

TABLE IV.

Bombay City: 1st Phase, June 10th—July 23rd, 1918.

Age and Sex Incidence among 3,000 cases of simple fever treated at municipal dispensaries.

(i) Sex.

District Number.	Males.	Females.	TOTAL.
1	164	32	196
2	241	60	301
3	367	180	547
4	119	36	155
5	235	119	354
6	190	60	250
7	235	120	355
8	204	73	277
9	169	69	238
10	219	52	271
GRAND TOTAL ..	2,143	801	2,944
Percentage to total number of cases.*	72.79	27.21	...

TABLE V.

Bombay City: 1st Phase, June 10th—July 23rd, 1918.

Age and Sex Incidence among 3,000 cases of simple fever treated at municipal dispensaries.

(ii) Age.

District Number.	0-10 years.	11-20 years.	21-30 years.	31-40 years.	41-50 years.	51-60 years.	61-70 years.	71-80 years and over.	TOTAL.
1	38	39	63	29	15	8	4	..	196
2	60	105	69	34	23	6	3	1	301
3	181	102	114	70	60	15	4	1	547
4	5	25	50	15	9	10	25	16	155
5	95	54	85	73	34	11	2	..	354
6	30	60	89	49	19	3	..	..	250
7	70	93	77	58	41	16	..	..	355
8	52	65	94	40	20	5	1	..	277
9	63	46	77	34	12	6	..	..	238
10	44	59	85	57	20	6	..	..	271
GRAND TOTAL ..	638	648	803	459	253	86	39	18	2,944
Percentage to total number of cases.*	21.67	22.01	27.28	15.59	8.59	2.92	1.33	61	..

* It is to be observed that the age and sex proportions of the *dispensary-attending* population are not necessarily those of the *general* population, and hence these figures do not represent age and sex incidence.

ARTIFICIAL PNEUMOTHORAX AND OTHER SURGICAL METHODS IN ADVANCED TUBERCULOSIS AND PLEURISY.

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DURING a little more than two years work in India the author has had the opportunity of

observing the considerable differences between the conditions of sanatorium work in India and in Europe. The data resulting from this difference are of much interest for the further development of the sanatorium movement in India. A detailed discussion of these data, however, would claim more space than can be given to such a subject by a general medical journal. But a certain portion of the work during these few years is of such a particular kind as to make the author, on his departure from India, feel not only justified but obliged to render a report thereof to the medical profession in India.

This obligation is not explained by marvellous results in surgical activity against pulmonary tuberculosis. The 90 cases in which such treatment has been carried out have all been so advanced that any other kind of treatment was really not possible. Artificial pneumothorax is not to be considered as an unfailing and infallible remedy for all forms of pulmonary tuberculosis. But just because the specific treatment (whether of bio- or chemo-specific nature) has turned out, so far, to be more or less a failure, there is good reason for adopting the modern surgical methods as a help in such cases in which sanatorium treatment alone is not sufficient to secure a lasting positive result.

While at the very beginning of our discussion these limitations have been mentioned, there are, however, other reasons for calling attention to this question. The pneumothorax idea has brought about a new era in the study of many phenomena, the importance of which had hitherto been overlooked. New light has been thrown upon many interesting physiological questions with regard to the thorax and its organs. New diagnostic methods invented through this particular form of treatment have allowed a more exact localisation and precise diagnosis of the individual affections concerned with regard to extent and activity. The great advance in diagnosis by the use of X-rays was to a large extent developed along with surgical experiments. The exact measuring of the intra-thoracic pressure, as one of the essential principles in pneumothorax treatment, has opened up new ways for the treatment of pleural complications, such as pleurisy and spontaneous pneumothorax.

These are some of the beneficial attributes which have secured to "collapse-therapie" a permanent share in the fight against tuberculosis and have been responsible for the publication of more than a thousand articles and books by scientists all over the world.

Theories on the effect.—When the Italian genius Forlanini suggested artificial pneumothorax it was from the simple observation that natural healing of a tuberculous lung takes place through *retraction*. When nature fails, this is often due to the comparatively narrow limits of the stiff chest wall, and that only a very limited dislocation of mediastinum, heart and diaphragm is possible. It seems very reasonable, then, to establish a condition in which the lung retraction can be induced to any necessary extent. This condition is provided when, through the introduction of air into the pleura, the lung is allowed to withdraw from the parietal pleura.

Further experiments have added to this original theory other observations, perhaps of still more importance. It was seen how even the biggest cavities, the healing of which could not be expected by any amount of retraction, were caused to heal by the actual *compression* of the ulcerated walls by the pneumothorax. Being brought into contact with each other the sides of the cavities

united together, the abscess was changed into a solid ulceration, and the connective tissue was allowed to enter and to transform the previously discharging cavity into a solid scar. It was also observed how the steadily increasing tubercular process was often stopped by the *immobilisation* afforded by the pneumothorax. It is a well known fact that surgical tuberculosis benefits by immobilisation. The decreased expansion on the affected side might also here indicate a natural effort of healing. But effective immobilisation is only provided when the lung retires from its function for a sufficiently long time to allow the demarcation to take place. Practically the pneumothorax may be compared to a bandage on the diseased lung.

Finally, anatomical analysis as well as clinical experience show that the collapse leaves the lung in a condition of venous and lymphatic stasis. Through the venous stasis the lung is benefiting by the same factors as in Bier's treatment. Lymphatic stasis is the only explanation of the very striking dis-intoxication which is occasionally observed in successful cases, and the immediate fall of temperature to normal.

Physiological and anatomical possibilities.—The question is now, how far is it possible to practise lung collapse without causing serious complications?

From a physiological point of view there is no definite objection. Like other coupled organs, *e.g.*, the kidneys, the lungs provide sufficient reserve capacity to enable the system to neutralise the effect of exclusion of one lung from the respiratory and circulatory functions. The initial breathlessness is not of any serious nature. The heart does not show any remarkable reaction to the considerable change in the pulmonary circulation.

The well known danger of accidental and spontaneous pneumothorax does not occur in cases of artificial pneumothorax.

From an anatomical point of view there would be no hindrance to establishing a complete pneumothorax in normal individuals. The negative intra-thoracic pressure is the only cause that keeps the elastic lung tissue in its expanded condition by which air is inhaled into the alveolæ. Introduction of a sufficient amount of air into the pleura to neutralise this negative pressure produces a complete collapse of the lung.

Somewhat different conditions meet us when the lung is changed by an advanced affection. The infiltration fibrosis and destruction have to some extent diminished the elasticity of the lung, and a complete collapse can only be obtained by a more or less positive pressure in a pneumothorax, by which the lung is forced to collapse against the rigidity of its tissue.

A still more important factor is to be faced. The state of the pleura in the majority of advanced tubercular cases is changed by its participation in the inflammatory process of the lung.

The pleura is already partially or completely destroyed and replaced by organised adhesions. Even in cases with no history whatsoever of pleuritic symptoms the whole pleura may be found obliterated in this way. Experience shows that in less than 20 per cent. of "third stage" cases do we find the affection so located to the deeper parts of the lung tissue as to leave the pleura intact. Between the two extremes of complete adhesion and completely intact pleura all degrees of transition are possible, and it is impossible beforehand to know how to classify the case. Localised adhesions may be found anywhere covering a lobe or a part of a lobe, or in the shape of strings or bands from the surface of the lung to the chest wall. Naturally this fact interferes in the most distressing way with the treatment, hampering its effects, making the technique very complicated and influencing the results even in the most experienced hands. It is not surprising therefore, that those scientists who had understood the value of lung collapse and had reaped its results in successful pneumothorax cases, have exerted themselves to improve the technique and to find out new ways of rendering help to such patients as could not be successfully treated with pneumothorax treatment on account of adhesions. While all previous attempts at treating this disease by operation have turned out a failure, the modern principles of lung collapse have opened up a new scope for surgery which will be briefly dealt with at the end of this article.

Indications.—In spite of the difficulties mentioned above, the indications for producing artificial pneumothorax still claim a considerable field.

The fact that lung collapse is applicable only in *unilateral cases* might seem to make its value rather doubtful, inasmuch as according to special experience almost no advanced case of lung tuberculosis is strictly unilateral. Although examination will in almost all cases reveal dullness and adventitious sounds in the less affected lung, further exact methods of diagnosis will often enable us to settle the indications for pneumothorax. Firstly, the adventitious sounds in the less affected lung may be "transferred sounds," the origin of which is to be found in the more affected lung. The character of such transferred sounds will often be easily recognised, but in some cases a repeated careful stethoscopic examination compared with X-ray examination is necessary in order to settle the origin of the sounds. Secondly, even if such sounds evidently belong to the better lung, this does not always mean that this lung is actually affected. Even in evidently arrested lung affections some adventitious sounds will sometimes be heard due to an old, inactive healed process (scar sounds). And thirdly, experience has shown that even in cases with a limited affection of the better lung the patient may benefit by a collapse of the more active and more advanced lung. Far from being seriously injured, the lung that is left behind for single-hand work often showed a striking improvement during the course

of pneumothorax treatment. This of course does not mean that any advanced or more active affection of the better lung is not a contra-indication.

In the cases under review the indications for pneumothorax were restricted (by the lack of X-rays) to such cases where either the unilateral character of the affection was evident or where no room was left for ordinary sanatorium treatment. In all cases the pneumothorax treatment was applied only after an unsuccessful trial with the usual sanatorium régime for a reasonable period of time.

Dosage, Technique, Complications.—The air that was injected was in all cases atmospheric air (for want of nitrogen, which is more reliable with regard to absorption). The quantity of air varied according to the need and the particular circumstances of the individual cases. No rules can be fixed with regard to dosage. The observations during the course of treatment concerning the capacity of the pleura, the presence of local adhesions, the effect upon the local and the general symptoms, etc., have guided the dosage in each individual case. The lack of X-rays was a very serious handicap in the observation of all these details. The height to which the intrathoracic pressure was brought up by the injections varied from about 0 to 40 cms. of water pressure.

On the first injection a dose of only 200 to 300 c.c. of air was ordinarily given. The following day 300 to 500 c.c.; afterwards one or two days were added to the interval between successive injections, until the intervals reached three or four weeks or even more. In this way the collapse of the lung was established gradually and later on kept as stationary as possible. The gradual decrease of the resorptive power of the pleura during the treatment enables us to carry on with increasing intervals.

In the majority of cases the treatment is still being continued, but some of these patients have been discharged from the sanatorium and are now being treated in their own homes. Ordinarily it is necessary to continue the pneumothorax treatment for at least a couple of years, especially in dealing with old chronic cases of destructive tuberculosis. Only in cases of more fresh and superficial affection is a shorter course of treatment sufficient (*vide* case 3).

In a few of the recorded cases the treatment was discontinued after a few injections as the special indication in such cases was a chronic dry pleurisy with friction sounds (*vide* cases 4 and 13); a short separation of the rubbing pleural surfaces was enough in these cases to stop the pleuritic symptoms.

The question of duration of the treatment has to be settled in each single case according to individual circumstances. After stopping the treatment the patients were kept under close observation so as to enable us to begin the treatment again if the gradual expansion of the lungs should cause any sign of activity. When once the collapsed lung has entirely expanded it will not be possible

to reproduce a pneumothorax, and universal adhesions will take place between the expanding lung and the chest wall. The *technique* of the operation was according to Saugman's method. Many modifications have been suggested with regard to apparatus, needles and technique. An ordinary siphon system with manometer joined on to the tube from the reservoir to the needle has been used by us. The type of needle used for the first injection was the Saugman's pneumothorax needle; for the further injections Kjer-Petersen's needle was used,—(this needle is closed at the end and has its $\frac{1}{4}$ inch long opening on the side of the needle, just near to its end). The re-injections do not cause any technical difficulties, but the first injection has to be carried out very carefully with an accurate knowledge of the physiological conditions in the thorax and with a thorough familiarity with all technical details, as any mistake may involve considerable danger to the patient.

It is of cardinal importance never to allow any air to enter through the needle until the manometric movements show that the opening of the needle is in free pleura. If any air is forced in before the manometer shows the typical reaction, the air might enter into a blood vessel and cause serious embolism. The manometer during the whole operation is always kept in open connection with the needle.

The first injection is usually given under local anæsthesia of the different layers of the chest wall, preferably in the fifth intercostal interspace and in the mid-axillary line, after an injection of morphia ($\frac{1}{4}$ grain). Though no local anæsthetic was given at the re-injection, no serious pain or trouble was caused to the patients.

Scrupulous asepsis is necessary. The needles and the cotton filters, by which the air is sterilised on its passage from the reservoir to the needle, are kept in a dry sterilised condition with formalin.

No serious *complications* took place in any of the cases under review. Of a more troublesome rather than serious nature was the complication of pleurisy with effusion in the pneumothorax. This complication was observed in about 50 per cent. of the cases and the same frequency is observed by other authors. Without causing any harmful effect on the general condition, this complication sometimes gives an indication for aspiration on account of its disturbing influence upon the equable collapse of the lung. In several cases the effusion caused secondary adhesions with considerable difficulties in a continuance of treatment. In one case this complication made it impossible to continue the injections at all.

Results.—It is as yet too early to make any final statement upon the results in these cases, as many of them are still at the beginning of the treatment and none have been observed for a sufficiently long time to give a reliable idea about the lasting effect. At the present stage, however, the author feels justified in putting forward statistics which are the result of three years of research work and

to add to them a few notes with regard to the cases under review.

The author has had the opportunity of studying under Professor Saugman at Vejlebjerg Sanatorium, Denmark, the largest number of cases regarding which results have hitherto been published, namely about 400 "third stage" cases treated with artificial pneumothorax. This material deals with cases which had been discharged from the sanatorium 3 to 13 years before the statistics were collected. The material falls into two groups which are to be considered equal with regard to extent and prognosis of the disease. One group includes cases in which practically no pneumothorax was applicable on account of pleural adhesions. The state of the patients of this group, at the time of the statistical examination showed that only about 10 per cent. were capable of work; the remaining 90 per cent. had either died or were still suffering from the disease. The other group includes all cases in which a total or partial pneumothorax had been carried out. Of this group about 35 per cent. were capable of work at the time that the statistical examination was made.

The difference between these two groups speaks emphatically enough in favour of the pneumothorax treatment, though none of the temporary results are taken into consideration. But a closer observation of the last group reveals the fact that still better results might have been attained if more or less localised adhesions had not exerted their effects; especially if, in this group, we confine our attention to those cases in which practically no adhesions were observed, the capability of work after 3 to 13 years' observation was not less than 70 per cent.—a percentage that will scarcely be met with in any other treatment for third stage cases of pulmonary phthisis.

Sanatorium work in India makes one feel somewhat doubtful as to the possibility of reaching similar results. Several circumstances seem to handicap the treatment of all kinds of tubercular diseases in this country. The cases that come under treatment seem to show on an average more active disease and less power of resistance than in Europe. This is probably due to a great extent to the fact that many more complications are observed in this country than in western countries. Tropical fevers and their after-effects, syphilis and insanitary conditions weaken the power of resistance to such an extent as to severely handicap all work amongst tubercular patients in India. In all probability under such circumstances, the result of pneumothorax treatment in this country will be proportionately limited. Moreover, pneumothorax work in this sanatorium has been handicapped by the lack of X-ray examinations which are almost indispensable in obtaining the best possible results.

The following is a statement of the results obtained during the last two years at this sanatorium:—

90 cases were considered to be fit for pneumo-

thorax treatment according to the above mentioned indications.

In 28 of these cases it was impossible to apply pneumothorax treatment on account of universal adhesions. (This group may include some few cases in which X-ray screening would have made it possible to induce a partial pneumothorax.)

Of the remaining 62 cases, in which it was possible to induce a pneumothorax, one patient left the sanatorium for private reasons after a few injections, and 7 have been started so recently that it is still impossible to form any judgment about the results. Of these 7 some give good reasons to expect a positive result.

54 cases are left for further discussion. 34 of these cases proved unsuccessful, either on account of adhesions or strong activity of the disease, and so the treatment was given up after a very temporary beneficial effect. In 20 cases the result has so far been positive.

Short record of 20 cases with positive results:—

(1) Female.—Total affection of left lung with cavity in apex, slight affection of right apex, low chronic fever. First injection 26-1-21. Discharged 20-10-21, much improved, T.B.O.* (later on occasionally a few T.B. found). Treatment continued, ambulant, condition good.

(2) Male.—Total affection of right lung, commencing cavity in apex, irregular fever. First injection 7-3-21. Discharged 10-12-21, much improved, T.B.O. Pneumothorax continued, ambulant for short time after discharge. Re-admitted 1-6-22 to 24-8-22, treatment stopped after 17 injections in all. No symptoms.

(3) Male.—Left lung affected throughout with fresh process. Dry pleurisy with friction sounds all over. Fever. First injection 14-3-21. Discharged 6-12-21, much improved, T.B.O. Treatment continued for a few months, ambulant; stopped after 19 injections, May 22. Doing medical work, no symptoms.

(4) Female.—In this case the condition present was a chronic, dry pleurisy with permanent friction sounds. First injection 29-3-21. After 3 injections the pneumothorax was stopped. Patient discharged 9-8-21, slightly improved.

(5) Male.—The whole of right lung involved in a destructive process. Back wall of the larynx ulcerated, chronic low fever. First injection 8-4-21. Still under treatment, much improved, T.B.O. Larynx healed, complicated with serious effusion which was evacuated twice. Walks about.

(6) Male.—Double affection with râles all over both lungs, big cavity in right apex. Frequent hæmoptysis. First injection (during hæmoptysis) 7-6-22; treatment stopped after 29 injections. Discharged 7-6-22, improved. T.B. +, occasionally coloured sputum, lingering at home.

(7) Male.—Re-admitted case with destruction all over left lung, chronic fibrous affection in upper half of right lung. Left vocal cord infiltrated. High fever. First injection 1-7-21; still under treatment. T.B.+; no fever, walking about.

(8) Female.—Acute destructive affection all over left lung, a few râles in right apex. High fever. First injection 4-7-21, pneumothorax stopped after 13 injections. Discharged 29-9-22, much improved, T.B.O.; weight increased by 72 lbs.

(9) Female.—Chronic affection with cavity in left apex; frequent attacks of fever. First injection 7-7-21. Still under treatment, much improved, T.B.O. Walking about.

(10) Male.—Acute destructive process all over left lung. Fever. First injection 8-7-21. Still under treatment. The effect delayed by a localised adhesion. Thorascopical examination tried with failure. Later

on pleural effusion. Signs of activity in the right lung (+ fremitus). Now much improved, T.B.O. Walking about without fever.

(11) Male.—Pleurisy with effusion on left side; fluid withdrawn, replaced by air; pleurisy subsided: later on developed dry pleurisy with chronic fremitus on right side. For this 4 injections were given. Discharged 29-12-22 with no fever, improved condition.

(12) Male.—Right lung affected all over, cavity in apex, high fever. First injection 28-11-21. Discharged 7-12-22, much improved, no fever. Still a little morning sputum (T.B. +) on account of adhesions. Treatment continued, ambulant.

(13) Male.—Indication, chronic, dry pleurisy. After 4 injections treatment stopped; no more pleuritic sounds. Discharged 31-8-22, much improved; working.

(14) Male.—Right lung affected throughout. During summer of 1921 an acute broncho-pneumonia in left axillary region. When this affection had cleared off first injection was given 2-1-22. Temperature dropped to normal at once. Discharged 28-10-22, much improved; T.B.O. Pneumothorax continued, ambulant, condition good.

(15) Male.—Old bilateral affection treated for several years without effect. At his own insistent request pneumothorax was given on the left, more affected lung. Striking improvement; still under treatment. No fever; T.B.O. Walking about.

(16) Female.—Fresh, acute pneumonic affection all over right lung. First injection 27-3-22. Discharged 31-8-22. Pneumothorax continued, ambulant. Much improved, T.B.O. Working at home.

(17) Male.—Left lung affected throughout, cavity upwards, slight affection in right apex, complication; chronic appendicitis. First injection 16-5-22, still under treatment, much improved, T.B.O. No fever; walking about.

(18) Female.—Left lung affected all over, cavity in apex, dense infiltration of lower lobe. Slight affection of right apex. Losing weight, chronic fever. First injection 31-8-22. Still under treatment, but much improved, T.B.O. No fever, walking about.

(19) Male.—Right lung severely affected throughout; slight affection in left apex, advanced laryngeal tuberculosis. First injection 29-11-22, still under treatment, promising prognosis.

(20) Male.—On admission the patient was found to be suffering from an advanced pleurisy with extreme dullness all over right side. The dullness was evident also to the left of the sternum and the effusion caused considerable compression of the left lung. The heart was dislocated, beating in the left mid-axillary line, severe subjective symptoms (breathlessness and palpitation). Soon after admission 3650 c.c. (about 8 lbs.) of fluid were withdrawn and were replaced by an equal volume of air. Some weeks later a smaller aspiration had to be done in the same way. Since then the fluid has not returned. The heart slowly moved back to its normal place and the subjective symptoms subsided. As, during the expansion the lung developed râles, the pneumothorax was continued; patient still under treatment, improving; no lung symptoms, gaining in weight, walking about.

Bearing upon treatment of pleural effusion.—

The last case recorded leads us to mention one of the practical bearings of pneumothorax treatment upon other questions. The principles of treatment for pleural effusions have to be thoroughly revised in the light of our knowledge gained through pneumothorax work.

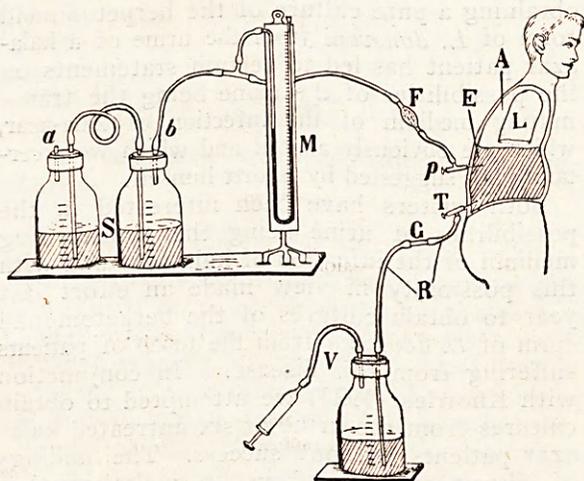
Theoretically, the comparatively good prognosis of an initial pleurisy may be explained by some of the same theories as were mentioned above with regard to the effect of artificial pneumothorax.

The primary lung affection, which is almost sure to lie behind, whether it has developed to a

* Tubercle bacilli absent.

stage where local lung symptoms have been observed or not, is being checked by the effect of the fluid. If this theory be true the leading motive in practical treatment must be to draw the best possible benefit out of this complication. This purpose will in many cases be fulfilled by leaving the fluid without aspiration. The rules which at present guide us as to when a pleural effusion should be aspirated or not do not seem to pay much attention to the facts revealed by pneumothorax treatment.

The following rules have been adopted by us with regard to indications for aspiration:—(1) When the fluid causes trouble on account of its pressure upon and dislocation of neighbouring organs (the heart, mediastinum and the other lung, as in the case recorded above). (2) When the effusion causes a prolonged intoxication, weakening the general condition and liable to activate the lung affection through resorption of toxins. This indication will especially be present in cases where diagnostic puncture shows a more or less purulent character of the fluid. (3) When the pleurisy occurs as a complication in an advanced affection of the same lung, for which a longer and more effective collapse of the lung is desirable than the one produced by the effusion. In such cases the effusion should be replaced by a pneumothorax before the pleurisy gives rise to unavoidable adhesions which hinder the application on pneumothorax.



Schematic diagram of Combined Pneumothorax and Aspiration Technique.

S Syphon system, which acts when the bottle is raised.

If more air is required than is contained in one bottle, the rubber tube *b* can be moved over to *a*.

C Stop cock for opening and closing the connection between pneumothorax troper *P* and air reservoir.

M Manometer.

F Cotton filter through which air is sterilised. When the pneumothorax trocar is above the level of the effusion (E), the respiratory movements will be indicated on the manometer.

A Injected air.

L Lung.

T Aspiration trocar.

G Glass tube put in between the two rubber tubes *R*.

V Vacuum system.

Not only the indications for, but also the technique for pneumothorax have to be considered.

In all cases where a pneumothorax is indicated we have adopted a technique of aspiration which is a combination of the ordinary Potain's aspiration and a simple pneumothorax technique as seen in the accompanying figure. As the aspiration proceeds an equal amount of air is injected through a separate needle into a higher intercostal space.

This technique offers several advantages. The effusion is withdrawn without an immediate interruption of the useful collapse of the lung. The further treatment of the case can be carried out according to individual needs, whether with or without continued pneumothorax treatment. The operation itself, which can be performed under local anaesthesia and in the sitting posture, affords a complete evacuation of all fluid without any of the troubles and dangers—such as sudden expansion of the lung—which are ordinarily caused by simple aspiration.

The same technique has in several cases proved beneficial in the treatment of empyema. A tuberculous empyema should never be treated by resection of the ribs and open drainage, as the sinuses, after such operations, will ordinarily remain open and will cause a serious condition to the patient. Also, for the serious complication of spontaneous pneumothorax, this technique enables us to so modify the treatment that better attention is paid to all the physiological and pathological conditions provoked by this critical state.

Collapse operations in case of pleural adhesions. In conclusion the writer may add a few remarks regarding the endeavours to overcome pleural adhesions in pneumothorax treatment.

During the last 10 to 15 years quite a number of methods have been published, especially by continental authors. The majority of these suggestions have not proved to be of much practical value, but two different methods have proved so valuable as to secure a permanent position in collapse therapy. As representing two different ways of solving the question, these two methods are to be used according to the quantity and character of the adhesions present in individual cases.

One of the two methods is to perform an endopleural operation by which the localised bands or string-like adhesions are removed and the pneumothorax is carried on with more complete collapse than before. A wide opening of the pleura in such cases meets with such dangerous complications as to make it inadvisable to experiment further in this direction. By Jacobæus' invention, however, a method has been found which involves much less risk when used only in cases fulfilling the conditions for this special technique.

The principle of Jacobæus' method is to cut through the adhesion, which is keeping a part of the lung expanded, by means of cauterisation, without opening the pleura by incision. Through a wide trocar, introduced under local anaesthesia in an intercostal space near the adhesion (localised by careful X-ray examination) a thoracoscope is

inserted into the pneumothorax cavity. Through the thoracoscope the whole pleural cavity can be examined. Through another smaller trocar a small platinum knife on a long piston is introduced in another part of the chest, conveniently for manipulation. Led by the thoracoscope, the knife is placed upon the adhesion and when in position the knife is made white-hot by an electric current and can now be passed through the adhesions.

This operation, by which the author has previously had successful results, was tried in one of the above cases (No. 10) in which a cavity seemed to be kept in expansion by a localised adhesion. This attempt proved a failure owing to the lack of any satisfactory electric outfit. The technique is rather complicated, but the operation is of much interest as a unique example of the surgical possibilities of modern days.

The second method, which may be used in cases where the adhesions do not allow the use of Jacobæus' method, or where it is impossible to apply any larger pneumothorax at all, is to establish the same collapse of the lung as is afforded by a successful pneumothorax by means of an extra-pleural operation, thus causing the bony chest wall to collapse, together with the lung.

The "extra-pleural thoracoplasty" (Friedrich Brauer, Sanerbruch, etc.), has been developed to such a degree of technical and clinical success that, in spite of all more or less justified criticism, this heroic method is really to be reckoned with as a last resort in many cases, which otherwise would not have any chance of successful treatment.

Sanerbruch's technique, which is to be modified according to the special needs of individual cases, leaves the lung in a condition of collapse by removal of larger or smaller parts of all the ribs (excluding the lower one or two) through a long hook-shaped incision running from the spine of the scapula, parallel to the spine down to the tenth rib, which it follows to the mid-axillary line. Through this incision the whole of the back part of the thoracic wall is laid freely open and subperiosteal resection can be made to the necessary extent, especially of the spinal ends of the ribs, by the rigidity of which the shape of the thorax is normally kept in its capacious position.

The comparatively encouraging results previously obtained by the author in 60 cases of thoracoplasty made us use this operation in one of the 28 cases in which it was impossible to apply any pneumothorax at all. This case was judged to be so advanced that there was no possible hope of obtaining a lasting result by ordinary treatment.

Pneumothorax was tried in order to check severe hæmoptysis, but the attempt showed that universal adhesions were present. Later on thoracoplasty was performed, but in this case the patient succumbed seven hours after the operation on account of heart failure. This sad complication may have been due to the fact that no

other anæsthesia could be provided than general chloroform narcosis. As this operation itself affects the heart a good deal, it is usually performed under local anæsthesia (novocain-suprarenin), or by light ether narcosis, or by a combination of these two kinds of anæsthesia (as suggested by the author; vide *Tubercle*, June 1921). The disappointing results in this case made us feel that further attempts on the same lines must be postponed until the sanatorium could afford an equipment with X-rays and a full operation outfit necessary for the adoption of such formidable surgery.

It is to be hoped that further studies may be made on these subjects in India. The average stage of those tuberculous patients who seek medical help in this country is so advanced as to make it desirable to adopt any treatment by which some of these sufferers may be relieved.

CULTURAL EXAMINATION OF THE URINE IN KALA-AZAR.

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OUR excuse for publishing this note is the fact that the success of Shortt (1923) in obtaining a pure culture of the herpetomonad form of *L. donovani* from the urine of a kala-azar patient has led to certain statements on the possibilities of the urine being the transmitting medium of the infection of kala-azar, which are obviously absurd and which were certainly not suggested by Shortt himself.

Both writers have been interested in the possibilities of urine being the transmitting medium of the infection of kala-azar and with this possibility in view made an effort last year to obtain cultures of the herpetomonad form of *L. donovani* from the urine of patients suffering from this disease. In conjunction with Knowles (1923) we attempted to obtain cultures from the urine of six untreated kala-azar patients without success. The findings of Shortt encouraged us to make another attempt. At first we took catheter specimens of urine, but we subsequently found that by carefully washing the meatus with perchloride of mercury followed by distilled water, a sterile specimen could be obtained with rather more certainty and with considerably less trouble to us and discomfort to the patient. The first few ounces of the flow of urine were discarded and then about 25 c.c. taken into a sterile test tube. This was allowed to stand for a couple of hours before a drop or two was pipetted from the bottom of the tube, including the deposit if there were any, into 3 or 4 N.N.N. tubes which were then incubated at 22°C.