

XLIX.

BLOOD CULTURES IN OTOLGY.*

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The relative frequency of instances is noteworthy in which the positive or negative result of a blood culture is of distinct diagnostic value to the otologist. The comparatively few published accounts of its use would seem to indicate that this valuable diagnostic aid has not had the general attention in the routine practice of the specialist it deserves.

Emanuel Libman of the Mt. Sinai Hospital is certainly entitled to the credit of having done much original work in blood culture studies in diseases of the ear, and his pioneer publications on this subject are both interesting and instructive. The attempt to base positive and unexceptionable rules solely on the outcome of this procedure is an error, just as in any other laboratory aid, and it is this effort that has led to controversy and more or less discredit. The object of this communication is to rehearse briefly the value found in positive as well as negative blood cultures in otologic practice and to demonstrate the relative ease of the technic.

In cases of acute purulent otitis media without or with mastoid involvement, bacteria are not usually found in the blood cultures. There are exceptions, however, and these cannot always be ascribed to errors in technic, as they have occurred in the experience of numerous competent clinicians and accurate laboratory workers. It also does not seem justified to claim that an unrecognized thrombosis exists in these exceptional cases. Fortunately these exceptions are rare, particularly after efficient surgical treatment of the middle ear and mastoid.

In the cases in which there is a thrombosis of the sinus, bulb or vein, bacteria are found in the blood cultures in a

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very large percentage of the cases. Exceptions to this rule also occur. A thrombus is quite firm at first, and if it contains but few organisms those may be killed by the bactericidal power of the blood itself. Even if infected to a greater extent, the firm clot may prevent the organisms from getting into the blood current. It is even possible that pieces of infected clot may break off and be carried by the blood to distant parts, causing metastatic suppurating foci without bacterial infection of the blood stream itself. In the large majority of instances, however, the softening of the thrombus causes bacteria to be fed to the blood stream in increasing numbers, and then positive blood cultures are invariably obtained. Not only an extension of the infection to the sinus with a resulting thrombosis will produce a bacterial infection of the blood current, but a secondary meningitis, a brain abscess or even an extradural suppurative focus may subsequently do the same. It is also very important to remember that these general invasions of the blood current may result from local processes other than in the ear, and the mere fact that a bacterial infection of the blood stream is found naturally does not necessarily indicate otitic origin.

In a given case of acute suppuration of the middle ear with mastoid involvement, a positive blood culture should not be accepted alone as certain evidence of a coexisting thrombosis of the sinus. It has been demonstrated, as previously stated, that exceptionally a bacteremia does occur without a thrombosis of the sinus, but this is certainly unusual, to say the least. After proper surgical treatment of the middle ear and mastoid in these exceptional cases, the bacteremia should decrease and disappear together with the proper behavior of the condition clinically. On the other hand, should the colonies increase in number in the subsequent cultures, it may be accepted as strong presumptive evidence that an extension of the invasion has occurred. The most frequent extension is into the sinus with resulting thrombosis, and for this reason the bacteremia is usually quite properly looked upon as one of the evidences that such extension has occurred. In the great majority of instances, however, a bacterial invasion of the blood current does not occur in the cases of middle ear and mastoid infection unless there has been an extension into the sinus or elsewhere.

While the presence and particularly an increasing degree of bacteremia may justly be accepted as an indication of such extension, the clinical evidences are imperative to determine what structures have been invaded. It is self-understood that the direct invasion of the circulatory apparatus will lead to positive blood cultures far more easily than an invasion of the meninges or brain tissue, and subsequent infection of the blood stream, but, after all, the clinical symptoms and not the blood culture must determine the nature of this extension. An extension of the process beyond the mastoid may occur and still may not give rise to a bacteremia for the reasons previously stated, namely, a firm clot with a small or large number of organisms may not cause infection of the blood current until softening of the thrombus occurs. For this very reason it is evident that a single culture, if negative, may be misleading. When suggestive symptoms occur, a negative blood culture may be used as an argument against sinus thrombosis possibly for the moment, but if these symptoms continue, repeated cultures are necessary, as the former negative culture can have no weight whatever.

It is natural that intercurrent diseases or complications of the original causative disease, with consequent elevation of temperature, may occur during the course of an otitic infection. The blood culture aids in the differential diagnosis, though careful clinical observation with indicated laboratory aids, are at least equally important and sometimes more so. Acute articular rheumatism shows a negative blood culture, while a pyemic joint is usually associated with a bacteremia. Pneumonia usually gives physical signs and possibly a bacteremia of other type than the otitic infection. Typhoid shows a leucopenia and relative lymphocytosis, and possibly characteristic organisms on blood culture or a positive Widal reaction, while an extension of the otitic infection shows a leucocytosis and relative polynucleosis and possibly a positive blood culture of the organism found in the ear. Tuberculosis also shows a leucopenia and relative lymphocytosis and even a positive Diazo reaction at times, but the blood cultures are sterile, and a von Pirquet or Calmette may be positive. Unusual temperatures and disturbing symptoms, such as headache and local neuralgia, due to an unrecognized acute nephritis, may develop during the convalescence of a scarlet fever mastoid.

If perchance a streptococcemia exists, which is not unknown in this disease, an erroneous diagnosis of sinus thrombosis would easily be made, if the rule is accepted that a bacteremia invariably indicates this complication.

The following conclusions seem justified: Early positive blood cultures with an unopened mastoid infection usually indicate coexisting sinus thrombosis. The possible exception must be kept in mind, especially in absence of all clinical signs. Negative blood cultures under like conditions usually allow the exclusion of a sinus thrombosis. The possible exception must be remembered, especially if suspicious clinical signs exist.

Late positive blood cultures in operated cases of mastoiditis with exacerbations of temperature after a longer or shorter afebrile period, also usually indicate thrombosis. But it is in these cases that particular care must be exercised in concluding that the infection of the blood stream is due to a thrombosis and not to a meningitis or brain abscess, to say nothing of a more distant point of invasion not necessarily secondary to the mastoid suppuration. Negative blood cultures under like conditions usually allow exclusion of a thrombosis and indicate careful search for other causes to explain the temperature curve; but the exceptions to this rule must not be forgotten.

With reference to the organisms found, the streptococcus is without doubt the most frequent invader of the mastoid and deeper structures, and in consequence is the organism most frequently obtained in blood cultures. The streptococcus mucosus and the staphylococcus occur next in the order of frequency. While most of us have not seen a sinus thrombosis follow a pneumococcus infection of the ear, the evidence is not yet nearly sufficient to justify a conclusion that it does not occur. With due regard to the difficulty in differentiating streptococci and pneumococci, and admitting the inability to do so in some instances, there does seem sufficient evidence at hand to believe that the pneumococcus does act as a pyogenic organism in the mastoid, and consequently it seems difficult to understand that it cannot produce a sinus thrombosis as well.

It is certainly true that the staphylococcus and pneumococcus found in otitis media are far less apt to cause mastoid

and deeper seated complications than the streptococcus and streptococcus mucosus, but absolute rules should not be made concerning the relative virulence of one organism as compared with another, or that certain structures are immune to certain bacterial invasions. More searching investigations of the bacteria concerned in the production of the suppurative processes under consideration may teach much of value, for the anerobic organisms present have had but little attention as yet.

Blood culture work in this as in other fields should be done quantitatively, that is, not only the organism should be determined, but the number of colonies per cubic centimeter should be estimated. This is of particular value when cultures are repeated, as a decrease or an increase in the bacteremia is thus learned. If the organisms present produce hemolysis is a point which should also be carefully observed, as it invariably indicates a more serious condition than when this solution does not occur.

Blood cultures should when possible be made by those thoroughly familiar with the laboratory technic, as the distribution of the blood in the different media must be done before coagulation occurs, and to do this accurately and quickly with blood at the point of coagulation requires dexterity only acquired by practice.

A suitable vein, if possible at the bend of the elbow, is selected and a constricting bandage is applied above. The region is thoroughly cleansed with green soap, ether and alcohol, and a drop of tincture of iodine allowed to dry where the puncture is to be made. If a properly sterilized 10 cc. all glass syringe with fine iridoplatinum needle is used in place of the 25 cc. hospital affair with a trocar-like weapon attached, the patient usually makes no objection whatever to the original or repeated aspiration. Having obtained from 5 to 10 cc. of blood, an assistant or nurse removes the bandage, holds the arm up for a few minutes and applies a drop of collodion over the puncture. The obtained specimen is quickly and accurately distributed in the different media, namely, flasks of plain bouillon and glucose bouillon, and plates of glucose agar, serum agar and glucose serum agar. These are incubated at 37.5° C. and examined at eighteen hour intervals. The rapidity of growth varies decidedly with the same type of organism,

and prolonged observation is essential before the culture can be considered sterile.

The difficulty of transporting the various culture media to the bedside in private practice and the danger of partial coagulation before the blood has been accurately distributed, induced Epstein (*American Journal of Medical Sciences*, September, 1907) to suggest the use of a method to prevent the coagulation of the blood and thus allow the distribution to be made at leisure in the laboratory.

A large tube containing 10 cc. of an isotonic ammonium oxalate solution, the whole properly sterilized, is carried to the bedside, into which the aspirated blood is immediately introduced and a complete mixture made. This specimen can then be accurately distributed in the various media at the laboratory. Ryttenberg (*Journal of Medical Research*, XX, No. 1) has demonstrated the comparative value of this method, and a limited experience with it tends to corroborate his results. Another advantage it has is that it can be put into the hands of the surgeon for the purpose of obtaining the specimen which is subsequently handled by the laboratory worker.