tendency associated with the other severe changes in any of the chicks maintained on their numerous deficient rations. Furthermore, the delay in prothrombin clotting time reported by us is not associated with a spontaneous hemorrhagic tendency to date. The blood clotting time was within normal limits for the vitamin A deficient and pellagra-like chicks. What relation these deficiencies have with the statement of Almquist and Stokstad[8] that spontaneous recovery occurs in vitamin K depleted birds as they grow older is not yet clear.

At the present time the presence of anemia is being investigated. Also other vitamin deficiencies are being studied and their rôle on the prothrombin clotting time. Vitamin K assays on the avitaminosis A and pellagra-like chicks are being carried on.

Summary. Chicks receiving avitaminosis A and pellagra-like "F" rations failed to show normal prothrombin coagulation time. The plasma prothrombin clotting time was greatly delayed in these avitaminotic chicks without the distinct hemorrhagic tendency of a vitamin K depletion manifesting itself.

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Effect of Chemical Irritation of a Venous Segment on Peripheral Pulse Volume.

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In view of clinical observations suggesting the possibility of ipsolateral arterial and arteriolar vasoconstriction in femoro-iliac thrombophlebitis,[1] the present investigations were undertaken to study some of the factors which may be concerned with such a phenomenon.

The influence of local chemical femoral thrombophlebitis upon the volume of pulsations was studied in the hind feet of 12 dogs. The volume of pulsations was determined plethysmographically and recorded continuously by Turner's[2] method, sensitive to volume

8 Almquist, H., and Stokstad, E., *J. Nut.*, 1937, **14**, 239.

1 Ochsner, Alton, and DeBakey, Michael, *Surgery*, 1939, **5**, 491; also *J. A. M. A.*, in press.

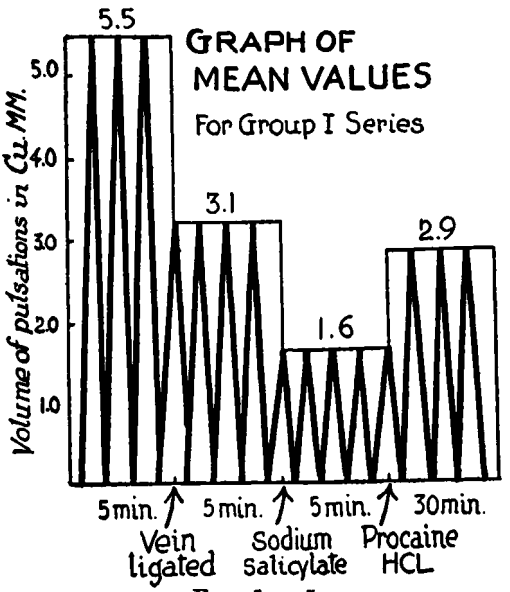
2 Turner, R. H., *J. Clin. Invest.*, 1937, **16**, 777.

changes of 0.1 cu mm. By means of a specially constructed cellulose-acetate plethysmographic cup the apparatus was adapted to the hind foot of the dog. Ether anesthesia was used on all dogs during the period of observation and aseptic precautions were observed in the operative procedures. In all observations comparable venous segments were isolated and ligated with silk. The perivascular tissues were not disturbed except for a distance of a few mm at the sites of the proximal and distal ligatures. This venous segment included the femoral vein from just proximal to the saphenous entrance below to Poupart's ligament above. Venous pressures were determined directly[3] in the saphenous vein at heart level before and after the venous ligations in most of the dogs. All observations were conducted under controlled atmospheric conditions, temperature 75° and humidity 50%.

The studies were divided into 5 groups of experiments as follows: (1) in 6 dogs (Nos. 1 to 6 inclusive) the venous segment in the left leg was exposed and ligated. Five minutes later 1 cc of blood was aspirated from the ligated segment and replaced by an equal quantity of 40% aqueous solution of sodium salicylate. Following another 5 minute interval the perivascular tissues of the entire venous segment were carefully infiltrated with 5 to 7 cc (depending upon the size of the dog) of 1% procaine hydrochloride. Observations were then continued for a period of 30 minutes. (2) In 2 dogs (Nos. 7 and 8) the Group 1 experiment was repeated on the left leg except that the procaine hydrochloride infiltration was done immediately after exposure of the vein and then followed by ligation and injection of the salicylate solution. (3) In 5 of the above dogs (Nos. 1, 2, 3, 6, and 8) 24 hours after resection of the right lumbar sympathetic ganglia and intervening chain, the respective procedures outlined in the first group of studies were repeated on the right leg. (4) On the left leg of dogs (Nos. 9, 10, and 11) the respective procedures outlined in the first group of studies were repeated except that the salicylate solution was injected into the perivascular sheath of the venous segment of the left leg. (5) In 3 dogs (Nos. 9, 10, and 12) 24 hours after resection of the right lumbar sympathetic ganglia and intervening chain, the procedures outlined in Group 4 were repeated on the right leg except that the perivascular tissues were not infiltrated with procaine hydrochloride.

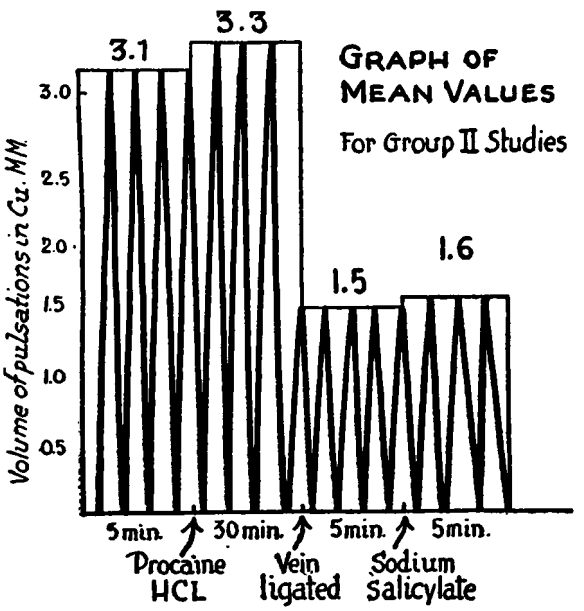
Whereas the sequence of each procedure in the 5 groups of ex-

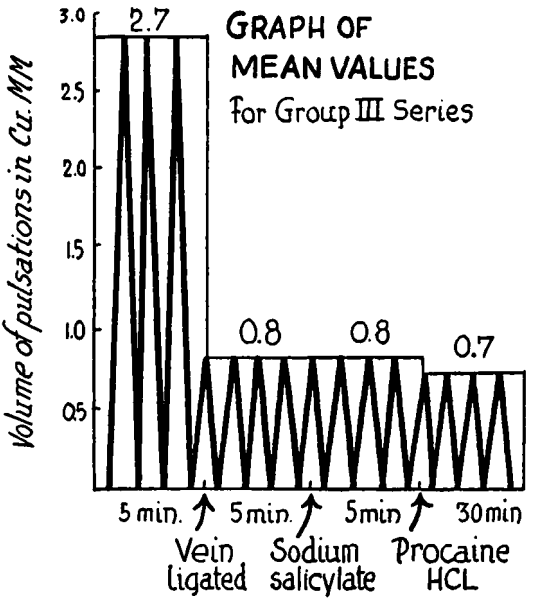
[3] Burch, G. E., and Sodeman, W. A., *J. Clin. Invest.*, 1939, **18**, 31.

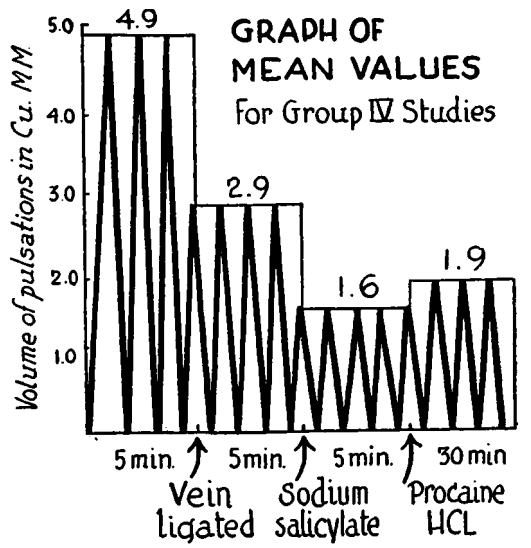


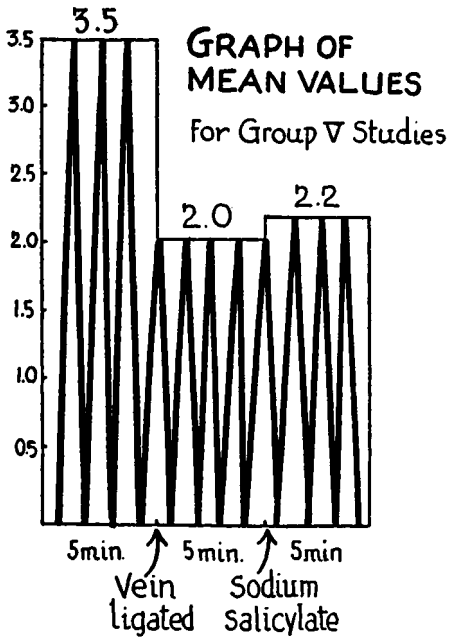
FIGS. 1 TO 5.

Graphic representation of mean values of results obtained in the 5 groups of studies.




GRAPH OF
MEAN VALUES
For Group III Series
Volume of pulsations in Cu. MM
3.0
2.5
2.0
1.5
1.0
0.5
2.7
0.8
0.8
0.7
5 min.
5 min.
5 min
30 min
Vein ligated
Sodium salicylate
Procaine HCL


GRAPH OF
MEAN VALUES
For Group IV Studies
Volume of pulsations in Cu. MM
5.0
4.0
3.0
2.0
1.0
4.9
2.9
1.6
1.9
5 min.
5 min.
5 min.
30 min
Vein ligated
Sodium salicylate
Procaine HCL



periments varied, the time periods of observation were the same for comparable procedures in all experiments.

Results. The mean results for each group of studies are illustrated in Figs. 1-5. Every dog in each of the five groups reacted in exactly the same manner as indicated by the corresponding graphs of the mean values, the individual variations being only one of degree. It was invariably found in all groups of studies that the volume of pulsations in the foot decreased markedly (52.5%) following ligation of the femoral vein reaching a maximum within 5 minutes. The decrease in volume occurred whether the lumbar sympathetic ganglia and intervening chains were intact or not. In the Group 1 studies, the volume of pulsations was decreased markedly (51.6%) following the introduction of the solution of sodium salicylate into the venous segment. This effect was abolished by the perivascular infiltration with procaine hydrochloride (Fig. 1). In the second group of studies in which the perivascular tissues were infiltrated with procaine hydrochloride before ligating the venous segment, the instillation of sodium salicylate into the venous segment did not affect the volume of pulsations in the foot (Fig. 2). The same results as obtained in Group 2 studies were obtained in Group 3 in which the lumbar sympathetic ganglia and chain were resected 24 hours before the observations were made (Fig. 3). In

the Groups 4 and 5 studies, similar to Groups 1 and 3 except that the chemical irritant was injected into the perivascular sheath of the vein, the results were similar to those obtained in Groups 1 and 3 respectively, in which the chemical irritant was placed intravenously (Figs. 4 and 5). The volume of pulsations decreased 55.2% following the perivascular chemical irritation in the fourth group of studies, a decrease quite similar to that following intravenous irritation. In this group of studies following the procaine hydrochloride infiltration, the volume of pulsations did not return to the values obtained after venous ligation, as in Group 1. This is probably due to the fact that the procaine hydrochloride solution did not permeate adequately the sclerosed perivascular tissues. Follow-up studies of the dogs revealed that volume pulsations returned to normal within a period varying from 3 days to 8 weeks.

Discussion. It is readily evident from all graphs that ligation of the main vein of the posterior extremity of the dog resulted in a marked diminution (52.5%) in the volume of pulsations in the foot. It was also observed that the venous pressure increased from a mean value of 7.7 cm H_2O before ligation to 97.0 after ligation. This effect was not influenced by the presence or absence of the sympathetic ganglia and intervening chain. At present, the explanation for this phenomenon can only be conjectured. However, investigations are being continued in an attempt to evaluate the factors concerned with its mechanism.

It is evident that a chemical irritant placed either in the lumen of the main vein of the extremity or in the perivascular tissues of this vein produces a marked diminution in the volume (51.6%) of peripheral pulsations. However interruption of nerve pathways by local infiltration with procaine hydrochloride at the site of the chemical irritation or by resection of the lumbar sympathetic ganglia and chain abolished this effect. This would suggest, therefore, that the decrease in volume pulsations following chemical phlebitis and periphlebitis is due to vasoconstrictor impulses initiated locally by the chemical irritant and coursing through the sympathetic ganglia in order to reach the terminal arterial vessels of the extremity.