2 in good health after nearly three years, 1 after one year and nine months, 3 after one year, 1 after six months, and 1 after three months; 1 case has not been seen since leaving the hospital.

E. H. Taylor, of Dublin, in an excellent article in the *Annals of Surgery* for April of this year, states that the mortality of this operation is from 20 to 25 per cent., whilst Cheyne, in his lectures already referred to, estimates it at from 18 to 20 per cent. He says: "The mortality varies considerably between the perineal and sacral operations, being naturally higher for the latter." In this I must agree with him, for out of many cases of perineal excision I have not had a death. He further says that König's total mortality is 38 per cent., Billroth's 34, Kocher's 28, Albert's 18; Iversen's estimate of Kraske's operation 25 per cent., and Czerny's 19.4 per cent. I have not been able to find any statistics regarding the work of British surgeons. Ball, in the second edition of his work, states that he has had four cases, which were all cured, and Littlewood's three cases I have already mentioned. Allingham, in his last edition, says he has performed the operation several times, but with what result is not stated, whilst I can find nothing on this subject from the pen of Harrison Cripps, a pioneer in the perineal operation.

In conclusion, I would remark that, owing to the enterprise of our Continental brethren, the field of operable cases of rectal cancer has been very considerably widened. Many patients, on whom even the most heroic would have refused to operate by the perineal route, can by Kraske's operation at least be relieved of their disease, and in a few of these the normal functions of the part may even be restored. The mortality, high as it is on the Continent, is decreasing, whilst in Great Britain, as far as I can learn, it is not more than twice that of the perineal operation; so that with extended experience, a more careful selection of cases, and strict attention to antiseptics, we may confidently expect it to become yet lower.

REFERENCE.

1 *Lancet*, September 12th, 1896.

## ON THE EMPLOYMENT OF DEAD BACTERIA IN THE SERUM DIAGNOSIS OF TYPHOID AND MALTA FEVER,

### AND ON AN EASY METHOD OF EXTEMPORISING A BLOWPIPE FLAME FOR MAKING CAPILLARY SERO-SEDIMENTATION TUBES.

BY

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THE utility of the method of serum diagnosis of typhoid and Malta fever has now been so firmly established, and the technique of this method is now so simple that this method of diagnosis will probably be everywhere employed by clinicians who have at their disposal pure cultures of the bacillus typhosus and of the micrococcus melitensis of Bruce, and who have further at their disposal a supply of culture media and an incubator and a microscope, or in default of a microscope a supply of capillary sero-sedimentation tubes.[1] Simple as this equipment may seem, there are very few practitioners at home, and there are practically none abroad, who have all these requisites at their disposal. We therefore consider that it may not be without interest to draw attention to the fact that the whole apparatus of culture media and incubators can be dispensed with by employing instead of living cultures of the bacteria of typhoid and Malta fever dead cultures of these same bacteria. These dead cultures can be very conveniently carried about or sent by post in sealed glass capsules.

The fundamental observation in connection with this question, and the suggestion that this observation might be turned to practical account, is to be found in a paper by Widal published in the *Presse Médicale* of September 30th, 1896. Widal showed that the agglomeration which is obtained when the diluted serum of a typhoid patient is brought in contact with a living culture of bacteria is obtained in an equally characteristic manner when the serum of the patient is brought in contact with a culture of bacteria which has been killed by exposure to a temperature of 60° C.

We have repeated this observation of Widal's, and have found that it is perfectly accurate. We have further found that it holds true also of the micrococcus melitensis of Bruce. We employed in our test experiments "emulsions" of fresh agar cultures of the respective bacteria. In each case these emulsions were drawn up into small glass capsules similar to those which are employed for bacterial vaccines; these capsules were then exposed in a water bath to a temperature of 60° C. for a period which varied from five to ten minutes. The capsules of dead bacteria[2] were then put aside in a cupboard for three to nine weeks. After the expiration of this time their contents were thoroughly shaken up, and they were then employed for purposes of serum diagnosis. The serum, which was employed in the test experiments reported below, in the case of the micrococcus melitensis, was derived from a case of Malta fever which is at present under treatment in the Royal Victoria Hospital, Netley. The serum, which was employed in the case of the typhoid bacillus, was furnished by one of us, who vaccinated himself against typhoid some six months ago, and whose blood in consequence of that vaccination exhibits a typical sedimentation reaction in dilutions of 1 in 10 to 1 in 100.

In the case both of the bacillus typhosus and of the micrococcus melitensis the mixtures of diluted serum and dead bacteria were examined both under the microscope to elicit the agglutinative effect, and also in capillary sero-sedimentation tubes to elicit the sedimentation effect. In each case control experiments were made in which dilute specific sera were mixed with perfectly fresh living cultures of the respective bacteria. In each case also further controls were made with mixtures of dead bacterial cultures with non-specific sera.

Microscopical examinations showed that the cultures which had been killed by heating to 60° C. did not differ in any marked way from the living cultures. There was no trace of clumping in the dead cultures, and the movements of the isolated bacteria did not in any case differ strikingly from those which were seen in the living cultures. Close attention, however, revealed that in the case of the typhoid bacteria no progressive movements occurred in the heated cultures. In the case of the micrococcus melitensis it was impossible to be sure that there was a qualitative difference between the movements in the living and in the dead cultures.[3]

Comparative microscopic study of the effects produced by adding dilute specific sera respectively to dead and living cultures of the bacillus typhosus and the micrococcus melitensis, did not reveal any differences in the method in which agglomeration occurred in the respective specimens.

The experiments which were conducted in capillary sero-sedimentation tubes gave even more interesting results. These results are given on the next page in tabular form:

The following points in these experiments appear to deserve attention:

1. It is interesting to note that the sedimentation which occurs when a dead bacterial culture is mixed with a specific serum can be readily distinguished from the deposition of bacteria which sooner or later occurs in every dead bacterial culture. The specific sedimentation can be distinguished not only by the fact that it occurs infinitely more rapidly than the deposition of bacteria which occurs in the unmixed bacterial culture, but further by the fact that the sedimentation which is produced by an admixture of a specific serum is floccular and unevenly disposed as contrasted with the impalpably fine and perfectly evenly disposed deposit which takes place in the unmixed dead culture. These differences in appearance are, of course, correlated with the fact that the deposit in the case of the specific sedimentation is a deposit of agglomerated masses of bacteria, whereas in the case of the unmixed culture the deposit is a deposit of individual bacteria.

2. It is further interesting to note that, contrary to what might have been expected, the specific sera did not exert any greater effect upon the dead bacteria than upon the living bacteria.

It is almost unnecessary to dilate upon the great practical importance of the method of diagnosis by means of dead

TABLE I.—*Micrococcus Melitensis.*

| No. of Tube. | Contents of Capillary Sedimentation Tube. | Sedimentation Effect after 24 Hours. |
|---|---|---|
| 1 | Unmixed *dead* bacterial culture | Practically nil. |
| 2 | *living* " " | " |
| 3 | *Dead* bacterial culture mixed with an equal quantity of a 10-fold diluted non-specific serum | " |
| 4 | *Living* bacterial culture treated in exactly the same manner | " |
| 5*a* | *Dead* bacterial culture mixed with an equal quantity of a 10-fold diluted specific serum | Complete |
| 5*b* | *Living* bacterial culture treated in exactly the same manner | " |
| 6*a* | *Dead* bacterial culture mixed with an equal quantity of a 50-fold diluted specific serum | " |
| 6*b* | *Living* bacterial culture treated in exactly the same manner | " |
| 7*a* | *Dead* bacterial culture mixed with an equal quantity of a 100-fold diluted specific serum | " |
| 7*b* | *Living* bacterial culture treated in exactly the same manner | " |
| 8*a* | *Dead* bacterial culture mixed with an equal quantity of a 500-fold diluted specific serum | |
| 8*b* | *Living* bacterial culture treated in exactly the same manner | " |
| 9*a* | *Dead* bacterial culture mixed with an equal quantity of a 1,000-fold diluted specific serum | |
| 9*b* | *Living* bacterial culture treated in exactly the same manner | |
| 10*a* | *Dead* bacterial culture mixed with an equal quantity of a 2,000-fold diluted specific serum | |
| 10*b* | *Living* bacterial culture treated in exactly the same manner | " |
| 11*a* | *Dead* bacterial culture mixed with an equal quantity of a 3,000-fold diluted specific serum | |
| 11*b* | *Living* bacterial culture treated in exactly the same manner | " |
| 12*a* | *Dead* bacterial culture mixed with an equal quantity of a 5,000-fold diluted specific serum | Marked but not complete. |
| 12*b* | *Living* bacterial culture treated in exactly the same manner | " |

TABLE II.—*Bacillus Typhosus.*

| No. of Tube. | Contents of Capillary Sedimentation Tube. | Sedimentation Effect after 24 Hours. |
|---|---|---|
| 1 | Unmixed *dead* bacterial culture | Practically nil. |
| 2 | *living* " " | " |
| 3 | *Dead* bacterial culture mixed with an equal quantity of a 10-fold diluted non-specific serum | " |
| 4 | *Living* bacterial culture treated in exactly the same manner | " |
| 5*a* | *Dead* bacterial culture mixed with an equal quantity of a 10-fold diluted specific serum | Complete. |
| 5*b* | *Living* bacterial culture treated in exactly the same manner | " |
| 6*a* | *Dead* bacterial culture mixed with an equal quantity of a 20-fold diluted specific serum | |
| 6*b* | *Living* bacterial culture treated in exactly the same manner | |
| 7*a* | *Dead* bacterial culture mixed with an equal quantity of a 40-fold diluted specific serum | , |
| 7*b* | *Living* bacterial culture treated in exactly the same manner | " |
| 8*a* | *Dead* bacterial culture mixed with an equal quantity of a 50-fold diluted specific serum | |
| 8*b* | *Living* bacterial culture treated in exactly the same manner | , |
| 9*a* | *Dead* bacterial culture mixed with an equal quantity of a 100-fold diluted specific serum | Marked but incomplete. |
| 9*b* | *Living* bacterial culture treated in exactly the same manner | " |

bacterial cultures to the ordinary practitioner, and especially to the practitioner abroad and to the medical officer who is at sea or on military service. It will obviously be possible for every medical man to obtain a supply of capsules of dead typhoid and Malta fever bacteria for serum diagnosis from a central bacteriological laboratory. He will be able to carry about these cultures without risk, and he will not need to take precautions against infection when he is employing them in the serum diagnosis of doubtful cases of fever. His whole equipment in connection with serum diagnosis may, in fact, be narrowed down to a supply of these capsules of dead bacteria, a small supply of glass tubing of say $\frac{3}{16}$ to $\frac{1}{4}$-inch diameter, and the blowpipe apparatus which is described below. Any man who is provided with these requisites can easily teach himself to make such blood capsules and sero-sedimentation tubes as are figured in the BRITISH MEDICAL JOURNAL of January 16th, 1897, in connection with the paper which has already been referred to. He has only to keep in view that a capillary tube is made by heating a piece of glass tubing and then drawing it out *after it has been removed from the flame.*

*Method of Extemporising a Blowpipe Flame for making Sero-sedimentation Tubes.*—After casting about in various directions for a simple method of producing a blowpipe flame which should be practicable at a distance from a laboratory, we have found a method which we believe satisfies all requirements. This method consists in the employment of an ordinary spray producer, such, for instance, as an ether-freezing apparatus. The reservoir of the apparatus is filled with methylated spirit, and a steady current of air is driven through it by means of the hand bellows which is supplied with the apparatus. The alcohol spray is then simply ignited. We find that the flame which is produced in this manner is quite hot enough for all ordinary glass-working operations. It is, for instance, quite hot enough to enable us to draw out glass tubing into capillary sero-sedimentation tubes. The following appear to be the only points that have to be attended to in connection with the working of the flame: *first*, the alcohol must be tolerably finely divided (if a very coarse spray is employed the flame will not be sufficiently hot); *secondly*, the alcohol must be fed into the spray tube in sufficient quantity[4] and in a regular manner (if this last point is not attended to the flame will be very unsteady, or it will go out and will require to be relit).

In conclusion, we desire to revert to the question of serum diagnosis by means of dead bacteria, and to draw attention to the relation between this method of serum testing and the method of typhoid vaccination which was recently proposed by us in this JOURNAL.[5] It will be obvious that inasmuch as the vaccine material which is employed in the vaccinations in question consists of cultures of typhoid bacteria which have been killed by exposure to a temperature of 60° C., we have in the contents of the vaccine capsule not only a material with which we can vaccinate against typhoid, but also a material by the help of which we can determine whether a necessity for vaccination exists, and a material by the help of which we can measure the effect which is produced upon the patient by the vaccination process.

NOTES AND REFERENCES.

[1] For a description of these see a paper by one of us in the BRITISH MEDICAL JOURNAL of January 16th, 1897. [2] The death of the bacteria was in all cases verified by the inoculation of the contents of the capsules upon agar tubes. [3] This lends support to Surgeon-Major Bruce's view that the movements which occur in Malta fever cultures are purely Brownian in character. [4] This can very easily be provided for by depressing the nozzle of the spray producer below the level of the fluid in the reservoir. [5] BRITISH MEDICAL JOURNAL, January 30th, 1897.

## REMARKS ON THE OCCURRENCE OF PLAGUE PNEUMONIA.

BY SURGEON-CAPTAIN L. F. CHILDE, I.M.S.

As plague developed in Bombay, I began to examine the bodies of all hospital patients dead after acute disease, such as fever, pneumonia, etc., to see if any of them had really died of plague without buboes; and at the end of December I met with a case which had been diagnosed as broncho-pneumonia, but which turned out to be one of plague affecting the lungs, without causing any marked enlargement of the lymphatic glands—a case, in fact, of plague pneumonia; and as this *post-mortem* is exactly like many others that I have since made, and is typical of the disease, a brief account of it is subjoined.

B. L., Hindu, male, aged 25, was admitted on December 26th, 1896, for fever and cough, said to be of seven days' duration. He was very ill; no lymphatic glands were enlarged or painful, and the diagnosis made was broncho-pneumonia.

He died on December 28th, and the *necropsy* was made seven hours after death. The lungs showed much general engorgement and œdema, with sero-sanguineous frothy fluid in the bronchi, but no pus; the usual appearances of acute bronchitis were absent. There was one small pneumonic patch, the size of a walnut, in the early second stage, situated below the apex on the front of the right lung, and two similar but smaller patches at