

# ISCHÆMIC HEART DISEASE IN INDIA

BY

RUSTOM JAL VAKIL

*From King Edward Memorial Hospital, and Bombay Hospital, Bombay, India*

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Although considerable knowledge has been gained in recent years about the prevalence and epidemiological characteristics of ischæmic heart disease in Western countries (White, 1951), similar large-scale surveys have not been attempted in India. This is not surprising as most of the population of India lives in small villages and is therefore less accessible for such investigations. Besides this, there are numerous other difficulties in the collection of statistical data in this country. The different dietary habits of various communities, lack of medical personnel in rural areas, selective admissions of cardiac patients to hospitals, inadequacy of necropsy data (mostly through religious prejudices), lack of uniformity of methods of certification and classification of diseases, socio-economic discrepancies, and variations of climate in the different provinces or states are but a few of the many obstacles that beset the worker interested in the compilation of statistical data in India. Despite these drawbacks, several careful studies on the incidence of heart disease in India have been published in recent years by Sanjivi (1946), Chand (1946), Vakil (1948-1954), Malhotra (1951), Bhatia and Jain (1953), Samani (1956, 1959), Padmavati (1958), and Mathur (1960). The incidence of coronary heart disease in cardiac populations has been variously reported as 13 per cent in Madras (South India) by Sanjivi (1946), 13.5 per cent in Bombay (Western India) by Vakil (1948-52), 23 per cent in Amritsar (North-West India) by Malhotra (1951), 14.4 per cent in Calcutta (East India) by Gupta (Banerjea, 1960), 11.3 per cent in New Delhi (North India) by Padmavati (1958), 6 per cent in Simla (Himalayan ranges) by Chand (1959), and 16.9 per cent in Agra (North India) by Mathur (1960). The great majority of these studies are based on low income groups or hospital populations.

Very few studies have been made on the incidence of coronary heart disease in high and middle income groups, encountered in private or consulting practice. This has been reported by Vakil (1952), among cardiac patients only, as being 26 per cent. Mathur (1960) gives the incidence as 35 per cent.

In a more recent series of 15,063 cardiac patients, observed by Vakil (1962), in hospital and private practice over a 10-year period, the incidence of ischæmic heart disease was found to be 28 per cent (4277 cases), the ratio of men to women being 3.4 to 1.

India, with its population of over 360 millions, covers an area of one and a quarter million square miles, over the Tropic of Cancer. Bombay, the capital city of Maharashtra, the second largest state of India, has a cosmopolitan population of about 3 million persons, 60 per cent of them male. Cardiac patients in the major cities of India, such as Bombay, are drawn mainly from urban and semi-urban populations, although villagers from rural areas do migrate to these cities for medical aid.

The objects of the present investigation have been (1) to determine the incidence of ischæmic heart disease and of myocardial infarction in India, both in hospital and private patients; (2) to assess the influence of various factors, such as age, sex, race, diet, and occupation on the incidence of such disease; and (3) to review present-day knowledge of the subject of ischæmic heart disease in India.

## CLINICAL MATERIAL

From the author's private practice, which is mainly cardiological, a series of 3833 cases of ischæmic heart disease, with adequate case histories and follow-ups, were selected over the 15-year period 1941 to 1955 (inclusive). The majority of these patients belonged to high and moderate income groups and were drawn from professional, semi-professional, managerial, executive, business, and official classes.

During the same 15-year period, 1782 patients with ischæmic heart disease were observed at the King Edward Memorial Hospital, Bombay. The majority of these patients were drawn from low income groups and were mostly employed as mill-hands, domestic servants, labourers, and farmers.

The clinical material presented here is therefore comprised of a total of 5615 cases of ischæmic heart disease, inclusive of both hospital and private patients and drawn from upper, middle, and lower classes of society. It represents a fair cross-section of the population of Bombay city. Of these patients, 4425 were male and 1190 female giving a ratio of 3.7 to 1.

## RESULTS

*Incidence of Ischæmic Heart Disease.* Of 123,828 medical in-patients at the King Edward Memorial Hospital, Bombay, 8685 (7%) were cases of organic heart disease. Of these, 1782 cases or 20.5 per cent belonged to the category of ischæmic heart disease.

The incidence of ischæmic heart disease was considerably higher in private than in hospital patients. Of a series of 15,063 cardiac cases reported previously (Vakil, 1962) over a 10-year period, 4277 (28.4%) belonged to the category of ischæmic heart disease. A higher incidence of coronary disease in private than in hospital practice has been reported previously by the author (Vakil, 1952), the incidence of such disease in the two groups being reported as 12.6 per cent and 13.6 per cent respectively.

The incidence of ischaemic heart disease in the present series of cases worked out at 26.6 per cent for the entire group, there being 5615 cases of ischæmic heart disease belonging to high and low income groups in a total cardiac population of 21,065 patients.

*Age Incidence.* Patients ranged in age from 7 years to 96 years, with an average of 46.6 years (Fig. 1). As many as 54.9 per cent of cases were between the ages of 41 and 60 years, the peak of incidence (31%) being noted in the fifth decade of life, or a decade earlier than reported in most of the Western statistics (White, 1951) and consistent with previous observations (Vakil 1949; Samani, 1956).

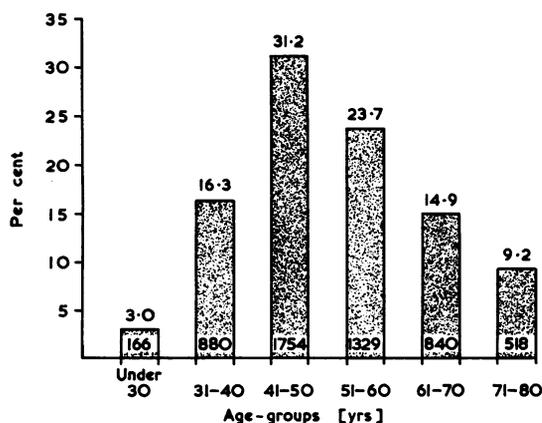


FIG. 1.—Age incidence of 5615 cases of ischæmic heart disease. Figures in white bars indicate number of cases.

As many as 166 patients were under 30 years of age, the incidence of young patients with coronary heart disease being unusually high in our series. Only 11 per cent of cases were over 70 years of age.

*Sex Incidence.* Of the 5615 cases of ischæmic heart disease, 78.8 per cent were male and 21.2 per cent female, the sex ratio being 3.7 to 1 for the entire series (4.3 to 1 for hospital and 3.5 to 1 for private cases).

The ratio of men to women was greatly dependent on the age-group studied, being 3.9 to 1 for patients between the ages of 31 to 60 years, 2.9 to 1 for those over 60 years and as high as 12.8 to 1 for subjects under 30 years. The male preponderance was particularly striking in the younger age-groups, a fact in keeping with previous observations. The incidence among women was

28.5 per cent for subjects over 70 years, 23.5 per cent for the 41 to 60 year age-group, and only 8.4 per cent for subjects under 40 (being as low as 4.8 per cent for hospital patients under the age of 40 years).

The age distribution of ischæmic heart disease according to sex is shown in Table I. While the highest incidence in men (32%) is noted in the fifth decade of life, that of women (34%) is a decade later. While 21.7 per cent of men were under the age of 40 years, only 7.5 per cent of women belonged to this age-group. While 46 per cent of men were over the age of 50 years, 66 per cent of women belonged to this group. Table I demonstrates the higher incidence in men in age-groups below the age of 50, and of women over the age of 50 years.

TABLE I  
PERCENTAGE AGE DISTRIBUTION OF MALE AND FEMALE SUBJECTS WITH CORONARY HEART DISEASE

	Number of subjects	Age-groups (years)							All ages (%)
		0-30 (%)	31-40 (%)	41-50 (%)	51-60 (%)	61-70 (%)	71-80 (%)	>80 (%)	
Male .. ..	4425	3.5	18.2	32.4	20.8	13.8	9.3	1.8	100
Female .. ..	1190	1.1	6.4	26.8	34.2	18.9	9.0	3.8	100
Both sexes ..	5615	3.0	16.3	31.2	23.7	14.9	9.2	2.2	100

Since 53 per cent of men (2357 cases) and 61 per cent of women (726 cases) were aged 41 to 60 years, the brunt of ischæmic heart disease is obviously in the "middle-age group". The "juvenile" cases (under the age of 20 years) were mainly among male patients, there being 34 compared with 2 female patients in the present study.

*Racial Incidence* (Table II). A relatively higher incidence of ischæmic heart disease was found in the so-called "minority communities" of India, e.g. Muslims, Christians, Parsees, and Jews, than among Hindus. A similar observation had been reported previously by Vakil (1948-54).

TABLE II  
PERCENTAGE RACIAL (OR COMMUNAL) INCIDENCE IN 5615 CASES OF CORONARY HEART DISEASE

Clinical material studied	Number of subjects	Races or communities					All races
		Hindus (%)	Muslims (%)	Parsees (%)	Others (e.g. Christians and Jews) (%)		
Coronary heart disease .. ..	5,615	43.8	16.4	28.6	11.2	100	
Organic heart disease .. .. (hospital and private cases)	14,590	54.3	14.7	7.8	20.3	100	
All medical cases .. ..	30,104	70.2	14.9	?	12.2	100	

Hindus, Muslims, Parsees, and "others" (including Christians and Jews) accounted for 44 per cent, 16 per cent, 29 per cent, and 11 per cent of the 5615 cases of ischæmic heart disease (inclusive of 2519 cases of acute myocardial infarction). The ischæmic heart disease was higher among the Parsees, Jews, and Christians than among the Hindus or Muslims.

It is noted that the different "communities" of India, e.g. Hindus, Muslims, and Parsees, do not conform strictly to the category of races, as reported in many of the Western surveys. Communal differences in India are based mainly on religious beliefs and involve different dietary habits and social customs. While the majority of Hindus are vegetarians, the great majority of non-Hindus are non-vegetarians. Our figures serve to support the contention that ischæmic heart disease displays a higher incidence in non-vegetarians than in vegetarians.

*Incidence of Hypertension.* The incidence of high blood pressure in ischæmic heart disease has been the subject of considerable controversy, the reported incidence ranging from 5.3 per cent to 83.3 per cent (Vakil, 1949b). The author's experience in an earlier series of cases was 53.1 per cent (50.9 for men and 72.7 for women) in hospital patients, and 61 per cent (60.5 per cent for men and 68 per cent for women) in private cases (Vakil, 1948, 1952).

In the present series of 5615 cases of ischæmic heart disease the incidence of hypertension worked out at 61 per cent (3443 cases), being 60 per cent for men and 66 per cent for women. A relatively higher incidence of hypertension in women, and particularly in elderly women, is a noteworthy feature of coronary disease. In the present study the incidence of hypertension was to some extent dependent on the age-group studied, as well as on sex. The incidence of high blood pressure was 50 per cent for subjects under the age of 40 years (50 per cent for men and 46 per cent for women), 61 per cent for subjects aged 41 to 60 years (61 per cent for men and 61 per cent for women), and 71 per cent for subjects over the age of 60 years (66 per cent for men and 83 per cent for women). The rising incidence of hypertension with age, particularly in women, was a noteworthy feature of this series.

#### CLINICAL FORMS OF ISCHÆMIC HEART DISEASE

Depending on the clinical picture presented at the time of initial examination or admission, four groups of cases were recognizable (Table III).

TABLE III

Groups	Number of patients	Percentage
Acute myocardial infarction (coronary occlusion) .. .. .	2519	44.8
Angina pectoris .. .. .	2728	48.6
Intermediate coronary syndrome (acute coronary insufficiency) .. .. .	264	4.7
Other forms of coronary disease .. .. .	104	1.9
Total .. .. .	5615	100.0

*Relative Incidence of Clinical Forms.* The relative incidence of the various forms of ischæmic heart disease was to some extent dependent on the age-group studied, the incidence of acute myocardial infarction being relatively higher in younger age-groups and the incidence of angina pectoris higher in the older age-groups (Table IV).

TABLE IV  
RELATIVE INCIDENCE OF CLINICAL FORMS OF CORONARY DISEASE  
IN VARIOUS AGE-GROUPS

Age-group (years)	Acute myocardial infarction (%)	Angina pectoris (%)	Miscellaneous forms (%)
<40	48.2	44.6	7.2
41-60	47.2	47.2	5.6
>60	37.7	55.0	7.3
All ages	44.8	48.6	6.6

While 55 per cent of coronary patients over the age of 60 years belonged to the category of angina pectoris, only 38 per cent of the same age-group were examples of acute myocardial infarction. On the other hand, in subjects under 40 years of age, coronary occlusion accounted for about one-half (48%) of all cases.

*Age Incidence.* The incidence of cases of acute myocardial infarction (2519 cases), angina pectoris (2728 cases), and intermediate coronary syndrome (264 cases), according to age-groups, is shown in Table V. The highest incidence of cases was noted in the fifth decade of life, in each of the three groups studied. As many as 60 per cent of cases of acute myocardial infarction and 53 per cent of cases of angina pectoris were between the ages of 41 and 60 years.

TABLE V  
PERCENTAGE AGE INCIDENCE IN MAJOR CLINICAL FORMS OF CORONARY HEART DISEASE

Clinical forms studied	Number of cases	Age-groups (years)						
		0-30 (%)	31-40 (%)	41-50 (%)	51-60 (%)	61-70 (%)	71-80 (%)	>80 (%)
Acute myocardial infarction .. .. .	2519	2.7	17.3	35.0	22.7	12.2	8.9	1.2
Angina pectoris .. .. .	2728	3.1	14.0	28.8	24.1	16.7	9.9	2.9
Intermediate coronary syndrome .. .. .	264	3.8	10.9	26.5	25.0	22.3	4.5	3.0

#### ACUTE MYOCARDIAL INFARCTION

*Age Incidence.* Of the 2519 cases of acute myocardial infarction, 20 per cent were below the age of 40 years. The frequency of youthful cases of coronary thrombosis has been commented upon by numerous observers (Yater *et al.*, 1948; Glendy, Levine, and White, 1937; Gertler and White, 1954; Vakil, 1949b). As many as 69 of our patients were under 30 years of age; only 10 per cent were over the age of 70 years, despite the fact that coronary thrombosis is usually regarded as a disease of the elderly.

*Sex Incidence.* Of the 2519 cases of acute myocardial infarction, 79 per cent were men and 21 per cent women giving a ratio of 3.6 to 1. The sex ratio was, to a great extent, dependent on the factor of age, the relative preponderance of men being far more striking in the younger age-groups (Fig. 2). While in subjects over the age of 60 years (560 cases), the sex ratio was 2 to 1 (with 67% men and 33% women), and in those aged 41 to 60 years (1455 cases) it was 4.1 to 1 (with 81% men and 19% women), the sex ratio was as high as 7.5 to 1 (with 88% men and 12% women) among patients under the age of 40 years (504 cases).

*Occupational Classification.* The relation between occupation and the development of ischæmic heart disease has been investigated by many workers in the last few years with conflicting results. While Boas and Donner (1932) report an unusually high incidence in the working classes, others find the incidence of coronary disease higher in the economically well-placed professional and executive classes. Most of the reported statistics on the subject are unfortunately inconsistent, as regards the criteria adopted for selection, the factors of sex, race, and nature of occupation being frequently neglected. Although Master, Dack, and Jaffe (1939) and Master and Jaffe (1952) regard the occupational factor as unimportant, Gordon, Bland, and White (1939) on the basis of 3400 autopsy records, and Vakil (1948-1952) on

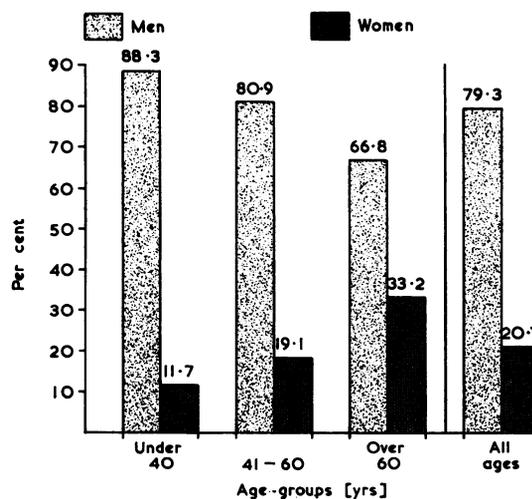


FIG. 2.—Sex incidence of 2519 patients with acute myocardial infarctions, according to age-groups. Figures expressed in percentages.

the basis of clinical material of 2460 cases, find the incidence of coronary occlusion twice as high in private as in hospital patients. General consensus of opinion favours a higher incidence of ischæmic heart disease in general, and of acute myocardial infarction in particular, in physicians, surgeons, directors, executives, lawyers, and skilled workers, people whose occupations involve tense competition, vigorous mental activity, and suppressed hostility.

Table V presents the occupational classification of 4000 men with ischæmic heart disease, derived from the present series of cases. It serves to confirm the high incidence in professional men, executive personnel, and business men, these three occupational groups being jointly responsible for as many as 61 per cent of all men with coronary disease.

TABLE VI  
OCCUPATIONAL CLASSIFICATION OF 4000 MEN WITH CORONARY HEART DISEASE

Occupation (broad classes)	Number of subjects	Percentage incidence
I Executive (managerial, supervisory, or administrative) personnel .. .. .	788	19.7
II Professional (e.g. physicians, surgeons, and lawyers) .. .. .	996	24.9
III Business men .. .. .	639	16.0
IV Members of the Armed Forces .. .. .	389	9.7
V Skilled and semi-skilled workers (e.g. mechanics, technicians) .. .. .	229	5.7
VI Unskilled workers (e.g. mill-hands, labourers, servants, railway porters, farmers) .. .. .	385	9.6
VII Office personnel with sedentary jobs (clerks, secretaries, typists, etc.) .. .. .	394	9.9
VIII Retired or unemployed .. .. .	180	4.5
Total .. .. .	4000	100

*Relation between Physical Effort and Myocardial Infarction.* In view of the high incidence of ischæmic heart disease in the prime of life, the relation between acute attacks of coronary occlusion and physical effort or trauma is very much in the public eye. Although the majority of acute attacks arise spontaneously, a certain proportion of attacks do seem to bear a cause and effect relation to physical strain or trauma. According to Master and Jaffe (1952), while anginal attacks are almost invariably (and those of acute coronary insufficiency quite frequently) related to physical effort, attacks of acute myocardial infarction usually arise spontaneously, a relation between physical exertion and the attack proper being traceable in only 2 per cent.

The relation between acute myocardial infarction and physical activity (at the onset of or before the attack) has been investigated in a large number of our cases, the results of the investigation being shown in Table VII. For this purpose, four grades of physical activity or effort were recognized. (I) *Severe* or *unusual* exertion, such as lifting heavy objects, running, or strenuous games, e.g. squash or tennis; (II) *moderate* exertion, such as climbing a staircase, walking up-hill, fast walking, coitus, or straining at stool; (III) *mild* exertion, such as travelling by car or bus, sitting in a theatre or lecture, taking a bath, slow walking, or talking; (IV) during *rest* or *sleep* (Table VII).

TABLE VII  
TYPES OF PHYSICAL ACTIVITY BEFORE OR AT ONSET OF 1100 ATTACKS OF ACUTE MYOCARDIAL INFARCTION

Nature of activity	Number of attacks	Percentage
I Severe or unusual exertion .. .. .	184	16.7
II Moderate exertion .. .. .	226	20.5
III Mild exertion or routine activity .. .. .	388	35.3
IV Sleep or rest .. .. .	302	27.5
Total .. .. .	1100	100

*Seasonal Incidence of Attacks.* The seasonal factor in acute myocardial infarction has been investigated by several workers. While some report a higher incidence of attacks in cold weather, and others during the warmer months of the year (Vakil, 1949b), Master and Jaffe (1952) could discover no seasonal variation. This factor was investigated in 1100 of our cases of acute myocardial infarction in Bombay. The incidence was somewhat higher in the warmer months of the year than during the cold or rainy seasons—38 per cent in the warm season compared to 32 per cent in the cold, and 30 per cent in the rainy season. The increased incidence of coronary attacks during the warm months of the year in Bombay may be due to a combination of increased humidity, strong sea-breezes, and hot weather, resulting in excessive sweating, heat exhaustion, and increased susceptibility to respiratory infections.

*Localization of Myocardial Infarcts.* The results of an electrocardiographic investigation of 1360 cases of acute myocardial infarction are shown in Table VIII. Anterior wall involvement was more frequently encountered than infarction of the posterior wall, the percentage incidence of the two forms being 48 per cent and 29 per cent respectively. Of the various cardiographic localizations, the most frequently encountered were antero-septal infarcts (350 cases), posterior wall infarcts (283 cases), and antero-lateral infarcts (124 cases).

TABLE VIII  
ELECTROCARDIOGRAPHIC LOCALIZATION OF MYOCARDIAL INFARCTS IN 1360 CASES OF CORONARY OCCLUSION

	Number of cases	Percentage
Anterior wall . . . . .	652	47.6
Extensive anterior . . . . .	108	—
Antero-septal . . . . .	350	—
Antero-lateral . . . . .	124	—
Localized anterior or antero-apical . . . . .	38	—
High antero-lateral . . . . .	32	—
Posterior wall . . . . .	391	28.8
Localized posterior . . . . .	283	—
Postero-lateral . . . . .	58	—
Postero-septal . . . . .	32	—
High postero-lateral . . . . .	18	—
Multiple or "anterior and posterior" . . . . .	119	8.8
Subendocardial . . . . .	102	7.5
Indeterminate or ill-defined . . . . .	96	7.0

#### SUMMARY AND CONCLUSIONS

A statistical study is presented of 5615 cases of ischæmic heart disease, observed over a 15-year period in private and hospital practice, in Bombay, India. Of these, 3833 cases were seen in private practice and 1782 in hospital practice.

The incidence of ischæmic heart disease in a total cardiac population of 21,065 cases was 26.6 per cent. The clinical material of 5615 cases included 78.8 per cent men and 21.2 per cent women, with a sex ratio of 3.7 to 1. The ratio of men to women was 2.9 to 1 for elderly subjects over 60 years, and as high as 12.8 to 1 for subjects under the age of 30 years.

Although ranging in age from 7 to 96 years, as many as 54.6 per cent of the patients were between 41 and 60 years, the peak incidence being observed in the fifth decade of life, a decade earlier than in Western surveys. As many as 166 patients were under the age of 30 years. The incidence of ischæmic heart disease was relatively higher among Parsees, Jews, and Christians than among Hindus and Muslims. The figures in this study supported the contention that ischæmic heart disease occurred more commonly among non-vegetarians than among vegetarians.

The incidence of antecedent hypertension worked out at 60 per cent for men and 66 per cent for women of all ages. For subjects over 60 years of age, however, the incidence was 66 per cent for men and 81 per cent for women.

Of the 2519 cases of acute myocardial infarction studied, as many as 20 per cent were below the age of 40 years and only 10 per cent over the age of 70 years. The high incidence of youthful subjects in our series appeared noteworthy. The relative preponderance of men is reflected by the sex ratio of 3.6 to 1 for cases of myocardial infarction. A relatively higher incidence of acute myocardial infarction was seen among the professional, executive, and business classes, these three occupational groups being jointly responsible for 61 per cent of all male subjects. An incidence of 63 per cent of heart attacks was found during mild or routine physical activity or at rest.

The electrocardiographic localization of infarcts in 1360 acute cases was as follows: anterior infarcts: 48 per cent; posterior infarcts: 29 per cent; multiple or anterior and posterior infarcts: 9 per cent; subendocardial infarcts: 7 per cent; and indeterminate types: 7 per cent.

In view of the world-wide interest shown recently in the prevalence and epidemiology of ischæmic heart disease, the results of the present investigation undertaken in India are offered as a contribution to the growing body of knowledge on this most important subject.

#### REFERENCES

- Banerjea, J. C. (1960). *Indian Heart J.*, **12**, 171.  
 Bhatia, B. B., and Jain, S. C. (1953). *Indian Heart J.*, **5**, 117.  
 Boas, E. P., and Donner, S. (1932). *J. Amer. med. Ass.*, **98**, 2186.  
 Chand, D. (1946). Proceedings of the Association of Physicians, India.  
 — (1959). *Indian Heart J.*, **11**, 117.  
 Gertler, M. M., and White, P. D. (1954). *Coronary Heart Disease in Young Adults*, Harvard University Press, Cambridge, Massachusetts.  
 Glendy, R. E., Levine, S. A., and White, P. D. (1937). *J. Amer. med. Ass.*, **109**, 1775.  
 Gordon, W. H., Bland, E. F., and White, P. D. (1939). *Amer. Heart J.*, **17**, 10.  
 Malhotra, R. P. (1951). *Indian J. med. Sci.*, **5**, 617.  
 Master, A. M., Dack, S., and Jaffe, H. L. (1939). *Industr. Med.* **8**, 327.  
 —, and Jaffe, H. L. (1952). *J. Amer. med. Ass.*, **148**, 794.  
 Mathur, K. S. (1960). *Amer. J. Cardiol.*, **5**, 60.  
 Padmavati, S. (1958). *Indian Heart J.*, **10**, 33.  
 Samani, O. T. (1956). *Indian Heart J.*, **8**, 104.  
 — (1959). *Indian Year Book of Medical Science, 1959-60*, p. 110. Current Medical Publications, Bombay.  
 Sanjivi, K. S. (1946). Proceedings of the Annual Conference of Association of Physicians of India.  
 Vakili, R. J. (1948). *Indian J. med. Sci.*, **2**, 465.  
 — (1949a). *Indian Heart J.*, **1**, 15.  
 — (1949b). *Indian Heart J.*, **1**, 201.  
 — (1950). *Indian Heart J.*, **2**, 31.  
 — (1952). *Indian Phycn.* **2**, 231.  
 — (1954a). *Indian Practit.*, **7**, 123.  
 — (1954b). *Amer. Heart J.*, **48**, 439.  
 — (1962). *Amer. J. Cardiol.*, **10**, 380.  
 White, P. D. (1951). *Heart Disease*, 4th ed. Macmillan, New York.  
 Yater, W. M., Trauma, A. H., Brown, W. G., Fitzgerald, R. P., Geisler, M. A., and Wilcox, B. B. (1948). *Amer. Heart J.*, **36**, 334.