torium is attempting to run it with too small a number of medical attendants. The sanatorium should stand for results. Results in tuberculosis are only obtained by keeping the patient interested. The patient can only be kept interested by association with and receiving encouragement from those who know. To this end a corps of medical men, sufficient in number to look carefully after the wants of all patients is essential.

In this short paper I have endeavored to take up some of the important questions bearing upon the sanatorium treatment of tuberculosis which are usually omitted from discussion. I have endeavored to show the relationship which the private sanatorium bears to the public on the one hand, and the members of the medical profession on the other; I have further attempted to show the true relationship which should exist between the patient body and the medical staff and other attendants; thus pointing out the true place of the private sanatorium in the warfare against tuberculosis.

ROCKEFELLER INTERNATIONAL HEALTH COMMISSION AND THE WORLDWIDE ERADICATION OF HOOKWORM DISEASE.

MR. WICKLIFF ROSE, director-general of the International Health Commission of the Rockefeller Foundation, has recently returned to Washington, D. C., from a trip on which he investigated the distribution of hookworm disease throughout the tropics. The commission has issued a statement describing his observations and its plans for the worldwide eradication of uncinariasis.

"In Egypt Mr. Rose found Lord Kitchener keenly interested in the work and eager to have the co-operation of the commission in a systematic campaign against the disease. Measures against hookworm disease were instituted in Egypt by the medical missionaries some fifteen or sixteen years ago, and more recently the government has undertaken the work in certain localities. Now that the International Health Commission has agreed to lend its co-operation, the work will begin on a much larger scale. The disease is extremely prevalent and of tremendous importance in lowering the vitality of the people.

"Journeying eastward, Mr. Rose visited Ceylon, Malaysia and the Philippine Islands, where he studied the existence of the disease and conferred with authorities concerning measures for its control. Returning by the Pacific route he had an opportunity to secure information about the existence of hookworm infection in China, Japan and Korea.

"In British Guiana an intensive campaign is being undertaken in the Peters Hall District, which has been divided for convenience into three sanitary districts. In one of these districts every person has been examined for hookworm disease; more than fifty per cent. were found to be infected; all of those infected have been placed on treatment; and a second microscopic examination is now being made of persons treated in order to determine the results of the work. In the second of these districts the work of examining all the inhabitants is well under way, and practically complete."

THE DEVELOPMENT OF MODERN ARTIFICIAL PNEUMOTHORAX.

A BRIEF SKETCH OF FORLANINI.—LIMITATIONS AND POSSIBILITY OF THE TREATMENT.—REMARKS ON THE TECHNIC.

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PROFESSOR CARLO FORLANINI, the originator of the modern method of artificial pneumothorax, was born in Milan, Italy, June 11, 1847. He completed his medical course at the University of Pavia from which he graduated in 1870. From 1871 to 1884 he was first an assistant physician and later an associate in medicine at the Ospedale Maggiore of Milan. In 1881 he was appointed chief of the dermatological department in the same hospital. In 1884 he was appointed professor of clinical medicine in the University of Pavia.

He was a student of Mantegazza, a friend and companion of Bizzozzero and Golgi, and was among the first to understand the importance of the experimental method, and the necessity of applying it to the field of clinical medicine. All his works show his love for truth and for clear and skillful research, and are a clear interpretation of the observed facts.

In looking at the numerous contributions one is surprised at the number and variety of subjects to which he applied his activity. There are studies and researches in anatomy, histology, experimental pathology, ophthalmology, dermatology and internal medicine, notes on therapeutics, especially aero-therapeutics and mechano-therapeutics, all forming a series of valuable contributions to medical science.

The study with which Forlanini's name is especially bound is the artificial pneumothorax treatment of phthisis. He first suggested treating certain forms of pulmonary tuberculosis by artificial pneumothorax in 1882, and has been its most persistent advocate ever since. Between 1882 and 1894 he made many experiments on the immobilization of the lung, both in animals and human beings. In 1895 before the Italian Congress of Internal medicine he reported the first clinical cure of an advanced case of unilateral pulmonary tuberculosis. This was a case that had developed a spontaneous pneumothorax. Forlanini simply maintained the pneumothorax complete by frequent injections of nitrogen. No other report was made by him on this method of treatment until 1906, although he carried on the work both in his clinics at the San Giovanni Hospital in Turin and at the University of Pavia, and in his private practice. Since 1906 he has given us some of the most valuable contributions on the subject.

In 1898 Murphy of Chicago reported five cases. The next year Lemke reported fifty-three cases. The technic was unlike Forlanini's. Murphy used the incision method and introduced into the pleural cavity large quantities of nitrogen, in amounts ranging from 1200 cc. to 4500 cc., repeating the injections after two or three weeks. Neither Forlanini's nor Murphy's technic was such as to inspire confidence and both were not devoid of serious danger to life. In Italy, no one took up the work outside of Forlanini's clinic and in America it had no enthusiastic followers after Lemke died, outside of Harris and Mary Lapham. It was not until Brauer and Spengler took up the work following Murphy's technic and published their brilliant work in 1906 that any marked attention was given to the treatment of phthisis by artificial pneumothorax.

A further important step was made by Saugman in adding a manometer to the apparatus to denote when the point of the needle was in the pleural cavity. By the addition of the Roentgen ray, artificial pneumothorax treatment has reached its present position of safety. Now every civilized country has its adherents, nearly all following Forlanini's puncture method. At the International Tuberculosis Congress held in Rome in 1912 it was the chief subject of discussion, and an international association was formed to keep the workers in this field in closer touch with each other.

The literature on this subject at present embraces over 600 articles. The leading contributions are from Italian, German and French clinicians. With the exception of Murphy's and Lemke's articles in 1898-99, only in the last few years have valuable contributions been made by American and English clinicians. The tenor of all these reports is favorable. Considering the large number of cases treated, few clinical recoveries have been reported. Still one must bear in mind that the treatment has been undertaken in almost all of the cases as a last resort; also that the method is naturally limited to unilateral cases or to cases with slight involvement of the better lung. A fair estimate of the patients suitable for artificial pneumothorax according to the present accepted indications may be gathered from the following observations.

Volhard found 56 suitable cases out of 789 patients examined. Burnand found 23 out of 628 patients. Keller attempted it in 40 out of 583 patients examined. During my six months' service in the out-patient clinic of the Massachusetts General Hospital, out of 100 tuberculous patients examined in the general clinic only five would have been suitable for artificial pneumothorax. From my series of 64 cases treated by pneumothorax, in only 23 was a complete collapse possible. In many cases attempted the practical value of pneumothorax is limited on account of the impossibility of creating a pneumothorax of sufficient therapeutic value. This

is due to partial or complete adhesions, cicatrized or indurated lung which cannot be compressed, and to severe lesions in the "better lung."

THE MANOMETER.

It is worth repeating here that the manometer may show respiratory oscillations of three kinds: Negative, even (namely the excursions on the manometer are equal on inspiration and expiration) and positive.

1. Negative respiratory oscillations always mean that the point of the needle is in the pleural cavity.

2. Even respiratory oscillations at a primary injection mean that the point of the needle is beyond the pleural cavity, *i.e.* in lung. No matter how much nitrogen is introduced under these conditions, the oscillations will vary but slightly.

3. Positive respiratory oscillations indicate that the point of the needle is either in a pocket of gas, a complete pneumothorax, or a hydro-pneumothorax; under these conditions the pressure becomes higher on the introduction of a very small amount of nitrogen.

4. At a secondary injection when a pleural effusion has formed, the point of the needle may be in the pleural cavity and the manometer may show only slight or feeble respiratory oscillations slightly negative or markedly negative in character. Or there may be simply a negative rise on inspiration, with no oscillations whatever. Under these conditions, when the needle is removed a drop of fluid may be observed on the end of the needle especially if the stylet is passed through its lumen.

If the point of the needle is in a blood vessel only a rising pressure will be noted.

VALUE OF ROENTGEN FLUOROSCOPIC AND PLATE EXAMINATION.

Before the induction of an artificial pneumothorax is attempted, whenever possible, a Roentgen examination of the chest should be made, both fluoroscopic and plate. It shows the precise topography of the lesions, and any enlargements of the larger blood vessels. A preliminary plate and fluoroscopic examination is advisable before instituting pneumothorax treatment. Not only can the extent of the tuberculous process in both lungs be determined more exactly than by physical signs, but also the presence of adhesions to the diaphragm and the costo-phrenic sinus can be demonstrated. It is of especial value after the first few insufflations, because it shows clearly just what has been accomplished and in just what manner the lung is being collapsed; 150 cc. of nitrogen injected into the pleural cavity will show a distinct outline; 1000 cc. will show the lung approximately half collapsed.

The pressure readings of the manometer alone are not sufficient to inform one of the degree of lung collapse, nor are percussion and auscultation at all times sufficient. The Roentgen rays

are the most precise and accurate means at our command not only to show in what manner the lung is collapsed but also to tell us how much the mediastinum and heart are displaced.

In the absence of adhesions, the lung is seen to be uniformly compressed around the hilus, and the pneumothoracic cavity sharply defined. Variations from this normal disposition of the pneumothorax are due to various causes: viz: Pleural adhesions, which are the most frequent; large cavities encapsulated in fibrous tissue, which permit one part of the lung to collapse more than another part; calcified areas, which are incompressible; and fibroid changes which are also incompressible.

Pleural adhesions are well defined and attempts to inject nitrogen into an adherent pleura must be made with great care. If the pneumothorax increases (which will be shown by the extent of the manometer's excursions) careful introduction of small quantities of nitrogen may be continued. Pleural adhesions appear either as single bands running from the lung to the thoracic wall, or as a net-work of such bands. Adhesions have been noted most frequently in the upper lobe.

When the pleural cavity is free, the collapsed lung appears to be a homogeneous mass. In one case the lobes were plainly discernible. Where adhesions exist, their length, form and distribution are readily ascertained. Case 12 showed the lung held in the center by a thick adhesion, which prevented a complete collapse posteriorly. Subsequent plates showed that this adhesion was decreasing and the collapse increasing, but it was impossible to effect a complete collapse.

The plate in Case 31 showed a net work of adhesions to the superior lobe, which, however, did not prevent a satisfactory compression. In Case 32 the pleura was adherent posteriorly and three bands extended from the superior lobe, thus preventing a good collapse. In this case it was impossible to secure a complete compression of the superior lobe which contained the cavity. In Case 21 (a lung abscess), the lung collapsed in an almost semicircular shape with the concavity outward, as a result of adhesions from the upper portion of the superior lobe and from the tip of the lower lobe. In Case 8 a small portion of the upper lobe was found to be adherent. In Case 20, the left lung showed a wholly adherent superior lobe, a condition that remained wholly unaffected by the injections. The activity in the process of the superior lobe continued unchecked although considerable relief in the symptoms was obtained. In Case 25 a similar adherence was found at the base of the right lung. In one case the lung was irregularly compressed and bands of adhesions from different parts of the lung were visible. This resulted in the formation of pockets of gas and sufficient collapse was obtained in this case to obtain marked symptomatic relief. The sputum was diminished from one-half cup to a teaspoonful in twenty-four hours,

with only a little cough in the morning and improvement in the general condition. These adhesions varied from very thick bands to mere threads.

These examples of abnormality are cited to show the value of the Roentgen examination. It helps in the selection of the proper place for the injection; it shows more accurately than physical examination the exact progress of the lung collapse, and the rate of gas absorption; it also shows whether the gas was actually introduced into the pleural sac or not.

The fluoroscope is invaluable in detecting an effusion in its very incipency. Small amounts of fluid will be discovered by its rise before the physical signs or even the Roentgen plate can show any definite evidence.

COMPLICATIONS.

An operator who has a thorough knowledge of the technic and has made a proper selection of cases will not meet with any serious immediate accidents. Gas embolism ought to be avoided and the so-called "pleural reflex" will rarely be met with if novocaine-adrenalin is used as a local anesthetic.

Spontaneous pneumothorax from rupture of an adhesion is possible from too high a pressure; also rupture of the mediastinum. Pain in the chest from increased tension and cough can be controlled. Dyspnea from reduced respiratory area or cardiac embarrassment may become an urgent symptom requiring the withdrawal of nitrogen to relieve it.

A febrile reaction usually follows an injection, lasting a short time. There is usually a loss of weight during the treatment; or the weight may remain stationary. In the favorable cases, in the absence of complications, the gain in weight on the re-expansion of a collapsed lung is very marked.

Of the later complications, pleural effusions will be met with in about 50% of the advanced cases where a partial or complete collapse can be obtained. Once an effusion has made its appearance, there is always present the danger of its becoming infected at a subsequent injection. The question of removal of the fluid depends on its effects. A serous effusion which does not aggravate the patient's condition is best left alone. If the patient's general condition is affected, the effusion should be aspirated and lung collapse maintained by nitrogen insufflations. Patients with serous effusion should be carefully watched. Frequent fluoroscopic examinations should be made, as the gas may suddenly absorb, the lung re-expand, and then further treatment will be impossible on account of the gluing together of the pleural surfaces.

A serous effusion may become purulent. This has happened in two of my cases. One I will discuss in another paper. The other (Case 8 of my series), has had pulmonary tuberculosis for

ten years. The disease was slowly progressing when he first came under pneumothorax treatment three years ago. He had an extensive infiltration of the left lung with a small cavity between the third and fourth ribs. Slight infiltration of right upper lobe. One year after instituting treatment a serous effusion developed with stormy onset. In two weeks the symptoms subsided; then gradually improved. Compression was maintained by the injection of nitrogen every two weeks. Collapse was only partial on account of adherent apex. The fluid aspirated and examined by Prof. Wolbach had all the character of a tuberculous serous effusion and tubercle bacilli were found. A year later this effusion became purulent. No other organisms as yet have been found in the pus except tubercle bacilli. The pus was aspirated and replaced by nitrogen, but the last time this was done the pus was forced, by coughing, along the site of puncture and formed a cold abscess (?) which is tender to touch. I do not like to tamper with this patient very much.

Whenever during treatment the condition of the non-collapsed lung becomes aggravated, the nitrogen insufflations should be suspended. It may even become advisable to extract some of the nitrogen so as to favor re-expansion. I have done so in one of my cases because of hemoptysis. The non-collapsed lung should be carefully watched. No one can tell for a certainty what the effect of the increased work thrown upon it may be.

Once the lung has re-expanded the pleural surfaces coming into contact adhere, preventing a further collapse of that lung. This is very important, for the lung must not be allowed to re-expand prematurely. The time to keep the lung collapsed varies with each individual case, depending on the extent and character of the lesions. It is better to err on the side of keeping the lung collapsed for a longer rather than a shorter time. Anatomical healing takes place slowly. As a rule at least a year is necessary. When a patient has been free from symptoms four or five months, we may allow re-expansion to take place. If while re-expanding there should be a return of the symptoms from the compressed lung, treatment should be immediately resumed.

The healed, compressed lung when re-expanded takes up its normal functions again and is capable of carrying on the necessary respiratory exchange even alone. The following is an extreme case illustrating this.

Forlanini drew out the nitrogen from the left side in a case where the left lung had been maintained collapsed for seven years, and this aided re-expansion. He then instituted a pneumothorax on the right. It was a very delicate procedure and of doubtful result. The outcome was beyond his expectation. In about 38 days the right lung was collapsed—the left lung had been practically wholly re-expanded; there was no evidence of recent disease, but a pleural friction

sound could be heard from the apex to the base. Respiration 24-26. The patient was in fairly good condition and improving. A lung can thus be maintained compressed for a long time and on re-expansion can alone carry on the necessary respiratory function. The healthy tissue does not appear to be destroyed by the long compression.

If the late or remote results are uncertain, the immediate results are striking. All operators are in accord as to the effects on temperature, control of hemoptysis, diminution and cessation of sputum, control of cough, and in some cases disappearance of tubercle bacilli. In other words, one can obtain symptomatic relief, but this may not always be lasting. Still, we can gain time, a few weeks, months or a few years, and an occasional clinical recovery. This is the actual value of artificial pneumothorax in the advanced cases.

The extension of the indications of this form of treatment is still difficult to give. Its field may be broadened to that large class of moderately advanced cases, perhaps even to certain incipient cases, which the experienced clinician knows would otherwise do badly.

It has been my experience that the second stage cases are less likely to develop a pleural effusion than advanced cases, and the proportion of failures in finding a free pleural cavity will be considerably smaller. No case, so long as it is progressive in character, can be regarded as too early for treatment. Sudden hemoptysis must be regarded as evidence of progressive disease from the standpoint of artificial pneumothorax treatment. In Case 61 of my series, the only symptoms were listlessness and a sudden hemoptysis which nearly killed the patient. This last attack had been his sixth in the course of a year. Between attacks he was in excellent health, having no cough, sputum or fever. The physical signs in the chest were very slight in comparison with the severe hemoptysis. There was slightly increased dullness in the right upper lobe, increased tactile and vocal fremitus, and broncho vesicular respiration. No râles. Left chest apparently normal. X-ray examination showed an infiltration of the right upper lobe with peribronchial thickening. Left chest apparently normal. We deemed this an opportune case for artificial pneumothorax. The pneumothorax has not disturbed him in the least, and he is up and about, driving an automobile. Meantime he sleeps out of doors and has improved in strength and weight under treatment. The pneumothorax will be maintained for not less than six months.

In the non-tuberculous cases such as early bronchiectasis and certain cases of lung abscess, it ought to be attempted.

In two cases of bronchiectasis, of my series, there was complete recovery in one and symptomatic relief in the other. In the latter, the abscess could only be partially collapsed.

In two lung abscess cases, complete recovery

was obtained in one and very little benefit in the other.

Bronchiectasis dating from childhood, as in case 59 of my series, will not be cured by artificial pneumothorax on account of the pathological changes that have taken place. But it may later enable the patient to withstand the strain of a more severe operation such as rib resection.

Success in the treatment will depend on the manner in which the pneumothorax is produced and maintained. It is best to produce the pneumothorax gradually by frequent injections of nitrogen, and bring it slowly up to the desired volume and pressure. The rapid production of a pneumothorax by large quantities of nitrogen is dangerous as it does not give the adjacent organs time to adjust themselves to the changed conditions; besides the expulsion or sudden evacuation of large quantities of purulent matter may infect the sound lung. The only exception to this is in unilateral hemoptysis where it is desired to control the hemorrhage quickly.

It is essential to have a free pleural cavity or one that can be made sufficiently free by subsequent injections to allow complete collapse of the lung.

The other organs must be in such a condition as to be able to withstand the extra work thrown upon them.

The patient ought to follow sanatorium régime treatment at the same time.

The physician must have complete control of the patient.

Frequent x-ray examinations are essential for the treatment.

Artificial pneumothorax is not an indifferent procedure and should be undertaken only after careful consideration of each individual case. The patient should be fully informed that the treatment is long, tedious, troublesome and expensive and not devoid of dangers.

PYLORECTOMY FOR ULCER.

By P. E. TRUESDALE, M.D., FALL RIVER, MASS.

THE treatment of gastric and duodenal ulcer is still a subject of controversy. It is obvious, nevertheless, that internist and surgeon by co-operative study and effort are approaching an attitude of harmony in dealing with this disease. Laboratory evidence has had a potent influence in molding present opinions. From the physiologist, the pathologist and the roentgenologist have come contributions of epoch-making importance, and the final analysis will depend much upon the continued zeal and product of their laboratories.

Hartmann¹ of Paris at the recent International Congress commented upon the present

situation in the following manner: "The surgical treatment of gastric and duodenal ulcer must not be opposed to the medical treatment, the first is only the frequently necessary complement of the second. The real results observed at a lapse of time of the medical treatment are far from being as good as was formerly supposed, without speaking of serious complications, such as hemorrhage, perforation and stenosis, which are indisputably urgent surgical indications, we consider that all ulcers (gastric and duodenal) showing resistance to medical treatment belong to the surgeon." So that, out of recent deliberations has come a fair degree of unanimity, placing the treatment of ulcer in its early manifestations within the province of the internist, and assigning to surgery the chronic ulcer which has failed to respond permanently after a reasonable period of medical treatment. Rodman² mentions Leube, the most optimistic of medical men, as insisting that the medical treatment in chronic ulcer should not be persisted in longer than a period of four weeks.

Inasmuch, therefore, as the treatment of chronic, intractable ulcer of the stomach or duodenum is assigned to the surgeon, the choice of operation becomes a problem of extreme importance. One may reasonably assume that the perfect operation has not yet been demonstrated. The fairly frequent and recent changes in technique offer ample evidence of this fact. To illustrate the different methods employed by eminent authorities, one may cite the work of Paterson³ of London and Mayo⁴ of America. Paterson invariably does anterior gastrojejunostomy and favors no sort of intervention at the pylorus or with the ulcer site, while Mayo has long since abandoned the anterior operation for his own more generally accepted modification of Woelfler and Von Hecker's posterior, no-loop gastrojejunostomy. He now makes the anastomotic opening directly beneath the cardiac orifice extending from the lesser curvature a little to the right of the incisura angularis, and passing vertically oblique to the left. Mayo, furthermore, as a rule infolds or excises the ulcer.

At present there are essentially two methods of dealing with ulcer of the stomach or duodenum. One may be called the indirect method, by gastroenterostomy alone. The other the direct method by excision of the ulcer and gastroenterostomy or end-to-end anastomosis. Finney's⁵ operation affords the best opportunity to execute the direct method whenever the pylorus is readily accessible and not fixed by adhesions.

Inasmuch as the development of cancer on duodenal ulcer is extremely rare, simple inversion by suture is here generally considered sufficient, while carcinomatous degeneration of ulcer in the pyloric zone is known to occur with such frequency that failure to excise the ulcer-bearing area after gastroenterostomy would now appear to be inexcusable. E. Payr⁶ contends that callous ulcers of the stomach should be resected every time that the general condition of the pa-