and diarrhoea. Vomiting was common, and chills, sweats, and headaches frequent. In most cases the initial symptoms were the severest, and the patient rapidly improved. The duration of the diarrhoea varied from a few hours in the milder cases to four to seven days in the severest ones. Headache was rare after the first day. In the majority of this group vomiting occurred at the outset, and continuation of the vomiting was the most serious symptom encountered. Pyrexia was unusual, even in the severest cases, and the temperature was often subnormal. There was no splenic enlargement or rash.

These authors conclude, therefore, that the disease varies from an acute gastro-enteritis to a mild diarrhoea. The onset is sudden and pyrexia is exceptional. The course has no resemblance to enteric fever, and the character of the stools is unlike dysentery. They also consider that the infection in this epidemic was by carriers, either acute or chronic.

Dr. Pleasance² describes a sporadic case of *B. aertrycke* infection occurring in a boy aged 3. The onset was very acute, with severe diarrhoea and vomiting; death occurred on the seventh day. *Post mortem* a large splenic abscess was found. Subsequently a Gram-negative, actively motile bacillus was isolated in pure culture from the gall-bladder and splenic pulp, but when first isolated the organism was not agglutinated by the specific serums for *B. paratyphosus* B or *B. aertrycke*. Repeated subcultures were made, and twelve months after isolation the organisms agglutinated with *B. paratyphosus* B and *B. aertrycke* antisera. Absorption tests were then performed and the organism identified as *B. aertrycke*. This illustrates the fact that *B. aertrycke* can at times assume invasive powers, and it is possible that in the case here recorded this occurred to some extent, since from the signs and symptoms it is evident that the organism was not confined to the alimentary tract.

An epidemic is described by Dr. Burgess³ comprising 703 known cases. The incubation period was two and a half to twenty-four hours, and the onset was very sudden, with pain, vomiting, and diarrhoea. There were also pyrexia, headaches, chills, and sweats. The diarrhoea was very severe. The acute stage is stated to have lasted two to ten days, but the average was four to five days, and convalescence was rapid. The outbreak was traced to cream used in the manufacture of cream cakes, and the organism isolated was *B. aertrycke*.

It will therefore be seen that, with the exception of Perry and Tidy's Type A, all the cases described by these authors had an acute onset with diarrhoea and vomiting, and as a rule pyrexia was not a marked feature of the condition.

Dr. Savage and Mr. Bruce White⁴ consider that Salmonella food poisoning is due, in the majority of instances, to *B. aertrycke*, and they assert that, in this country at least, this organism is responsible for three-quarters of the outbreaks. These authorities point out that they have failed to find any evidence of the ability of *B. paratyphosus* B to produce an ordinary attack of food poisoning, though they admit that paratyphoid fever may at times have a sudden onset which may temporarily simulate it. The converse is, however, illustrated by this case, in which at the onset the irritation symptoms so characteristic of *B. aertrycke* infection were so slight as to lead for a short time to a tentative diagnosis of paratyphoid fever.

Not infrequently the serums of patients suffering from *B. aertrycke* infection show coagglutinins for *B. paratyphosus* B. If such serums are sent for diagnosis for typhoid or paratyphoid fever, and if the investigations are restricted to the diagnosis of these infections, it may happen that such coagglutination may lead to a wrong diagnosis of paratyphoid fever; or if, as in the present case, coagglutinins are absent, a negative result for the typhoid-paratyphoid group is worthless. We therefore strongly urge that when sending blood samples to a laboratory for examination when typhoid or paratyphoid fever is suspected, and more especially when the clinical signs and symptoms are not typical, a full investigation as regards the Salmonella group and the associated organisms should be required; when multiple agglutinins occur their relative

importance must be established by absorption tests. We have reason to suggest that, should such comprehensive agglutination tests be more generally adopted, sporadic cases of *B. aertrycke* infection will be found to be more frequent.

We should like also to emphasize the importance of the bacteriological examination of the faeces in every case, as the isolation of the organism definitely clinches the diagnosis. This, however, takes some time and, provided that proper cultures and technique are utilized, examination of the patient's serum in the first instance is a valuable aid to rapid diagnosis; it may help in tracing the source of the infection, which may not be available by the time the organism has been recovered and proved.

To a few workers these statements may appear commonplace, but we know from our own experience and that of others that in routine work, both clinical and bacteriological, the Salmonella food-poisoning organisms are seldom considered, except when a typical and serious outbreak forces them on our attention.

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- ² Pleasance, R.: *Lancet*, 1922, ii, p. 609.
- ³ Burgess, W. L.: *Proc. Roy. Soc. Med.*, Section of Epidemiology and State Medicine, p. 61.
- ⁴ Savage and White: Medical Research Council, Special Report Series No. 51.

A COMPARISON OF THE WASSERMANN, KAHN, AND SIGMA TESTS.

BY

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For this purpose 2,019 serums were taken and submitted to all three tests. The greater number were from cases of treated syphilis. The remainder included cases in which the diagnosis was clinically doubtful and cases in which the first test carried out gave a doubtful result or one contrary to the clinical findings.

Technique.

The Wassermann test was No. 1 method, as described in the Medical Research Council, Special Report Series No. 14. Results were recorded as ++; +±; +; ±; and negative. For diagnostic purposes + was considered positive and ± doubtful (in treated cases ± = positive).

The Kahn test was carried out as laid down by the author,¹ but after the first few tests the first tube of each was omitted and only two tubes used—that is, those containing 6 and 12 parts of serum respectively to 1 of antigen. Results were read by artificial light with a ×6 hand lens, and were recorded as positive (P), negative (N), or doubtful (D), one letter being employed for each tube.

Positive is indicated by PP, but a DP result was considered positive in cases under treatment. DD = doubtful and NN or ND = negative.

The Sigma test was carried out as described in the Medical Research Council, Special Report Series No. 78; only five tubes were used, and the reading was taken at from twenty to twenty-two hours. A reading of 1.5 units and upwards was taken as positive, 1 to 1.5 as doubtful (positive in treated cases), and below 1 as negative.

Of the 2,019 serums examined 1,401 showed absolute, and 403 relative, agreement with all three tests, which is almost 90 per cent. Of the 215 serums which showed disagreement 205 were from cases of syphilis, either treated or untreated. Of these 205:

The Kahn test appeared to be most correct in	... 72
" Wassermann "	... 32
" Sigma "	... 5
" Kahn and Sigma "	... 57
" Kahn and Wassermann "	... 31
" Sigma and Wassermann "	... 8

Thus it would appear that the Kahn was most correct 160 times, the Wassermann reaction 71 times, and the Sigma test 70 times.

Of the remaining 10 there were 6 apparently false Kahn tests. In 2 there was agreement with the Wassermann

reaction, in 1 agreement with the Sigma, in 1 partial agreement with the Sigma, and in 2 partial agreement with the Wassermann reaction. False positives may therefore be reduced to 3 (in 2 of which the readings were N P, P, and D P P respectively). There were 6 apparently false positive Wassermann reactions. In 2 the Kahn agreed; in 2 the Kahn partially agreed; in 1 the Sigma partially agreed, and one case was probably syphilis. There were thus 3 "false positives," which gave the following readings: $+\pm$ (test repeated with the same result), $+$ (test repeated with the same result), and $+$. There was 1 apparently false positive Sigma test with which the Kahn agreed.

Conclusions.

From the above it would appear that whilst there was a high percentage of agreement between the three tests the results were slightly, but definitely, in favour of the Kahn. It is not suggested that this test could or should replace the Wassermann, but it is a very useful additional test, especially in cases where the diagnosis is in doubt

or where the Wassermann reaction gives a $\pm$ result. The Kahn test appears to give a definitely greater proportion of positives in cases of treated syphilis; in other words, it remains positive longer than the Wassermann during treatment. It is probable that had the Sigma tests been carried to the full incubation period of forty to forty-four hours a greater number of positives would have been obtained, but this was not done on account of the extra time involved and consequent delay.

The chief advantage of the Kahn test is its simplicity. It does not require as many ingredients as the Wassermann nor the complicated titrations; it is much more rapidly carried out than the Sigma with its somewhat elaborate apparatus. A reliable result of a Kahn test can be given within an hour of receiving the serum.

I have to thank Colonel L. W. Harrison, D.S.O., F.R.C.P.Ed., Director of the Venereal Department, St. Thomas's Hospital, for permission to publish these figures.

REFERENCE.

¹ Amer. Journ. Public Health, June, 1924.

A COMPARISON OF THE EFFICIENCY OF SOME METHODS OF OXYGEN ADMINISTRATION.

BY

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ANOXAEMIA has been classified by Barcroft¹ as follows: (1) Anoxic, when the blood has failed to pick up its proper load of oxygen in the lungs, so that its oxygen pressure is too low; (2) anaemic, when the blood has picked up all it can carry, so that its oxygen pressure is normal, but owing to deficiency of haemoglobin its load is not sufficiently great; (3) stagnant, when the oxygen in the arterial blood is normal, but the flow through the capillaries is too slow.

It is in the anoxic type that oxygen administration is especially indicated, as occurs, for example, in lobar pneumonia.

Methods.

Accounts of the different methods which are in use have been given by numerous authors.²⁻⁹ The methods studied in this paper are (a) the tube and funnel held closely over the mouth and nose, and

(b) at a measured distance; (c) a nasal catheter inserted in one nostril, with its end in the nasopharynx; (d) the Haldane mask; (e) a new mask over the mouth only.

The basis of comparison chosen is the pressure of oxygen in the alveolar air of a normal subject breathing at known rate and depth. Only respiratory methods of administration are mentioned here, because intravascular ways are considered dangerous and subcutaneous injections useless in view of the small amount that can be absorbed in comparison with the bodily needs.¹⁰

Findings.

Chart 1 shows that up to 4 litres a minute, given by a funnel held 10 cm. from the mouth, has no effect on the alveolar oxygen pressure. If, however, the funnel is pressed closely over the nose and under the chin the effect obtained is about the same as with a nasal catheter at the same rate of flow of oxygen. For example, oxygen given at $1\frac{1}{2}$ litres a minute will raise the alveolar oxygen pressure half as much again as when breathing air, whereas 3 litres will double it.

Chart 2, which is on a smaller scale, shows in addition

the alveolar oxygen when the Haldane mask is used. The figures here shown for the catheter and mask do not differ materially from those already published.⁸ Mention will be made later of the results obtained with the mouth-mask.

Comment.

It is incontestable that the face-mask method is a very efficient means of raising the alveolar oxygen; but every physician knows the clinical objections to the prolonged use of a mask which covers the mouth and nose. The reasons for a patient's intolerance may be physiological, such as slight obstruction to breathing, or an increase of the dead space with consequent rebreathing of a fraction of the expired air; it would seem that the reasons are also psycho-

logical, for even a normal person without dyspnoea feels hot and uncomfortable after wearing a mask for a few minutes. The nasal catheter is therefore used as a compromise. Against its manifest inferiority in raising the alveolar oxygen pressure must be set the fact of its simplicity and convenience both to patient and doctor. It can even be used in children.¹¹ By its use oxygen administration can be continued for days on end, uninterrupted by the necessity

of feeding, by coughing, or by sleeping. We have shown its effect on the alveolar oxygen. That this effect may be great enough to improve the oxygenation of the blood in lobar pneumonia is seen from the following cases.

Case 1.—Male, aged 44; respirations 42, pulse 125. The oxygen saturation of the arterial blood before giving oxygen was 85 per cent. Rate of flow of oxygen was 0.75 litre a minute by nasal catheter for fifteen minutes. The oxygen saturation was raised to 89 per cent.

Case 2.—Male, aged 50; respirations 35, pulse 112. The oxygen saturation of the arterial blood after having 0.5 litre of oxygen a minute by catheter for two hours was 80 per cent. The rate of flow was then increased to 1 litre a minute. Fifteen minutes later the oxygen saturation had risen to 88 per cent.

The rates of flow used in these two cases were, for experimental reasons, much below what should be employed. In pneumonia the flow should be slowly increased to at least 3 litres a minute. The catheter generally used in adults is a No. 9 oesophageal. The lateral hole should be near the tip; the terminal four inches are smeared with cocaine ointment, and the catheter is inserted into one nostril until a resistance is felt, when it is withdrawn slightly. If there is no obstruction in the nose the end should now be in the nasopharynx. The patient is more

CHART 1.

CHART 1.—Shows that oxygen given by a funnel held 10 cm. from the mouth does not enrich the alveolar air. Subject breathing 350 c.cm. per breath; respirations 15 a minute. (240 mm. is about equal to 33 per cent. oxygen in alveolar air.)

CHART 2.—(a) and (b) show pressures obtained with the new mouth-mask. (a) With the nostrils closed by cotton-wool. (b) Breathing air by the nose, oxygen by the mouth. (500 mm. is about equal to 70 per cent. oxygen in alveolar air.)

CHART 2.

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