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## TUBERCULOSIS CONTROL PROGRAMME

Tremendous advances have been made in the fight against tuberculosis during the last quarter of a century, with the result that in many affluent countries to-day tuberculosis has ceased to be a major public health problem and even its eradication has been brought within the realm of possibility. Notwithstanding these advances, tuberculosis still retains the pride of place amongst the 'men of death' in under-developed countries like ours. Control awaits bigger resources and proper utilisation of the available preventive tools of proven efficiency.

Tuberculosis services in our country have heretofore been concentrated in cities and towns. Rural population has been without even the barest diagnostic and treatment facilities. It is idle to talk of tuberculosis control without providing these services to the rural areas wherein more than three-fourth of the total patients in the country would be found. The district tuberculosis control programme, discussed elsewhere in this issue, aims at dovetailing available measures into one comprehensive, practical and economically feasible programme to cover the largest possible section of the population and thus to bring about constant and fairly rapid 'problem' reduction.

Integration with the general health services and felt-need oriented approach constitute the sheet anchor of this programme. Based on sheer common sense, its main virtues are not merely simplicity and feasibility but the mounting epidemiological dividend that would accrue from progressive elimination of sputum positive cases from the community.

The perfectionist, however, is not satisfied. He objects to double standards being advocated for urban and rural populations. The programme, no doubt, is far from perfect at present. But no apology is needed to sell this programme. It is by no means a poor strategy to provide for easy detection and quick conversion of the most infectious sources viz. direct smear positives, even if asymptomatic and abacillary (and therefore equivocal and epidemiologically less important) cases remain undetected.

The main stumbling block in the success of this programme is not so much the paucity of resources but lukewarmness in its implementation at the periphery. If it has not made much headway so far, it need not cause any diffidence with regard to its soundness and acceptability. Whenever new ground is broken, it evokes certain amount of apathy and even resistance. But handled with sympathy, tact and finesse, it is ultimately bound to get going. The programme has already been accepted by the Central and State Govern-

merits. Unmistakable signs of rising momentum are visible in many districts. It is a question of time for others to follow suit.

To emphasize the district control programme is not to deny the importance of other recognised anti-tuberculosis measure. *Pari passu* development of BCG vaccination, hospitalisation where domiciliary treatment is not possible for medical and/or special social reasons, health education and family planning cannot be neglected. Nor indeed can the programme do without active co-operation of voluntary organisations. No plan, howsoever efficient and promising, can succeed unless the community itself, for whom the plan is meant, actively participates in its implementation. To that end, education and publicity have to be stepped up considerably.

Lastly, the district control programme is not the end but only means to the end that is tuberculosis control. It is neither rigid nor an all-time one but subject to modification in the light of experience gained through its implementation. Further, if conditions improve to-morrow permitting application of more extensive diagnostic methods or new and better weapons for treatment become available, the programme can and should be reviewed and the new additional measures also deployed with the same vigour to hasten towards the goal.

# NATIONAL TUBERCULOSIS PROGRAMME

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The subject of National Tuberculosis Programme has attracted country wide attention in recent years. Many people are not clear as to what it means and what is implied by the term. These few lines are written to clarify "NATIONAL TUBERCULOSIS PROGRAMME".

It should be appreciated that the National Tuberculosis Programme of one country may vary from that of the others depending on a number of factors. The details of the programme included here obviously refer to India.

## Definition

"NATIONAL TUBERCULOSIS PROGRAMME" is defined as "Nationally applicable anti-tuberculosis measures aimed at reduction of the problem of Tuberculosis in foreseeable future and which is within the resources of the country".

The basic factors in the formulation of the National Tuberculosis Programme are Organisational and Technical.

**1. Organisational :** Formulation of the National Tuberculosis Programme is based on a number of factors which take into account the extent of the problem of Tuberculosis in the country, needs of the people, resources in men and material etc. which are required and are available for the programme. If these are assessed and efforts made to organise the services the foundation of a national programme will be firmly laid.

### I. *Epidemiological considerations*

Epidemiological situation in India demands that Tuberculosis services should be so organised that at least minimum essential service reaches all the areas of the country, both rural and urban, as the problem of Tuberculosis exists in all areas throughout the country.

### II. *On permanent basis*

Services have to be organised on a permanent, rather on a make-shift basis. Merely patchy development of services here and there or sporadic effort in mass case-finding campaign or provision of treatment of a few detected cases in some areas would not be effective to reduce the problem of tuberculosis in the long run.

### III. *Felt-need oriented programme*

Attending to symptomatic patients coming to the various health centres with chest symptoms and detecting them by careful sputum smear examination under the microscope can bring out 70% of patients of the area in the infectious stage. They could be offered treatment from near their homes. This is expressed as "felt-need" oriented programme. Symptomatic patients will come to health centres if service is provided. If sputum is found negative, the patient is kept under observation and provided with symptomatic treatment till diagnosis is established or is referred for the X-Ray examination and frequent sputum examination. Anti-Tuberculosis treatment by specific drugs is not started on mere suspicion. Even though some delay in establishing diagnosis is inevitable during this period of observation, this delay in starting anti-Tuberculosis drugs is not material to the end result of treatment in the community control of Tuberculosis.

### IV. *Integrated Tuberculosis service*

It is obvious that patients must be detected at Centres where they first report with chest symptom or symptoms by which patients can be suspected of Tuberculosis. These are mostly institutions taking care of all ailments and attending to health problems. These are Primary Health Centres, dispensaries and all types of general hospitals. Tuberculosis programme therefore has to be undertaken by health facilities and has to be integrated with the health services. The main Tuberculosis Centre at the District Headquarters provides guidance, training to peripheral staff, referral service, assists organisationally, by equipment and drug supplies. This Centre, called the District Tuberculosis Centre, also evaluates the programme in its area from time to time.

### V. *Maximum benefit out of rupee spent*

The programme must be so planned that the limited resources of the country in men, finance and material can be best utilised to provide the essential services throughout the country ensuring maximum achievement under the existing circumstances. Thus the nation should derive the utmost benefit out of every rupee spent.

## H. Technical basis

The utilisation of all available tools must be such that they are effective, cheap, applicable on a national scale and would be acceptable to the people. The main methods applied in the National Tuberculosis Programme in India are:-

### (i) *B.C.G. Vaccination*

Direct vaccination without Tuberculin testing to persons below 15-20 years of age depending upon the prevalence rate of Tuberculin allergy in the population is the most practical nationally applicable tool which people have accepted all over the country. Liquid vaccine may need replacement by Freeze dried Vaccine as preservation of the potency of the vaccine is vital to the success of the programme. This is easy with F.D. Vaccine. To achieve high degree of coverage of the population which is necessary for community effect, door to door vaccination is advocated.

### (ii) *Application of Anti-Tuberculosis Drugs*

(a) Standard drugs are remarkably effective. Their regular and extensive use on freshly detected cases in appropriate drug regimens forms the backbone of the National Tuberculosis Programme. As these drugs are as effective in the home as they are in the hospital or sanatorium they can be used with equally good results on domiciliary basis. They render the patient non-infectious fairly soon and if drugs are taken for an adequately long time the patients remain non-infectious most often permanently. In a few of these patients cavities persist but many remain non-infectious. Relapse rates following adequate Chemotherapy is small. Development of disease among contacts in the home treated is also not more than those treated in institutions. Therefore, there is no advantage in seeking admission to a hospital if a patient (i) has a shelter to live, (ii) can get ordinary food which he is accustomed to eat and (iii) has the determination to take drugs regularly and has no serious complication. It is imperative that effective drugs are made available. It is the responsibility of the administration to provide drugs to all detected patients of Tuberculosis.

Various drugs regimens in vogue in the National Tuberculosis Programme have been formulated specially at Chemotherapy Research Centre at Madras on the basis of their efficacy, easy administration, acceptability and their cost.

(ii) (b) *Chemoprophylaxis*: Use of INH to selected group of people like infected contacts of known Tuberculosis patients has given evidence of providing protection specially to

young contacts and children. However, this method is under investigation and is not applicable in mass programme.

### **Aim of treatment with anti-tuberculosis drugs in the national tuberculosis programme**

The objective of treating patients under the National Tuberculosis Programme can be achieved if fewer and fewer cases develop disease and are detected year after year in an area. To achieve this end all infectious cases should first be detected expeditiously and treated adequately with effective drugs to render them non-infectious. If only a small number of cases and that only in a few centres are detected and treated in the area incidence of disease will not be reduced over the years. It is, therefore, necessary for the success of the National Tuberculosis Programme that more than 50% of the existing infectious cases atleast are detected and effectively treated every year so that less and less cases develop disease over the coming years.

### **Planning for national tuberculosis programme**

Planning for development is an accepted principle of national life. Before planning a country-wide programme on the basis of the available epidemiological, sociological and demographic data, a pilot programme is formulated. This is put to test and is called the "test run". During this period of the development, various components of the programme are evaluated to see their strength and weakness. The weaknesses are rectified in the next phase of the "test run" (feed back). When the programme is reasonably tried out, it is put into use in a number of areas. These test-run experiments are studied with a view to their applicability in different areas and are evaluated from time to time in varying circumstances. Further development, evaluation, and improvement goes on simultaneously with national extension till the entire country is covered with the programme.

In the initial stage, priority has to be given to certain components of the programme. In the National Tuberculosis Programme, the priority is given to detection of infectious cases and their treatment with effective drug regimens which patients can take in their own homes. This programme is to be applied throughout the country. The district Tuberculosis Programme as evolved by the National Tuberculosis Institute today is the core of the National Tuberculosis Programme and is in force in 141 districts now. It should be extended throughout the country in the next five years. Addition of culture facilities at the

district laboratory will be of only marginal value and may not be advisable even in the long run. Need may come for addition of mobile X-ray units to some of the District Tuberculosis Programmes so that after the great bulk of infectious cases are detected and treated, freshly developed early cases can be detected every year who may be sputum negative by smear and culture but can be suspected by miniature X-ray only. These refined facilities can be added after (1) treatment organisation has fully developed throughout the area of the district Tuberculosis Centre in District Programme, (2) case finding service through sputum smear examination has been established from all the health facilities (3) referral system from and to has well-developed between the District Tuberculosis Centre and the peripheral services, and (4) when new cases being detected by smear examination are almost reduced to the estimated incidence of new cases only.

Isolation of incurable resistant infectious cases living in crowded homes will be necessary. Addition of drug regimens with reserve drugs will be required for drug failure cases at the late stage of the development of the National Tuberculosis Programme. Organisation of voluntary organisations to supplement Governmental effort is necessary for development of mass programme. They must muster public opinion for Tuberculosis and provide health education through Seals Sale Campaigns and other media.

#### **The fourth five year plan and the national tuberculosis programme**

It should be appreciated that the development plans are formulated to improve the standards of the people and Tuberculosis plans have been evolved with the aim of reducing Tuberculosis in the community. Our main activity in development plans in the tuber-

culosis control is the establishment and upgrading of District Tuberculosis Centres in each district of India which are to serve as centres for organising a comprehensive Tuberculosis service throughout their area based on the philosophy of the District Tuberculosis Programme. B.C.G. vaccination is an integrated activity with it in every district. Training and research continues to add to efficiency and to develop newer techniques and methods.

Establishment of indoor beds is meant to handle those problems which arise as a result of failure of domiciliary treatment or for other reasons, whether they are for emergencies or for patients needing surgery. Development of the regional Tuberculosis organisations is also to supplement, support, and improve the quality of the work at the District Tuberculosis Centres which are not always manned with personnel of adequate experience and supplementing their effort by more senior experienced staff.

Supply of anti-Tuberculosis drugs are vital to the success of the entire National Tuberculosis Programme. Now that the Government of India has taken up this responsibility for free supply of drugs to Tuberculosis centres run by voluntary bodies also and to the clinics run by State Governments, the weak link in the chain of measures for control organisation has been strengthened. In other words attempt has been made in the current plan to remove weakness of the previous plans.

Health is a State subject and Tuberculosis control is the responsibility of the State Governments. It goes to the credit of the State Governments and their people that a uniform national programme is being developed throughout the country with so many States and Union Territories participating as free partners.

# DISTRICT TUBERCULOSIS CONTROL PROGRAMME IN CONCEPT AND OUTLINE

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## Introduction

The District Tuberculosis Programme (DTP) was formulated by the National Tuberculosis Institute (NTI) in 1962. It was meant to be the basis of a community-wide programme to deal with the challenge of a large, predominantly rural, tuberculosis problem in this country. The urgency to deal with the problem and the limited available resources, in the shape of funds, trained personnel, and equipments, made it necessary that the proposed National Tuberculosis Control Programme (NTP) should be simple, easy to apply, and widely acceptable. Although the DTP was conceived as a "minimal" programme primarily for a poor country, in actual practice, over the past few years, it has proved more sturdy, dynamic, and valuable than was expected earlier. Flexibility is one of its great assets. Increasingly, DTP has not to depend upon "economic stringency" for its justification and "minimum that could be attempted" for its practice. On the other hand, its feasibility, sociological content and appeal to reason are making it accepted for National Tuberculosis Control Programmes in many other countries. This conceptual account of the DTP is meant for those who wish to know more about it.

## Historical

Prior to the National Tuberculosis Survey<sup>1</sup> (1955-58) which found pulmonary tuberculosis in India almost as prevalent in rural areas as in cities, the common belief was that tuberculosis was a problem of the thickly populated cities and slums. To control it, conventional measures like establishment of TB Hospitals, Sanatoria, and TB Clinics had been in vogue in this country<sup>2</sup> since 1906. As late as 1945, the Health Survey and Development Committee (Bhore Committee), set up to plan *inter alia* a comprehensive scheme for tuberculosis control, only recommended implementation of the long accepted conventional measures in the shape of a regular programme<sup>3</sup>. Perhaps, incomplete appreciation of the overall size of the problem in the community and the far greater relevance of communitywide measures to control the disease were responsible for the concentration of attention on individual patients and their suffering and the revolution that wide application of anti-tuberculosis drugs would usher

could not be foreseen till then. In spite of increasing use of chemotherapy, the traditional approach towards tuberculosis control continued till 1958 when the inappropriateness and inadequacy of those measures for the sparsely populated and difficult-to-reach villages provided the main compulsion to find an alternative methodology.

The rural areas at present contain 82% of our population<sup>4</sup>. The fresh approach to organise a rural tuberculosis control service had to make use of only the known tools of diagnosis, treatment, and prevention. The new requirements that had to be met, in the light of the new findings, were: the programme must cover the entire community; be well within the available resources in men, money and materials; and promise sizeable benefit to the community in the foreseeable future<sup>5</sup>. A separate programme for rural areas or different standards of diagnosis or treatment for villagers would neither have been practicable nor generally accepted. Practicability and acceptability were to be as important as economic feasibility. The DTP recommendations that eventually emerged<sup>6</sup> took the programme out of the hands of the "specialist" by integrating it with the General Health Services and orienting it towards the "symptomatics" in the community already seeking relief for their suffering from general hospitals and dispensaries.

The emergence of the DTP in 1962 helped to give a new content and meaning to the efforts at tuberculosis control that had been going on till then. No control measure in vogue was completely dropped out of the NTP. The re-arrangement of emphasis under the DTP, however, diverted attention from Tuberculosis Sanatoria and Rehabilitation Colonies to the primary need of providing adequate diagnosis, domiciliary treatment, and prevention services for the entire population.

## The District

A community-wide tuberculosis control programme must cater to the entire population. The basic demographic, economic, administrative, and political unit in this country is the DISTRICT. There are 330 districts<sup>7</sup>, each having a small urban and a large rural population. In order to make the district the pivot for disease control, an average district is

described from the point of view of programme logistics.

An average district is divided into 10 roughly equal administrative areas, called "Taluks". In one of the taluks is located the largest town of the district which serves as the "District Headquarters". Other taluks also have at least one town each, called "Taluk Towns". Each district has around 1,810 villages which are grouped into 20 "Blocks" each provided with a Primary Health Centre (PHC) for the purpose of rural community development and extension of services. In the National Tuberculosis Survey, wherein all 5 years old and above constituting about 82% of the population were sampled for examination, 1.8% had chest X-ray shadows suggestive of active pulmonary tuberculosis and 0.4%, or nearly one fourth of those with X-ray shadows, had tubercle bacilli in sputum. These prevalence rates have been reconfirmed,<sup>9,10</sup> and constitute best available estimates for application to an average district. In the entire population morbidity loads could not be less than those recorded for the 5 years old and above. A widely accepted definition of a "case" of tuberculosis is: "one suffering from bacteriologically confirmed disease"<sup>11</sup>. Accordingly, one would expect, on an average, about 200 cases in the Headquarters town; 65 cases in each of the

Taluk towns, and 2.3 cases in each of the 1,800 villages, totalling to around 5,000 bacteriologically confirmed cases in each district in the country.

The number of "suspects", namely those with suggestive shadows in chest skiagrams but not confirmed bacteriologically, would be three to four times the estimated number of real cases. The rate at which new cases (disease incidence) are added every year to the "pool" of cases (disease prevalence) is not definitely known at present. Roughly, the incidence rate may equal 20% of the prevalence or the number who leave the "pool" every year due to death and spontaneous cure<sup>12</sup> resulting in a state of near balance in prevalence over a span of few years. Whatever be the prevalence or the incidence rates, it is clear that cases of tuberculosis are widely distributed and have all to be dealt with, for the purpose of control.

**District Health Service**

An average Indian district already possesses a net-work of health institutions. These are of various types, sizes, and importance; mainly belonging to general health but include some specialised institutions as well. The "Health Service" pattern is: one 200-bed Government Headquarters Hospital; several 50-bed Government Taluk Hospitals; one Primary Health

**AVERAGE INDIAN DISTRICT**

*(Based on 1961 Census)*

		Total area Total population Birth rate Death rate Growth rate	10,000 Sq. Kilometers 1.5 million 41 per thousand 17 per thousand 23 per thousand		
	Number in district	Population	% of District population	Social importance	Number of TB Cases
<i>Urban</i>					
	Headquarters Town	1	60,003	4	Economic, Cultural, Health & Administrative Centre for entire district 200
	Taluk (Tehsil) Town	10	20,000x10	14	Trade, Health and Social Centre for Taluk (Population 0.15 million) (65x10) 650
<i>Rural</i>					
	Village	1,800	700x1800	82	Peripheralmost unit of rural population (2.3x1800) 4,150

Centre (PHC) with attached four to six beds in each Block; and a varying number of Local Fund Dispensaries (Panchayat Union Dispensaries or Rural Dispensaries); Maternity and Child Welfare Centres; Private Hospitals; and health institutions belonging to agencies such as Railways, Employees State Insurance, etc. The administrative set up in respect of these various types of institutions is different, but approximately 50 health institutions, each under the charge of a qualified Medical Officer, are available in every district. Fairly clear-cut lines of command, supervision, supplies and flow back of statistics also exist in respect of these health institutions in each district. But, many institutions are staffed and equipped only to the level that hardly meets the most pressing health needs of their patients. In other words, a good but skeletal District Health Service exists. The facilities provided by the service are expected to improve as more resources become available and some of the organisational problems are resolved.

#### Facilities available for Tuberculosis control

For tuberculosis, the usual provision is: one District TB Clinic (usually at the District Headquarters) and 20 to 100 TB beds usually under the charge of a Medical Officer who possesses either a Diploma or sufficient experience in tuberculosis. Most District TB Clinics have facilities for direct microscopy; many are also equipped with x-ray/fluoroscopy machines with necessary technicians for diagnostic activity. A TB Health Visitor or two may also be there, in addition to the (drug) Dispenser and other skeletal ancillary staff. The annual budget of an average TB Clinic seldom exceeds Rs. 20,000 of which only about Rs. 5,000 are earmarked for drugs; hardly sufficient to treat 50 to 100 cases for one year. Very few patients, therefore, get anti-tuberculosis drugs free for domiciliary treatment or get admission into the TB beds. Those who must purchase own drugs, may not be in a position to do so and drop off from treatment — sooner than later. Patients attending the Clinic from surrounding rural area also seldom continue their treatment because they can neither stay long enough in the city to complete their treatment nor can they make frequent trips to the city, if admission into TB beds is denied. Record-keeping in vogue in TB Clinics also does not facilitate a regular check upon those who tend to fall off from treatment, nor can the small clinic staff be expected physically to cope with “defaulters” to meet the stringent requirement of organising chemotherapy of tuberculosis on the accepted lines. Under such conditions an average

*District TB Clinic* hardly diagnoses 300 new TB patients (both cases and suspects) each year and the number completing treatment successfully hardly deserves mention. The effective area of influence of a conventional TB Clinic is restricted to the city and the few surrounding villages. Stress is more upon diagnosis than treatment. The overall inadequacy of the existing facilities is, therefore, obvious.

Apart from the TB Clinics and beds, is the preventive mass BCG Vaccination campaign which has been operating in this country *since 1951*. Total vaccinations achieved each year at present by the mass campaign teams fall short of even the total annual births. A district once covered can be revisited by a BCG team only after many years. Therefore, it is difficult to believe that much headway could be made to bring tuberculosis under control, even if the available limited resources were invested mainly on increasing the above described facilities, without first introducing some radical changes in the methodology of the programme.

#### Basis of DTP

Some important methodological considerations and conceptual approaches which went into the formulation of the DTP are discussed hereunder:

(1) In many developing countries, the resources that can be allotted for health programmes have to be limited because the schemes to relieve hunger and to provide clothes and shelter to the population have to be given priority. For organising a specialised tuberculosis control programme, however, one must have the required number of anti-tuberculosis centres with suitable trained staff; absence of which often leads to non-utilisation even of the meagre allotted funds<sup>13</sup>. It is common to ascribe all ills to paucity of funds but the capacity to utilise funds proves, very often, a far greater handicap in practice. Poor performance can both be a cause as well as result of lack of money. To avoid that, a specialised control programme tries to compete with an expanding General Health Service for its share of the resources and trained personnel or is forced to run own separate special training courses, thereby diverting the meagre funds from actual programme implementation to training, etc. An unhealthy competition could, however, be avoided by sharing the available resources with the General Health Service and exploiting them more deeply and rationally to the advantage of both. Apart from that, the inherent danger of disproportionate investment

of available resources on a special tuberculosis control programme damaging society, instead of helping it, by starving it of its other health and social needs<sup>14</sup> has to be guarded against. Therefore, control of tuberculosis, appropriately, must form a part of the overall effort to improve the health of a people, instead of functioning as an isolated effort to control one disease.

(2) The practical problems connected with case-finding and treatment of tuberculosis in the vast rural areas needed a new approach since one TB Clinic and a few TB beds in a district proved not only completely inadequate but largely out of reach of the majority of tuberculous patients. The solution of this difficulty, to most of us, would seem to lie in the choice between a mobile case-finding cum treatment unit or dependence upon the area General Health Service. For case-finding, putting up of separate TB Clinics at Taluk or PHC levels would obviously be impracticable and economically unthinkable. A mobile mass case-finding (and treatment) unit functioning as the peripatetic arm of the District TB Clinic, was tried under conditions of Operations Research in Tumkur District<sup>15</sup>. Examination of specially selected groups of population was adopted in order to increase the case-yield and bring down the operational costs. No special advantage was seen in the mobile unit approach because the yield of cases in the mass examination was no better than amongst those who already were reporting to PHCs for examination because of their chest symptoms. Operational reasons—leading to disappointing outputs and coverages—were apparently responsible for the “failure” of the mobile unit. Also, the cost of case-finding amongst “symptomatics” was far less compared to that of mass case-finding. For the purpose of treatment, it is helpful to know that domiciliary chemotherapy is as effective as institutional chemotherapy in spite of greater bed rest, good food, and nursing<sup>16</sup> available in TB institutions. In fact, domiciliary treatment is better as it is more acceptable to patients because their home life is not disrupted<sup>17</sup>. There is no apparent justification to plan for more TB beds at the district or sub-district levels. What is actually required is to find an agency which could bring domiciliary chemotherapy within reach of each rural patient; for which purpose the mobile unit approach could not prove useful in actual practice in spite of theoretical plausibility. Dependence upon the area General Health Service, both for case-finding and treatment, turned out to be the only practical possibility for the rural areas.

(3) A proper appreciation of “sympto-

matics” attending the health centres on their own for relief of their suffering led to a study of the overall awareness of symptoms amongst TB patients discovered in an epidemiological survey in a rural area. It revealed that 95% of the bacteriologically confirmed cases were aware of one or more symptoms suggestive of pulmonary tuberculosis and as many as 52% had visited practitioners of modern medicine in search of treatment<sup>13</sup>. This surprisingly high degree of “awareness” and “action taking” amongst a population traditionally regarded as ignorant and insensitive to their health needs provided the break-through required for the new approach. By exploiting this “felt-need” in the population, most of the 52% literally “knocking at the doors” of health institutions could be diagnosed without much effort and brought under proper treatment. At present the general health institutions in the districts are neither equipped to make correct diagnosis nor to offer proper treatment. Most of the “action taking” TB cases, therefore, are being missed till they reach an advanced stage of the disease when they are referred very late to the District TB Clinic for the needful. Even when such moribund patients are finally diagnosed at the District Clinic, they drop out of treatment for reasons already given. Therefore, integration of tuberculosis control activities with General Health Services, fuller exploitation of the “felt need”, introduction of simple and standard diagnosis and treatment techniques for General Practitioners, etc., emerge as the basic principles of the DTP.

(4) The sputum positive case: his early diagnosis and effective treatment receive priority in the DTP. For one thing, the sputum positive case constitutes the real public health risk to the community and should be dealt with first. For another, no definite proof is yet available that all or most of the X-ray suspects are really suffering from tuberculosis. Some studies in this country have shown that only above 8 to 15% of these suspects break down into sputum positive status over a period of 1-2 years<sup>19, 20</sup>. This may not be surprising because in tropical and sub-tropical climates X-ray shadows caused by non-specific infections could be considerable. In any case, a tuberculosis control programme need not dwell equally upon “suspects”, as long as the group of real cases cannot be effectively taken care of technically and organisationally as the first priority. A programme has to place the immediately required objectives in front of the potentially good but distant objectives.

(5) There is some evidence to suggest that “felt-need” and “action taking” in a community—seeking fulfilment in the “relief of suffering”

—are dynamic processes which are likely to improve, say, on the introduction of a service programme in an area where none existed before or similar other activities. A complex interplay of many factors may eventually express itself as “confidence” of the public in the programme and the area health service. Thus, one could envisage a far better cooperation of patients in their treatment, if convenience to the public and quickness with which the relief is afforded were kept to the forefront. It is one of the aims of the DTP to win, retain, and enlarge upon this public confidence by developing the TB Control Programme on sociological principles and in consonance with the overall effort to improve the health of the community. The consequently improved health of the people may then so improve the entire socio-economic fabric that the overall sickness (including tuberculosis) would fall sharply through requisite environmental changes and ability to provide more abundant resources required for further research and better services. In other words, a socially oriented health programme can become the ‘trigger’ for a benevolent spiral of socio-economic forces which has the potential to wipe out sickness as such.

(6) The “recording” and “reporting” in DTP has essentially to be programme oriented in order to (i) provide the necessary health intelligence, (ii) enable some sort of an operational assessment being made at each stage of the programme so that the methodology is applied more correctly and (iii) provide necessary “feed back” information to the programme headquarters to further improve the programme. Only the very essential and minimum technical information is recorded and reported. Many of the clinical data are omitted on purpose, in the belief that the major field of endeavour, especially in developing countries, now lies in the optimal use of available “resources” and the existing services and facilities to apply the available knowledge and methods, which are quite adequate, than continue to dwell upon collection of more clinical and technical informations.

#### **Case-finding, treatment and prevention under DTP**

It is possible to discuss only a few highlights of the case-finding, treatment, and prevention aspects of the DTP.

To enable case-finding being carried out by all the general health institutions, concentrating upon the sputum positive cases, the only practical diagnostic tool is the microscope. Sputum microscopy is both simple and reliable. It has been prac-

tically demonstrated that all categories of paramedical personnel usually employed by health institutions can be trained in sputum microscopy by brief inservice training. Reasonably good standards in microscopy can be maintained after such a training with only minimal supervision afterwards<sup>21</sup>. It has also been shown in the Bangalore area that “smear positive” cases constitute 82% of all infectious cases who are reporting to health centres with symptoms<sup>22</sup>. The “smear positive” cases in the “action taking” community could, therefore, be discovered by providing merely microscopy facilities at all the health centres. And, some of the 18% infectious cases who will otherwise escape detection on the date and time they report to health centres because only culture examination of sputum would have found them would be picked up subsequently through “referral X-ray service” which is explained later. In any case, the knowledge that cases who are positive on culture examination only are less infectious<sup>23</sup> compared to smear positive cases helps in setting the programme priorities properly.

On the basis of the already mentioned “awareness study”<sup>18</sup> it can be estimated that out of the stipulated 5,000 infectious cases in the entire district, nearly 2,500 infectious cases are reporting at various health institutions in the district and about 2,000 of them could be discovered forthwith as smear positive cases by the network of sputum microscopy centres, if medical officers of those centres could offer sputum examination to all those who complain of cough and other chest symptoms of more than a few week’s duration. In actual practice this would not mean more than 3 sputum examinations daily at each health centre<sup>24</sup>. Ideally, all the 5,000 cases must be found within a short time, but operational and organisation limitations may not permit a more ambitious programme goal to begin with. It has been practically demonstrated that most DTPs in fact do discover about 1,000 new sputum positive cases every year as soon as many of the health institutions in the district start participating in the programme, notwithstanding the very much restricted selection for microscopy which health institution medical officers often make on the excuse of “overwork”. Already, it has been mentioned that annual incidence of infectious tuberculosis in a district is likely to be 1,000 cases. Therefore any gain in annual case-finding, over and above 1,000 cases, is likely to pay dividends towards TB control as it would lead to quicker draining of the “pool” of infectious cases leading to a receding risk of infection in the community. More than 1,000 new cases per annum are

bound to be detected in any district if all the health centres in each district participate in the programme and the selection of cases for microscopy is more efficient or there is a jump in the level of action taking in the community or both. These developments can reasonably be anticipated in any DTP with the passage of time when the programme is understood better by all concerned and more and more people are benefitted.

The disposal of symptomatics found "sputum negative" at health centres requires further discussion. Only one out of every 15 to 25 sputum smears examined (depending upon the quality of selection amongst chest symptomatics) is expected to be smear positive<sup>25</sup>. If all the smear negative patients were to be x-rayed, two or three "suspects" could then be found (including those "cases" who would be culture positive) from every 15-25 smear negatives examined and the rest would obviously be suffering from bronchitis or other non-specific disease conditions. It is not practical to expect medical officers to refer all their sputum negative symptomatics to a distant centre for x-ray examination without first exercising their clinical judgement in favour of some obviously non-specific disease. Even if everyone is referred, only about 20% may actually report to a distant centre for x-ray examination<sup>8</sup>. It could be different if x-ray units were available nearer at hand. Distance, lack of money to travel, travel difficulties or just insufficient motivation may explain the noticed "cool" response of patients to x-ray referral. The DTP envisages, therefore, that Medical Officers shall exercise their clinical judgement before referring their patients to the District TB Centre for x-ray examination: at least till the entire question of x-ray referral is fully examined from the points of view of actual suffering in patients, the extent and quality of self-motivation to follow doctor's advice, how effectively is the advice given to patients to go to the District Centre for x-ray examination, the degree of "confidence" Medical Officers enjoy in the community, and the convenience with which x-ray examination is actually offered at the District Tuberculosis Centre. In any case, the question of offering specific treatment to a patient should not arise till either the sputum has been found positive or the x-ray examination suggests active tuberculosis.

That the real aim of case-finding is TREATMENT will be readily accepted. But, the aim of treatment must be both relief of suffering as well as "closure" of sources of infection. The first objective is as important as the latter and must not be overlooked on

the ground of epidemiological impact. There is considerable evidence that it is the depth of suffering which makes people report to health centres for diagnosis as well as influences the regularity with which treatment is taken subsequently. Therefore, relief of suffering assumes key importance under the programme as it powerfully influences treatment acceptability.

Both for relief of suffering and the desired epidemiological impact, treatment must be made as efficient as it is possible to make it. For this, free availability of drugs, the choice of drug regimens, ease of drug administration, freedom from toxic manifestations and other side effects, and the availability of an efficient treatment organisation, etc., assume great importance. Distance between Treatment Centres and patients' homes has proved to be of crucial importance for ensuring regularity in the prolonged treatment of tuberculosis. In one study the proportion of patients making 9 out of the prescribed 12 monthly collections in one year was 52% when the Treatment Centre was near at hand compared to 7% when patients had to cover a long distance to collect their medicine". Not only it is necessary that Treatment Centres should be conveniently situated for patients, but these should also be opened daily for defaulters; unlike peripatetic centres which open only on certain days of the week or month. Apart from that, the available knowledge about treatment regularity makes the taking of "defaulter actions", obligatory, namely "postal reminders" to patients who do not report on the "due date" to collect their drugs and fresh "motivation" about the importance of regular treatment when reminding alone does not seem to help. As regards consumption of drugs by patients after collection, it can be taken that if a patient makes the effort to collect his drugs he would most likely consume them<sup>28</sup>.

As long as the risk of infection in the community is high, a comprehensive tuberculosis control programme must include preventive BCG vaccination. The National Mass BCG Campaign was started in 1951 to vaccinate at first the estimated 170 million susceptible persons present in the community and then to concentrate upon the children who are being added constantly to the population. But, to successfully cover the ever incoming new borns the agency to vaccinate must be equal to the job and be available at most places all the time; which the current mass campaign cannot yet contemplate seriously for a variety of reasons. The most obvious situation at present is that the total

yearly vaccinations in all age groups fall considerably short of even the annual increase in population.

Besides a considerable increase in the number of BCG vaccinators participating in the campaign, far reaching methodological improvements are called for if successful competition with the ever incoming population of new borns and other susceptible persons is to be the aim. As a first step in that direction, DTP envisages integration of one mass campaign BCG team with each District Tuberculosis Control Centre to carry on BCG work in each district more systematically. The increase in the number of BCG teams (six vaccinators plus other staff) to the total number of districts in the country would at least ensure concurrent vaccination coverage in each district, instead of some part of each State as now. The next step must be integration of BCG vaccination with the routine function of the area General Health Service, School Health Service, and similar. Mobile teams are really not suitable for new born vaccination. In the event of other health centres taking up BCG vaccination regularly the BCG team could concentrate upon groups which could be reached by them more conveniently and effectively. Because of some serious drawbacks of the "liquid" BCG vaccine, the health services as a whole can come into the picture only when the freeze dried vaccine can be supplied liberally and the operational aspects of its use have been investigated fully.

Methodological improvements that have been suggested by the NTI in the traditional mass BCG campaign are several. It was shown that house-to-house registration in the rural population is a good way to ensure vaccination coverages of the order of 80% or better<sup>29</sup>. The main drawback of house-to-house campaign is its slow pace: the consequent sharp fall in daily outputs could put any campaign out of gear. To obviate this, direct BCG vaccination without performing the initial tuberculin test was introduced after ensuring that no serious adverse effect results<sup>30</sup>. This step not only doubles the speed of work, but cuts down costs proportionately, and improves coverages by saving losses due to absenteeism and refusal at the time of the second prick. For towns and cities, where vaccination as such and house-to-house registration particularly are less acceptable to the people, new born and infant vaccination in Maternity Hospitals and Child Welfare Centres, School Vaccination Programmes and special coverage of slums have been advocated. For direct vaccination, the age group below 20 years has

been adopted<sup>31</sup>, because in rural areas the infection prevalence till 0-19 years is only about 16.85%. In cities, where the infection rate rises more steeply, direct vaccination could be restricted to 0-14 age group, if considered absolutely necessary. Calculating on the average number of 150-175 registrations (all age groups, on house-to-house basis) per technician per working day, of whom 80 would be in the age group 0-19 years and he would be expected to vaccinate directly at least 70 of them, a six technicians team working for 250-300 working days in a year would cover the district completely in 5 to 7 years. During that period another 150,000 or so new borns would have been added to the population needing to be vaccinated in addition to those persons who could not be vaccinated during the earlier round. This "backlog" could be "mopped up" in another 2 or 3 years provided the agency to vaccinate the new borns takes over effectively during this period.

#### DTP in Outline

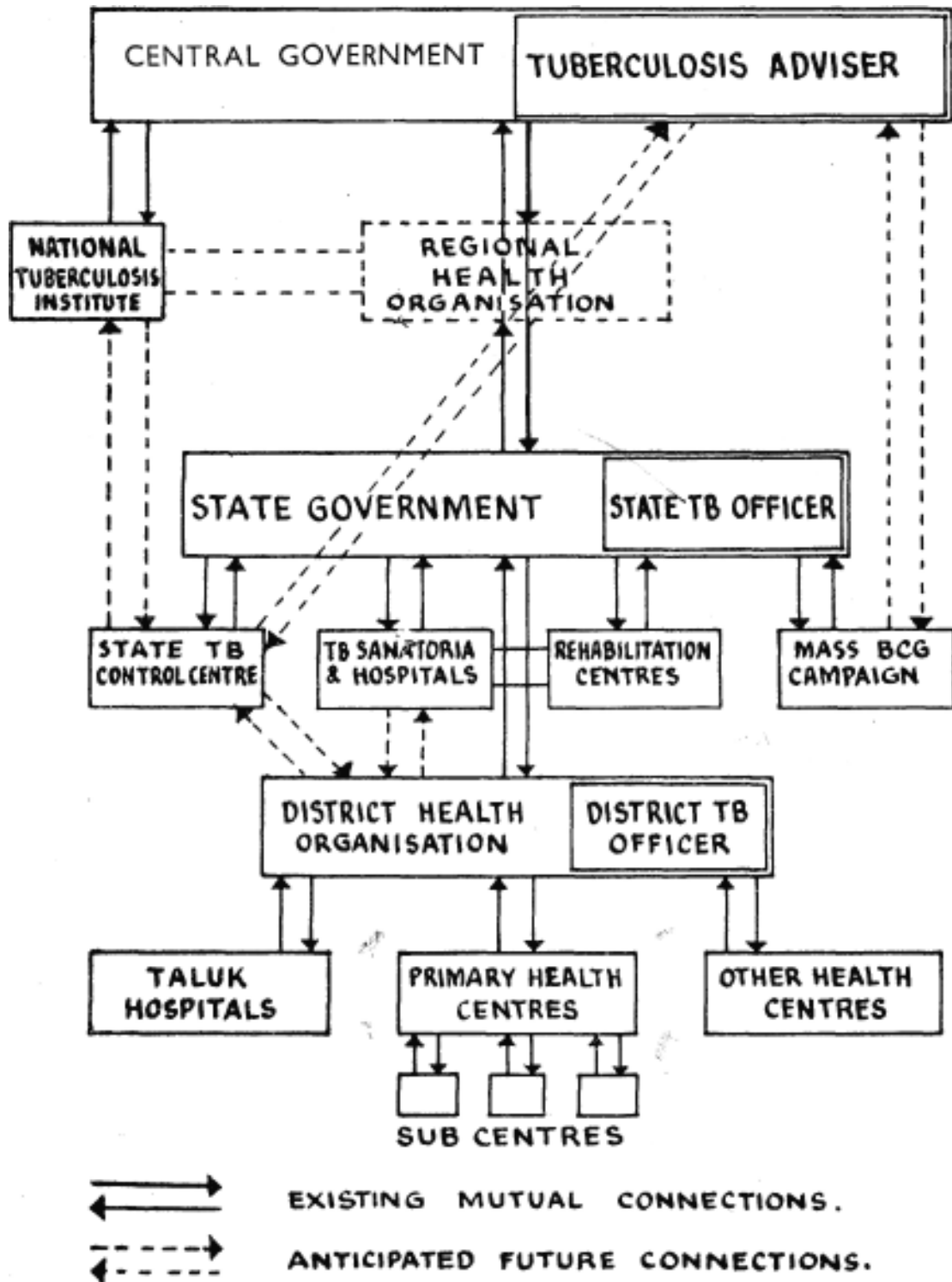
Diagram I is the schematic representation of the DTP making full use of all the health institutions available in a district.

#### (A) District Tuberculosis Control Centre (DTC)

As will be seen, the DTC represents the pivot around which the integrated DTP revolves. For this purpose, the erstwhile district TB Clinic becomes the DTC and takes up all the special responsibilities in respect of the programme on behalf of the district health authority. It now undertakes planning, implementation, coordination, and supervision of the DTP in the entire district besides offering the usual diagnosis and treatment service to the population under its direct care, like any other health centre. It also maintains the important "district TB case-index", and offers "referral" X-ray examination to the sputum smear negative symptomatics referred by other health centres. One BCG vaccination team also works under its direction. It would be obvious, that there is no place for more than one DTC in a district and the already existing additional TB Clinics become just "sub-centres" under the one DTC. New TB Clinics have not to be established in any district under the DTP unless there is no centre at all to become the DTC.

Each DTC must have provision for (i) adequate accommodation, (ii) necessary equipment for diagnostic work, (iii) transports for supervision and BCG work, (iv) and adequate staff for the clinic as well as programme promotion

# ORGANISATIONAL SCHEME OF THE NTP



functions. At this stage a culture laboratory is not visualised at the DTC as culture requires a high degree of skill and adds only about 18% "cases" to those who can be discovered by routine careful microscopy among symptomatics reporting at health centres. Supervisory staff for DTP have to be specially trained in the requisite managerial skills and supervision techniques and are often called "key" staff; in each District there are: one Medical Officer (District Tuberculosis Officer), a Treatment Organiser, a Laboratory Technician, an X-ray Technician, a BCG Team Leader and a Statistical Assistant. Service staff for the routine case-finding and treatment activities are trained as usual. About Rs. 65,000 per annum may suffice for staff salaries, the usual contingencies including supply of cards and forms, and repairs and maintenance of equipments and vehicles, etc. About one lakh of rupees would be needed for the expected 10 to 20 thousand exposures of X-ray miniature films and the commonly available anti-tuberculosis drugs for treating about 3,000 patients per year.

#### (B) *Peripheral Centre*

Other health institutions, except DTC, which participate in the DTP are called "Peripheral Centres". These are further categorised into "Microscopy Centres" and "Referring Centres" depending upon whether they possess own microscope or depend upon a neighbouring centre for microscopy. Both categories are fullfledged "Treatment Centres", since treatment under the DTP is decentralised to the farthest periphery.

No "specialised" staff need be posted at peripheral centres for anti-tuberculosis work. The Medical Officer incharge, the Microscopist, the Dispenser, the Sanitary Inspector, and the Auxiliary Nurse Midwives, etc., share the different responsibilities as functionally convenient. Normally, the Medical Officer selects such persons from amongst his routine out-patients attendance as should be offered sputum examination. He also prescribes treatment and does the initial motivation for those who are diagnosed as "cases". The Microscopist examines the sputa: the Dispenser distributes the drugs and the ancillary staff take defaulter actions on a routine basis under the guidance of the Medical Officer. Suitable in-service training is provided to the health centre staff by the DTO and his supervisory "key staff" team to discharge those duties. The DTO and his team also ensure that peripheral centres maintain good standards of diagnosis and treatment; keep proper records;

stock sufficient drugs; and report regularly and correctly to the DTC.

#### **Programme Procedures and Methods**

The National Tuberculosis Institute (NTI) has prepared a set of seven manuals<sup>32</sup> which provide detailed guidance on all the practical steps of the DTP. Those manuals should be consulted for all information not contained in this paper.

##### (A) *Case-finding*

Patients reporting at peripheral centres for relief of their symptoms are offered sputum examination, if there is cough or fever of few weeks' duration, haemoptysis, or chest pain. Sputum is examined immediately and if positive for acid fast bacilli the patient is motivated and put on treatment forthwith. At the DTC, the routine attendance is offered X-ray of the chest first, and sputum is examined only when a relevant shadow is seen in the skiagram in order to reduce the load of sputum examinations. But, sputum smear negative persons attending from the peripheral centres for referral X-ray examinations are offered a repeat sputum examination as well as chest skiagram at the DTC. All sputum positive cases and X-ray suspects are duly registered at the DTC in the District TB case-index and allotted a separate number. There is adequate provision for avoiding duplicate registration of cases already on the case-index.

If the result of sputum examination at a peripheral centre is negative, the medical officer may (i) repeat sputum examination: or (ii) give non-specific treatment and keep patient under observation for sometime; or (iii) give him a referral slip to attend the DTC (or nearest Taluk Centre equipped with X-ray) for an X-ray examination.

The result of X-ray examination at the DTC is intimated direct to the referring peripheral centre. If an X-ray shadow suggestive of pulmonary tuberculosis is seen, a TB case-index number is allotted simultaneously by the DTC and intimated to the peripheral centre so that the patient could be put on treatment straightaway when he contacts the medical officer again.

##### (B) *Treatment*

Treatment is given at all the peripheral centres. It is usually initiated where the patient reports first for his diagnosis. But, there is an effective "transfer" system which enables any patient to receive treatment from any peripheral centre convenient to him, no

matter where he was diagnosed initially, without any danger of duplication of his registration as a "case". The carefully thought out provision for starting treatment of the sputum positive cases on the same day they report for diagnosis is meant to minimize "initial default". Treatment is domiciliary and mainly on the basis of self-administered drugs. Drugs are issued once a month to the patient or his representative, when he calls for the collection at the arranged treatment centre on the "due date". Bacteriologically confirmed cases are put on a double drug regimen. Suspects, at present, are eligible for being treated with isoniazid only under the programme. Regimens containing streptomycin by injection have generally failed to keep rural patients regular beyond the first 2 or 3 months of treatment.<sup>33</sup> When a patient fails to collect his drugs, a letter is written to him (first action) and in the event of no response for 7 days, a home visit is paid (second action) by one of the health centre's field staff. Experience has shown that response to defaulter actions beyond the first two mentioned above are not commensurate with the effort inputs<sup>34</sup>.

#### (C) BCG Vaccination

The integrated BCG Team covers the district population systematically under the guidance and supervision of the DTO. After a house-to-house census in each village, those below 20 years are vaccinated directly. At the DTC, one of the regular staff is trained for BCG vaccination and the technicians of the regular BCG team are not "wasted".

#### (D) Recording and Reporting

A registration sheet, containing the names and addresses of all those patients whose sputa were examined during that week, is despatched every Saturday to the DTC by each Microscopy Centre. The purpose is to enable the DTC to register all sputum positive "cases" in the "TB Case-index" and allot them separate case-numbers. No record need be kept of those names at the peripheral centre, except for a chart showing the total number of sputa examined and the number found positive each week. "Treatment cards" and a "balance book" of treatment cards (containing an account of all the treatment cards available at the peripheral centre) are the only other records required to be maintained at peripheral centres. A monthly report on their treatment activity is sent by each peripheral centre to the DTC. The DTC in turn reports regularly to the Programme Headquarters. On the basis of those periodic reports, progress reports for

each State and the entire country are prepared and the necessary corrective actions are taken.

#### (E) Supervision

While the peripheral centres have to function under the administrative control of their respective authorities, such as the District Medical and the District Health Officers, the DTO and his key staff have permission to exercise technical supervision regularly over the programme on behalf of the District Health authorities. The work of DTO and his team is supervised periodically from the State Government and Central Government levels. Supervision includes guidance on solving the day-to-day difficulties, keeping the supplies moving, ensuring proper work standards, correct recording and reporting, and similar.

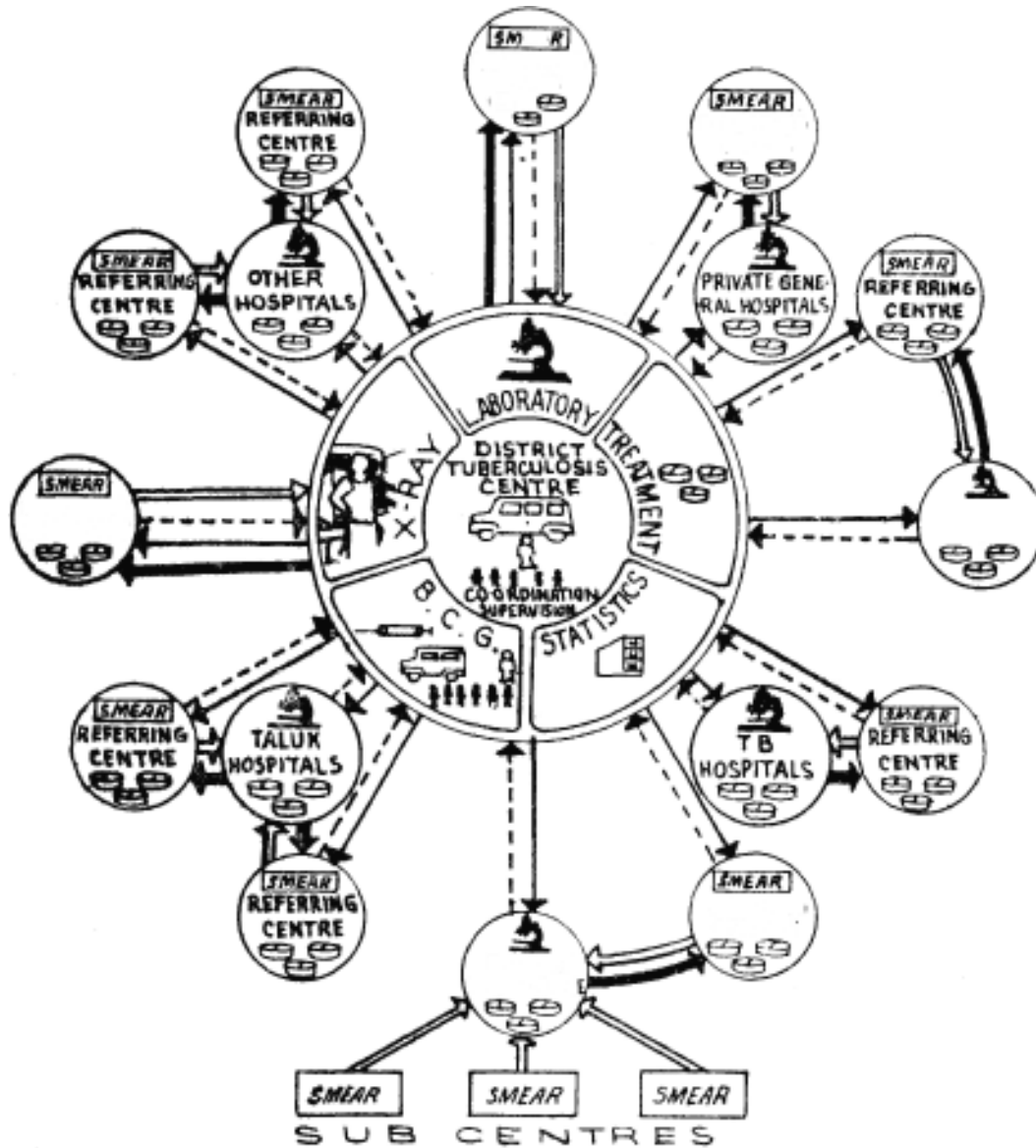
#### Place of DTP in NTP





It has been said that the DTP represents the "grass roots" of the NTP, in as much as it provides *the* functional basis for dealing with the problem of tuberculosis in 82% of our population living in rural areas. The other components of the NTP are: (a) the Special Mass BCG Vaccination Campaign, (b) large city programmes which take into consideration certain special urban conditions, (c) surgical treatment and the treatment of "drug failures" in specialised institutions such as Sanatoria and TB Hospitals, and (d) rehabilitation of the selected physically handicapped TB cases, on the one hand, and (e) overall planning, implementation, and coordination of all the anti-TB activities, (f) the basic training and orientation of the large number of personnel required for the NTP and (g) continuous programme assessment and the research (operational) required to improve the programme, on the other. Most of these other NTP components are not discussed here for obvious reasons. It must be stated however that, comparatively speaking, institutional treatment and rehabilitation represent activities which render only a marginal benefit (to the programme) at a proportionately very heavy cost. For humanitarian reasons, these activities must find a place in the programme but for the purpose of expansion of facilities and future investment of resources these should receive either a low or no priority.

Diagram II shows the scheme of the NTP which is directed and coordinated from the Central Government level while the actual implementation and control of the programme rests with the State health authorities in each State. The overall Programme Policies and Priorities are at first decided at the national level through mutual consultation amongst the

(Diagram II)

# DISTRICT TUBERCULOSIS PROGRAMME



 Symptomatics found sputum negative and periodic return to D. T. C.  
 Case Index numbers, X-Ray results and supplies to Peripheral Centres.  
 Sputum smears sent to Microscopy Centres.  
 Sputum smear results sent to Referring Centres  
 A REFERRING CENTRE CAN BE ANY TYPE OF HEALTH INSTITUTION

State and the Central Governments, the Planning Commission, the leading tuberculosis experts of the country, and international health

organisations like the World Health Organisation and the United Nations Children's emergency fund. After requisite broad national poli-

cies have been laid down, the detailed planning of the programme, the procurement of supplies—especially imports from abroad—the issue of periodic circular informations on the national treatment policy, the optimal drug regimens, instructions for BCG vaccination, etc., are then taken up by the Office of the Tuberculosis Adviser to the Government of India. The State Tuberculosis Officers (STO) or Assistant Directors of Health Services (TB) implement the Centrally circulated recommendations in their respective States and coordinate all the anti-tuberculosis activities under various heads and from different types of institutions. The Central Government provides full assistance to each State programme according to the pattern decided before hand. For closer liaison with the States, it is now proposed to set up Regional Health Organisations to be connected more intimately with a group of three or four States. Special mention must be made of the role which State Tuberculosis Centres (TB Demonstration and Training Centres) and the NTI are expected to perform in their respective State and the Central spheres. These institutions are to provide their respective programme chiefs, the technical “know-how” and field guidance, undertake training and the programme assessment, and render any other support that is required of them to push the programme further.

#### **DTP in Perspective**

A good programme always strives to achieve its objective by offering its services on a continuous basis to all those who need them, in tune with similar other programmes, till that time the effort is no longer needed.

The start of the DTP in any district would primarily depend upon the availability of competent administrative and financial sanctions, and of the essential facilities like buildings, equipments, and trained staff. In spite of the great pains that have been taken to ensure that the organisational set up of the DTP does not entail large scale investment of funds and other resources or involve competition with the General Health Service for the trained staff, a large number of difficulties and “bottle-necks”, mainly operational and organisational in nature, are likely to make the initial phase of the programme somewhat slow and prolonged. Further progress, therefore, would largely depend upon the initiative and the ingenuity of the DTO and his team and the cooperation that could be enlisted from participating General Health Service staff, private medical practitioners, the profession, as well as other district officials, Voluntary Associations and the gene-

ral public<sup>35</sup>. To this extent the success of the DTP is dependent upon so many outside organisations and factors. A strong and well organised DTC, however, is likely to influence powerfully the speed of expansion of the DTP to the periphery. At the average speed of adding two new health institutions to the programme every month, the entire district can be “implemented” on a sound basis in about 2 years, provided the DTC is functionally strong.

After the first 2 years, required to cover the district geographically, shall come the period when the programme must sink in depth. Its various components should now become increasingly more efficient functionally to be able to win the confidence of the public. It is not possible to suggest how long this phase may last, as the overall efficiency of the General Health Service would now become the determining factor. One component of an integrated health service cannot be far more efficient than the other. Even if the DTP were made to succeed by some special effort, the overall result may be lopsided development, because the special attention given to tuberculosis control may mean neglect of other aspects which is likely to retard the overall health interest of the community. In fact, it may be wise for DTP organisers to view the disappointments and the frustrations sure to be met with from the start in this light. Therefore, while they strive to push the DTP they should simultaneously endeavour to strengthen the General Health Service which is the fountain-head of the tuberculosis control programme as of all other health activities.

From the programme dynamics already given, it should be clear that the dividends expected from the NTP in terms of cases found and treated and the susceptibles protected cannot be inconsiderable even during the early phases of the “programme spread” and “programme seepage”. As the programme becomes stabilised and efficient, “awareness” and “action taking” amongst the population would improve to the extent that a “self-generating” process would set in which would not require special efforts. The selection of patients for microscopy would cover almost all the eligibles; diagnosis by referral would be more rewarding; treatment regularity and its completion would be far better and BCG vaccination will compete systematically and successfully with each addition of “new borns” cohort. A sizeable and constant decrease in the pool of infectors would lower the risk of infection, and simultaneous increase in the number of BCG vaccinated persons in the community would lower the incidence of fresh disease. Since the DTP is fully integrated with the General

Health Service and is "felt-need" oriented, a marked decrease in the number of sufferers from tuberculosis would automatically divert attention to the next most important health hazard without running the risk of continued and disproportionate expenditure of resources on a disease which would have lost its old importance as a health hazard.

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## DRUG DEFAULT IN AN URBAN COMMUNITY

S. P. PAMRA AND G. P. MATHUR

*(From New Delhi Tuberculosis Centre, New Delhi)*

Mathur et al (1964) analysing the results of domiciliary treatment from New Delhi TB Centre came to the conclusion that whereas 98.2% sputum conversion can be achieved in patients who take treatment with cent per cent regularity, the conversion rate comes down to about 55% in patients with regularity of less than 60%. Now that powerful and effective antimicrobial drugs are available, emphasis in treatment is, and should be, on preventing drug default. Almeida (1962) studied the problem of drug default in relation to personality pattern of the patients and concluded that whereas nearly 40 to 50% patients are docile and another 10% inherently rebellious, the remaining 50 to 40% are liable to be forgetful and lazy. The docile ones do not usually default if motivation is thorough and purposeful and the rebellious will discontinue treatment if they so choose, no matter what steps are taken. Repeated motivation and prompt defaulter action is however necessary to make the forgetful take treatment regularly and as long as necessary.

Pathak (1965) analysing the reasons for default found that majority of the patients defaulted because the symptoms having abated, they thought they were cured; or if they were working, visit to the clinic involved loss of wages. Whereas the latter is purely an organisational and economic problem, the former can be reduced by defaulter action. A new approach to defaulter action and its effect on the problem is presented herein.

### Method & Material

All patients from domiciliary service area of the New Delhi Tuberculosis Centre with a family income of less than Rs. 300/- p.m. get free drugs. The patient has to attend for collection of drugs once in 4 to 6 weeks in the earlier stages of treatment and once in 3 months when the lesion reaches quiescence. Before the treatment is started, motivation stressing importance of regular and prolonged treatment is carried out by the doctor who prescribes treatment for the first time, by the Medical Social Worker who investigates the patient's socio-economic needs and finally the Health Visitor who in addition to motivation regarding treatment also gives preventive advice to the patients in the Centre and in the home. Thereafter motivation with regard to regularity is repeated as often

as necessary if the patient tends to be irregular in drug collection.

For home visiting, the area is divided into 12 zones, one health visitor looking after each zone with a population of 50,000 to 100,000. The health visitors maintain a complete antimicrobial record of the patients in their area. Apart from occasional surprise checking, patients who attend regularly i.e. within 3 to 4 days of the due date are not visited as a routine. A visit is paid to the patient's home if he does not turn up within 3 to 4 days of the due date and 3 visits are paid during the course of next 2 to 3 weeks if the drug default continues. If the default continues in spite of the three visits by the health visitor, the patient is marked 'non-cooperator' and further routine visits are stopped except that a visit is paid once a year to ascertain if the patient is still alive and living in the area and if so, his general health and working status is recorded.

With a view to see if an additional visit by a senior member of the staff (hereafter known as—visit) to these 'non-cooperators' could serve any useful purpose, a study was started in 1965 wherein patients who could not be retrieved by health visitors were visited either by a doctor or the Chief Public Health Nurse.

During the period 1965-66, 786 non-cooperators as defined above, were referred for visit to the senior members of the staff. All these patients did not however give up treatment prematurely during this period. The year of their registration and the sputum status at the time of non-cooperation is shown in Table 1. Majority of the patients had stopped treatment long before the study and were sputum negative at the time of giving up treatment. Such cases continue to accumulate in the area register as names are taken off the register only in the case of death or emigration or when a treated case maintains an arrested status for 5 years uninterruptedly. Since they had not attended at all after stopping treatment against advice and their exact present status is not known, they remain on the register from year to year as 'non-cooperators'.

Of the 786 non-cooperators, 531 were visited by one of the 6 doctors detailed for this purpose and 255 were visited by the Chief Public Health Nurse. The results obtained from the visit of a doctor or Chief Public Health Nurse do not show any appreciable difference and hence in the analysis given below, the results have been combined.

TABLE 1

*Classification of non-cooperative cases by year of origin and last known sputum status*

	Year of Origin						Total
	1960 or earlier	1961	1962	1963	1964	1965	
Sputum Positive	75	27	26	22	23	4	177
Sputum Negative	213	104	116	94	60	13	600
Sputum Status not known	-----		3	1	4	1	9
Total	288	131	145	117	87	18	786

### Observations

The result of these visits is shown in Table 2. It would be seen that in nearly 42% of the patients such a visit was infructuous and they did not attend at all and of the remaining 58%

TABLE 2

*Result of visits to non-cooperator patients by medical officer/chief public health nurse*

Total patients visited	...	...	786	(100%)
Patients who did not restart Treatment	...	...	231	(42%)
Patients who restarted treatment but again stopped prematurely	...	...	131	(16%)
Patients who restarted treatment and completed as advised	...	...	263	(34%)
Patients who restarted treatment and are continuing it	...	...	61	(8%)

who responded at least once, 263 or 34% of the total, thereafter continued treatment till it was completed. Of the remaining 192, 61 (8%) are still continuing treatment while 131(16%) started treatment as a result of these visits but again gave it up before reaching the 'Target Point'\*

\* Target Point is defined as the stage when at least two consecutive sputum/LS cultures at 3 months' interval are negative, and radiographically no cavity is seen and the lesion has been stable for at least 6 months.

It may be pointed out that the treatment of 99 or nearly 30% of those who did not respond at all, had been started in 1962 or earlier. In other words, default had been of such long standing that retrieval would have been unlikely if not impossible.

Treatment was no longer considered necessary in 35 patients when they attended after this visit. Interval between initial non-cooperation and subsequent attendance had helped to establish the stability of the lesions. These 35 cases are included in 263 shown as having completed treatment.

Table 3 shows the duration of treatment of these patients before this defaulter action, in relation to the result of the visit.

It would be seen that majority of the patients (462 out of 786 or nearly 60%) had defaulted within one year of starting treatment and nearly half of them could not be retrieved even by such a visit. Of those who defaulted after 1 or 2 years of treatment, 45% and 35% respectively completed the treatment after retrieval. This is, to a large extent, due to the long and near complete treatment they had already taken.

Table 4 shows the duration of treatment after the visit in relation to the duration of pre-treatment in patients who attended at least once but again stopped attending before completing the treatment.

It would be seen from this Table that majority of the patients (70-80%) in this group

TABLE 3

*Evaluation of utility of visits related to duration of treatment*

Duration of treatment before default	Total No. of patients	Number of patients who			
		did not restart treatment	restarted treatment but stopped a.m. a.	restarted treatment and still continuing	restarted and completed treatment as advised
Less than 1 year	462 (100.0%)	227 (49.1%)	76 (16.5%)	30 (6.5%)	129 (27.9%)
1 to 2 years	209 (100.0%)	66 (31.6%)	27 (12.9%)	22 (10.5%)	94 (45.0%)
2 years and more	113 (100.0%)	38 (33.6%)	26 (23.0%)	9 (8.0%)	40 (35.4%)
No record	2	—	2	—	—
Total	786 (100.0%)	331 (42.1%)	131 (16.7%)	61 (7.7%)	263 (33.5%)

TABLE 4

*Duration of pre-de fault & post-default treatment far patients who restarted treatment but stopped prematurely again*

Duration of pre-default treatment	Total number of patients	Duration of post-default treatment			
		0-1 year	1-2 years	2 years & above	No record
Less than 1 year	76 (100.0%)	53 (69.7%)	11 (14.5%)	1 (1.3%)	11 (14.5%)
1 to 2 years	27 (100.0%)	19 (70.4%)	1 (3.7%)	—	7 (25.9%)
2 years & above	26 (100.0%)	21 (80.8%)	4 (15.4%)	—	1 (3.8%)
No record	2	—	—	—	2
Total	131 (100.0%)	93 (71.0%)	16 (12.2%)	1 (0.8%)	21 (16.0%)

took treatment after initial default for less than one year irrespective of the length of pre-default treatment. In other words their non-cooperation was only a shade less confirmed than of those who did not attend at all. Dis-

appearance of symptoms was the operative reason in most of them.

Table 5 shows the reasons for their failure to complete treatment when called. Up to the time of analysis, 24 had moved out of the

TABLE 5

*Reasons for non-completion of treatment of 131 cases who restarted treatment after visit*

Died	34
Left area	24
Non-cooperative *	73
	131

\* Last known sputum status:

Positive..... 20

Negative ..... 53

area, and 3 4 had died. Even though in many of them the treatment could be considered a failure, yet from the point of view of default, they have to be excluded from the 131 who defaulted again.

Further breakdown of the remaining 73 who became defaulters again after attending for some time, shows that 54 or nearly 75% of these, (almost like those who did not attend at all) had been put on treatment in 1962 or earlier. Twenty were still sputum positive when the fresh non-cooperation started and 53 were sputum negative. Further, out of the 20 sputum positives, previous treatment of 18 had been unsatisfactory. Some of them were too advanced to begin with and some because of irregular, interrupted and haphazard treatment or because of failure to accept advice regarding surgery, had already reached a stage which may be termed incurable, a stage at which many can neither be expected to continue treatment nor are they likely to benefit even if they do so.

### Discussion

The importance of regular and prolonged treatment, as long as considered essential, cannot be over-emphasised. Human nature being what it is, patients who voluntarily take the medicines regularly without break are not many. Success of domiciliary treatment depends to a very large extent on the efficiency of defaulter action. The more prompt and concerted such action is, the lesser will be the ultimate fall-out from treatment. In an urban clinic fall-out cannot always be prevented as many patients who come to the city only for treatment cannot afford to stay as long as necessary, (Pamra et al, 1967) and swell the number of apparent 'failures.' Default by those who continue to live in the area is, theoretically at least, preventable. Health visitor's visit and calling through letters are the two methods in use for retrieval. We have very little experience of the latter, which being

possible in the case of literate patients only, is of limited utility. It has been used in a special study (Sikand et al, 1965) in an educated group but even here it was found that calling through the health visitor yielded better results than calling through letters or in other words, personal contact appeared to be better than the impersonal approach through a letter.

The object of this study was to ascertain, whether visit by a senior member of the domiciliary service staff such as a Medical Officer or Chief Public Health Nurse could help to retrieve the defaulter after 3 visits by the Health Visitor during a period of 2/3 weeks had failed. The study has clearly shown that more than half (58%) of health visitors' failures could be called by the senior person. Whereas 34% completed the treatment thereafter and 8% were still continuing, in the remaining 16% success was partial. Counting those who did not attend at all (331) and those who after being called, did not complete treatment (73), the experiment was successful in nearly half (382 out of 786). This achievement is not inconsiderable.

If patients who in any case were doomed to failure are excluded and the study were to be based only on those who could have been cured, this additional retrieval assumes still greater importance. Similarly if this step had been taken soon after default and not some years later as in many of the patients in this study, it may have shown even better results.

It may also be pointed out that the treatment policy of this Centre during the period to which these cases belong has been to continue 'maintenance' treatment with INH for one year after the lesion had reached the 'Target Point'. A patient would, by definition, be labelled 'defaulter' even if he had reached the 'Target Point' of treatment and dropped out during the 'maintenance' phase. Thus the non-cooperation of many cases was probably only in name and of no significance, since most of them are known to be working and free from symptoms. Having remained asymptomatic for some years would tend to suggest that they may have already reached an arrested status, (like the 35 who did attend and were proved so) though continuing to be shown as non-cooperators in the area register, merely because they did not attend. In other words their non-cooperation was more 'procedural' than real.

The visit by a doctor may not be considered as only just an additional routine visit to the

patient's home. Not long ago the health visitors continued to visit the non-cooperators every 3 months for 2-3 years and yet we found that if the patient did not attend after being called twice or thrice, the chances of his coming later were practically nil till of course when he broke down again and developed symptoms in which case he came invariably post-haste whether there was a visit or not. It is felt that the senior person's visit had a special effect on the defaulters who probably reasoned with themselves that a senior person would not have come to their house to call them for treatment unless it was absolutely essential and in their (the patient's) interest. Thus there is no hesitation on our part in recommending that wherever possible the health visitors' attempts to retrieve the defaulters may be rounded off, at least by one visit from a senior member of the staff preferably a medical officer for maximum effort.

Whether such a visit is feasible in all situations is a different matter, and depends by and large on work-load in relation to the staff. National Tuberculosis Programms Manual No. SM/6 issued by the National Tuberculosis Institute in September, 1964 requires only two attempts to be made for retrieval either by a health visitor or through a letter and if that does not produce any result, the case is to be considered as 'lost'. Perhaps nothing better

is possible at the periphery for obvious reasons but where further effort with promising result is possible as in bigger clinics in urban areas, it is well worth a trial.

#### ACKNOWLEDGMENT

This study was initiated and directed by Dr. B.K. Sikand, former Director of the Centre and the credit goes mainly to him. The authors are very grateful to him, in addition, for his valuable suggestions and criticism.

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## REGULARITY IN DOMICILIARY TREATMENT

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The result of chemotherapy depends mainly on the regularity with which the patient takes the treatment and the duration thereof. Since in domiciliary management, drugs have to be self administered by the patients, they tend to be irregular and give up treatment prematurely against advice. These two lapses are often brought in as arguments against domiciliary treatment with apparent justification if the problem is examined superficially. From 1951 to 1954 less than 20% of the patients completed even one year's treatment (Sikand & Pamra 1956 a, b). It has been our impression, then and later, that a large majority of the patients who are shown as stopping treatment against advice at various stages do so because circumstances beyond their control force them to leave Delhi. Delhi, being a metropolitan city, draws a large number of patients from the adjoining districts where diagnosis and treatment facilities are inadequate. These patients often come and stay with friends and relations in Delhi and cannot continue staying long enough to complete the treatment which usually lasts more than a year. Since patients who stopped treatment at any stage were not worse off than those who continued treatment, it was logical to assume that failure to benefit from treatment may not be the main cause of premature termination of treatment.

An opportunity to test this hypothesis was provided by the ICMR co-operative study on primary drug resistance. In the first phase of this study, only patients who were bonafide residents of the domiciliary service area of the New Delhi Tuberculosis Centre were eligible. A resident was defined as one who had been living in the area for the last one year and was expected to do so for one year more. Thus, patients who at the time of reporting at the Centre for diagnosis and treatment were registered as living in the domiciliary service area got sorted into two categories, one of 'bonafide' residents' and the remaining of 'non residents' according to the above definition. Treatment record of these 'residents' and 'non residents' has been compared with regard to regularity and duration of treatment in this study.

### Material

During the period May 1964 to August 1965, 473 new cases of pulmonary tuberculosis who fulfilled all other criteria of the study were investigated with regard to whether they

had any treatment prior to reporting at the Centre and also whether they had been living in the area for the last one year and were likely to stay for one year or more. Out of these 473 patients, 147 had not taken any treatment before reporting at the Centre and were bonafide residents of the area; 118 were bonafide residents but had taken treatment before reporting at the Centre, and 208 with or without previous treatment did not qualify to be considered as residents. Since residents without prior treatment behaved slightly differently from residents with prior treatment, the two groups are being dealt with separately and the last group of non-residents is included as a sort of 'control'.

All these patients, irrespective of their category, were given free antimicrobial drugs and had similar domiciliary supervision. The health visitor made an initial visit to give the necessary preventive advice and to call contacts for examination but thereafter, apart from an occasional surprise checking, those who attended regularly for collecting drugs were not visited in their homes. However as soon as any patient defaulted, the home was visited to retrieve the defaulter.

Table 1 shows the number of patients completing one year's treatment in various categories and Table 2 the reasons for non-completion of treatment by the remaining patients. It would be seen that though only 79% in categories 1 & 2 and 33% in Category 3 completed one year's treatment, the actual number of patients who gave up treatment prematurely while continuing to live in the area was only 5 and 4 in Categories 1 & 2 respectively (Table 2). Patients living in the area but not attending the Centre and known to be taking treatment elsewhere are in any case not eligible for analysis regarding regularity and fall out.

A perusal of the reasons for not completing one year's treatment shows that in the case of Category 1, moving out of the area by transfer or forced change of residence or under the Delhi slum clearance scheme accounted for 23 patients, leaving only 2 patients who were obliged to go back to their village probably because they failed to benefit from the treatment. This means that if 23 patients who were forced to move out of the area for reasons beyond their control were excluded from the 140 who actually started treatment, the percentage of patients failing to complete treatment comes down to 6 only (i.e.

TABLE I

*Cases completing 1 year's treatment in various categories*

	Number of cases at start	Cases found ineligible later	Cases taking treatment elsewhere	Cases who actually started treatment	Cases who completed 1 year's treatment
Category I Resident cases without previous treatment	147	1	6	140 (100%)	110 (79%)
Category II Resident cases with previous treatment	118	26	8	84 (100%)	66 (79%)
Category III Non-resident cases	208	—	98	110 (100%)	36 (33%)
Total	473	27	112	334 (100%)	212 (63%)

TABLE 2

*Reasons for premature stoppage of treatment among 'Resident' Patients*

	Resident Patients without previous treatment	Resident Patients with previous treatment
A. Left the area:		
(i) Transferred out of Delhi	4	6
(ii) House demolished (slum clearance)	7	1
(iii) Shifted residence (other reasons)	12	7
B. Non-cooperative		
(i) Still living in the area	5	4
(ii) Left Delhi	2	—
Total	30	18

7 out of 117). Similarly, although patients in Category 2 according to their statement were all supposed to be bonafide residents, as many as 26 persons were subsequently found to be non-residents. The fact that they had treatment elsewhere also suggests that most of them were probably outsiders. If all these non-residents and those residents who were forced to move out of the area for reasons

beyond their control (14 in all) are excluded, the number of persons failing to complete treatment again comes to 6% (4 out of 70). Contrary to this, in Category 3 of self-declared non-residents, as many as 98 moved out of the area soon after diagnosis and of the remaining 110, 36 i.e 33% completed one year's treatment, the remaining moving out of Delhi at various stages. The conclusion is obvious that

patients who give up treatment prematurely were by and large those who had no roots in Delhi.

### Regularity

Table 3 shows the regularity of drug collection by patients who completed one year's treatment in various categories. Pattern of drug default is almost similar in all three categories.

always been deduced from our domiciliary service material and often referred to in the annual reports of the Centre; that a major reason for patients not completing one year's treatment was that they had to leave Delhi and since the patients who left Delhi were at the time of leaving treatment, clinically comparable to those who continued treatment (Sikand & Pamra 1956), it was obvious that failure to benefit was not the reason for leaving Delhi. Failure of these patients to complete treatment

TABLE 3

*Number of visits paid by Health Visitors to retrieve drug default in various categories of patients*

	No. of cases starting treatment	Visits paid during one year			
		None	1 to 5	6 to 10	Over 10
Category I 'Resident' patients without previous treatment	140 (100%)	62 (44%)	63	12	3 (2%)
Category II 'Resident' patients with previous treatment	84 (100%)	41 (49%)	33 (39%)	9 (11%)	1 (1%)
Category III Non 'Resident' patients	110 (100%)	64 (58%)	34	8	4 (4%)

Since the health visitors visit the defaulters usually once a week, the above table will show that whereas nearly half of the patients took treatment regularly for the entire year and did not have to be called by the health visitors because of drug default even once, the number of patients who took drugs with varying degrees of regularity from 80% to 100% were 89% in Category 1, 88% in Category 2 and 89% in Category 3. Grossly irregular patients (i.e. with regularity below 80%) were extremely few, viz 3, 1 and 4 in Categories 1, 2 and 3 respectively. In other words, if a patient came from outside for treatment, he took the treatment as regularly as the residents as long as he remained in Delhi and under treatment of the Centre. The only difference was that many of them were obliged to leave Delhi before completing treatment.

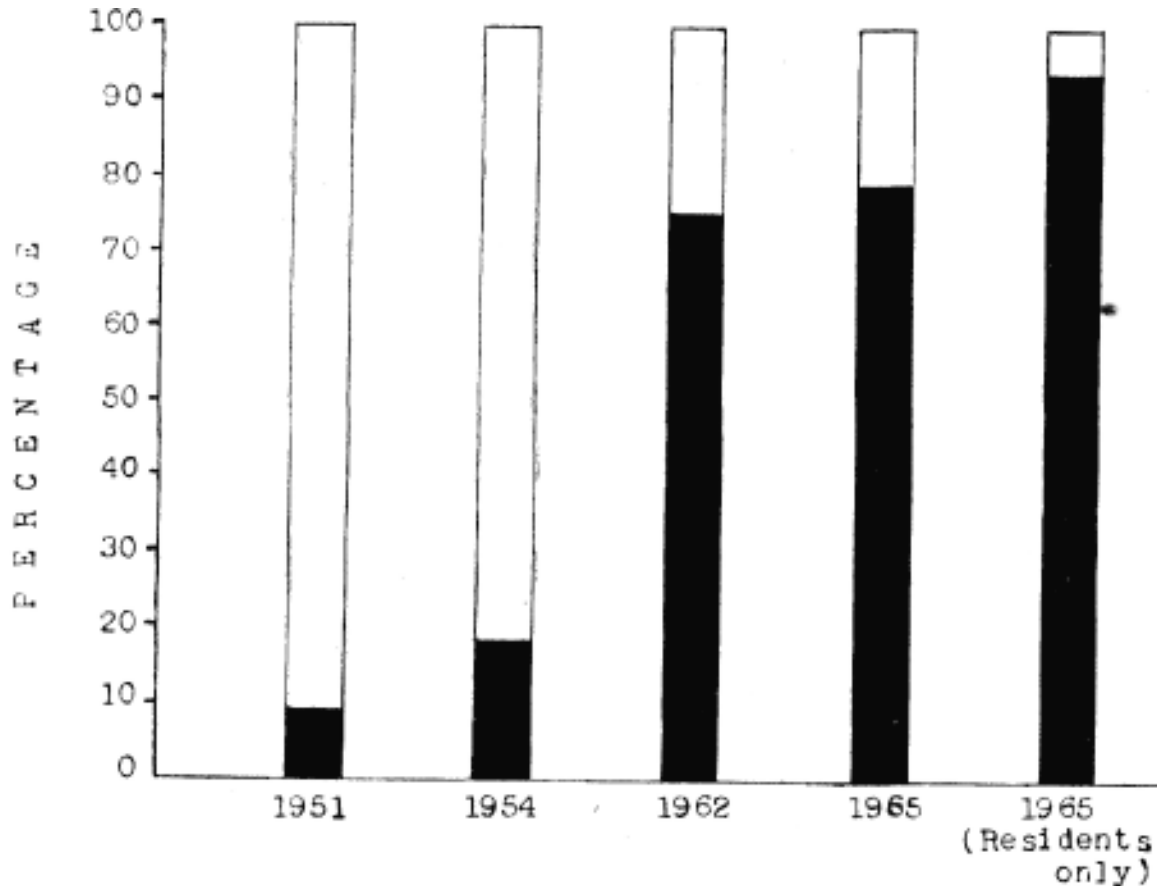
### Discussion

The above study has proved what had

need not therefore be an argument against domiciliary treatment.

Figure 1 shows how the number of patients completing one year's treatment has been improving. In the earlier years of chemotherapy, drugs were not freely available and it stands to reason that many patients could not continue treatment as advised. When the drugs were freely available (1962 and after), the percentage of cases completing treatment rose from 10 to 25; but they were still a composite lot, residents and non-residents according to the qualification mentioned earlier. If those who do not qualify to be full residents are excluded and drugs are provided free and as long as necessary, 94% of the patients complete one year's treatment. Alternatively, if adequate facilities for domiciliary treatment are provided at a place near the patients' residence, there is no reason why the patient should go elsewhere in search of treatment. If he does, he may very well leave it prematurely due to the difficulty

Fig. I: PROPORTION OF PATIENTS COMPLETING ONE YEAR'S ANTIMICROBIAL TREATMENT IN DIFFERENT YEARS



of sticking on in a distant place for the entire duration of treatment which unfortunately, in tuberculosis, is still quite long.

Another argument usually adduced against domiciliary treatment is that the patients stop taking drugs prematurely. It could be seen that in this material, only 5% of the patients did not take treatment long enough. This is no discredit to domiciliary treatment because this problem is equally applicable to hospitals also. About the same period as this study, 371 patients were admitted in the local hospital from the domiciliary service area of this Centre and of these 122 or 33.3% left the hospital against medical advice. In other words the non-cooperators of hospital treatment were 33.3%. No doubt many of them must have left the hospital because they knew that they would be able to get the drugs from the clinic through domiciliary service and if the alternative was not

there, they may not have left the hospital. But the difference between 5% and 33.3% is too big to be explained entirely by the above reasoning. Non-cooperation or refusal to accept advice, whether in the clinic or in the hospital, depends upon the behaviour or personality pattern of the patient. Almeida (1962) and Pathak (1965) also found that relief of symptoms and belief that disease was cured was one of the main reasons for non-cooperation in treatment. These are the patients who not only non-cooperate in treatment against tuberculosis but probably do so in all walks of life.

The main shortcoming of domiciliary treatment viz premature stopping of treatment is therefore not a defect of domiciliary treatment per se, but a defect in the organisation of the service. The defects of domiciliary treatment cannot be removed by substituting another system for domiciliary service, least of all hospital

treatment which as we have seen it as much, or perhaps more, conducive to non-cooperation and irregularity as domiciliary treatment. The defects of domiciliary treatment can be removed only by extending the service to areas where none exists and by improving its content and organisation, so that full diagnostic and treatment facilities are available to patients within a reasonable distance of their domicile.

#### **Acknowledgement**

The authors are greatly indebted to Dr. B.K. Sikand, former Director of the Centre for

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# HUMAN TYPE OF MYCOBACTERIUM TUBERCULOSIS ISOLATED FROM RHESUS MONKEYS

(PART I)

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In recent years, Monkeys as an experimental animal have been found most useful in certain aspects of medical research and their use in research laboratories has greatly increased. The type of animal most commonly used in the laboratories of India is *M. Mulatta* caught in the jungles of North India. A large number of these animals is exported for experimental work to other laboratories also. To ensure that laboratory staff is protected from the infection from the animal and fairly healthy and disease free animals are used for experimental work, some preliminary laboratory tests are done before animals are given a green signal for experimentation and one of these is the tuberculin test.

It is not unusual in the laboratories, when going around freshly caught monkeys, to come across one or two with dull looks and subdued persistent cough resembling that of a phthisis patient. Invariably such animals give a strongly positive tuberculin reaction and when sacrificed reveal extensive tuberculous lesions of the lung and/or other organs. To weed out such infected animals tuberculin test is done routinely when fresh animals are received in the laboratory.

To find out the type of tubercle bacillus infecting these animals and to find if it can cause disease in healthy animals following experiments were done.

## Material and Method

*Normal Monkeys* :—For this study North Indian Brown monkey (*Macaca Mulatta* Mulata) both male and female weighing 4-5 kilograms were used. The animals were brought from the contractors who caught them from Uttar Pradesh, Delhi and its neighbourhood. These animals before they were utilised for the experiment were subjected to a number of investigations and kept on a standard laboratory diet for a period of two to four weeks only. Tuberculin negative monkeys were used.

Each animal was kept in a separate cage (fig. 1) provided with a sliding door and movable trays for food and a fixed container for drinking water. Excreta were collected in tray kept under each cage.

The animal room was well ventilated,

washed with dilute phenol twice a day and food served after the wash at 8.00 A.M. and 5. P.M.

*Tuberculin Test* :—This test was used as the main distinguishing test between the tuberculous and non-tuberculous animal throughout the study (Benjamin 1955) and was repeated at fortnightly intervals. The purified protein derivative or P.P.D. was chosen as it was considered to be more accurate and specific than the old tuberculin (Kennard 1941) PPD supplied by the BCG Vaccine laboratory, Guindy, was diluted by sterile physiological saline to give 0.0000 mg of protein O.I ml and this quantity was inoculated intracutaneously into the left upper eyelid. Same amount of sterile physiological saline was inoculated into the right upper eyelid as a control. The test was read 24-48 hours later. No reaction was seen in normal animals but in tuberculous animals erythema, induration, oedema or necrosis developed in 12 hours. By 4th day no trace of the reaction was seen. The reactions were recorded as follows :—

No reaction	= negative
Slight erythema	= +
Erythema with induration	= + +
Erythema with marked induration	= + + +
Induration with necrosis	= + + + +

## Radiological study of the chest

Tuberculin negative monkeys were X-rayed before starting an experiment. None of the tuberculin negative monkeys gave a positive chest finding.

*Isolation and identification of the Organism* —Four tuberculin positive monkeys two from the neighbourhood of Delhi and two from Mathura in Uttar Pradesh giving a + + + or + + + + reaction were sacrificed for isolation of tubercle bacilli. Findings from several large scale epidemiological surveys indicate that the weak sensitivity does not reflect infection with *M. Tuberculosis* but is non-specific (Palmer 1954) therefore strongly positive reactors were chosen and all showed Fibrocaceous lesions of one or more organ (Fig. 2, 3, 4) Tissues

from the organs showing these lesions were collected under aseptic precautions. Some of the tissue from each monkey was processed for microscopic study and some ground with sterile sand and physiological saline, the resulting suspension was injected intraperitoneally into two rabbits and two guineapigs; This suspension was also cultured on Medlars', Dorset egg and Lowenstein medium. Material from the bronchial passage of monkeys with pulmonary lesions also was cultured on the same media. The results are shown in table I. Material from all the four animals grew mycobacterium tuberculosis. Similar growth was obtained from the bronchial swabs of the animal showing pulmonary lesion. Thus demonstrating that the bronchial secretions were infective. Suspension of the tuberculous tissue inoculated into the guinea pigs and rabbits killed the guinea pigs but not the rabbits. Same results were obtained when bacterium isolated from the tissues was inoculated into these animals. This confirmed that the mycobacterium isolated was of human type.

Growth on the culture media was seen on the fourth week and it became luxuriant in the sixth week. Colonies of bacteria were lifted from the edge of the culture so that no media was scrapped. These were pooled, weighed, ground with sterile saline and sand to a uniform suspension of known wet weight and volume. This suspension was used for infecting healthy tuberculin negative monkeys used in the following experiments. A pair of rabbits and guinea pigs also were inoculated with this suspension. Animal inoculation results were similar to those obtained in table 1.

*Experiment No. I:*—I Bacterial suspension 0.001 mg. wet weight/kg, body weight was injected into tuberculin negative monkeys subcutaneously and intraperitoneally results are given in table No. 2.

*Experiment No. II*—Only group B of table 2 inoculated 0.001 mg. of tubercle bacilli per kilogram body weight developed lesion there for a stronger dose was used in this

TABLE I

SOURCE	MONKEY			BRONCHIAL SWAB	RABBIT & G.PIG INOCULATION		
	TUBERCULIN TEST	AUTOPSY FINDINGS CONFIRMED MICROSCOPICALLY	BACTERIAL CULTURE		TUB. TEST BEFORE	AFTER	
DELHI 1	+++	CASEOUS LESION LUNGS. LYMPH-NODES.	GROWTH ON MEDLARS & LOWENSTEIN MEDIUM	-Ve	-	+	G.PIG DIED 5 & 6 WKS. AFTER INOCULATION SHOWED TUBERCULAR LESIONS. RABBIT SACRIFICED., NO LESION
	+++	CASEOUS LESION LUNG, LIVER & SPLEEN	— : DO : —	+Ve	-	+	
MATHURA 1	+++	CASEOUS LESION LUNGS G HILAR LYMPH NODES	GROWTH ON MEDLARS & LOWENSTEIN MEDIUM	-Ve	-	+	G.PIG DIED 4 & 5 WKS AFTER INOCULATION OF TUBERCULAR LESIONS. RABBIT SACRIFICED NO LESION-
	++++	CASEOUS LESION LUNGS LYMPH-NODES LIVER & SPLEEN	— : DO : —	+Ve	-	+	

TABLE II

A. SUBCUTANEOUS GROUP:- FORTNIGHTLY TUBERCULIN TEST																			
MONKEY	INITIAL		AFTER INOCULATION															AUTOPSY TUBERCULOSIS	
	1	2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
32	—	—	—	—	+	+	+	+	+	+	+	+	+	+	+	—	—	NO LESION	
33	—	—	+	+	+	+	+	+	+	+	—	—	+	—	—	—	—	NO LESION	
34	—	—	+	++	++	+	+	++	+	+	+	+	—	—	—	—	—	NO LESION	
35	—	—	—	++	++	++	++	+	+	+	+	+	+	—	—	—	—	SPLEEN, LIVER	
36	—	—	—	++	+	+	+	+	+	+	—	—	—	—	—	—	—	NO LESION	
B- INTRAPERITONEAL GROUP FORTNIGHTLY TUBERCULIN TEST																			
MONKEY	INITIAL		AFTER INOCULATION																AUTOPSY TUBERCULOSIS
	1	2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
37	—	—	+	+	+	+	++	+	+	+	+	+	+	+	+	+	+	+	ABD. LYMPH NODES
38	—	—	+	++	+	++	+	+	+	+	+	+	+	+	±	—	—	—	ABD. LYMPH NODES
39	—	—	+	+	+	+	+	+	+	+	<i>DIED</i>								LUNG LIVER, SPLEEN
40	—	—	—	—	±	±	+	+	+	+	+	+	+	+	+	+	+	DIED	ABD. LYMPH NODES
41	—	—	—	—	±	±	+	+	+	+	+	±	±	±	+	+	+	+DIED	LYMPH NODES

experiment. Bacterial suspension 0.01 mg. wet weight/kg, body weight was injected into healthy tuberculin negative monkeys subcutaneously and intraperitoneally. Results have been tabulated in table 3.

*Observation and conclusion:*—Monkeys caught from the neighbourhood of densely populated cities like Delhi and Mathura and showing higher activity to tuberculi when sacrificed were found to have fibrocaceous lesions of the lungs, hilar lymph nodes, spleen, liver and other organs. Mycobacterium tuberculosis was isolated from the infected tissue as well as from the bronchial secretions of two monkeys with fibrocaceous lesions of the lungs. Suspensions of the infected tissue and of the organism isolated from it were inoculated into the rabbits and guinea pigs. The results proved that the infective organism is human type of mycobacterium tuberculosis.

Organism thus isolated was inoculated into healthy tuberculin negative monkeys in the dose of 0.001 mg. and 0.01 mg/kgm body

weight by subcutaneous and intraperitoneal routes. Six out of ten monkeys inoculated 0.001 mg. wet weight of the organism/kgm of body weight became tuberculin positive during the second fortnight after inoculation. Only one remained doubtfully positive throughout. Only one out of the five, inoculated subcutaneously had a persistent tubercular lesion in the liver and spleen when scarified 30 weeks after the inoculation. This animal like the rest had however become tuberculin negative when sacrificed. However animals of this group who were inoculated intraperitoneally showed tubercular lesion when they died on their own or were sacrificed. Three continued to be tuberculin positive and two had become tuberculin negative before death.

Six out of the eight monkeys inoculated with 0.01 mg. of the organism/kg, body weight became tuberculin positive during the first fortnight after inoculation and all during the second fortnight. All the animals inoculated subcutaneously had become tuberculin negative

TABLE III

A. SUBCUTANEOUS GROUP:- FORTNIGHTLY TUBERCULIN TEST																			
MONKEY	BEFORE INOCULATION		AFTER INOCULATION														AUTOPSY TUBERCULOSIS LESION		
	1	2	1	2	3	4	5	6	7	8	9	10	11	12	13	14		15	16
42	—	—	+	+	+	+	+	+	+	+	+	+	+	+	±	±	—	—	NO LESION
43	—	—	+	++	+	+	+	+	+	+	+	+	+	+	±	±	—	—	NO LESION
44	—	—	+	+	+++	+	+	+	+	+	—	—	—	—	—	—	—	—	NO LESION
45	—	—	+	+	+	+	+	+	+	+	+	+	—	—	—	—	—	—	NO LESION
B- INTRAPERITONEAL GROUP FORTNIGHTLY TUBERCULIN TEST																			
MONKEY	BEFORE INOCULATION		AFTER INOCULATION														AUTOPSY TUBERCULOSIS		
	1	2	1	2	3	4	5	6	7	8	9	10	11	12	13	14		15	16
46	—	—	—	+	+	+	+	+	+	±	—	—	—	—	—	—	—	—	NO LESION
47	—	—	+	+	+	+	+	+	+	+	+	+	+	+	±	+	+	+	ABD. LYMPH NODES
48	—	—	+	+	+	+++	+++	+++	+++	<i>DIED</i>									LUNG, SPLEEN, LYMPH NODES
49	—	—	+	+	+	+++	+++	+++	+	+	+++	+	+	+	+	+	+	+	ABD. LYMPH NODES

when sacrificed thirty weeks after inoculation and only one showed persistent granulomatous lesion of the spleen and the liver. Of the intraperitoneal group three died on their own. These had shown tuberculin positive reaction till death and had tubercular lesion in different organs of the body. The remaining two were sacrificed both showed lesions though one had become tuberculin negative. The conclusion that can be drawn from these observations are:—

1. Tubercle bacilli isolated from a monkey source are infective to healthy tuberculin negative monkeys when inoculated subcutaneously and intraperitoneally. Intraperitoneal route is more effective than the subcutaneous one.

2. Hypersensitivity develops two or three weeks after exposure to tubercle bacilli and stronger the dose quicker the reaction.

3. Hypersensitivity in majority of the cases

persists as long as the lesion in the body is present.

4. Tuberculin reaction may be negative even when tuberculous lesions are present in the body.

*Discussion:*—It has been known for some time that North Indian Brown monkey (*M. Mulatta mulatta*) commonly known as rhesus monkey suffers from tuberculosis in nature. (Jaswant Singh et al 1951). Some workers have shown (Nair and Ray 1954) that at least one out of every ten monkeys caught in the neighbourhood of big cities like Delhi and Mathura suffer from active tuberculosis, and lungs are the main site of infection. They have also shown that monkeys from the neighbourhood of big cities give a higher percentage of reactivity towards tuberculin than those caught from the jungle.

It has been seen that percentage of infected monkeys goes on increasing when the animals are kept in captivity possibly by the infection

of the normal animals kept side by side with the infected ones (Kennard 1941, Abeles 1947). These observations provoked an interest in the pathogenetic mechanism of the tubercular infection in nature in monkey and an attempt was made to make a controlled study of this. To establish a pathogenetic mechanism of any disease it is essential that Koch's postulates be fulfilled. Present study has been able to fulfil these criteria. The organism isolated from the monkey lesions has been identified as mycobacterium tuberculosis of human type. This organism when inoculated into healthy tuberculin negative monkeys has been shown to make them tuberculin positive and produce lesions in various organs.

From this study it can be concluded therefore that monkey to monkey infection possible in the laboratory may occur in nature also. Considering that the organism is of human type man may be the source of infection for the monkey. To prove this further study is necessary.

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## MANAGEMENT OF POST OPERATIVE BRONCHO PLEURAL FISTULA

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The subject of management of Broncho Pleural Fistula is controversial and it will be worthwhile to relate our experience of a small series of this complication, in favour of conservative method. Broncho Pleural Fistula is a formidable and exasperating complication after pulmonary resection. The incidence of Broncho Pleural Fistula is much more common in tubercular cases than in non-tubercular cases. The average incidence reported by several authors is 8-10 percent and 4-5 percent respectively. This incidence has decreased considerably since the advent of higher antibiotics and improved surgical technique. However, the post-operative morbidity has not been much affected. B.P.F. usually occurs during the second post operative week, though it may present itself as early as the first day to a period of several weeks after the operation. Fistula occurring during the first few days is possibly due to mechanical defect. Infection causes it during the second week and after. Most of the B.P.F. are caused by the tubercular lesion of the bronchial tree or extension from the tubercular hilar glands. In malignant cases, this may occur as an extension of the malignant pathology in the vicinity of the hilum.

The diagnosis of B.P.F. is always made easily and promptly. The following factors signal its occurrence.

- (1) Appearance of mucopurulent or blood stained sputum in the post-operative period;
- (2) Re-appearance of fever;
- (3) Sudden increase in breathlessness;
- (4) Sudden expectoration of large volume of seropurulent material;
- (5) Appearance or increase in existing pneumothorax.
- (6) Sudden disappearance of pleural effusion.

The diagnosis of B.P.F. can be confirmed by investigations: —

- (1) Persisting air leakage in under water-seal intercostal drainage;
- (2) Stained expectoration when methylene blue is injected in pleural cavity;
- (3) Positive fistulogram (Bronchogram);
- (4) Analysis of the gases in the pneumothorax;

- (5) Increase in intrapleural pressure measurement.

Out of these the first is the simple and definite test and also forms the important step in the management of the B.P.F.

### Material and Methods

The present study comprises of 13 cases of B.P.F. occurring in 290 pulmonary resections. These operations were undertaken at the Poona Chest Hospital, Aundh Camp, (Poona) during 1961-1966. A broad summary of these cases can be seen in table I.

11 cases occurred during the period of 10-20 days. One was observed on 45th day. 7 occurred in 84 cases of pneumectomy and 4 occurred in 202 cases of lobectomies. Out of these cases 8 belonged to tubercular lesions, and 5 occurred in non TB cases. It is also observed that cases occurred in right upper lobe resections, 9 were on right side. In all these cases, appropriate pre-operative evaluation and preparation as regards chemotherapy, bronchial tree condition, bacteriological pattern and sensitivity etc. was thoroughly implemented. It will be very difficult to pin down any particular cause in the occurrence of this complication. However, in some of these cases, some inference can be deduced regarding the causative factor.

Case No. 12 who had undergone Rt. upper lobe bronchial ligation and extra pleural pneumonolysis developed the fistula on 45th day. In this case, the tubercular cavity in the affected lobe was not drained.

The extra pleural space was infected with formation of an abscess. The bronchial stump bathing in this infected space, gave way to form B.P.F.

Case No. 13 who had undergone right upper lobectomy and was given prednisolone during immediate post operative period to control toxæmia. It is likely that prednisolone prevented healing of the bronchial stump.

Case No. 1, 7, and 8 were operated for pneumonectomies and developed large quantity of pleural effusion which reappeared after repeated aspiration. Though the fluid level was kept below hilar level, the stump bathed in this fluid whenever the patient took up lateral or supine position. This fluid around the stump has likely retarded the healing and resulted in fistula.

TABLE I  
 Indicating day of Fistula occurrence and management.

No.	Age	Diagnosis	Operation	Day of	Management	Result
1.	30 M	Ch. Septic Pneumonitis Rt. side	Rt. Pneumo'my. 5-9-65	15	I. P. Intubation, No Plasty	Closed spontaneously
2.	50 M	Tubercular destroyed Rt. lung	Rt. Pneumo'my. 9-2-61	20	I. P. Intubation, Plasty on 8-12-64	Closed after plasty
3.	22 F	Tubercular Ch. lesion	R.U.L.R. 25-4-63	10	I. P. Intubation Plasty on 25-5-63	Closed after plasty
4.	40 F	Tubercular Chr. destroyed lung left side	Left Pneumo'my. 22-7-64	9	I. P. Intubation, Plasty on 17-9-63	Closed after plasty
5.	27 M	Tub. Cavity R.U.L.	R.U.L.R. 28-8-63	10	I. P. Intubation, Plasty on 17-9-63	Closed after plasty
6.	24 M	Cystic lung. Rt.	Rt. Pneumo'my. 22-10-64	17	I. P. Intubation, No Plasty	Closed spontaneously
7.	50 M	Chr. Septic Pneumonitis lung	Lt. Pneumo'my. 30-6-65	15	I. P. Intubation Plasty on 18-12-66	Closed after plasty
8.	44 M	Cystic lung Lt. side	Lt. Pneumo'my.		I. P. Intubation Plasty	Closed after plasty
9.	20 M	Bronchiectasis Rt.	Rt. M & L.L.R. 26-3-64	21	I. P. Intubation, Plasty on 11-6-64	Closed after plasty
10.	38 M	Rt. Empyema	Pleuropneumo'my. 7-4-66	16	I. P. Intubation, Plasty on 9-6-66	Closed after plasty
11.	16 F	B'sis R.U. Br.	Segmental Resection Rt. U.p. L. 15-4-66	14	I. P. Intubation, Plasty on 15-5-66	Closed after plasty
12.	45 M	Tuber Cavity R.U.L.	Rt. U.L. Br. ligation & Extrapleural apicectomy.	43	I. P. Intubation, Plasty on 25-7-66	Died
13.	21 M	Tuber cavity R.U.L.	R.U.L.R. 20-6-66	12	I. P. Intubation, Plasty on 25-7-66	Closed after plasty

Case No. 10 had undergone pneumonectomy which presented prolonged and difficult hilar dissection. This has possibly caused trauma and devascularisation of the bronchial stumps resulting in poor defective healing.

In remaining cases, it is presumed that the bronchial tree was either affected by pre-existing tubercular infection or got infected from extension of infection from opposite side or from residual lesion in remaining lung. No case was detected with resistant bacilli.

In the present series, the method of diagnosis of B.P.p. adopted, included clinical findings, radiological findings and intrapleural intubation. In most of the cases, fever and haemoptysis were the heralding signs. In 3 cases, sudden profuse expectoration creating alarm of asphyxia was observed. Methylene blue test was tried in two cases. Fistulogram was done in two cases. In all cases, gross persistent air leak under water-seal drainage was the positive test and the main part of management.

Table I presents the method of management and results.

In the present series, conservative method was adopted with success. This included intrapleural drainage to keep the space dry and infection-free, associated with appropriate antibiotic cover. Thoracoplasty—standard or osteoplastic—was undertaken when the fistula was stabilised and to obliterate the infected residual pleural space. There was no indication nor occasion for major surgical interference. Thoracotomy and resuturing of the stump is hazardous operation and involves great risk to the patient. The result of the series was satisfactory and successful with one mortality out of 113 cases presented. Cases 1, 6 and 8 healed without plasty. As regards morbidity 9 cases had morbidity with plasty operation which is considerable.

### Discussion

Lindkog has very rightly written in reference to B.P.F. "It is far better to prevent this dangerous complication than to be forced to treat it". Careful considerations of the following factors will go a long way to prevent and safeguard against this complication.

### Prevention

(1) Thorough pre-operative evaluation and preparation of the case assigned for pulmonary resection, particularly regarding respiratory system and blood system.

(2) Bacteriological examination of sputum, pleural fluid, determination of the sensitivity

of organisms involved. B.P.P. is observed to occur frequently in resistant cases.

(3) Careful Bronchoscopic and Bronchographic assessment on condition of the bronchial tree.

(4) Avoidance of use of anti-inflammatory and fibrolytic drugs like steroids during pre-operative and post-operative period.

(5) Use of correct technique of Bronchial suture and careful covering of the stump with viable tissue like pleura or intercostal muscle pedicle.

(6) Careful dissection of Bronchial stump with regards to its vascular supply, avoiding use of crushing clamps and haematoma formation in the hilar field.

(7) Prevention of excessive and explosive attacks of cough

(8) Regular post-operative bronchial aspiration to prevent stagnation of infected secretions, likely to infect the stump. Such aspiration prevents collapse of the remaining part of the lung and promotes its expansion. This is an important factor in healing of the stump in cases of lobectomy.

(9) Keeping the pleural space free from any collection of fluid by post operative drainage and later by aspiration. This prevents the stump being bathed in infected fluid.

(10) Prevention of all possible infection in the respiratory tract and lungs by maintaining appropriate antibiotic cover.

(11) Judicious use of drainage and negative pressure suction during early post-operative period.

(12) Encouraging breathing exercises to promote expansion of the remaining lobes of lung, which envelops the bronchial stump and promotes healing.

(13) Maintaining general health of the patient particularly the haemogram and protein values. Large doses of Vitamin C is claimed to promote healing.

### Management

In respect to the management, reports of majority of observers claim that conservative treatment is far more safe and successful than the heroic surgical interference. The conservative technique comprises of:

- (a) positioning the patient to prevent aspiration of the pleural fluid into the normal bronchial tree.
- (b) Continuous intra pleural drainage under water-seal.

- (c) Respiratory exercises to promote expansion of the remaining portion of the lung in case where lobectomy is undertaken.
- (d) Regular post operative bronchoscopic aspiration to maintain the respiratory tract clean and dry.
- (e) Appropriate antibiotic cover maintenance.
- (f) To maintain the general health and nutrition of the patient and particularly to correct any anaemia and hypoproteinaemia.

Accounts of several authors including Sanez, Ramrex and Bjork show that the resuturing either leads to reopening of the stump or death of the case. However, Gravel thinks that post-pneumonectomy fistula should be taken as emergency operation and along with drainage, good results are expected. Kent has used conservative management and has reported 13 cases of B.P.P. with cure in all 11 cases. A patient who has already suffered the major operation resection and whose defensive and healing capacities have been diminished, a new extensive thoracotomy and rehandling of hilar structures imposes on the patient severe and major trauma and shock, and exerts greater demand on patient's resistance and healing capacity. According to Lynn a major fistula, resulting within first week of post operative period should be corrected by thoracotomy, refashioning and resuturing with stainless wire and reinforcing it with pleuric or muscle pedicle. Late surgical interference in the form of standard or osteoplastic plasty has to be undertaken where the fistula fails to close or is stabilised. Padhi and Lynn has suggested

such plasty after 4-6 weeks. The purpose of this plasty is to obliterate the residual pleural space. All the cases presented here were managed by conservative technique alone. 3 cases healed without drainage and in the rest, post-operative plasty had to be undertaken to achieve the end result of closure.

#### Summary

- (1) 13 cases of B.P.F. out of 290 pulmonary resections done at the above mentioned Hospital are presented.
- (2) The methods of diagnosis, prevention and management are discussed.
- (3) The merits of conservative technique are discussed in the light of experience at other Chest Hospitals.

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# ELECTROCARDIOGRAPHS STUDIES IN ARTIFICIAL PNEUMOPERITONEUM\*

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E.C.G. changes in pulmonary tuberculosis and the effects of chemotherapy have already been reported. Present paper is an attempt at evaluation of effects of pneumoperitoneum on electrocardiogram.

While earlier workers believing in the institution of collapse measures in extensive cases, and aiming at a compression collapse obtained significant E.C.G. changes in almost all of their cases, today the situation appears different. The indications of these collapse measures have been more clearly defined and a relaxation collapse is aimed at. It was natural to see as to how many of those undergoing this collapse measure would show such significant E.C.G. changes. It was further attempted to correlate the findings following collapse measures, with the circumstantial evidences, wherever it was possible.

## Material and Methods

The material for study was selected from cases admitted to the Kasturba TB Hospital.

The cases were staged after X-ray examination according to the report of "Sub Committee on Classification of Pulmonary Tuberculosis."

25 Subjects were selected for P.P. treatment. Most of them suffered from stage II or Stage III of the disease. Nona had previous collapse measures such as A.P. or phrenic crush.

The majority were of asthenic built. All had electrocardiograms taken as a rule after III or IV inflation, in recumbency. The electrocardiograms were taken about 6 to 8 hours after the P.P. refills and the patients were subsequently screened or X-rayed to note the amount of rise of the diaphragm.

## Results

—Cases—25

—E.C.G. taken

Before the induction of P.P. and after the III or the IV refill.

—Amount of air introduced

In no case exceeded 800 cc.

—Simultaneous screening or the X-ray examinations were done.

This work formed a part of thesis submitted to Lucknow University for M.D. (Tuberculosis).

TABLE I

*Axis deviation*

Axis deviation	Number	Percentage
Shift to left	17	68
Shift to right	8	38

## Discussion

### *Axis Deviation*

In the present study right axis deviation occurred in 32% while the rest (68%) showed left axis deviation. Clear cut axis deviation was seen in only 4 cases, 3 showing left axis deviation. Various workers have shown the incidence of axis deviation as follows : —

<i>Author</i>	<i>Year</i>	<i>%with left Axis deviation</i>	<i>Right axis deviation %</i>
AGNELLO	1938	all cases	
ELWOOD et al	1939	high percentage	
WEINSHEL et al	1951	all cases	
POLLACK	1951	all cases	
MALHOTRA and KAPOOR	1954	66%	34%]
CARASSO et al	1954	89%	

The present study showing left axis deviation in only 68% cases stands in marked contrast to that of those authors who have found left axis deviation in 100% cases. Further, of 5 cases showing left axis deviation there was discrepancy between the rotation along the A.P. axis and the axis deviation. It is surprising, however, that Weinshel et al (1951) using exactly the same criteria have not reported such findings. The findings in the present study are in full confirmation with those obtained by Malhotra and Kapoor (1954).

Low incidence of left axis deviation in the present study could be attributed to 3 main factors. First, no case was given more than 800 cc's of air refills while other workers had given air refills ranging from 1000 cc to 1500 cc. Secondly, all the records were taken in supine position. It can be expected that higher incidence of left axis deviation would have

TABLE 2 Q

wave changes

Leads	Deeper Q waves				New Q waves						Pathologic				
	2mm or more		1-2 mm		Less than 1mm		2mm or more		1-2 mm		Less than 1mm		a 1 Q wave		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	%
LIII	2	8	1	4	2	8	—	—	1	4	—	—	1	4	28
aVE	1	4	—	—	—	—	—	—	2	8	1	4	—	—	16
V <sub>4</sub>	—	—	1	4	—	—	—	—	—	—	1	4	—	—	8
V <sub>5</sub>	—	—	1	4	—	—	—	—	1	4	1	4	—	—	12
V <sub>6</sub>	1	4	—	—	—	—	—	—	1	4	2	8	—	—	16
Total =	4	16	3	12	2	8	—	—	5	20	5	20	1	4	80

TABLE 3  
T Wave changes in lead III

T waves in LIII	Number	Percentage
Biphasic	1	4
Inverted	7	28
Isoelectric	4	16
Total =	12	48

TABLE 4  
Heart position (A.P. axis)

Heart position	Number	Percentage
More horizontal	16	64
More vertical	9	36

TABLE 5  
Heart position (long axis)

	Number	Percentage
Counterclockwise rotation	13	52
Clockwise rotation	7	28
No rotation	5	20

been obtained had the records been taken in sitting position (—Pollack 1951, Carasso et al 1951). Further, right axis deviation was reported in 32% cases. All such cases had shown tenting of the diaphragm on the left side prior to induction of P.P. and that after P.P. the rise of diaphragm was mainly on the right side (Shivpuri 1954). It has been found that (Malhotra and Kapoor 1954), elevation of the right “dome of diaphragm” tended to produce right axis deviation with vertical heart in “most” cases. Hence the lower incidence of left axis deviation in our series.

#### Q Wave Changes

In all, 56% cases demonstrated Q wave changes. Of these 56% showed new Q waves developing after induction of P.P. In only one case Q wave crossed the physiological limits (4 mm or less). Q wave changes were seen most commonly in leads III (28%) and aVF (16%). Other workers have obtained higher figures (Elwood et al 1939, Rubin and Most 1952, Carasso et al 1954, Malhotra and Kapoor 1964). Carasso et al (1954) (in 84% of their cases) obtained deep QIII waves, in 60% cases this wave was larger than even R wave.

Such Q waves have been known to appear after posterior myocardial infarction. The condition was excluded due to absence of any other clinical or E.C.G. evidences for the same.

That deep QIII and Q, aVF are related to the rise of the diaphragm has been proved by

various workers studying on pregnant women, obese persons and ascitic individuals (Master and Oppeneiraer 1929, Proger 1931, Carr et al 1933, Shookhoof and Douglas 1933-4, Edeiken and Wolfreth 1934, Leverton 1938, Zothe 1937-9 and Leimdorfer 1948).

It was further found that the QITI wave changes were observed much more commonly (60% cases) with left axis deviation than with right axis deviation with horizontal position of the heart was usually associated with deep QIII or QaVF. Rubin and Most (1952) believed that consequent on the rise of the diaphragm, there was marked lowering of the auricular and transitional zones to levels usually considered ventricular in oesophageal leads. The Q wave generally present at the auricular and transitional levels were, thereby, oriented towards the left leg resulting in deep Q aVF.

The incidence of Q wave changes in the present series was low as compared to those of other workers. It appeared that lesser amount of refills and supine position during the E.C.G. recording could be the factors for such discrepancy.

#### **Till wave changes**

These were present in 48% cases. In 92% it was associated with Q wave changes. It was further found that marked Q wave changes were associated with marked T wave changes. Such findings have also been reported by Rubin and Most (1952), Carasso et al (1954) and Malhotra and Kapoor (1954).

Primary T wave changes are said to be present also when there are "changes in the state of the myocardium". But no clinical evidences for the same were obtained. It appeared that same factors, as those responsible for Q wave changes, also operated in this case.

#### **Heart position**

More horizontal heart in 64% and more vertical in 36% cases were observed. Counter clockwise rotation was present in 56% cases after the P.P., usually being associated with more horizontal position of the heart; occasionally also with a vertical heart; Clockwise rotation was seen in 23% cases mainly being associated with a more vertical heart. No rotation was seen in 24% cases.

In our hospital, "in order to obtain an efficient therapeutic effect" we do not give air

refills of more than 800 cc. This has been our practice since we aim at producing a relaxation collapse rather than a compression one. Other workers have given 1000-1500 ccs of air and hence obtained E.C.G. changes in higher percentage of cases.

We have studied E.C.G. changes due to P.P. alone. In past many reports have come up where although phrenic crush was also done (Malhotra and Kapoor 1954) the changes were described under the heading of P. P. alone. Phrenic crush causes a higher elevation of the diaphragm, hence an accentuation of the effects of P.P.

E.C.G. records in the present study were taken in supine position and not in sitting up position, hence a lower percentage of E.C.G. changes, reported in this study.

#### **Conclusions**

The overall factor in the causation of E.C.G. changes due to P.P. appeared to be the elevation of the diaphragm. The significance of Q and T wave changes, earlier attributed to various factors now appear to be related to the elevation of the diaphragm. This has been verified with oesophageal leads E.C.G. tracings.

Most of the workers except one (Malhotra and Kapoor 1954) have tried to establish a correlation between the rotation along the various axis. The majority have found that as the heart became more horizontal, axis shifted to left and there was a counter clockwise rotation. In most of the cases in the present series such findings have been found. But in some (40%) cases there was a dissociation between the axis change and the rotation along the various axis. This dissociation is an established fact.

T wave changes in lead III were mainly of the nature of depressions, inversion or getting isoelectric from previous upright position. It was usually associated with a deep QIII wave and appeared to be related to cardiac rotation.

#### **Summary**

25 cases, studied before and after P.P., showed the changes due only to elevation of the diaphragm and cardiac rotation around various axis. Q wave changes appearing in leads III and aVF, in 56% cases of the present series, appeared to be due to shifting down of auricular and transitional zones to ventricular level and their reorientation towards left leg.

P.P. did not seem to produce any pathological changes in the heart.

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## NEWS & NOTES

### Meetings in Bombay

The Standing Technical Committee of the TB Association of India met in Bombay on the 1st and 2nd September, 1967. The Committee worked out the programme for the next TB Workers' Conference to be held in Bombay from 7th to 10th January, 1968. It reviewed the position regarding BCG Campaign, District Control Programmes and Domiciliary Services included in the Five Year Plans. Some of the important items considered by the Committee were medical education, classification of tuberculosis and training of basic health visitors.

The Annual General Meeting of the Maharashtra State Anti-TB Association was held on the 2nd September. The meeting was presided over by Dr. B.B. Yodh and was attended among others, by Dr. K.N. Rao, Chairman of T.A.I., and Director-General of Health Services and by the members of the Standing Technical Committee.

A meeting of the Coordination Committee of the Maharashtra State Anti-TB Association and representatives of official and non-official bodies dealing with TB in the Bombay City was held on 3rd September. This was presided over by Dr. K.N. Rao. Dr. Rao emphasised that the TB Control Plan for Bombay City be put in full operation as soon as possible.

A symposium on recent trends in the management of common Cardio-pulmonary diseases was held on 3rd September. This was jointly sponsored by the Maharashtra State Anti-TB Association and the Western Chapter of the American College of Chest specialists, medical practitioners and other TB Workers in the City. The Moderator was Dr. K.N. Rao and the participants were Dr. R. Viswanathan, who spoke on respiratory Allergy, Dr. N.L. Bordia on Anti-microbial Regimens in the treatment of tuberculosis, Dr. P.K. Sen on Suppurative Lung Diseases, Dr. R.J. Vakil on Chronic Cor-Pulmonale, Dr. Suresh D. Store on Chronic Bronchitis, Dr. K.K. Datey on Ishaemic Heart Disease and Dr. K.N. Dastoor on Surgery in Cardio Pulmonary Diseases. In summarising the symposium Dr. Rao stressed the importance of preventive aspect of Cardio-Thoracic disorders. A meeting of the TB Association of Goa was held on 5th September, 1967. This was attended by Shri B.M. Cariappa, Secretary-General, TB Association of India and Dr. N.L. Bordia, TB Adviser to Government of India and Honorary Technical

Adviser, TB Association of India. Dr. A.C. Vaga, Director of Health Services, Goa, presided over this meeting.

### TB Conference in Amsterdam

The XIXth International TB Conference will be held in Amsterdam, Holland, from 3rd to 7th October, 1967. Prof. Jank K. Kraan, President of the Royal Netherlands TB Association, the Hague, is the President of this Conference.

Some of the other important meetings scheduled to be held in Amsterdam at the time of this Conference are (1) Conference of Executive Directors of National TB Associations, (2) Meeting of the Council and of the Executive Committee of the Union, (3) Health Education Committee and (4) Meeting of the Eastern Regional Committee of the International Union.

### TB Seal Sale Campaign

The 18th TB Seal Sale Campaign will commence, as usual, on October 2, 1967. So far State Associations have intended for thirty million Tuberculosis Seals. The Railway Board, All India Radio, Rotary and Lion Clubs, YMCAs and YWCAs 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.

### School Health Services

A booklet on TB for School Health Services will be published by the Association with the help of Business Organisations. This will be published in English and regional languages and the Association hopes to bring out atleast 1,00,000 copies as the first edition.

### Increase in Prize for the next TB Seal Design

Tuberculosis Association of India will award a prize of Rs. 1,000 for the best TB Seal design from 1968 onwards. Upto now this Association has been giving Rs. 500 only as prize money for the Seal design. This offer is intended as an incentive to senior Artists for sending better designs for the TB Seal.

### Refresher Course in Madras

The Tuberculosis Association of Madras

organised in August, 1967 a Refresher Course in Tuberculosis for the benefit of general medical practitioners in Madras State.

#### **Chest and Heart Association's Scholarship**

Dr. D. Umapathy Rao of Hyderabad who was awarded a Scholarship by the Chest and Heart Association, London, for a period of three months in the United Kingdom, completed his assignment and returned to India after visiting on his way back Paris, Geneva and Italy.

#### **Mr. O'Brein's Visit**

Mr. E. J. O'Brein, Director of Ontario TB Association, Canada, who was in a Travel Seminar assignment in Eastern Countries visited India in the last week of August. On 30th August, 1967 Mr. O'Brein gave an interesting talk to the TB Workers in Delhi on his experience in voluntary TB work. Mr. O'Brein specially referred to the possibilities of the Colombo Plan authorities taking interest in aiding voluntary bodies like Tuberculosis Association of India and its affiliates in States. The meeting was presided over by Dr. K. N. Rao, Director-General of Health Services, Government of India and Chairman Tuberculosis Association of India.

#### **Medical Council's Award**

The Medical Council of India has instituted a cash award of Rs. 25,000 for outstanding research work in the field of medicine and allied sciences. The award, which will be presented after every five years, will be open to Indian and foreign nationals who have spent a considerable time doing research in India. The first award will be presented in November, 1969.

#### **Teaching Designation To Dr. H. B. Dingley**

The All India Institute of Medical Sciences has conferred an honorary teaching designation of Associated Professor on Dr. H. B. Dingley, Medical Superintendent, Lala Ram Sarup TB

Hospital, Mehrauli, New Delhi, who is collaborating with the Institute in its teaching programme in an honorary capacity.

#### **ICMR grant**

The Indian Council of Medical Research has sanctioned to the Lala Ram Sarup TB Hospital, Mehrauli, a grant for undertaking an enquiry into the 'Incidence of Endobronchial Tuberculosis with special reference to positivity and determination of primary drugs resistance in tuberculosis of Children'. The enquiry started on 1st July, 1967.

#### **Dr. B. C. Roy National Award for 1967**

The Medical Council of India has instituted an award called "Dr. B. C. Roy National Award Fund" to perpetuate the memory of the late Dr. B. C. Roy who was one of the founder members of the Council. The following three awards will be given during the year Oct-Nov. 1967:—

1. To recognise the merit of a good and capable teacher in Medicine (Civil or Military in various branches) by rotation.
2. To recognise best talents in encouraging the development of specialists of different branches of Medicine.
3. To recognise the best services in the field of socio-medical relief and in the establishment of medical organisations and medical institutions (both civil and military).

The Management Committee fixed an award of Rs. 2,000/- each for the above 3 categories—one award to be given in each category once in 5 years from 1969 onwards.

Blank nomination forms will be available from the Secretary, Dr. B. C. Roy National Award Fund, office of the Medical Council of India, Temple Lane, Kotla Road, New Delhi from November, 1967. The last date for receipt of nominations is the 31st March, 1969.

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# The Indian Journal of Tuberculosis

ABSTRACTS

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## **Sodium Nitroprusside Test for the Detection of Isoniazid and Acetylisoniazid in Urine**

*K. L. Nageswara Rao, L. Eidus, C.V. Jacob, S. Radhakrishna and S. P. Tirpathy, Tub, Lend, 1967, 48, 45.*

A test for detecting the presence of Isoniazid and acetylisoniazid in urine by using alkaline sodium nitroprusside and acetic acid as reagent is positive in all urine specimen collected at eight hours after administration of 200 mgm or 400 mgm of isoniazid in about 90% of the specimen collected between 10 and 12 hours.

It does not suffer any interference from Streptomycin, PAS and Thiacetazone at conventional dosage used in Clinical practice, but is affected by Pyrazinamide, Cycloserine and Ethionamide.

**H.B.D.**

## **Chemotherapy of Pulmonary Tuberculosis with Pneumoconiosis**

*Second Report to Medical Research Council from the Joint Investigations: Tub, Land 1967, 48, 1.*

A group of 59 patients who were 55 of age or more, diagnosed to be suffering from Pulmonary Tuberculosis and Pneumoconiosis and progressive massive fibrosis with a positive sputum were given a daily regimen of 333 mgm. of Isoniazid plus 15 gm. Sodium PAS after an initial treatment with Streptomycin Sulphate 1 gm. daily for three months followed by 1 gm. three times weekly for further three months.

At 12 months, 84% or 44 patients who had the treatment with an interruption of not more than six weeks had quiescent disease. Of 7 patients who had more than six weeks interruption, one had quiescent disease. Of the 8 patients in whom treatment was stopped for drug toxicity, one died of the drug 'Toxicity'.

31 patients, who had quiescent disease at 12 months were assessed at 18 months and 30 (97%) had quiescent disease.

At 24 months, of 10 patients who had stopped chemotherapy at 18 months, one (10%)

had relapse. Another 15 patients who continued treatment as prescribed for two years, all had quiescent disease.

Drug toxicity occurred in 33 (56%) of the 59 patients during the first year and in the second year, 12 (39%) of 31 patients.

Both the therapeutic response and the high rate of side effects and drug toxicity have shown that the regimen was not satisfactory for the middle aged males.

**H.B.D.**

## **The results of treatment in patients with cultures resistant to Streptomycin Isoniazid and PAS: A Five years Follow-up:**

*J. Tousek, E. Janick, M. Zelerka, M. Jancikova, Makova Tuber, Land; 1967, 48, 27.*

A group of 122 patients with far advanced tuberculosis and cultures resistant to Streptomycin, Isoniazid and PAS, were given ethionamide (0.5 Gm. twice daily), Pyrazinamide (0.5 Gm. three times daily) Cycloserine (0.25 Gm. three times daily), Viomycin (1 Gm. daily or 2 Gms. twice weekly). Of these, 39 patients had chemotherapy and early surgical treatment and 83 had chemotherapy alone. Of the 83 who had chemotherapy, 55 patients were treated initially with three of the secondary drugs for a minimum of three months and an average period of 12 months. Treatment was then continued with two drugs. Of these 55, in 53 (96%) sputum became negative on culture. In 2 patients the treatment failed initially and 8 (14%) had a late bacteriological relapse, because they did not take the drugs regularly. In 4 of them the cultures became resistant to secondary drugs. 5 became negative again with further treatment (2 of them after surgery). 10 patients died, 6 of them after the sputum had become persistently negative. 28 patients who had only one or two drugs initially, only 11 (40%) became negative, 3 of them after retreatment with three drugs combination. 19 died and in 16 of these sputum was still positive.

**H.B.D.**

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**Eosinophilic Pleural Effusion.,**

*George Bower: Amer. Rev. of Res., Dis. May, 1967, 95, No. 5.*

21 cases of eosinophilic pleural effusion have been studied.

The eosinophilic pleural effusion is almost always a unilateral exudate and is frequently blood tinged or haemorrhagic. Blood eosinophilia is not uncommon. Its duration is limited to a few weeks and prognosis is good except when associated with tumour, polyarteritis or bleeding aneurysm.

The cause of eosinophilic accumulation is not definitely known. In some cases an immune reaction may be responsible. The presence of foreign proteins, erythrocytes or fibrin may play a role in others.

H.B.D.

**A Study of Healing and Repair of Pulmonary Tuberculous Lesions with and without Chemotherapy**

*Arther Steer Amer: Rev. of Resp. Dis. 1967, 95, 209.*

Surgically resected lung tissue from 149 tuberculous patients treated with antimicrobial drugs were compared with 29 specimens resected in 1945 before antimicrobial therapy was available. Without antimicrobial therapy, perifocal reaction generally was more intense; bronchial inflammation, including tuberculous bronchitis, was more frequent; and caseo-necrotic cavities showed little evidence of healing. With the drug therapy, perifocal reaction was less intense; there was no instance of tuberculous bronchitis, and clean cavities were found frequently. In some cases extension of disease in the lung, as indicated by dissemination of proliferative tubercles occurred while patients were receiving chemotherapy and the organisms were susceptible to the drugs used. Response to treatment could not be evaluated reliably by histologic means alone because resected specimens contained lesions in all stages of repair. Healed clean cavities and active nodules containing culturable tubercle bacilli were found in the same specimen. Calcium deposition was not dependable evidence of healing. Healing and repair of caseous lesions by hyalinization and fibrosis is a slow, intermittent process not directly influenced or altered by antimicrobial therapy. A few tubercle bacilli may remain in such nodules evidently in a dormant state until healing is well advanced.

S.P.P.

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**Further studies on the Smear-Positive Culture-Negative Sputum for Tubercle Bacilli**

*I. Baba: Jap. J. Chest Dis. 1965, 24: 813-817  
Reproduced from Amer. Rev. of Resp. Dis. 1967, 95, 342.*

The patients with positive tubercle bacilli by smear and culture and treated by chemotherapy were divided into two groups: (A) 39 patients in whom culture became negative earlier than smear, and (B) 81 patients in whom smear became negative earlier than culture. Cavities were present more frequently in group A (32 cavities in 39 cases) than in group B (55 cavities in 81 patients) and the cavity was surrounded by other pathologic lesions more frequently (38 per cent) than in group A. The situation was reversed in group B. Reappearance of tubercle bacilli in the sputum was more frequent in the group A, but the incidence of worsening of radiologic findings and development of drug resistance were less frequent in group A than in group B.

S.P.P.

**Tuberculous Meningitis at Cleveland Metropolitan General Hospital 1959-1963**

*Alan R. Hinman. Amer. Rev. of Resp. Dis., 1967, 95, 670*

There were 35 well documented cases of tuberculous meningitis at Cleveland Metropolitan General Hospital in the five-year period 1959 to 1963. The over-all mortality rate was 32 per cent. Negroes fared better than did whites, and patients between the ages of 6 and 50 had lower mortality rates than those older or younger. Of the individual factors measured, the first to return to normal after the institution of therapy was the cerebrospinal fluid sugar. This was followed by the temperature, cerebrospinal fluid cell count and cerebrospinal fluid protein, in that order.

S.P.P.

**Identification of Active Pulmonary Cavitory Disease by Barium Bronchogram Technique**

*Neil C. Andrews, Philip C. Pratt and Anthimos J. Christoforidis. Diseases of the Chest 1967, 51, 596*

A clinician is often faced with the problem of differentiating a truly "open healed" cavity from the one which is potentially active and partially healed in a patient whose sputum does not contain tubercle bacilli. It is suggested that for these cases bronchography using

barium sulfate as contrast medium would be helpful. If the cavity is active and not healed, barium will be picked up by the epithelioid cells or macrophages and deposited by phagocytosis along the wall of the cavity. This "wall sign" if absent will indicate a healed cavity. Incomplete wall sign will indicate a partially healed cavity. If the wall sign is present all through, it indicates unhealed cavity but it will not help to differentiate a tuberculous cavity from a cavity due to lung abscess, his toplasmosis etc.

S.P.P.

#### **Changes in Pulmonary Function Before and After Pneumonectomy for Pulmonary Tuberculosis.**

*Mario Besso Pianetto, Hinman A. Harris & Herbert C. Sweet.*

*Amer. Rev. of Resp. Dis., 1967, 95, 189.*

The changes in pulmonary function affected by the removal of one lung in 54 pulmonary tuberculosis patients are reported. The effect upon the vital capacity, total lung capacity and maximal breathing capacity was considerably less in patients with destroyed lungs than in those with 'aerated' lungs. The group showing the least change was the one in which the lung was destroyed and a thoracoplasty had been done prior to resection thus proving that the underlying aerated lung does retain some of its function under thoracoplasty.

It was noted that the aerated lung group prior to surgery, usually show a better saturation than the group with destroyed lung. But after surgery the aerated blood oxygen saturation was higher in all patients indicating that there is a considerable shunt of blood from within the diseased lung. The removal of diseased lung therefore improved the oxygen saturation in all cases. Bronchspirometric findings suggested that the diseased lungs, even though showing some aeration on an X-ray film, had contributed very little to the total pulmonary function.

S.P.P.

#### **Clinicophysiologic Correlations in Diffuse Pulmonary Fibroses and Granulomatoses.**

*John T. Sharp, Paul van Lith and Stanford K. Sweany.*

*Amer. Rev. of Resp. Dis., 1966, 94, 332.*

Among 61 patients with diffuse pulmonary fibrosis and granulomatosis, disease-specific patterns of pulmonary functional impairment

were not found. However, selective and sometimes isolated impairment of diffusion was often seen, in nonspecific interstitial fibrosis. Patterns of pulmonary functional impairment specific to the stage of disease were seen only in sarcoidosis where patients who had had the disease longer had a greater prevalence of airway obstruction.

Of 18 patients with clubbed digits, all but one had arterial hypoxemia, its absence is not a reliable basis for excluding hypoxemia. Clubbing was particularly common in non-specific interstitial fibrosis and in fibrosis associated with bronchial and bronchiolar disease, and is seen less often in sarcoidosis and other diffused granulomas. Right heart failure was seen in 12 patients, usually as a pre-terminal event, refractory to therapy. Right heart failure and pulmonary hyper-tension are the result of irreversible anatomic restriction of the pulmonary vascular bed rather than the reversible vaso-constriction caused by hypoxia and hypercapnia. In 6 of the 12, failure was associated with purely restrictive ventilatory defects and in five of these the arterial PCO<sub>2</sub> was normal or low.

The presence of a reticular as opposed to a purely nodular infiltration in the chest film was associated with an increased prevalence of hypoxemia, airway obstruction, lowered diffusing capacity and impaired distribution of inspired air.

S.P.P.

#### **Weight Changes in the Terminal Stages of Chronic Obstructive Pulmonary Disease.**

*E. Vandenbergh, K P. Van De Woestijne and A. Gyselen.*

*Amer. Rev. of Resp. Dis., 1967, 95, 556.*

Weight changes in 100 patients suffering from advanced chronic obstructive pulmonary disease who presented obvious carbon dioxide retention at least once, were studied. Each emaciation of more than 10 per cent of the initial weight was regarded as weight loss. According to the initial weight the patients were divided into three groups: normal, underweight, or over-weight, as compared with the ideal weight. Weight loss was comparable in the three groups and amounted on an average to 20 per cent of the initial weight. It was particularly pronounced during the first year after the start of weight loss. The patients who subsequently died presented a further loss of weight during the following years.

Cumulative death rates showed a mortality of 30 per cent, three years after the onset of

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weight loss and 49 per cent five years after; these rates are significantly higher than those in patients without weight loss. Only one-fifth of the patients died without presenting weight loss.

A definite relation was observed between weight loss and the first attack of heart failure, which occurred, on the average, 21 months after the onset of weight loss. One third of the patients presented heart failure within six months after the onset of weight loss. In the over-all group of patients, no obvious correlation between weight loss and lung function tests could be established, because of the spreading of the values. In a restricted group composed of the same patients, a significant deterioration of some functional data was found. This was most pronounced for the one-second forced expiratory volume in patients who had lost weight as well as in the others.

A decreased caloric intake appears to be an

important cause of weight loss, as demonstrated by dietary studies.

S.P.P

**The Roentgen-Ray Diagnosis of Intrapulmonary Lymph Nodes.**

*Robert Shapiro, George Wilson and Orlando F. Gambrielle.*

*Diseases of the Chest 1967, 51, 621.*

Intrapulmonary lymph nodes with a well defined capsule are supposed to be extremely rare if not altogether absent. Cases are reported where such intrapulmonary lymph nodes caused multiple "coin" shadows in the chest X-ray resembling a host of other well-known conditions which give rise to similar looking single or multiple shadows. They are asymptomatic and usually discovered accidentally. Antemortem diagnosis of these nodes without lung resection is impossible.

S.P.P.