

STREPTOCOCCUS MUCOSUS CAPSULATUS INFECTION OF THE MASTOID BONE.*

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Of the various pathogenic organisms with which we have had to contend within the past few years as producing purulent infections of the middle ear and mastoid process, the streptococcus mucosus capsulatus has come to be the one that most arouses our interest for several reasons, not only on account of its tendency in many cases of producing a very rapid general involvement of the entire bony structure of the mastoid, but also because of its tendency in other cases for, as Whiting has described it, the development "of a most dangerous and insidious latent period which may justly occasion apprehension concerning the outcome of any inflammatory ear disease which has its origin in the activities of this infective agent."

Experience has taught us that it is an infective organism powerful in its ability to produce extensive destruction of bone tissue, and rapid in its action as well, but chiefly that its effectiveness may not be confined, as in many others of the bacteria producing bone necrosis, to those acute stages of the disease which we hope to relieve by a complete removal of all effected areas. Its effects, while active during the acute stages, may lie dormant during even an extended period in which the physiological process of repair is going on, and at some stage when we are secure in the feeling that all possibility of complication has passed, startle us with the realization that our judgment of security was unfounded, by the sudden bursting into action of an exacerbation which we are unable to combat.

The organism was first referred to by Howard and Perkins in 1901, in a paper entitled "The Streptococcus Mucosus Pathogenic for Man and Animals." They made cultures from the peritoneum and other organs of a woman who had died of suppurative peritonitis and demonstrated a coccus arranged in chains of varying numbers and surrounded by a thick capsule which, though similar to the pneumococcus in many ways, did not have the typical lancet shape of the pneumococcus. They described a characteristic appearance of the infected area acted upon by the organism they had

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isolated. The surface of the intestine was covered with a thin layer of opaque, grayish-white viscid exudate, and a considerable amount of creamy pus filled the abdominal cavity. The mucous membrane of the various organs was completely destroyed, the entire walls being infiltrated.

Later, in 1903, the organism was more carefully studied by Schotmuller who separated it from the pneumococcus in the class of the encapsulated cocci and gave it a distinct name, laying stress upon its characteristic of producing a tenacious mucoid exudate upon any surface upon which it became active.

That it is a bacterium closely associated with the pneumococcus is the opinion held by many writers, yet having sufficient characteristics individual to itself in its growth in various media, its reaction in immunological and fixation experiments and its pathological reaction in diseased tissues, to entitle it to especial attention. They all admit that much work still remains to be done to place it in the position of knowledge to which its virulence entitles it.

Buerger, in a discussion of the morphology of the encapsulated cocci, has divided the pneumococci into four groups. (1) Typical forms. (2) Small forms. (3) Large forms. (4) Bacillary forms; describing the third group as having especially wide capsules, and stating that "such diplococci may easily be mistaken for the streptococcus mucosus capsulatus but are, as a rule, very definitely lancet shaped, whereas, the latter are possessed of a more rounded or biscuit shaped form." In referring to the morphology of the streptococci he states that "many reported instances of the occurrence of encapsulated streptococci have added to the confusion which already existed in our views of the relationship of the pneumococcus and the streptococcus." His classification of the streptococci divided them into (A) 1—Streptococci without capsules, 2—Streptococci with capsules; (B) Streptococcus with mucoid capsules which he describes as the streptococcus mucosus capsulatus. "They appear in exudates and blood as round, biscuit or rarely almost lancet shaped diplococci, surrounded by a wide, mucoid, diffusely staining and definitely limited capsule, appearing in chains of five or six elements. The diplococcus forms may be mistaken for pneumococci. But the mucoid streptococcus is not lanceolate, its capsule elements are larger and short chains are usually to be found, and instead of the constriction between the diplococci as seen in the case of the pneumococcus, the capsule

is an elongated mass of mucoid substance with no indentation on the outer surface of the envelope."

On the other hand, Hanes, in a paper on "An Immunological Study of the *Pneumococcus Mucosus*" sums up his conclusion under five heads. (1) That the organism described by Schotmuller, under the name of *streptococcus mucosus* and characterized by the power of producing a tenacious, mucoid exudate in the peritoneal cavity of white mice, represents a well defined group with characteristics which indicate a close relationship to the pneumococci rather than to the streptococci. (2) That the members of the group (the *pneumococcus mucosus*) are especially agglutinable when treated according to the method of Porges. They do not agglutinate when subjected to the usual agglutination methods. (3) That complement fixation experiments with these organisms compared with similar experiments with pneumococci and streptococci indicate that they are closely related to the pneumococci. (4) That no protection of mice against *pneumococcus mucosus* by means of specific immune sera could be demonstrated. And he finally concludes by declaring that the name "*pneumococcus mucosus*" should be adopted for this group instead of the *streptococcus mucosus*. He further notes that in his series of cases of lobar pneumonia caused by the *pneumococcus mucosus*, sixty-six per cent had been fatal and that when the organism had been found in the blood, all had died.

Again Lyall concludes that the type reactions for the *pneumococcus mucosus* group are the same as for the true pneumococci, and it is interesting to note that the majority of the strains he studied, (ten in all) were isolated from cases of acute mastoiditis.

Dochez and Avery, writing on the "Varieties of *Pneumococcus* and their Relation to Lobar Pneumonia," present tables showing the relative occurrence of organisms of the different types during the year 1912-1913 and recording the fact that in thirteen per cent of their cases the organism fell in the group classified as the *pneumococcus mucosus*, and that in 1913-1914, eight per cent were of the *mucosus* group.

All of which indicate to us the uncertainty that exists in the minds of the bacteriologists of just where the organism that has grown to give us so much concern should be placed in the classification of the bacteria, but of its virulence and its insidious tendency for the production of late complications, we can have no doubt and, for the purpose of recording the various symptoms and con-

ditions which the streptococcus mucosus capsulatus may produce, the following cases are offered:

Case 1.—Mrs. S. J., thirty-five years of age, seen in consultation with Dr. Little on March 13, 1910, upon arrival from the South, had been attacked with what was considered to be a case of grippe with an acute coryza and tonsilitis. Two days following the onset of the grippe and fifty-two hours previous to my examination, she had been aroused from sound sleep by sharp pain in the right ear. This had persisted, the constitutional symptoms associated with the grippe had increased, and the temperature had ranged from 101 degrees to 103 degrees. Otoscopic examination demonstrated an acute exudative otitis media, associated with the cardinal symptoms of an acute mastoiditis, with pronounced prolapse of the posterior canal wall and exquisite tenderness over the entire mastoid area. The drum was incised and a moderate amount of thin, purulent fluid evacuated. Microscopical examination of a smear showed the presence of the streptococcus mucosus capsulatus in large numbers, and a simple mastoid operation was performed. The structure of the mastoid had apparently been one of large pneumatic cells but these had been completely destroyed and the completion of the operation showed an extensive cavity extending well up into the zygomatic process, and back over the sigmoid sinus into the occipital bone. The mastoid tip had been entirely removed. An interesting point in connection with the case, besides the extent of involvement, was an extensive destruction of skin and cellular tissue of the scalp composing the posterior margin of the wound which began within twenty-four hours following the operation and which was not under control for at least a week. During this time the patient showed marked evidence of general absorption with a septic temperature ranging as high as 103.6 degrees and pronounced prostration. Another point of interest which was also credited to the virulence of the infection was the prolonged duration of the healing process. Granulation tissue was slow of production and the wound was not completely cicatrized for thirteen weeks and then with a deep depression extending from the location of the tip well up into the cavity made in the zygomatic root. This failure of development of granulation tissue framework was credited to constant reinfection from the constantly active pathogenic organism. The patient finally made a complete recovery and has since been perfectly well.

Case 2.—Mrs. H. R., age twenty-six, when first seen in consultation April 14, 1910, had been suffering for a week with an acute

exudative otitis media and diffuse furunculosis with oedema extending well out over the mastoid bone. Symptoms of a possible complicating mastoiditis were thoroughly masked by those of the furunculosis, and it was only after a bacteriological examination of the pus from the middle ear had demonstrated the presence of the streptococcus mucosus capsulatus, that it was thought justifiable to consider the mastoid as also involved. An operation demonstrated the fact of a very extensive involvement with pronounced exposure of the dura and lateral sinus. The patient reacted satisfactorily following the operation, the wound progressed favorably and she was allowed to go home in two weeks, the second of May. At first, following the institution of every other day dressing in the office, the wound continued to improve, but later began to lag somewhat in the healing process, the granulations becoming flabby and pale with a tendency to break down and the surface became bathed in a more or less tenacious mucoid material, but her general physical condition remained excellent. On June 9, she became suddenly ill with a pronounced chill and, after the temperature chart had shown a rise to 105 degrees with a remission to 99 degrees on two successive days, a diagnosis of lateral sinus thrombosis was made and an operation immediately performed. Upon opening the sinus a well organized clot was found filling its entire lumen. The upper portion was picked out with a forceps and was followed by a pronounced gush of blood easily controlled by pressure. With the removal of the lower portion by forceps, a second gush followed which was easily controlled. From the fact that the clot had been removed apparently in toto, and feeling that the profuse extravasation of blood had washed out any remains of clot, it was determined not to excise the jugular vein. The patient ran a septic temperature for about a week when an abscess appeared in the forearm which was incised and drained. Following this, the patient reacted promptly and made a good recovery at the end of eight weeks, and has since been perfectly well having gained, in five years, about forty pounds in weight. This was a case of mucosus infection, rapid in its onset, with an extensive involvement of the mastoid and with the development of what Whiting has described as "the insidious latent period" which, while acting mildly in the granulation wound, was burrowing deeply without apparent symptoms until it bloomed forth as well developed sinus thrombosis.

Dr. McKernon has reported a case similar in post-operative history which the writer was privileged to study, on which a mas-

toid operation was performed following a streptococcus mucosus infection in which the wound was entirely healed and the patient going about when he developed acute symptoms of a cerebral complication, rapidly lapsed into coma and died. Operation demonstrated an extensive purulent meningitis which had begun at the site of a large dural exposure.

Case 3 was first seen on December 25, 1914, a boy of ten years who had complained for three days previously of some acute intestinal disturbance which was relieved by a cathartic. At the same time he had a pronounced general headache which for twenty-four hours had been improved. On the day previous to my seeing him he had complained of a severe pain in the right ear which had lasted for only a few hours and had been relieved by hot applications. Otoscopic examination demonstrated the presence of an acute exudative otitis media, but without excessive pressure against the drum. The drum was incised and a small amount of secretion, mucoid in character, was evacuated. Bacteriological examination of this secretion showed the presence of the streptococcus capsulatus. At the time of the myringotomy the temperature was 104 degrees, and in the evening it was 101 degrees. For two days following*he continued to show only the presence of the symptoms of a suppurative otitis media, with, at first, a scanty mucoid discharge, which later became thick and creamy, though not profuse, and the temperature ranged between 101 degrees and 103.6 degrees. But the headache of which he had first complained persisted. On the third day he had for the first time, a point of periostial tenderness over the mastoid antrum, but what was of far more importance, he began to show some evidence of cerebro-spinal irritation, with rigidity of the muscles of the neck, and increased general headache. He was operated upon without further delay. No free pus was found but the mastoid cells were found to be filled with serum and granulation tissue, especially at the tip. The sinus was apparently normal and a fairly extensive exposure of the dura demonstrated no lesion in that portion at least. The patient died five days later with all the symptoms of an acute meningitis. A lumbar puncture, done at the time of the operation, evacuated a cloudy cerebro-spinal fluid under pressure, and a cover glass smear showed the presence of the streptococcus capsulatus mucosus in large numbers.

Lack of time prevents the citing of other cases, two showing the extent and rapidity of involvement of the mastoid bone, neither

one showing sufficiently pronounced diagnostic signs for immediate operation other than the presence of an organism whose virulence we have come to recognize, and two in which, the organism was demonstrated in the beginning, drainage through the middle ear and additus was such as to take care of the products of destruction in the mastoid and the abscess cavity drained itself out without operative interference.

So that, in meeting a streptococcus mucosus capsulatus infection, experience has, I think, taught us that we are dealing with an organism whose power of rapid and extensive destruction of the mastoid bone may easily be able to combat our best efforts against it and that, in order to conserve our patients' best interest, we must, by early and frequent bacteriological examination of all discharges in a suppurative otitis media, be in a position to take advantage of every point that could be of value in determining the necessity for operative procedure, and further, that having made an attempt to stop its destructive course by operation as soon as there is any indication of mastoid involvement, we still have an uncertainty of prognosis to consider until even after the wound is healed and the patient apparently well.

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- 46 West Fifty-second Street.

Indications for Blood Transfusion. ARTHUR KRIDA, *Albany Med. Ann.*, April, 1916.

The indications are (1) in massive hemorrhage; (2) marked secondary anemias either as a palliative or as a pre-operative measure; (3) essential anemias; (4) hemophilia, purpura and other blood dyscrasias; (5) some acute infections. No blood transfusion should be undertaken without first making agglutination or hemolysis tests of the patient's and donor's blood.

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