cular clotting caused by intravenous infusion of fat emulsion. This clot acceleration, therefore, may not operate through the mechanism of prothrombin conversion. 3) Our experiments lend support to the concept that anticoagulation with coumarin-type drugs is not synonymous with antithrombotic effect.

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Digital Pre- and Postcapillary Vasoconstriction and Vasodilatation Resembling Pre- and Postglomerular Arteriolar Function in Kidney.* (25264)

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Spontaneous variations in digital vascular volume have been described(1) quantitatively for man. They are generally classified into 5 types—pulse, respiratory, alpha, beta and gamma deflections. *Alpha deflections* have a mean frequency of 7.9/min. (range 2 to 14) and mean magnitude of 14.5 mm^3/5 cc of part (range 0.1 to 81). *Beta deflections* have a mean frequency of 1.3/min. (range 1 to 2) and mean magnitude of 30 mm^3/5 cc of part (range 5 to 60). *Gamma deflections* have a mean frequency of 4/hr (range 1 to 8) and mean magnitude of 150 mm^3/5 cc of part (range 50 to 350). Pulse deflections are superimposed upon alpha, beta and gamma deflections (Fig. 1). With marked vasoconstriction and marked vasodilatation the alpha, beta and gamma deflections are small to almost absent(1,2). The function of these spontaneous volume deflections has been a puzzle. With development of the rheoplethysmographic method for measuring simultaneously time courses of volumes and rates of digital inflow and outflow during a single pulse cycle(2,3), the significance of these spontaneous deflections is becoming apparent.

Theoretic considerations. Large ascending and descending alpha, beta and gamma deflections are associated with large increases and decreases, respectively, in digital volume.

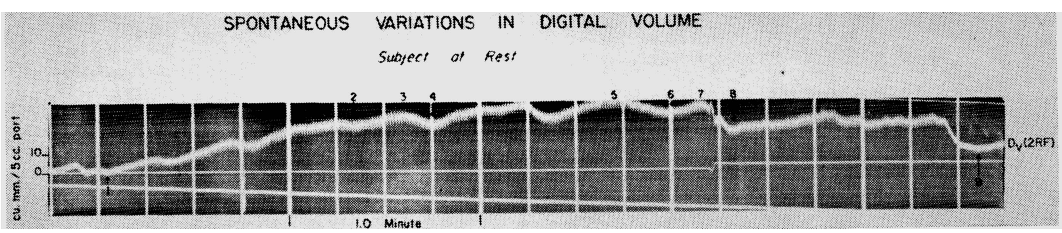

FIG. 1. A segment of a rheoplethysmogram recorded at slow camera speed showing variations in volume, D_V (2RF), of the tip of right second finger (index finger). The pulse waves are superimposed upon alpha deflections (arrows 2 to 3 and 3 to 4, for example) which, in turn, are superimposed upon beta deflection (points 1 to 5 and 5 to 9).

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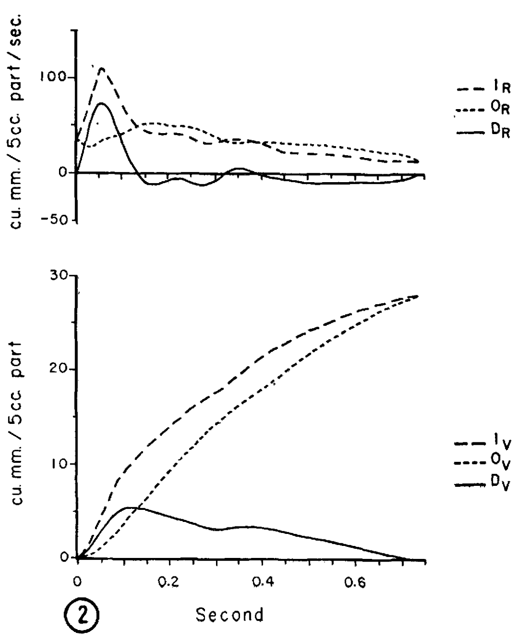

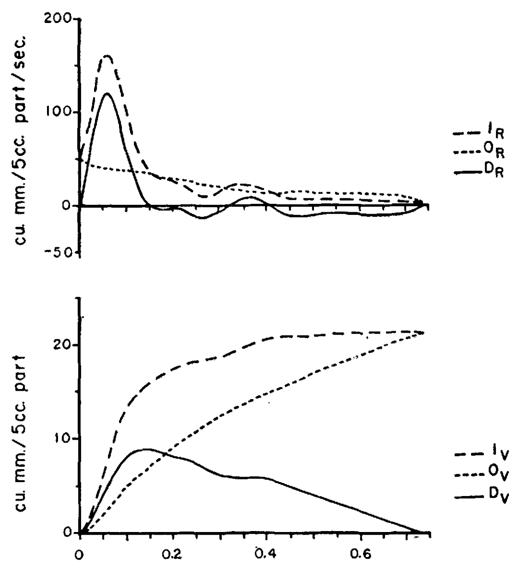

FIG. 2. Rheoplethysmogram of index finger tip (2RF) for a pulse cycle during a descending alpha deflection and an ascending beta deflection. Simultaneous time course curves of rates of digital inflow (I_R) and outflow (O_R) and difference between rates of inflow and outflow (D_R) are shown at top of illustration. Simultaneous time course curves of volume of digital inflow (I_V) and outflow (O_V) and difference between volumes of inflow and outflow (D_V) are shown at bottom of illustration. In this Figure and in Fig. 3, the 3 rate curves are time courses of the first derivatives of the 3 volume-time curves, derived as previously described(2,3). Magnitudes, configurations and temporal relationships of these curves should be compared with those of curves in Fig. 3.

FIG. 3. Rheoplethysmogram for the same digit and subject as in Fig. 2, recorded a few minutes later when alpha deflection was ascending and beta deflection was descending.

Fig. 1 shows the tip of second right finger (2RF) to undergo marked variations in volume. Arrow 1 of Fig. 1 shows the beginning of an ascending beta deflection of D_v (2RF) which reached its peak at point 5. This ascending beta deflection had several superimposed descending (arrows 3 to 4, for example) and ascending (arrows 2 to 3) alpha deflections which, combined, were associated with a net increase in volume of finger tip of 35 mm^3/5 cc of part in 155 seconds. The descending beta deflection began at point 5 and reached lowest level at arrow 9 in 110 seconds with a net decrease in digital volume of 24 mm^3/5 cc of part. This descending beta deflection also had superimposed ascending (arrow 6 to point 7, for example) and descending (point 7 to arrow 8) alpha deflections. Because of magnitude of volume change during ascending and descending beta deflections, the postcapillary vessels, including digital veins, must have been involved in dilatation and in constriction. It has been found rheoplethysmographically that when an alpha deflection ascends digital inflow increases, and when an alpha deflection descends digital inflow decreases. Therefore, whenever an ascending alpha deflection with its associated increase in rate of digital inflow of blood is located on a descending beta or gamma deflection which reflects a decrease in volume, there must be net dilatation of precapillary digital vessels (arterioles and arteries) with net constriction of postcapillary vessels. Whenever a descending alpha deflection with its associated decrease in digital blood flow is found on an ascending beta or gamma deflection which reflects an increase in digital volume, there must be net precapillary constriction and net postcapillary dilatation.

Results. Fig. 2 and 3 show that rate of inflow (I_R) was greater when alpha deflection was ascending than when descending, indicating precapillary vasodilatation in the former. The trace of volume inflow (I_V) obtained when alpha deflection was ascending on a descending beta deflection (Fig. 3) shows a rapid "plateauing off" due to leakage of blood past the collecting cuff as a result of "over-filling" or small capacity of the collecting vessels. The postcapillary collecting vessels accommodated only 18 mm^3 of blood before "over-filling," indicating that these vessels had small capacity and high tone, as would be expected for constricting postcapillary vessels associated with a descending beta deflection. However, when alpha deflection was descending on an ascending beta deflection, these same postcapillary or collecting vessels accommodated 28 mm^3 of blood and still did not "over-fill" (Fig. 2). This situation would be expected in a loose postcapillary vascular system such as would exist if vessels were dilating and, therefore, of relatively large capacity and low tone.

It can be seen from Fig. 1 that the pulse waves increased in volume during ascending beta and alpha deflections, whereas they decreased in volume during descending beta and alpha deflections. Burton(4) and I(2) have shown that, in general, under conditions of these experiments, the rate of digital inflow tends to vary directly with volume of pulse wave. Changes in volume of the pulse wave are further evidence of net changes in calibre of the precapillary vessels.

Discussion. Simultaneous discordant and disproportionate pre- and postcapillary vascular dilatation and constriction, which occur spontaneously at all times in tissues, resemble the functional relationships of afferent and efferent arterioles of the glomerulus of the kidney. These phenomena in tissues must be concerned with regulation of the exchange of fluid and solute between interstitial spaces and plasma. They must also be concerned with maintenance of the circulation of interstitial fluid and lymph. Time courses of lymph flow noted in tissues by McMaster(5) are similar temporally to alpha and beta deflections. This similarity possibly reflects the influence of properly integrated pre- and postcapillary vasodilator and constrictor activities upon capillary filtration of plasma water and solute and capillary reabsorption of water and other substances from the tissues. It may also reflect a source of energy derived from circulating blood which is responsible in part for the flow of lymph fluid in the sacs, capillaries and small vessels of the lymphatics.

The influence of normal physiologic factors, drugs and disease upon temporal relationship and magnitude of pre- and postcapillary vascular constrictor and dilator activity needs study. The relatively thick accumulation of smooth muscle noted in arterioles and small veins could function as pre- and postcapillary "sphincters" in this integrated regulation of the circulation of interstitial fluid and lymph.

Summary. These studies indicate that, in general, alpha deflections reflect net changes in calibre of precapillary vessels and beta and gamma deflections reflect net changes in calibre of postcapillary vessels and that these changes in pre- and postcapillary vessels are probably important in the regulation of peripheral circulation and flow of tissue fluid and lymph.

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