

TACHYCARDIA OF UNKNOWN ORIGIN *

THEODORE B. BARRINGER, JR, M.D.

NEW YORK

Among the draft registrants examined during the spring of 1918 by the New York Hospital medical advisory boards there were 141 men with organic heart disease and ninety-three with what we will describe briefly as "tachycardias of unknown origin." Further scrutiny of this latter group would probably have shown that a small number were early cases of Graves' disease (exophthalmic goiter) or tuberculosis, and that alcohol was the cause of the rapid heart rate in another small group. A surprisingly large proportion of the men suffering from circulatory disease, however, would be found in this group of what we have termed, for want of a better name, "tachycardias of unknown origin."

Fourteen of these men were examined a number of times, their histories being taken carefully and their circulatory reactions to graduated work being determined on at least three occasions. Chief importance will be attached to our objective findings, for many of these men either believed that they were not physically fitted for army service or wished to avoid such service, which did not tend to increase the reliability of their histories. Our experiments with graduated work led us to classify our fourteen cases into two groups — a severe type and a mild type. The reasons for this classification will be given later.

FAMILY HISTORIES

Six of our patients gave a history of neurotic taint in the family.

S. R., aged 21; severe type of case; mother hysterical; father of violent temper; one sister nervous; one brother has pulmonary tuberculosis.

S. B., aged 23; severe type of case; mother died of melancholia; one sister has melancholia.

C. G., aged 22; moderate type of case; mother epileptic.

F. S., aged 28; mild type of case; mother has melancholia, "nervous prostration" and pulmonary tuberculosis.

A. S., aged 22; mild type of case; mother has "nervous prostration" and hysterical attacks.

S. F., aged 22; mild case; father's father insane; mother is nervous and has rapid heart action.

* Submitted for publication June 19, 1918.

HISTORY OF INFECTION

In no one of our five severe cases had the patient ever had acute articular rheumatism; one had had scarlet fever and another diphtheria.

The patients in nine mild or moderate cases gave no history of acute articular rheumatism; two had had scarlet fever and one had had three attacks of pneumonia.

NATURE AND TIME OF ONSET OF SYMPTOMS

Severe Type of Case.—*P. P.*, for eight years has had pain around the heart, exhaustion and shortness of breath after exercise.

S. R., when a small boy couldn't play with other boys on account of shortness of breath. For five years he has suffered from palpitation and pain around the heart following exercise.

S. B., for three years has had palpitation and breathlessness after exercising.

P. R., when a child could not run on account of shortness of breath and cardiac pain. These symptoms, evoked by exercise, have persisted.

A. V., when a small boy had to stop running before his comrades did on account of shortness of breath. Has had rapid heart action for the past fourteen years.

Mild Type of Case.—Two of these nine mild cases gave histories of breathlessness on exertion beginning in childhood. One of these histories was probably false. The other seven men complained of breathlessness on exertion and palpitation or rapid heart action beginning from one to six years previously.

One man (*S. F.*) occasionally had a stinging pain over the heart after exercise and another (*K. X.*) complained of substernal pain after exercise.

Nine men said that they disliked whisky, one saying that it made his heart beat more rapidly and caused a choking sensation.

The physical examination of the circulatory systems was normal in all these cases. Occasionally a functional systolic murmur was heard over one of the valvular orifices. The lungs were negative and there was no evidence of exophthalmic goiter.

METHOD OF EXAMINATION

Each man rested sitting on a chair until the pulse rate became constant. Work was furnished by swinging dumb-bells weighing 10, 20 or 25 pounds. The same rhythm was maintained in swinging the bells and work was augmented by increasing the number of swings. Between the exercises the subjects rested for five or ten minutes.

From three to six groups of exercises were given on each day the patient was examined. The men were seen from three to twelve times, several days or a week intervening between the visits.

The pulse was counted in a number of instances immediately after work for fifteen seconds, and in all cases, after 110 seconds had elapsed, for twenty seconds. Thereby the rates immediately after work and at the end of 120 seconds were computed.

The blood pressures were read by the same observer by auscultation, using a Riva-Rocci type of sphygmomanometer. The frequent method¹ of observation was used in every experiment, and the infrequent method¹ in many instances.

REACTIONS TO EXERCISE, CIRCULATORY AND OTHERWISE

Severe Type.—There was a small group of men who responded to exercise in a way quite different from normal individuals. In the first place they were able to do much less work than normal men. Their upper limit of work varied between 1,600 and 4,500 foot-pounds performed in the manner previously described, whereas the normal upper limit at 20 to 30 years of age we have found to be between 6,000 and 12,000 foot-pounds. Again, when they reached the comparatively low limits of their efforts they became dyspneic, exhausted and in three instances complained of precordial pain. When a normal person reaches his limit of work his dyspnea may be quite as marked, but his fatigue is rarely as pronounced and persistent as in these cases. The precordial pain is also a symptom rarely found in normal persons.

The facial expression of these persons when they had finished the heaviest work was anxious and indicated unmistakably the distress they felt. The precordial pain was referred to the region below the left nipple and was accompanied by tenderness on pressure of the underlying intercostal muscles.

The production by relatively small amounts of work of the syndrome of symptoms just described is, we believe, of more value in determining the severity of the case than are the pulse rate and blood pressure reactions. This has, accordingly, been our chief guide in classifying our cases.

The reactions of the pulse rate are summarized for both severe and mild cases in Table 1 and those of the systolic blood pressure in Table 2. In Table 1 the expression "overtaxed" signifies that the person suffered from marked dyspnea, fatigue or exhaustion and, in severe cases, from precordial pain.

The pulse rates of the severe type of cases were all higher than normal and all showed greater increases immediately after work than

1. Barringer, T. B., Jr.: Am. Jour. Med. Sc., 1918, **155**, 864.

TABLE 1.—REACTIONS OF PULSE RATE TO GRADUATED WORK IN CASES OF TACHYCARDIA

Name and Age	Type of Case	Work in Foot-Pounds	Pulse Rate		Return to Normal in Sec.	Remarks	
			Before Work	After Work			
				Immedi-ately			At 120 Sec.
P. P. 22	Severe	1,600	104	144	116	180	Overtaxed*
		(10 s.20) 2,100	100	144	110	150	
		1,200	116	132	114	120	Overtaxed Overtaxed
		1,800	114	130	124	180	
		(10 s.25) 3,000	112	...	108	120	
		1,200	92	...	108	180	Overtaxed Overtaxed
		1,800	92	...	99	180	
		3,000	92	...	108	180	
(10 s.30) 3,600	92	...	112	180			
S. R. 21	Severe	2,000	130	142	108	180	Overtaxed
		3,000	122	144	128		
		(20 s.20) 4,000	112	156	126		
		2,000	112	...	140	180	Overtaxed
		2,300	118	...	120	180	
		3,000	112	...	132	240	
		2,100	102	...	108	180	Overtaxed
		3,000	104	...	118		
(20 s.20) 4,000	100	...	114				
P. R. 23	Severe	2,000	96	...	92	180	Overtaxed
		(20 s.15) 3,000	96	...	112		
		2,000	80	...	100	180	Overtaxed
		3,000	80	...	102	180	
S. B. 23	Severe	2,300	124	148	128	...	Overtaxed
		3,400	128	180	132		
		2,300	136	148	136	...	Overtaxed
		3,400	136	156	136		
		2,300	88	...	120	240	Overtaxed Overtaxed
		3,400	92	...	116	420	
(20 s.20) 4,000	88	...	104	300			
A. V.	Severe	2,300	92	120	104	180	Overtaxed Overtaxed
		3,400	96	136	100	...	
		(20 s.20) 4,600	96	160	112	240	
		2,300	92	132	92	240	Overtaxed
		3,400	96	160	116		
		4,500	100	...	105		
		6,800	108	...	114		
		7,700	100	...	117	180	Overtaxed
		6,600	100	...	108	...	Overtaxed
		7,900	100	...	108		
		(25 s.35) 9,200	102	...	106		
		6,600	90	...	108		
		7,900	104	...	117	180	Overtaxed Overtaxed
		9,200	102	...	112	180	
K. X. 27	Moderate	3,700	124	...	120	240	Overtaxed Overtaxed
		5,000	124	...	136		
		(25 s.20) 5,500	128	...	120	...	
		4,000	116	...	124	420	Overtaxed Overtaxed
		5,200	128	...	136	200	
		(25 s.25) 7,000	120	...	136	240	

* "Overtaxed" signifies that patient suffered from dyspnea, fatigue or exhaustion and, in some cases, precordial pain. "10 s.20" signifies a 10-pound bell swung twenty times.

TABLE 1.—REACTIONS OF PULSE RATE TO GRADUATED WORK IN CASES OF TACHYCARDIA—(Continued)

Name and Age	Type of Case	Work in Foot-Pounds	Pulse Rate			Return to Normal in Sec.	Remarks
			Before Work	After Work			
				Immediately	At 120 Sec.		
C. G. 22	moderate	3,100	96	...	100	180 ...	Overtaxed
		(20 s.20) 4,000	96	...	102		
		3,100	100	...	100		
		4,000	92	...	118		
		(20 s.25) 5,000	88	...	96		
P. R. 23	Mild	6,000	104	160	114	180	Overtaxed Overtaxed
		7,000	104	...	120	240	
		8,000	104	...	140	240	Overtaxed
		2,100	112	148	120	180	
		5,100	116	160	128	300	
		5,300	112	160	124	360	
		6,000	84	...	105	180	Sl. overtaxed
		9,000	100	...	120	180	
		10,000	104	300	
		6,000	90	...	120	300	Overtaxed
		7,500	104	...	124	240	
		9,000	108	...	160	300	
		W. R. 25	Mild	3,000	112	148	120
5,400	116			...	116		
6,700	112			...	132	240	
7,000	112			...	136	240	
5,400	100			...	129	280	Overtaxed
6,700	100			...	140	240	
7,000	100			...	132	420	
S. F. 22	Mild	5,100	76	...	88	240	Overtaxed
		7,700	90	...	100	180	
		5,100	84	...	105	300	Sl. overtaxed Overtaxed
		6,100	92	...	102	180	
A. S. 22	Mild	6,300	88	...	92	180 300	Overtaxed
		9,400	92	152	120		
		10,600	100	...	132		
		6,300	104	...	129	300	Overtaxed
		9,400	100	...	135	360	
		11,000	112	...	135	240	
F. M. 23	Mild	4,700	92	112	96	180 240	Overtaxed Overtaxed
		5,300	96	112	108		
		9,300	88	136	104		
		5,300	88	120	88	...	Overtaxed Overtaxed
		9,300	92	144	104	180	
L. H. 22	Mild	2,400	96	136	104	180 240	Sl. overtaxed Overtaxed
		3,500	92	140	120		
		4,800	92	160	124		
		3,500	100	120	104	180	Overtaxed
		4,500	108	144	112		
		5,300	108	156	120		

TABLE 2.—REACTIONS OF SYSTOLIC BLOOD PRESSURE TO GRADUATED WORK IN CASES OF TACHYCARDIA

Name and Age	Type of Case	Work in Foot-Pounds	Systolic Blood Pressure				Remarks
			Before Work	After Work			
				First Reading	Maximum Reading	Delayed Rise	
P. P. 22	Severe	1,200	122	136	146	No	Dyspnea; fatigue; pain Dyspnea marked; exhaustion; pain
		1,600	108	128	136	No	
		2,400	116	126	136	No	
		1,600	122	122	142	No	Dyspnea marked; exhaustion; pain
		*(10 s.20) 2,100	114	122	134	No	
		1,200	110	130	134	No	Dyspnea marked; exhaustion; pain
		1,600	112	126	136	No	
		(10 s.25) 3,000	114	130	130	No	
S. R. 21	Severe	2,000	130	126	140	No	Dyspnea and fatigue Dyspnea; fatigue; pain
		3,000	122	118	132	No	
		(20 s.20) 4,000	124	116	130	No	
		1,600	126	114	142	No	Dyspnea; fatigue Dyspnea marked; exhaustion; pain
		2,000	136	126	140	No	
		2,400	126	124	126	No	
		2,100	110	112	126	No	Dyspnea marked; fatigue; pain
		3,000	112	112	124	No	
		(20 s.20) 4,000	110	106	114	No	
P. R. 23	Severe	2,000	144	146	156	No	Dyspnea; fatigue; pain; palpitation
		(20 s.15) 3,000	142	142	152	No	
		2,000	140	144	152	No	Dyspnea marked; fatigue; pain
		3,000	134	138	152	No	
S. B. 23	Severe	2,300	122	132	156	No	Dyspnea; fatigue
		3,400	120	130	148	Yes	
		2,300	130	142	162	No	Dyspnea; fatigue Dyspnea marked; exhaustion
		3,400	130	138	160	Yes	
		(20 s.20) 4,600	122	128	154	Yes	
A. V. 28	Severe	2,300	124	144	144	No	Marked dyspnea and fatigue
		3,400	122	134	134	No	
		(20 s.20) 4,500	116	134	134	No	Marked dyspnea; exhaustion
		2,300	116	142	142	No	Marked dyspnea and fatigue
		3,400	120	136	142	Yes	
		2,300	118	144	144	No	Marked dyspnea and fatigue
		3,400	114	140	152	Yes	
		4,600	112	124	140	No	6 wks. since 1st observation; daily exercise since Dyspnea and fatigue
		6,900	106	112	142	No	
		7,900	102	118	136	No	Dyspnea marked; exhaustion
		6,600	106	118	140	No	2 mos. since 1st observation; daily exercise since Dyspnea marked; fatigue
		7,900	106	124	134	No	
		9,200	102	122	133	No	
K. X. 27	Moderate	3,700	152	156	178	No	Dyspnea marked; fatigue; pain
		5,000	146	154	168	No	
		(25 s.20) 5,500	156	152	156	No	
		4,000	148	166	168	No	Dyspnea marked; exhaustion; pain
		5,200	149	160	168	No	
		(25 s.25) 7,000	142	154	160	No	

* "10 s.20" signifies a 10-pound bell swung 20 times.

TABLE 2.—REACTIONS OF SYSTOLIC BLOOD PRESSURE TO GRADUATED WORK IN CASES OF TACHYCARDIA—(Continued)

Name and Age	Type of Case	Work in Foot-Pounds	Systolic Blood Pressure				Remarks
			Before Work	After Work			
				First Reading	Maximum Reading	Delayed Rise	
C. G. 22	Moder-	3,100 4,000 (20 s.25) 5,000	130 122 122	134 128 138	158 160 162	No No No	Marked dyspnea and ex- haustion
A. S. 22	Mild	6,300	124	150	170	No	Dyspnea and fatigue
		9,400	124	141	158	No	
		10,600	122	130	156	No	
		6,300	132	166	182	No	Dyspnea marked; fatigue
9,400	134	164	170	No			
11,000	134	152	162	No			
S. P. 22	Mild	5,600	126	144	172	No	Dyspnea marked and fa- tigue
		6,700	122	142	162	No	
		5,100	140	158	178	No	Dyspnea marked; exhaus- tion
		7,700	134	154	180	No	
		5,100	134	132	176	No	Dyspnea marked and fa- tigue
		6,100	132	138	174	No	
W. R. 25	Mild	3,000	148	160	182	No	Dyspnea; fatigue; palpi- tation
		5,400	148	164	182	Yes	
		6,700	146	168	182	Yes	
		7,000	146	154	180	No	Dyspnea; exhaustion; pal- pitation
		5,400	146	156	172	No	
		6,700	136	148	178	No	
7,000	134	152	182	No			
P. R. 23	Mild	7,500	148	158	176	Yes	Dyspnea and fatigue
		8,700	142	144	158	Yes	
		10,000	138	144	156	No	
		6,000	148	154	162	No	Dyspnea marked and fa- tigue
		7,500	146	154	162	No	
		9,000	136	146	152	No	
R. D. L. 26	Mild	5,300	114	120	132	No	Dyspnea; fatigue
		6,600	114	116	124	No	
		7,000	108	120	128	No	Dyspnea; fatigue
		9,000	104	100	122	No	
		9,300	110	100	119	No	
F. M. 23	Mild	4,700	128	136	142	No	Dyspnea marked; fatigue; vertigo
		6,900	128	142	158	No	
		9,300	128	138	156	Yes	
		4,700	130	142	166	No	Dyspnea marked; fatigue
		6,900	132	144	166	No	
		9,300	116	132	158	Yes	
L. H. 22	Mild	5,300	142	152	172	No	Dyspnea and exhaustion
		6,600	140	156	176	No	
		7,900	134	150	181	Yes	

do normal men after the same quantities of work.¹ The pulse rate failed to return to normal inside of 120 seconds in sixteen instances when the heart was overtaxed; five times it returned to normal inside of 120 seconds, although the heart was evidently overtaxed; on nine occasions it failed to return to normal inside of 120 seconds, although the heart was *not* overtaxed.

The curve of the systolic blood pressure showed several interesting anomalies when compared with the curves of normal individuals. "A delayed rise" in pressure ("delayed summit," Cotton, Rapport and Lewis²) following heavy work is an almost invariable finding in normal persons. In these persons, both of the severe and mild types, it is seldom found, and when present does not persist as in normal people.

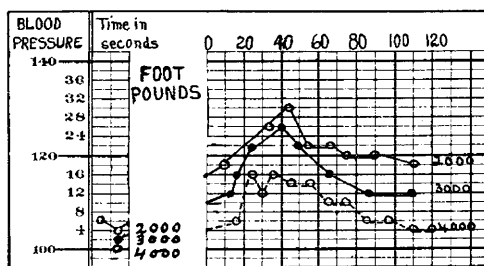


Chart 1.—Blood pressure curves ("diminuendo" type) following increasing amounts of work in S. R., a severe form of case.

The great majority of these patients, both severe and mild, also show blood pressure curves following increasing amounts of work of what may be called a "diminuendo" type. The curves, instead of mounting higher and higher as they do in normal persons after increasing quantities of work, fall lower and lower. The smallest amount of work was followed by the highest curve and the greatest amount by the lowest curve. Charts 1 and 2 exemplify these peculiarities. We have observed this type of curve occasionally in cases of cardiac insufficiency after increasing amounts of work.

The various reactions to work which we have described make it evident that, whatever the underlying cause of the circulatory condition in this small group of men may be, the heart's reserve power in each one was decreased.

One man (A. V.) was given daily graduated exercises with dumbbells and the excellent effect on the cardiac reserve power may be seen in Table 2.

These severe cases resemble closely those described by Lewis and his associates as suffering from "disordered action of the heart."

2. Cotton, Rapport and Lewis: *Heart*, 1917, 6, 269.

Mild Type.—There were nine patients who were placed in this class chiefly because of their ability to perform amounts of work approximately normal without evidencing the symptoms of distress exhibited by the former group. Several of these mild cases (K. X. and C. C.) were on the borderland between severe and mild, one of the patients having precordial pain after fairly heavy amounts of work.

The pulse rates were all above normal. Immediately after work they were occasionally higher than those of normal men after similar quantities of work; nineteen times when the heart was evidently overtaxed the pulse rate failed to return to normal inside of 120 seconds; three times the pulse rate *did* return to normal inside of 120 seconds, although the heart was overtaxed; sixteen times the pulse rate failed to return to normal inside of two minutes, although the work had *not* overtaxed the heart.

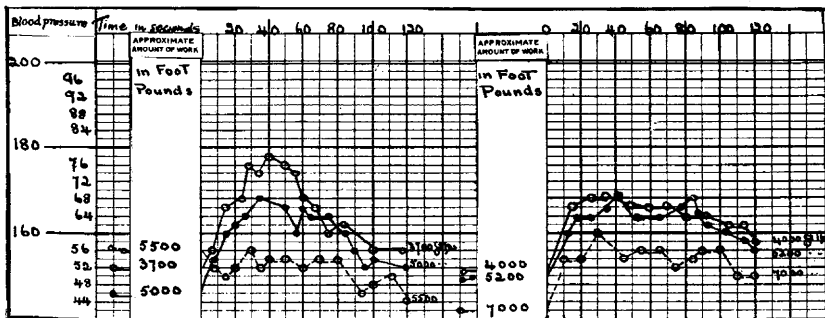


Chart 2.—Blood pressure curves ("diminuendo" type) following increasing amounts of work in K. X., a case of moderate severity.

The curve of the systolic blood pressure showed more frequently a "delayed rise" after heavy work than did the preceding group of severe types, but it was quite inconstant.

The curves of the pressure following increasing amounts of work frequently showed the "diminuendo" type referred to above.

In these mild types of cases the patients were apparently able to do, without undue distress, about as much work as normal men. The only variations from normal which they showed were the tachycardia, the infrequent presence of a delayed rise in the systolic blood pressure curve, and the frequent presence of a "diminuendo" type of curve.

SUMMARY

The reactions to work of fourteen men with tachycardia, between the ages of 21 and 30, were observed on a number of occasions.

Five men were classified as belonging to a severe type, chiefly because of their inability to perform amounts of work which normal

men are capable of and because the performance of comparatively small amounts of work was accompanied by signs of distress—dyspnea, exhaustion or precordial pain.

Reaction of the pulse rates and systolic blood pressure curve to graduated work and their deviations from normal have been described.

21 West Eighty-Fourth Street.