A COMPARATIVE STUDY OF THE CLOTTING POWER OF THE BLOOD AND LYMPH

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Although the clotting power of the blood has been studied intensively in recent years, the clotting power of the lymph has received insufficient attention. According to some authors, the clotting time and recalcification time of the blood and lymph are almost identical [1, 3], whereas the fibrinogen concentration in the lymph of cats, dogs and human subjects, obtained from lymph glands or the thoracic ducts, was only 27-62% of its concentration in the blood [3-6]. Most investigators have described results obtained by the investigation of two or three samples of lymph.

The object of the present investigation was to make a parallel determination of the clotting power of the blood and lymph in dogs.

EXPERIMENTAL METHOD

Blood was obtained from 17 animals anesthetized with thiopental from the femoral vein by means of a silicone-treated syringe. Lymph was collected through a polyethylene cannula from the thoracic duct at the point where it entered the left venous angle. The recalcification time, prothrombin time, and thrombin time [7], the heparin tolerance [8], the fibrinogen concentration and fibrinolytic activity [5] of the blood and lymph were determined. All the numerical results were analyzed by statistical methods.

EXPERIMENTAL RESULTS

The recalcification time of the lymph was higher than the recalcification time of the blood plasma in 15 of the 17 dogs by 10-328 sec, and in the other two animals it was shorter by 28-57 sec. Statistical analysis showed that the difference between the recalcification time of the lymph and plasma was 83 ± 21.26 sec ($P < 0.002$).

No regular difference could be found between the prothrombin time of the plasma and lymph (see table). In 7 dogs the plasma prothrombin time was shorter than the prothrombin time of the lymph (by 0.5-4.2 sec), in three dogs it was the same, and in 8 dogs it was longer (by 3.6-6.3 sec).

The thrombin time of the lymph showed a much greater increase. The heparin tolerance of the lymph was lower (in 15 of the 17 dogs). In the remaining animals the heparin tolerance of the plasma and lymph was the same. The heparin tolerance of the lymph was lower on the average by 460 ± 100.3 sec and this index in the blood plasma ($P < 0.001$).

The fibrinogen concentration in the lymph of all the animals was low (20-60%) compared with its concentration in the blood plasma.

Various Indices of the Clotting Power of the Plasma and Lymph of Dogs

Index	No. of dogs	Plasma M_1	Lymph M_2	m±	t	P
Recalcification time (in sec)	18	97	180	±21.26	3.89	0.002
Prothrombin time (in sec)	18	22.8	21.6	± 0.79	1.52	0.2
Thrombin time (in sec).	13	12.9	16.3	± 0.99	3.44	0.01
Heparin tolerance (in sec)	17	170	630	± 100.3	4.59	0.001
Fibrinogen concentration (in mg %).	17	415	165	± 45.0	5.56	0.001
Fibrinolytic activity (in %)	15	18	38	± 45.0	3.63	0.01

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It is important to note that the fibrinolytic activity of the lymph was higher than that of the plasma. This feature was observed in 11 of the 15 dogs, and in some of these animals the fibrinolytic activity of the lymph was between 2 and 3 times higher than in the plasma. Since the lymph contained little fibrinogen, the high level of activation of fibrinolysis sometimes caused complete lysis of the fibrin clot.

Hence, the clotting power of the lymph was found to be much weaker than that of the plasma. This is shown by the increased recalcification time and thrombin time and also by the lower heparin tolerance and the lower fibrinogen concentration of the lymph.

The lower clotting power of the lymph may be due to a reduction in its content of such clotting factors as AC-globulin, proconvertin, AHG-A, AHG-B, fibrinogen, and certain other factors [2, 3, 6], and also to the relative accumulation in the lymph of natural anticoagulants. In this connection it may be noted that heparin, present in large amounts in the mast cells of the liver, may accumulate temporarily in the lymph of the thoracic duct, causing a marked increase in its anticoagulant potential. According to the authors' findings, the prothrombin time of the lymph was shorter than the prothrombin time of the blood.

In individual cases other authors have found that the concentration of prothrombin and proconvertin in the plasma and the lymph obtained from different parts of the lymphatic system is practically identical [3, 4]. This is probably due to the fact that the liver is the main site of synthesis of many thrombogenic proteins influencing the one-stage prothrombin time. The concentration of these substances in the lymph at certain moments may increase considerably, thereby determining the shortening of the prothrombin time of the lymph in some of the dogs in the present experiments.

The fibrinolytic activity of the lymph is much higher than the fibrinolytic activity of the blood. This is most probably explained by the almost complete absence of inhibitors of fibrinolysis in the lymph [2, 3].

SUMMARY

Experiments on 17 dogs were carried out in order to compare the coagulative capacity and fibrinolytic activity of the blood and lymph. The time of recalcification and the thrombin time of the lymph proved to be increased, while the concentration of fibrinogen and tolerance of heparin were reduced as compared to the same indices of the blood. The fibrinolytic activity of the lymph was considerably higher than that of the blood.

LITERATURE CITED

1. D. M. Zubairov and V. I. Kurochkin, Byull. Éksp. Biol., No. 3 (1964), p. 28.
2. E. K. Albrechtsen, O. Storm, and M. Classen, Scand. J. Clin. Lab. Invest., Vol. 10 (1958), p. 310.
3. B. Blomstrand, I. M. Nilsson, and O. Dahlbäck, Ibid., Vol. 15 (1963), p. 248.
4. H. G. Hansen and K. Aepinus, Thrombos. Diathes. Haemorrh. (Stuttg.), Vol. 4, No. 435 (1960).
5. P. E. Hodgson and W. W. Coon, Surg. Forum, Vol. 4 (1954), p. 152.
6. R. D. Langdell, L. W. Bowersox, et. al., Am. J. Physiol., Vol. 199 (1960), p. 626.
7. E. Perlick, Gerinnungslaboratorium in Klinik und Praxis, Leipzig (1960).
8. L. Poller, Angiology, Vol. 5 (1954), p. 21.