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Further Notes on the Venous Connections of the Lymphatic System in the Common Rat

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FURTHER NOTES ON THE VENOUS CONNECTIONS OF THE LYMPHATIC SYSTEM IN THE COMMON RAT.

THESE T. JOB.

As long ago as 1825 the Italian anatomist, R. Lippi, published a paper on "Illustrazioni fisiologiche e patologiche del sistema linfatico-chilifero mediante la scoperta di un gran numero di comunicazioni de esso col venoso" in which he brought out the fact that the lymphatics not only connect with the veins at the Jugulo-subclavian juncture but also join the Inferior Vena Cava and Portal vein. J. Jolly in his work "Rescherches sur les ganglions lymphatiques des oiseaux," 1910, discredits Lippi's work because he thinks Lippi described the testes of the duck as lymphatic nodes; if such a mistake as this were made, he thinks all of Lippi's work should be doubted. However, this may be it is quite evident now that there are lymphatic connections with the venous system at other points than the Jugulo-subclavian taps in the common rat, which, even if they are not constant, appear at least in a good percentage of cases. Whether they are constant or variable is significant as will be shown later.

Two years ago the writer presented before this Academy a paper "On the Lymphatic System of the Common Rat" in which it was shown that the Jugulo-subclavian taps were not the only connections in the rat. A portal vein connection was proven then, and in addition the renal vein connection found by Chas. F. Silvester in the South American monkey, was demonstrated in the rat. Moreover, two specimens were observed in which there were ilio-lumbar connections. Two instances out of 100 would seem insignificant, but when one comes to interpreting the meaning of venous connections, they are very important.

With the renal, portal and ilio-lumbar connections proven, the writer wishes to present still another connection, that of the inferior vena cava at the level of the lumbar nodes.

Before considering the proof and significance of these connections it might be well to point out some important phases of the technic. The stab injection method, which has been employed in these studies, must be used with the greatest care and

the movement of the injecting mass watched very carefully to render the results trustworthy, because filling the veins with the mass directly from the point of injection does occur in some instances. In this connection the writer has considered as legitimate proof only those instances in which the injecting mass has been seen to leave the lymphatic channels and enter the veins, or, in which a dissection could be made to show a connection between a lymphatic vessel and a vein. Such conditions do not occur in every specimen injected, so a large number is necessary to furnish a basis for drawing conclusions. Furthermore, the physiological condition of the animal must be taken into consideration. There is evidence that specimens killed with illuminating gas give a higher percentage of instances of venous connections and show a finer network of plexuses than specimens killed with ether or chloroform. There is a basis also for the belief that the degree of activity, the length of time after feeding and the physical condition of the animals are facts which vary the response of the lymphatic vessels to the injecting mass. Thus it may be that in part the lack of constancy in the venous communications is due to these conditions.

In about twenty-five per cent of the specimens injected, portal vein taps can be shown by observation and dissection. Two cases of particular interest were observed. When the most distal intestinal node was injected the mass was seen to run along the lymphatic channel from this node to the region just dorsal to the pyloric end of the stomach: there it entered the portal vein and ran into the liver and out toward the injected node, thus giving as clear a demonstration of this connection as could be demanded.

The connection in the portal vein is of particular interest in connection with the experiments carried on by physiologists. If the amount of fat contained in the lymph taken from the thoracic duct, after feeding an animal a known quantity of fat, be added to the amount lost in the feces, a variable amount is shown to have disappeared by some other route. Physiologists have considered that this amount must be taken up directly by the venous capillaries of the villi, even though it is not a satisfactory explanation to them. The portal vein communication of the intestinal lymphatic channel can account for this variable difference.

In the inferior vena cava there is a larger percentage of communications shown. The writer is confident that this connection has been overlooked by him in many injections, because of either a complicated network of vessels between the two lumbar nodes, thus masking the connection, or in instances where the plexus was slight, by the communication being directly from the node and thus taken for a ruptured vein and not a lymphatic vessel. By careful dissection and observation this lymphatic communication has been demonstrated in about one-half of the specimens used since the first connection was noticed. Instances have been noticed where the mass left the main lymphatic channel and entered the vein by one or more taps, giving again undoubted evidence of the connection.

There is no correlation between the number and position of the venous communications in any one specimen. All connections may be present in one specimen, while only three or two or even just the jugulo-subclavian taps may be present in others.

The significance of these venous communications and their variability can be explained only after a thorough embryological investigation has been made. Whether they can be explained most satisfactorily by the sprouting theory, which is advanced by Dr. F. R. Sabin, as representing the original points of origin, or whether these taps represent later connections of the lymphatic system with the venous system, constitutes the problem now under investigation.

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