

NOTES ON AN OUTBREAK OF CATTLE-PLAGUE IN SHANGHAI, AND ITS LIMITATION BY THE GALL IMMUNISATION OF KOCH.

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THAT Cattle-plague (Rinderpest) is one of the most fatal and contagious maladies of cattle needs no further demonstration. The disease appears to be widely distributed in China, and is endemic in the hinterlands of Shanghai, Chinkiang, Hongkong, Peking, Tientsin, and Chefoo.

After an incubation period of about two days the onset of the disease is first manifested by increased temperature only: later loss of appetite appears, followed by constitutional signs of severe illness, drooping head, distressed look, standing coat, discharges from eye, nose and mouth, and diarrhoea, frequently bloody. Death usually takes place about the seventh day after the first rise of temperature. At autopsy the diagnosis can be confirmed by finding the pyloric region of the intestinal tract deeply congested, with patches of extravasation, erosion, and even necrosed yellowish areas which may have formed sanguinolent ulcers.

It has been completely established that the actual cause of the disease, the toxin, and the antitoxin, occur in the blood, and that immunity can be produced in cattle broadly as follows:

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| 1. By injection under the skin of gall from an animal dead of cattle-plague (Koch). | } Passive immunity |
| 2. By injection of blood of an animal which has had cattle-plague. | |
| 3. By injection of blood of an animal which has had cattle-plague, together with blood of an animal which has had cattle-plague (simultaneous method of Kolle and Turner). | } Active immunity |
| 4. By a previous attack of the disease. | |

Inasmuch as the production of active and lasting immunity (salting) by the simultaneous method of Kolle and Turner (antitoxic serum and virulent blood) causes a certain proportion of deaths, many animals to be sick, and the secretion of milk to be diminished, it would not be readily accepted voluntarily by the Chinese dairy-keepers. Moreover the local outbreaks occur at such irregular intervals (being absent often for several years) that a supply of antitoxic serum would be difficult to ensure at the required time. It is only necessary for the Sanitary Authority to protect the licensed dairies, for the dairy cattle are comparatively valuable Australian and half-bred milk cattle, difficult to replace locally, while the cattle used for slaughter are derived from immense and inexhaustible agricultural districts along the Grand Canal, where cattle-plague is endemic. It has appeared, therefore, that the gall immunisation method of Koch was most applicable to these isolated and limited herds of cattle in the Shanghai dairies and fulfilled the essential requirement, namely, rapid limitation of the disease when introduced. As strict sanitary inspection is exercised by the Health Department of the Shanghai Municipal Council over the dairies it is comparatively easy to apply the method. Moreover, on the occurrence of an epidemic means are immediately at hand of procuring the prophylactic gall, and the technique is simple and easily applicable to a large number of animals. The infected dairy can be first treated, then those adjacent, and finally those more remote. In this way the animals not yet infected are protected, and an epizootic prevented.

The origin of the present outbreak was as follows: A large herd of cattle infected with cattle-plague was brought to Shanghai from the hinterland (Tanyang district around the Grand Canal) for export to the allied troops in the north of China. The disease spread to an adjacent dairy, most of the cattle dying. On this dairy becoming infected a police cordon was established round it to prevent ingress and egress of cattle and ingress of persons unconnected with the dairy; while the outside infected herd was removed to an isolated part of the settlement. Having been previously convinced of the futility of police cordons in the prevention of cattle-plague, I was not surprised to find, within a short time, that the disease had spread, by the meeting together of cattle-coolies at a common tea-house, to three other dairies at a distance of a quarter, a half, and two miles from the original source of infection. As the animals are not as a rule taken away from the immediate vicinity of the dairy, there being no grazing fields, and as neither fodder

nor dung is taken from one dairy to another, it is practically certain the infection was carried by the dairy-coolies.

Immediately on this second series of dairies becoming infected it was resolved to apply the gall immunisation method of Koch, as being the means at hand. With this object an animal dying of the disease was opened up by a transverse incision across the right side of the upper part of the abdomen. The diagnosis was confirmed by finding the pyloric region both of the stomach and bowel congested and eroded. The gall-bladder was seized around the neck in the hollow of the hand and excised by cutting into the liver substance. The cut surface of the bile-duct was sterilised by washing with alcohol, and about 1500 c.c. of gall was slowly jetted into a sterile wide-mouthed bottle. The gall was clear and green, and 10 c.c. of it were injected into the dewlap of each of the 20 remaining cattle in the dairy. The rest of the gall was mixed with an equal part of glycerin and kept in an ice-chest till again required, the dose used of the glycerin-gall being 20 c.c., equal to 10 c.c. of pure gall. This was employed in the remaining infected dairies. Of three dead animals opened for the furnishing of gall two yielded clean green gall, while in the third the gall was thick and red, and was rejected. This gall mixed with an equal quantity of glycerin remains up to the present time (two months after collection) clear and green, and is sterile when inoculated on agar.

The injection of the gall into the dewlap caused slight local swelling and tenderness but no constitutional symptoms and no alteration in the milk supply, an important matter in a dairy. In all, 68 cattle were injected with cattle-plague gall. Of these 17 were among isolated uninfected herds, the remaining 51 belonged to infected herds; and among the latter 11 died of cattle-plague subsequent to the injection; namely, 4 on the fifth day, 2 on the seventh day, 1 on the eleventh day, 2 on the twelfth day, 1 on the fourteenth day, and 1 on the twentieth day after injection with gall. Taking eight days as the maximum incubation period of the disease and seven days as the usual period after onset of the disease that death may take place, it is clear that an animal dying of cattle-plague before the fifteenth day may have contracted the disease previous to the injection of the gall and hence may be eliminated in estimating the immunity gained. One animal, therefore, out of the 51 injected with gall and exposed to infection, with certainty contracted the disease after the injection, namely, that one which died twenty-one days after injection. Considering the usual

excessive mortality during an outbreak of this disease the result may almost be compared to the success of vaccination against small-pox.

Three young bullocks, each having received 20 c.c. of cattle-plague gall, were purposely exposed to severe infection. They remained well, while unprotected animals around them died of the disease.

In China generally the division of the land into small holdings, each owner keeping one, two, or at most three cattle, chiefly for the purpose of ploughing, is a sufficient safeguard, as regards isolation, against the disease, though endemic, causing great loss. There are in China no large herds except those acquired from the small owners by the cattle-dealers, who rapidly transfer the animals to the butchers for the non-Chinese consumers. It is, however, in the great centres where population, Chinese and non-Chinese, is aggregated, and herds of cattle for slaughter and dairy cattle come in touch, that cattle-plague becomes a source of great loss. And here its effect is chiefly felt among the permanent herds, *i.e.* among the dairy cattle only. The Chinese do not drink milk. It, therefore, becomes necessary to render these dairy cattle immune in non-Chinese communities.

To produce under these circumstances a permanent immunity (salting) by Kolle and Turner's method is a matter requiring considerable preparation and means at hand. This method is, therefore, difficult to apply in an emergency, *i.e.* in isolated places among small herds whose units are constantly changing. It has, therefore, appeared that the attainment of a permanent immunity of a proportion of the herd (a method which always causes the loss of a certain proportion of the herd in its production) may be sacrificed and an outbreak of the disease met by the means in hand, cattle-plague gall, which produces an immunity lasting for some four months (causing no loss of animals nor even temporary illness in its attainment) and which can be easily re-applied.

CONCLUSION.

The method of immunisation by gall being inexpensive and easily applicable, when once a case of cattle-plague has furnished the gall, may be considered perhaps the best for meeting future outbreaks of the disease in isolated places like Shanghai among small herds of dairy cattle.