

districts of Nadia and Jessore. These labourers returning in February certainly take cholera with them.

Calcutta has had yearly and monthly a high cholera death-rate for many years. Rangoon, though outbreaks frequently occur, has not suffered to anything like the same extent. Similarly, Singapore, Bangkok and other eastern ports have never suffered such continuous endemicity, though the factors of mean winter temperature, humidity and soil moisture are every bit as suitable as in Calcutta.

Similarly, the disease, though frequently introduced into the West Indies and Central America, has never established an endemic home as it has in Eastern Bengal.

Therefore there must be some epidemiological factor peculiar to Bengal and Calcutta which fixes the disease here. Racial susceptibility, density of population, economic conditions have all been discussed above. The Indian,—from Hirsch's records,—seems to be much less susceptible than the Negro races. Jack's book shows that the economic condition is good. Density of population is undoubtedly a factor, but I believe the main one to be the habits and religious customs of the people.

In Bengal every man and woman takes a daily bath in the open,—winter and summer,—standing in the water well above the knees and at intervals completely immersing the whole body. A single cloth of some size is worn by both sexes, and it is the common practice to wash this garment at the same time in the same water. In nine cases out of ten the water for drinking and cooking is derived from the tank in which all wash. If a crowded community contains one cholera carrier, there is a daily re-infection of the water. Should a case die of the disease the body itself is in all probability prepared for funeral rites and washed on the banks of the pond or river; the clothes of the deceased person also.

In addition to the daily bath, the Hindu section of the community during their ceremonial ablutions drink of the water. In Calcutta the water of the Hooghly and Tolly's Nullah being part of the sacred Ganges is drunk by many, though there is piped water of good quality available.

That carelessness in regard to drinking water is the cause of endemic cholera is supported by the following facts:—

(1) The home of endemic cholera is in those districts where water supplies are from rivers and tanks, and where wells are not used, such as Lower Assam and South Eastern Bengal. As recorded in the *Gazetteer* of the district of Chittagong, in the two years where rivers and tanks were filled with salt water during a tornado, there immediately followed an epidemic of cholera and the cause given is the shortage of drinking water.

(2) The reports of the Health Officer of Calcutta show that those wards which border on

the River Hooghly or Tolly's Nullah have year by year the highest cholera mortality. In his annual reports the Health Officer includes a "black list" of those wards with the highest cholera mortality, and Wards V, XXV, and XXIII, which are riparian, invariably figure in this list. He says in his report for 1922 that "the heavy incidence of the disease on Hindus whose religion enjoins bathing in the river and Tolly's Nullah corroborates his view that a large proportion of the cholera of Calcutta is water-borne. Besides the tanks and river the unfiltered water-supply intended only for flushing drains is freely used by the ignorant and careless for domestic purposes."

Summary and Conclusions.

1. India may still be regarded as the home of cholera and deltaic Bengal may still be considered the endemic home where endemic cholera is just as regular and severe as ever.

2. That there is a fair body of evidence to show that cholera in the rest of India is dependent on cholera in Bengal, but owing to increased facilities for and rapidity of travel, it is not so easy to trace the spread.

3. Why deltaic Bengal is the endemic home of cholera is not proved. It is obvious that density of population, conditions of humidity of air and soil, and of winter and summer temperature are suited to the requirements of the infecting agent, and that the notorious carelessness of the people regarding their drinking water favour its spread; but we want to know to what extent the "chronic carrier" exists.

4. That the deltaic region of Bengal is the place where cholera should be attacked. Of all preventable diseases cholera is the easiest to tackle, and could we get to grips with it in this region, we might ultimately wipe it off the earth.

5. I suggest intensive vaccination in a selected district and a very rigorous propaganda campaign. If this is successful, to extend it throughout the province.

6. It is our very obvious duty to take the most stringent measures at our ports and frontiers to prevent the spread of the disease.

PRELIMINARY OBSERVATIONS ON ACQUIRED DISEASES OF THE HEART AND AORTA AS MET WITH IN BENGAL.*

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THE observations I have recorded in this paper are based upon a series of 446 cases examined by me during the course of hospital and private practice in this city, extending over a period of ten years. From the table containing the statistics of the different varieties of cases it will be

*Being a paper read at a meeting of the Medical Section of the Asiatic Society of Bengal on the 11th of March, 1925.

TABLE.

Disorders of the Heart seen in Bengal from July 1915 to March 1925. 446 Cases.

Different Varieties.		Numbers.			
Pericarditis ..	{ Due to rheumatic fever .. .. .	..	4	
	{ As terminal event in nephritis .. .. .	..	2	
	{ Due to puerperal infection .. .. .	..	1	
		Total ..	7		
Disorders of the myocardium.	{ Arrhythmias ..	{ Extrasystoles	37		
		{ Paroxysmal tachycardia	6		
		{ Auricular flutter	4		
		{ " fibrillation	14		
		{ " Complete	5		
		{ Heart-block ..	{ Incomplete ..	{ Pneumonia	23
				{ Typhoid	8
				{ Dysentery	6
				{ Influenza	4
				{ Malaria	2
		Total ..	109		
Angina ..	{ Due to coronary sclerosis .. .. .	..	5	
		{ Exhaustion of heart muscles	35		
		Total ..	40		
Dilatation ..	{ Due to secondary anæmia of bleeding fibroid .. .. .	..	20	
		{ Bleeding piles	12		
		{ Kidney disease	9		
		{ Pure anxiety and worry	6		
		Total ..	47		
Degeneration of the myocardium as the result of heat, poor diet and infections like cholera, dysentery, malaria and kala-azar .. .. .		..	127
Endocarditis ..	{ Acute ..	{ Due to rheumatic fever	16		
		{ Influenza	5		
		{ Small-pox	3		
		{ Measles	2		
		{ Diphtheria	1		
		{ Typhoid fever	1		
				Total ..	28
Chronic ..	{ Rheumatic origin .. .. .	..	17	
		{ Syphilitic origin	4		
		{ Degenerative type	8		
		{ Idiopathic variety	6		
		Total ..	35		
Bradycardia due to high arterial tension ..	{ Malignant .. .. .	..	6	
		{ Heart of Graves' disease	4		
Toxic heart ..	{ Tobacco heart .. .. .	..	4	
		{ Alcoholic heart	36		
		{	3		
		Total ..	43		

(of whom 2 suffered from Stokes-Adams' syndrome).

evident that structural lesions of the heart and aorta due to acquired diseases as met with in Bengal differ as widely from those that are seen in the different clinics of Europe as the hieroglyphics of Egypt differ from the picture writings of Mexico.

Chronic endocarditis, whether in the young or in the old, which is so frequently seen in Europe is certainly less common in Bengal. Consequently the familiar red faces of mitral disease and the staring looks and pale appearance of aortic regurgitation so common in the clinics of Europe are conspicuously rare in Bengal; the former is rare because rheumatic fever which is, *par excellence*, a disease of the cold climate is a rare affection of the people of this province; the latter is less common because granular kidneys, alcoholism and athletic strain are much less

often observed here than in Europe. The degenerative type of chronic endocarditis is also seldom met with as the majority of the people of Bengal hardly attain that age in which it is commonly prevalent. In cases of rheumatic endocarditis seen in Europe the prognosis is very often grave because the infective process—like pneumococcal infections—has the morbid tendency to recur, and we are fortunate in this country in this respect as recurrences are comparatively infrequent; yet in spite of this, chronic endocarditis—whatever may be its ætiology—very often runs a rapid course and compensation soon fails, which is just the converse of what is generally seen in Europe. Another type of acquired chronic endocarditis which I observed in my series was the idiopathic variety which affected chiefly the young males and sometimes

the females, and which damaged either of the two orifices almost equally and in whom rheumatism and syphilis could be definitely excluded.

In the aetiology of acute endocarditis in Bengal in my series of cases, influenza, small-pox, measles, diphtheria, typhoid fever and sometimes streptococcal infections—specially when of puerperal origin—ranked next to rheumatic fever in their respective frequency in the order in which they have been mentioned. In the case of enteric where acute endocarditis was present it could be attributed to the secondary streptococcal invasion.

For obvious reasons rheumatic pericarditis was rare, and when present very often co-existed with myo- and endocarditis. In a few cases of nephritis it was seen as a terminal event.

In the heart-kidney complex met with in Bengal the heart is responsible for the kidney disease in many cases, which is just the opposite of what is commonly seen in Europe.

If we define angina as coronary sclerosis then, of course, such anginas are seldom met with in this soil as it very often consorts with arteriosclerosis which is comparatively rare. If on the contrary, as I pointed out a few years ago, we look upon the symptom-complex as an expression of exhaustion of the heart muscle then such anginas—for reasons given below—are by no means uncommon.

The extra-systoles observed in my series of cases were to a great extent of reflex vagal origin. The eccentric heart manifesting such arrhythmias as paroxysmal tachycardia, auricular flutter and auricular fibrillation was rare compared with those seen in Europe. A notable feature in some cases of auricular fibrillation that came under my observation was absolute regularity of the pulse in striking contrast with the occasionally irregular pulse very often seen in such arrhythmias. And from what I have seen of these irregularities I can definitely say, from the polygraphic tracings I took of some of them, that such irregularities could often be linked in one chain. The different types were but manifestations of different grades of one and the same disorder which was very often an eccentric focus of irritation within the heart muscle. When that focus was mild it produced extra-systoles; when moderate, paroxysmal tachycardia; when severe, auricular flutter; and when serious, fibrillation.

Real cases of complete heart-block and Stokes-Adams' disease were very rare, and for the former malady—when present—syphilis was mainly responsible. Partial heart-block as the result of such infections as pneumonia, typhoid fever, bacillary dysentery and very rarely malaria was certainly not uncommon. Bradycardia purely due to high arterial tension—so common a feature in the European clinics—was seldom seen.

The poisoned heart of Graves' disease was very occasional. Seeing that the principal types of diseases of the heart prevalent in Europe were uncommon in my series of cases, it might

very well be asked "Is heart disease then uncommon in Bengal?" No! The majority of the people of Bengal suffer from one of the most serious types of heart lesion, namely, myocardial disease of the heart. We all know by this time that the endocardium constitutes anatomically a very small portion of the heart, and that the prognosis of endocarditis depends largely on the condition of the myocardium. It is this vital structure that is the seat of disease in the overwhelming majority of the cases seen in Bengal. It is not, strictly speaking, a myocarditis but a degeneration of the myocardium absolutely independent of coronary sclerosis, and this degeneration is responsible for the early death of its people. It symptomatically manifests itself in the lack of physical endurance so well known amongst the Bengalis that it hardly merits a detailed description. Clinically it attracts the notice of the physician by a rapid rate of the heart, the pulse very often ranging between 80 to 90 per minute at rest. Some degree of hyperæsthesia over the precordium was present in many cases. The apex beat was very often difficult to localise, X-ray examinations seldom revealed dilatation, On auscultation the first sound was very often muffled and tonicity murmurs, as was pointed out by me some time ago, indicating a toneless flabby myocardium could often be heard, as also the basal systolic murmurs. In a limited number of cases the pulmonary second sound was also accentuated. Such patients very often exhibited effort syndrome.

It is thus evident that there is a fundamental difference between the types of heart disease prevalent among the inhabitants of the countries in question. And what constitutes this difference?

The cardinal factor responsible for this difference is the climate. This was very ably pointed out as long ago as the year 1910 by Lieutenant-Colonel J. W. D. Megaw, I.M.S., in an excellent paper on this subject contributed by him to the *Indian Medical Gazette* for March. He said "debilitating climatic conditions are distinctly calculated to bring about early enfeeblement of the heart"; the reference was to Anglo-Indians and domiciled Europeans. There could be no gainsaying that high air temperatures produced vasodilatation which threw greater work upon the heart and thus drew largely upon the cardiac reserve. It made the people lazy and lethargic, the majority of whom consequently did not take proper exercise and thus rendered the ill-nourished heart—like the arm in a sling—to waste from want of proper blood supply. The factor next of importance in the production of a degenerated myocardium is the poverty of the masses from dearth of industrial developments in this country. As a matter of fact, the chief disease of Bengal is inanition. Poverty demoralises the myocardium chiefly in two ways, the first of which is the inferior quality of the food that is consumed.

While I do not concur with Lieutenant-Colonel D. McCay that the nitrogen-poor diet markedly affects the physical growth of the people of Bengal for the simple biological reason that the elephant, whose diet is certainly poorer in nitrogen than the tiger's, is unquestionably much more developed than the tiger, I fully agree with this eminent observer that large quantities of unassimilable proteid in a Bengali diet leave enormous nitrogenous residue in the intestines which furnishes a fruitful source of intestinal putrefaction and toxæmia; nor is the quantity of food which is necessarily enormous less important in this direction. Such monstrous alimentation leads to visceroptosis and intestinal stasis. The natural consequences of such a diet are intestinal catarrh and diarrhœa, dysentery, and septic ulceration of the gums—all of which are well-known common disorders of Bengal. The combined effect of climate and poverty leads ultimately to a change in the physiology of the Bengalis materially from that of the Europeans, and such changes in the blood as diminution of the percentage of hæmoglobin are well known. Since in the effective maintenance of pressure in the tubes the condition of the pump is important, we find a low blood pressure amongst the Bengalis which is the direct result of a myocardium which is ill-nourished as a result of anæmia consequent upon the gastro-intestinal infections noted above.

The climate also markedly changes the pathogenesis of diseases present in the two countries. Indeed, Bengal is the best natural incubator I have ever known for the growth and development of bacteria on account of its heat and moisture. All the four scourges of Bengal, namely, cholera, dysentery, malaria and kala-azar damage the myocardium, whose vitality—for reasons given above—has already been sapped. A vicious circle is thus established—anæmia, infection anæmia—and the heart thus becomes progressively weak. Infection damages the heart in two ways; in the first place due to temperature which quite apart from the insufficient food and imperfect metabolism it enforces upon man, directly damages the delicate parenchyma and indirectly exhausts the heart by vasodilatation. The next factor is the toxin which acts directly on the cells and indirectly by the resultant hæmolysis and anæmia. Such infections as beriberi and very often filarial fevers do not spare the myocardium, and if they are less important than those mentioned above, it is because their incidence is less. The infrequent consumption of alcohol by the Bengalis is of no advantage to the heart muscle as it is made worse by the various forms in which tobacco is used, as also opium and in some cases, at least, *bhang*.

It thus happens that infections common to all climates, such as influenza, pneumonia, enteric and diphtheria, which are notorious in attacking the cardiac musculature—when they visit the Bengali homes find a ready soil and often create

disaster. The Bengalis thus die prematurely as the result of such infections as compared with the Europeans who, as a rule, stand infection better and attain to a much older age.

What the exact nature of changes in the myocardium is, I shall be able to say at a later date when I have concluded my observations on the pathological examination of the cardiac muscles of the Bengalis, the investigation of which I am at present engaged in.

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A NOTE ON THE EFFICACY OF NEEMBATTIS IN THE DESTRUCTION OF RATS AND RAT-FLEAS IN RAT BURROWS.

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WHILE conducting some experiments on disinfection of houses by fumigation with substances like cresol it was found that the fleas in the rat-holes were not killed and the rats were not at all affected. It would, therefore, seem reasonable that the rat burrows being the most likely places to harbour fleas, would act as protected reservoirs for these insects, which would infest the room after the disinfection was over and thus defeat the object. In order to kill the rats and fleas in the burrows, Lane (1914) devised the *neem-batti*. A standard *neem-batti* as issued from the Punjab Plague Equipment Depot, Jullundur, is prepared as follows:—

Pot. chlorat. 2 dr., Pot. nit. 1½ dr. and sulphur 2 dr. are powdered together and mixed with 5 dr. of oil (any kind *Taramira-mustard*, castor-oil, etc.), to form a paste to which 1 dr. of chilli-powder (red pepper) and a handful of crushed dried *neem* leaves (*Azadirachta-indica*) are added. A wick of about 9 inches, made of thick cloth (*khaddar*) is soaked in saturated solution of Pot. chlorat. The paste as prepared above is put over