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TUBERCULOSIS AS A FOCAL DISEASE *

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It is sometimes important to get a new point of view for those serious problems that are most constantly with us. Like moving from one house to another, it brings to light things that have been forgotten, and loses others that were constantly in evidence. If we can do this with regard to tuberculosis, if we can bring out old facts that have been neglected and see them with a new significance, if we can lose some of our misconceptions that have been too constantly with us, hiding the real significance of what we observe, it may be a profitable use of our time.

GENERAL AND FOCAL DISEASES

A focal infection is an infection of some part of the body, localized by the defensive reactions of the tissues. Tuberculosis is the sum of the defensive local and general reactions of the organism against the tubercle bacillus, and the sequels of such reactions. We have commonly thought of tuberculosis as a chronic general disease.

In a sense we have no such thing as local disease in the human body. Injury to the smallest and most distant part produces general reactions of the whole organism, whether the injury be mechanical, chemical, or due to bacterial invasion or simply to strong emotion. That is what our connecting nervous and vascular mechanisms are for. Any imperfection or excess of such reactions, and also their most perfect adaptation to their purpose, constitute disease. They reach every part of the body. A professional colleague administered an ill-advised remedy to his daughter, resulting in her death. Three months later he pointed out on each of his finger-nails the transverse furrow which marked the influence of the nervous shock on every epithelial cell that had been in a certain stage of development.

What we call general diseases exhibit their characteristic changes only in certain portions of the body, as scarlet fever or measles in the skin and mucous surfaces, or typhoid in the intestinal lymph glands. Away from these regions of acute disturbance, physiologic function is carried on much as in health. Just as in France during the war, beyond the sound of the guns and out of the region of air attacks, the life of the community and the production of food continued along the same lines as it had in the years before the

German assault on civilization. At certain points war disorganized everything, destroyed everything, substituted its activity and accumulations for those of peace. The whole nation felt the effect of war; but its characteristic and obvious changes were localized. These were foci of war, and in quite a similar sense we speak of the foci of disease—of focal infections.

Every focus of infective disease is a point of attack and defense, of armed aggressive force. The opposing forces may be for the time accurately balanced, may sink into a state of siege, or only keep up the minor exchanges of trench warfare; but there is always present the aggressive disposition and the possibility of attack intended to annihilate all defense, and carry the warfare into new fields, there to produce a similar devastation. That is the nature and significance of every focal infection.

The typical tubercle is a typical focal infection. It is created by the reaction of the invaded tissue to the injurious influences of a colony of tubercle bacilli, sufficiently numerous and sufficiently virulent to establish themselves in that particular locality, and make their influence felt. It exhibits all grades of pathologic achievement, from massing of leukocytes and the proliferation of fixed tissue cells required to resist invasion, through degenerated epithelioid and giant cells to fatty, cheesy and calcareous masses of cell debris. It is a lesion preeminent in the length of the siege that the invading bacilli can withstand, maintaining their vitality to sally out when conditions become more favorable, and plant new colonies; thus to repeat the same process in other parts of the body. The single tubercle with these characteristics is the organic basis of tuberculosis; the essential feature of the disease, the one that all cases have in common, and the entity complete in itself. Tuberculous organs or regions are areas in which multiple foci have been massed.

The other phenomena that have been grouped in our minds to form the clinical picture of tuberculosis are occasional, incidental and temporary. They belong with coincident infections and complications, or are connected with a certain stage or particular locality of the focus of tuberculous invasion.

HISTORY OF TUBERCULOSIS

The history of our knowledge and recognition of tuberculosis is peculiar. Typhus and typhoid fevers, absolutely distinct diseases, were long confused. "Abdominal typhus," "typhus exanthématique" are terms that still remind us of the period when efforts were made to distinguish between them. Gonorrhea, syphilis and chancroid were all regarded as one disease. The terms "French measles" and "German measles" commemorate the classing with measles of a roseola or röteln. One dysentery was classed with

* President's address, read before the Medical Society of the City and County of Denver, Jan. 6, 1920.

another, as though they were the same disease, and not in some respects strongly opposed to one another. They still are called dysenteries in loose phraseology; much as the "gutta serena" of older writers embraced whole classes of affections of the deeper tunics of the eye.

But with tuberculosis quite the opposite was the case. Phthisis was one disease, scrofula another, Pott's disease and coxalgia were quite independent. Pulmonary hemorrhage, pleurisy, cold abscess, and lupus were not thought of as having any essential in common, or with meningitis, or chronic pyelitis, or recurring vitreous hemorrhage.

Only when the causative bacillus was recognized and studied, and established as pathogenic, did the finding of it with these different clinical manifestations connect them up into the general modern conception of tuberculosis. So much does locality modify these manifestations, that it never had occurred to the students of disease that they all were of one and the same origin.

When I studied medicine, scrofula was one of the most important, confused and obscure conditions described in the textbooks, and among the first to confront the young practitioner. It was suspected then, as was known a few years later, that it was nine-tenths tuberculous, and one-tenth other confusing chronic conditions. But it had come down to us from Hippocrates as a distinct pathologic diathesis, or constitutional disease resting on a diathetic tendency, for which there was as much prospect of discovering a specific cause as there was for syphilis or tuberculosis. The anatomic investigations of Virchow had only added to the confusion.

Hip joint disease, clinically recognized and studied for 2,000 years, had then been subjected to the microscopic investigation that identified the tubercle. In 1779 the famous surgeon, Percival Pott, had published "Remarks on That Kind of Palsy of the Lower Limbs Which Is Frequently Found to Accompany a Curvature of the Spine." This condition had been followed back toward its etiology far enough to recognize in it the ubiquitous tubercle. The tubercle itself had risen to due prominence in connection with pulmonary tuberculosis through the work of Bayle and Laënnec almost 100 years ago. And sixty-four years ago Villemin had shown that it was infectious.

Koch's discovery of the bacillus caused the rapid crystallization of our present views regarding tuberculosis; but the importance of the latent focus of infection, and its bearing on our theory of etiology and treatment are still not fully appreciated. Even the author of "Cellular Pathology" failed to recognize that what he called "caseous hepatization"—the tuberculous infiltration of Laënnec—was but the débris of the bacteriocellular tuberculosis battle.

THE TYPE LESION IN THE EYE

The single tubercle is the typical lesion of a focal infection; each is complete in itself. The crowding of many tubercles into one larger mass has always tended to obscure the real character of the disease, by raising issues and causing symptoms that were incidental and nonessential; it has tended to draw attention away from the smaller fields of the vital struggle in which the real battle of defense against the invader was being fought. But a single tubercle usually is not recognized in the living body. Generally a large number of single tubercles developed in the same region, as

in a lymph node or a lobule of the lung, have been spoken of as the focus of infection.

Much that applies to the single tubercle applies to the larger mass; but a better insight into the nature of the disease began with the anatomic study, the microscopic analysis of the single tubercle; and there are important lessons still to be learned by the study of the evolution of such a lesion, and the careful noting of the symptoms it causes during life. There is one place in the body where such a study is possible, the background of the eye; and when the ophthalmoscope has been properly and persistently employed in this investigation, we shall have learned some very important facts with regard to the pathology of tuberculosis. The tubercle present in the ocular fundus varies in dimensions, being 0.1 to 1 mm. or larger. It can be watched often from its beginning to its complete involution. It may be recommended as a subject for study to all who are interested in tuberculosis.

Choroidal tubercles, as a late symptom in tuberculous meningitis or general miliary tuberculosis, were recognized early in the use of the ophthalmoscope. The first report regarding them was made by Manz in 1858. But when they appear in these cases, the patient is nearing the fatal termination of his disease; and only their initial stage became familiar to ophthalmoscopists. If carefully looked for they may be found within a few days of the end, in 50 per cent. of these cases. About fifteen years ago, Stock, experimenting with rabbits, found that tubercles of the choroid, beginning with much the same picture already familiar in the human eye, ran a course that ended in patches of choroidal atrophy, similar to the patches of choroidal atrophy even more familiar in human eyes.

The same series of changes has now been followed out in human eyes, by numerous observers. The connection with tuberculosis in other parts of the body has been noted. The focal reaction of such lesions after subcutaneous injections of tuberculin has been watched. It is established that a certain proportion, and probably a large proportion of the patches of choroidal atrophy found in our routine ophthalmoscopic examinations, are patches of atrophy left by the healing of focal infections of tuberculosis. These atrophies show destruction of the normal tissue, pigment massing, ultimate thinning of scar tissue, sometimes hyaline change or even ossification; but no cheesy or calcareous débris.

More recently still we have come to identify tuberculous focal infections in the retina. For thirty odd years the clinical picture of recurring hemorrhage from the retinal vessels into the vitreous has been recognized as an important ocular condition, causing temporary and sometimes permanent blindness. Ligation of the common carotid has been done for it, sometimes apparently followed by the desired result, but more often by failure.

We know now that many of these hemorrhages, probably all in a distinct clinical group, are due to tuberculous focal infections in the retina. The hemorrhages in some cases are not massive, causing blindness and shutting off the view of the basic lesions with the ophthalmoscope, but are small enough to permit the watching of the causative lesion. In the Colorado Ophthalmological Society we have had the opportunity of watching several of these cases for periods running one, two or three years; and the observations are full

of interest, because of the light they throw on the focal infections of tuberculosis in general.

The retinal tubercle is generally clearly connected with a blood vessel: either an artery or a vein, but more frequently the latter. The vessels thus involved vary from 0.01 to 0.1 mm. in diameter. In the beginning the vessel appears normal, except that at the seat of the lesion it is covered by a yellowish white or grayish white, rounded cloud, with an indefinite margin. This area reaches its full size in a very few days. On either side of the tubercle the appearance of the vessel may remain about normal, or may change slowly. The arteries commonly show little alteration, except that the perivascular sheath may become visible as white lines parallel to the blood column. The veins are more likely to become dilated in limited portions, which may be several millimeters in length. Such a dilated portion may have three or four times the diameter of the normal vein at either end of it; and the dilated part may end quite abruptly. It is as though that part of the venous wall had been weakened by some noxious influence exerted on it, while other parts of the wall remained healthy.

After many days or several weeks, newly formed vessels are seen on the surface and periphery of the tubercle, attended with some increase in the size of the mass and more clouding of its edges (added exudates). The vascularity includes all sizes of vessels from swollen capillaries (which are easily distinguishable with the ophthalmoscope) to vessels almost as large as the trunk on which the tubercle is located. Then, very gradually the reddish gray area shrinks, becomes lighter in color, less vascular, and more transparent so that the fundus red shows through. Finally, the lesion fades away completely, leaving the vessels, the choroid and apparently the retina in the same condition as before the attack. This fact of complete resolution of some retinal foci of infection seems of great importance in its bearing on the possibility of complete healing of tuberculous lesions elsewhere in the body.

More frequently, the stage of peripheral vascularity and exudate does not go on to complete resolution. The gray mass becomes whiter but not transparent. It extends in certain directions, developing into a band or connecting bands of brilliant white fibrous tissue, on the surface of which stand out sharply a reduced number of blood vessels, often still quite tortuous. This condition, known as retinitis proliferans, appears to be quite permanent. It has been observed many years after the original focal infection and period of hemorrhage.

The development of such masses of white fibrous tissue generally, perhaps always, follows hemorrhage. Hemorrhage is at first quite absent from these retinal lesions, although in most cases the loss of vision caused by hemorrhage is the first thing that brings the patient under observation. This is extremely interesting when we remember the long controversy in which many famous names were marshaled in support of the view that hemoptysis was the cause of phthisis. It seems always to be present in cases of retinal tuberculosis; and it is probable that in a majority of cases, massive hemorrhage occurs, arresting attention by great reduction of vision.

The hemorrhage is first observed several days or weeks after the first retinal lesion. In Finnoff's case, which was seen very early on account of corneal lesions

and eye strain, the first hemorrhage was found at about the fourth week. From the time they begin they continue to recur so long as the disease remains active, often for many months or years. The tendency to the formation of white fibrous tissue is closely connected with the occurrence of relatively large hemorrhages. Hemorrhage, so far from being the cause of the disease, is one of the defensive resources of the organism, although very disastrous to sight when occurring in this situation. I have twice seen it occur within forty-eight hours after therapeutic subcutaneous doses of tuberculin.

The focus of infection may occur in any part of the eye. In the skin of the lids it has the varied characters of lupus, and in the conjunctiva almost as wide a variety. In both of these structures the lesion is apt to depart rather widely from the typical tubercle; both here and in tuberculosis of the lacrimal passages it is generally difficult, and sometimes impossible, to distinguish the bacillus by the usual staining methods. I would suggest that in these lesions the search be carried on with the help of other than the Ziehl stain. In the cornea, a nonvascular tissue, tuberculosis generally appears as an extension from the anterior chamber, iris or ciliary body. Occasionally the focus has seemed to be originally in the substance of the optic nerve, although much more commonly in the neural sheaths.

UNRECOGNIZED TUBERCULOUS INFECTIONS

From what has been observed in the eye, the part of the body most completely open to observation, the statement seems justified that the tuberculous focus of infection may be found, and may first attract attention, in any organ or tissue of the body. This is generally admitted. What is not generally appreciated is the fact that tuberculous focal infections do occur and pass unrecognized in other parts of the body more frequently than they do in the lungs, lymph glands, spine and hip joint, where they are generally recognized.

The great obstacle to the recognition of a tuberculous focal infection where we are not looking for it has been the fact that there was no tuberculosis where we expected to find it. In one case of ocular tuberculosis, failure to react to tuberculin tests and the absence of any signs of the disease in lungs, bones, joints or notably enlarged glands was supposed by a competent internist to rule out tuberculosis. But a few months later the opening of the skull for organic brain disease revealed a tuberculous meningitis. The diagnostic use of tuberculin is known to fail us sometimes in pulmonary and general military tuberculosis. We must admit that its negative showings do not rule out a tuberculous focus of infection in some other part of the body, where such a focus would be less likely to be thought of.

It may be that Naegeli's statistics, showing that, up to the age of 18, 97 per cent. of all persons coming to necropsy have suffered from some focus of tuberculous infection, do not apply generally, and exaggerate the prevalence of such infections. However, only a belief in some such prevalence will eliminate a large number of errors of diagnosis in the direction of failure to recognize such lesions.

When, a few years ago, I had tuberculin given for a chronic choroidal lesion, the reaction of pain and swelling in the metatarsophalangeal joint of the great toe helped to confirm the diagnosis; it revealed a lesion that otherwise would have escaped attention, or its

significance would never have been thought of by the patient. Probably this "confirmation" would have left the diagnosis of tuberculosis subject to a great deal of skepticism on the part of doubting colleagues. But such skepticism would hardly have stood up against the severe tuberculous pleurisy that this patient developed with a new focus in the choroid six years later.

My experiences with tuberculosis have disposed me to look widely for its foci of infection, and accept its great chronicity and prolonged latency or arrest. A woman was supposed to have phthisis in her early twenties, and early death was anticipated. One of her brothers and a sister had died of the disease. But her husband, a farmer, got her a horse and buggy which were always kept for her own use. She scandalized her country neighbors by the amount of time she spent driving about. She always had a cough; and when she died at over 75 years of age, necropsy revealed cavities, calcareous and cheesy nodules, and other foci which were active.

Early in my general practice, I assisted at a necropsy of a patient who died of phthisis; the attending physician explained to us that he expected to find in one kidney the evidence of a tuberculous infection that he had diagnosed as a kidney lesion more than twenty years before. We found there the calcareous and cheesy masses, with active tubercles. Another patient had suffered and apparently recovered from a tuberculous pleurisy ten years before the onset of discoverable pulmonary symptoms that ended three years later in death from phthisis. If there is one lesson of my professional life that stands out more strongly than any other, and which seems to deserve all the emphasis that can possibly be put on it, it is that an enormous number of tuberculous focal infections occur in persons not considered tuberculous by themselves, their friends, or even their physicians.

Perhaps not every one is tuberculous; but successful diagnosis requires that every one presenting symptoms which might arise from a tuberculous focal infection should be assumed tuberculous until the contrary is proved. Above all, we must get away from the error of letting family history, recent exposure, favorable conditions of life, or apparent recent health, influence our judgment of the probabilities of the existence of a focus of tuberculous infection somewhere within the body. All these things are invoked to prove that a lesion is not tuberculous; and they all tend to prevent the recognition of unusual or minor infections.

PATH OF INFECTION

Some very practical points are connected with this conception of tuberculosis as a focal infection. It has often been asked whether the lesion was primary or secondary, and on the answer to this it was sought to decide the plan of treatment. Excision of tuberculous foci in glands, bones, conjunctiva or eyeball has been fairly tried, sometimes with results a little better than those of nonoperative treatment, but in some cases with results distinctly worse.

There has been at times, and in certain people, an almost hysterical fear of the "contagiousness" of consumption, leading to folly and inhumanity in the treatment of those manifestly suffering from phthisis. Health regulations have been ruthlessly enforced by officials who carried in their own persons the active lesions or the latent focal infections of tuberculosis. Such fear and such regulations have been based on

suppositions regarding the channels by which tuberculosis is usually transmitted and enters the human body.

When we come to examine the facts, it becomes evident that we know very little about the path of infection. Two portals of entry have received much attention, the respiratory tract and the alimentary canal. But the facts that stand prominently forth in all the accumulated literature are: The tubercle bacillus gets entrance to the body usually long before any of the effects of its presence are recognizable, and often makes itself known first in the interior of the eye, in the head of the femur, or the bodies of the vertebrae. It has been known to enter the body without giving the slightest evidence at the point of entrance.

Possibly when the first manifestations are in a chain of lymph glands, as in the neck or mesentery, these point correctly to the portal of entry. But at the point of entrance there is no evidence of disease; primary tuberculosis of the tonsils or of the mucous lining of the intestine is of extreme rarity. In the great mass of cases the involvement of these surfaces is manifestly late and secondary.

Even in the lungs the evidence of lesion at the point of entrance is contradictory and inconclusive. In the human being, pulmonary tuberculosis is always discovered after the essential lesion has reached an advanced stage of evolution; or it is recognized after the lesion has run its course, broken down and is discharging bacilli. In animal experimentation there are great gaps between the inhalation of the bacilli, and the finding of lesions in the lung. With lupus, in many respects an aberrant form of tuberculosis, the beginning and course of the lesions ally it with internal focal infections rather than suggest that it is an initial lesion.

Only in the wartlike lesions that follow slight injuries to the hands of postmortem workers, and a few cases of tuberculosis of the conjunctiva, is the preponderance of evidence in favor of lesion at the site of entrance. There is just one case on record of tuberculous ulcer of the cornea following lesion from the nail of a tuberculous child.

The evidence we now have indicates that the point of entrance plays little part in determining the location of the primary focus of infection, unless possibly when this is some lymph gland. The bacilli find their way into the circulation without provoking reaction; and in some favorable situation, some point of lowered resistance, establish a colony, a focus of infection. The possibility of the development of such a lesion, and of its subsequent power for extension and general harm, lies in insufficient resistance of the body tissues.

IMMUNITY

The great majority of human beings, at least those living under the conditions of civilization, harbor tubercle bacilli at some time in their lives, just as every country that has attained a social organization harbors anarchists. It may be wise and right to reduce and keep down the infection to a minimum. But for the mass of us the only effective defense that stands between health and a generalized, acute military tuberculosis is a certain amount of tissue resistance, of tissue immunity; and it is toward understanding and building up this resistance that the war on tuberculosis must be more and more directed, if it is to be successful.

Some things we know about it: the value of outdoor living, sunshine, rest, alimentation, a cheerful disposition toward the events of life, the value of injecting a specific provocative (tuberculin), when this is not

furnished in sufficient quantity by the focus of infection. But surely there is a great deal more to be learned about this immunity; there is an immense field of labor for the medical profession, in forcing on the community the importance of the facts about it that we already know, and it is the duty of our civilization to see that by legal enactment, by social custom, by individual example, by universal teaching in our educational system, our knowledge is applied in the life of the people.

CONCLUSIONS

Briefly, we have learned that:

The different forms of this focal infection are one disease—the unity of tuberculosis.

A very large proportion of those who suffer such infections never suffer the conditions that were formerly recognized as tuberculous—phthisis, scrofula, bone disease, etc.

At its point of entrance, the tubercle bacillus very rarely provokes any reaction or excites a noticeable lesion.

Foci of infection are established within the bodies of a great many people, where they are kept in check by tissue resistance.

A MODIFIED TECHNIC IN OPERATION FOR OBLIQUE INGUINAL HERNIA

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This modification of standard technic for the operative cure of oblique inguinal hernia has been developed over a period of time. It is a product of gradual evolution, in which the basic features are classical; but by a successive adaptation and combination of features that in my experience and observation have been found desirable, the classic has undergone changes and variations. The results have proved quite uniformly successful and satisfactory.

DETAILS OF TECHNIC

STEP 1.—After the patient comes to the operating table, the site of the operation is twice painted with 5 per cent. picric acid in 95 per cent. alcohol. The landmarks of the operative field are located: the anterior superior spine of the ilium, pubic spine, middle of the base of the penis, Poupart's ligament, and the external inguinal ring. An

Fig. 1.—Exposure of aponeurosis of left external oblique, showing line of incision not entering the external ring. Ilio-inguinal nerve emerging through external ring.

Fig. 2.—Incision has been made in aponeurosis, exposing internal oblique muscle, cord and ilio-inguinal nerve.

Fig. 3.—The internal oblique and transversalis muscles have been pulled upward, and peritoneum is caught with forceps; cord not disturbed.

The overcoming of tuberculosis is chiefly a matter of building up and sustaining immunity by wise and careful living.

318 Majestic Building.

Resolutions on Use of Vaccines in Influenza.—At a meeting of the sanitation committee of the Allegheny County Medical Society, a resolution was adopted to cooperate to the fullest extent with the Department of Public Health of Pittsburgh with whose action this committee is in complete accord. Another resolution provided that the committee indorse a request suggested by Major Davis that all physicians in the city of Pittsburgh report their cases of influenza. The committee announces its position with reference to the use of prophylactic vaccine in connection with the present possible epidemic of influenza as follows: 1. There is no evidence to show that any of the so-called prophylactic vaccines which have been used will prevent influenza. 2. No physician or other person has a right from the data on hand to guarantee protection to any individual because of the administration of a prophylactic vaccine for influenza or pneumonia. 3. It is possible that the antipneumococcus vaccine has value in the prevention of pneumonia. 4. Prophylactic vaccination to be protective should be completed before exposure to the disease.—*Bulletin Allegheny County (Pa.) Medical Society.*

incision is made through the skin and superficial fascia parallel to and about three-fourths inch above Poupart's ligament, extending from the external ring upward and out to about one inch beyond midline of Poupart's ligament. Superficial vessels are caught up and ligated. Vessels liable to be severed are the superficial epigastric and superficial external pudic arteries and veins. This incision exposes the aponeurosis of the external oblique and the external ring (Fig. 1). The aponeurosis should be well cleaned by wiping back the superficial tissues to Poupart's ligament below and about $1\frac{1}{4}$ inches above the incision. Care must be taken not to injure the ilio-inguinal nerve, which sometimes emerges through the aponeurosis above the external ring. The wound is thoroughly dried before the next step.

STEP 2.—An incision is made through the aponeurosis of the external oblique muscle, beginning about one-fourth inch above the external ring and continuing upward in the direction of the fibers of the aponeurosis or slightly across them toward Poupart's ligament to a point just beyond the internal ring (Fig. 2). By cutting slightly diagonally across the fibers, the exposure of underlying structures is facilitated. With the handle of the knife the inside of the aponeurosis is cleared first downward along the shelf of Poupart's ligament from the internal ring to the pubic spine, then upward exposing the internal oblique muscle, the internal ring, the conjoined tendon and the sheath of the rectus. Care must be taken not to injure the ilio-inguinal nerve