THE SEASONAL INCIDENCE OF CARDIAC INFARCTION AT GROOTE SCHUUR HOSPITAL, CAPE TOWN*

V. SCHRIRE, M.Sc., PH.D., M.B., CH.B. (CAPE TOWN), M.R.C.P. (LOND. AND EDIN.)

From the Cardiac Clinic, Groote Schuur Hospital, Cape Town, and Department of Medicine, University of Cape Town

During the past few decades the effect of weather conditions on the incidence of cardiac infarction has been the subject of several studies, particularly in the USA. Opinion in general has been that there is a higher incidence in cold weather. Thus, figures published from New York,[1,2] Boston,[3-5] Philadelphia,[6] Pittsburgh,[7] Cincinatti,[8] Chicago[9] and Rochester[10] support this contention. Even in the temperate areas which correspond to our local conditions in Cape Town such as Los Angeles[11] and Nashville, Tennessee,[12] a higher incidence in the winter months has been recorded. Only in Dallas, Texas,[13] has the reverse been reported and in a later paper this discrepancy has been attributed to sudden inflows of polar and of tropical air masses.[14] In London[15] an increased incidence in cold weather has also been reported, whereas in Israel[16] weather conditions appeared to have no effect on the incidence.

* An article on similar investigations in Johannesburg will be found at page 427 of this issue (see letter from Dr. Nellen, National Chairman, S.A. Cardiac Society, on page 436).

This study was stimulated by a preliminary report from Johannesburg by Bradlow and Zion[17] on an increased incidence of cardiac infarction in that city during the cold months of the year and reported in more detail later.[18] The incidence of this disease in Cape Town over a comparable period was, therefore, investigated.

MATERIAL AND METHODS

The electrocardiographic service of the Cardiac Clinic during the period under survey (1952-56) included all in-patients and out-patients attending Groote Schuur Hospital and the 44 in-patient teaching beds of the New Somerset Hospital. In the former hospital there are 854 beds and approximately equal numbers of European and non-European patients are treated. As there is a means test, the poorer section of the European community only are permitted to attend, but this does not affect the non-European attendance. The incidence and seasonal variation of infarction as shown by our figures therefore apply to those sections of the community that are relatively underprivileged and do not necessarily correspond to the total population of Cape Town. There is no reason, however, to believe that the more privileged members of the community behave differently.

The first group of patients studied was obtained from the files of the anticoagulant service of the hospital. The patients receiving long-term anticoagulant therapy for coronary vascular disease were re-examined in the Cardiac Clinic, including electro-cardiography and roentgenoscopy, and their case histories were reviewed. The practice of long-term anticoagulant therapy only became generally used in the hospital in 1955, so that in the 12 months of 1954 there were only 19 cases, whereas in 1955 and 1956 there were 60 and 46 cases respectively, the total number therefore being 125. It must be accepted that this is a specially selected group, but the selection does not appear to depend upon the weather. Patients suffering from angina pectoris without a clear story of infarction were excluded from this study.

The second group of patients was selected from the electrocardiographic records in the Cardiac Clinic over a 4-year period from January 1952 to December 1955. Any patient suspected of having coronary vascular disease in this hospital automatically had an electro-cardiogram taken and all tracings were examined by the author. The electrocardiographic records were classified in 3 groups as follows:

Type 1. Electrocardiograms showing the classical pattern of infarction.[19] Thus, in anterior infarction wide or deep Q waves in the praecordial leads (V1-V7), or diminution in the R waves across the praecordium, were required in addition to T wave inversion or ST segment change. In posterior infarction a Q wave of at least 0·04 seconds in width or a Q wave deeper than 30% of the R wave in AVF was accepted. In the presence of right bundle-branch block a Q wave of 0·04 seconds in AVF or abnormally wide Q waves in the praecordial leads were held to indicate infarction. Infarction was seldom diagnosed in the presence of left bundle-branch block unless a Q wave or gross ST segment depression over the left ventricle were present. There were 621 patients in this group.

Type 2. Electrocardiograms taken from patients with a clinical history of angina pectoris or cardiac infarction, showing T wave inversion without Q waves over the antero-lateral or posterior aspects of the left ventricle, or bundle-branch block without significant Q waves (20). There were 534 patients with this type of pattern.

Type 3. Electrocardiograms which were normal at rest from patients with an undoubted story of coronary vascular disease often confirmed by positive effort tests. There were 58 such patients.

Thus in the 3 groups there were 1,213 patients. As it was not possible to examine the files of all 1,213, a sample of each was made as follows. All those patients who appeared on the files of the anticoagulant therapy service of the hospital as having received anticoagulant therapy, whether short- or long-term, were reviewed. There were 239 with Type-1, 69 with Type-2 and 9 with Type-3 electrocardiographic patterns. The remainder were selected at random, the determining factor being the ability of the hospital records department to find the appropriate record. Of the 621 patients showing a Type-1 electrocardiographic pattern 543 were analysed and of the 534 showing Type-2 pattern 230 were analysed. All 58 of Type 3 were analysed. The sample, therefore, consisted of 831 of the 1,213 cases.

For the purpose of this study only cases with episodes of prolonged pain suggestive of cardiac infarction were selected for study from these 831 cases. There were 23 cases of angina pectoris who were, therefore, excluded. The month of the year when each patient developed the acute prolonged attack of pain was recorded wherever possible, but in 16 this was not known, leaving 792 cases for analysis. In a few cases, the date of a second infarction only was known. Recurrent infarctions were considered separately. The total number of cases analysed, therefore, was 792 first infarctions and 95 recurrent infarctions.

RESULTS

In Table I is shown the monthly incidence of first infarctions in 792 cases (European and non-European) during the 4 years 1952-55; in Table II the monthly incidence up to December 1957 of all the 887 infarctions in the same 792 cases; and in Table III the monthly incidence of first infarctions in the 125 cases (all races) receiving long-term anticoagulant therapy during the 3 years 1954-56. In Table IV is shown the monthly

TABLE I. MONTHLY INCIDENCE OF FIRST INFARCTIONS IN 792 CASES SEEN IN 4 YEARS 1952-55

ECG Type	*Race*	*Jan.*	*Feb.*	*Mar.*	*April*	*May*	*June*
1	European	26	26	35	25	32	44
	Non-European	12	7	10	15	8	28
2 and 3	European	7	8	14	16	13	13
	Non-European	5	4	10	3	5	5
Total	European	33	34	49	41	45	57
	Non-European	17	11	20	18	13	33
	All Races	50	45	69	59	58	90

ECG Type	*Race*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
1	European	38	40	43	33	42	27
	Non-European	5	7	16	7	7	10
2 and 3	European	17	15	24	12	10	17
	Non-European	10	8	9	12	9	3
Total	European	55	55	67	45	52	44
	Non-European	15	15	25	19	16	13
	All Races	70	70	92	64	68	57

TABLE II. MONTHLY INCIDENCE TO DATE OF 887 INFARCTIONS IN 792 CASES SEEN IN 4 YEARS 1952-55

ECG Type	Race	Jan.	Feb.	Mar.	April	May	June
1	European	31	30	40	33	37	49
	Non-European	12	9	11	15	8	31
2 and 3	European	7	10	14	18	13	18
	Non-European	5	4	10	3	5	5
Total	European	38	40	54	51	50	67
	Non-European	17	13	21	18	13	36
	All Races	55	53	75	69	63	103

ECG Type	Race	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	European	46	47	49	36	48	31
	Non-European	5	7	16	8	8	11
2 and 3	European	17	20	26	14	11	18
	Non-European	10	8	9	12	9	3
Total	European	63	67	75	50	59	49
	Non-European	15	15	25	20	17	14
	All Races	78	82	100	70	76	63

TABLE III. MONTHLY INCIDENCE OF FIRST INFARCTIONS IN 125 CASES ON LONG-TERM ANTICOAGULANT THERAPY IN 3 YEARS 1954-56

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
11	12	8	10	10	13	10	12	16	11	0	12

TABLE IV. THE MONTHLY INCIDENCE OF 339 DEATHS FROM ALL CAUSES IN 877 PATIENTS WITH CORONARY VASCULAR DISEASE

ECG Type	Race	Jan.	Feb.	Mar.	April	May	June
1	European	11	12	16	9	14	17
	Non-European	4	2	5	3	8	7
2	European	2	5	3	3	5	4
	Non-European	3	1	0	2	4	4
3	European	0	0	1	0	0	2
	Non-European	1	0	0	0	1	0
Total	European	13	17	20	12	19	23
	Non-European	8	3	5	5	13	11
	All Races	21	20	25	17	32	34

ECG Type	Race	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	European	18	17	17	21	17	17
	Non-European	5	6	8	4	5	5
2	European	6	3	7	14	0	3
	Non-European	3	1	2	1	1	4
3	European	1	0	0	2	1	0
	Non-European	0	0	0	0	0	1
Total	European	25	20	24	37	18	20
	Non-European	8	7	10	5	6	10
	All Races	33	27	34	42	24	30

incidence of the 339 deaths from all causes in all the 877 cases examined in this survey. For the purpose of this analysis the date of the onset of the disease is not relevant; Table IV therefore includes the 831 cases analysed in 1952-55 and the 46 cases on long-term anticoagulants in 1956 and subsequently.

DISCUSSION

The results in Tables I, II and III show a significant seasonal difference in the incidence of myocardial infarction in Cape Town. Thus, if one divides the year into 'summer' and 'winter', as Bradlow and Zion[18] have done in their Johannesburg analysis, the first attack of myocardial infarction (Table I) occurred in 353 cases in the 'summer' (6 months October to March), and in 439 cases in the 'winter' (6 months April to September). If all the episodes of infarction are included (Table II), the incidence in 'summer' was 392 cases and in 'winter' 495 cases.

The seasons are not quite identical at Cape Town and Johannesburg. At Cape Town the climatic conditions can be more correctly described as 'summer' (4 months December to March), 'winter' (4 months June to September) and 'between seasons' (October, November, April and May)*. If this seasonal division is adopted, the number of first infarctions (Table I) in 'summer' is 221 and of all the episodes of infarction (Table II) 246; in 'winter' the figures are 322 and 363 and in 'between seasons' 249 and 278. The survey is over a period of 4 years and the differences are statistically significant for both racial groups.

The 831 cases analysed represent a statistically significant sample of the 1,213 cases of coronary vascular disease recorded in the Groote Schuur Hospital during the 4 years 1952-56. The findings are essentially the same for both racial groups whether the cases were selected on purely electrocardiographic criteria (Type 1) or on clinical criteria (Types 2 and 3). They can be assumed to represent the seasonal incidence of the disease as it occurred in Groote Schuur Hospital during these 4 years. The 'population at risk', particularly the European, fluctuates considerably, as Cape Town is an important port and a summer resort. Thus, during 1956 it is estimated[21] that there were 220,000 visitors to the city and 120,000 are regarded as having been present during December, January and February. Even taking into consideration the fact that many of the visitors belong to an income group which is officially debarred from attending the hospital, the population which the hospital drains is larger in summer than in winter. Not only is the population movement towards Cape Town in the summer but there is an exodus from Cape Town during the wet winter months. In view of these population fluctuations, there is added significance in the fact that more infarcts are recorded in winter than in summer.

It is therefore of interest to analyse where the visitors were domiciled: 81 cases were found who lived out of Cape Town with an incidence of 28 infarctions in 'summer', 22 in 'winter' and 31 in the 'between seasons'. The race particularly involved was the European.

When the data obtained from the 125 patients (1954-56) receiving long-term anticoagulant therapy (Table III) is studied, the results are essentially the same. Thus, there were 54 cases of infarction in 'summer' and 71 in 'winter', dividing the year according to Bradlow and Zion,[18] or 31 in 'summer', 51 in 'winter' and 43 in 'between seasons', according to the method suggested in this study. For this very selected group of cases the results obtained are similar to those shown in Tables I and II, though the difference is not statistically significant.

The findings are in keeping with figures published by the majority of authors elsewhere.[1-12,15,22-26] In some of the series the data were obtained from necropsy material and therefore reflect deaths from cardiac infarction, in others the material was obtained from clinical experience. Analysis of the

* The average mean temperature in degrees Centigrade during the 5 years 1952-56, as supplied by the Metrological Department of the Royal Observatory, Cape Town, supported this arrangement of the seasons. Thus in 'summer', i.e. 4 months December to March, the temperatures were 19·8, 21·9, 21·5 and 20·5°C; in 'winter', i.e. 4 months June to September, they were 13·5, 12·4, 12·9 and 14·9°C; in 'between seasons', i.e., October, November, April and May, they were 15·5, 19, 17·2 and 15·2°C. The average mean rainfall in inches over the same 5-year period was as follows: 'summer' 0·9, 0·2, 0·9 and 0·6; 'winter' 3, 5, 4·3 and 1·9; 'between seasons' 1·5, 1·2, 2·8 and 4·8.

clinical data in this study strongly supports the view that the incidence of infarction is higher in the winter than in the summer.

Analysis of our series of deaths (Table IV) supports the clinical findings. Of the original 877 patients analysed, 42 cases could at no time be traced. Since 1956 a further 26 Europeans and 43 non-Europeans were lost sight of. Information is available to date on the remaining 766 patients; amongst these there have been 339 deaths. In a few cases death was due to causes unassociated with the heart, but in the great majority cardiac infarction was recorded as the cause of death. The information was generally obtained from the practitioner in charge of the case or the relatives. Both immediate deaths and death many years after the onset of the disease were included. There were 163 deaths in 'summer' and 177 in 'winter', dividing the year according to Bradlow and Zion,[18] or 96 in 'summer', 128 in 'winter' and 115 in 'between seasons', as used in this study. The incidence of death in cases of cardiac infarction is, therefore, also higher in the winter than in the summer months.

Lastly, although the incidence of this disease is far greater in the European than in the non-European[19,20] the same seasonal variation is seen in the two racial groups.

SUMMARY

1. The seasonal incidence of cardiac infarction in 792 patients seen at Groote Schuur Hospital during the 4 years 1952-55 is analysed.

2. There is no difference in seasonal variation between European and non-European patients.

3. The seasonal incidence of cardiac infarction in 125 patients at Groote Schuur Hospital during the 3 years 1954-56 receiving long-term anticoagulant therapy is also analysed.

4. There is a statistically significant increased incidence of the disease in the winter months as compared with the summer. The incidence in 'between seasons' lies between the winter and summer incidence.

5. The seasonal incidence of deaths in 877 patients suffering from coronary vascular disease is also analysed.

6. The seasonal incidence of deaths parallels the clinical incidence of the disease.

I wish to thank Dr. C. Merskey for putting the files of the anticoagulant service at my disposal and for his help with the statistical analysis. My special thanks are due to Dr. J. Prisman for his unceasing help and interest in the development of the Cardiac Clinic. Mrs. C. Hall gave invaluable assistance in the analysis of the data and follow-up of the patients investigated. I also wish to thank the City Council of Cape Town and the Council for Scientific and Industrial Research for their financial assistance in this investigation.

REFERENCES

1. Master, A. M., Dack, S. and Jaffe, H. L. (1937): J. Amer. Med. Assoc., **109**, 546.
2. Master, A. M. and Jaffe, H. L. (1952): *Ibid.*, **148**, 794.
3. Bean, W. B. (1937): Amer. Heart J., **14**, 684.
4. Wolff, L. and White, P. D. (1926): Boston Med. Surg. J., **195**, 13.
5. White, P. D. (1926): J. Amer. Med. Assoc., **87**, 1525.
6. Wood, F. C. and Hedley, O. F. (1935): Med. Clin. N. Amer., **19**, 151.
7. Mullins, W. L. (1936): Pennsylvania Med. J., **39**, 322.
8. Bean, W. B. and Mills, C. A. (1938): Amer. Heart J., **16**, 701.
9. Mintz, S. S. and Katz, L. N. (1947): Arch. Intern. Med., **80**, 205.
10. Miller, R. D., Burchell, H. B. and Edwards, J. E. (1951): *Ibid.*, **88**, 597.
11. Hoxie, H. J. (1940): Amer. Heart J., **19**, 475.
12. Billings, F. T., Kalstone, B. M., Spencer, J. L., Ball, C. O. T. and Meneely, G. R. (1949): Amer. J. Med., **7**, 356.
13. Heyer, H. E., Teng, H. C. and Barris, W. (1953): Amer. Heart J., **45**, 741.
14. Teng, H. C. and Heyer, H. E. (1955): *Ibid.*, **49**, 9.
15. Bedford, D. E. (1939): Lancet, **1**, 634.
16. Lewitus, Z. and Neumann, J. (1957): Amer. Heart J., **53**, 339.
17. Bradlow, B. A. and Zion, M. M. (1957): S. Afr. Medical Congress, Durban.
18. *Idem* (1958): S. Afr. Med. J., **32**, 427.
19. Vogelpoel, L. and Schrire, V. (1955): Lancet, **2**, 1108.
20. Schrire, V. (1958): S. Afr. Med. J., **32**, 177.
21. Visitors' Bureau, Cape Town.
22. Statistical Bulletin Metropolitan Life Insurance Company, vols. 36-38, 1955-57.
23. Cohn, A. E. (1926): Amer. Heart J., **2**, 275.
24. Bundesen, H. N. and Falk, I. S. (1926): J. Amer. Med. Assoc., **87**, 1987.
25. Rosahn, P. D. (1937): *Ibid.*, **109**, 1294.
26. Mills, R. A. (1953): *Ibid.*, **153**, 910.