THE RECOGNITION AND ISOLATION OF THE MENINGOCOCCUS IN THE NASO-PHARYNX OF CEREBRO-SPINAL FEVER CONTACTS.

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The late outbreak of cerebro-spinal meningitis has afforded considerable opportunities for the study of the disease, and many observations made in previous epidemics have again been confirmed as the result of bacteriological investigation. In particular, attention has been directed to the question of the incidence of meningococcal carriers, since it is now well known that in the environment of patients the subject of the disease individuals are found who harbour the meningococcus, often in large quantities in the naso-pharynx. The importance of these so-called contacts is now generally admitted, and it would appear rational that such contacts should be isolated if the disease is to be prevented from spreading. The feasibility of carrying out such a plan would depend upon the number of such contacts, and the persistence of the meningococcus in the throat, always assuming that the diagnosis of meningococcus was correct. Now, as is well known to all bacteriologists, the certain diagnosis of meningococcus is not always easy, and an erroneous diagnosis might entail great hardship on the individual the victim of such a diagnosis. A glance at the recent literature would seem to show that in a number of cases the diagnosis of meningococcus was correct. As its name implies, it is a mixture of nutrose, ascitic fluid and agar. Nutrose was used by Wassermann (1897) for the growth of gonococci as he found that in its presence the serum could be heated to the boiling point without coagulation, and thus he was able to overcome the trouble of easily obtaining sterile serum. Wassermann’s nutrose pig serum has not in general been found equal to the unheated serum agar as a medium for the growth of gonococci, and nasagar in our hands has been uniformly inferior to the serum agar above described. The following descriptions are entirely to growth of the meningococcus with microbes likely to be associated with it in throat swabs, on a medium the basis of which is serum agar.

Meningococcus.—The colonies of meningococcus are more or less characteristic, and with a little practice can be recognised with considerable ease. While examining the plates there are four main features to bear in mind—namely, (1) the size of the colony, (2) its shape, (3) its colour, and (4) its transparency. The Petri’s plate should first be held up against a good light (window) and looked over generally, and any likely colonies examined with a hand lens (X 8). The plate is then placed on a dark surface and the colour of the colonies noted. The meningococcus colonies after 24 hours’ incubation measure from 1 to 2 mm., colonies less than 1 mm. are either streptococci or pneumococci; the meningococcus colonies are quite circular, compact with a regular margin, are clear and transparent, and of a moist and slightly slimy consistence. When the plate is held up against the light the colonies have a slight bluish appearance not unlike very young coli colonies; viewed with the hand lens, however, the colonies are practically colourless. Under the microscope the colonies are colourless and show a faint granularity. But when the plate

Medium.

After giving extensive trials to a number of different media, the one which we have found most satisfactory is serum agar of the following composition: Nutrient 3 per cent. agar, 3 parts; horse serum, unheated, 1 part. The nutrient agar should be neutral to phenol-phthalein and made from beef broth. On this medium the meningococcus will grow with great rapidity, and after having undergone one or two subcultivations will live several weeks without further subculturing. The importance of unheated serum in obtaining cultures of the gonococcus was emphasised many years ago by Wertheim, and has been abundantly confirmed. The difficulty of obtaining sterile horse serum which has not been sterilised by heating can be overcome by the use of etherised serum. After the blood has been collected in a sterile pot at the slaughter-house it is allowed to clot and the serum obtained. Ether to the amount of 5 per cent. is then added to the serum in a glass-stoppered bottle. The stopper is tied in and the bottle heated in a water-bath at 45° C. for one hour, after which it is placed in the incubator at 37° C. for several days, by which time the serum is sterile. For use the serum is removed from the bottle with a sterile pipette, placed in a large test-tube, and stored in the refrigerator until required. The Petri’s plate should first be held up against a good light (window) and looked over generally, and any likely colonies examined with a hand lens (X 8). The plate is then placed on a dark surface and the colour of the colonies noted. The meningococcus colonies after 24 hours’ incubation measure from 1 to 2 mm., colonies less than 1 mm. are either streptococci or pneumococci; the meningococcus colonies are quite circular, compact with a regular margin, are clear and transparent, and of a moist and slightly slimy consistence. When the plate is held up against the light the colonies have a slight bluish appearance not unlike very young coli colonies; viewed with the hand lens, however, the colonies are practically colourless. Under the microscope the colonies are colourless and show a faint granularity. But when the plate

1 Fildes and Rajchman: THE LANCET, June 12th, 1915.
is placed against a dark background the colonies are seen to be a distinct pearl grey.

**Micrococcus catarrhalis.**—This grows as a distinct greyish-white, compact, more or less rounded colony, about 1 mm. in diameter; under the hand lens the colonies are seen to be much less transparent and more granular than the meningococcus, while their margins are often slightly irregular with a clearer surrounding zone. The characteristic features are a tenuous consistence, tendency to come off whole on the platinum loop, and the facility with which the growth can be emulsified with the meningococcus be emulsified in saline.

**Micrococcus pharyngis sicca.**—The colonies are not so round and are much more opaque than the meningococcus and are yellow, dry, and tenacious.

**Streptococcus muccosus.**—It grows as a round, perfectly translucent, clear as water colony, measuring on the average about 2 mm. in diameter. The extraordinary clearness of the colony is usually sufficient to distinguish it, quite apart from the fact that it is Gram-positive.

**Micrococcus flavus.**—The micrococcus flavus colonies are at times not at all unlike those of meningococcus, and especially when the colour has not developed; in many instances indeed the production of the colour is the only reliable distinguishing feature. The colonies, however, may be said to be rather more opaque than those of the meningococcus, with a tendency to be less discrete and to have a yellowish-brown colour. In older growths the colour may become well marked, varying from a yellow brown to a distinct golden yellow.

**Streptococcus and pneumococcus group.**—Here the colonies, as already mentioned, are clear and pin-point in size and therefore easily excluded.

**Staphylococcus group.**—The size and opacity of the colonies are sufficient to put them out of question at once.

### Supplementary Tests

The macroscopic appearance of the colonies of course serves only to identify meningococcus-like growths, and one has to confirm this macroscopic diagnosis as far as is possible by certain supplementary tests, such as fermentation reactions, complement-fixation reactions, agglutination reactions, &c. But some of these procedures in our hands have not proved sufficiently constant to be used as a routine measure. In particular this refers to the agglutination and complement-fixation reactions. Arkwright found that more than half of his strains were not agglutinated by a specific serum prepared by him, while Elser and Huntoon say that about 40 per cent. of meningococci strains are practically inagglutinable. The only applicable tests remaining are the fermentation reactions, the question of growth at 22° C., and the colour of the growth, but even with these, as we shall see later, the results obtained are not always absolutely definite.

#### 1. Fermentation

- It was found most convenient to use solid media for these tests—namely, etherised horse-serum agar as used for growing the meningococcus, containing 1 per cent. of the necessary sugar and 5 per cent. of litmus solution. We used the following five sugars—maltose, glucose, saccharose, lactose, and levulose, fermentation being judged to be complete after four days. In the case of some 50 strains of undoubted meningococcus isolated from the cerebro-spinal fluid of cerebro-spinal fever cases, all except 3 fermented only glucose and maltose, these being the accepted fermentations of meningococcus. Of the three exceptions, one fermented glucose only and the other two did not ferment any of the test sugars. Most of these strains have again been tested after an interval of three to six months and no change in the fermentations has been observed. Of the strains isolated from the throat, and which were believed to be meningococcus, all except one fermented only maltose and glucose, and this one fermented only glucose (parameningooccus). The strains of micrococcus flavus which we have isolated have fermented only maltose and glucose, and never levulose as stated by von Lingelsheim. There is, however, a quantitative difference in the fermentation powers of meningococcus and micrococcus flavus; the latter ferments the sugars more rapidly and produces more acid, as is shown by the medium frequently becoming opaque from coagulation of the protein. Micrococcus catarrhalis fermented none of the five test sugars.

#### 2. Question of growth at 22° C.

- The inability of the meningococcus to grow at 22° C. (as observed by Gordon) we have found to be a very useful confirmatory test, as none of our strains of meningococci would grow at that temperature while practically all the catarrhalis group did. But one must bear in mind that the growth at this temperature is apt to become more mycelial, and in fact, some of the micrococcus flavus strains took several days to appear. Buchanan also found that some of his strains of M. flavus showed no growth in 48 hours at this temperature.

#### 3. Colour of the growth

- The colour of the suspected growth is of great importance, as in many instances it is the last practicable method of distinction. Kolle and Hetche say that it is almost impossible to distinguish the meningococcus growth from that of the micrococcus flavus if the colour of the latter has not developed. From our own observations we are convinced that the above writers are correct. The presence of the slightest amount of yellow colour in the growth we regard as being sufficient evidence that the culture is not the meningococcus. This is borne out by the fact that all strains of meningococcus isolated from the cerebro-spinal fluid of actual cases are of a distinct pearl-grey colour. The yellow tinge of colour, however, is often so slight that it requires a very careful examination carried out in good daylight to detect it. The colour of the micrococcus flavus growth is somewhat intensified by growth on an agar medium containing glucose and 2 per cent. of gelatine. In some strains the colour takes several days to develop. In others the maximum amount of pigment is produced in 24 hours, after which the colour becomes less intense.

### Concluding Remarks

- It must be admitted, however, that the foregoing procedure is not quite all that could be desired, and in our experience the greatest difficulty lies in distinguishing the meningococcus from certain strains of micrococcus flavus, especially when the pigmen in the latter is slight and growth at 22° C. is delayed, as we have seen that their fermentation reactions, apart from a quantitative difference, are identical. The differential diagnosis therefore, in a certain number of instances, rests on a slight difference of colour alone. From what has been said it is clear that the importance of judging this difference in colour cannot be over-estimated, and we may repeat none of the strains of meningococcus isolated by us from the cerebro-spinal fluid of actual cases produced the slightest trace of a yellow colour, in all the colour being of a distinct pearl-grey.
Altogether over 2000 throats were examined for meningococcus, and of actual contacts 5.5 per cent. were found to be meningococcus carriers. In the various batches examined the percentage of positive results varied from 0 to 25; the highest figures were only found when the epidemic was at its height, and where there was considerable overcrowding and therefore a close association between patient and contacts. The detailed results of these examinations have been reported elsewhere. The average percentage of positive results obtained by us, though low in comparison with that obtained by some other workers, is, if anything, on the high side.

It is generally agreed that the isolation of undoubtedly meningococcus carriers is of great importance, and the question, therefore, of their frequency requires to be definitely determined. If the high percentage of positive contacts found by some workers approximates the real facts, then, apart from the difficulty of examining the huge number of contacts in a large epidemic, the isolation of carriers becomes impracticable. But from our extensive experience we are convinced that meningococcus carriers are less frequent than is generally believed; and given an easy, rapid, and definite means of detecting the meningococcus in the naso-pharynx, it should be possible to check an epidemic of cerebro-spinal fever in any small community or body of men—e.g., a military unit—where the movements of individuals are under control. Unfortunately, however, the whole subject of meningococcus carriers appears to require a thorough and an elaborate investigation, as hitherto it has been treated in much too un-critical a manner.


DOUBLE EPISIOTOMY DURING LABOUR.

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The operation of double episiotomy during labour is one which has been known and carried out for many years, but I think that its value as a means of preventing perineal laceration is not sufficiently recognised. I have therefore taken this opportunity of bringing it once more before the profession, having had a large experience of its utility.

The ordinary perineal laceration is best observed by erecting the posterior wall of the vagina through the vulva by the insertion of two fingers into the rectum. After carefully washing the vulva, I draw them together with a tenaculum, first in one direction and then in another, until the position in which they come together best is found.

My observations would tend to show that the chief lacerations consist of three essential portions. First, two bilateral, nearly longitudinal, tears of the vaginal walls, united at their lower extremities by a transverse tear, which is the second and most essential portion of the laceration. The plane of this tear is practically at right angles to the vaginal axis, and it is situated just within the constricting band formed by the superficial muscles. To these two portions may be added a third, that of the superficial fascia, which is usually called the perineal laceration. There seems to be no doubt that the former take place much before the latter, and that therefore when one sees the anterior part of the perineum tearing during the passage of the vertex we may be quite certain that there have already occurred one, if not both, of the deeper lacerations of the posterior vaginal wall higher up. The object of double episiotomy is to obtain one or all of these tears.

Technique of the operation.—Let us suppose that the vertex is in process of crowning, the pains regular and strong, the patient inhaling a little chloroform, though not deeply under its influence. As the occiput begins to protrude through the vulva a finger is slipped into the orifice and the tension of the two sharply defined rings that constitute the chief obstruction is carefully noted. The inner ring is the lower orifice of the vagina or byrnoe in the stricto; the outer ring is the vulval orifice, made up mainly by dense skin and a little fascia. When the proper moment arrives the operator should take a pair of blunt-pointed scissors and make an incision on either side of the vulva, commencing inside the inner constriction ring and sufficiently deep to sever the skin, the subcutaneous connective tissue, the fascia, and possibly the bulb-cavernous muscle. The length of the incision should be from 1 to 2 inches, or about a quarter of an inch deep; the direction of the incision should be horizontal or in the long axis of the body. If the incision is directed towards the tuberosity of the ischium and points towards the posterior vaginal wall, the cut will tend to be prolonged into it and the perineal body, thus making any laceration worse instead of preventing it. The proper incision—namely, at right angles to the vulva, affords more expansion and no danger, and is situated where the anterior and posterior vaginal walls fall together.

The chief theoretical objection to the method, which has never been able to confirm in practice, may be brought against the incision—namely, that the vulvo-vaginal gland may be severed or injured and the bulbous vestibule may be wounded. The cut, however, usually in all probability passes anterior to the duct and should never be deep enough to injure the vessels. Should the patient be deeply under an anaesthetic and the forceps applied, the value of the operation can be seen at once, as the head may be fairly described as "tumbling out." Immediately after the delivery of the child, and before the expulsion of the placenta, I usually pass two or three gut sutures transversely through each incision, securing the ends temporarily by Spencer Wells forceps; the parts come together quite easily and after the placenta is removed the sutures may be tied. In ten days scarcely a trace of the scar is left.

Indications for the operation.—1. An exceptionally large head. 2. A long and rigid perineum. 3. Atresia, congenital or acquired, of the vagina. 4. A threatened central rupture of the perineum. 5. An unreduced occipito-posterior presentation, where restitution is impossible. 6. In breech cases in which the after-coming head has to be rapidly delivered owing to threatened stillbirth of the child. 7. A narrow pelvic arch, as is present in the "male" type of pelvis.

In the last few years, during which period I have practised this operation, I have performed it 156 times. In 118 cases the patient was in labour for