

SUMMARY

A case of traumatic chylothorax is reported. A review of the literature shows 33 well authenticated cases already on record.

In common with previous reports, this case showed a latent period between the time of the accident and the onset of the chylothorax, rapid reaccumulation of large amounts of fluid in the pleural space, and progressive cachexia.

Traumatic chylothorax raises physiological and metabolic problems which have no satisfactory explanation at the present time.

A detailed analysis of the chylous fluid is presented.

We wish to express our appreciation to Dr. H. W. Soby, of High River, who had this patient under his care during the greater part of the illness. We are also

indebted to Prof. George Hunter, of the Department of Biochemistry, University of Alberta, for the analysis of the chylous fluid.

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A PLEA FOR EARLY COMPRESSION IN PULMONARY TUBERCULOSIS*

BY NORMAN BETHUNE, M.B., F.R.C.S. (ED.)

Montreal

THE conception of adult pulmonary tuberculosis in the 19th century and the early part of the 20th century held that this disease was an extension or a lighting up of an old apical infection. The continental pathologists Naegeli¹, Burkhardt², and others found that 90 per cent of all city dwellers at autopsy had tuberculous lesions at one or both apices. These lesions showed more or less completely healed areas of tuberculosis, surrounded by collapse indurations and fibrosis of the parenchyma. Many tubercles still contained caseous foci with tubercle bacilli. These lesions are quite distinct anatomically and pathologically from the discrete primary foci found scattered throughout the lungs—the remnants of childhood infection. They are true manifestations of re-infection. It was thought that the endogenous extension downwards from the apex was accomplished by or through the rupture of lymph nodes near the old focus, retrograde lymphatic stem, or by the hæmatogenous or aerogenous routes. Adult disease was thought to be just an advanced stage of this early "incipient" apical infection or an acute exacerbation of this stage. The observations of Ewart³, Dunham^{4,5}, Gekler⁶, Redeker⁷, Wessler⁸, and Assmann^{9,10}, have altered this conception, although it is still held by some pathologists,

such as Loeschke¹¹. The old apical disease is now thought by most to be more or less harmless, (7 per cent Braeuning¹²), and that the adult disease, as seen by x-ray, is usually a sub-clavicular pneumonic infiltrate of greater or less extent in the 1st, 2nd, 3rd or 4th interspaces, and located in the posterior part of the upper lobe or the apex of the inferior lobe, above the hilus, and most frequently at the periphery of the lung. This infiltrate, which may appear suddenly shows little or no discoverable anatomical relationship to the old apical disease, and is often in its early form relatively small before advanced spread occurs and discloses its presence by constitutional symptoms. The x-ray, and less frequently the stethoscope, is often the only means of its discovery if constitutional symptoms of intoxication are slight or absent. This sub-clavicular patch of broncho-pneumonia is an acute form of re-infection in an allergic individual. It is often as acute a disease as non-tuberculous broncho-pneumonia. In its early form it may be entirely cured or absorbed if given proper treatment. If treatment is withheld, it tends in most to sluggish progression, instead of resolution, but in others may advance very rapidly, with cavity formation and extension to other parts of the lung.

Whether or not this acute re-infection is of exogenous or endogenous origin, this newer con-

*From the Medico-Surgical Pulmonary Clinic, Royal Victoria Hospital, Montreal.

ception of phthisis as frequently an acute disease and in its early appearance most often unilateral has altered our ideas of treatment. If this new disease was simply an acute exacerbation of a slow apico-caudal spread of an old "incipient" lesion of years' duration, then prolonged rest for a period of a year or more would seem to be a reasonable procedure to allow the acute exacerbation to subside. Little hope could be held out that the disease would be completely cured—it would merely be held in check; once tuberculous, always tuberculous. The advent of the x-ray has shown that this patch of small tuberculous pneumonia is a new and fresh re-infection, and if properly and promptly treated may be absorbed, leaving only a few strands of fibrosis behind, or that after artificial pneumothorax treatment many lungs will be as clear of disease as if they had never been invaded. Tuberculosis can be cured, not only clinically but often anatomically, if properly treated in its early acute stage. The idea of the chronic nature of this disease has arisen from the evidences that the body shows in its prolonged efforts to repair the damage of the acute stage. This new conception of the acute development and often rapid advancement of adult pulmonary tuberculosis has stimulated more active and aggressive treatment in the early infiltrate stage to hasten fibrosis, to prevent extension, and to limit cavity formation.

The treatment of pulmonary tuberculosis involves two problems. The first is that of the infected individual, regarded as a whole, acting and reacting in his social and physical environment, and the second, the reaction of that individual's body, and more particularly his lungs, to the presence of the tubercle bacillus. The tubercle bacillus may be considered, as it truly is, just another factor in the environment of man, impinging on him, causing certain changes in his body and modifying its behaviour. The first problem then becomes chiefly an economic and social one, and the second, a physiological and immunological one. In the final analysis they are mutually reactive and inseparable. Trudeau well said, "There is a rich man's tuberculosis and a poor man's tuberculosis. The rich man recovers and the poor man dies." This succinctly expresses the close embrace of economics and pathology. Any scheme to cure this disease which does not consider man as a whole, as the resultant of environmental strain and stress, is bound to fail. Tuberculosis is not merely a disease of the lungs; it is a profound

change of the entire body which occurs when man, regarded as an organism acting under the dictation of, and the product of, his environment, fails to circumnavigate or subjugate certain injurious forces acting on his body and mind. Let him persist in continuing in such an environment and he will die. Change these factors, both external and internal, readjust the scene, if not the stage, and he, in the majority of instances, will recover. The sanatorium with its bed rest, fresh air, and good food, is such an external environmental change. The second requirement is to alter the local environment of the tubercle bacilli, and this change is most quickly and effectively obtained by collapse therapy. In the case of a man acutely infected with the tubercle bacillus, activity in his daily struggle to adapt himself to his social and economic environment is almost invariably followed by a coincidental activity of the disease. Rest in the first direction is followed by arrest in the other.

Tuberculosis is commonly regarded as a chronic disease. This only means that the tuberculous takes an unconscionably long time in dying. Did the lung, alas, not "suffer in silence," but did it protest more vigorously, tuberculosis, like syphilis, would be treated in the first acute stage with a high hope of cure, and we would not await the development of the second or third stages, when a satisfactory result is difficult and sometimes impossible. These early lesions are not infrequently missed by a physical examination and a stethoscope. They will be discovered through a careful history and an x-ray film.

Early pulmonary tuberculosis is of all so-called chronic diseases the easiest to cure. The remedy is *rest*. Dr. John Flinn, has well called this the "specific treatment." Pulmonary tuberculosis shows an inherent tendency, a willingness for recovery, which when considered beside chronic heart, kidney or liver diseases, which show little or no tendency to cure, makes it unique among the diseases of long duration afflicting man. Given half a chance, pulmonary tuberculosis will meet the physician half-way towards recovery. Our sanatoriums are filled to-day with the incurable sequelæ, the deplorable after-results, the uncollapsible cavities, the avoidable complications of what was once, for many patients, an entirely curable disease in the early stage. The incurable tuberculous who will fill our sanatoriums for the next five years are now walking the streets, working at desks or machines with early curable tuberculosis, and

coming into doctors' offices with loss of appetite, loss of weight, tiredness, and are getting bottles of medicine for their stomach complaints or tonics for their fatigue. They eventually will come to the sanatorium with moderately or far advanced disease with cavitation. We, as a people, can get rid of tuberculosis, when once we make up our minds it is worth while to spend enough money to do so. Better education of doctors, public education to the point of phthisiophobia, enforced periodic physical and x-ray examinations, early diagnosis, early bed-rest, early compression, isolation and protection of the young are our remedies.

We, as physicians, can do but little to change the external environmental forces which predispose to re-infection. Poverty, poor food, unsanitary surroundings, contact with infectious foci, overwork, and mental strain are mostly beyond our control. Those essential and radical readjustments are problems for the sociologists and economists. We produce in a sanatorium, for a few short months, a new and harmonious environment and attempt to counteract years of disharmony and maladjustment. All the more reason, since the time is so short, to take advantage of these months by actively altering the local environment of the bacillus in the diseased lung by collapse therapy. Rest, either physiological or so-called mechanical, will not by itself cure the disease; it merely induces local conditions favourable for the re-establishing of the body's defensive mechanism, those mysterious and incalculable elements, the sum total of which are called resistance. Once resistance has been built up it must be carefully protected. This preservation of resistance is the chief problem of rehabilitation and its watchword is "The Fatigue Conscience." It is thus seen that there are three acts to the drama; the first, the predisposing environment and the onset of the acute re-infection; the second, the temporary change of this injurious environment in the sanatorium, with an active attempt to enforce lung relaxation; and the third, the readjustment to the external environment after the sanatorium. The first and last are the important ones and the most difficult problems in the treatment of this disease.

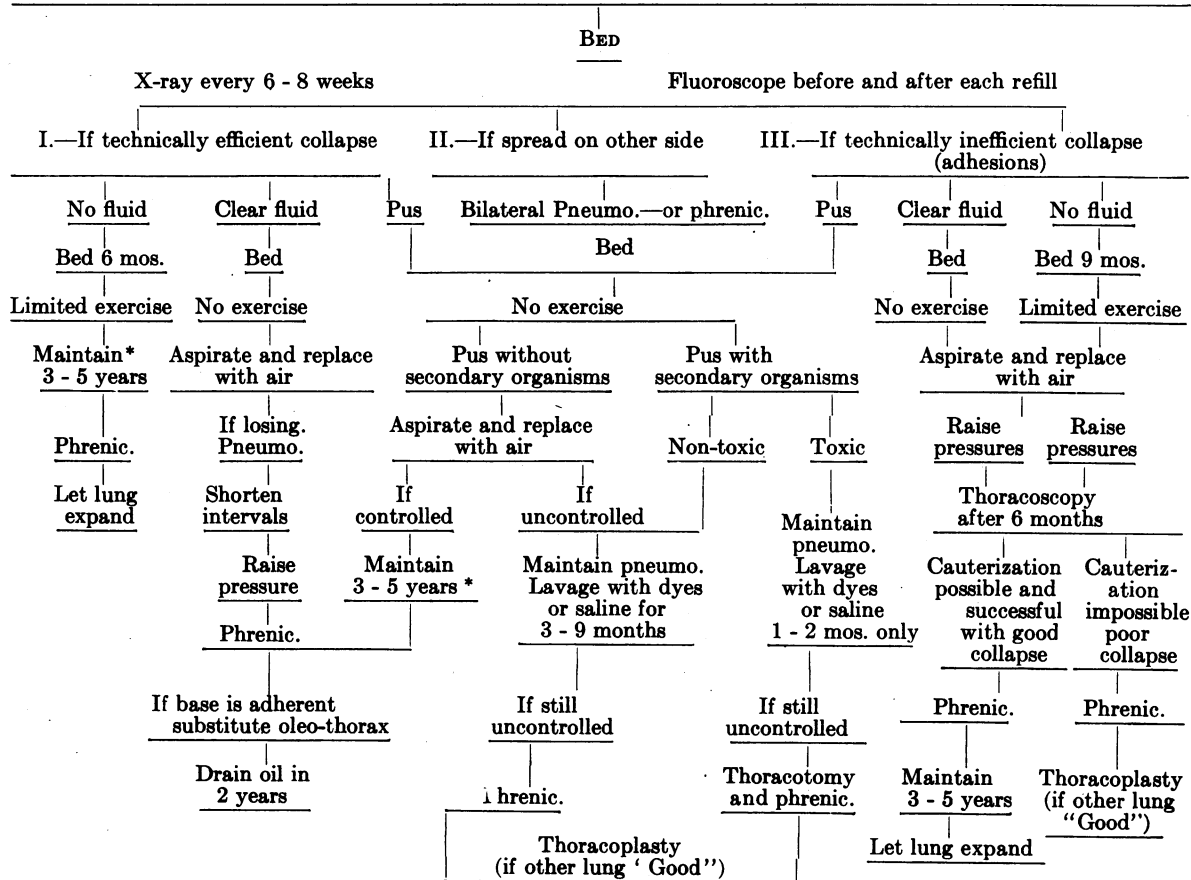
Until that happy day breaks when the immunologist and serologist solve the problem of how to prevent invasion and, once invaded, to destroy in vivo the tubercle bacillus, the phthisiotherapist is forced to adopt the mechanistic viewpoint in the treatment of this disease. This is

no new idea. It was suggested by William Carson, of Liverpool, in 1821, who said in part—"It has long been my opinion that if this disease (phthisis) is to be cured, and it is an event of which I am by no means disposed to despair, it must be accomplished by mechanical means, or in other words by a surgical operation." He urged artificial pneumothorax and other collapse procedures. While this mechanical viewpoint is a confession of failure to treat this disease directly, while some of the procedures advocated are clumsy, crude, and often dangerous, yet lung relaxation and lung compression must be accepted to-day for want of something better. That partial or complete respiratory immobilization will hasten absorption and induce fibrosis in a lung invaded by the tubercle bacillus faster and more surely than any other procedure is the outstanding fact we know about the treatment of this disease. The treatment of pulmonary tuberculosis to-day is the treatment of neglected cavities. The remedy is earlier diagnosis and earlier compression.

Burrell,¹³ writing on "The Future of Artificial Pneumothorax Treatment," states "If artificial pneumothorax can save the lives of many patients who have failed to improve under other treatment, how many more would it save if employed in the earliest stage before adhesions have formed and while the disease is unilateral? I think that in the near future all early cases of unilateral disease will be treated by pneumothorax unless there is some definite contraindication. When once crepitations are heard the case cannot be regarded as in the early stage, and certainly pneumothorax should be advocated. It is only a waste of time to try other methods, because, although it is true some do well, many do not, and even those who do well at first are very liable to relapse."

The treatment of pulmonary tuberculosis with cavities is a surgical problem; not that surgical procedures (and artificial pneumothorax is here included) are immediately indicated in every case, but I feel strongly that surgery for cavities and for lesions which will in all probability develop cavities later is nearly always indicated. The decision whether or not, and when, to invoke surgical rest is one of the most difficult in the whole realm of modern therapeutics and demands the highest form of clinical judgment and experience. There are only two contraindications, and only one of these is absolute. The first is the rapidly spreading, toxic, terminal and hope-

SUMMARY OF THE MANAGEMENT OF UNILATERAL PNEUMOTHORAX—OTHER SIDE GOOD OR FAIR



*The reply of Rist of Paris, to those patients who complain of the length of time required for Pneumothorax Treatment is "Yes, it takes longer than it does to die of tuberculosis."

less bilateral disease; and the second is the minimal or, occasionally, the moderately advanced disease without cavitation which is showing marked evidence of rapid absorption, healing or fibrosis under absolute bed-rest, where the affected person can afford the time and the money to carry on for an indefinite period with the confident assurance of complete restoration of health at the end of several years of rest. All others, the pre-cavernous and the frankly cavernous, should have some form of active collapse therapy.

Some of the same objections are being raised to-day against active treatment for early pre-cavernous and frankly cavernous tuberculosis which were raised at the beginning of the century against operations for appendicitis. Optimism as to the outcome in cavity cases when treated conservatively is not only fatuous but unjustifiable. That many cases will recover and a few cavities close without surgical intervention no one will deny, but when sanatoria show in their

records on discharge only 25 per cent arrested minimal cases, and only 2 to 5 per cent of arrest in the moderately and advanced groups, one begins to wonder if this is good enough. It certainly would not be considered good enough in the treatment of many other diseases. Obviously it is necessary to diagnose more minimal and early cases and to treat them more actively to bring up the percentage of arrests out of the quiescent or unimproved class. Barnes and Barnes¹⁴, studying 1,454 cavity cases, found a mortality rate of 80 per cent within 1 year and 90 per cent within 5 years. Sprungman¹⁵ followed 626 cases of untreated cavities over a period of 16 years. He found a total mortality rate of 78.2 per cent and a death rate of 61.7 per cent for the first 2 years. Of the small surviving group, 69.1 per cent were totally or partially disabled and only 4.1 per cent of the whole number were working. Under collapse treatment by pneumothorax, of 86 labourers, 61.6 per cent had regained and retained their working

and earning ability after 1 to 5 years; only 21.1 per cent were incapacitated and 17.4 per cent had died. Northville Sanatorium, Michigan, had in 1927 a mortality rate of 25.8 per cent and only 8 per cent of all cases were discharged as arrested. In 1931, the mortality had dropped to 10 per cent and the arrested cases on discharge had reached 34 per cent. At the present time 77 per cent of all cases are under some form of collapse therapy^{16,17}.

Bachmeister,¹⁸ speaking of the experiences in Swiss Sanatoria says—"Given a cavity the size of a cherry at the onset of sanatorium care, and unless that cavity has steadily shown a tendency to close, and does close, or has been closed by artificial means, only 20 per cent of chances exist that the patient will be alive in six years, even with continuous sanatorium care."

More and more, rightly or wrongly, and I believe, wrongly, we are regarding pulmonary tuberculosis as a disease of a lung instead of the entire body. It is truly a form of scientific despair which will seem absurd when immunology and serology come into their own. Yet, that narrow and empirical viewpoint of the mechanical mind, with its eyes fixed on practically nothing but the local pulmonary lesion, has contributed more to the successful treatment of this disease than a hundred years of forced feeding, fresh air, vaccine and chemiotherapy, change of work, or intermittent rest with exercise.

Who can regard the millions of money lost in earning capacity each year, the high cost of sanatorium upkeep, the poor results of short-time hospitalization, the drain on the patient's, his family's, or his country's purse, the years wasted in curing, and the lives lost, without thinking that sanatoria and short bed-rest are not worth while? The day of the sanatorium as a sort of boarding-house is past. The modern sanatorium is a hospital for active treatment. No sanatorium to-day can call itself modern which does not have at least 50 per cent of its patients under some form of collapse therapy, a distribution of say 30 per cent pneumothoraces, 15 per cent phrenicectomies, and 5 per cent thoracoplasties or extra-pleural wax fillings, etc. Compression saves time, saves money, and saves life. The patient with early tuberculosis who, through economic pressure, can afford to spend less than two to three years in a sanatorium must have mechanical pressure. Lack of time and money kills more cases of pulmonary tuberculosis than lack of resistance to that disease. The poor man dies because he cannot afford to live. Here the

economist and the sociologist meet the compressionist on common ground.

SOME SUGGESTIONS IN COLLAPSE THERAPY

1. *Bed-rest*.—The irreducible and minimal "time period" for complete bed rest for any type of pulmonary tuberculosis is six months. A few minimal lesions need only one time-period in bed; all moderately advanced lesions should have two periods in bed; and the far advanced up to three and four.

Bed-rest should mean *complete* bed-rest, a vegetative existence. The maximum non-mechanical immobilization of the lungs must be insisted upon, to utilize the short time at our disposal and not waste time on "limited" exercises. All patients should be put to bed immediately and placed under observation for a period of one week to one month before collapse therapy be instituted.

Postural bed-rest for unilateral cases, especially of the soft type, will sometimes bring most gratifying results. It is achieved by the Davis sling, shot bags, or by lying on one side, and must be persisted in for a long period of time.

2. *Clearing*.—Clearing should be very marked to encourage one in persisting in bed-rest without mechanical relaxation therapy. A clearing report, with ill defined, irregular areas of rarefaction and a positive sputum, must be accepted as cavitation, and demands compression of some sort.

3. *No change*.—Most lesions, except the fibrotic type, will swing one way or another. The unchanged, sluggish, mixed type needs surgical treatment.

4. *Increase*.—This shows poor general resistance, and no time is to be lost in compressing this type, or eventually cavity formation will take place.

5. *Temporary phrenicectomy*.—For bilateral disease, a temporary interruption only, that is, a crushing with excision of accessory phrenic branches may be done. This will give relaxation from three to six months, or even longer. No permanent phrenicectomy in bilateral disease should be done, as it may be needed urgently and later on the other side. If, of course, the other side is holding well, after the first appearance of movement of the diaphragm following crushing the temporary phrenicectomy may be made permanent, but even before this is done the question should arise whether or not to substitute a pneumothorax instead and keep the permanent

phrenicectomy in hand for the possible increase or spread on the other side, in the event that pneumothorax there might be unsuccessful. It might even be suggested that the careful surgeon should determine whether or not the other side has a free pleural space.

6. *Permanent phrenicectomy.*—This should be tried first for small early unilateral lesions of the soft or mixed type, with or without small cavitations. If cavities are present, they should be of the thin-wall or "moth-eaten" variety, irrespective of their geographical position in the lung, and these can be expected to close in about 50 per cent of the cases. The operation is not to be trusted to produce much benefit in fibrotic lesions with fixed wall cavities; occasionally it will make a pneumothorax unnecessary. Not infrequently, following a phrenicectomy, improvement will be observed for a couple of months, when no further progress is made. If the x-ray film shows these lesions not clearing after two months, or increasing after one month following phrenicectomy, then pneumothorax should be done. Regard the principle of all relaxation therapy as *purchasing collapse as cheaply as possible*. The ideal is simplicity and cheapness of procedure with a maximum of benefit. Phrenicectomy is the cheapest form of lung relaxation and, also, the least efficient; pneumothorax comes next and is by far the best; thoracoplasty is the most expensive but also irrevocable. It is also inadvisable to do a permanent phrenicectomy on the same side as an incomplete pneumothorax if the other lung is at all questionable, and also if it is not known definitely that a free space may be obtained on that side. Bilateral pneumothorax may become indicated there for a spread or a re-activation, and may be unsuccessful. A phrenicectomy is then the only procedure left to do. Massive, soft, tuberculous pneumonias should have the partial relaxation which a temporary phrenicectomy will give for a period of a month or longer before a pneumothorax is applied, to see how they will react to this moderate degree of relaxation. If well borne, then the establishment of a low-tension pneumothorax, with a small collapse, gradually increasing, taking several months to establish, is a good policy to follow.

7. *A phrenicectomy on one side and a pneumothorax on the other.*—If a choice is permitted, keep the phrenicectomy for the small thin-wall cavity, and the pneumothorax for the more extensive, softer and newer lesions. Older fibrotic

lesions with stiff-wall cavities are far more likely to have adhesions preventing collapse by pneumothorax than the softer type, which have not had time to form massive adhesions. It is also a good rule to attack first the softer and newer lesions and later the older and more stabilized type, where most of the damage has already been done. If cavities have thick walls it is useless to do a phrenicectomy, as they will not collapse on account of the resistance surrounding them. This type of cavity should have a high pressure pneumothorax applied. In many cases it is a waste of time to try and control a lesion with a phrenicectomy that demands a pneumothorax. Such bilateral cases should have bilateral pneumothorax.

8. *Scalenectomy.*—For upper apical lesions with cough and sputum, with or without small cavities surrounded by a fair amount of approximately good lung, scalenectomy may be tried at the same time as a phrenicectomy, if pneumothorax is unsuccessful, or if extensive apical adhesions are holding open cavities in pneumothorax.

9. *Bilateral pneumothorax.*—This is best for not too densely infiltrated bilateral, mixed type lesions confined to both upper half lung fields. Keep the pressure low and equilibrated. Refill each side once or twice a week, alternately. Avoid accordion-like action of either lung. Content yourself with 50 per cent collapse on each side. Do not put either side down suddenly, but take a month or six weeks to establish your end.

10. *The time to keep pneumothorax maintained.*—This will depend on (a) the original pathological substratum; (b) the percentage of collapse obtained, and whether efficient or not; (c) the condition of the pleura, thickening, etc.; (d) the ease of obtaining refills; (e) complications arising, such as bilateral spread, fluid or spontaneous rupture.

We feel that many minimal, and some moderately advanced, lesions, with or without original small cavitations, which have had a technically efficient collapse, may be let out in three years. Cavities with originally thick walls and which took some time to compress should be kept down for five years. An 80 to 90 percent collapse for three years is better than a 30 to 50 per cent collapse with partially uncollapsed cavities for five years. Pleurae which are thickening rapidly, either through fluid or otherwise, should be watched carefully and let out as soon as possible, say in three years, owing to danger of rupture if

left too long and then allowed to stand. We have seen spontaneous rupture of a lung which was allowed to expand after fifteen years' pneumothorax. These old standing pneumothoraces will frequently have pain on re-expansion in the attempts of the thoracic contents and the chest walls to compromise. They specially need the protection of a phrenicectomy before re-expansion is induced. If cavities are uncollapsed after one year of partial successful pneumothorax, and after high pressure has been applied unsuccessfully, they should have a thoracoplasty, if the other side will stand. In general terms, the more complete the collapse, the better the final result, but the pursuit of this ideal may be penalized by the rupture of cavities, fluid or pus formation, cardiac or mediastinal dislocation.

11. *Wax filling*—may be used for unilateral cavitations which, if the other lung were good enough, would demand thoracoplasty. It may be used also for bilateral apical cavitations in place of bilateral upper stage thoracoplasty. In upper thoracic localized compressions no phrenicectomy should ever be done.

12. *Thoracoplasty*—is a reasonably safe procedure (mortality in selected cases, 5 per cent)

for unilateral cavitations of the predominately fibrotic type. The operative mortality is much reduced by previous pneumothorax of a year or longer. It is an operation on survivors. There are many varieties—the total two, three or four stage posterior, the supplementary early or late anterolateral, the unilateral and bilateral partial upper, the unilateral upper with pneumothorax on the same or the other side. Thoracoplasty is usually a sign of neglected or delayed treatment in the past and should be a rare procedure in the future!

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THE ROLE OF IODINE IN THE MANAGEMENT OF HYPERTHYROIDISM*

BY GORDON S. FAHRNI

Winnipeg

IODINE in the form of Lugol's solution has been freely used within the last few years in the management of hyperthyroidism. A drug so valuable in the treatment of such a prevalent disease merits deep consideration. The chief purpose of this paper is to discuss the indication for the administration of iodine in the treatment of hyperthyroidism, in the hope that it will contribute to a more lucid understanding of the subject, particularly by those who rarely encounter this condition.

In 1895, Bauman showed that iodine was a normal constituent of the thyroid gland and since that date a great amount of experimental and clinical work has been done, dealing chiefly with the prevention and treatment of simple goitre in childhood and adolescence. Although occasionally one heard of its beneficial use in exophthalmic goitre, it was not until about nine

years ago that iodine was really accepted as being of great value in treating hyperthyroidism. Plummer unquestionably deserves the credit for popularizing its use in this disease. Lugol's solution, consisting of iodine, potassium iodide and water, was used in hyperthyroidism of the exophthalmic goitre type with such success that some clinicians began to use it in all forms of hyperthyroidism and with this view I am in sympathy.

When a new agent is brought out for the treatment of some particular type of disease the profession very often overestimates its usefulness and applies it in too broad a fashion and poor results are sure to follow. The introduction of Lugol's solution for the treatment of hyperthyroidism has been no exception to this rule, chiefly because many physicians fail to remember that the early improvement from the use of iodine is very often not sustained and that the operative treatment should be carried out during

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