

THE CHANGES FOUND IN THE CENTRAL NERVOUS SYSTEM IN A CASE OF RABIES WITH ACUTE MENTAL DISTURBANCE.¹

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The pathological anatomy of rabies has been studied by numerous observers, both in the human subject, and in various animals, notably in the dog and in the rabbit. The results of all coincide in showing that the poison of the disease spends its force chiefly upon the nervous system, the changes described being hyperemia and dilatation of vessels, smaller or larger hemorrhages, round cell accumulation both in the sheath of the smaller vessels and in the perivascular spaces, degenerative changes in the nerve cells, local areas of softening, and meningitis in different portions of the central nervous system, but usually most marked in the bulb. The process according to Golgi is to be considered as an acute encephalo-mylitis. The part of the nervous system most affected has seemed in some cases to bear a relation to the location of the infecting bite, Schaffer having found profound changes in the anterior horn of the cord in the lumbar region of the corresponding side in a patient bitten upon the leg, while in another person bitten upon the arm, the cervical region of the same side was specially affected. The anatomical changes described have, however, been in the main such as are observed also in other diseases. Babes has called attention to the presence especially in the bulb, of collections of round cells grouped characteristically about the nerve cells of that region, to which he has given the name of "rabie tubercle," and to which he attaches great diagnostic importance. As far back as 1872, Pollailon and Nepveu in a case of rabies found the Gasserian ganglion infiltrated with round cells, and compressed, but this lesion does not seem to have been considered at that time of much importance. In 1899 and 1900 Van Gehuchten and Nélis, in a series of articles, called attention to the changes which they had observed in a number of cases of rabies, in the ganglia of both cranial and spinal nerves, and which they considered as specific. These changes consist in round cell inva-

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sion, and especially in the proliferation of the endothelial cells lining the capsules in which the large nerve cells of the ganglia are placed. This proliferation may go on to the complete destruction and disappearance of the nerve cells, the capsules being filled with round cells, presenting in some instances an appearance not unlike an alveolar sarcoma. These changes are said to be most characteristic in the dog, less so in man. The matter was speedily taken up by other observers, and in the dog and the rabbit at any rate the changes described have been thought to be characteristic. For their production the action of the fresh virus, and the complete evolution of the disease seem necessary, and Van Gehuchten and Nélis have considered them of diagnostic value only in street rabies. Sano examined the ganglia from a case of human rabies, but failed to find in them the changes described as characteristic by Van Gehuchten and Nélis, while Crocq, after a thorough study of the subject, is not convinced of the specificity of either the ganglion lesions or the rabic tubercle of Babes, though he admits that each may have very considerable diagnostic value in a suspicious case. In this country the subject has been specially studied by Ravenel and McCarthy, who found the changes described by Van Gehuchten and Nélis, in the ganglia of a number of dogs and rabbits, of one cow, and in one human being. Dr. McCarthy has, I believe, also reported some additional cases in man, though his paper has not yet appeared in print.

So far as I can ascertain no one else in this country has as yet published the results of an examination as to the presence or absence of the lesions claimed to be specific in a case of human rabies. The following case came under the observation of the writer during the past fall.

R. T., white, a farm laborer thirty-two years old, addicted to the use of alcohol, but to what extent not ascertainable, about August 15, 1902, being at the time intoxicated, was bitten on the hand by a dog which had been acting strangely, whose mouth he was attempting to open, as he explained, to find out whether the animal was mad or not. The dog in question was said to have been bitten by another dog which is stated to have been mad, and to have also bitten several other dogs and a cow. There is no record as to an examination of any of these animals, but the cow is reported to have remained well. The dog which bit R. T. was killed shortly afterward, and no examination of his body was

made. The patient, R. T., having listened to numerous comments upon the occurrence, and having had the symptoms of rabies repeatedly detailed to him by his neighbors, grew nervous and depressed, gave up his work, and began to drink heavily. Upon November 8 he became excited and violent, tore his clothing, is said to have "barked like a dog," was unable to swallow, and took neither food nor drink from that time on. He was brought to the New Jersey State Hospital at about midday November 11, tied hand and foot. At this time he was extremely restless and excited, kept constantly in motion, secreted a great quantity of saliva, and was absolutely unable to swallow. He did not seem to have any definite delusions, hallucinations or illusions, and in an interval of comparative calm told the attendant that he had hydrophobia and hated to die.

On account of the questionable history, however, the case was regarded as being most probably one of acute excitement supervening upon alcoholism. Nevertheless, as the patient was in a condition of extreme exhaustion an unfavorable prognosis was given. This was speedily verified by his death at 9.30 the same evening. An autopsy was performed at 2.30 P.M. on November 12.

The macroscopic findings were: Adherence of the dura along the posterior part of the longitudinal fissure, with thickening of the pia-arachnoid in the same region, moderate congestion of the vessels of the meninges, and to a less extent of those of the brain, adherence of the lungs, and congestion of their bases, and congestion of the kidneys. The gastro-intestinal tract showed no special change. Portions of the brain and spinal cord were immediately forwarded to Dr. Ravenel at the Pepper Laboratory, with the request that he inoculate some rabbits for me. This he kindly did with the result that each of the two animals used developed typical paralysis of the hind limbs on November 31, and died on December 3, after the paralysis had ascended to the fore limbs.

There were taken for microscopical examination, portions of the cortex from the paracentral, frontal and occipital regions, and from the cerebellum, sections of the brain axis at different levels from the lower medulla up into the internal capsule, pieces of the spinal cord from different regions, the Gasserian ganglion, and several spinal ganglia, besides parts of the lung, heart, liver, spleen and kidney. The sections of the nervous system were stained by methylene and toluidin blue, by Held's method, by carmine, hematoxylin and eosin, the Wolters-Weigert, and the Marchi methods. Most of the large cells of the paracentral lobule, of the bulbar nuclei, of the anterior horns of the spinal cord, and of the columns of Clarke, stain diffusely, showing no granules. Many of them contain a deposit of dark pigment, and in a few there is displacement of the nucleus towards the periphery.

Throughout the whole nervous system, there is dilatation of

small vessels and much round cell accumulation both in the perivascular spaces, and in the sheaths of the vessels, these changes being most marked in the brain axis, but also evident in the cortex, and in the cord. In various locations there are small hemorrhages, notably in the vagus and hypoglossal nuclei. A careful search for the rabic tubercle of Babes, shows in a few places a grouping of round cells about the nerve cells. This is plainest in the vagus nucleus, in one of the arcuate nuclei, in the external acoustic nucleus, among the deeply pigmented cells of the substantia nigra cruris, and in the optic thalamus.

In the Gasserian and spinal ganglia there is great capillary dilatation, and the spaces between the cells are filled with a large number of round cells. There is slight proliferation of the capsular endothelium, and the nerve cells appear shrunken in some places, but the changes present can hardly be considered as characteristically those described by Van Gehuchten and Nélis. There are numbers of large pigmented bodies, apparently degenerated cells distributed throughout the ganglia, notably in the Gasserian. Neither the Wolters-Weigert, nor the Marchi methods show the presence of degenerated nerve fibers.

The heart muscle shows beginning fatty degeneration, the liver and spleen are greatly congested, the lung shows congestion and escape of erythrocytes into the alveoli, and the kidney is intensely congested, and shows slight swelling of the epithelium of the tubules.

A review of the findings in this case shows that the lesions agree in general with those which have been previously described in rabies, but while strongly suggestive in a case with so suspicious a history, taken alone without the animal inoculations, they would hardly justify a positive diagnosis.

None of the changes found are characteristic of rabies alone, but each may be present also in other diseases. The lesions of the ganglia considered as specific by Van Gehuchten and Nélis have been found by Crocq in the vagus ganglion of a child dead from diphtheria, by Spiller in a case of endothelioma of the Gasserian ganglion, by Ravenel in the ganglion of a cow with the so-called "forage poison" (epizootic), and by Burr and McCarthy in a case of neuritis. In a case of acute ascending paralysis, Spiller found general perivascular round cell deposit and small hemorrhages throughout the nervous system, while in the lumbar region of the cord the ganglion cells were surrounded by round cells, and many of them were destroyed, giving a picture much like the rabic tu-

bercle of Babes. Sano, in a case of rabies in a woman fifty-one years old, failed to find the ganglionic changes of Van Gehuchten and Nélis, or the rabic tubercle of Babes. The case here reported was complicated by alcoholism, which would account at least in part for the perivascular round cell deposit, the thickening of the pia-arachnoid, and the pigmentary degeneration of the nerve cells. The examination was made so long after death, however, that it is hardly possible to form a definite opinion as to the cell changes.

From the study of the literature of the subject, together with that of this case, it seems justifiable to conclude that neither the ganglionic changes of Van Gehuchten and Nélis nor the rabic tubercle of Babes is absolutely characteristic of human rabies, though their presence in a suspicious case may be of considerable diagnostic importance. The value of these changes in the nervous system of a dog suspected of rabies is not yet entirely decided, but when found in a case otherwise suspicious they are at least strongly suggestive, and they should invariably be sought for, at any rate until we acquire some more definite information upon the subject.

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