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Resting Peripheral Blood Flow in Hypertensive Subjects.*

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In the course of plethysmographic studies on the peripheral vascular responses of hypertensive patients, it was noted that in about 50% of the cases the resting blood flow in the forearm was much greater than that in subjects with normal blood pressure. Such findings differ from those presented previously by Prinzmetal and Wilson[1] using a similar method, and from those obtained by Pickering,[2] who utilized Stewart's calorimetric procedure.[3] These investigators found that the average blood flow reading for the forearm in a series of hypertensive subjects was no greater than that in a normal group, and on the basis of these observations, together with some confirmatory studies, they concluded that the increased vascular resistance in hypertension is generalized throughout the systemic circulation rather than confined to the splanchnic area. Pickering[4] subsequently pointed out, as did also Stead and Kunkel,[5] that in the light of Grant and Pearson's work,[6] the data included in the two investigations represented not only arterial inflow to the forearm, but also venous return from the hand. It is well known that blood flow through the hand can be affected by a variety of stimuli,[7] and hence readings obtained under such conditions cannot be considered representative of peripheral blood flow generally. Further, as Prinzmetal and Wilson indicated, the opposite conclusion to the one presented by them, namely that the hypertonus is limited to the splanchnic region, could have been drawn if an increase in blood flow had been found in the forearm of hypertensive subjects of the magnitude of 1.5 times the normal figure, *i.e.*, approximately 2.65 cc per min. per 100 cc of limb volume instead of 1.7 cc.[1]

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1 Prinzmetal, M., and Wilson, C., *J. Clin. Invest.*, 1936, **15**, 63.

2 Pickering, G. W., *Clin. Sc.*, 1936, **2**, 209.

3 Stewart, G. N., *Heart*, 1911, **3**, 33.

4 Pickering, G. W., *Proc. Staff Meet. Mayo Clinic*, 1939, **14**, 310.

5 Stead, E. J., Jr., and Kunkel, P., *J. Clin. Invest.*, 1940, **19**, 25.

6 Grant, R. T., and Pearson, R. S. B., *Clin. Sc.*, 1938, **3**, 119.

7 Capps, R. B., *J. Clin. Invest.*, 1936, **15**, 229; Kunkel, P., Stead, E. A., Jr., and Weiss, S., *J. Clin. Invest.*, 1939, **18**, 225; Abramson, D. I., and Ferris, E. B., Jr., *Am. Heart J.*, 1940, **19**, 541.

In the experiments herein reported, care was taken to maintain a pressure of at least 350 mm Hg at the wrist during blood flow determininations in the forearm, so that venous return from the hand could not affect the results.[6] The bath temperature was kept at 32° C and the room temperature at 25° C; the technic used being similar in all respects to that previously reported.[8] The results ob-

TABLE I.
Resting Blood Flow in the Forearm.
Hypertensive Subjects.

Case No.	Age years	Blood flow	Blood pressure mm Hg	Case No.	Age years	Blood flow	Blood pressure mm Hg
			172 218				164 192
1	64	2.1	— – —	15	74	3.4	— – —
			92 90				86 92
			170 200				160 158
2	31	2.0	— – —	16	43	4.0	— – —
			110 110				100 98
			160 205				156 190
3	71	3.3	— – —	17	29	1.9	— – —
			80 102				108 130
			218 236				182 202
4	43	4.6	— – —	18	70	3.3	— – —
			120 134				90 110
			160 230				160 192
5	72	5.9	— – —	19	40	1.7	— – —
			90 112				100 110
			236 264				230 270
6	52	6.3	— – —	20	57	3.0	— – —
			104 110				108 140
			150 180				226 236
7	45	4.0	— – —	21	67	6.1	— – —
			88 90				126 132
			166 170				230 230
8	62	2.1	— – —	22	64	4.0	— – —
			100 120				110 130
			160				230 240
9	54	1.6	—	23	38	4.0	— – —
			100				140 140
			162				220 250
10	46	1.2	—	24	51	1.4	— – —
			130				122 118
			158 170				160
11	64	1.4	— – —	25	23	2.5	—
			80 100				94
			230				180 192
12	53	2.6	—	26	59	1.4	— – —
			140				110 122
			152 208				180
13	44	4.7	— – —	27	31	1.5	—
			102 110				124
			220 230				204
14	69	3.1	— – —	28	41	3.0	—
			120 130				124

Avg—3.1 cc

[8] Abramson, D. I., Zazeela, H., and Marrus, J., *Am. Heart J.*, 1939, **17**, 194, 206; Ferris, E. B., Jr., and Abramson, D. I., *Am. Heart J.*, 1940, **19**, 233.

Case No.	Age years	Blood flow	Blood pressure mm Hg	Case No.	Age years	Blood flow	Blood pressure mm Hg
			Subjects with Normal Blood Pressure.				
1	52	1.8		20	25	3.3	
2	27	1.9		21	26	2.5	
3	20	2.0		22	37	1.2	
4	18	1.3		23	33	1.8	
5	27	1.5		24	36	1.5	
6	34	1.5		25	25	0.9	
7	26	1.8		26	20	1.8	
8	18	2.2		27	30	1.8	
9	36	2.2		28	19	2.7	
10	28	1.5		29	25	2.2	
11	42	0.9		30	23	1.5	
12	43	1.9		31	15	1.2	
13	50	1.1		32	19	1.7	
14	56	1.1		33	23	1.6	
15	30	2.2		34	36	1.7	
16	19	0.8		35	28	1.0	
17	24	1.7		36	53	2.3	
18	30	3.1		37	74	1.6	
19	26	2.5		38	77	2.2	
			Avg—1.8 cc				

Bath temperature—32°C. Blood flow in cc per min per 100 cc limb vol.

tained in a series of 28 hypertensive patients of various types were compared with those in a series of 38 normal subjects. The average forearam blood flow in the latter (Table I) was found to be 1.8 cc per min. per 100 cc of limb volume, while that for the hypertensive group (Table 1) was 3.1 cc (1.7 times greater than that for the control series). In the case of 4 known hypertensive subjects, but in whom normal blood pressure readings were obtained in the period in which the tests were performed, the average forearm blood flow was 1.8 cc.

In view of the disparity between our results and those reported by other investigators, it becomes necessary to reëxamine their conclusion that an increased vascular tonus exists at the periphery in hypertension.