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IMPORTANCE OF LABORATORIES IN THE FIGHT AGAINST TUBERCULOSIS

Those who have been following recent developments in tuberculosis work must have noticed the emphasis that certain workers give to the need for identifying tubercle bacilli in the secretions or the lesions of the individuals before diagnosing them as tuberculous. Better knowledge of the pathology of the lung diseases casts doubt on the correctness of diagnosis of many cases which were previously considered as pulmonary tuberculosis on the basis of clinical and x-ray findings. Extensive use of miniature x-ray for case finding among apparently healthy persons have also revealed that many shadows in the chest which one would have previously taken as tubercular are proving to be non-tubercular. Therefore, there is a growing opinion that no mass x-ray should be undertaken unless at the same time there are facilities for laboratory examinations for identifying tubercle bacilli in those who have shadows in the chest.

Further, the developments in connection with the treatment of patients with various anti-bacterial drugs have brought to light the importance of an efficient laboratory service for judging the results of such treatment, testing resistance of bacilli against drugs and detecting variations in their virulence following treatment. Extensive use of tuberculin in recent years in connection with mass BCG vaccination programmes in different countries of the world has also revealed that all positive tuberculin reactions may not be the result of infection with tubercle bacilli. Bacteriological studies are necessary to find out the agents other than tubercle bacilli that may cause tuberculin sensitivity.

One has to admit that in India at present much of the work done in tuberculosis is based on clinical observations and in some cases associated with x-ray examinations. A set-up for efficient bacteriological examination is lacking in many institutions. It is essential,

therefore, for all those engaged in anti-tuberculosis work to recognise the importance of having a laboratory service at their disposal to make their observations as accurate and scientific as possible.

The efficiency of these laboratories will depend upon whether they are manned by trained staff. Till recent years it was the practice to accept only doctors as bacteriologists. While the importance of doctors specialising in laboratory work is obvious we have also to consider the need for training large number of technicians as it will be impossible to find an adequate number of doctors to take up this work. Doctors trained in bacteriology will be needed for supervisory work and research but much of the routine work in laboratory can be taken up by properly trained technicians. In fact it has been demonstrated that good technicians can take up with ability most, if not all, of the routine work in a laboratory and even those connected with research.

In our plans for the development of anti-tuberculosis work during the Second Plan Period provision has been made for the establishment of at least 300 tuberculosis clinics and a large number of other institutions. All these would have laboratory facilities. The time has come also to recognise the need for training the personnel required to man these laboratories. There are some institutions in India where technicians for this work can be trained. Are these facilities adequate, and if so are they fully utilised ? If not, immediate steps have to be taken to remedy the deficiency. Tuberculosis workers in the country have a heavy responsibility in seeing to it that adequate laboratory facilities are at their disposal.

Sputum Swab Culture Compared With Sputum Homogenization Culture

By

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Sputum homogenization both for smear and culture has long held an important place in laboratory procedures in the search for tubercle bacilli. There are, however, few if any laboratory workers who would not prefer a simpler method if one could be found which would get rid of the necessity for the shaking during homogenization and then the rather long centrifuging followed by some kind of neutralization of acid or alkali or other homogenizing agent. In recent years many doubts have also been thrown on the efficiency of centrifuging as a concentrating factor. Further the occurrence of negative cultures with positive smears has suggested that the homogenizing fluids may have a damaging effect on the bacilli. In addition cultures have sometimes to be made under conditions when a well-equipped laboratory with an electric centrifuge was not always available. For these reasons search for an alternative method has been stimulated. One method recommended, following experience with laryngeal swabs, is the sputum swab culture which for speed and simplicity has every advantage over the older homogenizing methods. Therefore, a trial has been made of the process to ascertain how it compared with the homogenization process.

Material

In October 1954 and from February until the end of September 1955, one thousand and twenty-five specimens of sputum which came to the laboratory for routine culture, were dealt with simultaneously by the homogenizing method previously in use, and by the sputum swab culture method. The majority of specimens were from patients under drug therapy. The sputum specimens were either for diagnosis or control of treatment, or primary cultures for indirect sensitivity tests.

Methods

The homogenizing of the sputum was carried out with an equal volume of 6 per cent (vol.) sulphuric acid, the acid being mixed with the sputum and left for 20 minutes with occasional shaking, the mixture being then centrifuged for 20 minutes at approximately 2000—2200 revolutions per minute (the maximum of the centrifuge) ; the sediment was washed with sterile distilled water and it was centrifuged for 20 minutes. McCartney 1-oz. screw capped bottles were used for the whole process. The sediment was then sown with a large platinum loop on 2 tubes of Jensen-Lowenstein medium.

The sputum swab culture method was carried out as follows : 2 sterile cotton swabs were dipped in sterile distilled water and then were dipped in the sputum. Then they were placed in test tube containing 5 per cent oxalic acid sufficient to cover the swabs. After 10 minutes the oxalic acid was poured off and a similar quantity of 5 per cent sodium citrate was poured on. After 10 minutes the swabs were taken out.

pressed very gently on the side of the test tube and then rubbed well on to Jensen-Lowenstein medium, one swab to one tube.

All the cultures were incubated at 37° C. up to 6 weeks, when, if no growth was seen, they were discarded.

Results

The general results of the cultures were as follows :

TABLE I
*Result of Cultures of Sputum by Homogenization
and by Swab*

Homogenization Method	Swab Method	Number
-	-	492
+	+	184
+	—	104
—	+	57
	Sub-total	837
C	—	60
-	C	37
C	+	34
+	C	32
C	C	25
	Sub-Total	188
Total		1,025

+ Growth — No growth C Contaminated

From this it will be seen that out of 837 cultures (omitting those in which one specimen was lost by contamination) 288 or 34.4 per cent were positive by homogenization, and 241 or 28.8 per cent were positive by swab culture. Of the 345 positives, 288 or 83.8 per cent were found by homogenization and 242, or 70.0 per cent by sputum swab. If the sputum swab only had been used 104 or 30.3 per cent of the positives would have been missed and if only the homogenization had been used 57 or 16.5 per cent would have been missed.

Contamination

One of the problems of culture for TB is to find a method which will kill the contaminants and leave the TB alive. How does the swab method compare with the homogenization method ? In the homogenization method 119 or 11.6 per cent specimens were lost by contamination and in the swab method 94 or 9.2 per cent. This is rather a high percentage for both methods, and the high figure was largely due to a

heavy contamination in the hottest month, (May), where 52 homogenization cultures and 18 swab cultures were lost out of a total of 208 cultures by each method. This difference is remarkable and statistically highly significant. The reason for it is not certain. Possibly it was due to the growth in the sputum in conditions of high temperature in the interval between expectoration and culturing of large numbers of contaminants difficult to kill by the homogenization method; in the swab method considerably less numbers of contaminants would have to be dealt with. However, this is not true of the other months with a high atmospheric temperature. Another explanation could be that the oxalic acid sodium citrate method was more efficient against the particular contaminants than the sulphuric acid method. Another explanation could be the contamination of the distilled water used for washing the sediment after centrifuging, either due to a period of inefficient autoclaving or during work ; an earlier experience showed this to be the explanation for a batch of contaminations. Apart from this one month there is no difference in the percentage of contaminations by the two methods, homogenization having 77 and swab 76 contaminations out of 813 specimens.

Seasonal Variation

Barton *et al* (1951) reported a seasonal variation in culture results in a period extending over 6 years, the percentage of positive cultures being inversely proportional to the maximum atmospheric temperature. The material dealt with in that survey was of sputum examinations for patients with small numbers of bacilli and negative by the smear method. The present material is not quite comparable because it included a large number of cultures the purpose of which was the obtaining of a growth for sensitivity testing and therefore included specimens positive by direct smears. Does the swab method make any difference in respect of seasonal variations ? The general result is shown in Table II.

TABLE II
Positive Culture Results by Homogenization and Swab Methods According to Months and Atmospheric Maximum Temperature.

Month	Oct. 1954	Feb. 1955	Mar. 1955	April 1955	May 1955	*June 1955	July 1955	Aug. 1955	Sept. 1955
Mean maximum atmospheric temperature	81.9	85.9	90.7	94.1	91.1	(89.7)	86.5	82.5	86.9
Total cultures omitting contaminations	64	75	133	124	145	(249)	91	100	105
Positive homogen	No : 19 % 29.5	20 26.7	41 30.8	28 22.6	44 30.3	(74) (30.0)	45 49.5	52 52	40 38.1
Positive swab.	No : 13 % 20.3	19 25.3	35 26.3	35 28.2	34 23.4		36 39.6	36 39.0	33 31.4

*Owing to absence of the senior technician on leave, swab, cultures were not done in June.

From Table II it will be seen that the results in this series are on the whole similar month by month with maximum air temperatures varying between 80.0 and 95.7° F., except that in both methods the results were higher in July and August. This difference was, however, probably mainly due to a difference in material as in these 2 months 40 per cent of the sediments showed TB on direct smear as against 27 per cent for the other months. The general result is that there is not much variation in the different months.

The material may be examined from the aspect of the results of culture positive as obtained from negative smears. The general result is shown in Table III.

TABLE III

Positive Culture Related to Smears of Sediment

	No. of Specimen	Homogenizn. No.	+ %	Swab No.	+ %
Smear —	247	186	75.3	156	63.2
Smear —	590	102	17.3	85	14.4
Total	837	288	34.4	241	28.8

With both positive and negative smears the homogenization method is significantly better than the swab method.

Examined according to months in which the cultures were done, we find :

TABLE IV

Result of Cultures Compared Monthly with Positive and Negative Smears

	Smear				Total specimens	Smear—				Total specimens
	Homog. +		Swab +			Homog. +		Swab +		
	No.	%	No.	%		No.	%	No.	%	
1954										
October	11	78.6	9	65.0	14	8	16.0	4	8.0	50
1955										
February	8	47.1	9	52.6	17	12	24.0	10	20.0	58
March	30	83.3	25	69.5	36	11	11.3	10	10.3	97
April	21	56.8	21	56.8	37	7	8.0	14	16.1	87
May	36	80.0	27	60.0	45	8	8.0	7	7.0	100
June	—	—	—	—	—	—	—	—	—	—
July	26	78.8	25	75.8	33	18	31.0	11	19.0	58
August	33	82.5	26	65.0	40	19	31.7	10	16.7	60
September	21	84.0	14	56.0	25	19	23.7	19	23.7	80
	186	75.3	156	63.2	247	102	17.3	85	14.4	590

From Table IV several interesting observations may be made, if we consider the results obtained in the three hottest months, March, April or May and compare them with the results in the less hot months, we get the following figures :

TABLE V

Results of Cultures in Hot Months and Cooler Months Compared

	Smear +				Total specimens	Smear —				Total specimens
	Homog. +		Swab +			Homog. +		Swab +		
	No.	%	No.	%		No.	%	No.	%	
Hot months	87	73.7	73	61.9	118	26	9.2	31	10.9	284
Cooler- ,,	99	76.7	83	64.3	129	76	24.8	54	17.6	306

With the specimens with positive smear there is little seasonal variation and the swab method is significantly inferior to the homogenization method both in the hot and the cooler months. In the specimens with few bacilli, that is, with negative smears, the picture is different. There is a large decrease in the number of positives in the hot months as compared with the cooler months, in both the homogenization and swab methods. In the hot months the swab culture is as good as the homogenization method but in the cooler months the homogenization method is still superior to swab method.

Discussion

In the present study it has generally appeared that the homogenization method is superior to the swab method although it has been shown that there were a number of specimens in which the homogenization method was negative and the swab method positive ; therefore the employment of the swab method in addition to the other did increase the number of positive findings. One reason for this is rather obvious, namely, that in the homogenization method a large volume of material was concentrated, but only a small amount could adhere to the swabs; it is perhaps a little surprising that the difference between the two methods was not greater. Increasing the number of swabs might improve the swab method, but this would be offset by the cost of increased medium and the labour in making it.

It might be criticized that it is not fair to compare in the way that has been done in this study two different ways of treating material, the sulphuric acid method for homogenizing and the oxalic acid sodium citrate method for the swabs. While it would be impossible to have exactly the same method for both, it would be possible to homogenize the sputum with oxalic acid and this would perhaps give a more scientific basis of judging method and method. The present study, however, is reasonable, namely to take two standard methods, a usual technique for sputum homogenization, and a usual technique for swabs as is done with laryngeal swabs.

It is possible that material may be lost from the swabs in both the oxalic acid and the sodium citrate and bacilli may be left in the cotton wool so they do not reach the medium. Wallace *et al* 1955, have suggested calcium alginate wool for a swab material and digesting it in trisodium phosphate, centrifuging the trisodium phosphate and culturing the sediment. They found the number of positive cultures considerably increased when they used the centrifuged deposit as compared with rubbing the swab on the medium. Calcium alginate wool, however, had no advantage over ordinary

cotton wool. But in this method the advantage of simplicity is taken away to some extent by the need of centrifuging.

The experience in the three hot months suggests that in specimens with few bacilli, where these few bacilli may perhaps be damaged by the combination of homogenizing agent and temperature, the swab method is as effective as the homogenizing method. Therefore, the swab method could be possibly used in places having a high atmospheric temperature over a long period, with the possibility of getting as many positives as the homogenization method.

Summary

- (1) 1,025 specimens of sputum were cultured by homogenization and by swab culture.
- (2) The results are reviewed in general.
- (3) The question of seasonal variation in results by both methods is considered.
- (4) In general the homogenization method is superior to the swab method except during the hot months in specimens containing few bacilli, when the swab method is as good as the homogenizing method.

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Asian-Pacific Tuberculosis Conference, Sydney

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The Conference was held in the buildings of the Sydney University—Australia—from August 15 to 21, 1955. It was organised by the National Association for the Prevention of Tuberculosis in Australia (NAPTA).

Perhaps a few words about the NAPTA under whose aegis the Sydney Conference was held, would form a fitting introduction to this article especially since the writer went to Australia partly as a representative of the Tuberculosis Association of India.

The NAPTA was formed during a Congress of the British Medical Association held in Perth (Capital of the State of Western Australia) in 1948. Thus it will be seen that the NAPTA is only 7 years old—9 years younger than the Tuberculosis Association of India which was found in 1939.

Organisation and Attendance

Thirty overseas delegations comprising nearly all the S.E. Asian and Pacific countries and islands were present at the Conference. Representatives of the NAPTA and the State Tuberculosis Associations of Australia were there in large numbers. In addition, the Tuberculosis Section of the Commonwealth Ministry of Health, the NAPT London, and the W.H.O. and its S.E. Asian Regional Section were represented. In addition to the author of this article, the Government of India deputed Dr. S.M. Majumdar, Assistant Director of Health (Tuberculosis), Government of West Bengal as its delegate to the Conference. Prof. E. J. Underwood, President, and Sir Darcy Covven, Hon. Secretary of the NAPTA, Sir Harry Wunderly, Director of Tuberculosis, Government of Australia and Dr. Johannes Holm, Tuberculosis Chief, WHO, controlled and directed the deliberations and activities of the Conference.

The activities of the Conference consisted of scientific sessions, visits to medical institutions, social functions and visits to non-medical institutions and places of general interest. The plenary sessions of the Conference were all held in Sydney University. The other activities including bedside clinics and demonstrations were distributed in various institutions in the cities of Sydney, Canberra and Melbourne.

Subjects Discussed

The main subjects dealt with at the Conference were Antibiotics, Tuberculin testing, B.C.G. Vaccination, Public Health Problems of Tuberculosis in “unprotected” peoples, and “The Team” in anti-tuberculosis work. The term “unprotected” was introduced by the Australians to avoid the term “underdeveloped” which is commonly used in this connection.

The paper on antibiotics prepared by Dr. Walsh McDermott of the U.S.A. and presented at the Conference by Sir Harry Wunderly made the point that the tuberculosis problem today is characterized by three major developments :

1. That from the point of the view of control and management, tuberculosis in areas of high prevalence and that in areas of low prevalence may be considered almost two different diseases.
2. That home treatment can now be rendered almost as effective as institutional treatment and
5. The possibility that Isoniazid can be used as a preferable substitute for B.C.G. in tuberculosis control by the treatment of recent "Converters".

In the discussion that followed, the differences in the nature of the disease as seen in the more advanced countries of the West, and the disease as seen in the S.E. Asian Countries, from the point of view "of the infectivity and treatment methods required, were brought out. From the point of view of prevention and control, it was agreed that while in the disease of low-prevalence area, mass B.C.G. Campaign may not be needed, in the areas of high prevalence, mass immunisation was desirable and likely to prove effective.

I.N.H.

A lively discussion took place on the proposal to treat "recent tuberculin converters" with I.N.H. Dr. Andrew Moreland, the official representative of the NAPT London, pointed out the difficulties in tracing "recent converters". As many as a hundred tuberculin tests may have to be done on a single "tuberculin negative" before his conversion time is detected. The Indian delegation thought that looking for recent converters among 170 million tuberculin negatives in India would be like looking for needles in haystacks. The Indian delegation further pointed out that among a 100 tuberculin converters, it was only one who was likely to develop actual disease. Therefore by adopting the proposal made by Dr. McDermott, one would be drugging 99 persons with I.N.H. unnecessarily in order to protect one from the disease. The few tubercle bacilli that might have entered into a body making it tuberculin positive, may be dealt with effectively by a week or two of I.N.H. treatment. To treat such a case with I.N.H. for 18 months as suggested in the paper, was "writing in water". If in the name of public health, one decides to use I.N.H. in such an indiscriminate fashion, "one might as well put I.N.H. into city water supplies."

There was general agreement on the finding mentioned in the paper, that it is often advantageous to switch from one combination of two antibiotics to another combination when the effectiveness of the first combination is clinically found to get less and less. This switching will not be possible if Streptomycin, I.N.H. and PAS are all given together from the beginning. Therefore this practice was to be discouraged.

The discussion on the use of I.N.H. for self-administration by patients in the domiciliary treatment of tuberculosis on a mass scale was inconclusive. It was thought that it was yet too early to give scientific sanction to such a procedure. However, it was generally agreed that if any drug was to be used in that fashion at all, I.N.H. was probably the most suitable, as it was cheap and effective, had a wide margin of safety and did not need any injection for its administration.

The Conference was of opinion that in the vast majority of clinical cases of tuberculosis anti-biotic treatment to be effective must be prolonged, in some cases even up to 2 years. On the whole the sense of the house was that where there was conflict between clinical observations and laboratory findings in respect of the emergence of resistance to drugs in long-term treatment, it was safe to follow the clinical lead.

New Drugs

Among new chemotherapeutic drugs under research and trial Dr. McDermott mentioned Pyrazinamide, Cyclospirine and Hinconstarch. The hepatic toxicity of Pyrazinamide being more often seen in women than in men, it was thought that estrogens probably exert an influence on the course of hepatites. The neurotoxicity shown by Cycloserine is accompanied by an increase in total proteins in the cerebrospinal fluid ; and this is regarded as indicating an irritative phenomenon in the central nervous system. The drug Hinconstarch, a chemical (molecular) combination of Isoniazid and Thiosemicarbazone, was developed in the Irish Medical Research Council Laboratories. It has considerable antituberculosis activity *in vitro* and in animals. The question whether the molecule maintains its integrity with the body or simply breaks down into its components, is not yet known.

Professor Rubbo of the Melbourne University Public Health Laboratory, revealed that a drug called "Verazide", a copper complex of Isoniconicacid Hydrazide, is being elaborated and tested by him and his colleagues.

These drugs are yet in the experimental stage in respect of their degree of anti-tuberculous activity, toxicity, optimum dosage, etc. They are at present of interest to research workers and highly specialized institutions only.

Methods of Prevention

The discussions regarding the methods of prevention of tuberculosis centred around the functions of clinics, organisations of domiciliary control and B.C.G. The fact that the role of B.C.G. in "unprotected countries" is different from its use in countries where tuberculosis is no more a serious public health problem, was emphasised.

During the discussion on B.C.G. the Indian delegation gave a short account of the Mass B.C.G. Campaign in India. It was evident that figures such as 170 millions needing tuberculin testing, 60 millions already tested, 20 millions vaccinated, 140 doctors and 750 technicians engaged in the Campaign, etc. made a great impression on the Conference. Many delegates commented on the magnitude of the problem that India is facing. Keeping in view the opposition to B.C.G. that is met with from time to time in some S.E. Asian Countries, the Indian delegation suggested, that the Conference should put on record its recommendations regarding mass B.C.G. Campaigns in unprotected countries. This was done in the concluding session along with other recommendations of the Conference, as given later in this paper.

Dr. Shubbar Hassan, sole delegate from Pakistan, presented a well documented paper on "Tuberculin testing and B.C.G." He stated that in Pakistan, from August 1949 to the end December 1954, Thirteen million persons have been tested and 4.1 million vaccinated. As in India, the work is being done with the cooperation of UNICEF and WHO. The Cambodian delegation on behalf of "The Royal Government of Cambodia", presented a report of its first 6 months experience of mass B.C.G. Campaign and expressed great enthusiasm for the future of the campaign in that country.

The paper on "Public Health Problems of Tuberculosis amongst unprotected peoples" was presented by Dr. John Holm, Chief, Tuberculosis Section, WHO. The paper was based on the experiences of Dr. Marchi and his colleagues in the WHO assisted anti-tuberculosis Campaign in East Pakistan. The vigorous discussion that followed centred around the comparative merits of pure preventive measures as carried out by Public Health Workers assisted by technicians and consisting of general hygienic measures, isolation of cases, B.C.G., etc. on the one hand, and the indirect preventive

value of rendering open cases of tuberculosis non-infective by treating them on a mass scale by antibiotics and other treatment methods, as carried out by tuberculosis clinicians and general practitioners on the other hand. One group thought that this was the age of public health and that the days of tuberculosis clinicians were numbered. The other groups held that in the anti-biotic age, the clinicians were probably contributing more towards the prevention of tuberculosis than pure public health measures. Of course every one understood that this cleavage of interest and attitude was largely academical and that the anti-tuberculosis work was directed against the eradication of tuberculosis from the community. However it was evident that the heat and the light that were generated by the lively discussion were enjoyed by the Conference.

The paper on "The Team" in anti-tuberculosis work presented by Dr. De Marchi dealt with the composition and functions of the various types of teams, central and field, administrative and clinical, that were needed for a balanced and co-ordinated fight against tuberculosis in particular areas. The paper placed emphasis on the fact that properly trained technicians can and should play a large part in anti-tuberculosis projects. This was thought particularly true in this age of standardized techniques and especially so in countries where the numbers of qualified doctors available for public health work are not adequate for the magnitude of the problems to be dealt with.

In the discussion that followed, the need for team work on the international, national, provincial and district levels was brought out. Dr. Holm described how the W.H.O. the International Union Against Tuberculosis, the U.N.I.C.E.F., the Colombo Plan and other bodies are co-operating in the world-wide campaign against tuberculosis. Mr. Bishop, Treasurer of the NAPTA, spoke on co-operation between voluntary bodies like the NAPTA and Tuberculosis sections of Government Health Ministries. Later, representatives of various types of workers such as radiologists, pathologists, epidemiologists, statisticians, clinical and public health nurses, social workers, occupational therapists and others described briefly their particular contributions to wards anti-tuberculosis teams. The Chairman of the session pointed out that the Australians being an outstanding sporting people, it was only natural that "The Team" should have formed an important subject of discussion in this Conference. He added that the conference itself was a product of the team spirit in anti-tuberculosis work on an international level.

GUIDING PRINCIPLES

At the concluding session of the conference, the delegates agreed on the following "guiding principles":

Control

1. The essential preliminary to tuberculosis control programme is to define the extent of the problem. The most practical and reliable method of achieving this is to ascertain the prevalence of tuberculosis infection by tuberculin testing. Wherever it can be done, this should be followed by an epidemiological survey of random sample groups, using mass radiography, followed by bacteriological confirmation.
2. For any control programme, it is essential to concentrate on finding the cases of pulmonary tuberculosis amongst adults excreting tubercle bacilli. The only way of doing this is by demonstrating the tubercle bacillus in the sputum. Suspected cases for this investigation can best be found by x-ray examination.
3. In the application of control methods, domiciliary treatment with anti tuberculous drugs seems likely to play an increasingly important part in rendering a patient non-infectious. Further investigation of this question is urgently necessary.

Drug treatment does not, however, eliminate the necessity for segregation, adequate sputum disposal and other accepted preventive measures.

B.C.G.

1. Where the incidence of tuberculosis is high, and other control facilities are inadequate, it is considered that the mass B.C.G. administration is a safe and effective measure.

2. In countries in which tuberculosis is less prevalent, and where other facilities for control are adequate, vaccination programmes should be concentrated in high risk groups.

Drugs

Prolonged administration of anti-tuberculous drugs is considered a vital part of the treatment of infectious patients. In order to render a patient non-infectious, where one drug or drug-pairing is not completely effective, a change to another drug or drug-pairing is likely to be beneficial.

Isoniazid is considered the best single drug for domiciliary treatment under self-administration.

The Team

For an effective tuberculosis control programme, team-work is essential on all levels—international, national, provincial and local. The voluntary organisations have an important role to perform in co-operation with the official health services.

Personnel

An effective tuberculosis control programme can be executed by extensive use of technicians when especially trained for a specific function, and properly supervised. No work should be carried out by a doctor which can be done as well by a nurse, and nothing done by a nurse which can be done as well by a technician.

At the last scientific session, I had the privilege of extending to Australian Tuberculosis Workers and all the bodies which the overseas delegations represented, a warm invitation to the Congress of the International Union Against Tuberculosis to be held in New Delhi in January 1957. This was done on behalf of the Government of India and the Tuberculosis Association of India and at the instance of Dr. P. V. Benjamin, the President of the International Union Against Tuberculosis. There is reason to believe that there will be a good response to this invitation from Asian-Pacific countries. On this occasion, Dr. Andrew Moreland mentioned the regional organisation of the I. U. A. T. which is proposed for S.-E. Asia.

Visits to Medical Institutions

At a thoracic surgical session held at Hawel Memorial Hall, Sydney, Mr. Monk and his colleagues gave a demonstration of the technique of the reconstruction of trachea and bronchi. The thoracic unit of the Royal Northshore Hospital, the hospitals of the Sydney University Medical Faculty, tuberculosis clinics in Sydney and the Bodington Sanatorium were visited.

At the Commonwealth Serum Laboratories, Melbourne, the B. C. G. manufacturing and freeze-drying units were demonstrated. The Commonwealth Serum Laboratory is comparable to the Serum Institute at Copenhagen or the Central Research Institute, Kasauli, but larger in size. At the Royal Melbourne Hospital, the large blood bank organisation conducted by the Australian Red Cross, and the huge mechanised common laundry serving a large number of hospitals in Melbourne were demonstrated. Clinical conferences were held at the Austin Hospital and the "Repatriation General Hospital" for war veterans at Heidelberg. At the Repatriation hospital, skiagrams of "Wandering Suppurative Pneumonia" and "Torulosis of lung" were demonstrated. Torulosis is an invasion of the lung by a variety of yeast. At the Crosswell Sanatorium a good rehabilitation section run by an organised Ex-Patients' Association was visited. At the Melbourne University Public Health Laboratory Prof. Ruboo and his colleagues put up a well arranged detailed demonstration of the fluorescence microscopy techniques and different methods of drug resistance tests for tubercle bacilli. Various methods of screening drugs for anti-tuberculous activity were discussed. The technique of the method of injecting the skin of guinea pigs with tubercle bacilli and measuring the size and watching the course of the ulcers thus produced was demonstrated. Groups of guinea pigs were :

- (1) under treatment with the drug under trial,
- (2) under treatment with an anti-biotic of known potency, and
- (3) no treatment.

At the reception by the NAPTA, I took the privilege of conveying to the NAPTA the greetings and good wishes of the Tuberculosis Association of India. The NAPTA heartily reciprocated the sentiments expressed.

BREAST TUBERCULOSIS

By

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Tuberculous involvement of the breasts was first described by Sir Astley Cooper in 1829. Since then, many such cases have been reported but the condition remains rare and few clinicians see enough cases to have an extensive experience or see all the varieties that have been described in the literature from time to time. The opportunity afforded by presentation of three such cases in a brief period of a few months, and the fact that in the first two cases the condition was misdiagnosed and entirely missed in the first instant, has prompted us to review the main clinical features of the disease and its differential diagnoses and discuss the treatment.

The incidence of breast tuberculosis, among all breast lesions, has been computed by various authors as between 0.54%-1.87%. The age incidence is between 20 to 50 years *i.e.*, the period of active sexual life. The sex incidence shows that the male breast is very rarely affected, although Demme, quoted by Goldberg (1946), has reported one such case in a male child four days old. As the male breast is an undeveloped and non-functional tissue, it is not expected to be involved in the disease process. The female breast is more often involved in married women, and those who have borne children. Local trauma very often plays a predisposing part.

In considering, how the infection reaches the breast tissue, the following portals of entry are possible :

- (1) Tubercle bacilli may gain entrance through fissures and cracks in the nipple or through openings of the lactiferous ducts on the nipple. Morgen (1931) quotes Ely who describes the case of a woman who covered her breasts with a contaminated piece of linen and "soon after developed a tuberculous lesion in that breast. However, this can not be a common mode of entry.
- (2) Infection through blood stream is probably the common mode of infection, but clinical evidence can only be provided when there is evidence of multiple disseminated foci, at one time or at different periods.
- (3) Retrograde infection among lymph channels—from tuberculous cervical, axillary or parasternal glands has been mentioned by some authors. This assumption appears to be based upon the usual association of enlarged tuberculous glands in the axilla of the same side as the breast lesion, but is unphysiologic in conception.
- (4) Local extension of the disease process from the underlying tuberculosis of the sternum, costo-chondral junctions, or ribs may involve the breast secondarily in the females as the female breast overlies a large area of the front of the chest. In the males the breast being rudimentary, usually escapes secondary involvement.

Haematogenous infection appears to be the most plausible of all the routes of infection. But because it is uncommon to find multiple tubercular foci, in one of

both the breasts, and more common to find that the breast involved is on the same side as the disease in the lung, and the lesion is usually solitary and often associated with enlarged axillary glands; it stresses the importance of infection through the lymphatic system.

Pathologically there are two main varieties, namely, "Primary breast tuberculosis" when there is no obvious evidence of a tubercular lesion elsewhere in the body and "Secondary breast tuberculosis", when the breast lesion is secondary to a lesion in the lungs, pleura, glands or ribs. The focus of disease usually starts in the interacinous fatty tissue, but a few cases are on record in which the inflammatory process was confined to the walls of the excretory ducts and the periacinous tissue : the interacinous tissue being very slightly involved. Microscopically we find the formation of typical tubercular granulation tissue. The caseous mass may break down and lead to the formation of an abscess which in turn may burst through the skin, forming chronic indolent sinuses.

Clinically the lesion can be classified as under :

(1) Nodular Type :

A discreet "lump" of variable size forms in the breast. The upper and outer quadrant of the breast is the most frequented site. More than one nodule may form in one breast and Norris, quoted by Goldberg (1946), described a rare case where the whole breast was studded with nodules. The "lump" is almost always painless, smooth and freely mobile and may remain so for varying lengths of time. Later when an abscess forms, the lump may appear cystic to palpation. Later the overlying skin becomes red or bluish red and the abscess points but the process may still be painless. If the abscess bursts a chronic sinus is left on the overlying skin.

Case Report

Mrs. S.B., 27 years old married Hindoo female, attended the outpatients', department on November 15, 1954. She was diagnosed to have pleurisy with effusion on the left side and a patch of disease in the upper zone of the right lung. Sputum was negative for A. F. B., by the concentration test; E. S. R. was 66 mm. first hour (Westergren); and diagnostic puncture of the left chest revealed straw coloured fluid. She was put on bed rest and anti-tubercular drugs. A check up on 13-12-54 showed that the fluid on the left side had completely disappeared and otherwise she had shown sufficient alround progress. On 23-12-54 the patient, on a routine visit, volunteered the statement that there was a lump in her right breast which needed attention. On examination it was found that there was a lump of the size of a large walnut in the upper and inner quadrant of the right breast, discreet, smooth, freely mobile, painless and the skin overlying the lump was not adherent. Axillary glands were not enlarged. A tentative diagnosis of malignancy was made and the case was referred to the general hospital for proper investigation. There the lump was found to be cystic in consistency and so a diagnostic aspiration was made and about 10 c.c. of thin pus was aspirated (the pus could not be examined for A.F.B.) and one vial of "Streptopas" dissolved in 5 c.c. of distilled water was put in. A skiagram of the ribs did not reveal caries of the ribs. The case was sent back to the chest clinic to carry out the treatment. Only two more such weekly aspirations and instillations sufficed to reduce the size of the lump to that of an almond. In February 1955 the clinic lost touch with the patient, who feeling quite well and not in a position to buy more drugs abandoned the treatment. On 7-4-55 the patient presented again with a small painful swelling on the 8th rib in the right anterior axillary line which was found to be due to caries of the rib (suggesting a haemotogenous source of infection for both the breast and the rib lesion). The chest lesion and the breast lesion were found to be in the same condition as during the last check up.

(2) Sclerosing Type :

This type occurs in the older patient. The lesion is hard and fibrous. The course is very chronic and the breast may become small and hard and there may be nipple retraction. Sinuses usually do not form. This type is very easily mistaken for carcinoma of the breast.

(3) Cystic Type :

Rarely the breast lesion manifests itself as a large cystic swelling. This may be due to the tubercular process involving the wall of the excretory duct and leading to collection of fluid behind the obstruction.

Case Report

Mrs. S., 20 years old married Hindoo female, was admitted on 6-6-54, complaining of fever (120° F), cough with expectoration and enlargement of the left breast. Four months back she had noticed that her left breast was getting larger and tense but there was no accompanying pain or discomfort. She was then admitted to a general hospital where a diagnostic puncture was tried but did not reveal anything. Then local fomentation and infra-red exposures were given and this removed the tenseness in the swelling but the size of the swelling remained more or less the same, and so the patient got a discharge against medical advice.

About a month back she started getting cough with expectoration and then developed fever also and so presented herself at the chest clinic for examination. She also stated that the left breast which was considerably larger than the right had started getting larger again and was causing a painful discomfort to her.

On examination the patient looked toxic and very poorly nourished. Cervical glands were palpable. The left breast was about four times the size of the right breast. The enlargement of the breast was generalized and the overlying skin showed prominent engorged network of veins. A distinct throbbing pulsation was visible in the breast. On palpation the enlargement was firm, painful and pulsatile. There was no enlargement of the axillary glands. Physical examination and radiography of the chest revealed cavitory disease in the left lung in the upper and middle zones. Other tests were as follows:—Hb. 11G per 100 c. c., total R.B.C. count 2.83 million per cmm., total W.B.C. count 6200 per cmm., with polys 64%, lymphos 33%, monos 1%, and eosino 2%, sputum positive for A.F.B.; E.S.R. 70mm. first hour (Westergren) and urine N.A.D. The patient was put on the usual antitubercular treatment.

Suspecting that the condition in the breast was an acute malignant condition, the patient was referred to a surgeon for total mastectomy. However it was found that the condition was due to a very large cyst full of turbid fluid. The cyst was removed entirely and the wound healed by first intention under streptomycin-P.A.S. cover. Microscopic examination of the tissue revealed chronic inflammatory tissue with occasional giant cells.

(4) Atypical Lesions :

A superficial ulcer may form on the nipple which may later spread towards the breast tissue. Caries of the ribs, or costo-chondral junctions, underlying the breast may point through the breast. In such cases there is usually an evidence of a thick fibrous band leading to and adherent to the involved rib. Tuberculosis of the breast may co-exist with carcinoma of the breast.

Because of close similarity between carcinoma of the breast and tuberculosis of the breast, the diagnosis may be missed at the first instant and rendered almost impossible in the primary forms when there is no obvious other tubercular focus in the body. Microscopic study of the removed tissue only reveals the correct diagnosis. However, the condition must be kept in mind if a patient in the age group 10 to 50, in apparent good health, with a past or coexisting history of tuberculosis, presents a painless lump in the breast with or without enlarged axillary glands. The lump may be freely mobile or adherent to the overlying skin with or without retraction of the nipple. The lump may appear cystic and diagnostic puncture may reveal thin pus or a turbid or serous fluid which may or may not show A. F. P. by microscopic examination. Differentiation from carcinoma of the breast in the sclerosing type is difficult. The following points may help.

In carcinoma the degree of hardness of the lump is greater, and the enlarged axillary glands are also hard. The deformity and retraction of the nipple is also greater and the age group is older. Again in doubtful cases biopsy alone can settle the matter. Tuberculosis and cancer of the breast have been known to co-exist, and this possibility has to be remembered as not to miss an associated carcinoma and the resulting serious consequences to the patient. Certain benign conditions, namely, fibroma fibro-epithelioma, cystic hyperplasia or traumatic fat necrosis also come into the differential diagnosis and are distinguished by their suggestive features or by biopsy.

When the case presents as a breast abscess trying to point and burst, it has to be distinguished from an abscess of non-tubercular origin. Many a time the abscess is drained by the surgeon and only when a chronic sinus persists that the diagnosis comes into view.

A skiagram of the chest, and investigation of the past or present history of tuberculosis and biopsy of the lesion, if necessary, are essential for purposes of differential diagnosis.

Treatment

Previously the approach was to combine the general sanatorium line of treatment with local excision of the lesion and if necessary do a block dissection removal of the enlarged axillary glands. We feel that these days such an approach to treatment is not justified. Firstly, attention must be given to the primary lesion and for this the general sanatorium line of treatment, with a view to improve general health and resistance ; and anti-tubercular drugs and treatment becomes necessary. The local lesion may be treated as follows :

(1) If the lump is small with no associated enlarged regional glands or evidence of breakdown and formation of pus in it, then it should be carefully watched while the primary lesion is being treated. Our third case was of this type and improved on antitubercular drugs.

(2) If the lump appears cystic and diagnostic puncture shows pus in it then local treatment must be added to the systemic administration of antibacterial drugs. Local treatment consists of aspiration of pus and instillation of one gramme of streptomycin dissolved in about 5 c.c. of 10% P. A. S. solution or one vial of "Streptopas", at weekly intervals till it dries up.

(3) If the general or local and general administration of antitubercular drugs fails to control the lesion or when chronic indolent sinuses have already

formed or when the breast lesion is a primary lesion then it is best to carry out a local excision under cover of antitubercular drugs. The axillary glands are best left alone and treated conservatively.

(4) If cancer of the breast is found associated with the breast lesion or is very strongly suspected, then radical excision as for carcinoma of the breast is advisable.

(5) In the cystic variety of breast tuberculosis, local excision of the cyst under cover of antitubercular drugs is the ideal treatment. Axillary glands are again best left alone.

(6) For involvement of the breast secondary to tuberculosis of the ribs or costo-chondral junctions, local mastectomy has to be combined with removal of the offending portion of the rib or costal cartilage.

We are aware that this programme of treatment is being advocated on a very meagre data of good results in three cases, but feel that this approach is quite rational and worth a trial by other tuberculosis workers.

SUMMARY

The incidence, pathogenesis, clinical features, differential diagnosis and treatment of tuberculosis of the breast have been reviewed. Two case records have been quoted.

Acknowledgment

We are grateful to surgeon P. D. Mathur of the Sawai Man Singh Hospital and his staff for valuable help towards diagnosis and treatment of the cases quoted above.

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Does Pleural Symphysis Prevent Adequate Rise of Diaphragm by Pneumoperitoneum or Pneumoperitoneum Combined with Phrenic Paralysis ?

By

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Clifford Jones and Macdonald (1943) and Fraser (1950) pointed out that in cases with previous pleural effusion followed by adhesion of the pleurae, a marked rise*of the diaphragm cannot be expected even by established pneumoperitoneum plus phrenic paralysis. Whereas Crow and Welchel (1945) state that in individual cases, symphysis of pleurae prevents the adequate rise of diaphragm.

On the other hand Thompson Evans (1953) reports that out of 25 cases with previous pleural involvement (effusions empyema, hydropneumothorax) 20 (80%) had elevations from 21 to 45%. The time factor played no part as good rises were obtained where effusion had occurred many years previously.

Wallax Fox (1950) studied 40 cases of pleural adhesions or symphysis and reported that the diaphragmatic rise and mediastinal shift by pneumoperitoneum plus phrenic in these cases was approximately the same as the mean figures for the whole series of 80 cases. Hence he concluded that the presence of complete or partial pleural symphysis is quite compatible with occurrence of both considerable diaphragmatic rise and mediastinal shift. The author has not come across in literature any analysis, as to which type of pleural symphysis prevents the adequate rise of diaphragm by pneumoperitoneum and which type does not do so.

In view of the conflicting opinions expressed by the above mentioned workers and others, it was decided to study the reduction of apico-basal diameter with pneumoperitoneum first and then with pneumoperitoneum plus phrenic paralysis in cases of proved pleural symphysis.

A total of 72 cases were studied. A batch of 46 cases of proved pleural symphysis was divided into four groups according to the mode of development of pleural symphysis. Another control batch of 32 general cases were studied for comparison.

Methods :

Roentgenograms of all the 78 cases were taken with standard technique before and during the treatment with pneumoperitoneum. These serial pictures were taken from a distance of 6 feet with the patient in the upright position at the end of full inspiration one to two hours before pneumoperitoneum refills.

Pneumoperitoneum refills were regulated by fluoroscopy. The usual interval being 7 to 9 days.

The measurement of Apico-Basal Diameter was done by means of 30.5 centimeters plastic transparent scale. The vertical distance between the plane passing through the lower border of the transverse process of the first thoracic vertebra and the highest point on the diaphragmatic contour was measured in the serial roentgenograms.

The absolute figures in the centimeters representing the actual reduction in the Apico-Basal Diameter due to rise of diaphragm do not provide a reliable index of the degree of vertical relaxation. For in a long chested individual 4 cm. rise of dome may actually cause less vertical relaxation than 3.8 cm. rise of dome in a broad chested individual.

Therefore, in order to avoid errors due to variation in the size of the thorax a better estimate of vertical relaxation of lung in a given individual can be made by finding out the percentage of reduction in the Apico-Basal Diameter which was calculated by the following formula :—

$$\text{Percentage Reduction in the Apico-Basal Diameter} = \frac{\text{Decrease in Apico-Basal Diameter} \times 100}{\text{Original Apico - Basal Diameter.}}$$

$$\text{For example \% reduction} = \frac{4 \text{ cms} \times 100}{20 \text{ cms}} = 20 \%$$

In other words there has been a reduction of 20 % in the Apico-Basal Diameter of the lung in this case.

Results

Average reduction in Apico-Basal Diameter, in case with Pleural Symphysis, and in Control Group

No.	Group	No. of patients	Reduction in Apico-Basal Diameter with P. P. alone.		Reduction in Apico-Basal Diameter with P.P. plus Phrenic Paralysis.	
			Centimeters	%	Centimeters	%
1	Where induction of A. P. P. was not successful.	16	28	16.2	5.37	31.4
2	Where A. P. was contraselective and was stopped. Or a satisfactory A. P. was stopped for some other reason.	19	3.5	16.1	5.8	27.6
3	Where small amount of fluid developed and A. P. was stopped and P. P. was started within 3 to 4 weeks.	6	3.75	19	5.5	23.3
4	Where large amount of fluid developed got organized P. P. started a few months later.	4	*	—	3	12.75
5	General control group.	32	3.3	16	5.8	28.5

*Some X-ray films taken with P.P. alone were not available in this group.

First group : consisted of 16 patients in whom pneumothorax could not be induced. The average reduction in Apico-Basal Diameter was 16.2 % with pneumoperitoneum and 31.4 % with pneumoperitoneum plus phrenic paralysis.

Second group : consisted of 19 patients in whom a contra-selective basal pneumothorax was abandoned and pneumoperitoneum was started two to three weeks after expansion of the lung. The average reduction in Apico-Basal Diameter was 16.1 % with pneumoperitoneum and 27.6 % with pneumoperitoneum plus phrenic paralysis.

Third group : consisted of patients who developed small amount of fluid during contra-selective pneumothorax. It was abandoned and after about three weeks pneumoperitoneum was started *i.e.* before the fluid had time to organize into fibrous tissue. The average reduction in Apico-Basal Diameter was 19 % with pneumoperitoneum and 23.3 % with pneumoperitoneum plus phrenic paralysis.

Fourth group : consisted of 4 patients. It was similar to the third group except for the fact that the amount of pleural effusion was larger. After abandoning contra-selective Pneumothorax several months elapsed before Pneumoperitoneum was started. In other words, during this long interval the fluid had organized and thickened pleura with gross obliteration of costophrenic angle was visible on the skiagram.

The average reduction in Apico-Basal Diameter was only 12.7 % with pneumoperitoneum plus phrenic paralysis. It could not be measured with pneumoperitoneum as some skiagrams were not available.

Control group : In the control group of 32 patients we found that the average reduction in Apico-Basal Diameter was 16 % with pneumoperitoneum and 28.5 % with pneumoperitoneum plus phrenic paralysis.

Discussion and Conclusions

It is apparent from the table that the corresponding figures of reduction in Apico-Basal Diameter in the first three groups approach quite closely those of the control group (*i.e.* about 16 % with pneumoperitoneum and about 29 % with pneumoperitoneum plus phrenic paralysis). But on the contrary in the fourth group the reduction in the Apico-Basal Diameter even with pneumoperitoneum plus phrenic paralysis were only 12.7 %. Obviously this was due to the poor rise of the diaphragm which was bound down by the organization of large amount of fluid.

These studies, therefore, reveal that pleural symphysis "*per se*" does not prevent an adequate rise of diaphragm by pneumoperitoneum alone or by pneumoperitoneum plus phrenic paralysis except in those cases where the organization of pleural fluid is so much as to be manifest on x-ray in the form of a grossly obliterated costophrenic angle or markedly thickened pleura of at least a few months' duration.

Summary

Reduction in Apico-Basal Diameter brought about by pneumoperitoneum and pneumoperitoneum plus phrenic paralysis has been measured in 46 cases of proved pleural symphysis and 32 general cases which served as a control.

It was found that the reduction in Apico-Basal Diameter in patients with pleural symphysis was approximately the same (*i.e.* about 16 % with pneumoperitoneum and about 29 % with pneumoperitoneum plus phrenic paralysis) as was found in the control group except in those cases of pleural symphysis where organization of pleural fluid was so much as to be manifest on plain roentgenogram in the form of grossly obliterated costophrenic angle or markedly thickened pleura. Further it was found that even a small amount of pleural fluid did not prevent an adequate rise of the diaphragm by pneumoperitoneum, provided, this collapse measure was started within 3 to 4 weeks *i.e.* before the fluid could organize into fibrous tissue.

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Moniliasis of The Lung

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At times the diagnosis of moniliasis of the lung becomes rather difficult, as it very closely resembles pulmonary tuberculosis both in its symptoms complex and clinical course.

The sputum may be negative for A.F.B., still one has to exercise considerable caution before arriving at its diagnosis.

Candida Albicans, the causative fungus can be isolated not infrequently from the throats of healthy individuals and its presence in the sputum may be coincidental, alternatively this may be found in the sputum also of patients, who are having pulmonary tuberculosis, bronchiectasis, carcinoma of the lung, lung abscess, etc. Repeated examination of the sputum by culture on the Sabouraud's agar medium, and by various biochemical examinations and animal inoculation, are conclusive in arriving at a correct diagnosis of this condition.

CASE REPORT

C. L., Male, aged 28 years, milkman by profession, first reported in our Out-Patient Department on 12-8-1954, with the complaints of cough, profuse expectoration, repeated haemoptysis, fever coming in bouts and pain in the right back. Duration four months.

Family History :

No family history of tuberculosis.

Previous History :

Apparently good health.

General Examination :

Patient was of average height and built and was looking rather toxic. Marked clubbing of the fingers. Weight : 101 lbs. Temperature at 9 a.m. 102°F.

Respiratory System :

Right Chest : Impaired percussion note with harsh breath sounds, moist rales and crepitations both in the front and back of the upper chest.

Left Chest: Occasional crepitation in the left-infra clavicular region.

Cardio-Vascular and other Systems :

Nothing abnormal detected.

Sputum Examination :

The sputum was purulent and foul smelling.

Microscopic Examination :

Showed fair amount of pus cells. No micro-organisms seen. Concentration examination was negative for A.F.B. The sputum was cultured on the Lowenstein Jensen's medium.

Blood Examination :

Total W.B.C. 13,750, polymorphs 80%, lymphocytes 20%, E.S.R. 46 m.m. 1st Hour Westergren's Technique.

Mauntoux Test :

5. T.U.P.P.D. : Positive (48 hours)

X-ray Chest :

Right Lung : Exudative area and a cavity with fluid level in the upper zone.

Left Lung : A small exudative area with breaking down around the left hilum.

Treatment:

The patient had no sepcific treatment so far. A diagnosis of bilateral pulmonary tuberculosis was provisionally made. He was given Streptomycin and Isonicotinic Acid Hydrazide.

FOLLOW UP**11-11-1954**

Had gained 7 lbs weight. No fever.

Sputum :

Showed no change in quality and quantity. Repeated Cone. Examination of sputum done on 13-9-1955, 23-10-1955 and 11-11-1954 and by culture was negative for A.F.B. Another specimen was cultured on 12-11-1954 : Negative E. S. R. 8 m.m. 1 hour.

X-ray Chest :

Right Lung : Haziness of the upper zone, no definite cavity seen.

Left Lung : Some clearance of the exudative area around the left hilum.

Though the sputum was negative for A.F.B. by culture examination the patient was advised to continue treatment with Streptomycin 1 gm. bi-weekly, 200 mgms of I.N.H. daily, as there was considerable improvement in his general and clinical condition.

31-1-1955

Patient who was maintaining progress so far, started getting rise of temperature with increased cough and expectoration for the last four days.

He was looking rather toxic and had lost 6 lbs. weight.

Sputum :

Showed no change in quality and quantity.

Blood Examination :

Total W.B.C. 17,800, Polymorph : 71%, Lymphocytes 26%, Monocytes 3%, E.S.R. 38 m.m.

X-ray :

Right Lung : Showed exudative area with evidence of breaking down in the centre in the upper zone.

Left Lung : Showed Fresh exudation around the left hilum.

The patient had nearly 60 gms. of Streptomycin and 200 mgms. of I.N.A.H. daily for nearly five months.

In spite of continuous treatment, with drugs, x-ray, chest showed fresh reactivation.

The patient was advised to have combiotic injections.

18-2-1955.

X-ray Chest : Showed some clearance of the exudative area in the right upper zone leaving a cavity.

Left Lung : Some exudation around the left hilum, but it was more marked in the lower zone.

23-4-55.

Patient had profuse haemoptysis about 3 days back following which he started fever, with increased cough and expectoration.

X-ray Chest :

Right Lung : More exudation with evidence of breaking down in the upper zone.

Left Lung : Exudative area around the left hilum.

Patient was advised to have Estopan injections daily, and to come for check up after a fortnight.

13-7-1955.

Patient reported after about 3 months. During this time he was not keeping good health and was under native treatment. He was having irregular fever, increased cough with expectoration and was looking fairly toxic. Weight : 98 lbs. As the sputum was still negative for A.F.B. It was inoculated on Sabouraud's agar medium. After 48 hours, it showed round, smooth and elevated colonies of white or greyish white in colour. Some of the colonies showed mycelial fringes and it had a strong yeast like odour. Morphologically the colonies were indistinguishable from the colonies of *monilia albicans*.

Microscopic Examination of the Culture :

Showed both round or oval cells and inter-spersed between them were some elongated cells,

X-ray Chest:

Right Lung : Dense exudation with breaking down in the upper and middle zone :

Left Lung : Fresh exudation around the left hilum. A tentative diagnosis of moniliasis of the lung was made.

The patient was advised to have 5 drops of Pot. Iodide three times daily by dissolving 480 grs. of Pot. Iodide in one oz. of water. The dose was gradually increased by one drop, till he was getting 10 drops thrice daily.

19-7-1955

The patient was feeling better. Sputum became thinner and less in quantity. Sputum was again cultured on Sabouraud's medium, which showed colonies of moniliasis albicans.

Screen examination showed considerable clearances of the diseased area.

Fermentation test with glucose and fructose was positive but it was negative with galactose.

26-7-1955

Patient had developed an Ischiorectal abscess with pus discharge and had swelling and lachrymation of the eyes.

Sputum :

Culture on the Sabouraud's medium showed colonies of monilia albicans.

X-ray Chest :

Showed considerable clearance of the exudative area on the right side, exudation around the left hilum was still present.

Animal inoculation was not done because of lack of facilities. He was advised to continue with Pot. Iodide.

7-10-1955

General condition was somewhat stationary. No fever, cough and expectoration less, fistula had almost disappeared.

Sputum culture showed monilia albicans colonies.

Blood Examination:

Total W.B.C. 6,650 Polymorph 55%, Lymphocytes 44%, Monocytes 1%, E.S.R. 15 m. m.

X-ray Chest:

Considerable clearance of the exudative area in both the lungs.

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DISCUSSION

A case with a negative sputum for A.F.B. presents all the vexing problems in any of the chest clinics. Clinical course along with the symptoms complex are only suggestive in arriving at a diagnosis and the radiological findings are only supportive.

The crucial test in arriving at a diagnosis are the bacteriological findings. In case of mycotic infections of the lung, the problem is further complicated, as the fungus causing moniliasis of the lung is a common inhabitant of the throats of healthy individuals or it may be isolated from the throats of those who are already having pulmonary tuberculosis, lung abscess, etc.

Repeatedly positive culture for the fungus on the Sabouraud's medium, various chemical tests and animal inoculation are conclusive in arriving at a correct diagnosis.

For differential diagnosis, the condition has to be borne in mind.

Pulmonary moniliasis is an endogenous infection unassociated with any season, climate or geographical strata and is unlike some of the other fungus infection, such as coccidiomycosis, blastomycosis, etc., which have a more or less fixed distribution.

The infection is due to inhalation of the fungus, which is a common inhabitant of articles such as fruits, dead leaves, old straw, etc. *Candida albicans*, a species of monilia is responsible for infection in the human beings.

The infection may be acute or sub-acute and the site of involvement may be mouth, bronchii, lungs or skin. Rarely it may cause septicaemias. Involvement of meninges or endocardium have also been mentioned.

In the body tissues these invoke a joint cell reaction and a state of hypersensitivity very much akin to tuberculosis.

Unlik actinomycosis or blastomycosis, moniliasis has a mild clinical course.

The causative organism is not infrequently an inhabitant of the throats of healthy individuals or in those who are suffering from other respiratory diseases.

The diagnosis is on laboratory findings and is by exclusion of the other aetiological agents. Repeatedly positive findings of a fresh sputum by culture examination are indicative of the condition. Sugar frementation tests and animal inoculation are further conclusive. As yet there is no specific treatment.

Administration of Iodides or dyes are helpful in amelioration of symptoms and clinical cure of the various antibiotics. Neomycin is also helpful.

Summary

A case of pulmonary moniliasis has been described. The various aetiological factors have been discussed. Its diagnosis is mainly by laboratory findings.

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NEWS AND NOTES

N.A.P.T. Scholarship

The National Association for the Prevention of Tuberculosis, London, has decided to award a scholarship worth £ 350 to an Indian doctor for advanced study in tuberculosis in the United Kingdom during 1956. The candidate will be selected by the Tuberculosis Association of India which will receive applications on prescribed form on or before January 1, 1956.

Regional Committee of I.U.A.T.

A meeting of representatives from South East Asian countries will be held in Trivandrum on January 9, 1956 to discuss matters relating to the formation of a South-East Asian Regional Committee of the International Union Against Tuberculosis.

1957 International Congress

The International Tuberculosis Congress under the auspices of the International Union Against Tuberculosis will be held in New Delhi from January 7 to 11, 1957. Rajkumari Amrit Kaur, Union Health Minister, and President of the Tuberculosis Association of India is elected as Honorary President and Dr. P. V. Benjamin as the President of the Congress.

XIIIth Workers' Conference

The Thirteenth Tuberculosis Workers' Conference will be held in Trivandrum from January 5 to 8, 1956. Dr. T.J. Joseph will preside over the Conference.

1956 Health Visitors' Course

The 1956 Tuberculosis Health Visitors' Course will begin in New Delhi on January 2, 1956. The candidates will receive training in the College of Nursing, New Delhi, New Delhi Tuberculosis Centre and the Lady Reading Health School, Delhi, for seven months and in the Lady Linlithgow Sanatorium, Kasauli, for one month.

Result of 1955 Health Visitors' Course

The following candidates passed the 1955 Tuberculosis Health Visitors' Course Examination held in New Delhi in September, 1955.

Miss Abinash Kaur (Pepsu), Miss Usha Sayal (Delhi), Miss Shrimati Mishra (Orissa), Mr. Kailash Nath Verma (Rajasthan), Mr. Nakul Chandra Pati (Orissa), Mr. Tikendra Nath Chaudhry (Assam), Mr. Amir Singh (Punjab), Mr. Jadu Nath Bhanja (Orissa), Mr. Mahadeo Krishna Tattoo (Madhya Bhrrat), Mr. Shamacharan Singh (Manipur), and Mr. Prem Nath (Pepsu).

Patiala Post-Graduate Refresher Course

A post-graduate refresher course in tuberculosis was held in Patiala from October 3 to November 2, 1955. The following candidates who completed the training were awarded certificates :

Dr. Hari Kant Sharma, Dr. Rama Nandan Prasad Sinha, Dr. Lall Singh Gill, Dr. Brij Lall Dular, Dr. Joginder Singh, Dr. Sohan Lall and Dr. Sewa Singh Kairon.

Sixth Seal Campaign

The Sixth Tuberculosis Seal Sale Campaign which is now in progress will close on January 26, 1956, Republic Day.

International Congress of Medical Radiophotography

The following is the provisional programme of the Second International Congress of Medical Radiophotography which will be held in Paris on April 4, 5, 6, 7, 1956:

SECTION I: RADIOPHOTOGRAPHY IN PULMONARY TUBERCULOSIS

Chairman : **Prof. R. Griesbach** (Germany)

Rapporteur : **Prof. Babolini** (Italy)

“The present place of radiophotography in early case finding and later control of cases of pulmonary tuberculosis.”

Co-rapporteurs : **Prof. F. Gomez** (Uruguay)

“The influence of radiophotographic case finding on tuberculosis morbidity.”

Dr. H. Brocard (France)

“The course of the disease in patients diagnosed by radiophotography.”

Dr. Durieu (Belgium)

“The results of radiophotography as regards the different professional and social groups.”

Dr. Knud Winge (Denmark)

“Organization and results of radiophotography in countries showing a low tuberculosis morbidity.”

Dr. Papanicolaou (Greece)

“Organization and results of radiophotography in countries still showing a high tuberculosis morbidity.”

SECTION II: RADIOPHOTOGRAPHY IN NON-TUBERCULOUS DISEASES OF THE THORAX AND IN ITS NEW APPLICATIONS OUTSIDE THORACIC DISEASES

Chairman : **Prof. Jaroslav Jedlicka** (Czechoslovakia)

Rapporteurs : **Dr. Peter Kerley** (Great Britain)

“Case finding by radiophotography of cases of cardiovascular diseases.”

Prof. N. Pende (Italy)

“Radiophotography of cranium and bones.”

NEWS AND NOTES

- Co-rapporteurs* : **Dr. Katharine R. Boucot** (U.S.A.)
“Case finding by radiophotography of cases of bronchopulmonary carcinoma.”
Dr. Casanova Alves (Portugal)
“Case finding by radiophotography of mediastinal diseases other than tuberculosis and carcinoma.”
Prof. Ch. Gernez-Rieux (France)
“Case finding by radiophotography of professional diseases of the lungs.”

SECTION III : APPARATUS AND TECHNIQUES IN RADIOPHOTOGRAPHY

- Chairman* : **Dr. Urgoiti** (Spain)
- Rapporteur* : **Mr. H. Martin**, Consulting Engineer of the French National Railways.
“The latest technical improvements in radiophotography and their uses”.
- Co-rapporteurs* : **Prof. Hein Lossen** (Germany)
“The choice of the most suitable film format and of the most suitable film quality in radiophotography”
Prof. K. Wegelius (Sweden)
“Standardisation of radiophotographic techniques at the national and international level.”
Dr. M. Mattler (France)
“A method of increasing the luminosity of radiosopic screens by subjecting them to an electric field.”

SECTION IV : THE READING AND INTERPRETATION OF RADIOPHOTOGRAPHIC FILMS.

- Chairman* : **Dr. Courcoux** (France)
- Rapporteur* : **Dr. R.J. Anderson** (U.S.A.)
“The reading and interpretation of radiophotographic films.”
- Co-rapporteurs* : **Dr. Yerushalmy** (U.S.A.)
“The importance of personal factors in the interpretation of films and the value of multiple reading.”
Prof. Bariety, Dr. Coury and Dr. Choubrac (France)
“Comparative value of radiophotography and standard radiography. The subjective factor in reading.”
Prof. Janina Misiewicz (Poland)
“Suggestions regarding an international nomenclature for the interpretation of microfilms and for the statistical utilisation of case finding results.”

SECTION V: METHODS AND PRINCIPLES OF ORGANISATION IN THE PREPARATION AND EXECUTION OF RADIOPHOTOGRAPHIC EXAMINATIONS

Chairman : **Prof. Cramarossa** (Italy)

Rapporteur : **Dr. A. Maisani** (Italy)

“General organisation of radiophotographic case finding on the national level—Coordination of the means and of the results.”

Co-rapporteurs : **Dr. J. Brim** (France)

“Radiophotographic case finding among the rural population”.

Dr. Chauvet (Switzerland)

“Radiophotographic case finding among the urban population, in universities and in the army.”

Dr. Leggat (Great Britain)

“Utilisation of radiophotography in hospitals.”

Dr. Lundquist (Sweden)

“Results of a radiophotographic campaign on a national level—Administrative and financial problems.”

Prof. J. Abello (Spain)

“The protection of the personnel employed in mass radiographic examinations.”

The Indian Journal of Tuberculosis

ABSTRACTS

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Abst. No. 1

Tuberculous Epididymitis.—Parallel series of 80 cases of non-tuberculous epididymitis and 28 cases of tuberculous epididymitis have been compared and contrasted by the authors. The average age of the patients in both series was 42 years and the age ranges were virtually identical. In both series the right side was involved as frequently as the left: bilateral involvement was relatively less common in the non-tuberculous cases. A short history of scrotal swelling occurred in 80% of the non-tuberculous cases and in 33% of the tuberculous. Pain occurred in both the series but it was more common in the non-tuberculous cases. Recurrent swelling occurred in 15% of the cases of non-tuberculous epididymitis but swelling persisted in the tuberculous cases. Urinary symptoms were commonly present in both the non-tuberculous and the tuberculous cases, but a long precedent history of urinary symptoms favoured the diagnosis of tuberculous epididymal disease. Macroscopic haematuria occurred in 30% of the cases of non-tuberculous epididymitis and was probably due to cystitis. Sterile pyuria was noted in 10% of the cases of non-tuberculous epididymitis: it was considerably more common in the tuberculous cases. Coliform and/or coccal infection of the urine was commonly present in the non-tuberculous cases but occurred also in 26% of the tuberculous. Tubercle bacilli were isolated from the urine in 12 of 22 cases so examined.

A scrotal sinus was rare in the cases of non-tuberculous epididymitis but developed in 35% of the tuberculous cases. Prostatic and vesicular nodularity was noted in 63% of the non-tuberculous cases and in 70% of the cases of tuberculous epididymitis. Clinical tuberculosis elsewhere in the body, either concurrent or precedent, was found in 76% of the tuberculous cases. The majority of the cases of non-tuberculous epididymitis were treated expectantly and ran a benign course. The tuberculous cases were treated by surgical excision—before streptomycin and the adjuvant drugs were available. Thirtysix per cent of the patients were dead within a few years. The differential diagnosis between the two conditions is sometimes difficult and is apparent only after the lapse of time: full urological investigation is advisable.

—(*Non-tuberculous and Tuberculous Epididymitis*, Messent, David and Shackman, Ralph, *British Medical Journal* (1955), 4914: 643).

Dangers of Bronchography.—Two cases in which patients developed tubercle bacilli in their sputum following bronchography with oily media have been recorded by the author. In further three more cases, tuberculous bronchopneumonia was precipitated by the investigation. This evidence supports the theory that iodine activates tuberculosis and shows, therefore, that bronchography is a dangerous investigation in patients suffering from that disease.

—(*The Dangers of Bronchography in Pulmonary Tuberculosis*, Perry, Kenneth, M.A., *Brit. J. Tuberc.* (1955), 4: 284).

Effect of Drug Combinations in Ocular Tuberculosis in Animals.—Tuberculous iridocyclitis was induced experimentally in rabbits by injection of tubercle bacilli into the anterior chamber of the eye, the effect of treatment with streptomycin alone, isoniazid alone and streptomycin plus isoniazid being assessed by clinical examination, and search for tubercle bacilli at post-mortem examination. Treatment was carried out for sixteen weeks and the surviving animals were observed for a further period of sixteen weeks.

All treatment groups fared better than the controls: those treated by streptomycin plus isoniazid fared better than those in the other two groups.

Of 20 animals surviving at the end of the experiment, tubercle bacilli were found in the ocular lesions at necropsy in eight animals on culture and in eleven animals by any method. Dissemination to viscera was observed in three animals—one in each treatment group.

Tubercle bacilli were cultured from three eyes—one in each treatment group—assessed as clinically cured.

—(*The Effect of Streptomycin, Iso-nicotinic Acid Hydrazide (Isoniazid) and Streptomycin plus Isoniazid in Ocular Tuberculosis in Animals*, Macaskill, J.; Somner, A.R. and Home, N.W., *Brit. J. Tuberc.* (1955), 4: 308).

Bacterial Resistance in Tuberculosis.—

Resistance of tubercle bacilli to various unfavourable and environmental factors is one of the fundamental laws of biology.

ABSTRACTS

The resistance that develops varies with each factor and each strain of bacteria.

So far as the common antimicrobial agents against tuberculosis are concerned resistance develops completely to isoniazid rather promptly—within two to four months in the preponderant majority of strains—to streptomycin about 70-80 per cent and to para-aminosalicylic acid about 50 per cent.

By combining the three drugs in different combinations emergence of resistance is delayed, due to what is thought to be a double mutation which is found to be much rarer than the mutants resistant to the drugs individually.

Accordingly, streptomycin and isoniazid together prolonged the emergence of resistance at least to twice the time of either of the drugs alone, sometimes much longer. Streptomycin and para-aminosalicylic acid together prolong the time of emergence of resistance much longer than when the respective drugs are used separately, and even longer than any other combination studied.

From the meager data at hand of the authors the combination of the three drugs together does not seem to offer any advantages not possessed by various two drug combinations. Furthermore, there is the advantage of having a potent drug available if resistance should develop to any two.

A plan of treatment has been suggested based on the authors' knowledge that would use SM and INAH in critical or panic cases; SM and INAH and PAS where resistance has developed for SM.

—(*The Problem of Bacterial Resistance in Antimicrobial Therapy of Tuberculosis*, Sweany, Henry C., Dunbar, Frank P., and Wood, Eric, *Dis. Chest*, (1955) 3 : 260).

Congenital Pulmonary Agenesis.—Although pulmonary agenesis is an uncommon condition, it warrants consideration in all patients whose clinical course is not readily explainable on some other more satisfactory basis. This is particularly true in younger subjects.

Patients with pulmonary agenesis have other defects, e.g. patent ductus arteriosus, patent foramen ovale, atresia an, atresia of the esophagus, short bowel, atresia urogenitalis, exencephaly, horseshoe kidney, ventricular defect, hypoplasia of the face, hare lip and left cleft palate, absence of the left diaphragm, absent left hand, absence of right radius, bifid uvula, spina bifida, wedge-shaped vertebrae, hemi-vertebra, deformed ribs, accessory thumb, closed foramen epiploica, rudimentary atlas, deformed external ear, congenital ptosis of both eyelids, small left scapula, and pulmonary veins entering the azygos vein.

Pulmonary agenesis is not incompatible with life. Twenty-three patients (27 per cent) of the series were known to have lived between 15 and 72 years. In reviewing the literature regarding age and agenesis, the authors were impressed with the fact that those who were known to have pulmonary agenesis in early life survived it only because the associated anomalies and complications were not incapacitating. Agenesis in the patient over 15 years of age is, in all likelihood, unassociated with other malformations which are of clinical significance. On the other hand, pulmonary agenesis in early life, which is, clinically manifest, is often associated with other malformations which make the condition incompatible with life.

All patients who are suspected of having pulmonary agenesis should be investigated thoroughly before being subjected to any thoracic surgical procedure. A relatively minor procedure in such a patient may terminate fatally because of the lack of appreciation of the significance of other anomalies.

—(*Congenital Pulmonary Agenesis*, Hochberg, Lew A., and Naclerio, Emil A., *Dis. Chest* (1955), 3 : 275).

Combined Therapy in Tuberculosis.—A simultaneous combination of collapse therapy (pneumothorax or pneumoperitoneum) and isoniazid 8 mgs. per kilogram, streptomycin one gram two times weekly if tolerated, and PAS 12 gms. or less if tolerated, is the best method of using isoniazids and its synergists according to the authors who also say that it is not necessary to give up the art of collapse therapy.

—(*Combined Therapy in Pulmonary Tuberculosis*, Ornstein, George G., and Lercher, Lawrence, *Dis. Chest* (1955), 3 : 290).

Bronchoscopic Appearances in Unexplained Haemoptysis.—Thirty cases of haemoptysis 'out of the blue', whose x-ray appearances were normal, were classified according to bronchoscopic appearances.

In 13, appearances were normal; 4 had appearances of bronchitis and 5 showed mucopus coming from one bronchus; there was 1 bronchial stricture thought to be tuberculous in nature and 1 inflammatory structure of unknown aetiology.

These 24 cases comprised the non-malignant group of which one died of secondary adenocarcinoma seven months after haemoptysis. The 23 survivors were re-examined after an average period of twenty-three months and, with one exception, had no further serious trouble. The exception, the only patient shown to have bronchiectasis, had a second haemoptysis.

There were six patients in the malignant group—4 had carcinomas for certain and of these 3 died and 1, following removal of his right lower and middle lobes, was well and working twenty-four months after his first haemoptysis. Of the two doubtful carcinomas both were alive and no worse than at the times of bronchoscopy, the one nine months and the other twenty-two months later.

Though bronchoscopy should never be recommended lightly it is usually worth trying to establish the diagnosis for certain in bronchial carcinoma. It enables the family doctor to manage the patient better after discharge from hospital even when there is no question of advising surgery or x-ray therapy. In the present series this was done in 4 instances and one of these patients had, after operative treatment, a reasonable chance of cure. In addition 23 patients were correctly told that there was no carcinoma present and no doubt benefited from this assurance.

—(*Bronchoscopic Appearances in Unexplained Haemoptysis with Normal Chest x-ray*, Mitchell, John, *Tubercle*, (1955), 9 : 260).

Detection of Adult Tuberculosis by Tuberculin Testing of School-Children.—A

survey of school children and their family contacts was carried out in East Belfast to determine if there was a higher proportion of tuberculosis among contacts of children with positive reactions to tuberculin jelly than in contacts of non-reactor children.

The children who were tuberculin tested and/or x-rayed numbered 2,062 (91.3 per cent of those originally selected).

Of the children x-rayed 8 (0.38 per cent) were found to have active primary tuberculosis and 64 (3.06 per cent) to have inactive primary tuberculosis.

The total number of adult family contacts was 4,274, of whom 1,582 (37.0 per cent) attended for chest x-ray examination.

The incidence of active post primary tuberculosis was five times greater in the male family contacts of reactor children than in the male contacts of non-reactors, and it was almost twice as great in the female contacts of reactor children as in the female contacts of non-reactors. When both sexes were combined the incidence of active post-primary tuberculosis in the contacts of reactors was three times that found in the contacts of non-reactors. For males the percentage of active post-primary cases found in contacts of non-reactors was 0.51 against 2.50 per cent for contacts of reactors, while for females the percentages were 0.42 and 0.75 respectively. For both sexes the respective percentages were 0.45 and 1.51. The difference observed between the two groups of male family

contacts was greater than that which could easily have arisen by chance, and this difference was still significant after the data had been standardized for age.

The differences between male family contacts of children with positive and negative reactions relative to inactive primary and post-primary tuberculosis and other chest abnormalities were not as great as those in females.

The results of the survey suggest that all children who are tuberculin positive should be x-rayed together with their adult family contacts, both to detect tuberculosis in children and to discover unknown sources of infection in the family environment.

—(*The Detection of Adult Tuberculosis by the Tuberculin Testing of School Children*, Ritchie, J. Calwell, H.G., and Barr, A' *Tubercle*, (1955) 10 : 301).

Cyanacetic Acid Hydrazide.—*In vitro* experiments showed that cyanacetic acid hydrazide (C.A.H.) has antituberculous activity, but that this was about one-fiftieth of isoniazid.

This same relative antituberculous potency was found in studies made with experimental tuberculous infections in mice, to which both drugs were nevertheless equally toxic.

Generally speaking, if a strain of *Mycobacterium tuberculosis* was resistant to isoniazid it was resistant to G. A.H. also. Yet anomalies were found in which such cross-resistance did not exist.

The authors suggest that in clinical practice C.A.H. should not be used alone, nor are there likely to be many instances when it will be more effective than isoniazid. There is, furthermore, a possible danger of using these two drugs in combination.

—(*Antituberculous Activity of Cyanacetic Acid Hydrazide*, Barnett, Margaret; Bushby, S.R.M. ; Goulding, Roy ; Knox, R. and Robson, J.M. *British Medical Journal*, (1955) 4940 : 647.)

Suppurative Lymphadenitis following B.C.G.—A Preliminary report of a study of B.C.G. vaccination in newborn infants is presented by authors.

The study was designed to investigate the frequency and severity of lymph-node involvement and the degree of post-vaccination tuberculin sensitivity in relation to the dose of B.C.G. given by intradermal vaccination.

A total of 1,513 newborn babies were vaccinated within 11 days of birth by one of twelve procedures: injection in one or both deltoid regions with six different total doses of B.C.G. vaccine ranging from 0.15 to 0.0047 mg. The one-year follow-up, which includes periodic

examination of regional lymph nodes, quantitative measurement of tuberculin sensitivity, and examination of the local vaccinal lesions, would be complete for all babies about January 1956. However, a report of results obtained so far has been presented because of their immediate practical implications for vaccination of the newborn.

The relation between total dose of B.C.G. and the frequency of lymphnode involvement was clear: the strongest dose (0.15 mg.) gave rise to enlarged or perforated nodes in 25% of the babies examined at six months or later after vaccination, the 0.075-mg. dose in 10%, and 0.0375-mg. dose in less than 5%; the weaker doses caused only an occasional enlargement or perforation. For perforated nodes and overlying skin changes only, the frequencies were 20%, 6% and 2% for the three strongest doses.

The degree of tuberculin sensitivity was also directly related to the dose of the vaccine, although halving the total dose results in a reduction of only about 1 mm. in the average size of the reaction to the 5 T.U. intradermal test. The reactions increased in size up to about four months after vaccination, then remained stable throughout the remainder of the year.

Vaccinal lesions were largest, averaging 6.5 mm. in diameter, with the 0.15-mg. intradermal dose and about 3 mm. smaller with the weakest dose.

Little advantage was found in giving the total dose of B.C.G. in two injections, one in each shoulder, rather than in a single injection.

An indication was also found that the B.C.G. vaccine used five days after harvest produced a slightly higher frequency of glandular complications than vaccine used twelve days after harvest, while the degree of allergy was apparently no different.

The present results confirm reports of other workers that the frequency of glandular complications is markedly reduced by reducing the dose of B.C.G. by one-half or one-quarter. Moreover, the present study has shown that such a reduction has only a slight effect on the degree of post-vaccination tuberculin sensitivity.

—(*Suppurative Lymphadenitis Following Intradermal B.C.G. Vaccination of the Newborn—A Preliminary Report, Guld, Johannes; Magnus, Knut; Tolderlynd, Knud; Biering-Sorensen, Knud, and Edwards, Phillis Q., British Medical Journal, (1955) 4749:1048.*)