NOTE ON THE LYMPH CIRCULATION.

By J. S. ASHE.

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IN thinking over their course and surroundings it has occurred to me that in the relation of the constantly pulsating aorta to the thoracic duct may be found the explanation of one of the chief forces which aid in the carrying on of the lymph circulation.

The onward passage of the lymph through the lymphatic vessels and thoracic duct is usually attributed to the following causes:—(1) The *vis-a-tergo*, derived from the pressure in the capillaries acting on the lymph in the lymph spaces. (2) The pressure of the contracting muscles in the limbs and other parts of the body acting upon the lymphatics, which are provided with valves that allow lymph to flow in one direction only. Whenever outside muscular pressure is brought to bear on the vessels the result must be a flow of lymph towards the larger veins, this being largely assisted by the lateral anastomosis of the vessels. (3) The aspirating action of the thorax is generally held to be an important factor in the flow; the negative pressure, which is constantly present in that cavity, drawing the lymph into the thoracic duct. (4) Other forces which assist are—(a) the contraction of the abdominal muscles pressing upon the receptaculum chyli and the abdominal lymphatics; (b) the pumping action of the diaphragm as described by Ludwig; (c) the contraction of the muscular fibres of the villi—probably of the lymph vessels generally; and (d) the aspirating action of the heart, producing a negative pressure within the large veins, into which the thoracic duct opens.

To these forces I would venture to add another. It has occurred to me that the distension of the aorta which takes place at each contraction of the heart must have a considerable influence in forcing the lymph onwards through the receptaculus chyli and the thoracic duct, owing to the close anatomical relation which exists between these latter structures and the aorta. In the middle and lower portions of the thorax the thoracic duct is placed behind and to the right of the thoracic aorta, and in close relation to it. To the right of the duct lies the vena azygos major, and behind, but a short distance removed, is the rigid vertebral column. These

Diagram of Posterior Mediastinum.
(From a frozen section.)

three vessels are placed within the posterior mediastinum, between the two pleural sacs. At every contraction of the heart a large increase of the contents of the aorta takes place, and as a result a considerable expansion of that vessel is produced. This expansion would affect the thoracic duct

in two ways. In the first place, it would compress it against the vertebral column and the surrounding part, and owing to the disposition of the numerous valves within the duct, this pressure could not send the lymph backwards towards the abdomen. Were lateral anastomosis of the duct present there is no doubt that the pressure would send it onwards, as in the case of the muscular pressure in the limbs already referred to; but even without this lateral anastomosis it seems probable that at least part of the lymph would be forced onwards towards the upper end of the duct by the pressure of the expanding aorta. The receptaculum chyli, lying, as it does, between the aorta and the right crus of the diaphragm, would be similarly affected.

The second way in which the aorta might influence the flow is by raising the pressure within the posterior mediastinum. The expansion of aorta within this limited space, which takes place at each stroke of the ventricle, must increase the pressure within the mediastinum. The effect of this increase of pressure would be to drive the contained lymph from the lower part of the duct into the upper, where it lies on the left side of the œsophagus, and is freely exposed to the general negative pressure within the thorax.

In order the more clearly to explain the view which I, with great diffidence, have ventured to put forward above, I have constructed a simple schema, which, I think, demonstrates the course of events as I have described them.

DIRECTIONS.

Milk (Lymph) is poured down the funnel *G*, flowing through *K* (which represents afferent lymphatic trunk) to receptaculum chyli, *I*; when the latter is full the heart, *A*, is then squeezed, which causes distention of aorta, *B*, beneath the crura of diaphragm, *D*, which then presses upon the receptaculum chyli, *J*, pumping the milk into *F* (the thoracic duct), from which it cannot return owing to valves at *H*. On further working of heart milk is pumped up, showing distinct pressure in the mercurial manometer, *E*. *C* allows the air to escape from aorta at anything over a pressure of 120 mm.

A—Heart.
B—Aorta
C—Valve 120 mm.
D—Crura of diaphragm.
E—Mercurial manometer.
F—Thoracic duct.
G—Funnel for milk.
H—Valves in duct.
J—Receptaculum chyli.
K—Syphon for milk.