BREINL

Pathological Report on the Histology of Sleeping Sickness and Trypanosomiasis, with a Comparison of the Changes Found in Animals Infected with T. Gambiense *and other Trypanosomata.*

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Three cases of Sleeping Sickness and one case of Trypanosomiasis dying in Liverpool have been histologically examined. The central nervous system of the Sleeping Sickness cases showed the changes described by different observers, Mott, Low, the Portuguese Commission and others. One case exhibited an intra-pial hæmorrhage of the spinal cord, extending from the sixth cervical segment to the third thoracic segment, about 7 mm. broad. In another case there occurred four larger hæmorrhages, besides numerous smaller ones, in the grey substance, chiefly affecting the posterior cornua and the thoracic part of the cord. Microscopically the brain and spinal cord showed small celled infiltration around the vessels, consisting for the most part of lymphocytes, some plasma cells and phagocytes, between which were a varying number of red cells in different stages of disintegration. The intima of the vessels showed a proliferation of the endothelial cells. Red and white blood corpuscles were often seen in the vessel walls. Here and there the blood vessels were filled with white blood corpuscles resembling a thrombosis.

It is most striking that the small celled infiltration is much more marked in the grey substance of the nervous centres, especially in the large grey ganglia, than in the peripheral parts. Very numerous capillary hæmorrhages of different sizes were present in these situations. Infiltration around the vessels of the membranes and in the tissues of the pia and arachnoidea was observed. Around the infiltrated vessels degeneration of the fibres and an excess of glia cells were seen, sometimes exhibiting the picture of red softening. The ganglia cells showed an irregularly distributed degeneration, central and peripheral chromatolysis and also partial pyknosis.

Signs of inflammation and small celled infiltration in the endo- and peri-

neurium of the peripheral nerves were seen. In two cases of longer duration and with more pronounced symptoms of the disease, more definite changes around the vessels of the brain and spinal cord were seen than in the third case of shorter duration with less marked symptoms. In this case the peri-vascular changes in the brain were small and were still less so in the spinal cord.

In all groups of the lymph glands numerous ones were found showing the typical appearance of hæmo-lymph glands with a pronounced hyperplasia of the connective tissue, a widening of the follicles and the formation of a system of sinuses containing red blood cells and large phagocytes in a fine threadwork of connective tissue. Others showed a transition between the hæmo-lymph glands and normal glands, one part appearing normal, the other presenting a typical sinus formation with numerous red blood cells and phagocytes. Nearly all the glands contained between the lymph cells a number of blood corpuscles, many in all stages of degeneration. The spleen was greatly congested and contained a few necrotic areas, scattered through the organ was a little blood pigment giving the iron reaction. The bone marrow exhibited the typical picture of red marrow with gelatinous degeneration. The liver and kidneys showed hæmorrhages between the parenchyma cells, which latter appeared to be undergoing degeneration. In all three cases a few large bacilli and cocci were seen which did not stain by Gram's method, these I consider to be due to *post-mortem* contamination.

The bacteriological cultivation, anaërobic and aërobic of the cerebro-spinal fluid and the blood of two cases, did not give any growth, and moreover, animals infected with large quantities of cerebro-spinal fluid or blood did not show any other symptoms than those caused through the presence of trypanosomes in the blood.

In only one case, dying with a fair number of trypanosomes in the blood, could I find occasionally a parasite in the congested vessels of the organs.

The one case of trypanosomiasis, which died from an intercurrent pneumonia, did not show any other changes in the central nervous system than the very large peri-vascular spaces, partially filled with transudate, and sometimes containing a few white blood corpuscles. The ganglion cells showed the changes corresponding to the hyperthermia. The lymph glands were very hæmorrhagic, some showed the typical appearance of hæmo-lymph glands.

The brains, spinal cords, and organs of numerous animals infected with *Trypanosoma Gambiense*, monkeys, rabbits, guinea-pigs, dogs, rats, and mice were examined. One of the monkeys showed a typical hæmorrhagic cicatrix in the left *lobus centralis* of the brain; other monkeys and a chimpanzee

showed a high congestion of the vessels of the brain and spinal cord, with hæmorrhages, around the vessel walls, containing lymphocytes, a few leucocytes, and phagocytes. The intima showed large proliferated endothelial cells, the vessels often contained very many leucocytes. Numerous hæmorrhages in the grey substance of the spinal cord were frequently seen. Some of the dogs, rabbits, and guinea-pigs showed the changes in the spinal cord, and to a less extent in the brain. The ganglion cells exhibited similar alteration as in the human cases. In some of the animals no changes around the vessels and very little alteration of the ganglion cells and fibres were noted.

Many of the lymph glands presented the picture of hæmo-lymph glands with a few pigment granules; sometimes an irregular patchy appearance was seen, the centre consisting of a light stained area with numerous red cells and phagocytes, the periphery of normal lymph tissue with a small number of follicles. The spleen showed congestion in the more acute cases, with irregular hyperplasia of the malpighian bodies, in the older cases hyperplasia of the connective tissue. For comparison the brains, cords, and organs of animals infected with *T. dimorphum* (Gambian horse disease) were examined. In a few cases the same hæmorrhages as described above and localised in the grey substance of the nervous centres were seen. The lymph glands showed the peculiar appearance; as noted above the light spaces were completely filled with blood pigment. The spleen showed hardly any pigment. Trypanosomes were found mostly clumped together in the vessels of the different organs of all animals dying with numerous parasites in the peripheral blood.

Conclusions.

(1) In the cases of Sleeping Sickness there is a pronounced congestion of the blood vessels of the central nervous system together with a small celled infiltration around the vessels of the brain and spinal cord, especially in the grey substance.

(2) Chromatolysis and pyknosis of the ganglion cells of brain and spinal cord.

(3) Inflammation of the leptomeninges of the brain and spinal cord.

(4) Neuritis of the peripheral nerves.

(5) The more chronic the case and the more pronounced the symptoms the greater the changes in the brain and cord.

(6) The majority of the lymph glands exhibit the picture of hæmo-lymph glands.

(7) Small necroses of the spleen and signs of degeneration of the bone marrow.

(8) The brain of a case of Trypanosomiasis did not show small celled infiltration.

(9) Animals infected with *Trypanosoma Gambiense* show sometimes changes in the nervous system, localised in the grey matter, hæmorrhages, lymphocytes, and a few leucocytes in the peri-vascular space: hæmo-lymph glands in large numbers, and sometimes necrosis of the spleen and degeneration of the bone marrow.

(10) Animals infected with *Trypanosoma dimorphum* exhibit similar changes in the nervous system and organs. A far greater deposit of pigment in the lymph glands and in older cases in the spleen is present.