take snuff. Chart II illustrates the case of a carrier in whom the organism reappeared between courses of treatment.

CHART I.—Carrier of staphylococcus.

S = Treatment with 33.3% sulphathiazole snuff.
M = " " magnesium carbonate control snuff.
SP = " " equal parts of sulphathiazole and sulphapyridine snuff.

staphylococcal colonies counted on the blood-agar plates after forty-eight hours' incubation. Counts of over 100 were recorded as > 100 , and are marked as 100 on the charts.

Results with Nasal Carriers of Hoffmann's Bacillus

Eleven of the 17 staphylococcus carriers also carried Hoffmann's bacillus. In every instance the bacillus disappeared directly after sulphathiazole snuff treatment was begun. The 10% sulphathiazole snuff was as effective as the others. With 7 of these carriers the organism, having

The findings with Hoffmann's bacillus clearly suggest that these snuffs might be of use in the treatment of nasal carriers of the diphtheria bacillus, and Drs. Payne and Auchinleck (1941) record promising results in a very small preliminary trial. In view of this and other reports since obtained, a systematic inquiry, adequately controlled, is being made by the Emergency Public Health Laboratory Service into the effect of these snuffs on convalescent cases and carriers.

Some *in vitro* experiments demonstrated that the diphtheria bacillus is less sensitive than Hoffmann's, and it would therefore be advisable to use snuff (b) or (c) if the treatment of nasal diphtheria carriers is to be attempted. It is of practical interest to record that children are eager and enthusiastic snuff-takers.

Results with Nasal Carriers of Pneumococcus

The pneumococcus, so far as this investigation goes, seems to be completely resistant to every kind of snuff used in this experiment.

There were 9 subjects who carried pneumococci for varying periods. One carried the organism throughout the whole of the investigation, 3 carried it for only a short time, and from 4 the pneumococcus was first isolated about a week after the onset of a cold and disappeared after a few days or weeks. The ninth subject first had a pneumococcus in his nose during the third week of a cold and thereafter became a chronic carrier.

CHART II.—Carrier of Hoffmann's bacillus.

S = Treatment with 33.3% sulphathiazole snuff.
M = " " magnesium carbonate control snuff.
SP = " " equal parts of sulphathiazole and sulphapyridine snuff.

CHART III.—Carrier of pneumococcus.

S = Treatment with 33.3% sulphathiazole snuff.
P = " " 1% penicillin in magnesium carbonate.
SC = " " 1% penicillin with 33.3% sulphathiazole in lycopodium.
SP = " " equal parts of sulphathiazole and sulphapyridine

once disappeared after one course of treatment, was never again isolated even after many weeks. In 3 other carriers the organism returned in two to three weeks after the cessation of treatment, but after a third period of snuff the nose

Two subjects who first showed pneumococci in a snuff-free interval continued to carry a pneumococcus in undiminished numbers, one for two weeks and one for four weeks, while taking sulphathiazole (33.3%) snuff. Another subject (see

Chart III) carried a pneumococcus during the entire investigation in spite of treatment with sulphathiazole (33.3%) snuff and sulphathiazole - sulphapyridine snuff. He was known to be a chronic pneumococcus carrier, Type III and other pneumococci having been isolated from throat and nose on many occasions over several years. Most of the swabs obtained during the present experiment grew Type III pneumococci, but sometimes a mixed growth of Type III and other pneumococci was obtained.

Two further subjects began to carry a pneumococcus while taking sulphathiazole (33.3%) snuff, and each continued to carry the organism for two weeks. Another subject began to carry a pneumococcus in the autumn of 1940, in the third week of a cold, while taking 5% proflavine snuff. He was later treated with sulphathiazole (33.3%) and sulphathiazole - sulphapyridine snuffs for thirteen consecutive weeks, but never lost the pneumococcus. The pneumococci isolated from these carriers were sensitive to sulphathiazole and sulphapyridine *in vitro*, which makes the failure of the snuffs to affect the carriage of this organism difficult to explain. It is possible that this organism tends mainly to colonize the sinuses and sinus cells and other inaccessible nooks and crannies in the nasal cavity.

Results with Other Organisms

Meningococci.—These organisms are not commonly isolated from the nose, and in this investigation the chance of obtaining a culture of meningococcus was small, because the swabs were emulsified in heart broth and the broth was then used to inoculate plates. Meningococci in heart broth may die in a few minutes. In spite of this, meningococci were isolated during January and early February from four subjects who were taking plain magnesium carbonate snuff. From one subject the organism was obtained only once, but from the other three it was obtained on three or four occasions during two weeks. After this each carrier started a course of sulphathiazole (33.3%) snuff, and the meningococci disappeared and were not seen again during the remaining weeks of this investigation, even during snuff-free intervals.

Haemolytic Streptococci.—One subject carried a haemolytic streptococcus (Group A, Type 5) in his right nostril only. It was grown from 19 out of 25 swabs during a period of ten weeks and did not disappear with sulphathiazole (10%) snuff treatment. Afterwards the carrier was treated with sulphathiazole (33.3% snuff) for seven weeks and then with sulphathiazole - sulphapyridine snuff. During the first three weeks of this treatment there were four positive swabs each yielding only one or two colonies. The organism then disappeared, and had not returned four weeks after cessation of treatment.

Neisseria catarrhalis.—There were five carriers of a Gram-negative coccus which did not ferment dextrose, maltose, or sucrose, and had dull grey-yellow colonies which could be easily pushed over the surface of the plate with a wire loop. Only one subject lost this organism when taking sulphathiazole (10%) snuff, and with him it never reappeared. Three others lost it during treatment with sulphathiazole (33.3%) snuff: with one of them it reappeared four weeks after stopping snuff. The fifth subject did not lose the coccus till treated with sulphathiazole - sulphapyridine, and it returned two weeks after stopping snuff.

Proteus vulgaris.—There was one carrier of this organism. Four swabs were all positive when he was first examined. It appeared less often under treatment with sulphathiazole (33.3%) snuff, and was grown from only one of eleven swabs during treatment with sulphathiazole - sulphapyridine snuff. After stopping snuff three out of seven swabs were positive. *In vitro*, *P. vulgaris* was only slightly sensitive to sulphathiazole even in saturated solution.

Antiseptic Snuffs in Relation to Colds

There is now further evidence from a number of people that the snuffs, if taken within two days after the onset of a cold, shorten the course of the disease. The discharge usually remains clear and the purulent stage is either prevented or lessened in intensity. There is no evidence that the snuff prevents colds.

Oral Insufflation of Antiseptic Powders

Three individuals were treated by the oral insufflation of sulphathiazole (33.3%) in magnesium carbonate. The

tonsils and visible part of the nasopharynx were thickly coated with the powder three times a day on five days a week, from Monday to Friday. No evidence was obtained, from swabs taken on Tuesday to Thursday inclusive, of any alteration in the type or numbers of organisms present.

Summary

An antiseptic snuff containing sulphathiazole is effective in causing an extreme reduction in the number of staphylococci in nasal carriers of this organism. The carriers are not cured, as the organisms reappear within a few weeks of the cessation of treatment.

It is effective in the cure of carriers of Hoffmann's bacillus and is likely to prove effective in the treatment of chronic nasal diphtheria carriers.

It may be effective in the treatment of nasal haemolytic streptococcus carriers.

It may be of value in the treatment of carriers of meningococci.

It is worth further trial in cases of the common cold, in which it tends to affect the course of the disease favourably although it is not a preventive.

There is no evidence that it affects the nasal carriage of pneumococci.

We wish to express our thanks to all those who have submitted themselves to repeated swabbings and snuff treatment over many months. We are also greatly indebted to Messrs. May and Baker, Ltd., for their generous help in supplying us with the sulphathiazole and sulphapyridine used in this and the earlier investigation.

REFERENCES

- Cameron, M. H. V. (1941), *British Medical Journal*, **1**, 607.
 Delafield, M. E., Straker, Edith, and Topley, W. W. C. (1941). *Ibid.*, **1**, 145.
 Erb, I. H. (1935). *Surg. Gynec. Obstet.*, **60**, 40.
 McCormick, E. J., and Ramsey, T. L. (1941). *J. Amer. med. Ass.*, **116**, 817.
 Payne, A. M. M., and Auchinleck, G. M. (1941). *British Medical Journal*, **1**, 332.

JUGULAR THROMBOSIS AFTER TONSILLITIS

BY

R. L. FLETT, M.D., F.R.C.S.

Aural Surgeon, Derbyshire Royal Infirmary

Three cases of jugular thrombosis have been treated. A description of the condition is best given in the details of their clinical history.

Case I

A man aged 21 was admitted to hospital on November 8, 1934. Two weeks before admission he had had a quinsy without pus formation, and swelling below the left mastoid. The temperature was 104°. This responded to local antiseptic treatment. Then just before admission he complained of pain behind the right mastoid process, but no pain in the ear or deafness. There was some thickening over the area of the mastoid emissary vein. The temperature was normal. The tympanic membrane was congested but translucent. Paracentesis was performed and about two drops of serous exudate was obtained. The patient looked so ill, and his temperature had been so high with his throat condition, that a cortical mastoid operation was performed. The mastoid cells were practically normal except for some congestion, and no pus was obtained. The lateral sinus plate was so posteriorly placed that the sinus was not exposed. After a swinging temperature for five days the clean mastoid wound was reopened and a lateral sinus full of pus exposed. This was opened and the outer wall cut away. Bleeding was secured from the torcular but not from the jugular end. Packs were inserted, being removed after five days. Before the operation both optic disks showed about three dioptries of optic neuritis. The whole condition cleared up, apart from an attack of German measles, one month after the first operation.

A blood investigation showed 75% haemoglobin, and ferrous iron was administered in large doses. There had been no swelling in the neck at the time of the lateral sinus operation,