TRAUMATISM AS A FACTOR IN THE ETIOLOGY OF PULMONARY TUBERCULOSIS.

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INJURY as a causative agent in the production of tuberculous disease in bones and in joints is generally admitted. In most cases in which such conditions exist it is very frequently spontaneously obtruded to the notice of the surgeon by the patient or his friends during the recital of the morbid history; if not so voluntarily referred to, it is often readily elicited on inquiry. Seldom, if ever, does one hear of the physician inquiring for such a history in a case of tubercle of the lungs; rather, indeed, is it the injury that is complained of in cases of pulmonary phthisis following traumatism, and the symptoms of the pulmonary trouble that are to be inquired after. It is true that some deny the possibility of any close connexion existing between injury to the thoracic parietes and the genesis of tuberculous in the subjacent organs, but this connexion is admitted in most quarters, and it seems to me that a full recognition of this factor in the etiology of pulmonary lesions has very important bearings on the treatment of such conditions.

It is principally for therapeutic reasons that I give the history of the following case, in which the factor of injury is very well marked in the causation of the condition.

P. R., aged 44, hammerman, consulted me on August 4th, 1902, at the Victoria Infirmary. He complained of progressive general weakness and lassitude, which prevented his being able to work. He gave a history of having been injured a month previously by receiving a blow with a heavy pair of tongs in the course of his occupation. The tongs had struck him on the right side over the base of the lung in the mid-axillary line. He was treated at the time for a bruised side. During the fortnight following the injury he suffered from what would appear to be symptoms of pleurisy, the acuteness of which, gradually fading, left him after a time with what he terms a "catch in the breath." He had pneumonia in the left lung more than twenty years ago, otherwise he had always enjoyed good health. The patient's family history strikes a very tuberculous note. One sister is said to have died of phthisis following an injury inflicted on the chest by a pebble projected from a catapult. Among the patient's own children, too, the tuberculous tendency was undoubtedly strong.

August 4th.—Patient seen for first time; no cough; nocturnal sweats absent; complaints of weakness and loss of flesh; anorexia. Chest: dull area at base of right lung between posterior and mid-axillary line; respiratory murmur deficient in same area, and obscured by numerous fine superficial crepitations (chronic pleurisy with stretching of pleuritic adhesions). Vocal fremitus and vocal resonance diminished (pleura thickened).

August 29th.—Coarser and distinctly pulmonary moist crepitations heard at the right base in the area specified at last note; at right apex some comparative dullness with auscultatory signs of commencing consolidation. Cough absent. Chest measurements, 33½ in. on complete expiration, 35 on forced inspiration. Weight, 10 st. 4 lb. Patient is taking cod-liver oil and creosote.

October.—At the beginning of this month he developed a cough; a fortnight later this was accompanied by expectoration, and at the end of the month by a trifling hæmoptysis. Sputum: Thin, slightly frothy, and almost entirely mucoid; exhibited tubercle bacilli in fair numbers. Weight, 10 st. 2 lb.

November 19th.—Condition of right lung little changed, apical condition more pronounced; left lung pure. Chest measurements, 32½ in. on expiration, and 34 in. on inspiration. Note (1) Both measurements less than on August 29th, probably due to general emaciation. (2) Amount of chest expansion diminished, due to the fact that the more a lung is diseased the more grossly is its function impaired. (3) Increase of disease: diminution in chest expansion. Breathing exercises advised for the purpose of increasing the amount of chest expansion, and so allowing of fuller inflation of the lungs.

December 10th.—Weight, 9 st. 12 lb. Cod-liver oil and creosote increased.

December 31st.—Weight, 9 st. 12½ lb. Measurement of chest: Expiration, 32½ in.; inspiration, 35½ in. Right apical condition clearing up; condition at base improving.

January 14th, 1903.—Right apex practically clear; base exhibits no signs of interstitial pulmonary disease, but is still dull to percussion, and vocal fremitus and vocal resonance are still markedly diminished. Weight, 9 st. 13½ lb. Cough and expectoration still troublesome. Sputum: Many squamous and epithelial cells, myriads of micrococci, no tubercle bacilli.

The patient was about this time examined on behalf of an insurance company by a leading physician, and was, I understand, declared to have nothing the matter with his chest except some bronchial catarrh.

This is a fairly distinct case of pulmonary tuberculosis, which would seem to have been definitely consequent upon a by no means severe injury to the thoracic parietes; and, inasmuch as it would seem that this man is on the fair way to

recovery, it behoves us to look more closely at the case as illustrating traumatic tuberculosis particularly, and as raising important points in the consideration of pulmonary tuberculosis generally.

In the matter of etiology, notwithstanding the strong tuberculous element in the family history of the patient, there are several points against the theory of coincidence—an idea which might very readily strike one.

The age of the patient is 44 years; not that the prime of life is exempt from tuberculous infection, but it is a fact that we look for the disease at a somewhat earlier age—during adolescence or in early adult life. Now, in this man's history there is recorded an attack of pneumonia at the age of 22; and it is more probable, had he been fated, as some people seem to be, to have been laid hold of by the bacillus tuberculosis, that the germ would have found him out on this occasion, when his left lung was in an extensively impaired condition, and he himself in low general health.

Then it is important to note that when tubercle does lay hold of him, it attacks the right lung, which had never been previously diseased, and that too in a region which is not the usual one for tuberculosis to affect; but more striking still is the fact that the part affected is exactly the region which was injured by the tongs.

It is hardly possible to get away from the idea that there must be a very close connexion indeed between the traumatism and the tuberculous deposit when we consider the foregoing facts, and even more so when we reflect on his own statement that his health up till the time of the accident had been excellent, nay more, he is emphatic on the point, that always active in his habits and of spare physique, for twelve months prior to the onset of his present illness he was actually getting stouter.

The sequence of the symptoms in the patient's illness exhibits very fully the progress of the pathological phenomena which followed his injury; the initial symptoms of pain and inability to respire deeply or move his trunk freely in the course of his labour, were, no doubt, due to the bruising of the chest muscles from the blow of the tongs; this morbid process would seem to have gradually involved the deeper tissues until it extended to the serous covering of the lung, when we find symptoms of low pleurisy. No doubt the injury thus inflicted on the pleura left an appreciable effect on the subjacent lung tissue, or this tissue may have been only functionally impaired as a secondary effect of the pleurisy. Here arises a point of the utmost importance—if not the crux of the whole question, certainly a point upon which, in my opinion, hangs the true part traumatism plays as an etiological factor in the production of pulmonary tuberculosis.

Physicians generally are agreed that off-recurring pleurisies in a case are symptomatic, or at the least suspicious, of the presence of tubercle in the lung tissue itself, which, however, at the time may be undiscoverable to physical examination.

Inflammatory diseases of the lung substance, whether acute as in pneumonia, or chronic as in phthisis, do frequently bring about some serous inflammation in the superjacent pleura; but is it possible directly to connect inflammation of one portion of the deeper lung tissue with a pleurisy existing simultaneously at any distance from the site of the purely pulmonary lesion as cause and effect respectively? Truly I think not, and yet I believe the converse proposition to be a verity, as will appear in the sequel.

Is it probable that undiscoverable inflammatory mischief in the lung, which we must assume to be fairly beneath the surface of the organ, is able to produce a pleurisy? Central pneumonias are seldom accompanied by pleurisy until the physical signs reveal the fact that the zone of inflammation is nearing the serous coating of the organ.

Is it not possible that physicians have been putting the cart before the horse with regard to the connexion between pleurisy and pulmonary tuberculosis? Quite as tenable, and in my opinion much more acceptable, a theory is that the pleurisy is the primary lesion, and that the effect of the serous inflammation is so to impair the great function of the lung as to afford a suitable nidus upon which the tubercle bacilli may implant themselves. Let me elaborate this idea. It is recognized that the apices of the lungs are the happy hunting grounds of the tubercle bacillus. Why? The late Professor Coats of Glasgow, writing of phthisis in his *Manual of Pathology*, says, "The localization at the apex of the lungs of the earliest lesions is probably related to the fact that the apices of the lungs are the least expansile portions," and later he writes, "Remembering that the tubercle bacillus

is of slow growth, we may presume that it is more likely to obtain a footing when it is left undisturbed in parts where the air is more or less stagnant."

Wherefore we may take it that in the apical portions we have the parts of the lungs which are the most inaccessible to the purifying influences of the tidal air, for which reason, the germs of tubercle being once implanted thereon, there is nothing to disturb the progress of their growth, or to prevent the elaboration of their baneful influences.

When pleurisy affects the chest it leaves traces in the form either of thickened serous membrane or of inflammatory adhesions, or almost universally of both, which must have an influence on the expansile power of at least one part of the lung; grant this diminution in the power of expansion of a so affected area, and you admit the existence of a patch of lung tissue, analogous in functional characteristics to the apices, and therefore predisposed to invasion and attack by the germs of consumption.

This is most probably the manner in which the case under review has been attacked by the disease. It is possible, of course, that tubercle may have developed as a sequel to a traumatic hæmorrhage from contusion of the lung at the seat of injury, which would thus furnish a suitable soil for the growth of the invading bacilli, but the fact that there was no cough and no hæmoptysis for some considerable time after the infliction of the injury leads me to the idea that the tuberculous infection was in reality superimposed upon a deflated area of lung tissue consequent upon traumatic pleurisy.

In the treatment of the case there are several points of interest; the patient during the entire course of treatment was in a state of semi-starvation; in receipt of only 6s. 11d. per week as benefit from his friendly society, he contrived by means of cod-liver oil and pulmonary antiseptics reinforced by breathing exercises, not only to place something to the credit of his body weight, but to free himself, as far as physical and microscopical examinations could ascertain, from an attack of pulmonary tuberculosis.

It seems to me, as the outcome of observation, that if there is one thing in the treatment of this scourge above another to which due attention has not been given, it is the question of pulmonary physical culture. This seems to me to be the one method whereby this anchoring and consequent devitalizing of the pulmonary tissues by pleuritic adhesions may be rendered comparatively impotent.

I have for some time past taken the opportunities which have been afforded me of measuring the range of chest expansion in cases of pulmonary phthisis, and I find that it practically never approaches the normal or average of the healthy chest, which may be put at from $2\frac{1}{2}$ in. to 3 in. Anything between 1 in. and 2 in. is a very common range in cases of chest disease—which being the case, the question arises, of what use is all the fresh air in the universe to a man who, suffering from phthisis, is unable so to expand his chest as to permit the purifying influence of the air to reach the most ultimate alveoli of the lungs? In pulmonary physical culture, I believe, we have the means whereby this is to be effected.

I have had several cases in which treatment by this method combined with the exhibition of pulmonary antiseptics has proved remarkably beneficial. The case under consideration is one of these, but I should like to read short notes of a case which was treated by pulmonary gymnastics alone, and that too in a tainted atmosphere, with excellent results, inasmuch as it serves, more distinctly than those in which the treatment has been combined with drugs, to demonstrate the value of the purely physical treatment.

The patient, an overgrown lad of 18 years, had been troubled with a cough for only a few weeks; the expectoration accompanying the cough was scanty, but contained tubercle bacilli in abundance. It is unnecessary to detail the physical signs found on examination; suffice it to say that they were not exactly typical of a fully inflated apex solidified by tuberculous deposit, and led me to suspect that the left apex was in a condition most probably of apneumatosis, with a tuberculous infection superimposed upon the collapsed area. The range of chest expansion taken at the nipples was $1\frac{1}{2}$ in. Pulmonary antiseptics were prescribed, with cod-liver oil, but all were rejected from the beginning. Treated entirely by physical culture, in about three months' time his range of expansion had increased to 3 in., his cough gradually disappeared, and all trace of abnormality in the lung vanished. It is only fair to state that this treatment was carried out to the end in the very heart of our city. The lad is now—four years later—still in perfect health.

Breathing as a curative agent—that is, forced or dynamic breathing, by which is intended that mode of respiring in which inflation and deflation of the lungs, instead of being an

unconscious and involuntary act, is subjected to the dictates of the will and as far as possible brought under voluntary control—is no new method of treatment, for as a writer in one of our leading journals, writing on Full Breathing as a Therapeutic Agent, Restorative and Curative, says: "Frequently has attention being called in these pages to the great value of cultivating the habit and practice of filling the lungs to the utmost capacity as a curative measure in all scrofulous and other constitutional conditions.....In constitutional disease depending on malnutrition, and associated with impaired assimilation of the kind that is belonging to the deeper tissue renovation and repair, this practice of breathing in oxygen to the fullest extent is of remarkable curative powers."

There can be no doubt that deep and forcible rhythmic breathing, by means of which the lungs, which ordinarily only take in 20 or 30 cubic inches of air at each inspiration, may be made by practice to accommodate as much as six times the quantity, generates a large quantity of vital energy, and indeed forms of itself a superb physical culture; and quite apart from the physiologically vitalizing influence, its power as a scavenger of the uttermost interstices of the respiratory apparatus must alone commend it as a therapeutic agent in pulmonary tuberculosis.

Numerous as are the various points in the systems of dynamic breathing at present in vogue, all the exercises are perfectly simple and most of them have strong points in favour of their acceptance by exponents of the healing art.

Taken generally, respiratory gymnastics as recommended by professional physical culturists, are valuable exercises, and all have very much in common as regards the ultimate result.

With a general knowledge of these systems, any one who is familiar with the muscular mechanism of ordinary and extraordinary respiration may, with little trouble, evolve an excellent system of breathing exercises, or, in the presence of disease of the lungs, invent a scientific system of respiratory movements suitable to the special condition of the patient and the site of the disease.

As a side issue in connexion with the question of chest expansion, its bearing upon life insurance is of considerable importance. It has been a matter of surprise to me that all life offices do not make specific reference to this point in the catechism of their medical forms. Some ask definitely for a note of the chest measurements on expiration and on inspiration, but these offices would seem to be in a minority.

I would commend to the notice of "life" companies the advisability of demanding a fairly good chest expansion as an additional safeguard against pulmonary disease, especially in considering the lives of young adults, and would suggest as a passable minimum range of expansion a difference of $2\frac{1}{2}$ in. from forced expiration to forced inspiration.

On the side of the applicant for life insurance there is also something to be said. It is well known how great the stress is that is laid upon a tuberculous family history. It seems to me that this may in very great measure be discounted when the applicant himself is of good physique, of healthy appearance, and where the chest expansion is fully up to the normal.

THE SO-CALLED ANTHRACOSIS AND PHTHISIS IN COAL MINERS.

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In former years these conditions were stated to be prevalent in miners of coal; in fact, they were said to be so prevalent that they were classified by many statisticians in "occupational diseases" of this class of workmen.

Probably largely owing to the great improvements in mine-ventilation in this country, these conditions are very uncommon now; it is probable also that, as regards anthracosis at any rate, a considerable amount of misapprehension has led to the symptom "black spit" being taken as diagnostic of anthracosis when the diseased condition of the lung may have been due to something altogether different from coal dust.

Though all coal miners would show a blackening of the lungs due to the inhalation of coal dust, smoke from powder and other explosives, and soot from their lamps and candles, in the *post-mortem* room, this blackening or anthracosis is by no means necessarily due to a diseased condition of the lungs,