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MICROSCOPY IN DIAGNOSIS OF TUBERCULOSIS

Of the three main epidemiological indices in tuberculosis, tuberculin test is recognised as the means of identifying tuberculosis infection, the chest X-ray as a method of determining the presence of disease frequently in an early asymptomatic stage and sputum examination as the standard procedure for detection of active, infectious case. Pulmonary tuberculosis proved bacteriologically by microscopy of a single sputum specimen is the best index of the size of the infectious pool in a locality or a community. Such microscopy makes it possible to identify majority of persons who are excreting tubercle bacilli and who are not only danger to themselves but to the community as well. This index can also help in international comparison. Similarly the incidence of new cases proved bacteriologically by microscopy is another helpful index of changing trends.

Persons with pulmonary tuberculosis discharging tubercle are the sources of infection through which transmission is maintained in the community. The main object of tuberculosis control is to break the chain of transmission by detecting the source and treating it.

Rural India constitutes as much as 82% of the total population where sputum examination is the main diagnostic tool and hence its importance in our district control programme. For effective implementation of National Tuberculosis Programme, diagnosis and case-finding should be as perfect as possible. Integration of this programme into the national health and medical facilities is essential both at the rural and urban levels.

Effective but simple diagnostic techniques have to be applied to tackle the problem of tuberculosis individually and collectively on community basis. Naturally the question arises : is integration of National Tuberculosis Programme with the general health services likely to add to the work load of the existing health institutions and what can be the quantum of work which can be carried out by the existing personnel?

Studies carried out in Tumkur have shown that tuberculosis case-finding at the rural general health institution on an integrated basis can be carried

out by existing staff without providing much additional work load. It was further observed that the health institutions in the rural areas alone will be able to diagnose about 65% of the point prevalence of direct smear positive. Cases of pulmonary tuberculosis are about 45% of the point prevalence of all cases confirmed by smear or culture in the rural areas of the district.

Diagnosis and case-finding by sputum smear examination by direct microscopy is reliable, simple, cheap and can be undertaken by any satisfactorily trained para-medical person. The provision of facilities for the direct smear sputum examination of symptomatic out-patients at the peripheral health institutions and their optimum functioning will result in the diagnosis of a substantial proportion of cases in the districts.

"AWARD OF HONOUR" FOR INDIAN T.B. ASSOCIATION CHIEF

The notation of British Information Services, British High Commission of India is reproduced below:

LONDON, August 7—For Services in the fight against tuberculosis Mr. B.M. Cariappa, Secretary-General of the Tuberculosis Association of India, has been given the Award of Honour, 1968, by Britain's Chest and Heart Association. He is the first Indian to receive this honour since it was introduced in 1960.

The Chest and Heart Association, a voluntary organisation, operates through affiliated societies in Commonwealth countries.

In announcing the award yesterday, the Association said that the impact of Mr. Cariappa's work had been felt throughout India. "He has dedicated his life to TB work and this has earned him respect, and he has also travelled extensively in India in connection with voluntary work".

The Association added: "His services to the Eastern Regional Committee of the International Union Against Tuberculosis and his efforts to bring together many of the Eastern countries as working partners in voluntary work are well known".

Sri B.M. Cariappa's educational career was interrupted in 1930 due to his intense desire for social service. He joined the Tuberculosis Association of India in 1944 as its Secretary. He was awarded Kaiser-i-Hind Medal in 1948. In 1952, as a WHO scholar, he visited all the important countries of Europe and USA and studied the working of the Tuberculosis Associations in those countries. Again in 1961 he was awarded the Colombo Plan Fellowship to visit Canada. With passing years not only his work at home became much heavier but he had also to shoulder international responsibilities and assignments. His contributions, as the Secretary and Organising Secretary, for the great success of the XIV International Tuberculosis Conference of the International Union Against Tuberculosis, held in New Delhi in 1957, was outstanding. As the Secretary and Treasurer of the Eastern Regional Committee of the International Union from 1956-1964 he showed rare ability for organisation and working of Conferences and Meetings. He attended many International Conferences in many countries, worked on different Committees, addressed Rotarians and Lions and helped in the organisation of a number of Tuberculosis Associations outside India in the eastern region. His exceptional power in this respect in our Association is too well known to stress here. He is one of the most widely travelled persons and the impact of his services is really world-wide. He was designated "Secretary General" in 1964 to give him a national status for his great and devoted services not only to the Centre but for the States also.

It is in the fitness of things that this great honour is conferred on Shri Cariappa. His deep knowledge and sincere and extensive services in the conduct of voluntary organisations for the control of tuberculosis makes him eminently suitable for this Award. The Tuberculosis Association of India and the Editorial Board of this Journal in particular with which he is intimately associated and India should be very happy over his achievements. The Award is to be presented to Shri Cariappa at the Eastern Regional Conference of the International Union Against Tuberculosis in Kuala-Lumpur in November, 1968. We heartily congratulate him and, feel proud that one of our Co-workers has won this unique distinction.

POTENTIAL YIELD OF PULMONARY TUBERCULOSIS CASES BY DIRECT MICROSCOPY OF SPUTUM IN A DISTRICT OF SOUTH INDIA

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(from the National Tuberculosis Institute, Bangalore, India.)

Introduction

The formulation of a national tuberculosis programme must rest on a clear understanding of the epidemiological situation, on the availability of reliable diagnostic tools and on preventive and curative means that are efficient and cheap (WHO Expert Committee on Tuberculosis, 1964). Organizational aspects of a tuberculosis programme should take into consideration the epidemiological , sociological, administrative and economic conditions in a country. While the data collected may be accurate and representative, even when they are applied objectively the weightings attached to the various factors may bias them to the detriment of the defined objectives. It thus becomes necessary to test in part, and even in full, the programme or its components to assess their potential for achievement.

The National Tuberculosis Programme (NTP) in India is essentially a permanent country-wide programme based on the epidemiological and economic conditions in the country and integrated into the general health and medical facilities at both the rural and the urban levels. The programme is organized and supervised by a nucleus of specialized staff at each administrative unit, the District Tuberculosis Programme (DTP) (Piot, 1962; Nagpaul, 1967), based on districts with a population of approximately 1,500,000 persons.

The important results of the study by Banerji & Andersen (1963) on the awareness of symptoms among persons with pulmonary tuberculosis, have been applied to the operational pattern of case-finding in this programme. Case-finding, especially in rural areas, is carried out among routine out-patients at the dispensaries and health units. Persons with symptoms (mainly a prolonged cough) have a direct-smear sputum examination made and, if it is considered to be necessary, they are referred to an X-ray unit some distance away. These functions are carried out by the existing staff of the peripheral health institutions.

In the evolution of such a programme, various assumptions, both technical and operational, are made, some of these assumptions are as follows : (1) that patients do seek relief from symptoms at the *nearest* health institution ; (2) that, if they function satisfactorily, all peripheral health institutions can diagnose a large proportion of the cases in the area ; (3) that the work-load due to tuberculosis work on each one of the health institutions will not upset the other work of these institutions ; and (4) that the referral services for X-ray screening will be complementary to sputum examinations. A series of doubt on these and other factors may be raised by persons directly or indirectly involved.

The present study was planned to lead to understanding some operational aspects of case-finding in an integrated programme. First, what is the frequency of persons showing symptoms of pulmonary tuberculosis among the normal out-patient attendances at the rural health institutions, how many suspect cases can be found by radiography and how many cases can be confirmed bacteriologically among those persons showing symptoms of tuberculosis during a period of, say, a year ? Secondly, what will be the work-load per peripheral health institution per unit of time (say, 1 day) due to case-finding activities, and can it be carried by the existing personnel at these institutions ? Thirdly, what proportion of persons showing symptoms of pulmonary tuberculosis will be willing to, and actually will, attend X-ray units provided at a reasonable distance from their homes ?

It may be seen that the problems investigated are basically more quantitative than qualitative. In such a programme, the identification of a new case would be more relevant than a determination of whether the patient is excreting sensitive or resistant organisms.

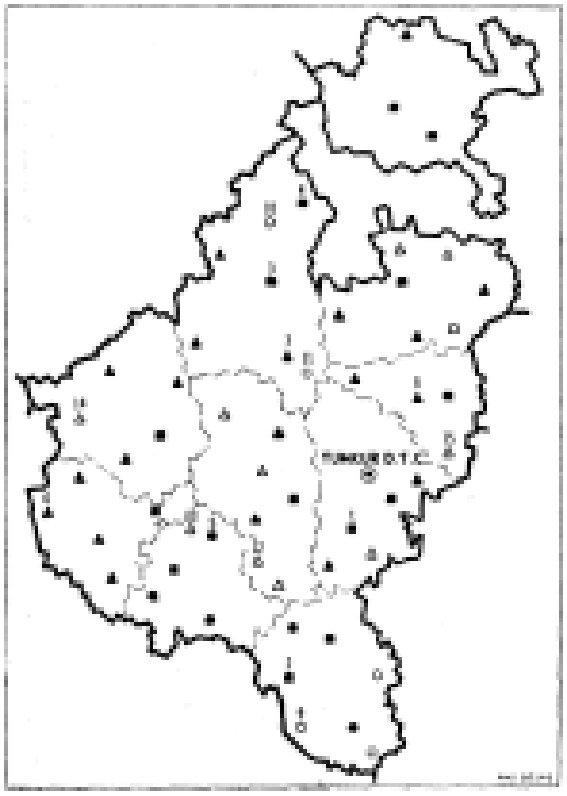
Methods

Selection of area for the study

As the data sought were mostly of an operational nature, a basic prerequisite was that the study should be carried out under the normal administrative conditions of a programme, and interference, if it could not be eliminated altogether, should be kept to a minimum.

Tumkur district (see accompanying map) in Mysore State was selected as the area of study. This district, with an area of 4052 square miles (10,510 km^2), 2392 villages and 11

MAP OF TUMKUR DISTRICT, MYSORE STATE, INDIA, TO SHOW LOCATION, TYPE AND CATEGORIES OF RURAL GENERAL HEALTH INSTITUTIONS[a]



[a] Institutions selected for the study are indicated by serial numbers.

■ □ Primary health centres
● o Health units
▲ Δ Rural dispensaries

Solid symbols indicate microscopy centres, open symbols, referring centres.

towns, corresponds in area and population-density to an average Indian district. In addition to the general Hospital and district tuberculosis centre (DTC) at the district headquarters town (Tumkur), there are in the rural areas 94 general health and medical institutions that are run by the Mysore Government. These rural health institutions are of different types depending on the functions they perform. In Tumkur district, three different types are recognized—namely, the primary health centre (PHC), the health unit (HU), and the rural dispensary (RD). The primary health centres and the health units perform both curative and preventive functions while the rural dispensaries have only curative functions.

The curative work is carried out mostly on an out-patient basis at all the three types of health institutions. The preventive functions carried out by the PHC are usually well organized and cover the fields of smallpox immunizations, general sanitation, family welfare, maternity and child health, etc., and are systematically organized so that each PHC covers an area with a population of approximately 75,000 persons distributed in about 100 villages. The preventive functions performed by the health units are limited to a population of about 20,000 only per health unit.

The tuberculosis programme (DTP) in Tumkur district was organized 2 years before this study was started. The tuberculosis centre at the district headquarters town is mainly responsible for organizing and supervising the programme in the entire district. In addition, the district centre runs a tuberculosis clinic in the district headquarters town, catering mainly for the population of the town and some nearby villages, and provides also referral services for patients from rural general health institutions. Thus, in the entire district there is only one specialized tuberculosis centre—the district tuberculosis centre. Of the 94 rural general health institutions 55 were considered suitable to participate in the programme, that is, suitable in their coverage of the population and capacity to perform the functions. Of the 55 peripheral institutions, 38 are microscopy centres[1] and 17 are referring centres.[2] At the time this study was undertaken, the programme had been functioning for at least a year at each peripheral health institution.

Selection of health institutions for the study

A stratified random sample of 15 rural general health institutions, out of the total 55 participating in the programme, was selected for study. The factors considered for stratification were (1) the category of centre, namely, microscopy and referring centres ; (2) the type of health institution, namely, primary health centre, health unit, and rural dispensary ; and (3) the distance from the DTC at the district headquarters town to the health institution.

[1] Rural general health institutions provided with a microscope for multipurpose work such as examinations of sputum, blood, and stools, etc. A microscopist may or may not be provided, depending on the work load. When a microscopist is not provided, laboratory work is done by some other category of staff trained to do the work. For the purposes of the DTP, these health institutions are called microscopy centres.

[2] Rural general health institutions, not provided with a microscope. For the purposes of the DTP, these are called referring centres, ,though they do not refer patients for sputum examination but collect sputa on the spot and make smears which they send to the nearest microscopy centre for examination. The results are posted back to the referring centre.

TABLE 1

Type and category of rural health institutions participating in the district tuberculosis programme (DTP) and those selected for study

Category of health institution (according to the DTP)	Type of health institution (HI)							
	Primary health centres (PHC)		Health units (HU)		Rural dispensaries (RD)		All types	
	Total in the district	Selected for study	Total in the district	Selected for study 1	Total in the district	Selected for study	Total in the district	Selected for study
Microscopy	14	4	5	1	19	3	38	8
Referring centres	—	—	5	4	12	3	17	7
Total	14	4	10	[5]	31	6	55	15

Three distance strata were considered : less than 20 miles, 20-39 miles and over 40 miles (<32 km; 32 km—63 km;>64 km). One centre from each stratum was randomly selected, giving a total sample of 15 centres. Three strata ,,did not have centres. Some centres changed to another type during the course of the study. Table 1 shows the different categories of peripheral health institutions in the district and those selected for study.

Personnel for the study

The general planning and supervision of the study were carried out by one medical officer from the National Tuberculosis Institute, Bangalore (NTI). The field-personel consisted of two health visitors, one laboratory technician, and a laboratory attendant from NTI, formed into two investigating teams. The first team (team A) consisted of one health visitor and the laboratory technician while the second (team B) consisted of one health visitor and the laboratory attendant.

Team A normally worked at a microscopy centre and team B at the referring centre. The work of these two teams was co-ordinated by a senior health visitor from NTI.

Duration of study

At each selected health institution, one of the teams worked for a period of 1 month or 26 consecutive, full working days, excluding travel-time. The study lasted from 1 February 1966 to 21 December 1966.

The following terms are used in this report of the study.

Out patients : General out-patients attending the health institution because of any complaints including those suggestive of tuberculosis.

New patient: General out-patient who is not actually on treatment on the day of visit to the institution.

Old pat lent: General out patient who is actually on treatment and has returned basically to collect medicines.

Case of tuberculosis : Applies to an out-patient in whom the diagnosis of pulmonary tuberculosis has been established bacteriologically.

New case : A case of pulmonary tuberculosis which has been diagnosed as a case for the first time, i.e., the patient is not on the case-index of the programme.

Old case : A case of pulmonary tuberculosis which has been diagnosed earlier in the tuberculosis programme. To assess whether a case of tuberculosis is old or new, the district case-index (see below) is checked. It may be pointed out that a new general out-patient may represent an old case of tuberculosis.

Symptom elicitation

On each working day, the investigating health visitor sat with the doctor of the health institution, while symptoms as defined above were elicited from each out-patient by the doctor. The elicitation was done initially by asking non-suggestive questions such as

"What are your complaints ?" and "Any other complaints". If a description of the denned symptoms was not forthcoming through these non-suggestive questions, the doctor then asked leading questions, such as "Do you have a cough ?", "Do you have a chest-pain ?" etc. If, either as a result of non-suggestive questioning or of suggestive questioning, any denned symptoms were described, the person was considered as being "symptomatic" for pulmonary tuberculosis and was immediately passed on to the investigating health visitor who requested all necessary details for the preparation of an "individual form".

The individual form : initiation

The individual form was initiated by the investigating health visitor for all new out-patients considered symptomatic by the doctor or by himself. The identification particulars of the patient and the symptoms were recorded taking due care to obtain, as accurately as possible, an estimate of the duration of each symptom

Sputum collection and examination

At the microscopy centre, the symptomatic patient was sent with his individual form to the investigating laboratory technician, who checked the identification, and collected, processed and examined the sputum while the person waited. Relevant entries were made on the individual form and the person was sent back to the health visitor. Sputa were examined by the direct-smear-Ziehl-Neelsen staining technique by the NTI investigating labortory technician at the microscopy centre itself. If the person was not willing to wait for the result of the sputum' examination, he was asked to return in 24 hours.

At the referring centre, the laboratory attendant collected the sputum, prepared smears, then sent the person back to the health visitor. The prepared sputum-smears were sent to the microscopy centre for processing and examination. The person was asked to return in 48 hours for the result of the examination.

Referral for X-ray

Both at microscopy centres and at referring centres, the symptomatic patient was advised by the doctor to go for an X-ray examination, irrespective of his sputum result. If he was willing, the person was given a referral slip and was asked to attend the DTC for radiography. He was advised to return for his X-ray result after 10 days and was then also given the result of his sputum examination at the microscopy centre. Treatment was started if the sputum was positive.

Preparation and maintenance of lists of referred patients

A list, with entries identifying each person referred for X-ray, was prepared by the health visitor. The date on which the person returned to the institution for the X-ray result and the date on which the X-ray result was received from the DTC were recorded by the health visitor. Later in the programme, these entries were made by the doctor attached to the institution. The lists were collected from the doctor 1 month after the last date of the study in the institution.

Card-index of X-rayed patients: preparation and maintenance

A card-index of names was maintained by the senior health visitor for all persons X-rayed each day at the DTC during the entire study-period and for 1 month afterwards. This was maintained in order to get an accurate indication of whether the patients did report for X-ray and, if so, when.

Through periodic checking of this card-index, particulars concerning the reporting by referred persons for X-ray examination were entered on the individual forms by the senior health visitor. Those persons who did not report within 1 month of the date of issue of the referred slip were considered as "not reported".

Symptomatic patients

Four categories of new out-patients aged 10 years and over were considered symptomatic in respect of tuberculosis and therefore eligible for further action. Out-patients aged below 10 years were not eligible. The categories were as follows :

(1) A cough for more than 1 week;
(2) A chest pain for more than 1 month;
(3) A history of haemoptysis;
(4) A fever for more than 1 month.

Analysis of data

The data collected on the individual forms for each symptomatic patient, and the data on actual distribution of new out-patients were analysed in 10-year age and sex-groups. As

the age-groups did not show marked differences, only three broad age-groups, namely, 10-24 years, 25-44 years and 45 years and above have been presented. The informotion for the 0-9 years age-group is presented only for the out-patient attendances since they were not eligible for symptom-elicitation or for sputum examination.

As a stratified random sample of peripheral health institutions was included in the study, quantification of the objectives was done by the "ratio estimate method" using the estimated totals. These ratios were also calculated separately by treating the material as a simple random sample. The comparison of the two sets of calculated ratios did not show marked differences. Hence, for further analysis, the material was treated as a simple random sample in order to get a reasonable number of persons in each category for detailed analysis by age, sex, etc.

Findings

Out-patient attendances at the peripheral health institutions

In India there are normally no regulations governing the area or population that medical institutions, especially in the rural areas, may serve for curative purposes. Thus, each rural health institution serves the population in the village or town where it is situated and in the surrounding areas irrespective of administrative jurisdiction such as district, state, etc. Further, there are several categories of rural health institutions; in the study reported here, the district had three distinct types, namely the primary health centres, the health units and the rural dispensaries, as described previously. Table 2 shows the nature of out-patient attendances at the selected health institutions.

It can be seen that, on average, there were 27 new out-patients in the age-group 10 years and over at a health institution each day among whom case-finding for tuberculosis would have to be carried out. The microscopy centres, particularly the PHCs, however, had higher out-patient attendances than the referring centres. Of the total new out-patients, about 9% did not come personally for medicines but sent a representative who described the patients' complaints to the doctor and collected medicines. These represented patients were not eligible for registration even though the representatives described symptoms suggestive of pulmonary tuberculosis.

Table 3 gives the breakdown by sex and age of the new out-patients during the period of study at all the health institutions selected for the study. It can be seen that for both sexes combined the proportion in different age groups is similar, except in the elderly.

According to the most recent census data of the total general population in Tumkur district, 29.5% were in the 0-9-years age-group, 28.2% in the 10-24-years group, 25.5% in the 25-44-years group and 16.8% in the group 45 years and over. The age distribution of the out-patients in the age-groups is thus similar to the age distribution of the general population.

The number of female out-patients was about half that of males and the sex ratio showed some significant variations from one age-group to another. In the 0-9 years age-group, there were 685 females per 1000 males, in the 10-24-years age-group 461, in the 25-44-years age-groups 617 and in the 45 years and over age-group there were 382. In the general census population, the sex ratio showed a steady decline from 1039 females per 1000 males in the 0-9-years age-group to 803 females per 1000 males in the 45 years and over age-group and this could partly account for the variations of sex ratio in out-patients.

Symptomatic patients among new out-patients at health institutions

Patients may attend a rural general health institution for the relief of chest symptoms or for any other complaints during the investigation of which chest symptoms may be elicited. Among the total out-patients in the age-group 10 years and over (10,792), there were 724 symptomatic patients who complained of chest symptoms as defined above either spontaneously or as a result of leading questions being asked. Table 4 gives the breakdown by age and sex of the total new out-patients and the symptomatic patients aged 10 years or over. It can be seen that nearly 7% of the total new out-patients in this group are considered to be symptomatic. This proportion increases steadily with age for males but for females there is no increase in the higher age-groups—a pattern which has been observed also for tuberculosis prevalence rates in the same district (Raj Narain et al., 1963).

Satisfactory spot-specimens of sputa were collected from 97% of the spmptomatic patients, and from the remaining 3% overnight samples were requested and obtained. Thus, all the 724 sputum samples were considered as satisfactory specimens.

Nature of symptoms among patients considered symptomatic

Whereas the severity and duration of the

TABLE 2

Number of institutions sampled, number of days worked by the investigating team and nature of out-patient attendances at the selected health institutions

Particulars	Microscopy centres			Referring centres		All centres
	PHC	HU	RD	HU	RD	
Total No. of institutions in the category included in sample	4	1	3	4	3	14
Total No. of actual days worked by the investigating team	105	29	81	108	79	402
Total new out-patients (all ages)	6,988	947	3,095	1,843	2,005	14,881
Total old out-patients (all ages)	2,559	150	646	501	352	4,208
Total new out-patients in age-group 10 years and over	4,944	619	2,264	1,379	1,586	10,792
Average new out-patients, age 10 years and over, per day per HI	47.1	21.3	28.0	12.8	20.1	26.8

TABLE 3

Distribution by age and sex of the new out-patients at all health institutions during the study period

New out-patients	Age 0-9 years		Age 10-24 years		Age 25-44 years		Age≥45 years		All ages	
	M	F	M	F	M	F	M	F	M	F
Total new out-patients	2,426	1,663	2,977	1,372	2,551	1,575	1,676	641	9,630	5,251
Percentage of total of sex-groups	25.2	31.7	30.9	26.1	26.5	30.0	17.4	12.2	100	100
Percentage of total in both-sexes	27.5		29.2		27.7		15.6		100	

symptoms were different for different persons (though the duration, as quoted by the person, may be open to doubt as being purely subjective), the fact that description of a symptom or symptoms was spontaneous, or was elicited by active suggestive questioning, is highly relevant to the study. It is significant that 723 of the 724 persons considered symptomatic gave a history of coughing for various durations, either spontaneously or after suggestive questioning, though it is recongnized that among all these persons coughing was not the *presenting* symptom. Since almost all patients had coughing as one of their symptoms, the nature of the symptoms is related in Table 5 to coughing alone and to coughing with any other symptoms.

It is observed that 622 out of 724 symptomatic patients spontaneously complained of coughing (85.9%) and, of the remaining 102 symptomatic patients, 101 described a history of coughing on being actively questioned. One symptomatic patient had chest pain as the main symptom and did not have a cough.

TABLE 4

Distribution of the new out-patients and tuberculosis symptomatic patients among them by age and sex]

Out-patients and symptomatic patients	Age 10-24 years		Age 25-44 years		Age≥45 years		All ages		
	M	F	M	F	M	F	M	F	M+F
Total new out-patients	2,977	1,372	2,551	1,575	1,676	641	7,204	3,588	10,792
Total symptomatic patients	48	38	199	134	247	58	494	230	724
Percentage of symptomatic patients	1.6	2.8	7.8	8.5	14.7	9.0	6.9	6,4	6.7

TABLE 5

Distribution of symptomatic patients by age, sex and nature of symptoms

Symptoms	Age 10-24 years		Age 25-44 years		Age≥45 years		All ages		
	M	F	M	F	M	F	M	F	M + F
Cough (spontaneous)	44	34	173	113	211	47	428	194	622
Cough (elicited)	4	4	26	20	36	11	66	35	101
Cough with chest paina	26	19	143	106	178	41	347	166	513
Cough with feverb	25	25	84	74	98	30	207	129	336

a Cough and chest pain both either elicited or spontaneously described,
b Cough and fever both either elicited or spontaneously described.

Duration of symptoms

As most of the direct-smear positive cases diagnosed in the study were in the 622 persons complaining spontaneously of a cough (as will be seen below), these patients are considered in relation to the duration of the symptom. It is significant that more than a third of the patients described a history of coughing up to 13 days only, i.e. I completed week (see Table 6).

Cases among the symptomatic patients

A total of 45 new cases were diagnosed bacteriologically among the total new (724) symptomatic potients.. Of these 45 cases, 44 were from those patients who described a history of coughing alone or a cough in association with any other symptoms where coughing was reported spontaneously. The single remaining person also had a cough but the information wus elicited. Of the total symptomatic patients, 6.2% were positive bacteriologically, while 7.1% with spontaneously described coughing, 7.4% with a cough and chest pain, and 8.9% with a cough and fever were bacteriologically positive. (During the study, a total of 114 cases, suspect cases and extrapulmonary cases, were diagnosed. After careful consideration of all the available data and history of the patients, 45 were considered as new bacteriologically confirmed cases from among the new symptomatic cases. A total of 55 old cases already under treatment or previously registered on the tuberculosis case-index maintained at the DTC, though still showing symptoms, are not included in the 724 new symptomatics. Some of the old patients were actually under treatment and had come

TABLE 6

Symptomatic patients with spontaneously described coughing distributed by the duration of cough

	Duration of symptoms (completed weeks)						Total
	1	2	3-4	5-8	9-13	≥14	
No. of patients with cough	241	106	96	42	25	112	622

TABLE 7

Yield of bacteriologically confirmed cases among different categories of symptomatic patients

New bacteriologically confirmed cases among :	Age 10-24 years		Age 25-44 years		Age ≥45 years		All ages		
	M	F	M	F	M	F	M	F	M+F
Total symptomatic patients	2	3	18	5	16	1	36	9	45
Cough (spontaneous)	2	3	18	4	16	1	36	8	44
Cough (elicited)	—	—	—	1	—	—	—	1	1
Cough with chest pain	1	3	15	4	14	1	30	8	38
Cough with fever	1	3	9	5	11	1	21	9	30

for a routine examination while others had either stopped or completed their initial course of chemotherapy. In addition to the above, 7 new radiologically detected cases from among the new symptomatic patients and 7 extrapulmonory cases (not symptomatic as defined above) were also diagnosed (see Appendix Table 2).

Thus it appears that positivity rates are almost similar whichever of the above-mentioned combinations is considered, but in certain combinations, such as "coughing and chest pain" or "coughing and fever" a proportion of cases is missed (Table 7). On examining the number of cases diagnosed in relation to the duration of a spontaneously described cough (Table 6), it is found that among those persons with a cough for less than 2 weeks, i.e., from 241 symptomatic patients, only 1 out of the 44 cases was diagnosed. Therefore, by examining the sputa of 381 persons who spontaneously described a cough of more than 2 weeks' duration, we would still find that 43 out of the 45 cases were confirmed bacteriologically and 11.3% of total sputa collected would be positive. Of the 45 cases, 36 were found among males who reported coughing spontaneously, indicating a high case-yielding potential in this group.

Behaviour of rural patients towards referral for X-ray

The District Tuberculosis Programme in India provides for the referral of symptomatic patients from rural general health institutions to the DTC for X-ray examinations. The X-ray unit (using 70-mm film) is available in an average district only at the DTC at the district headquarters. Those persons found to be bacteriologically negative at the general health institutions in rural areas and those for whom the medical officer of the health institution feels that an X-ray is required, are referred to the DTC, which is, on average, about 35 miles (about 55 km) away from the peripheral institution.

TABLE 8

Behaviour of symptomatic patients towards referral for X-ray at the district tuberculosis centre

Behaviour pattern	Age 10-24 years		Age 25-44 years		Age ≥45 years		All ages		
	M	F	M	F	M	F	M	F	M+F
Total symptomatics	48	38	199	134	247	58	494	230	724
Of total symptomatics, those willing to attend for X-ray	39	25	149	86	169	22	357	133	490
Of those willing, those Who attended for X-ray	7	4	26	10	26	3	59	17	76
Percentage of the willing who attended for X-ray	17.9	16,0	17.4	11.6	15.4	13.6	16.5	12.8	15.5
Of those who attended for X-ray, those who returned for result	4	3	18	8	19	3	41	14	55
Bacteriologically confirmed cases among those willing to attend for X-ray	2	3	17	4	13	—	32	7	39
Of those bacteriologically confirmed cases willing to attend for X-ray, those who attended	—	2	6	—	3	—	9	2	11
Of those bacteriologically confirmed cases who attended for X-ray, those who returned for result	—	2	5	—	3	—	8	2	10

However, in the study (see "Methods"), all persons from whom sputum was collected were referred for X-ray examination in order to study the behaviour of symptomatic patients in the rural areas towards referral for X-ray. It was decided to study referral in relation to *total* symptomatic patients as it was felt that certain basic operational questions might have to be answered : for instance, instead of collecting the sputa of all symptomatic patients at the rural health institutions, would it be possible to refer them all to the DTC for X-ray and make a sputum examination when they subsequently returned for the result ? Table 8 shows the behaviour of symptomatic patients towards X-ray referral.

It was observed that 490 of the 724 symptomatic patients, i.e., about 68% of the total, were willing to attend for X-ray at the DTC. The proportions were the same in different age-groups or at different kinds of peripheral health institutions. Of these 490 persons, only 76 (15.5%) attended for X-ray and of the 76 who attended only 55 returned to the peripheral health institution for the result. Among the 76 persons who attended for X-ray, 7 new radiologically positive "cases" were diagnosed which were bacteriologically negative. A reasonable motivation was given to the patients to attend for X-ray and still only a small proportion attended within 1 month of referral. Thus there is a strong suggestion that X-ray referral plays a modest role in case-finding activities at the rural institutions and X-ray screening, through routine referral of all symptomatic patients, cannot be considered as practicable.

Further, it may be argued that of the 76 persons who attended, possibly all sputum-positive cases may have been included. It is observed that of the 45 sputum-positive cases, 39 were willing to go for X-ray while only 11 actually attended. Thus, at best, if all symptomatic patients at rural health institutions were referred for X-ray without prior sputum exami-

nation, only 11 sputum positive cases might have been diagnosed.

Of the 11 sputum-positive patients who attended for X-ray, 10 returned to health institution for the result of their X-ray examination (since X-ray results are not given on the spot at the DTC but are sent by post to the referring health institution) while of the 7 new X-ray-suspected cases, 5 persons returned to obtain the result.

Factors influencing sputum case-finding and X-ray referral at the peripheral health institutions

A number of factors can be visualized which may influence case-finding in a tuberculosis programme in India; to quote a few: the prevalence and incidence of disease in the community, prevalence of other conditions that give rise to symptoms similar to those of tuberculosis, the number and capacity of the health institutions, and quality of specimens collected and the examinations made, etc. In addition, certain operational factors are relevant to case-finding and will now be considered.

Role of distance between the patient's residence (village) and the peripheral health institutions

In the distirict where the investigation was undertaken, it was estimated that a health institution normally covers an area with a radius of about 6 miles (nearly 10 km). The map of the district (p. 876) shows the distribution of health institutions. The population covered by each type of health institution, however, differs considerably, depending on the type of health institution.

Table 9 demonstrates that the majority of symptomatic patients (48%) come from a distance of up to 4 miles (6 km.) from the peripheral health institution. In all, 33 of the 45 (73%) cases are diagnosed from these symptomatics. Centralization of sputum examinations, either at the district centre or at some divisional centres, may not achieve the same coverage. However, to what extent can decentralization be achieved? That is, should each of the 2,392 vallages in Tumkur district have a health institution, or, if not, how many villages can a peripheral health institution serve? It is difficult to obtain an answer to these questions, based on the findings of the present study since the area served by each rural health institution would have to be known accurately. But, as shown below in the Discussion, it can be said that all the rural health institutions have the capacity to diagnose a large proportion of the total cases in the entire district.

Duration of cough and yield of cases

The duration of a cough in relation to spontaneously reported coughing has already been examined. It was also surmised that the duration of the cough, as quoted by the patient,

TABLE 9

Symptomatic and bacteriologically confirmed cases among patients distributed according to the distance from residence (village) to the rural health institution

Types of patient	Distance from residence to peripheral health institution (miles)					Total
	0	1-2	3-4	5-6	≥7	
Total symptomatic patients	256	192	162	56	58	724
Percentage of symptomatic patients from different distances	35.4	26.5	22.4	7.7	8.0	100.0
Bacteriologically confirmed cases	17	9	7	5	7	45
Percentage of cases from different distances	37.8	20.0	15.6	11.1	15.6	100.0
Bacteriologically confirmed cases as a percentage of total symptomatic patients	6.6	4.7	4.3	8.9	12.1	6.2

TABLE 10

Proportion of bacteriologically confirmed cases among symptomatic patients with different durations of coughing spontaneously described

Duration of cough (completed weeks)	Symptomatic patients	Bacterio-logically confirmed cases	Proportion of cases
1	241	1	0.4
2	106	6	5.7
3-4	96	12	12.5
5-8	42	7	16.7
9-13	25	5	20.0
14-26	29	6	20.7
27-52	36	4	11.1
≥53	47	3	6.4
Total	622	44	7.1

might not be reliable, though efforts have been made to assess the duration as accurately as possible. It can be futher examined in relation to the yield of cases from among patients with different durations. In Table 10, an analysis is given of the duration of spontaneously reported symptoms in relation to case-yield. It is observed that as the duration increases, the yield of cases also increases until the 26th week. A cough persisting beyond 6 months appears to be probably more often due to reasons other than tuberculosis.

Quality of sputum processing and examinations

Over-and under-diagnoses are recognized hazards in X-ray reading and sputum examination techniques. These hazards may be increased in an integrated programme when sputa are collected and examined by personnel who are not formally trained in laboratory techniques. This aspect will be dealt in another paper. In the present study, sputum samples were not cultured and radiological findings were not available for the bacteriologically confirmed cases. The sputa were, however, collected, processed and examined by an NTI technician. To ascertain the quality of this examination, the smears prepared were submitted to a second reading at the NTI laboratory. It was found that of the 45 positive smears re-examined at NTI, 4 smears were considered negative by the second examiner. A second sample of sputum was collected from them 4 patients and on examination, all 4 were found positive by reliable NTI readers. The error in the re-examination of the first smear is likely to have been due to the fact that smears were stored for a period before the second examination. It could be concluded that the 45 smears classified as positive by the field-technician were truly positive for acid-fast bacilli on direct microscopy.

Persons returning for sputum results

At the microscopy centre, sputa collected from symptomatic patients were examined at once and the results were given to the person immediately. Even so, some could not wait for the result and preferred to return later in the day or another day. However, 95% either waited long enough for the result or retured for the result, the majority being in the former category.

At the referral centres, spupta were collected as at the microscopy centres and smears were made and sent to the microscopy centres for examination. The patients were, therefore, asked, as a routine, to come back after 48 hours for the result. At these centres only 71.3% returned for the result. Among the 24 new bacteriologically confirmed cases diagnosed at the microscopy centres, all were in patients who waited for the result of sputum examination. At the referring centres, of the 21 cases diagnosed, 6 patients did not return after 48 hours to obtain the result of the sputum examination.

Reasons for not going for X-ray

Of the 234 symptomatic patients not willing to go for X-ray examination (Table 8), 171 (73%) reported that they could not go because of financial difficulties, 42 (18%) refused without giving any special reasons, and the rest gave other reasons.

Symptomatic patients not willing to go for X-ray were studied according to the distance from their homes to the DTC. It was observed that in any distance-group, nearly 30% were unwilling to go for an X-ray. Thus, distance of the DTC from their homes did not influence their willingness.

The influence of distance was studied among those patients willing to go for an X-ray but who did not actually attend. No pattern was seen. Thus it can be observed that distance from home to the X-ray centre does not play a key role among those who are either willing or unwilling to go for X-ray examination.

Discussion

The basic prerequisite for integration of tuberculosis services exists in India ; this is the network of general health and medical institutions. At the present stage, integration is limited to case-finding and treatment while BCG-vaccination is still, done on a mass-campaign basis. At the general health institutions where the tuberculosis programme is integrated, no extra staff are provided for this work, which is carried out by the existing staff.

In the present study, some operational aspects of case-finding at these institutions are examined—namely the work load due to tuberculosis case-finding, the potential case-yield in an Indian district if case-finding is carried out according to the methodology laid down in the programme, and the behaviour of symptomatic patients toward referral for X-ray examination.

Workload due to tuberculosis case-finding at the rural general health institutions

With the introduction of the district tuberculosis programme, case-finding through direct microscopy of sputa of out-patients with symptoms suggestive of pulmonary tuberculosis, and treatment of cases diagnosed on an ambulatory basis, are carried out by the rural general health institutions. The case-finding aspects include selection of out-patients for sputum examination, collection, preparation and examination of sputa, and maintenance of the requisite records. As no special microscopist is provided exclusively for tuberculosis work, it would be imperative to assess the work-load due to tuberculosis case-finding. The work-load depends mainly on the average daily attendances at these health institutions. Table 11 indicates the estimated work-load and the annual case-yield (based on 312 working days per annum) if all the general health institutions participated in case-finding at the same intensity as in the study sample. It is seen that in the district selected for the study, the average daily new out-patients (aged 10 years and over) varied from 13 to 47 only, of whom 1 was considered as symptomatic. Thus on each day, on an average, only 1 sputum need be examined at each one of the peripheral institutions. Indeed, in many smaller institutions it is only 1 every alternate day. Even at the primary health centres where the out-patient attendances are the largest, each centre, on an average, has to examine only 2 sputa per day. All primary health centres and many rural institutions with larger out-patient attendance are already provided with a microscopist for multipurpose laboratory work. It can therefore be concluded that tuberculosis case-finding at the rural general health institutions on an integrated basis does not justify the provision of a specialized worker and can be carried out by the existing staff.

The capacity of rural health institutions to diagnose cases, i.e.. the case-finding potential, of the rural health institutions

If all the 55 participating health institutions in the district work at the same intensity for a year, as was done in the study sample during the study period, it can be estimated that from among the new out patients in the age-group 10 years and over, examining the sputa of all patients with a spontaneously described cough of more than 2 weeks duration, 1870 cases can be diagnosed bacteriologically (Table 11).

Of the 43 cases diagnosed during the study (from among those with spontaneously described coughing for more than 2 weeks), 3 were from outside Tumkur district and hence may not represent the Tumkur district case-load. Then, of the estimated 1870 cases that can be diagnosed during a year, 130 cases (at the rate of 3 : 43) can be estimated as cases from outside the district. Thus 1740 cases will be from within the district.

Table 12 represents the case-finding potentials of all the rural health institutions during a period of 1 year. The district case-load at any one point of time has been calculated on the basis of a carefully conducted prevalence survey[1] in the district (Raj Narain et al., 1963). The survey indicated the prevalence of direct smear-positive cases at 2.5 per 1000 of the population aged 10 years and over. Sputum cultures added another 1.6 per 1000 making the prevalence of all bacteriologically confirmed cases 4.1 per 1000 of the total population in the age-group 10 years and over.

Working at the intensity reported in the study, the health institutions in the rural areas alone will be able to diagnose about 60% of the point prevalence of direct smear-positive cases of pulmonary tuberculosis or about 41% of the point prevalence of all cases confirmed by smear or culture in the rural areas of the district (see Raj Narain et al., 1963). If the

[1] The district case-load estimated as point prevalence based on the prevalence survey has been adopted as a yard-stick for comparison of case-yield, However, the true yard-stick for comparison against the *annual* case-yield will have to take the entire dynamics of epidemiology (namely, incidence, deaths, etc.) into consideration. Similarly, the case-load also constitutes the old cases while they are excluded from among the case-yield.

achievements of the district tuberculosis centre are included, it can be seen that 65% of the point prevalence of direct smear positive cases in the district can be diagnosed in the programme during the period of 1 year. Thus provision of facilities for the direct-smear sputum

TABLE 11

Estimated work-load and case-yield [a] at various health institutions

Particulars	Microscopy centres			Referring centres		Averuge for all His in the district
	PHC	HU	RD	HU	RD	
Total No. of rural health institutions in the district	14	5	19	5	12	—
Total No. of out-patients per day per health						
institution age≥ 10	47	21	28	13	20	27
Symptomatic patients age≥10 per HI per day (cough						
volunteered, more than 2 weeks duration)	2	1	1	1	1	1
Symptomatics patients age ≥ 10 per HI per annum (sputa to be examined per HI per annum)	500	260	250	180	230	300
Cases that can be diagnosed per HI per annum	30	40	30	30	40	30
Cases that can be diagnosed at all HI per annum	450	210	580	150	470	1870

[a] All values in rows 2-6 have been calculated by applying specific rates. Values in rows 2 and 3 have been rounded off to the nearest unit, those in rows 4-6 to the nearest 10. Row 6 has been estimated independently of row 5 in order to avoid magnification of the corrections (to the nearest 10) which have been adopted in row 5.

TABLE 12

Case-finding potential of all rural health institutions in 1 year

	Estimated total population (1966)	Estimated population age 10 years	Case-load			Estimated annual case-yield	
			Direct smear	Added by culture	Direct smear cases	Percentage of direct smear case load	Percentage of total case load
District HQ town	56,000	40,000	110[a]	50[a]	200[b]	NA[c]	NA[c]
Rural areas	1,466,000	1,033,000	2,890	1,340	1,740	60.2	41.1
Total district	1,522,000	1,073,000	3,000	1,390	1,940	64.7	45.6

[a] For calculation of the case-load in the district headquarters town, the same rates as for rural areas are adopted.

[b] The DTC in Tumkur on average diagnoses about 300 bacteriologically confirmed (by direct smear) cases per year. Many of these cases are from the rural areas. If the rural health institutions work at a capacity as indicated in the study, a proportion of these cases would probably be diagnosed at the rural institutions themselves. Hence an arbitary number of 200 cases diagnosed bacteriologically at the DTC has been adopted to indicate the performance at the optimum functioning of the case-finding at the DTC if all participating rural health institutions work at the level indicated in the study.

[c] NA—not applicable. The DTC at the district headquarters town caters not only to the patients from the town but also to those from the rural areas go directly to the DTC for diagnosis and treatment.

examination of symptomatic out-patients at the peripheral health institutions and their optimum functioning will result in the diagnosis of a substantial proportion of cases in the district.

Without an integrated tuberculosis programme, the DTC at the town could, in isolation, diagnose bacteriologically, at best, about 400 cases per annum, i.e., about 10% of the total prevalence. Thus the tuberculosis programme could improve the achievements several times. The achievements in terms of the yield of bacteriologically confirmed cases is also much higher than the yield of a mass case-finding programme utilizing one moble X-ray unit in the district (National Tuberculosis Institute, unpublished data).

Based on the findings, it can be estimated that during the period of 1 year, nearly 17,000 sputa will have to be examined at all the 55 rural health institutions in the district to diagnose bacteriologically 1870 cases. This would represent the optimum achievement for sputum case-finding at these health institutions. However, in several districts where the programme has been implemented, the achievements in terms of the numbers of sputa examined, the number of cases diagnosed and the cases, diagnosed in relation to number of sputa examined are smaller. This indicates that while the programme has a reasonable case-finding potential, several operational aspects of the programme (e.g., provision of necessary supplies, training, selection of patients for sputum examination, etc.) will have to be carefully considered to achieve the optimum.

Contribution of the X-ray facility of the district head-quarters town

The contribution of the static X-ray unit at the DTC has been examined from two different aspects in relation to persons referred for X-ray examination from the rural health institution to the DTC. Firstly, what would be the additional yield of suspect cases if symptomatic patients who are sputum-negative were referred for X-ray; and secondly, what would be the yield of bacteriologically positive cases if, instead of first examining the sputa of symptomatic patients, they were first referred for X-ray and only after the X-ray result had been obtained were they subjected to a sputum examination ? Due to various operational factors, the additional yield of suspect cases would seem to be small; about 300 additional suspect cases would be diagnosed in the entire district during 1 year. Similarly the yield of bacteriologically confirmed cases would be small if an initial X-ray were insisted upon, i e. about 430 cases would be diagnosed (11 out of 45 in the study). Thus, to the rural patients, X-ray referral has very limited potential and a greater stress placed on the sputum smear is operationally justified.

CONCLUSIONS

(1) Since coughing is the major symptom of pulmonary tuberculosis, case-finding can be carried out among the new out-patients spon taneously complaining of a cough with a duration exceeding 2 weeks. Patients com plaining of a cough in the course of suggestive questioning and those having had a cough for less than 2 weeks yield only a very small pro portion of cases of pulmonary tuberculosis,

(2) The work-load due to tuberculosis case-finding in a rural health institution is small, i.e., about 4% of new out-patients aged 10 years and over spontaneously complaining of a cough lasting more than 2 weeks are symptomatic and need further examination.

(3) The integrated district programme can in 1 year diagnose about 65% of the total direct smear-positive cases or 45% of the entire number of cases estimated to be pre valent in the district at a point of time that could be confirmed by any bacteriolygical method. This rate of diagnosis is most pro bably considerably higher than the rate of in cidence of the disease.

(4) The contribution of radiography in diagnosing rural cases is small, whether it is used as a referral for initial diagnosis or for diagnosis of additional suspect cases,

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APPENDIX TABLE 1

Age and sex distribution of new out-patients (OP) and the symptomatic patients (S) among them arranged by category of health institution

Age-group years	Sex	Microscopy centres						Referring centres				All centres, all types	
		PHC		HU		RD		HU		RD			
		Total new OP	Total S	Total new OP	Total S	Total new OP	Total S	Total new OP	Total S	Total new OP	Total S	Total new OP	Total S
0—9	M	1,160	–	178	–	503	—	308	—	277	—	2,426	—
	F	884	—	159	—	331	—	156	—	142	—	1,663	—
10—24	M	1,205	28	173	2	610	6	450	7	539	5	2,977	48
	F	718	24	36	1	313	2	128	2	177	9	1,372	38
25—34	M	594	47	88	7	280	15	190	10	205	18	1,357	97
	F	510	43	59	4	205	10	91	6	101	11	966	79
35—44	M	523	48	77	2	246	17	168	16	180	19	1,194	102
	F	322	28	37	3	129	9	57	7	64	8	609	55
45—54	M	430	50	64	8	202	25	138	13	148	17	982	113
	F	213	18	25	1	86	6	38	6	42	1	404	32
>55	M	304	79	45	7	143	15	97	18	105	15	694	134
	F	125	20	15	—	50	2	22	3	25	1	237	26
All ages	M	4,216	252	625	26	1,984	78	1,351	64	1,454	74	9,630	494
	F	2,772	138	322	9	1,144	29	492	24	551	30	5,251	230
Total	M≥F	6,988	390	967	35	3,098	107	1,843	88	2,005	104	14,881	724
Total OP Age≥ 10yr			4,944		619		2,264		1,379		1,586		10,792
Symptomatics age≥10 yr			390		35		107		88		104		724
Symptomatics Age≥10 yr (%)			7.9		5.7		4.7		6.4		6.4		6.7
Coughing (spontaneous) of ≥ 2 weeks) duration			169		24		66		65		57		381
Total OP age>10yr(%)			3.4		3.9		2.9		4.7		3.6		3.5

APPENDIX TABLE 2

Age and sex distribution of new sputum cases (NSP), new suspect cases (NXR) and old cases (OC) arranged by the category of peripheral institution detecting them

Age-group (years)	Sex	Microscopy centres									Referring centres						All centres		
		PHC			HU			RD			HU			RD					
		NSP	NXR	OC	NSP	NXR	OC	NSP	NXR	OC	NSP	NXR	OC	NSP	NXR	OC	NSP	NXR	OC
10-24	M			2				1						1			2		2
	F	1		1				1						1			3		1
25-34	M	2	2	2	1			1		4	2		2	I		2	7	2	10
	P	1		1	1					1			2	1			3		4
35-44	M	2	1	2			1	3		2	3		3	3		4	11	1	12
	F	2		4						1						1	2		6
45-54	M	3	1	2	1			1		4	3	1	2	3		2	11	2	10
	F	1		1													1		1
>55	M		2	3	1			1		6	2			1			5	2	9
	F																		
All ages	M	7	6	11	3		1	7		16	10	1	7	9		8	36	7	43
	F	5		7	1			1		2			2	2		1	9		12
Total	M + F	12	6	18	4		1	8		18	10	1	9	11		9	45	7	55
NSP cases as % of total symptomatics (age≥ 1 0)					11.4			7.5			11.4			10.6			6.2		

APPENDIX TABLE 3

Age and sex distribution of persons with a spontaneously described cough arranged by of the symptom together -with numbers of sputum-positive cases

Age-group (years)	Sex	Duration of coughing (weeks)									Sputum-positive cases
		0-1	2	3-4	5 o -o	9-13	14-26	27-42	>53	Total	
10-24	M	26	2	5	2(1)	2(1)	1	1	5	44	2
	F	15	8	3	4(1)	—	3 (2)	1	—	34	3
25-34	M	40	12 (2)	12 (4)	6	—	1	6 (1)	4	81	7
	F	27	13	9 (1)	3	6(1)	2(1)	4	2	66	3
35-44	M	42(1)	19 (2)	15 (4)	1	3 (1)	2(2)	2(1)	8	92	11
	F	19	7	5(D	4	1	3	4	4	47	1
45-54	M	32	16 (1)	17(1)	9 (2)	4(2)	6(1)	4(1)	7(3)	95	11
	F	11	5	5(D	1	—	1	2		27	1
>55	M	24	20(1)	24	11 (3)	8	7	7(1)	15	116	5
	F	5	4	1	1	1	3	8	—	20	—
All ages	M	164 (1)	69(6)	73(9)	29(6)	17(4)	17(3)	20(4)	39(3)	428	36
	F	77	37	23 (91	13(1)	8 (1) i	12 (3)	16	8	194	8
Total	M + F	241	106	96	42	25	29	36	47	622	44
		(1)	(6)	(12)	(7)	(5)	(6)	(4)	(3)	(44)	

a Numbers in parentheses.

INTERPRETATION OF THE REPEAT TUBERCULIN TEST

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Introduction

A great degree of confusion prevails in the interpretation of the tuberculin test. The definition of a "positive" reaction has varied in several studies. Mostly, more or less arbitrarily, 5 mm or bigger reactions have been taken as "positive" (for example, Medical Research Council, 1959). Raj Narain and others (1963) recommended "somewhat arbitrarily", for epidemiological studies, 10 mm and bigger reactions for estimating infection rates. Edwards and Smith (1965) stated that 12 mm and bigger reactions to 5 TU PPD-S "is believed to indicate tuberculous infection". Comstock and Palmar (1966) estimated "population truly infected" by doubling the number of those with 15 or more mm of induration.

To be meaningful a "positive" reaction should mean infection with Mycobacterium tuberculosis and the infected should show greater tuberculosis morbidity or mortality than the uninfected. Unfortunately there have not been many studies or opportunities to confirm in man whether a particular size or induration does really always mean infection with the Mycobacterium.

But, what is more confusing and often not even realised is that, when a tuberculin test is *repeated* in an individual at a different site, its interpretation is more difficult and the criteria for a positive reaction at the repeat test have to be entirely different.

The definition of a positive tuberculin reaction either by a first or a repeat test has gained great significance and importance due to the increasing use of isoniazid chemoprophylaxis for the infected.

The aim of this paper is to underline the difficulty in the interpretation of a repeat test, explain the nature of this difficulty and to suggest a new criterion for interpreting the reapeat test. Furthermore, indirect data for a more meaningful interpretation of the first test is presented.

Conversion Rates

Generally those found "negative" to a tuberculin test and giving positive reactions at a later test are regarded as newly infected. (For example Daniels and others, 1948). Far too many persons at the repeat test are found tuberculin positive than it is possible to explain by new infection. This phenomenon of an extremely large number of positive reactions at the repeat test has been observed by several workers. (Raj Narain, Kul Bhashan and Subramanian, 1961; Ferebee and Mount, 1963).

It is illustrated in Table I from two of our studies. In study 1 the population was retested after 18 months and in study 2 after 2 months. Normally one may expect a larger proportion of the uninfected to become infected after an interval of 18 months than after an interval of 2 months. It is not so in Table I. In fact in study 2, after an interval of 2 months, for most age-groups, larger percentages have become infected than after the interval of 18 months in study 1. This phenomenon of larger, and not lesser, proportions showing evidence of new infection after 2 months than after 18 months is also seen even when 14 mm and larger indurations have been regarded as evidence of infection. Such a phenomenon cannot be true.

Another incongruity may be pointed out. The number infected at the beginning of each study can be easily calculated from Table I. For instance, in study 1, for age-group (10-14) years of the 2,102 children tested, 1,799 were uninfected i.e. 303 or 14% were infected. It took 10-15 years, for 14% of these children to get infected, while, as seen in table I, after an interval of 18 months, a further 16.4% and after an interval of 2 months 28.5% were newly infected. This incidence of new infection, as measured by conversion rates, is too high to be compatible with prevalence rates. The nature of the error resulting in extremely high conversion rates is explained in the following para.

Enhancing of tuberculin allergy by a tuberculin test

It is not generally realised that a repeat tuberculin test with the same dose and at a different site usually gives bigger reactions than the first test.

Raj Narain and others (1966 c) tuberculin tested a previously untested and unvaccinated population, testing a 25% random sample with placebo only. Tuberculin tests repeated after 2 months showed greater mean induration for the previously tuberculin tested than for the controls tested initially with placebo only. The difference was highly significant. As the two groups were subject to the same conditions

TABLE I

Incidence of New Infection by Conversion Rates at two different intervals by age

Age-group (Years)	Number tested and read at both rounds		Number uninfected < 8 mm) at 1st test		Incidence ratet (%) according to two levels of reaction taken as evidencs of infection			
					> 8 mm		>4 mm	
	Study 1*	Study 2**	Study 1	Study 2	Study 1	Study 2	Study 1	Study 2
1	2	3	4	5	6	7	8	9
0-4	2440	145	2396	140	2.5	-0.7	1.7	—
5-9	2406	150	2243	134	7.2	7.5	3.9	2.9
10-14	2102	170	1799	137	16.4	28.5	6.8	7.9
15-28	1899	110	1388	66	25.9	43.9	12.9	26.8
25-44	3392	217	1861	81	35.2	37.0	18.6	33.0
45 +	2173	126	1022	49	37.6	36.7	21.8	30.0
All Ages	14412	918	10639	607	17.8	20.6	10.0	14.0

*Interval between the two tests—18 months

**Interval between the two tests— 2 months

between the two tests, the only conclusion possible is that the first tuberculin test enhanced the reaction elicited by the repeat test. This increase in mean induration, at the repeat test, was most marked among those with intermediate reactions (or non-specific allergy) at the initial test, and among them increased with increase in age. Not all, but only about 40% of those with non-specific allergy showed the increase in reaction size at the repeat test. Thus reactions elicited by an initial and a repeat test can not be equated and criterion for a positive reaction at the repeat test must be different.

Interpretation of the repeat test

To overcome the difficulty for the estimation of incidence of new infection, Frimodt-Moller (1960) regarded only those who had (0-4) mm reaction at an earlier round and gave 10 mm or bigger reactions at a later round, as newly infected. The critetion is arbitrary and also provides no guidance for interpreting the repeat test among those with 5 mm induration or more at the initial test.

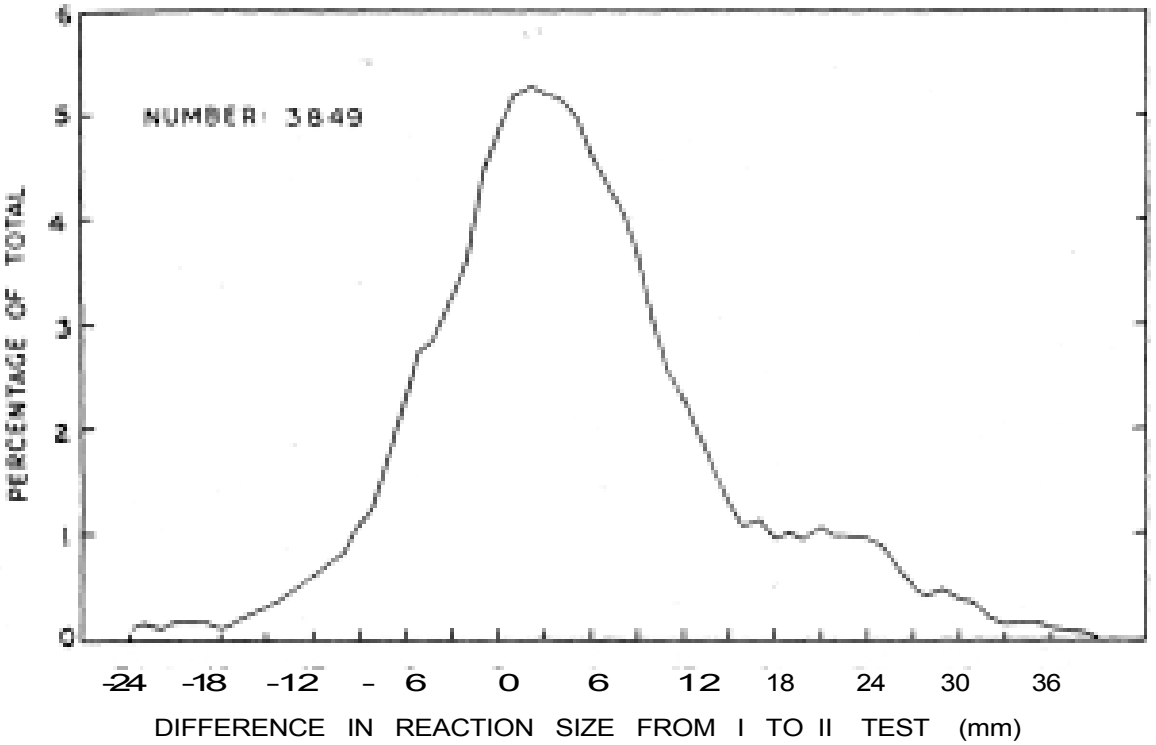
In addition to 'enhancing', experimental errors involved in a tuberculin test, more so when repeated after an interval, add to the problem of defining a positive reaction at the repeat test. We were led to form the hypothesis that unless new infection results in a large or distinct increase in size of reaction at the second test, it will not be possible to distinguish it from increases in reaction size due to other causes, such as enhancing of allergy, experimental errors etc.

To test this hypothesis the increase or decrease in reaction size from the first to the second test was calculated for each person in a population of 50 villages retested after 18 months, and a curve for the distribution of these differences was drawn, (for details, refer to Raj Narain and others, 1966 b).

The curve, so drawn, was symmetrical, with the mode showing a shift to the right corresponding to the general increase in reaction size at the retest, but the newly positive reactions, expected to be seen distinctly on the right side of the curve, were not seen. Probably the numbers newly infected constituted such small percentages of the total, that these were "lost" among the much larger proportions of those who were either definitely infected or definitely non-infected at each of the two tests. The latter two groups, which obviously do not present a problem in the interpretation of the tuberculin tests and constituted over 70% of the total number of persons tested, were excluded and the curve was redrawn (Figure 1). This figure shows a

FIG. I

DISTRIBUTION OF THE DIFFERENCES IN REACTIONS TO TWO TESTS AFTER EXCLUSION OF PERSONS WHO WERE EITHER INFECTED OR NON-INFECTED AT EACH OF THE TWO TESTS



distinct bulge in the right hand tail of the curve. The bulge means that the population constituting the curve contains a group which has shown a distinct increase in the size of reaction at the retest. The exclusions described resulted in an increase in the relative proportion of the newly infected, which then showed up as the bulge.

Similar distribution curves have been drawn for different age groups in Fig. 2. For the age-group (0-4) years, there is no 'bulge' but an entirely separate distribution on the right side. This means that the newly infected form an entirely separate group in this age-group and there is no overlapping or mixing of this group with those who show an increase in reaction size at the retest due to other causes than new infection. Non-specific allergy, waning and boosting are likely to influence this age-group to a much smaller degree. The absence of these sources of error has resulted in the sapa-rate distribution on the right. This would seem to support the hypothesis that new infection does result in a large and distinct increase in reaction size.

Curves for the other age-groups in Fig. 2 show two interesting features :

(1) the bulge generally starts at about 16 mm for each age group.

(2) the bulge in the right hand tail be comes less prominent with increase in age.

The latter finding could mean that there are others, besides the newly infected, who show a large increase in allergy in the absence of new infection and that their number increases with age, thus blurring the clear distinction seen in the curve for the age-group (0-4) years. It has been shown earlier that enhancing of allergy at the second test increased with increase in age (Raj Narain and others, 1966c). Such persons showing considerable increase in allergy in the absence of infection lead to false interpretation of a positive reaction at the repeat test. Such errors increase with age, as may also be seen from Table I.

In order to estimate the newly infected, it was assumed that experimental and other errors are likely to be equally distributed on the two sides of the curve. Therefore, starting from the beginning of the bulge, the corresponding

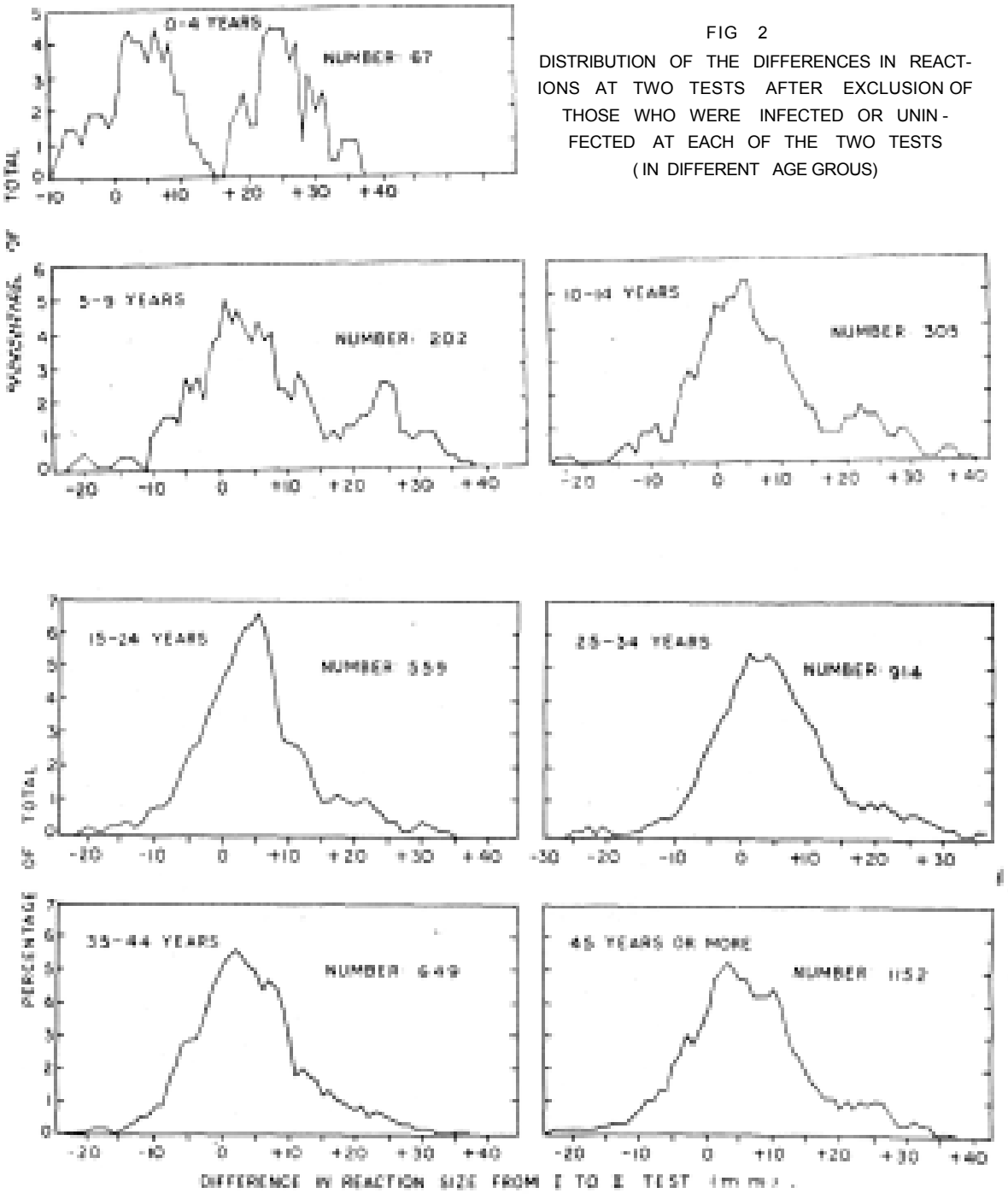


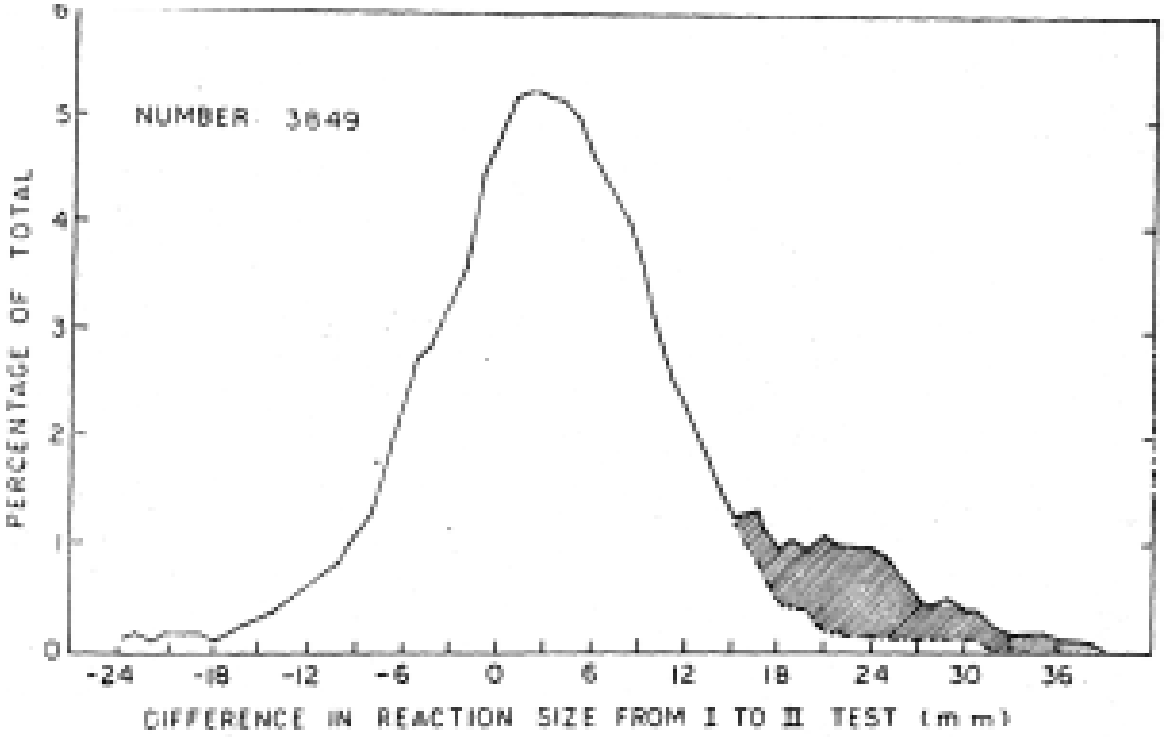
FIG 2
DISTRIBUTION OF THE DIFFERENCES IN REACTIONS AT TWO TESTS AFTER EXCLUSION OF THOSE WHO WERE INFECTED OR UNINFECTED AT EACH OF THE TWO TESTS (IN DIFFERENT AGE GROUS)

portion of the left hand tail was projected on the right side (broken line in Figure 3). The area between the two lines (shaded area) then represents the number of persons showing an increase in expected size of 16 mm or more minus the number of those who could be expected to show such an increase as a result of experimental errors and causes other than new infection.

The frequency curves of the newly infected represented by such shaded areas in different age-groups and for all ages are shown in Fig. 4

FIG. 3

DISTRIBUTION OF THE DIFFERENCES IN REACTIONS TO TWO TESTS AFTER EXCLUSION OF PERSONS WHO WERE EITHER INFECTED OR NON-INFECTED AT EACH OF THE TWO TESTS AND A METHOD OF CALCULATING THE NUMBER NEWLY INFECTED.



(continuous line). In the age-groups 0-4, 5-9, 10-14 and 15-24 years the numbers are quite small and the curves show large fluctuations. However, normal curves[1], which fit fairly well the major portion of these frequency curves, are also shown in Fig. 4 (broken line). These normal curves show a mean induration of about 24 mm and standard deviation of about 4 mm. Thus in each age-group the newly infected form a homogeneous group with a normal distribution showing a mean increase of about 24 mm from the first to the second test. Further, 98% of this group would show an increase of at least 16 mm (24 mm minus 2 X Standard Deviation). This also explains the earlier observation that the bulge starts at about 16 mm in the curves for the different age-groups in Fig. 2.

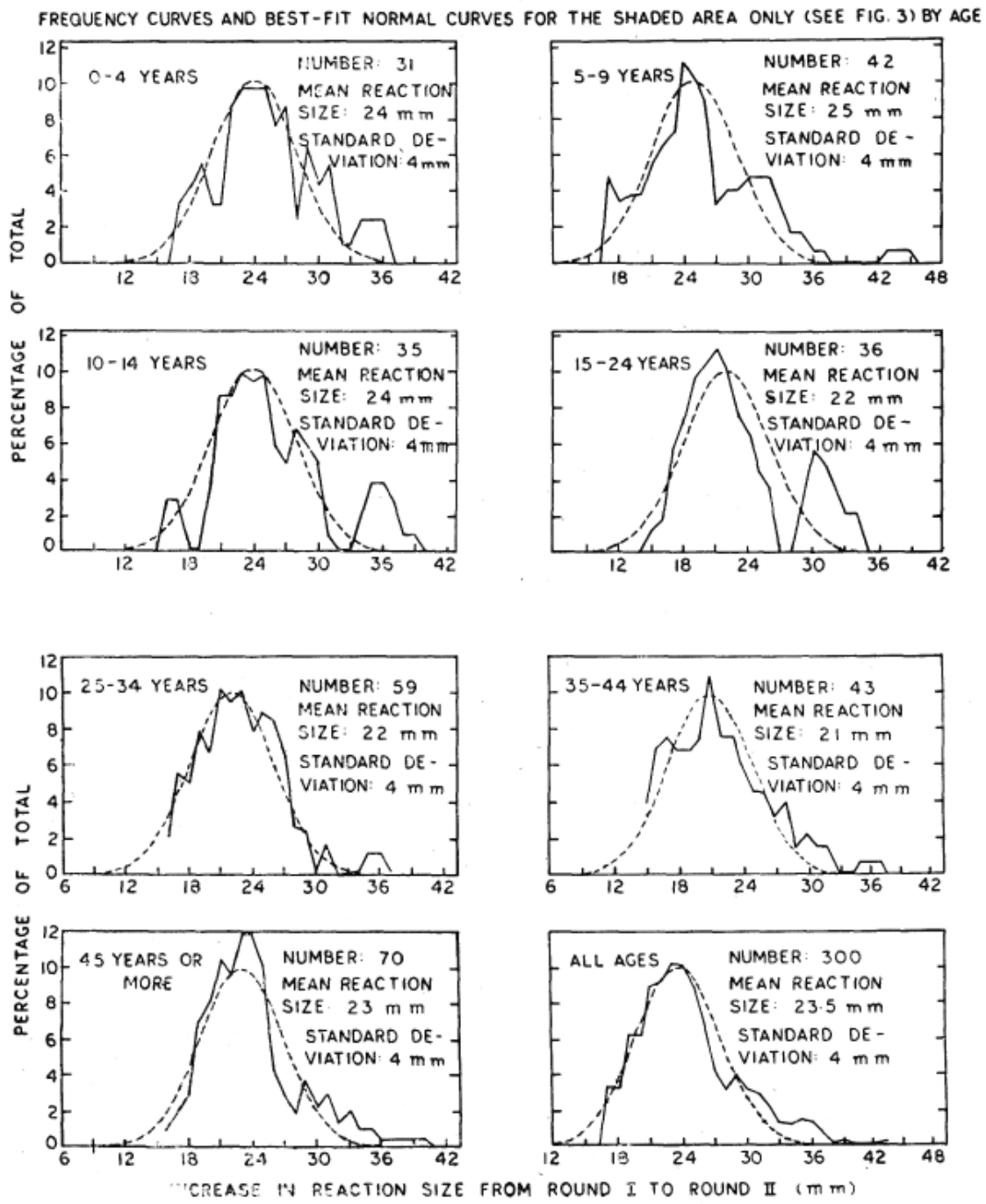
To sum up, a repeat test should not be called positive unless there is an increase in reaction size of 16 mm or more from the previous test. Furthermore, not all reactions with such an increase in size will be true positive reactions meaning new infection, especially in higher age-groups, in which an increase in the diameter of induration of 20 mm or more provide more satisfactory evidence of a positive tuberculin reaction.

1 The increase in alletgy after new infection is likely represented by a normal curve, as increase in size of induration after BCG vaccination shows a normal curve.

Implications of the findings

(1) In clinical practice, repeat tuberculin test should be interpreted cautiously. For example, for diagnostic purposes with a reaction of 6-8 mm to 1 TU, the test may have to be repeated some time later. A reaction of 15 mm, or even more, at this repeat test, should not necessarily be taken as evidence of new infection. The significance and frequency of this error has increased due to greater use of chemoprophylaxis especially among tuberculin positive contacts of patients.

(2) A far reaching implication is on the design of future epidemiological sur-



Veys In all surveys where follow – up studies are planned, tuberculin testing of the entire study population is not adviable. Only a random sample of suitable size should be tested in each round. In this way a better understanding of the change in tuberculin status at different point of time would be possible

(3) Allergy producing capacity of a BCG

vaccine cannot be measured by estimating conversion rates after vaccination. Even a weak vaccine may produce high conversion rates and be wrongly judged as satisfactory. This happened in the early stages of the production of the BCG vaccine in India, when a vaccine as weak as 1/12th the strength of the standard Danish Vaccine was declared by several competent workers as satisfactory (Raj Narain, Kul Bhushan & Subramanian. 1961).

(4) Similarly, conversion of negative reac tions into positive ones must not be used to estimate incidence of new infection, as has often been done, for instance, in the well known Prophit Survey (Daniels and others, 1948). The error in conversion rates is that the interpretation of the second test is on the same basis as that of the first.

(5) With the suggested criterion for inter preting the repeat test, incidence rates for new infection are much lower than those reported before. For the age-group 0-4 years, these work out to less than 1% per annum. The question arises "Is th rate of incidence of infection really so low, inspite of a large number of open cases in the community (Indian Council of Medical Research, 1959; Raj Narain. 1962; Raj Narain and others, 1963) and an almost utter lack of measures for the prevention of infection ?" The answer must be in the affirmative. At the initial examination in the 50 villages under report, of the 616 children below one year, only one had a reaction of more than 4 mm to 1 TU, namely, 16 mm. At repeat test, 18 months later, the reaction of this infant was 0 mm. In the resurvey, none of the 578 children below one year (all of whom were born after the initial ex amination) had a reaction of more than 6 mm.

The hypothesis is being tested further by following the newly infected persons according to this criterion and comparing the development of new disease among them with new disease among other groups.

Limitations of the Study

It has been suggested that only a large increase in allergy should be regarded as evidence of infection between two tests. If there are any infected persons who fail to show such an increase, they would represent a source of error. It is known that after intradermal vaccination (infection) with BCG, a number of persons fail to become tuberculin-positive. Further, a large number of children in households with bacteriologically confirmed tuberculosis pattents were found tuberculin-negative (Raj Narain and Others, 1966d). It is possible that some of these children were infected and yet remained tuberculin negative. The size and extent of this source of error, is not known but, as in case of BCG vaccination, it may not be large.

Our study has been carried out in an area of high prevalence of non-spceific allergy. Similar studies in areas of low prevalence of non-specific allergy should help in deciding whether the same criterion for the interpretation of a repeat tuberculin test holds true for such areas also.

Positive reaction at the first test

As stated in the introduction, there have not been many studies or opportunities to confirm in man whether a positive reaction at any level does mean infection with Mycobacterium tuberculosis. Distributions by size of reaction to find a suitable dividing line between two distinct groups, the infected and the uninfected have been a recent development. Unfortunately, far too many times, the distributions do not yield a sharp dividing line between the two groups (Nyboe, 1960, Raj Narain and others, 1953).

In cattle, for tuberculosis control, the most effective routine has been to slaughter all with a 'positive' reaction. This gives an ideal opportunity and the loss involved in slaughtering a useful animal makes it obligatory to study if the animal was really infected. In this way, as early as the end of last century, it was found that a positive tuberculin reaction did not always reveal, on careful and detailed post mortem examination, a focus of tuberculous infection. Such cattle were referred to as "No lesion Reactors".

Need for a meaningful classification of positive and negative reactions have been mentioned. If, on a follow-up, the subsequent development of new tuberculous disease of mortality among the positives and the negatives is of the same order, the distinction may serve no useful purpose. The results of the British Medical Research Council BCG Trial (1963) do show clearly that the commonly used 5 mm. level of induration does not mark out two groups with distinctly different risks of developing new tuberculosis disease. (Table II). In fact the tuberculin negative group showed

TABLE II

Annual incidence of definite cases of tuberculosis during 10 years by size of tuberculin reaction

Size of reaction 3 Units Old Tuberculin		Annual Incidence per thousand
I Tuberculin negative (0-4) mm (18,852)		1.55
II Tuberculin Positive (5-14) mm (8,838)	0.71	1.25
15 mm or more (6,866)	1.95	

Numbers tested are shown in parenthesis
(Adapted from the Brit. Med. J., April 13, 1963)

greater incidence of new disease, namely 1.55 per thousand per annum against 1.25 per thousand per annum for the tuberculin positives. Further, the tuberculin positive group consists of two different groups ; those with 15 mm and bigger reactions with a significantly higher risk of new disease (1.95 per thousand per annum) and those with (5-14) mm reactions with considerably smaller risk (0.71 % per annum). The two groups, both regarded as tuberculin positive, may not be considered similar. If infection really means greater risk of developing disease, then only the group with 15 mm and larger reactions to tuberculin showing the higher risk of developing new disease may be regarded as infected.

In Table II, the incidence of new disease, both for the infected and the uninfected (after excluding those with 5-14 mm reactions) is high. The development of new disease among the uninfected depends on the risk of new infection in the community. In countries with a low risk of new infection, the development of new disease among the uninfected should be low. Comstock and Shaw (1960) found incidence of new disease among the uninfected in the USA to be low and thought that risk of new infection in England, as shown by the MRC, BCG Trial was several times higher than in the United States. The higher incidence of disease in the infected indicates the risk of developing disease after infection

A follow-up study in India

A follow-up study of a large group as done by the British Research Council offers considerable difficulties in a developing country. Diagnosis of all new cases of tuberculosis, that may develop, is nat easy. Many remain unknown (Benjamin & Nash, 1952 ; Sikand and Raj Narain, 1957). Under the circumstances, we have correlated crude mortality on a follow-up with the size of initial tuberculin reaction in different age groups in children. This has shown that tuberculin reactions, with 15 mm or bigger diameter of induration, carry a significantly greater risk of death than reactions of a smaller size.

A random sample of 119 villages out of the 734 from a part of Bangalore District was examined by survey techniques (Raj Narain and others, 1966a). Crude mortality rates recorded at the time of the Re-survey after 18 months, for children in 3 age groups, (0-4), (5-9) and (10-14) years, by size of their initial reaction to 1 TU RT 23 with Tween, are shown in Table III. For the two age groups (04) and (5-9) years, the mortality rates are significantly higher (with more than 99% level of confidence) for those with 15 mm and larger reactions to tuberculin than for those with less than 15 mm reactions.

In the age-group (10-14) years, mortality is highest, namely 8.3 per thousand, for those with reaction size of (10-14) mm, but this rate is based on only two deaths among 240 persons and cannot be accepted with much confidence. The difference in mortality rates for those with 15 mm and larger reactions and for those with smaller reactions than 15 mm is significant at 25% level of confidence.

The question still remains—"Do 15 mm and bigger reactions, though they ore associated with greater crude mortality in children, represent infection with Mycobacterium tuberculosis ?" Crude mortality include deaths due to all causes and not only those due to tuberculosis. But deaths due to causes other than tuberculosis are likely to be equally distributed among all reaction sizes to a tuberculin test. If crude mortality among the infected is more than among the uninfected children, then this is seen only for those with 15 mm or bigger tuberculin reactions. Thus, it is only this level of induration to the tuberculin test that may divide the population into two groups with distinctly different crude mortality rates. Even if some induration of less than 15 mm also represent infection with Mycobacterium tuberculosis, a clinician or an epidemiologist may not be interested in classfying them separately, as this may not serve any particular purpose. For a meaningful classification only induration of 15 mm or more to a tuberculin test may be regarded as evidedce of infection.

TABLE III

Crude mortality after 18 months among children by age and by size of tuberculin reaction to 1 TV RT 23 with Tween.

Diameter of induration in mm.	Age (0-4) years		Age (5-9)years		Age (10-14) years	
	Number followed	Mortality (per 1000)	Number followed	Mortality (per 1000)	Number followed	Mortality (per 1000)
1	2	3	4	5	6	7
0-4	6947	26.5	6382	4.4	4472	3.6
5-9	130	23.1	441	—	1016	1.9
10-14	18	—	69	—	240	8.3
<15	7095	26.4	6892	4.1	5748	3.5
>15	136	73.5	490	12.2	815	6.1
Tuberculin test) not done or read)	177	16.9	217	4.6	286	10.5
Total	7408	27.0	7599	4.6	6849	4.1

This method of recording crude mortality rates for defining a positive tuberculin reaction is indirect, but is simple enough to be tested in most developing countries where, due to lack of facilities for diagnosis, reliable estimates of incidence of new disease among the infected and the uninfected are not available and such facilities for treatment, as are available, do not much influence mortality due to tuberculosis, at least, in rural areas. It would be interesting to have similar data from other countries.

Summary

A study with proper controls showed that a repeat tuberculin test, given at a different site, may give significantly larger reaction than the initial test *in the absence of* new infection. This was much more common among those with "non-specific allergy". Mere conversion of a previous 'negative' reaction to a 'positive' one at the repeat test does not constitute evidence of new infection. Lack of realisation of this fact has quite often led to errors in the interpretation of the repeat test and estimation of the potency of a BCG vaccine.

A study of the distribution of differences in size of reaction from the first to the second tuberculin test has shown that those with an increase of 16mm or more at the second test constitute a distinct and homogeneous group. These are probably the newly infected. On this basis it is suggested that an increase in reaction size of less than 19 mm from the first test should not be regarded as evidence of a positive reaction at the repeat test.

The study has been carried out in an area of widespread prevalence of non-specific allergy. Whether this criterion for interpretation of the repeat tuberculin test holds true for areas with low prevalence of non-specific allergy can be better known by a similar study in such areas.

A study of crude mortality rates, among children with various sizes of tuberculin reaction at the first test, showed that reactions, 15 mm or more in diameter of induration, were associated with significantly higher crude mortality than smaller reactions. It is suggested that only such reactions may represent a meaningful classification for the infected.

The above two hypotheses imply that with the incidence rates of new infection and the prevalence of infection with Mycobacterium tuberculosis may be much lower than estimated so far.

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A FOLLOW-UP STUDY OF PATIENTS OF PULMONARY TUBERCULOSIS TREATED IN AN URBAN CLINIC

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Introduction

It has been possible to develop an organizational network for the Union Territory of Delhi to provide tuberculosis services to the community according to the broad pattern laid down in the National Tuberculosis Programme (1). In this programme, the intake of patients is mostly from among those who report to the clinic or are referred to them from other institutions, because of symptoms. Radiography of the chest as well as examination of sputum by direct microscopy are used as principal aids for arriving at a diagnosis. Most of these patients are given anti-tuberculosis treatment on a domiciliary basis, with a limited degree of supervision provided by health visitors of the clinics.

Domiciliary treatment of tuberculosis patients on such a large scale has raised a number of clinical, epidemiological, administrative and sociological problems.

Studies at the Tuberculosis Chemotherapy Centre, Madras (2) provide sound grounds to believe that, *given proper supervision,* in clinical and epidemiological terms, results of treating patients on a domiciliary basis are similar to those obtained by treating them in sanatoria.

A three-year follow-up of domiciliary treatment of patients of a Bangalore Clinic (which has a treatment organization that conforms to the pattern recommended for the National Tuberculosis Programme) (3), has brought into focus some significant clinical, sociological and epidemiological issues. It was found that many of the "defaulters" continued to take the treatment and completed it after the first year and that the rate of bacteriological conversion of sputum (from positive to negative) in this group was not significantly different from that in the "regular" group, which completed the treatment within one year. This study also disclosed that some of these defaulters, who did not complete the treatment even during the extended period, were actually not "cases", so that in them defaulting did not lead to any unfavourable consequence.

Following this report from Bangalore, the authors designed a two-year follow-up study to find out the extent to which such considerations affected the fate of the patients who were offered domiciliary treatment in the Delhi Tuberculosis Programme. As a part of this study had to be based on old clinic records and as only limited resources were available for carrying it out, efforts were concentrated to:

(a) Locate the cases which were available for follow-up at the end of two years;
(b) Determine the extent of drug collection during the two years from the available; records and
(c) Relate the extent of drug collection by different categories of patient to their bacteriological status at the end of two years.

Material and methods :

A: S. P. Mukerji Marg Tuberculosis Clinic :

The Union Territory of Delhi, with 88.3% of its population living in Delhi City, is served by eight tuberculosis clinics and two tuberculosis hospitals. One of the clinics, that at S. P. Mukerji Marg, was selected for conducting this study. This clinic was chosen because it has been functioning according to the recommendations of the National Tuberculosis Programme from 1964. For organizing domiciliary treatment, the clinic has been assigned a population of *402,569, residing mainly at the central part of the old city of Delhi. Diagnosis and treatment facilities are offered free of cost to the patients.

Majority of the tuberculosis patients are derived from among those who report at the clinic because of the symptoms. Some cases are referred to it by general hospitals, dispensaries (including those belonging to insurance agencies like the Central Government Health Scheme and the Employees State Insurance), general practitioners, etc. A few cases are sometimes referred by B. C. G. Technicians on the basis of symptoms or tuberculin reactions in the course of their door to door vaccination campaign within the clinic area.

All persons attending the clinic are given a tuberculin test and a radiological examination in the form of a 70 mm photofluorogram.

* As per 1961 census.

Every one who is found to have an abnormal shadow on the photofluorogram is given a clinical examination and from the same person a sputum specimen is collected on the spot. The sputum specimen is examined by microscopy at least two or three times. A. full size conventional skiagram is also taken when the smaller film is found inadequate. All the diagnosed cases are prescribed two anti-tuberculosis drugs: either INH (300 mgm in a single dose) and PAS (10-12 gms daily in two divided doses) or intramuscular streptomycin (1 gm daily) and INH (300 mgm in a single dose daily). The INH and streptomycin combination is prescribed for a maximum of 90 days, thereafter it is changed to PAS and INH combination.

In the system of treatment organization evolved at the clinic, patients collect their drug from the clinic once in a month. A home visit is paid only if the patient does not turn up to collect his drug within the three days of the appointed date. For each defaulting, two home visits are paid. If a patient does not collect his drug even after two-successive visits, he is considered as a final defaulter. Twelve months after the diagnosis, after a check-up, most of the patients who want to continue the treatment are allowed to collect the drug for another one or two years, but during the extended period no home visits are paid to patients who fail to collect their drug.

B. Hospital facilities :

The two tuberculosis hospitals located at Delhi have a total capacity for 1,463 beds. These facilities are generally used to reinforce the domiciliary services of the clinics. This is brought about by following certain criteria for admission of patients diagnosed at various clinics to these hospitals. These criteria generally are :

(a) Acute emergencies — for example, spontaneous pneumothorax, massive haemoptysis, etc.
(b) Miliary and meningeal tuberculosis.
(c) Those needing surgical treatment.
(d) Destitutes and those facing compelling socio-economic problems.
(e) In addition to the above four categories of patients, sputum positive cases with acute symptoms are also considered for admission.

C. Study population :

All the patients living within the jurisdiction of the clinic, who were diagnosed as cases of pulmonary tuberculosis between January 1, 1964 to June 30, 1964 were included for this study. This number was 539. At the end of two years, i. e., in the month of July, 1966, when home visits were made to follow-up these patients, it was found that 134 (i.e. 24.0%) of them had migrated from that area; the houses of 159 (i. e. 29.5%) could not be traced as the addresses recorded at the clinic at the time of their registration were found to be inadequate. Thus, as in the case of the study reported from the National Tuberculosis Institute (4), this study also draws attention to the fact that more than half of the patients in a clinic are "lost" because of shortcomings in administrative fields—e. g. shortcomings in recording addresses and inadequacies of referral facilities to ensure continued treatment of those who migrated.

Of the remaining 246, 50 (i.e. 20.3%) were reported to have died during this period; only 3 (i.e. 1.2%) were highly non-co-operative and did not come to the clinic for a check-up.

Thus, in all, 193 persons were available for this study at the end of two years. The distribution of the dead, the migrated house-not-traced and the population taken up for the present study according to their initial status is given in table 1.

It can be seen that of the migrated/house-not-traced group, only 27.6% were initially smear positive, while the corresponding percentage for the study population was 43.5. This indicates that the proportion of serious cases is lower among the migrated/house-not-traced group, as compared to the study population.

Also, as 20 (i.e. 40%) out of the 50 patients who died during this two-year period were initially smear negative, it cannot be said with certainty that in all these cases the cause of death was pulmonary tuberculosis. Nevertheless, the fact that a significant proportion of the located cases had died during the two-year period should be considered as a factor in evaluating the effectiveness of the programme.

D. Methods :

All the 193 persons, who were available for this study, were taken to the clinic for bacteriological and radiological examinations. Bacteriological examination consisted of examination of sputum by direct microscopy and by culture. For microscopy, one specimen was collected on the spot while the other was an overnight collection. A laryngeal swab was taken for culture from each patient.

TABLE 1

Distribution of the 539 Patients who visited the Clinic during January-June 1964, after a two-year follow up

Initial clinical status	Sputum Positive		Sputum Negative								Total	
Postition of patients after two years			Cavity/Adv.		Moderate		Minimal		Total			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Migrated/House-not-traced	81	27.6	104	35.5	61	20.8	47	16.0	212	72.4	293	100.0
Dead	30	60.0	14	28.0	6	12.0	—	—	20	40.0	50	100,0
Non-co-operalive	1	33.3	1	33.3	1	33.3	_	_	2	66.7	3	100.0
Study Population	84	43.5	38	19.7	39	20.2	32	16.6	109	56.5	193	100.0
Total	196	36.4	157	29.1	107	19.9	79	14.6	343	63.6	539	100.0

It might be noted that adoption of a more precise method of becteriological examination at the end of two years (i.e. adoption of direct microscopy and culture methods at the end of two years as compared to examination of sputum by direct microscopy only at the initial stage), tends to under-estimate the extent of bacteriological conversion at the end of two years. If a similar culture examination were also done at the initial stage, some of the patients who were smear negative but radiologically positive at the initial stage might have turned out to be culture positive. In the Bangalore Study (3), 29.9% of the initial culture positive cases were smear negative.

Of the 193 patients taken up for this study, 33 (i.e. 17.1%) were admitted to one of the tuberculosis hospitals. The average duration of their stay was 162 days. The amount of treatment taken by the patients during their stay in the hospitals was taken into account in calculating the extent of drug collection during the period under study.

Results:

A. Pattern of drug collection and definition of a defaultar

(a) "Working" definition of a defaulter :

It has not been possible to arrive at a generally accepted definition of a "defaulter". Different definitions have been used by different workers to suit specific needs of their studies. Workers at the National Tuberculosis Institute, Bangalore, have been generally regarding those who take less than 40 weeks' drugs as defaulters (4). For the purposes of this study, as was done by workers in National Tuberculosis Institute, *anybody who had collected drug for less than 10 months was considered as a defaulter.*

(b) *Defaulter rates at the end of 12, 18 and 24 months :*

Of the 193 persons included in this study (table 2), 110 (i. e, 57.0%) had collected less than 10 months' treatment within the first 12 months; if, however, defaulting rate is calculated on the basis of those making less than 10 collections in 18 months, the number was 89 (i.e. 46.1%); and when the duration allowed for collection is 24 months, the number was 85 (i.e. 44.0%). There is thus a fall from 57.0% to 44.0% when the duration for calculating defaulting is increased from 12 month to 24 months. Clinical implications of such a pattern of drug collection are studied in a later table (table 4).

(c) *Correlation of defaulter rate with the initial clinical status :*

At the end of 12 months, the percentage of defaulting among the initially sputum positive cases was 35.7% (table 2) while among the sputum negative cases it was as high as 73.4%. It may also be noted that the percentage of defaulting among the sputum positives

TABLE 2

Correlation of drug collection with initial status and time allowed for collection

Time allowed for collection	Sputum Positives			Sputum Negatives												Total		
				Cavity/Advanced			Moderate			Minimal			All sputum negatives					
	Ten months or more	Less than ten months	Total	Ten months or more	Less than ten months	Total	Ten months or more	Less than ten months	Total	Ten months or more	Less than ten months	Total	Ten months or more	Less than ten months	Total	Ten months or more	Less than ten months	Total
Collection in 12 months	65 (64.3%)	30 (35.7%)	84 (100%)	13 (34.2%)	25 (65.8%)	38 (100%)	16 (41.0%)	23 (59.0%)	39 (100%)	0 (0%)	32 (100%)	32 (100%)	29 (26.6%)	80 (73.4%)	109 (100%)	83 (43.0%)	110 (57.0%)	193 (100%)
Collection in 18 months	65 (77.4%)	19 (22.6%)	84 (100%)	22 (57.9%)	16 (42.1%)	38 (100%)	17 (43.6%)	22 (56.4%)	39 (100%)	0 (0%)	32 (100%)	32 (100%)	39 (35.8%)	70 (64.2%)	109 (100%)	104 (53.9%)	89 (46.1%)	193 (100%)
Collection in 24 months	67 (79.8%)	17 (20.2%)	84 (100%)	24 (63.2%	14 (36.8%)	38 (100%)	17 (43.6%)	22 (56.4%)	39 (100%)	0 (0%)	32 (100%)	32 (100%)	41 (37.6%)	68 (62.4%)	109 (100%)	108 (56.0%)	85 (44.0%)	193 (100%)

TABLE 3

Correction of total drug collection in two years with the initial status

Initial status	Less than 10 months	10 months or more						Total
		10-12 ms	13-15 ms	16-18 ms	19-21 ms	22-24 ms	Total	
Sputum Positive	17	3 (4.5%)	3 (4.5%)	4 (5.9%)	12 (17.9%)	45 (67.2%)	67 (100%)	84
AH Sputum Negatives	68	2 (4.9%)	3 (7.3%)	3 (7.3%)	9 (22.0%)	24 (58.5%)	41 (100%)	109
Sputum Negative Cavity/Advanced	14	2 (8.3%)	3 (12.5%)	3 (12:5%)	4 (16.7%)	12 (50.0%)	24 (100%)	38
Sputum Negative Moderate	22				5 (29.4%)	12 (70.6%)	17 (100%)	39
Sputum Negative Minimal	32	---	---	---	---	---	---	32

fell from 35.7% at the end of 12 months to 20.2% at the end of 24 months. The corresponding drop in the case of sputum negative cases was from 73.4 to 62.4%. A remarkable feature of the behaviour of the sputum negative cases is that, at the end of two years, while all (i.e. 100%) those who were described to have minimal lesions in their lungs were defaulters, among those with moderately advanced disease the percentage was 56.4 and among those having cavity and/or advanced lesions it was 36.8. The corresponding percentages of defaulting at the end of 12 months were 100.0, 59.0 and 65.8, while the percentages at the end of 18 months were 100,0, 56.4 and 42.1.

From the above findings it appears that the rate of defaulting is related to (a) the extent of the lesion and (b) the precision of the diagnosis. For instance, in the sputum positive group, where the diagnosis is precise and where lesion is expected to be fairly extensive, defaulting was lowest (20.2%). Among the sputum negative cavity and/or far advanced radiological cases, it was somewhat higher (36.8%); it rose further (to 56.4%) with the sputum negatives having moderately advanced lesions and it was maximum (100%) with those having minimal lesions.

A study of awareness of symptoms among persons with pulmonary tuberculosis in a rural community in South India (5) revealed that when the radiological lesion was confined only to one zone, only 35.6% were worried about the symptoms; but when the lesion covered 5-6 zones, the percentage went up to 84.6. If it is assumed that the extent of worry caused by the disease is related to the extent of the lesion, it can be inferred that the extent of worry caused by disease provides the motivation for different patterns of collection among different categories of cases. One conclusion from this finding is that motivation for drug collection is selectively high among those who, from epidemiological as well as sociological and clinical angles, need them most.

(d) *Total collection of drug during the 24 months :*

It may be observed (table 3) that among the sputum positives, of the 67 who had completed collections for 10 months or more, 57 (85.1%) had made 19 to 24 months' collection, with 45 (67.2%) being in the 22 to 24 months groups. The pattern of drug collection among the sputum negative "regulars" is almost similar. Of the 41 sputum negatives who made collections for 10 months or more, 33 (80.5%) had collected between 19 to 24 months, with 24 (58.5%) being in the 22 to 24 months group.

B. *Correlation of drug collection with bacteriological status at the end of two years :*

(a) *Bacteriological status of the initially sputum positive cases :*

Only 5 out of the total of 84 initially smear positive cases were found to be culture positive at the end of two years (table 4). This gives a 94.0% sputum conversion from positive to negative. It is significant that of these 5, only 1 had taken less than 10 months' treatment; one case had 10 months' treatment, and the other 3 had taken 22 to 24 months' treatment. Also, out of the 17 who failed to take 10 months' treatment, even in two years, 16 (i.e. 94.1%) were found to be culture negative at the end of two years. The conversion rates among the 17 "defaulters" and 67 "regulars" were thus almost the same.

(b) *Bacteriological status of the initially sputum negative cases :*

(i) *Status of the sputum negative cases as a whole :*

Of the 68 "defaulters" (table 4), only 1 became culture positive at the end of two years. Of the 41 who were "regulars", none became culture positive.

(ii) *Status of sputum negative cases having cavities and\or advanced lesions :*

14 out of 38 patients belonging to this category (i. e. 36.8%) were defaulters (table 4), but none of these defaulters became sputum positive.

(iii) *Status of sputum negative cases with moderate lesions :*

Of 39 cases in this group, 22 (i.e. 56%) were defaulters. Of them (i. e. the 22 defaulters), only 1 became culture positive at the end of two yerrs. None of the regulars became culture positive.

(iv) *Status of sputum negative cases having minimal lesions:*

All the 32 (i.e. 100%) cases which had minimal lesions turned out to be defaulters. Culture examination of the sputum at the end of two years revealed that, despite all the "defaulting", none of them became sputum positive at the end of two years.

TABLE 4

Correlation of total drug collection with sputum status at the end of two years

Initial sputum Status	Sputum status after two years	Less than 10 months	10 months or more			Total
			10-18 months	19-24 months	Total	
Sputum positive	Positive	1	1	3	4	5
	Negative	16	9	54	63	79
	Total	17	10	57	67	84
All sputum Negatives	Positive	1	—			1
	Negative	67	8	33	41	108
	Total	68	8	33	41	109
Sputum Negative Cavity /Advanced	Positive	—	—	—	—	—
	Negative	14	8	16	24	38
	Total	14	8	16	24	38
Sputum negative Moderate	Positive	I	_		—	1
	Negative	21	—	17	17	38
	Total	22	—	17	17	39
Sputum negative Minimal	Positive	—				_
	Negative	32	—	—	—	32
	Total	32	—	—.	—	32

Discussion:

The findings of this study have tended to confirm some of the main conclusions of the Bangalore study, namely:

1. A substantial number of patients continue to collect their drug even after completion of the first 12 months; by calculating defaulting in terms of drug collection in 12 months, 110 out of 193 (i.e. 57.0%) were defaulters; however, in terms of collection in 24 months, 85 out of 193 (i.e. 44.0%) were defaulters.
2. The propensity to default appears to be inversely related to precision of the diagnosis—while only 17 out of 84 (i.e. 20.2%) of the initially sputum positive cases were defaulters at the end of two years, all the 32 patients (i.e. 100%) who were put on treatment on the basis of minimal radiological lesions, were defaulters.
3. Despite obvious irregularities in the collection of drug among the patients, the results of bacteriological follow-up at the end of two years were unexpectedly encouraging—79 out of 84 (i.e. 94.0%) of the initially smear positive cases were found to be culture negative at the end of two years. More significantly, among the 17 smear positive cases who made less than 10 months' collection in two years, 16 (i.e. 94.1%) were found to be culture negative.

Defaulter rate, as defined traditionally (i.e. percentage of persons collecting drugs for less than a specified period, say 10 months, within one year) has frequently been used as an index of effectiveness of a tuberculosis programme. The findings of this study indicate that calculation of drug collection over a longer period of time, say two years instead of the traditional one year, and greater precision in the diagnosis of the persons who are put under treatment can go a long way in developing a more precise index of effectiveness of a programme. These findings thus lend support to the contention of the WHO Expert Committee on Tuberculosis (1964) (6), that only the bacteriologically confirmed persons should be categorised as cases of pulmonary tuberculosis and that those having radiological manifestations only might be treated as mere "suspects".

While it might not be justifiable, on epidemiological, clinical as well as sociological grounds, to deprive all the sputum negative radiological cases (the mere "suspects") of benefits of chemotherapy, there appears to be a strong case for adopting somewhat stricter criteria for making radiological diagnosis in tuberculosis clinics. The Bangalore study (3) revealed that of the 179 culture negative cases, who were put under treatment on the basis of radiological findings, only 52 (i.e. 29.0%) were confirmed as cases by a panel consisting of two independent readers and an umpire reader. Application of stricter criteria for diagnosis of sputum negative radiological cases would thus help in cutting down the number of "non-cases" who are put under treatment. This improvement in the precision of diagnosis will, as borne out by the findings of the present study, help in bringing down the defaulter rates in tuberculosis clinics.

An overall assessment of the consequences of treatment default in the clinic reveals that of the 85 patients who failed to collect 10 months' treatment in two years, at the most two can be conceived of having an unfavourable result i.e. of the 17 sputum positive defaulters, only one failed to convert from positive to negative, while of the 68 sputum negative defaulters, only 1 became culture positive. In other words, had the clinic taken most vigorous steps to ensure that there were no defaulters among the patients who were put under treatment, they could have, at the most, done some benefit to only two persons.

These findings are in conformity with the Bangalore findings and they underline the fact that in the National Tuberculosis Programme, the problem of defaulting does not present as big an obstacle as is now being made out.

Another interesting finding of this study is that the high conversion rates (table 4) do not seem to be related to the degree of collection. It would, however, be hasty to conclude from this analysis of the clinic records that the drugs collection had nothing to do at all with conversion rates. As revealed in the more detailed study carried out with the Bangalore patients (3), such factors as treatment prior to coming to the clinic for diagnosis, treatment obtained from sources other than the clinic, spontaneous cure among some tuberculosis cases and nature and extent of the initial pulmonary lesion, also play a significant part in bringing about conversion.

It may also be noted that both in this as well as in the Bangalore study, a fairly large proportion of the patients (20.3% in this case) had died at the time of the follow-up study. If these cases were kept alive through early

treatment and had some of them remained sputum positive during this period, the conversion rates would have been somewhat lower than what is recorded in this study.

Another consideration in this context is that of those who were initially resistant to the drugs. As it was not possible to have any facility to carryout sensitivity tests, either at the initial stage or at the final stage of the study, it is not possible to get any idea of the nature of behaviour of those persons who were initially resistant to the drugs. It is also not possible to find out the extent to which treatment of the initially drug sensitive cases became ineffective because of development of drug resistance in the course of the treatment. However, the peculiar finding that of the 5 initially sputum positive cases who did not convert at the end of two years, 3 had collected the drug for the maximum period, i.e. 22 to 24 months, can be explained by assuming that these 3 cases were initially resistant to the drug. Also, on the basis of the Bangalore study, it will not be unreasonable to suspect that a substantial number of those who died during the two years were resistant to one or more of the drugs.

Summary

A two-year follow up study of treatment default among 193 patients of pulmonary tuberculosis receiving domiciliary treatment in a Delhi urban clinic, providing services according to the broad recommendations of the National Tuberculosis Programme, revealed that the percentage of defaulting (i.e. collecting drug for less than 10 months) fell from 57.0% to 44.0% when the duration for calculating drug collection was raised from 12 months to 24 months. The propensity to default appears to be inversely related to—(a) the precision of diagnosis; and (b) the extent of lesion; while the defaulter rate was 20.2% among those who were intially sputum positive, it was 100% among those sputum negative cases who had only minimal radiological lesions. Perhaps, because of these considerations, of the 85 cases who were considered as defaulters on the basis of collections even in 24 months, only 2 showed unfavourable results on bacteriological examination.

This study thus questions the rationality of assessing the performance of a tuberculosis clinic on the basis of the "traditional" definition of a defaulter. It has presented data to make a case for a more precise definition of a defaulter by offering a longer period for calculation of drug collection and by stressing the need for greater precision in diagnosis of cases who are put under treatment. Such a definition will have a more realistic clinical, epidemiological and sociological basis. And when such a definition is adopted, the problem of defaulting will not appear as big as is now being made out.

ACKNOWLEDGEMENTS

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LEIOMYOMA OF THE LUNG

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I Primary sarcoma of the lung is uncommon, though a few cases have been reported. The majority of the tumours have proved to be leiomyoma/leiomyosarcoma.

A leiomyoma is also a rare lesion and by definition a malignant growth of smooth muscles. The smooth muscle in the lung is normally a constituent of the bronchial wall and of the blood vessals.

II Case Report :

H. P. male, aged 30, was examined on 13-4-67 for his complaints of irregular fever, cough with expectoration and occasional haemoptysis duration one and half year.

There was no previous history of any apparent illness, nor any family history of tuberculosis.

General examination of the patient showed a person of average built, fairly nourished with no apparent evidence of any anaemia, jaundice or oedema. Clubing of fingers was present. Physical examination showed diminished excursions of the left hemithorax with decreaed resonance and distant breath sounds at the left base. No other abnormal clinical findings were demonstrated.

Laboratory findings regarding blood, urine and stools were within normal limits. Sputum was negative for A. F. B. by direct smear and culture examination.

A radiograph of the chest showed clouding at the left base and retraction of the mediastinum to the left.

Bronchoscopy showed partial narrowing of the left main bronchus with deviation of the carina towards the left. Bronchography was noncontributory.

The patient was kept under observation and treatment with broad spectrum drugs, but there were repeated episodes of Hemoptysis, which were never frank.

A repeat x ray chest after one month did not show any change in the pathology.

On 9-8-67 left thoracotomy was performed. The lung was adherent along the base of the lower and in the costo vertberal gutter. Palpation of the lower lobe showed a circular mass of the size of a hen's egg in the superior segment of the lower lobe which was very densely adherent with the base of upper lobe and the greater fissure was obliterated.

The hilar reaction was moderate with few enlarged hilar glands. A few isolated hard nodules could be palpable in the upper lobe.

A total pneumonectomy was done. The patients convelascence was uneventful.

III Morbid appearance of the resected specimen :

A solid mass about the size of a hen's egg was palpable in the hilar region. A small greyish solid mass was also occluding the lumen of the main bronchus. A few isolated hard soft glands at the hilum were present. A few isolated hard nobules were palpable in the upper lobe. The rest of the lung was healthy and no tubercles were seen. On section, the solid mass was bright yellow in colour and friable in texture. The mass protruding from the bronchus was continuous with main mass and it was extending into the bronchus of lower lobe. The upper lobe was free.

Two of the nobules in the upper lobe were enculeated and were found to contain caseous material. (Cultures of the nodules and the caseous mass were negative for A. F. B.)

IV Histo Pathological Report:

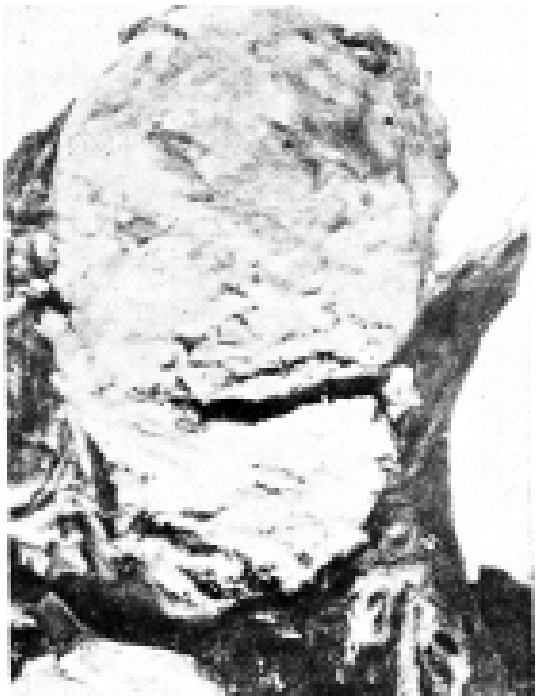
A moderate sized globular mass breaking through the wall of the bronchus but localized and not infilterating the lung parenchyma. The mass was composed of inter lacing bundles of spindle shaped cells with blunt nuclei and acidophilic cytoplasm. Occasional giant cells were seen, but mitosis was infrequent. The lung parenchyma formed a Pseudo capsule and was conjested and collapsed.

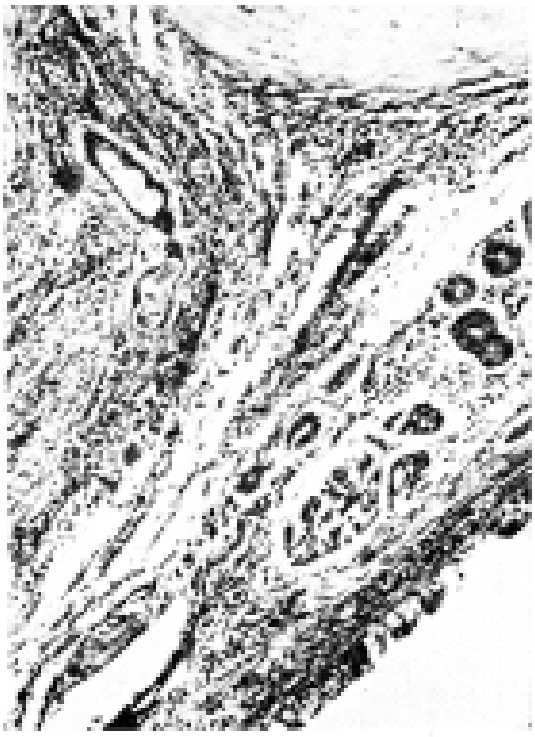
The lower lobe showed bronchiectasis with collapse and fibroses. The upper lobe showed a focus of old healed tuberculosis. The lymph nodes were free.

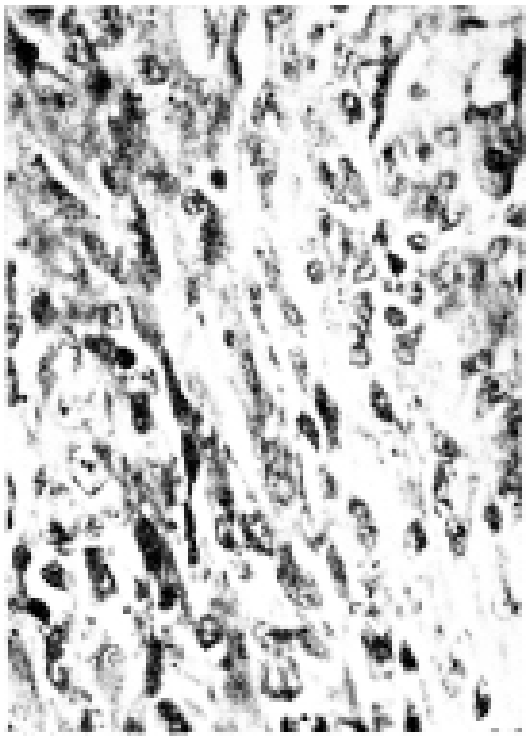
Conclusion :—Leiomyo-Sarcoma of the main bronchus of low grade malignancy obstructing lower lobe and causing bronchiectasis.

V Discussion

Leiomyoma may arise any where in the lung. Sometimes these are in the periphery, sometimes these involve almost an entire lobe and at other times these may arise from a bronchus.







Aakhus and Mylius are of the opinion that these tumours develp only from the smooth muscles of the bronchii rather than from the smooth muscles of the blood vessals. These may be located in the main bronchus or in the peripheral lung fields.

The tumour resembles carcinoma in their macroscopic appearance except that these have a more fleshy appearance and even the poorly differentiated tumours tend to be circumscribed and apparently encapsulated.

Occasionally a whirled pattern may be seen with well differentiated lesions. In the less common intrabronchial tumours there may be a polypoid mass of growth extending up to the lumen of the bronchus (Yacuobian-et-al[3]) Metastasis is more frequent from the poorly differentiated tumours and when present these are blood borne. Absence of lymphnode metastasis is one of the characteristics of the neoplasm.

Microscopically the tumours range from the well differentiated fibroleiomyosarcoma with easily demonstrable muscle cells to anaplastic tumours, where histological diagnosis is difficult.

Benigen leiomyomatas have been recorded in the lung in a small number of patients (Agnos and Starkey[2]). It may not be easy to distinguish between a benign tumour of this nature and one of low grade of malignancy.

On rare occasions such a benign tumour may undergo a malignant change (Glennie-et-al[4]).

Most of the leiomyomas reported have been located peripherally in the lung and these peripheral tumours caused no symptoms. Starkey found no characteristic signs or symptoms in the 14 cases reviewed by him.

Newman reported the first authentic case in 1938.

The first case in the English literature was reported by Brunn and Goldman in 1941, followed by Randell and Blades in 1946. Dyson and Trentalance[3] in 1964 collected 26 cases treated surgically. Two cases were treated surgically by Mason and Azeem[8] in 1965. Gale and Debarue reported another case in 1967.

Analaysis of the material of these 29 cases showed that the ages of the patients varied from 20 to 72. 21 were men and 8 were women. In 17 cases the tumour was situated in the main bronchus and in 11 of these the diagnosis was established by bronchoscopy. In 12 cases, the tumour was situated peripherally and bronchoscopy was negative.

The final diagnosis of any of these tumours is histological and is straight forward for well differentiated lesions.

The treatment of Leiomyoma of the lung and bronchii has been surgical excision. Irradiation has little therapeutic value. Early excision is the only hope of cure.

The Prognosis with surgical excision is excellent.

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A FEW CASE REPORTS OF PULMONARY TUBERCULOSIS WITH INTERESTING ASSOCIATED PULMONARY CONDITIONS

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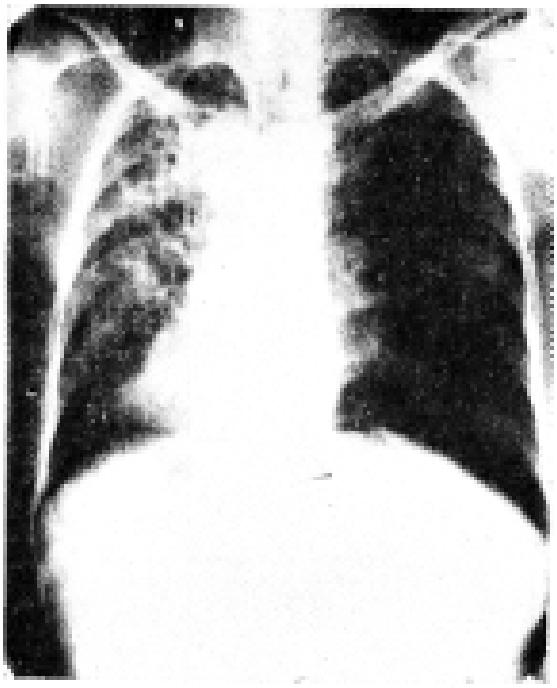
Introduction

Patients with pulmonary tuberculosis are subject to non-tuberculosis pulmonary lesions **e.g.** inhalational diseases notably silicosis, bronchial asthma or malignant neoplasms may often co-exist with pulmonary tuberculosis and may sometime be of greater concern to the patients than tuberculosis. Because of the comparatively rare coincidence with pulmonary tuberculosis cases of Kartagener's syndrome, situs inversus, multiple cysts in lung, pulmonary aspergillosis and primary thoracic neuroblastoma with pulmonary tuberculosis (sputum positive) amongst the patients attending District Tuberculosis Centre, Bikaner, are being reported here.

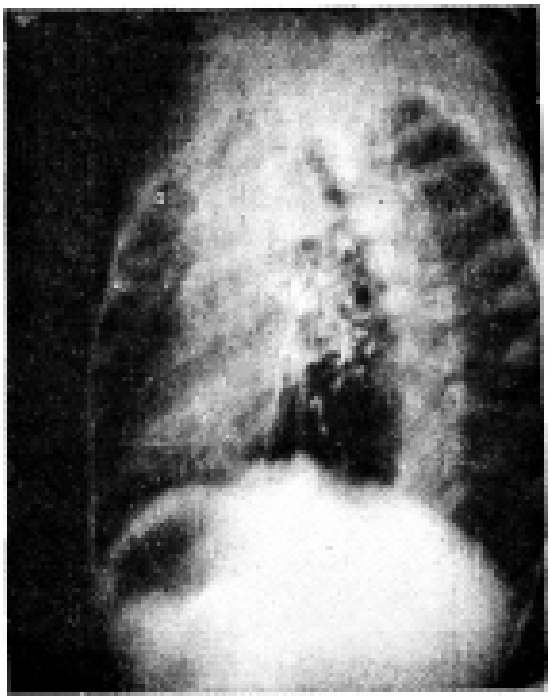
**Case I*— Pulmonary tuberculosis with Kartagener's syndrome.

Shri S. L., male aged 25 years, reported to this centre, on 6-4-1966, complaining of cough of 17 years' duration, at first dry and later on with expectoration which was progressively increasing in quantity during last 7 to 8 years. During last two years cough and expectoration were more troublesome and he had recurrent haemoptysis. He was a married man with one son. He had three brothers and two sisters, all of whom were healthy except for one brother who was brought for investigations on our advice and whose case is also being reported here. Physical examination of Shri S.L. revealed that he was a well built and fairly nourished person.

Skiagram of chest (Fig. 1) after barium meal swallow, revealed the stomach to be on the right side, dextrocardia, homogeneous opacities in right upper and mid zones and mottled opacities in the left upper zone. Patient was hospitalized. Bronchogram (Fig. 2) revealed bronchiectasis in the right lower lobe. Skiagram of skull (Fig. 3) showed agenesis of frontal sinuses. Sputum was repeatedly positive for AFB by direct smear method. ESR was 110 during first hour and the total and differential leucocytes counts were normal. Electrocardiogram (Fig. 4) was consistent with situs-inversus. The case responded favourably to anti-tubercular treatment with isoniazid, streptomycin and thiacetazone.

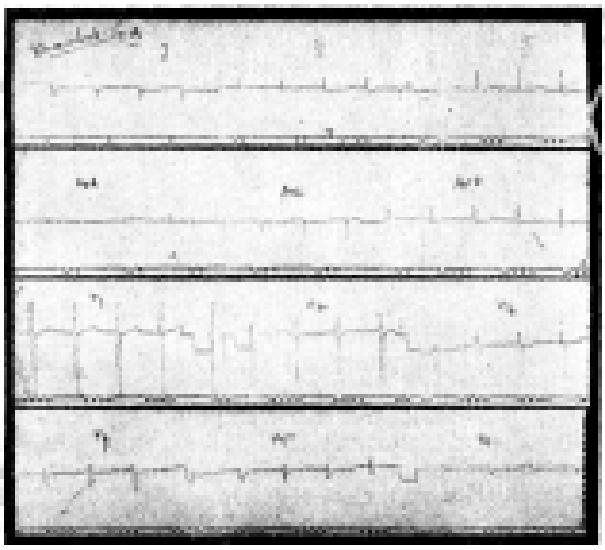


(Fig. 1)



Also being reported in Indian Journal of Chest Diseases as one of the two case reports of Kartagener's syndrome.

(Fig. 3)



(Fig. 4)

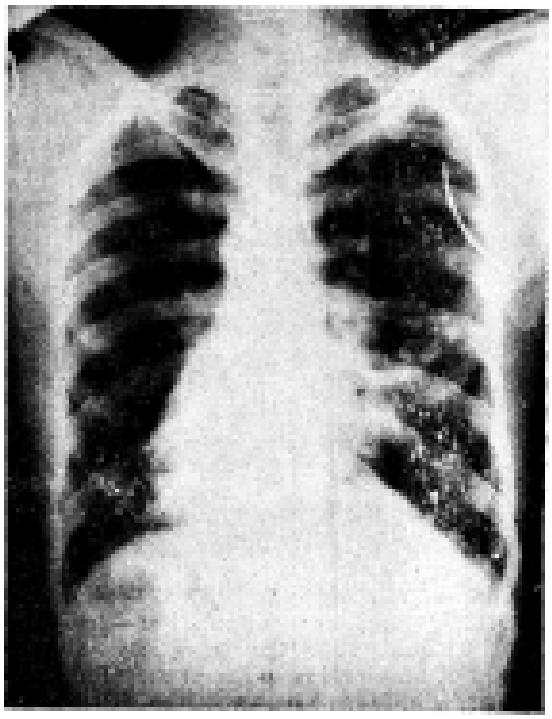
Comments

This case manifested the three classical components of Kartagener's syndrome namely situs inversus, bronchiectasis and agenesis of paranasal sinuses in addition to the bacillary (sputum positive) pulmonary tuberculosis.

Incidence of situs-inyersus among general population is 1 in 8,000" (Varrand et al, 1960). Bronchiectasis occurs in 15 to 20% (Oslen, 1943 : Adam and Churchill, 1937) of the persons with situs-inversus. Thus Kartagener's syndrome is a rare clinical entity. Upto January, 1962 Chang reviewed 162 cases in the world literature and after that many more have been reported by Schoemberlen and Carey (1963), Segal (1963), Logan (1965) and Ballestro (1967). In addition to these, many cases have been reported in Indian literature particularly by Jassani (1962), Mital (1965), Verma (1965), Saxena (1965) and Chandarsekhar and Pai (1966). Co-existence of this syndrome with other associated pulmonary pathology, particularly pulmonary tuberculosis has not been reported so far in the available literature (except that Kartagener, 1933 observed a few tubercles in the lungs of his fourth case of this syndrome during postmortem study). Co-existence of these two clinical entities can not be explained by any hypothesis and is probably a mere coincidence.

Case II--Pulmonary tuberculosis with situs-inversus.

Shri M. L., male, 22 years reported because his brother (case I of this paper) was advised to call all his brothers and sisters for examination to support the possibility of familial incidence of Kartagener's syndrome in sibllings. On enquiry he revealed that he was having cough with expectoration for the preceding few months. His chest skiagram (Fig. 5) showed situs-inversus and a few cystic spaces in left mid zone. His sputum was positive for AFB by direct smear. He totally



(Fig. 5)

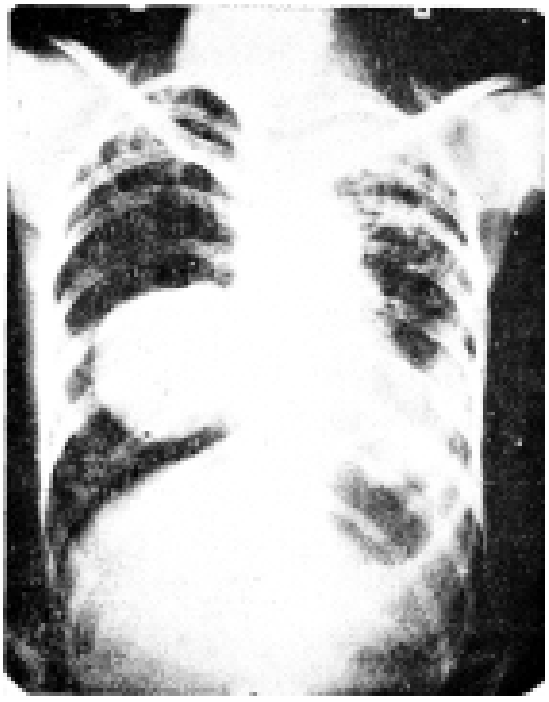
refused other investigations necessary for a case of situs-inversus. However the investigations which could be carried out provided evidence of situs-inversus with pulmonary tuberculosis.

Comments

High familial incidence of Kartagener's trial (which includes situs-inversus) has been reported by Kartagener (1933), Bergstrom (1950), Safian (1959), Menon (1961), Jassani (1962), Morals and Ramos (1962), Schoemberlen (1963) and Logan (1965). The fact that Kartagener's syndrome occurs in a single generation points to an environmental rather than a genetic factor (Tausseq, 1960). Source of tuberculous infection was most probably, his brother S.L. (Case I of this paper) who was an open case of pulmonary tuberculosis.

**Case III*—Pulmonary Tuberculosis with Neuroblostoma.

Smt. G. D., female, 18 years, was under treatment at this centre for pulmonary tuberculosis. She had irregular anti-



(Fig. 6)

tubercular treatment during last 4 to 5 years. On 14th July, 1966 she reported with a complaint of heaviness in the right chest for preceding one month. Skiagram of the chest (Fig. 6) was then taken which revealed a round opacity in right lower zone in addition to bilateral tubercular shadows. For further investigations regarding this shadow the patient was hospitalized. After a few days of admission, patient felt weakness of her lower limbs, which rapidly progressed into complete loss of motor power of lower limbs associated with loss of control over bladder and bowels. Physical examination revealed spastic type of paraplegia. The knee and ankle jerks were brisk and Babinski's sign was positive on both sides. Abdominal reflexes were absent. On palpation there was a tenderness at the level of spinous processes of D-7, 8 vertebrae.

Skiagram of chest (Fig.6) revealed (a) patchy opacities and multiple ring shadows scattered over whole left and upper zone of the right lung; (b) and almost rounded homogenous shadow adjacent to 7th, 8th and 9th dorsal vertebral bodies in the right lower zone; and (c) erosion of the posterior ends of the 6th, 7th and 8th ribs. Myelogram from lumbar route showed a hold of myodil column at the level of D-8 , vertebral body. The cranial end of myedil column along with translucent shadows of the spinal cord were deviated to the left suggestive of extradural medullary growth.

Sputum was repeatedly positive for AFB by direct smear. ESR was 110 mm. first hour. Other laboratory investigations were not of significance. Laminectomy exploration from D-5 to D-10 revealed a violet coloured mass extended for about 8 cm.; vertically in extradural space. It appeared to have connection with intra-thoracic mass through intervertebral forameon. Thoracotomy through 8th rib was performed simultaneously, a spherical soft bluish mass could be seen denting the lung parenchyma but had small connection with intraspinal part of the tumour. The tumour was removed and sent for histopathological examination. The pathologist reported it to be a neuroblastoma.

Comments

In this case pulmonary tuberculosis (bacteriologically confirmed) was associated with primary intrathoracic neuroblastoma. Primary intra-thoracic neuroblastoma is of rare occurrence. The tumour was primary in the thorax in 2 of 32 cases studied by Kinacid (1957), 6 out of 43 cases reported by Barett and Toye (1963) and 11% of 217 reported by Gross (1959). Most of the cases usually occur in first few months to early childhood. The patient now being reported was an adolescent which is an unusual occurrence,

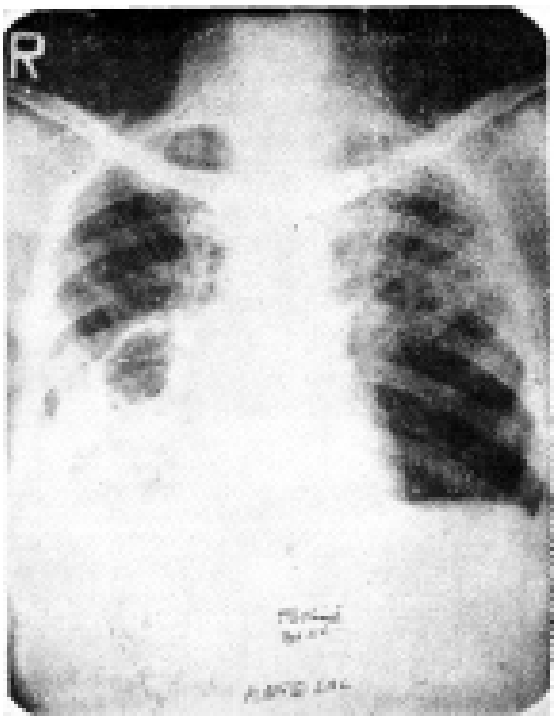
*Also reported in the Indian Journal of Radiology, 21 ; 156, 1967.

In the absence of any metastasis the diagnosis was dumb bell neurofibroma till the tumour was removed and histopathological examination revealed it to be a neuroblastoma.

Co-existence of pulmonary tuberculosis and neuroblastoma is also probably a coincidence.

Case IV—Pulmonary tuberculosis with aspergillosis

Shri M.L., male, 50 years, who was a stone cutter for 30 years, was diagnosed as a case of silico-tuberculosis on 22-7-63. His sputum was repeatedly positive for AFB by direct smear. He had anti-tubercular treatment (63 gms. of streptomycin, 1,000 tablets of isoniazid 100 mgm. each and 120 tablets of Isoniazid thiacetozone combination) upto January, 1965. There was no recorded evidence of the use of corticosteroid. Routine periodically assessment of the disease was made on 9-1-1965. His sputum was still found to be positive for AFB and skiagram of chest revealed (Fig.7) a fairly big cavity in



(Fig. 7)

right lower zone and scattered opacities in both the lungs more in the upper zones. Since there was no improvement, his sputum was sent for culture and sensitivity tests. Sputum culture was reported to be negative for AFB but positive for aspergillus fumigatus. Culture on Sabouraud's medium was repeated twice and both the cultures yielded a rich and luxuriant growth of the fungus.

Comments

This case had bacteriologically confirmed pulmonary tuberculosis; and probably aspergillosis, since rich and luxuriant fungal growth was obtained twice in culture, though radiological and histo-pathological evidence were lacking. The co-existence of fungal disease and tuberculosis has been reported previously. Reams (1960) and Davis et al (I960) reported cases of coccidiodomycosis with tuberculosis. Hall and Colley (1960) and Stein et al (1962) reported cases of Nocardiasis with tuberculosis. Fisher et al (1966) reported a 54 years, old woman having generalised tuberculosis with pancytopenia and aspergillosis as a terminal event and remarked that presumably due to reduction in patient's resistance as a result of leucopenia with infection and effects of steroids, wide-spread lesion of aspergillosis developed. Teramatsu (1966) opined that decreased local and generalised resistance appeared to be contributory factors in the occurrence of aspergillosis secondary to pulmonary tuberculosis. He further remarked that debilitating disease, prolonged use of antibiotics and chemotherapy, use of corticosteroids, anti-tumour drugs and irradiation, all seem Jo be pre-disposing factors.

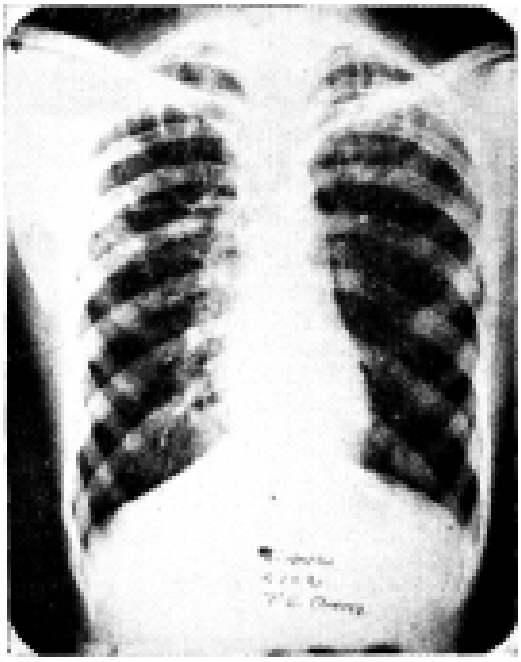
In the case under report, decreased general and local resistance because of far advanced tuberculosis with silicosis and use of anti-tubercular antibiotics are presumably responsible for pulmonary aspergilbsis.

Case V—Pulmonary tuberculosis with multiple cysts in lung.

Shri J. R., male, 20 years, reported to this centre on 2-10-1965 complaining of cough with moderate expectoration of six months' duration. On careful enquiry he revealed that in fact he had had slight cough (dry) since the age of six months but that it had lately become more troublesome and productive. He also complained of low grade fever and loss of appetite. He completely denied history of previous treatment for his cough.

The patient was a young man of average built and nutrition. Digital clubbing was not definite. Left upper half of the chest was dull on percussion and manifested bronchial breathing, increased vocal resonance and coarse

moist 'sounds. His sputum was positive for AFB, by direct smear. His chest skiagram (Fig. 8) revealed a fairly big cavity with an

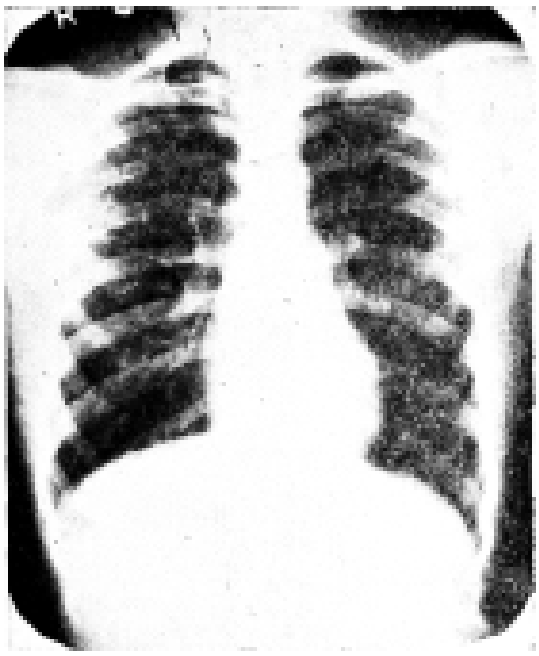


(Fig. 8)

opacity in the left upper zone. There were multiple thin walled spaces in whole of the right upper zone. He was treated with 150 mgm. thiacetazone plus 300 mgm. isoniazid to be taken in one dose daily for a period of one year. Conversion of his sputum was obtained within three months and the disease in the left lung almost completely cleared after a treatment of one year and cystic spaces in right upper zone of the lung field remained unchanged as seen in the skiagram of the chest dated 21-9-1966 (Fig. 9).

Comments

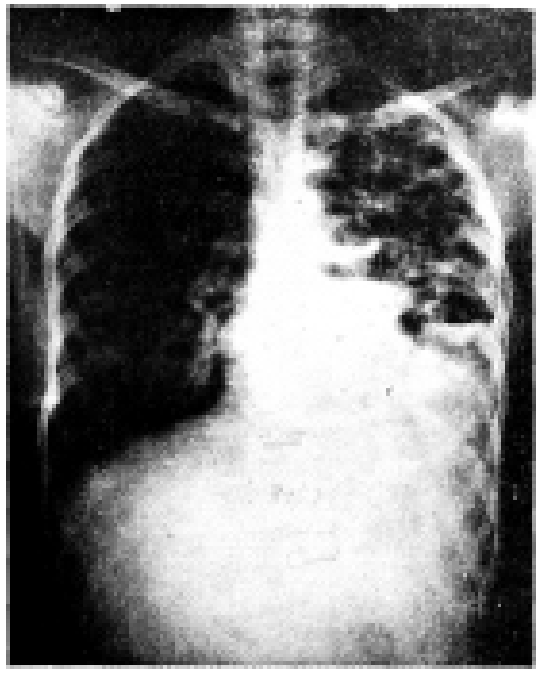
The patient was a bacteriologically confirmed case of pulmonary tuberculosis who responded favourably to anti-tubercular treatment. There were multiple cystic spaces in right upper zone which remained unchanged after the anti-tubercular treatment for one year. They seemed to be lung cysts though their presence could not be confirmed because the patient refused hospitalization for further investigations. These cysts may have been the cause of slight cough (dry) since the age of six months. Because of the duration on cough it may be presumed that cysts were probably congenital in nature. As an alternative these could be acquired cysts e. g. INH cysts or



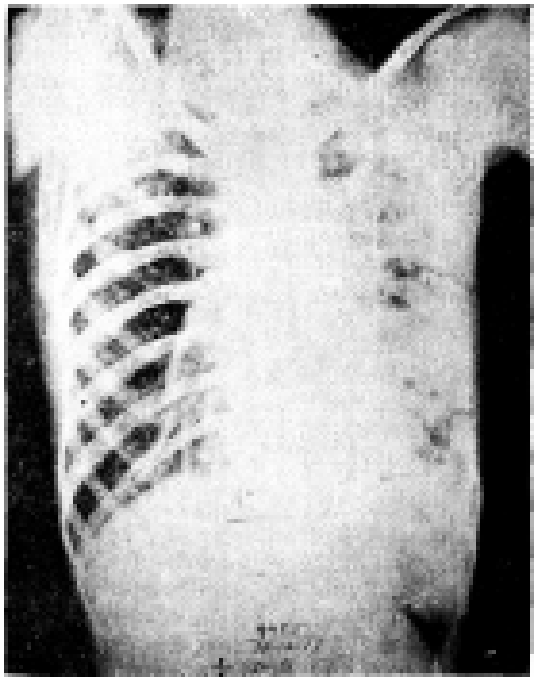
(Fig. 9)

staphylococcal cysts. Co-existence of cystic disease of lung and pulmonary tuberculosis may be only a coincidence.

Two more cases, whose clinical and radiological pictures (Fig. 10 & 11) simulate cysts in left lung and their sputum have been found



(Fig. 10)



(Fig. 11)

General comments

positive for AFB (direct smear) are currently under observation of the author. They are being investigated.

In District Tuberculosis Centres, where radiological (skiagrams of chest) and bacteriological (sputum smear examination) facilities are available, one is likely to come across and can suspect co-existence of other pulmonary disease with pulmonary tuberculosis and therefore such possibilities though very infrequent may be kept in mind. Occasional attendance of such cases in District Tuberculosis Centres keeps our clinical acuity sharp and alive. Such suspected cases should be persuaded to get hospitalized where this facility is available, for further investigation and treatment.

ACKNOWLEDGMENT

Author is thankful to Dr. D. G. Ojha, Principal and Controller, S. P. Medical College, Bikaner, for his kind permission to use the hospital records to publish these case reports.

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NEWS & NOTES

TB Seal Sale Campaign

The 19th TB Seal Sale Campaign will commence, as usual, on October 2, 1968. So far the State Associations have indented for 1,68,00,000 TB Seals. The Railway Board, All India Radio, Rotary and Lions Clubs, Y.M. C.A.s and Y.W.C.A.s and other welfare organisations have been requested to help the campaign. Donations of space and cash to buy space in the Newspapers for the publicity of this campaign are being received by the Tuberculosis Association of India.

Major (Dr.) Khushdeva Singh Honoured

Major (Dr.) Khushdeva Singh, Honorary Secretary, TB Association of Punjab, has been nominated as Emeritus Fellow of the American College of Chest Physicians, Chicago.

Stamp collections

All TB workers, hospitals, sanatoria and clinics etc. are requested to send used Indian postal stamps to this Association for sending them to Norwegian TB Association, Oslo. They have offered to assist this Association by selling them and remitting the proceeds.

Second Visit to Matheran : Maharashtra : New Centres Opened

The Maharashtra State Anti-TB Association conducted the second visit to Matheran early in June in order to carry out (1) examination of children and adults whose Mantoux test was positive, (2) to give BCG Vaccination to children who missed it earlier and (3) to give oral polio vaccine to children below the age of 5 years. The party consisted of Drs. M.D. Deshmukh, M.M. Wagle, S.A. Shah, J.C. Kothari, B.T. Patil and Shri R N. Kalo. The party examined nearly 110 children out of whom 60 were marked for screening. 29 contact families were also advised screening examination. A total of 50 direct BCG and 150 polio vaccinations were given. 500 tablets of Isonex were donated for carrying out prophylaxis of Mantoux positive children.

Another party which consisted of Dr. S.N. Bhayekar and Mr. S.L. Anerao visited Neral with the purpose of screening the selected patients from Matheran and to open a treatment centre at Neral. Medical Officers who examined 45 patients marked 30 for screening. Out of 30, radiological evidence and disease was found in 10 cases. Sputum of suspected cases were also collected.

A TB Centre was also opened at Virar in view of the interest in tuberculosis control programme shown by Mrs. Vartak, Chairman of Virar Panchayat Samiti, Mr. Choudhuri, Chairman of Taluka Panchayat Samiti, Virar and Dr. S.R. Koti, Medical Officer in-Charge of Public Health Centre. The party consisted of Drs. M.D. Deshmukh, T.B. Master, S.N. Bhayakar, Shri R.N. Kalo and S.L. Anerao. The inaugural meeting was attended by local doctors, social workers and members of Manila Mandal etc.

Dr. Deshmukh in his speech emphasised the importance and effectiveness of domiciliary treatment as compared to institutional treatment and put forward the results of the famous Madras trial.

Another TB Centre was opened at Tare in Kolaba district at the request of Dr. Parekh, Shah and many others who have been giving free advice at Yusuf Meheralli clinic branch at Tare. The party consisting of Dr. M. D. Deshmukh, Dr. S.N. Bhayekar, Dr. B.T. Patil, Shri R.N. Kalo and Shri B.S. Kadam visited Tare and examined nearly 50 patients and selected 23 for screening. Treatment cards were made for the patients. Dr. Deshmukh explained to social workers the need of regular treatment and showed how to maintain Index and Treatment Cards.

Eastern Regional Conference

The Sixth Eastern Regional Conference of the International Union Against Tuberculosis will be held in Kuala Lumpur, Malaysia from llth to 15th November, 1968. The delegation will include Dr. M.D. Deshmukh, Dr. R. Viswanathan, Dr. N. L. Bordia, Dr. H. B. Dingley, Dr. S.P. Pamra, Dr. C.N. Hazarika and Sri B.M. Cariappa.

Shri B.M. Cariappa is a member of the Executive of the Regional Committee and also the Convenor of the Ad-hoc Committee on contributions to the Regional Committee by member countries.

The British Nepal Medical Expedition

Early in 1967, Sir Clement Price Thomas, KCVQ, the distinguished chest surgeon, invited the Director General of Chest and Heart Association to meet a young English doctor who was collecting funds for medical research in Nepal. This doctor. Dr. John Cunningham, with medical colleagues and nurses, is hoping

to establish the British-Nepal Medical Expedition, the primary aim being to carry out research into tuberculosis and lung cancer in Nepal. The members of the Expedition would give their services freely, and funds collected would be used for the expenses of the expedition and the research project itself.

Dr. Harley Williams introduced Dr. Cunningham to Shri B.M. Cariappa, Secretary General of the Tuberculosis Association of India with which the CHA has always had a very close working relationship. They met in New Delhi in April, 1967 before Dr. Cunningham went on to Kathmandu to make a preliminary reconnaissance. Shri Cariappa was able to put Dr. Cunningham in touch with Dr. Joshi, Honorary Secretary of the Nepal Tuberculosis Association and Miss T.K. Adranvala, Nursing Adviser to the World Health Organisation in Kathmandu.

Now, a year later, in the spring of 1968, Dr. Cunningham is leading an eleven member strong medical team to Nepal. This project which is under the sponsorship of Princess Princep Shah, Chairman of the Nepal Red Cross, is planned to last three years. Initially the expedition will establish a base clinic for outpatients with small dispensaries in distant villages, where locally recruited staff can be trained in basic nursing and medical techniques. The team also propose to build a small hospital when the clinic has been in operation for six months.

Funds are to be made available to the British Medical Trust through the MacRobert Trust in India, who are backing this project and will do everything possible to make the mission in Nepal a success.

Secretary General Felicitated

Shri B.M. Cariappa, Secretary-General, Tuberculosis Association of India, was felicitated by friends and leading TB workers in Bombay under the auspices of the Maharashtra State Anti-TB Association recently on the announcement of the 1968 "COMMONWEALTH AWARD" from the Chest and Heart Association, London, in recognition of his distinguished services in the field of voluntary TB control programme.

Technical Committee Meeting

The Technical Committee of the Tuberculosis Association of India met in Trivandrum (Kerala State) on the 23rd and 24th of September. After working out the programme for the 24th National Conference on TB and Chest Diseases to be held in Trivandrum from 3rd to 6th January, 1969, the Committee finalised the Manual on Classification of Tuberculosis and formulated certain recommendations to cover institutions in TB in Medical Education. The Committee was invited by the Principal of the Medical College in Trivandrum to address the medical students. During a two-hour discussion, Drs. Bordia, M.D. Deshmukh, H.B. Dingley, S.P. Pamra, Y. Rajasekhara and N.K. Menon spoke to the Medical College students on diiferent aspects of TB Control. The students showed keen interest in the discussions. It was suggested that at the time of the National TB Conference, TB specialists may kindly visit the College and organise a Symposium on the various aspects of tuberculosis.

Another Rotary Club's Gesture

The Association has received an intimation from the Rotary Club of Bangalore that they will be actively participating in the TB Seal Sale Campaign and donating a water pump to the Shantabai Devarao Shivaram Sanatorium for the benefit of TB patients in that Sanatorium.

Rail Travel Concession

The Railway Board, Government of India have agreed to single fare double journey rail travel concession for delegates attending the conference in Trivandrum. The concession is allowed only to persons with earnings/emoluments of not more than Rs. l,000/-per month and subject to the following conditions :

(i) In the case of first class, the concessional return fare will be subject to a *minimum* of two single journey full first class fares for 400 kilometres ; and

(ii) In the case of second and third class the concession will be admissible for persons travelling from beyond 250 kilometres from the place of the conference (Trivandrum) without any minimum fare.

Tuberculosis Health Visitor's Course

The Tuberculosis Health Visitor's Course conducted by the Association will commence.

in the New Delhi TB Centre in the first week of January, i968. The duration of the course is one year of which one month will be in the College of Nursing, seven months in the New Delhi TB Centre and one month in the Lady Linlithgow Sanatorium, Kasauli. The candidates will be examined at the end of nine months training and those who are successful will be required to do practical work in home visiting for three months at the New Delhi TB Centre. Certificates will be awarded at the end of one year after successful completion of practical training in the field.

The minimum qualification for admission to this course is Higher Secondary/Pre-university with Science and/or Hygiene and Physiology in the Matriculation. Applications on the prescribed form should reach the Secretary-General, Tuberculosis Association of India, 3-Red Cross Road, New Delhi on or before 25th November, 1968.

The Indian Journal of Tuberculosis

ABSTRACTS

Vol. XV December 1967 Abst. No. 1

Pathogenesis of a First Episode of Chronic Pulmonary Tuberculosis in Man; Recrudescence of Residuals of the Primary Infection or Exogenous Reinfection ?

William W. Stead. Amer. Rev. of Resp. Dis., 1967, 95, 729.

In order to shed new light upon the infectability and re-infectability of man by M. tuberculosis, data from the literature on the development of tuberculosis in two comparable groups of persons have been reviewed and analysed: one group exposed heavily to tuberculosis and the other exposed only in the course of living in European cities in the period of 1920 to 1940. The results show: (1) Tuberculosis in tuberculin-negative subjects developed proportionate to exposure; (2) among heavily exposed subjects the tuber culin reactors enjoyed a distinct protection from development of disease; (3) among tuber culin reactors the development of chronic tuberculosis did not appear to be influenced by re-exposure to the infection. The small differ ence that was present is readily explained by other factors, such as the greater fatigue and longer working hours in nursing and medical students of that day compared with the con trol college students and office workers.

Thus, there is evidence that man is as difficult to reinfect as are the various laboratory animals in which the problem has been studied. The disadvantage of protection acquired from a healed virulent infection is that it carries with it the danger of reactivation later in life. Such reactivation may occur in various organs, but is most common in the lungs in which hematogenous metastases during the primary infection often leave nodular upper lobe residuals (Simon foci).

A brief account is given of the origin of the erroneous concept that exogenous reinfection is "not uncommon" as a cause of chronic pulmonary tuberculosis in man. A unitary concept of the pathogenesis of chronic pulmonary tuberculosis is presented which appears to explain all the observed facts of the infection more satisfactorily. A most unusual case is presented to illustrate the development of chronic pulmonary tuberculosis 17 years after primary infection despite remarkable protection from further exposure.

Much remains to be learned about the pathogenesis of the first clinical episode of chronic pulmonary tuberculosis in a tuberculin reactor. However, the facts now appear adequate for us to abandon 'exogenous reinfection" as a significant factor. The evidence indicates that chronic pulmonary tuberculosis develops from reactivation of dormant foci implanted during primary infection. The need now is to elucidate the mechanism by which late activity develops even after many years of apparent good health and a stable host-parasite relationship.

S.P.P.

A Controlled Trial of Community-wide Isoniazid Prophylaxis in Alaska.

George W. Comstock, Shirley H. Ferebee and Leurel M. Hammes. Amer. Rev. of Resp. Dis , 7957, *95, 935.*

In 1957, a controlled trial of Isoniazid Prophylaxis was initiated in Alaska covering a population of about 7,000. Only 3% of the population refused to participate in the trial. Nearly 95% were Eskimos. Half of the participants were randomly allocated to the placebo group and half to the Isoniazid group, the latter drug being prescribed in a dosage of 5 mg. per kg. body weight for one year. The median length of observation is about 6 years.

The risk of active tuberculosis developing during the study period was greatest among young adults, among positive reactors to tuberculin, and among persons with initial evidence of tuberculosis for which treatment did not then seem to be indicated. For all groups this risk was substantially decreased by isoniazid prophylaxis. The reduction in tuberculosis attributable to isoniazid persisted essentially unchanged throughout the entire period of observation, averaging about 60 percent. Although protection was greatest among persons who took medication regularly for a

full year, some protection was noted even among persons who took isoniazid irregularly and for short periods.

Each year of personnel time invested in a programme of community-wide prophylaxis has already resulted in the prevention of 10 cases of tuberculosis, accounting for 100 person-months of hospitalization. It is concluded that community-wide prophylaxis is feasible under conditions similar to those in Alaskan villages, and that such programmes can be successful both from the humanitarian and economic points of view.

S.P.P.

Epidemiological basis of Tuberculosis Eradication.

01e Horwitz, Penelope G. Payne, and Erik Wilbeck, WHO Bulletin 1966, 35, 509.

A double blind trial in chemoprophylaxis was carried out in the adult population of Western Greenland. About 8,000 adults (constituting 70% of the population) were included in the trial. The treated group were given 2 tablets each of 100 mg INH on two consecutive days of the week for 3 months followed by a 3-month interval of no medication. The 6-month cycle was then repeated. The control group was given 2 identical looking 100 mg tablets of a placebo to which a non-pharmacological dose of INH (0.1 mg) was added to make the placebo resemble INH tablets in taste also. Both the groups were followed for 6 years.

The average annual rate of tuberculosis in the placebo group was 14 per 1,000 population as compared with 10 per 1,000 in the INH group—a reduction of 19%. The treated group had both initial and a prolonged advantage though it seems that this effect decreased over time. The maximum reduction of 22% was found in the first year and the lowest, 22%, in the last year. This reduction is less than in the USPH service trial in Alaska and is probably because the dose of INH given in the Greenland trial was about l/5th of the total dose given in USPH service trial. The author recommends a selective use of chemotherapy viz. in the groups which have a greater tuberculosis risk and which contribute most to the fresh cases of tuberculosis. On this basis the most suitable group would be one with lesions of doubtful activity. In Greenland this group constituted 17% of the population but contributed a case reduction of 33%.

S.P.P.

Psychotoxic Reaction during Ethionamide Therapy.

Frances S. Lansdown, Marianne Beran and Thomas Litwak, Amer. Rev. of Resp. Dis., 1967, 95, 1053.

A case is reported of a 36 years old man in whom striking psychologic changes developed after taking Ethionamide for one year. The patient suddenly developed gross weakness of the extremities and ataxia. Romberg sign was absent. He could obey only simple commands and answer in monosyllables but otherwise sat staring straight ahead without change of facial expression. Symptoms and signs disappeared on withdrawing Ethionamide. The patient was a heavy and chronic alcoholic. It is by no means certain that Ethionamide *alone* was responsible for this manifestation but it is definite that Ethionamide played at least a significant part.

S.P.P.

The Influence of Para-Aminosalicylic Acid on Isonicotinic Acid Hydrazide Blood Levels after Oral and Intravenous Administration.

J. Kreukniet, P.M. Blom van Assendelft, R.P. Mouton, A. Tasman and P.J. Bangma, Scand., J. Resp. Dis., 1966, 47, 236.

The influence of PAS on the INH serum concentration 3 hours after administration of these drugs in 38 patients with pulmonary tuberculosis was studied. PAS both by oral and intravenous administration caused an unmistakable rise in the INH serum concentration in the "rapid INH inactivators". In the group of "slow INH inactivators" there was no statistically significant change in the INH serum concentration for combined INH/PAS therapy.

S.P.S.

Tolerance to Ethionamide and PAS in Original Treatment of Tuberculous Patients.

L. Verbist, J. Prignot, J. Cosemans and A. Gyselen, Scand. J. Resp. Dis., 1966, 47, 225.

One hundred thirty-three patients with previously untreated pulmonary tuberculosis were divided at random into three groups subjected to therapeutic regimens containing besides isoniazid and streptomycin, PAS, or ethionamide (ETH) suppositories. The side effects were compared and the correlations studied between intolerance symptoms and different

other factors, e.g. blood levels, additional pathology, administration of vitamin B complex. The ETH suppository regimen was the best tolerated therapy, whereas the ETH tablet regimen provoked most intolerance. Vitamin B complex had no influence on the frequency of gastro-intestinal and mild neurological disturbances in patients under ETH therapy. The frequency of gastric complaints in the ETH tablet group was found to be inversely proportional to the maximum ETH blood levels reached. With the exception of nausea and vomiting, which were significantly more pronounced in women under ETH tablet therapy, sex, age, profession, and alcoholism did not influence the frequency of disturbances in any of the three regimens,

S.P.P.

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ABSTRACTS

Vol. XV March 1968 Abst. No. 2

Infectiousness of Tuberculosis.

A statement by the Ad Hoc Committee on Treatment of Tuberculosis Patients in General Hospital. Amer. Rev. Resp. Dis.; 1967, 96, 836.

1. Tubercle bacillus is a non-motile organism, readily killed by heat, drying, sunshine, and ultraviolet light.

2. Bacilli must reach the suspected lung tissue, settle down, survive, and multiply before infection is established.

3. The bacillus is transmitted from one person to another by air in the residue of minute droplets of moisture produced during coughing, sneezing, laughing etc.—"droplet nuclei".

4. When larger particles are inhaled, they are stopped in the nasal and upper respiratory passages and are eliminated. Thus they do not lead to infection even though laden with tuber cle bacilli since the upper respiratory tract is resistant to infection.

5. Available evidence suggests that tuber cle bacilli lodged on fomites—linen, furniture, books, and floors—do not constitute a signific ant infection hazard. Hand washing is efficient in removing organisms possibly picked up from fomites or direct contact with infectious sputum or other discharges.

6. Dried secretions are very difficult to fragment and suspend in the air and are ordinarily innocuous, being too large to penetrate into the lung.

7. Breaking the chain of transmission of bacilli from person to person has 2 aspects namely prevention of contamination and elimination of contamination once it has occurred.

8. Effective chemotherapy and covering the nose and mouth by the patient when caughing, sneezing, laughing, etc. are the most effective tools for achieving prevention of contamination.

9. Elimination of contamination can be brought about by effective ventilation and exposure to ultra violet light, if possible.

10. The use of gowns by personnel is ineffective and not called for. Neither are masks indicated for personnel except in instances of intimate face to face contact. If any one is *to be masked, it should be the patient.*

11. In as much as the discharges from body areas afflicted with non-pulmonary tuberculosis do not become air borne, the danger of infection from such sources is remote.

12. The greatest risk of infection arises from undiagnosed and unsuspected cases of pulmonary tuberculosis.

S.P.P.

Education of Patients by Tuberculosis Hospitals.

Jennie H. Rakich, Thomas Moulding. Amer. Rev. of Resp. Dis.; 1967, 95, 866.

One of the frequently expressed justification for hospitalization of patients with active tuberculosis is education of the patients about his disease and to stress and ensure the importance of regular chemotherapy. In 1964, a revealing survey was carried out by the United States Public Health Service in Denver. Questioning and follow up of 87 patients showed that after "discharge from the hospital, only 27.6% were properly motivated regarding the necessity of regular and uninterrupted chemotherapy during their stay in the hospital. The survey strongly suggests that hospitals (even in America*) have not caught up with the times and are not doing a good job of educating their patients.

S.P.P.

Relation between Pre-vaccination and Post-vaccination tuberculin sensitivity.

Gerard Wijsmuller. WHO Bulletin; 1966, 35,459.

BCG vaccination is commonly assessed in terms of post-vaccination sensitivity to tuberculin. While it seems reasonable to equate post-vaccination and BCG-induced tuberculin sensitivity in areas where low-grade sensitivity is uncommon, it might be unjustifiable to do so in areas where such sensitivity is prevalent. The relation between pre-and-post-vaccination

*Editor's remarks.

tuberculin sensitivity in a community with high prevalence of naturally acquired low-grade tuberculin sensitivity has been analysed. It appears that post-vaccination tuberculin sensitivity may be only partly BCG-induced and cannot therefore be considered reliable measure of the success of BCG vaccination in the presence of naturally acquired low-grade sensitivity.

S.P.P.

Effect of Isoniazid on Tuberculosis in Guinea Pigs.

Tor Bjerkedal & Carroll E. Palmer. Scand. J. of Resp. Dis ; 1967,48, 94.

The anti-tuberculous effects of INH of well established infection in over 1600 guinea pigs have been studied for two methods of administering the drug. In one group the daily dose of the drug was given in one single subcutaneous injection and in the other group the daily dose was mixed in drinking water. Treatment was started 3 to 10 weeks after infection, depending on the challenge dose, and was continued for about 1 year.

No appreciable difference between two methods of treatment was observed. Progression of infection was halted and the tuberculin sensitivity waned equally in the two groups. It is concluded that antimicrobial effect of INH is not influenced by a high peak for 4 to 6 hours with negligible concentration for the rest of the day as in the case of single daily dose or by absence of high peak but a sustained concentration when the drug is given in drinking water.

S.P.P.

Tuberculosis in an Autopsy Material.

F. Linell & G. Ostberg. Scand. J. of Resp. Dis.; 1966, 47, 200.

Necrospy was performed in 6,606 deaths (constituting 60% of all deaths) in Malmo from 1960 to 1964. Active tuberculosis was found post mortem in 102(1.54%). Forty eight of the 102 cases were not known to have tuberculosis before death, though they had been cared for in different departments of the hospital for varying periods for conditions other than tuberculosis. The tuberculous lesions were most common in the lungs (94 out of 171). Corticosteroids had been given only in a few of these cases and could therefore not be blamed for activation of any existing inactive lesions. It is concluded that unknown cases were those in which the lesions were sub-clinical though active. The higher age groups contributed more in the entire material as well as in the tuberculosis group especially among the clinically unknown cases.

S.P.P.

Isoniazid Hypersensitivity Reaction involving the Eyes.

Iftikhar Ahmed & Lee A. Clark, Jr. Diseases of the Chest; 1967,52,112.

An unusual case of INH hypersensitivity causing subconjunctival hemorrhages, optic neuritis, iridoplegia and cycloplegia is reported. The patient, 39 year old Negro woman, weight 114 pounds and 2 months pregnant was found to have pleural effusion and was put on INH plus PAS treatment. Daily dose of INH was 300 mg. and PAS 12 gm. The drugs were tolerated very well for nearly 6 weeks before she started having itching, a burning sensation, marked redness and impairment of vision in the right eye. Kidney function was normal. Withdrawal of INH and a short course of steroids led to satisfactory recovery although cycloplegia persisted. The reaction was due to hypersensitivity and not toxicity.

S.P.P.

Ethambutol Isoniazid versus PAS-Isoniazid in original treatment of Pulmonary Tuberculosis.

I. D. Bobrowitz & Donald E. Robins. Amer. Rev. Resp. Dis; 1967, 96, 428.

In a randomized study, 248 previously untreated patients of pulmonary tuberculosis were assigned to one of the 3 following drug regimens:

1. INH 300 mg. daily+ethambutol 25 mg. per kilo for the first 60 days and then 15 mg. per kilo thereafter.
2. INH 300 mg. + Ethambutol 15 mg. per kilo throughout.
3. INH 300 mg.+Pas 4 gm. 3 times a day.

The results were analysed after 4 months treatment. The loss due to problems related to the drug usage, mainly toxicity, was 33% in regimen 3 as against 8% in regimen 1 and 10% in regimen 2 1 i.e. the loss from the INH + PAS schedule was significantly more than in ethambutol regimens. The sputum conversion was 94% in regimen 1 and 88 and 82% in regimen 2 and 3 respectively. There was no appreciable difference in the radiological improvement in the 3 regimens. Far fewer patients were able to

tolerate PAS than ethmabutol. There was only 1 patient who developed eye toxicity (retrobulbar neuritis) to ethmabutol. Many patients showed variations in visual acuity determination during the trial but these patients were almost equally from ethmabutol and non-ethambutol regimens The fluctuations thus were not indicative of visual toxicity and had no relationship to the drugs. In the author's opinion, ethambutol as a companion drug to INH has therapeutic advantages over PAS, gives fewer losses from drug reactions is far better tolerated. S.P.P.

Radiologically undetectable pulmonary collapse in the supine position.

C. Prys-Rberts, J.F. Nunn, R.H. Dobson, R.H. Robinston, R. Greenbaum, R.S. Harris. The Lancet; 1967. ii, 399.

Conventional skiagram in the supine position may sometimes fail to show a collapse of the lung. The differences is due to the fact that, in the upright position, the dependent parts of the lungs are concentrated in the costophrenic angles and in the neighbourhood of the diaphragm where collapse can be easily detected. In contrast, in the supine position the dependent part of the lung is spread out over a comparatively large area lateral to the thoracic vertebrae, spreading over a distance of about seven rib spaces. It might be expected that collapse would occur in a plane parallel to the skin of the back and that this would be specially difficult to see on a P.A. film. The lateral and oblique views may also fail to show the collapse. The fall in arterial PO_2 is a much more sensitive index of shunting through areas of lung which have undergone absorption collapse with the subject in the supine position.

S.P.P.

Clinico-Pathologica Correlation in Chronic Cor Pulmonale.

Gonzalo Sepulveda, E. Rios, J. Leon, A. Illanes, V. Acosta, J. Ahumada and R. Raggio. Diseases of the Chest; 1967, 52, 205

The principal clinical and pathological findings in 40 cases of chronic cor pulmonale have been analysed. In almost every case left ventricular enlargement was seen in addition to the classical right ventricular hypertrophy. The left enlargement was not due to any associated disease that may lead to primary overloading of the left ventricle but was probably secondary to general response of the myocardium to hypoxia, associated with polycythemia, hypervolemia and increased cardiac output, or to a direct hypertrophic stimulus on the myocardial fibres.

Orthopnea and paroxysmal nocturnal dysponea were present very frequently. Pulmonary capillary pressure however was normal in practically all of them and therefore these symptoms could not be due to ventricular failure and were probably due to retention of bronchial secretions since expectoration brought immediate relief. It is suggested that the left ventricular enlargement is not severe enough to impede its performance sufficiently to lead to failure. Electrocardiogram in these cases is not a good index of the severity of ventricular hypertrophy. Further, arrhythmias are rather infrequent in this condition.

S.P.P.

Mediastinoscopy

Eric Carlens & Goran M. Hambraeus. Scand. J. ofResp. Dis.; 1967, 48, 1.

Nine years experience of mediastinoscopy based on more than 6,000 patients is reported. The rate of complications was about 1%; most of the complications being not serious and deaths very few. The reason for a low complication rate is believed to be due to the use of general anesthesia with controlled ventilation by authors.

The main indications are lymphadenopathies and malignancies in the medistinum. In sarcoidosis the diagnosis may be confirmed in almost 100 per cent of the patients in whom other methods have failed. In patients with apparently operable lung cancer, mediastinal spread was found in about 35 per cent of cases. Most of these patients, particularly those with contra-lateral medistinal spread, a finding not detectable by other means, can be spared an exploratory thoracotomy. After routinely performed mediastinoscopy, the rate of exploratory thoracotomy has in many series decreased from an earlier 40 to less than 10 per cent. Mediastinoscopy can also be used for introduction of atrial electrodes in synchronous pacemaker treatment of patients with heart block.

S.P.P.

The immunity confered by effective BCG and vole bacillus vaccines, in relation to individual variations in induced tuberculin sensitivity and to technical variations in the vaccine:

P.O. Arcy Hart, Jan Sutherland and Jacob Thomas: Tub, Land, (1967), 48, 201.

BCG and Vole bacillus vaccines used were highly effective in preventing tuberculosis. The

percentage efficacy of the BCG vaccine (Danish Substrain) was 80% and of the vole bacillus vaccines (four substrains) was 74 %, 91%, 78% and 86% respectively.

The immunity conferred by the BCG vaccine did not depend on the degree of tuberculin sensitivity induced in the individual, which varied widely even though the average level was high.

The immunity conferred by the vole bacilus vaccine also did not depend on the degree of tuberculin sensitivity induced in the individual, this conclusion held equally for subitrain one (which induced a low average level of sensitivity) and for substrain 2 to 4 (which induced much higher average levels of sensitivity, similar to that induced by BCG vaccine).

The average level of tuberculin sensitivity induced by the BCG vaccine was greater for the batches with higher viable counts than for those with lower viable counts and with two successive improvements in manufacturing and issuing technique but there was no definite association of the protective efficacy with viable counts.

The average level of tuberculin sensitivity induced by substrain one of the vole bacillus vaccine was greater after an increase in opacity standard (but still remained well below the level induced by substrain 2 to 4). The protective effect was not definity influenced.

It is concluded that with highly effective tuberculosis vaccines the degree of protection conferred on the individual is independent of the degree of tuberculin shown sensitivity induced in that individual by the vaccinations,

Though technical variations between the various batches of vaccines, within the normal production range, affected the average level of induced tuberculin sensitivity, but did not have an important influence on the protective efficacy of the vaccine.

H.B.D.

Treatment of patients with pulmonary Tuberculosis by twice-weekly intra-muscular injection of streptomycin and isoniazid: A preliminary report of experience in marrakech.

Francois J.M. Burzoni and Claude Durante: Tub, Land, (1967), 48, 187.

Sixty eight patients with Pulmonary Tuberculosis and sputum positive on microscopy were given intermittent Streptomycin 1 Gm (meandose 18.5 mgm/1 Kgm) and Isoniazid 752 Mgm (meandose 14 mgm/1 Kgm body weight) in single dose on two days each week.

All had culture sensitive to both drugs.

Of these, 55 patients completed eight months treatment.

Of these 39 (71%) had negative microsscopy results of sputum examination; 27 or 53% of 51 patients had negative culture of the 24 positive culture, 21 were resistant to one or both of the drugs. 15 were resistant to both Isoniazid and Streptomycin, 5 only to Isoniazid and 1 only to streptomycin.

The results were disappointing and less good than had been reported from the tuberculosis chemotherapy centre in Madras.

H.B.D.

The Immunity conferred by effective BCG and vole bacillus vaccines, in relation to individual variations in induced tuberculin sensitivity and to technical variations in the vaccines.

P. *D'Arcy Hart, Ian Sutherland and Jacob Thomas. Tubercle ; 1961, 48, 201*

Analysis of the 10 years' incidence of tuberculosis in various sub-groups of participants in the British Medical Research Council Trial of BCG and Vole bacillus vaccine shows that the protection conferred by both vaccines was nearly 80%. Further the degree of protection conferred on an individual is independent of the degree of tuberculin sensitivity induced in that individual by vaccine. This conclusion is however valid if the vaccine is technically adequate, is properly stored and properly administered.

The study has also shown that even if post-vaccination allergy is low, the immunity conferred is not parallel to the post-vaccination allergy. It would thus appear unwise to decry the vaccine merely on grounds of a low level of post-vaccination sensitivity.

The analysis however provides no information either on the extent to which post-vaccination sensitivity wanes or disappears or on the relative risk of disease among such individuals and those who maintain their post-vaccination sensitivity. The study therefore does not show whether it is necessary or not to re-vaccinate individuals in whom post-vaccination sensitivity has waned or completely disappeared.

S.P.P.

Sociologic Concomitants of tuberculin sensitivity

Jaine M. Kuemmerer & George W. Comstock. Amer. Rev. of Resp. Dis., 1967, 96, 885.

Tuberculin testing among junior and senior high school students in Maryland has been used to study the influence of sociologic characteristics on tuberculin sensitivity. For the most part, small reactions were considered to represent infections with atypical mycobacteria and large reactions, infections with mycobacterium tuberculosis.

Students with large reactions tended to live under poorly and more crowded conditions, to have had household exposure to tuberculosis, and to come from broken homes. Their parents were more likely to be cigarette smokers and less likely to attend church frequently. Students with small reactions tended to rank higher on a number of socio economic indices, and to have moved from outside the county to its urban areas. There was considerable household aggregation of children with large reactions but not for those with small reactions, suggesting that intra-household factors are not major determinants of infection with atypical mycobacteria.

S.P.P.

Sarcoidosis : An exercise in Differential Diagnosis

Rosaline R. Joseph and Robert V. Cohen. Diseases of the Chest; 1967, 52, 458

Presenting symptoms or unusal developments during the course of disease in a series of 70 patients of sarcoidosis are reported. All cases were confirmed by biopsy. Two patients had massive splenomegaly ; one had portal hyper-tension ; one had such abdominal enlargement that pregnancy was suspected ; one was mistaken for parathyroid adenoma and one was suspected of enchondroma. Among the uncommon features noted were severe and repeated hemoptysis in 2 cases (one of them died of hamoptysis) ; one had repeated spontaneous pneumothorax ; one had pericardial effusion and one had phrenic nerve paralysis.

The authors conclude that sarcoidosis is fast becoming the "great immitator".

S.P.P.

The Kveim-Siltzbach Test

D. Geraint James, Om P. Sharma, Patricia Bradstreet. Lancet; 1967, ii, 1274

Kveim-Siltzbach test antigen, now available from the Central Public Health Laboratory, Colindale, is potent and specific. In a nation-wide series of 1617 patients in whom it was used diagnostically, there has been no evidence of misleading false-positive reaction. False-negative reactions are due to several possible causes. The test should be undertaken as early as possible in the disease, for it is far more likely to be positive in fresh active acute sarcoidosis than in chronic fibrotic disease or in patients whose disease has subsided spontaneously or with the help of corticosteroids. Three quarters of the tests were positive in patients tested within six months of the apparent onset of the disease.

S.P.P.

Tuberculin Reactivity in Kveim Positive and Kveim Negative Sarcoidosis

Carl-Johan Gothe & Ake Hanngren Scand J. Resp. Dis.; 1967, 48, 294.

Glucocorticoid and ACTH-treatment wea-

kens the Kveim reactivity but has no significant influence upon the tuberculin reactivity in sarcoidosis. The tendencies of sarcoidosis to cause Kveim reactivity and to weaken the tuberculin reactivity seem to be two independent characteristics of the disease. Though there is a significant weakening of the tuberculin reactivity in groups of patients with sarcoidosis, it is not possible in single cases, however, to exclude the diagnosis of sarcoidosis on the basis of a high tuberculin sensitivity.

S.P.P.

Hilar Adenopathy in Tuberculosis

Donald C. Kent and Robert C. Elliott. Amer. Rev, Resp. Dis.; 1967, 96, 439.

The report is based on 11 patients with active tuberculosis showing hilar adenopathy on radiological examination. One of the patients was 2 years old and the remaining above 18 years. The relationship of hilar adenopathy and racial predilection is suggested by the study. Differential diagnosis poses special problems in this group since physical findings are practically nil. The necessity for exact diagnosis, and the value of tissue biopsy has been brought out. Peripheral node biopsy often fails to reveal the true condition of the hilar nodes. There is real need for open biopsy or mediastinoscopy in such cases.

S.P.P.

Tuberculosis of the Lymphatics in Children: Its relation to Spinal Tuberculosis

M. Fordo de Tavera and Estrella P. de Leon Diseases of the Chest; 1967, 52, 469

An anatomical, clinical and radiological review is presented suggesting that spinal tuberculosis may arise as a result of a direct extension of the disease to the vertebrae from thrombotic focalization in prevertebral lymphatic tissues especially mediastinal, mesenteric and/or cervical lymphadenopathy.

S.P.P.

A Method for the Determination of total Lung Capacity from Poster Oanterior and Lateral Chest Roenthenograms

Amer. Rev. Resp. Dis., 1967, 96, 548.

A simple method has been described for determining total lung capacity by measurements of the chest skiagrams and application of the following formula : —

Total lung capacity =0.67x radiological chest volumes+320.

The radiological chest volume is calculated as follows :—

1. Multiply the area of the right lung field on the P. A. skiagram by the area on the lateral skiagram.

2. Multiply the area of the left lung field on P. A. skiagram by the area on the lateral skiagram.

(1)

3. Calculate fourth root of volumes and (2) above and cube this.

4. Add the two volumes.

The co-efficient of co-relation between the volumes thus calculated and actual volumes has been found to be 0.95 and the standard error has been only 210 ml.

S.P.P.

B. C. G. Vaccination of Children Against Leprosy In Uganda : Results At End Of Second Follow Up.

J. A. K. Brown, M. Mary Stone, IAN Sutherland Brit. Med. Jour., 6th January, 1968.

A total of 19169 children all contacts or relatives of known leprosy patients, and all free of leprosy lesions were included in a controlled trial of B. C. G. vaccination against Leprosy. The cases were followed for an average of three and half years. Cases were allocated at random to B. C. G. vaccinated and unvaccinated group.

94% examined for Leprosy during the first round of follow up visits and 91.5% during the second.

The percentage reduction in leprosy incidence in the B. C. G. vaccinated group compared with the corresponding unvaccinated group was 87%.

The percentage reduction was similar for those with weak degrees of tuberculin sensitivity initially and for those with negative tuberculin reactions and did not appear to depend upon the age at vaccination.

Those who developed leprosy lesions, there was a slight tendency for the untreated lesions

to progress, or to cure under treatment less frequently and to regress more frequently in the B.C.G. vaccinated patients than in the corresponding group of unvaccinated patients.

The incidence of leprosy in the unvaccinated children varied with their initial sensitivity to tuberculin. Those with negative tuberculin reactions had the highest subsequent incidence of leprosy, those with weak degrees of naturally acquired tuberculin sensitivity the next highest and those with strong degrees of tuberculin sensitivity the lowest subsequent incidence of leprosy.

B. C. G. confers substantial protection against early form of leprosy that natural tuberculosis infection also confers some protection but the infection with non-tuberculous mycobacteria (other than the leprosy Bacillus) confers little or no protection.

H.B.D.

Chloroquine in the Treatment of Sarcoidosis

A Report from the Research Committee of the British Tuberculosis Association. Tuber, Land, (1967) 48, 257.

A double blind trial was undertaken to adjudge the effect of chloroquine on Pulmonary Sarcoidosis in patients who had lung shadows of at least six months duration and had had no corticosteroids.

The patient was allocated at random to two groups, one group had inert tablets and the other had Chloroquine sulphate 600 mgm daily for 8 weeks and 400 mgm daily for 4 weeks.

Assessment was made at one, two, four, six and 12 months.

There was significant improvement in the Chloroquine group compared with control group at four and six months radiologically clinically as shown by improvement in dysponea and ventilatory tests. After six months then; was some deterioration in the Chloroquine group and some spontaneous improve ment in the control group, so that there was no significant difference between them at 12 months. The effect of Chloroquine is there fore believed to be suppressive rather than curative. H.B.D.

Geographic variations in the Prevalancc of sensitivity to PPD-S and PPD-B in Western Australia.

J. T. Symth and R. B. Porter Tuber, Loud, (1967), 48, 273.

Mantoux testing using PPD-S and PPD-B was performed in 11885 school children living in different areas in Western Australia.

The proportion of school children giving a large reaction to each antigen increased with age and boys gave a slightly higher proportion of large reactions to both antigens.

Geographic variation was seen in two ways. A large reaction to PPD-S was given by 10% of children not born in Australia and by only 3.1% of Australian born children. This accords with the known higher incidence of Pulmonary Tuberculosis in migrants to this state.

A large reaction to PPD-B was given by less than 25% of boys age 13-17 years in the southern part of the state and by over 50% of the same age group in the northern and eastern parts, which in general have a lower rainfall and higher average temperature.

The proportion of large reactions to PPD-B was lower in Perth, the principal city of the state than in the surrounding agricultural areas.

The proportion of children giving a large reaction to PPD-S showed little geographic variations. H.B.D.

The Indian Journal of Tuberculosis

ABSTRACTS

Vol. XV September 1968 Abst. No. 4

Pyrazinamide-isoniazid: Its apparent influence on the reactivation rate in pulmonary tuberculosis.

Sammel Philips; Veterans Administration Hospital, Memphis, Tennesses. Amer. Rev. of Resp. Dis., 1967, 95, 503

A series of 93 active pulmonary tuberculosis patients in which the therapeutic effect of an INH-pyrazinamide (PZA) regimen was compared to that obtained with INH-PAS regimen have been followed up for a period of 10 years. It is found that the reactivation rate among the patients treated with INH-PZA regimen was markedly reduced as compared to those treated with INH-PAS (3 in the former against 15 in the latter). The average length of INH-PZA therapy was 10.8 months.

S.P.P.

Prednisone as an adjunct in the chemotherapy of lymph node-Bronchial tuberculosis in childhood: A double blind study.

Rosa Lee Nemir, John Cardona, Farideh Vaziri & Rosario Toledo. Amer, Rev. of Resp. Dis., 1967, 95, 402

To evaluate the effectiveness of steroids as an adjunct to chemotherapy of bronchial lymph-node tuberculosis in childhood, a double blind study using prednisone was carried out in the department of pediatrics, New York University School of Medicine. There were 58 children in prednisone group and 58 received placebo in addition to INH and PAS therapy. The overall improvement in the prednisone group of 67.2% a sagainst 45.7% in the placebo group, a difference which is statistically significant. Marked improvement was seen in 36% in the steroid group as against 15% in the controls. Patients receiving steroids before 4th month of tuberculous infection had a 76% chance of improvement as compared with 36% of the patients in the placebo group. No harmful effect were seen in any child in the prednisone group and the side effects (seen in 10% only) were few, transitory and not serious.

S.P.P.

Observations concerning 487 patients returned to active military service after treatment for pulmonary tuberculosis

SJ. Berte, J. DiMase, D.S. Piegenberg, S.E. Levy, H.W. Phelps, P.A. Thomas & H. Weiss. Amer. Rev. of Resp. Dis., 1967, 95, 379.

Four hundred eighty seven patients out of 1,263 with proved pulmonary tuberculosis were returned to active military service after successful treatment for the disease developing during the course of military service. These patients received antimicrobial therapy for the first time between January 1957 and June, 1964. Practically all of them became non-infectious after 4 months of treatment. Arrest of disease was brought about by surgical procedures in 122 (about 25%).

Only 151 patients could be followed for 5 years or longer, shortfall being due to resignation, retirement or termination of enlistment. The resultant relapse rates have been based on a follow up of 1684 man-years instead of a possible maximum of 2,587 man-years. There were 15 deaths amongst these patients, only one of which was due to tuberculosis. Relapse was noticed in 14 patients only (2.8%) and none of these patients had an earlier surgical intervention. This is probably fortuitous and does not indicate that surgical intervention has prevented subsequent relapse.

S.P.P.

Drug Dosage for Children

R.H. Leach, B.S.B. Wood Lancet, 1967, ii, 1350

Neither age nor weight provide reliable guides for calculating doses of drugs for children. Body-surface area approximates more closely but requires computation or reference to a nomogram. A scale has been produced which gives doses as a proportion of the adult dose at six different age levels after Catzel's percentage method. These ages can be regrouped for estimation on a weight basis as follows : if adult dose is 1 mg, per kg., then dose at 12 years is 1.25 mg. per kg., at 1-7 years it is 1.5 mg. per kg., and at 2 weeks

THE FINEST MACHINE THAT WAS NEVER INVENTED

DR. HARLEY WILLIAMS

I am thinking of a pump, the Chairman said to the Production Engineer, a pump which will fulfil a pretty tough programme performance.

That's what we' are here for, the Production Engineer said.

Now listen to me, the Chairman went on. The pump must keep eight pints of fluid in continuous circulation at the temperature of 37° Centigrade. It must work against constantly varying resistance and must adapt itself instantaneously, sometimes pumping eight pints a minute, sometimes fifty.

What do you mean by instantaneously ?

Within a tenth of a second.

The Production Engineer, blanching below the eyelids, gave a whistle, and made a note.

The pump must weigh no more than 12 ounces. It must function at the altitude of Mount Everest, in the Sahara, or at the North Pole. It will have to give day and night service and deliver 130 strokes per minute—then in a couple of minutes, drop to seventy. It will be controlled by a self-regulating, electrical mechanism.

You mean automation ? the Production Engineer asked. We are quite used to that.

The pump also be responsive to human control—which at any time may countermand that wonderful automation. The controller of the pump may be asleep, or drunk—it makes no difference.

It's going to be hard to design a pump like that.

Then, the pump must be able to operate at half the fluid capacity.

The Production Engineer became grim. You said this was a tough assignment !

Another thing. This pump has four chambers with four valves, and has to drive the fluid simultaneously in opposite directions.

I won't say it can't be done, the Production Engineer said. I am making a note of all this. What about running repairs ?

Running repairs ? Servicing will have to be done without the pump losing a single stroke. I tell you this pump must never stop.

I will have to take this up with the factory, the Production Engineer said in desperation.

Another thing. The pump must go on for anything up to a 100 years.

The Production Engineer let his pencil fall.—It can't be done, Sir. A pump like that simply could not be designed. Then the Production Engineer saw a smile of triumph on the Chairman's face.—Oh, 1 get you. It is an imaginary pump ; it's your dream—for the future.

No, it is a real pump. You have one inside your shirt. The finest pump that was never invented, it grew on its own. Mine's been going for half a century—with automatic servicing. There has never been anything like the human heart —it's nothing but a pump with tubes attached. Four chambers, two circulations, all kept up with perfect automation. And it even works when we are not thinking. It can respond to any requirement—heat and cold—bad temper, beating the mile record. It is a lesson in design, in servicing—everything.

But the real point is—here the Chairman paused—the heart does go wrong. The material wears out before it should. Those artery tubes become rough inside and silted up. The valves get glued up. The automation goes wrong and we simply don't know enough about how the darned pump works, to put it right.

The Production Engineer became more hopeful.—Surely, Sir, that's a subject for study ?

It surely is. To get to the bottom of that problem we shall need to spend half a million pounds a year for many years, as an insurance I mean—on research.

From Heart Magazine.

to 1 year it is 2 mg. per kg. This gives a simple correlation between the three variables in current use.

S.P.P.

Major Thoracic Surgery during Pregnancy

J. Tarnoff, WM. Lees and R.T. Fox. Amer. Rev. of Resp. 'Dis. 1967, 96, 1169.

Major thoracic surgery was performed for residual pulmonary tuberculous lesions in 29 pregnant women. The age range was from 16 to 39 years. Twenty seven of them were operated upon in the second trimester of pregnancy, one in the 2nd month and one in the 7th. There were 2 pneumonectomies. all lobectomies, 8 segmentectomies, 5 subsegmentectomies, 1 lobe plus wedge resection, 1 thoracoplasty with extra periosteal plombage and one paraffin plombe removal. Twenty one patients had no post-operative complications. One had a still birth 5 days after pneumonectomy, and the other 28 women delivered at term with normal babies and without any evidence of ventilatory insufficiency at the time of labour. All patients achieved an inactive status after further chemotherapy.

The authors conclude that in the presence of standard indications, pulmonary surgery may be safely performed on patients in the 2nd trimester of pregnancy.

S.P.P.

The Sodium Lauryl Sulphate Method in Culturing Sputum for Mycobacteria.

H. Chr. Engbaek, B. Vergmann & M. Weis Bentzon. Scand J. Resp. Dis. ; 1967, 48, 268.

Because of the high contamination rate of cultures of sputum treated with sodium hydroxide, a series of methods for culturing sputum were examined in respect of contamination rates. Of these, the sodium lauryl sulphate method of Tacqpet and Tison in a slightly modified form was considered the most suitable. The authors have used this method with satisfactory results since February, 1966 and the contamination rate has been reduced to 1%. The specimens were easy to homogenize with this method and the sediment was suitable for inoculation on Lowenstein-Jenson medium. Tie percentage of positive cultures with this method is higher than with the sodium hydroxide method.

The part played by lauryl sulphate in the low contamination rate was further tested on gram-nagative and gram-positive bacteria isolated from sputum. It was found that with combination of lauryl sulphate and sodium hydroxide, the bactericidal effect was achieved with at least 3-6 times lower concentration of sodium hydroxide than with the sodium hydroxide alone.

S.P.P.

Active Pulmonary Tuberculosis with aegative tuberculin skin reactions.

Donald C. Kent and Ronald Schwartz. Amer. Rev. of Resp. Dis. ; 1967, 95, 411.

Twelve patients with active pulmonary tuberculosis who had a negative tuberculin test respeatedly are reported. All of them were sputum positive and the bacilli were of human type as confirmed by cultural characteristics and cyto-chemical studies and were susceptible to INK, PAS and Streptomycin at all levels. All usual reasons for a negative tuberculin test were excluded and specific energy appeared to be the only reason for a repeated negative tuberculin reaction. The authors conclude that a negative tuberculin reaction does not always exclude tuberculosis from differential diagnosis of an abnormal chest x-ray.

S.P.P.

Droplet expulsion from the respiratory tract

Robert G. London and Rena Marie Roberts. Amer. Rev. of Resp. Dis. ; 1967, 95, 435

The number and sizes of droplets and droplet nuclei expelled from the mouth during coughing and talking were determined in a series of experiments. The number of droplets produced by coughing varied considerably between experiments and seemed to depend on several factors which are difficult to control or to measure accurately, e.g. the amount of secretion present in the mouth and its location, the placement and movement of the lips, tongue, and teeth during the cough. Even minor alterations in these factors had a marked influence on the number of droplets produced. The machanism of droplet formation may be stretching of strings or sheets of secretion between two moistened surfaces that are separated during the cough and the shattering of these strings or sheets by subsequent blast of air rather than by the whipping up of secretions from a moist surface by air passing over it, as has previously been suggested.

From the point of view of numbers of droplets produced, one cough is the equivalent of about 30 seconds of loud talking. From the point of view of droplet nuclei one cough

is equivalent of about 5 minutes of loud tolking. Reservation, however, has to be made about the latter, since droplet nuclei less than 1 micron in diameter could not be recognised by the techniques used in the experiments. However, from the point of view of transmission of tubercle bacilli, it is of no real importance since nuclei smaller than 1 micron could not harbour even one tubercle bacillus.

On the whole the results tend to support the belief that cough and talking are important mechanisms in the production of droplets and droplet with infective potential.

S.P.P.

Recent Clinical and Epidemiological studies of Chronic Bronchitis

Scand. J. Resp. Dis. ; 1967, 48, 285.

Research on chronic bronchitis and emphysema in the past fifteen years has been helped by clearer definitions of these conditions and by advances in epidemiological, pathological and physiological techniques. Bronchial and emphsematous types of patient can usually be distinguished when the disease is severe. The hypothesis that bronchial infection plays a major role in the pathogenesis of irreversible airways obstruction has not been confirmed in a prospective study of working men. The rate of progression of this condition is positively correlated with its severity. Antibiotics treatment consequently has no effect on progression but it can prolong the terminal phases of the disease.

S.P.P.

Smoking and pulmonary tuberculosis: An analysis based on a study of volunteers for mass miniture radiography.

A.M. Adelstein and J. Rimington. Tubercle ; 1967, 48, 219.

Association of active pulmonary tuberculosis needing treatment with smoking habits of over 75,000 volunteers in a mass miniature radiography campaign has been studied. The study has shown positive association between the number of cigarettes smoked and active pulmonary tuberculosis. The rate of bacillary disease was also higher among smokers than non-smokers. It is also suggested that smoking could account for much of the difference in the morbidity and mortality rate between men and women above the age of 35 years.

S.P.P.

Therapy of Pleural Effusion.

A Statement by the Committee on Therapy : Amer, Rev. Resp. Diseases, Vol. 97, No. 3, March, 1968.

Etiology.

Normally the pleural surfaces are moistened by a film of fluid which is formed by the visceral pleura and absorbed by the visceral and parietal layers. The rates of fluid production and absorption have been measured by isotopes method and are equal. In the normal state the fluid is driven into the pleural cavity from the pleural capillaries by hydrostatic pressure and is absorbed by the pleural lymphatic vessals. Any disturbance of absorption or increase in the rate of formation will thus lead to an abnormal amount of fluid.

Pleurisy with effusion is usually secondary to another disease and may be the first evidence of disease or a complication of it.

The principal causes may be inflammatory, neoplastic or circulatory.

Inflammation is due to pulmonary disease or sub-diaphragmatic in origin.

The circulatory may be due to heart disease or osmotic imbalance.

Pleural fluid collects in the posterior costophrenic sulcus and as much as 300-500 ml may collect and may not be detected by physical examination or conventional chest roentgenograms when it is seen roentgenographically, the fluid appears as a broad curved shadow, most dense towards the base and thining towards the upper and medial aspects of thorax. When the fluid accumulates in the interlobar fissures, paramediastinal space or above the diaphragm, the picture is different and there may be difficulty in diagnosis.

Good clinical judgement, physical, chemical and bacteriological characteristics of the fluid establish the etiology in only about 60 percent of effusions. No single physical or morphological characteristics differentiates with certainty among the various causes when these methods fail, biopsy obtained by needle or open thoracotomy should be performed since effective management requires knowledge of the specific etiology.

A negative tuberculin reaction offers strong evidence that the effusion is not tuberculous in origin. In massive tuberculous effusion however the tuberculin test may remain negative until the fluid is drained from the pleural space. Evidence of recent infection such as tuberculin

conversion or history of exposure, constitutes strong evidence for tuberculosis.

A positive culture for acid fast bacilli can usually be expected from only 25 percent of tuberculous effusions, whereas only 10 to 15 percent of sputum of gastric specimens from such cases will yield tubercle bacilli.

The following properties of the effusion fluid are of lesser differential 'diagnostic acid : color, clarity, consistency, specific gravity and level of protein, sugar, lactic dehydrogenaes (LDH). Pleural fluid sugar content may be decreased when there are free cells or a thickened serous membrane. Pleural fluid LDH is increased in non-malignant disease when the fluid contains a large number of degenerating red blood cells, white blood cells or other cellur debris.

The Amylase level in the pleural fluid is usually elevated to 500 to 2000 units per milliliter when the effusion is due to Pancreatitis. The Pleural fluid amylase level is characteristically greater than that of serum. Determination of Calcium, Phosphorous and Alkaline Phosphatase have been of no value.

Neoplastic cells can be identified in the fluid in 50 percent of patients with effusion due to malignancy.

The exact diagnosis may be made by biopsy, closed biopsy is helpful in as many as 80 percent. Open biopsy is for those when the closed biopsy has failed.

The internal mammary lymph node biopsy is an important aid in diagnosis.

Treatment.

The treatment must be based upon the cause of the effusion. In the absence of any contraindication the pleural effusion should be aspirated as early as possible. Needle biopsy should be done at the time of first aspiration. Thereafter fluid should be removed to relieve symptoms e.g. air hunger, dyspnea, or restlessness.

Tuberculosis :—Conventional chemotherapy utilizing at least two drugs, one of which should be isoniazid for 24 months. Adrenal corticosteroid therapy either orally or intrapleuraly appears to be of little benefit either clinically or by physiologic testing for its use.

Pleural effusion due to bacterial pneumonia:—Effective and appropriate antibiotic therapy of pneumonia is essential fibrin accumulation and loculation of fluid may develop into a thick pleural peel leading to diminution of lung function, for which decortication may be necessary.

Haemothorax : —Tube drainage with underwater seal (because pneumothorax is so frequently present) to keep the pleural space dry. Replacement of blood may be necessary. Continued bleeding may require thoracotomy and decortication if there is pleural peel.

Chylothorax :—is as a result of malignant invasion of the lymphatic system or trauma to the theracic duct. Aspiration if there is respiratory embarrassment. Repeated removal of the chylous effusion depletes the fatty stores of the body, which must be replaced by intravenous infusion of the filtered pleural fluid or by fat emulsion given paranterally. Surgical repair of the ruptured thoracic duct and bypass procedures are difficult. Ligation of the duct is well tolerated in malignant chylothorax. Irradiation of the involved area of the thorax may provide some relief.

Pleural effusion associated with malignancy.—Pleural effusion may occur with any neoplasm but the focus most frequently responsible are carcinoma of the breast, carcinoma of the lung, lymphoma, and mesothelioma. Except for mesothelioma, pleural effusion generally indicates wide spread dissemination.

Failure to find other causes for effusion, rapid reaccumulation of fluid and hoemorragic appearance are in favour of malignancy. Occasionally malignant effusion are serous (particularly in lymphoma). Inflammatory effusion (Tuberculous) may be bloody. Demonstration of malignant cells in fluid is usually diagnostic, but pleural mesothelial cells shed into the pleural fluid may resemble malignant cells.

Needle biopsy of the pleura leads to definitive diagnosis. Occasionally open biopsy *is* necessary.

The most common mechanism leading to formation of an effusion is exudation from scattered tumour implants on the pleural surface. These are caused by lymphatic or hematogenous dissemination. Rarely a large malignant pleural plaque is responsible for effusion. Involvement of lymphnode may interfere with lymphatics or venous drainage of the pleura and results in chylous or serous effusion. For it radiotherapy may be effective.

For management, extent of metastatic

disease elsewhere, duration of life and rapidity of reaccumulation of fluid must be kept in mind. Malignant effusion occasionally remains stable or disappear spontaneously and do not require therapy.

If the pleural effusion reaccumulates rapidly, intrapleural instillation of nitrogen mustard (0.4 mgm. per Kgm of body weight) is palliative in about 50 percent. Radioactive colloidal gold (50-100 me) is no more effective and presents a definite radiation hazard to those in attendance. Tale instillation may help obliterate the pleural space in those patients who fail to respond to nitrogen mustard. Pleurectomy may be helpful in recurrent effusion. At the time of initial thoracotomy abrasion of the pleura should be done to encourage pleural symphysis. In the case of metastasizing tumour treatment directed to the primary lesion may obviate further treatment of the effusion.

Other causes of Effusion.

Therapy for pleural effusion for other causes should be directed towards the primary disease. Correction of renal or hepatic failure or serum protein deficit or prompt control of conjestive failure as effective effusion after pulmonary embolism seldom requires aspiration therapy should be directed towards the pulmonary embolism histoplasmosis or coccidiodomycosis therapy is indicated if dissimination is present.

H.B.D.

Adrenal Cortico Steroids and Tuberculosis.

A Statemant by the Committee on Therapy. Amer, Rev. Resp. Diseases., Volume 97, No. 3, Mar. 1968.

Administration of adrene corticosteroids lead to interference with the normally occurring antigen antibody phenomenon and reduction of the body's inflammatory response to the infection.

Unlimited dissemination of the infection occurs when tubercle bacilli are administered to animals pretreated with adrenal corticosteroids. Increased pathogenicity of tubercle bacilli of low virulence has been reported during adrenal corticosteroid administration. The necrotizing effect of the tubercle bacilli is impeded in animals treated with adrenal corticosteroids and progression of disease causes death.

The con-current administration of effective anti-tuberculosis therapy and adrenal corticosteroids in animals may produce certain beneficial effects. There has been decreased cavity formation, less pronounced hilar lymph node involvement and decrease in the exudative component.

In several controlled studies animals treated with adrenal corticosteroids and anti-tuberculosis drugs appeared to fare better with respect to survival maintenance to body weight toxicity and spread of infection.

The inherent danger of administration of adrenal corticosteroids to patients with inactive tuberculosis is well documented. That concurrent use of anti-tuberculosis drugs will prevent this deleterious effect has been demonstrated.

To prevent reactivation and dissemination of tuberculosis, when administering steroid therapy for any period in excess of two weeks, a careful examination of the patient for evidence of tuberculosis must be done. After treatment with steriod is begun the patient may not react to tuberculin, for the tuberculin hypersensitivity may be suppressed by the steroid.

Antimicrobial treatment : The patient with previous tuberculosis, an abnormal chest roentgenograms suggestive of inactive tuberculosis or a positive tuberculin reaction should be given isoniazid alongwith steroid therapy. Isoniazid should be given in a dosage of 300 mgm. per day daily orally (or 10 mgm/Kgm of body weight for children). The drug should be gived during the period of steroid therapy and for six weeks after it is discontinued. If the patient receiving steroid has had no prior antituberculosis therapy or is a verified tuberculin converter, the therapy with isoniazid should be continued for a total of 12 months as a chemoprophylactic measure.

The administration of corticosteroids to patients with active tuberculosis who are being treated with effective antimicrobial drugs has been shown to be safe. Demonstration of bacterial susceptibility to the drugs being administered is a necessity. Specific manifestations of tuberculosis for which corticosteroids have been used in treatment are the tuberculous meningitis, primary tuberculosis with lymph node involvement, pleural effusion (either oral or intrapleural instillation) and tuberculous pericardites.

Adjuvant adrenal corticosteroid therapy has no place in the routine treatment of patients with pulmonary tuberculosis where steroids are indicated for non-tuberculous disease,

there is no need to withhold them from patients with active tuberculosis as long as effective antituberculosis medication is being given.

Corticosteriods are also given to desensitize patients who are hypersensitive to antituberculous drugs. Desensitization to isoniazid in four days, to PAS tn six and to streptomycin in five days is possible with steroids. When steriod therapy is used, effective antituberculosis drug therapy must be administered. The Physician must be certain that the prescribed drugs are being taken by the patient. The adrenal corticosteroids should be prescribed in a pharmacologic dose (30 mgms of prednisone per day is the usual dosage at the beginning). This is given in divided doses for one month and then reduced to 20 mgm daily for one to three months.

The therapy should be continued until clinical and roentgenographic improvement have become stabilised. Steroid withdrawal should be then very gradual over a period of one month. During the period of steriod therapy the patient must be watched for known complications such as glycosuria, hypertension, peptic-ulcer and super-infection. Rebound phenomenon occurs in small' percentage of cases. Thus except for a few instances, the advantages of adrenal corticosteriod therapy in conjunction with antituberculosis drugs in treatment of tuberculosis over the latter alone are not well documented. This therapy is not hazardous as long as effective antituberculosis drug therapy is being administered. The decision to treat a patient in this manner must be an individual one based on knowledge of the known benefits of such treatment weighted against the known complications. It depends upon the clinical judgement of the physician.

H. B. D.

Current Status of the Surgical treatment of Emphysema and Asthma.

A Statement of Committee on Therapy. Amer. Rev. Resp. Dis. Vol. 97, No. 3, Mar. 1968.

Disappointment with medical therapy and the occasional benefit from surgery continue to stimulate interest in surgical procedures.

Pulmonary resection may be done in *localized bullous disease with relatively normal surrounding lung tissue.* The indications for resection of bullae are (i) lesions of such size as to cause dysponea, (ii) lesions which are increasing in size or which have attained such size as to cause compression of surrounding lung tissue, (iii) lesions which are infected, (iv) and lesions which result in recurrent pneumothorax. The resection should be as limited as possible to preserve as much lung tissue as possible.

Buttons disease with generalized emphysema : The indications for surgery in the patient with this type of disease are not well defined or generally accepted, yet there is evidence that obliteration of bullae occasionally improves function.

Surgery should only be considered in such patients if symptoms are unresponsive to other forms of therapy and are of such gravity that the risks and uncertainties of operation become acceptable.

Recurrent pneumothorax or infection also may be indications for surgical therapy.

Surgery should be limited as much as possible to eradication of functionless bullous areas." Gross departitioning with the development of bullous disease in some part of the remaining lung may soon follow such surgery.

Generalized pulmonary emphysema without bullous disease : —

Surgery of the tailoring type (in which peripheral portions of lung are resected or plicated to reduce the volume and increase the lung retractive forces and thereby the radial traction on air ways) combined with denervation has been reported to result in symptomatic improvement. Removal of diseased, but probably still functioning lung tissue is a basic feature of the procedure.

Surgery on major airways :—

Collapse of major air ways such as the lower trachia or major bronchia results in limitation of flow of air. Operations have been designed to stiffen these structures so that flow limiting collapse does not occur. Difficulty is anticipated in recognizing these patients in whom collapse of major air ways is significantly obstructive and not just secondary to more distal obstruction. Improvement in expiratory flow and asterial PO_2 has been noted.

Glomectomy :—has no place in the treatment of patients with asthma or emphysema.

Tracheostomy :—Permanent tracheostomy has been proposed for patients with pulmonary

emphysema to allow aspiration of secretions, to reduce dead space and to provide for ventilation if acute failure occurs. Problems due to secondary infection loss of humidification, increased airway resistance due to tracheostomy tube leading to impairment in effectiveness of cough is always there. To overcome these a flap type or fenestration tracheostomy has been devised.

On the nature of Tuberculin Sensitivity in South India :

Gerard Wijs Muller, Raj Narain, S. Mayurnath and Carrol E. Palmer. Amer. Rev. Rtory Disease, Vol. 97, No. 3, Mar. 1968.

Three thousand four hundred sixty eight persons not previously vaccinated with B.C G. in a South India village population of 5407 were tested simultaneousiy with two intradermal tests, one containing in term of nitrogen content a similar quantity of PPD G.

Small and large reactions were more prevalent among females, but males had a higher prevalence of reactions of intermediate size. No possible explanation of this sex difference could be given.

The size of reaction to PPD-G increases with age. This increase is independent of the size of the reaction to PPD-S and suggests that low grade sensitivity to tuberculin (PPD-S) is caused by a group of non-tuberculous mycobacteria rather than by a single species all of which are more closely related antigenically to the gause bacillus than to M. tuberculosis.