as described in dogs by Allen, Bollman and Mason[7] after unilateral nephrectomy and partial resection of remaining kidney.

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Cardiovascular Studies in Patients with Single Functioning Lungs.*

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On the service of Dr. Harold Neuhof at The Mount Sinai Hospital, New York, we have had the unique opportunity of making cardiovascular studies of patients with one functioning lung. Multiple thoracoplasties were performed by Dr. Neuhof for unilateral chronic empyema, pulmonary tuberculosis or lung abscess. The lung on the non-affected side was normal. Table I.

Dyspnoea on exertion, not at rest, was universally present. There were no orthopnea and cyanosis. The hearts were normal, although perhaps displaced and slightly rotated. This was judged by physical examination, teleoroentgenogram, fluoroscopy and electrocardiogram. In 2 cases there was a tendency to right ventricular preponderance on the electrocardiogram, probably the result of the long standing previous pulmonary disease with slight rotation of the heart. In one case there was a definite left ventricular preponderance.

The pulse rate was always rapid. The blood pressure was normal. The respirations were usually 20 per minute, occasionally 28 per minute, but the slightest exertion increased the respirations. The vital capacity was markedly diminished, ranging between 1200-2700, the normal being 3500-4500. The venous pressure by the direct method[1] was definitely elevated on the involved side in one case. The velocity of the blood, measured from the arm to the tongue[2] or the arm to the lung,[3] was definitely increased, that is, the

7 Allen, R. B., Bollman, J. L., and Mann, F. C., *Arch. Path.*, 1935, **19**, 174.

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1 Taylor, F. A., Thomas, A. B., and Schleiter, H. G., PROC. SOC. EXP. BIOL. AND MED., 1930, **27**, 867.

2 Fishberg, A. M., Hitzig, W. M., and King, F. H., PROC. SOC. EXP. BIOL. AND MED., 1933, **30**, 651.

3 Hitzig, W. M., PROC. SOC. EXP. BIOL. AND MED., 1934, **31**, 935; Miller, H. R., PROC. SOC. EXP. BIOL. AND MED., 1934, **31**, 942.

TABLE I.

Single Functioning Lung.

	W. R. 16 yrs. Multiple Thoracoplasty Chr. Empyema	D. B. 25 yrs. Multiple Thoraco. Tbc.	*B. K. 27 yrs. Multiple Thoraco. Tbc.	W. K. 22 yrs. Lobectomy Chr. lung abs.	J.G. 45 yrs. Multiple Thoracoplasty Chr. empyema cavity	
Affected side	Right	Right	Left	Left	Left	
Kyphoscoliosis	Marked rt.	Marked rt.	None	None	None	
Mediastinum	Fixed	Fixed	Fixed (to left)	Fixed	Shifting	Fixed
Dyspnoea on exertion	Present	Present	Present	None	Marked	None
Orthopnea	None	None	None	,,	Present	,,
Cyanosis	,,	,,	,,	,,	None	,,
Heart	Normal	Normal	Normal	Normal	Normal	
Heart rate	80-90/min.	80-96/min.	100-130/min.	92-100/min.	90-110/min.	90/min.
Respiratory rate	20-26/min.	20/min.	20-28/min.	20-18/min.	20/min.	20/min.
Bl. pressure	120/80	110/78	110/60	140-150 / 90-100	120/80	
Vital capacity	1200	1700	1200	2700-1600-2100	1000	1500
Venous pressure	R.6-10	R.-7½	L.-8	L. 12-27; R. 3½ / 7	L. 9; R. 9	R. 1
Circulation time						
Arm to tongue	12	10¾	7-9	10-11	9¾	
Arm to lung	5	5-7	2½-3½	4	5	
Electrocardiogram	L.V.P.	R.V.P.	T_2 low	Normal	R.V.P.	
Exercise tolerance	Reduced	23/27	T_3 inverted	15/24		10/25
Hemoglobin	65%	90%	80%	72%	55-60%	66%
O_2 content				17.7		17.7
O_2 capacity				19.0		18.8
% saturation				93.3		94.2
Bl. volume per Kg.		86 cc.				73 cc.
Basal metabolism		—14, —11, —2				+7, +2, +5

*Female.

circulation time was decreased. In every case the mediastinum was fixed except that a shifting mediastinum was present for a short time in one patient (J. G.). On inspiration the entire mediastinum moved to the left and on expiration to the right. This produced decided embarrassment to the patient, *i. e.,* marked dyspnoea and orthopnea, even while he was in bed.

The basal metabolic rates were normal in the 2 patients tested.

The oxygen content and capacity of the arterial blood was normal in the 2 patients in whom it was studied.

The exercise tolerance as quantitatively measured by the two-step test[4] was definitely diminished.

It appears that a man with only one functioning lung is comfortable while at rest; the blood velocity is speeded up and the heart rate increased, resulting in a greater flow of blood through the remaining lung and therefore resulting in adequate oxygenation for metabolism at rest, despite the very low vital capacity. However, the additional burden involved in even moderate exertion suffices to produce symptoms of cardiorespiratory insufficiency.

[4] Master, A. M., and Oppenheimer, E. T., *Am. J. Med. Sci.,* 1929, **177**, 223.