THE IMPORTANCE OF THE STUDY OF SYMPTOMS

WITH A DISCUSSION OF MACKENZIE'S LAW GOVERNING THEIR PRODUCTION

F. M. POTTENGER, M.D.
MONROVIA, CALIF.

THE IMPORTANCE OF THE STUDY OF SYMPTOMS

WITH A DISCUSSION OF MACKENZIE'S LAW GOVERNING THEIR PRODUCTION

F. M. POTTENGER, M.D.
MONROVIA, CALIF.

This being preeminently the laboratory age of medicine, its progress is estimated largely by laboratory standards. Studies based on clinical observation alone receive but scant attention, because they are not in line with the present predominating medical thought. Such judgment, however, is not necessarily correct. In each age medicine, the same as all other sciences, has considered that the thought prevailing at the time was correct. Sydenham, writing in 1685, spoke of "modern medicine" with the same praise that we speak of it today. We can make most progress by recognizing that medicine is a continually unfolding science and by not being afraid to investigate along lines somewhat different from those already followed. We must not be slaves to the existing order of things, but must recognize progress no matter how it comes, and realize that it often comes along lines unsuspected and by some one doing what previously had seemed impossible of accomplishment. While the laboratory has been the favorite field of investigation as far as the discovery of medical facts is concerned in the recent past, yet medicine is not a laboratory study alone. It is a study of the disease and pathologic processes produced by it, on the one hand; and the patient and the way in which he reacts to it, on the other hand. The latter, while by no means the less important, has been almost entirely neglected during recent years with the result that clinical observation has been relatively barren of results when compared with laboratory investigation.

* Read before the Section on Practice of Medicine at the Seventy-Second Annual Session of the American Medical Association, Boston, June, 1921.

No matter what our purpose in medicine whether it be preventive or curative, we cannot progress without having clinical pictures of diseases. We must have a description by which we may recognize that which is to be cured or prevented. This point has been ably made by MacKenzie. One of our great faults as clinicians today is that we have ceased to be observers and students of the sick man, and have assumed the rôle of interpreters of laboratory data, thus recognizing the laboratory as being the essence of medicine. Such a course will not bring the greatest degree of progress. Instead of being confused and overpowered by the revelations of the laboratory, clinicians should have been stimulated by the mass of newly discovered facts to the making of better clinical observations and the better interpretation of disease pictures.

A comprehensive understanding of symptoms and the manner in which they are produced is essential to the understanding and treatment of disease. The study of symptoms is difficult; and clinicians, following the lines of least resistance, have been apparently assuming that the laboratory would make such a study unnecessary. On the contrary, their study and comprehension is as necessary or even more necessary than if these laboratory branches had never been developed. So, now, after three or four decades of marvelous discoveries in pathology, bacteriology and chemical pathology, medical science is face to face with the fact that one cannot successfully practice medicine by the knowledge gained from these studies alone; and further, that they are of little value to medicine except as they are applied to the patient. We now face the duty of intelligently applying laboratory data to clinical medicine, and this can only be done by acquainting ourselves with the human laboratory as thoroughly as we have with the physical laboratories, and understanding how pathologic stimuli produce pathologic changes in anatomic and particularly in physiologic processes.

Disease expresses itself through symptoms. We recognize a given disease, if at all, by grouping symptoms together and finding that certain ones are peculiar to one disease and others to another. It is surprising, as MacKenzie so well points out, how few symptoms are actually understood, and in how few diseases the

full clinical picture is known. It is further surprising how uncertain medical men really are in their diagnoses. The uncertainty is not always due to not using the available data either, but in many instances our knowledge is limited and our ideas far from clear.

Patients suffering from pulmonary tuberculosis, for example, because of a failure on the part of the physician to grasp the reflex nature of many of the symptoms, are often treated for diseases of the organs which show the reflex disturbances in function without the lung being suspected. They often show irritation in the larynx, with hoarseness and cough, for which they go to throat specialists who, finding abnormalities in the tonsils and septum, think these structures are causing the symptoms, and operate with a result that in many instances the activity in the tuberculous process is hastened. Others go to the gastro-enterologist because of reflex digestive disturbances, and are treated by them sometimes to advantage and at other times to disadvantage. The patient with pleurisy at the base of the lung sometimes shows pain and rigid muscles down over the abdomen, and if a surgeon is called, an operation is often advised instead of a diagnosis being made.

Such errors and shortcomings are evident in every field of practice. These are cited merely as examples. We are disturbed and sorry for their occurrence; but until we understand symptoms better and know how they are produced, such errors will continue to be common. The exploratory incision may at times be necessary, because of our lack of knowledge, but it is a reproach to medicine. Laboratory methods alone cannot prevent errors in the practice of medicine. They can be greatly reduced, however, by adding to present laboratory knowledge an understanding of the manner in which disease expresses itself in the human body, that is, by understanding how disease interferes with the normal smooth running of the human machine in the production of symptoms. To this end an understanding of the nervous system, particularly the vegetative, is essential.

A disease process, no matter what its nature, causes biochemical reactions in the body. While the ultimate nature of these reactions is not wholly clear, yet we know that they result in nerve stimulation, which in

turn causes altered physiologic action or symptoms. If we could only understand what nerves are disturbed by each disease producing factor and their relationship to the body functions, we would be much farther advanced in our understanding of disease than we are now.

Fundamental to the understanding of symptoms is a knowledge of how normal or physiologic action is produced. In a previous paper,[1] in discussing the causation of symptoms, I called attention to principles which I believe to be fundamental. If symptoms are disturbances in normal physiologic action, then we must know two things: (1) through what agencies normal action in the body is produced, and (2) from what sources these controlling agencies are subject to modifying influences.

It is probable that every cell of the body is presided over by nerves and stimulated to action and inhibition of action through them. Aside from this there are normally found in the body many substances of a chemical nature, some of which we call internal secretions or hormones which have to do with normal physiologic action. Some believe that these act through the nerves, others that, some of them at least, have an independent action. However, if all cells are presided over by nerves, and action and inhibition of action are the only two functions which can be performed, then hormones act either through or with nerves, and the effect on the organism is the same as though it were due to nerve stimulation. When we know the action of nerves in a given tissue and the relationship between the different chemical substances and the nerves, then we shall have a basis for understanding physiologic and pathologic activity in structures. This line of investigation should be prosecuted with zeal in the immediate future.

Symptoms of disease are far more commonly expressed in disturbances of function on the part of those tissues presided over by the vegetative nervous and endocrine systems, than in those presided over by the voluntary nervous system. This fact unfortunately reacts badly on medicine today because the vegetative systems have received so little attention by clinicians who are attempting to elicit and interpret symptoms. The importance of these systems, presiding, as they do,

1. Pottenger, F. M.: The Patients Reaction, A Neglected but Important Phase in the Study of Medicine, Ann. Med., April, 1920.

over the contraction of smooth muscle and glandular secretion, thus controlling digestion, metabolism, circulation and procreation and partly controlling respiration, the ingestion of food and the ejection of the unutilized portions from the body, must be evident to every student of disease. The fundamental facts regarding the vegetative nervous system as described by Gaskell [2] and the integrative action of the nervous system as described by Sherrington,[3] together with a general knowledge of the action of the various hormones,[4] should be common knowledge of teachers of medicine, and clinicians who desire to intelligently understand symptomatology.

Nerves may be stimulated to action by impulses from without or within, and these stimuli may be either of a physical or psychic nature.

Based on these facts I postulate that symptoms of disease may be due to abnormal stimulation of the nerves or endocrines and that the stimuli which produce them may be either of physical or psychic origin.

This accounts for the symptoms found as a result of both abnormal physical and psychopathologic states. I realize that this in no way attempts to explain the nature of the primary biochemical reactions which result in nerve or endocrine stimulation, but it does attempt to show the manner in which the symptoms are produced, the bridge over which a given cause acts in order to produce an effect.

It is a physiologic conception that equilibrium or normal action in the body is maintained through reflex nerve action. Based on this conception, MacKenzie [5] has recently suggested that most symptoms of disease are due to disturbances in normal reflexes. He has announced this as the law underlying the production of most of the symptoms of disease. In this he considers that hormones and all other chemical substances which affect function act through the nervous system. He

2. Gaskell, W. H.: The Involuntary Nervous System, New York, Longmans, Green & Company, 1916.

3. Sherrington, Charles S.: The Integrative Action of the Nervous System, New York, Charles Scribner and Sons, 1906.

4. Paton, Noel: Regulators of Metabolism, London, the MacMillan Company, 1913. Falta, Wilhelm: The Ductless Glandular Diseases (translated by Meyers), Philadelphia, P. Blakiston Sons and Company, 1916. Biedl, A.: Innere Secretione, Berlin, Urban & Schwarzenberg, 1910.

5. MacKenzie, Sir James: The Theory of Disturbed Reflexes in the Production of Symptoms of Disease, British M. J., Jan. 29, 1921.

further considers that the act of perception of pain is the effector component of the reflex. The far reaching effect of this conception on the understanding of disease and its symptomatology must be evident to all.

This conception goes farther than the suggestion recently made by me [1] that symptoms are due to disturbing the normal equilibrium maintained by the nervous and endocrine systems. Both, however, have the same purpose, that of showing what it is that carries the influence of an effecting stimulus, whether it be a micro-organism or an injurious chemical substance, and expresses it as a disturbance in equilibrium which we call a symptom. Both suggest the path through which an ulcer in the stomach causes pain in the upper left quadrant of the abdomen; an inflamed lung produces flushing of the face; a toxemia causes malaise, lessened endurance and an inhibition of appetite and digestion. They both suggest that all such symptoms as leukocytosis, acidosis, protein retention, hyper glycemia and hypoglycemia and glycosuria, the same as pain and disturbed motor and secretory functions, are not entities, but results of disturbance in physiologic action, and have back of them a disturbance in the normal nerve or nerve and endocrine stimulation.

Such a conception shows that the study of the nervous system, particularly the vegetative system, and the endocrine system is of paramount importance, if we would understand through what agencies the patient reacts to disease. It is the duty of medicine to prosecute the study of these problems with the same vigor that it has attacked the laboratory problems which have arisen in the course of study of pathology, bacteriology and chemical pathology, and at the same time prosecute the search for the nature of the primary reaction between morbific elements and body cells.

I first obtained an idea of the importance of these problems when in 1908 I discovered the spasm of the muscles of the shoulder girdle as a symptom of tuberculous inflammation of the lung.[6] It required many months of search before a satisfactory explanation was

6. Pottenger, F. M.: A New Physical Sign Found in the Presence of Inflammatory Conditions of the Lungs and Pleura, J. A. M. A., March 6, 1909; Musklespasmus und Degeneration, Ihre Bedeutung für die Diagnose intrathorazischer Entzündung und als causal Fakotr bei der Produktion von Veränderungen des Knöchernen Thorax und leichte Tast Palpation, Brauer's Beitr. z. Tuberk. (Brauer's) **22**: 1, 1912.

forthcoming. While due to the same cause as the spasm of the abdominal muscles in appendicitis, gall-bladder diseases and ulcer of the stomach, yet I was surprised to learn that few medical men had any conception at all of how these reflexes were produced. Later I realized it more fully when in 1913 I suggested an eitologic classification of the symptoms of pulmonary tuberculosis.[7] By this classification, I placed the many symptoms which are commonly met in pulmonary tuberculosis in three groups. Instead of twenty-five or more entities, I saw that two factors were operating to cause nearly all of them—the toxins and the local stimulation of the nerve endings in the lung. A third group, which consists of two symptoms, sputum and hemorrhage, and two groups of symptoms, tuberculous pleurisy and tuberculous bronchitis, results from the local process. Still later I showed how muscle spasm, pain and degeneration caused by intrapulmonary inflammation could be differentiated from the spasm, pain and degeneration caused by pleural inflammation by knowing the difference in nerve supply and the difference in mediating neurons.[8] This same principal can be extended to other diseases and to every important organ of the body, as I have endeavored to show.[9] I can illustrate the value of understanding symptoms best by a study of pulmonary tuberculosis because I have given it most thought.

Disregarding the distinction which is often made between symptoms and signs and between subjective and objective symptoms, and classifying all disturbances of physiologic equilibrium which present in tuberculosis as symptoms, we have the grouping presented in the accompanying tabulations, which contain most of the common symptoms and some of those found less frequently. This is a modification and amplification of the groups which I have hitherto published.

With our present knowledge of the vegetative nervous system, we are able to offer a fairly complete

7. Pottenger, F. M.: The Etiological Classification of the Symptoms of Pulmonary Tuberculosis, Northwest Med., January, 1914.

8. Pottenger, F. M.: Symptoms of Visceral Disease, St. Louis, C. V. Mosby & Co., 1919, p. 167; The Significance of Limited Respiratory Movement, and the Viscero-Motor, Viscero-Sensory and Viscero-Trophic Reflexes, in the Diagnosis of Pulmonary and Pleural Inflammation, Am. Rev. Tuberc., February, 1919.

9. Pottenger, F. M.: Symptoms of Visceral Disease, St. Louis, C. V. Mosby & Co., 1919.

analysis of these symptoms, an analysis which clarifies the disease picture and furnishes an intelligent grasp of what is happening to the patient's physiologic mechanism, or, according to MacKenzie, how his normal reflexes are being disturbed.

I would suggest the following explanation of the common symptoms of tuberculosis: In Group I, we find those symptoms which results from toxemia. They may appear at any time in the course of the disease, yet when we realize that they cannot appear until sufficient toxins are being thrown into the blood stream to upset the normal nerve equilibrium, we are forced to conclude that the process is already well established.

TABLE 1.—SYMPTOMS OF PULMONARY TUBERCULOSIS

GROUP I. SYMPTOMS DUE TO TOXEMIA

Caused by Harmful Stimulation of	Symptoms
I. Nervous system II. Endocrine system	1. Malaise 2. Lack of endurance 3. Loss of strength 4. Nerve instability
III. Sympathetic nervous system IV. Sympathicotropic endocrines, particularly suprarenals and thyroid	5. Diminished digestive activity 6. Increased metabolic rate 7. Loss of weight 8. Increased pulse rate 9. Night sweats 10. Rise of temperature 11. Leukocytosis

This group apparently has two factors which enter into its causation, harmful stimulation of the central nervous system and harmful stimulation of certain endocrine glands.

Malaise, lack of endurance, loss of strength, and nerve instability may result from many things acting harmfully on the central nervous system and certain glands of internal secretion, such as overwork, exhausting influences of many kinds, worry and neurasthenia, as well as toxins.

Diminished digestive activity, the increased metabolic rate, loss of weight, increased pulse rate, night sweats and rise of temperature represent disturbances in the physiologic processes which are caused by stimulation of the sympathetic component of the vegetative nervous system and those glands of internal secretion, particularly the suprarenals and thyroid, which are known to belong to the sympathetic system. The common blood

changes of hyperleukocytosis in which an increase in the polymorphonuclears is the striking picture, is undoubtedly due to forcing these out of the bone marrow, as a result of stimulation of the sympathetic nervous system.

TABLE 2.—SYMPTOMS OF PULMONARY TUBERCULOSIS

GROUP II. REFLEX SYMPTOMS FROM THE LUNG

		Symptoms	Efferent Nerves
Inflammation of lung	Afferent nerves	Hoarseness	Laryngeal nerves
		Laryngeal irritation	Superior laryngeal nerve
		Cough	Laryngeal and nerves to all expiratory muscles with inhibition of nerves to inspiratory muscles
		Inhibition of heart	Motor fibers of cardiac vagus
	Afferent through (vagus) Parasympathetics	Increased muscle tonus and glandular secretion in gastro-intestinal canal	Motor fibers of gastric and intestinal parasympathetic
		Flushing of face	Sensory fibers of fifth trigeminus
		Spasm of sternocleidomastoideus and trapezius	Spinal accessorius
		Deviation of tongue from median line	Hypoglossus
		Degeneration of facial muscles	Trigeminus
	Afferent through sympathetics	Flushing of ear	Third sensory cervical
		Dilatation of pupil	Motor from Budges center (lower cervical and upper dorsal)
		Spasm of muscles of shoulder girdle and diaphragm	Cervical motor nerves, second to eighth
		Lessened motion of chest wall, partly due to muscles spasm as above	Cervical motor nerves, second to eighth
		Pain above second rib and spine of scapulae (superficial)	Cervical sensory nerves, particularly third, fourth and fifth
		Pain in muscles of shoulder girdle (deep pain)	Cervical sensory nerves, second to eighth
		Degeneration of skin and subcutaneous tissue above second rib anteriorly and spine of scapulae	Cervical sensory nerves, third, fourth and fifth
		Degeneration of muscles of shoulder girdle	Cervical sensory and motor, second to eighth

In Group II we find all symptoms which are caused reflexly by sensory stimuli arising in the inflamed lung. This gives us two groups of reflexes, one in which the stimulus travels centrad over the sympathetics, the

other over the parasympathetics. Those reflex symptoms which are best known are produced by the stimulus traveling centrad over the vagus of the parasympathetic system, to mediate with other nerves in their production as follows: (1) Hoarseness, through mediating with the superior and inferior laryngeal nerves. (2) Irritation in the larynx, a sensory disturbance through the superior laryngeal nerve. (3) Cough, a very complex reflex consisting of (*a*) a sensory disturbance in the larynx through the superior laryngeal nerves; (*b*) a closure of the glottis through the superior and inferior laryngeal nerves; (*c*) a contraction of the expiratory muscles (internal intercostals and abdominal) through the dorsal spinal nerves; (*d*) relaxation of the inspiratory muscles (diaphragm, external intercostals, intercartilaginous and muscles of the shoulder girdle), through the cervical and dorsal spinal nerves. (4)

TABLE 3.—SYMPTOMS OF PULMONARY TUBERCULOSIS

GROUP III. SYMPTOMS DUE TO THE PROCESS PER SE

Frequent and protracted colds (tuberculous bronchitis)
Spitting of blood
Pleurisy (tuberculosis of the pleura)
Sputum

Cardiac inhibition through cardiac branches of the vagus. This is sometimes noticed in early cases, but more often in later cases when inflammation in the lung is very marked, such as when abscess is forming. (5) Gastro-intestinal symptoms. Those of increased muscle tonus and increased secretory activity, produced through the gastro-intestinal branches of the vagus. (6) Flushing of the face, due to dilatation of the vessel through the trigeminus. (7) Spasm of the sternocleidomastoideus and trapezius muscles, through the accessorius. These muscles also receive impulses which result in spasm through the sympathetics mediating with the cervical motor nerves as given in No. 12. (8) Deviation of the tongue toward the side of involvement through the hypoglossus. (9) Degeneration of the facial muscles, through the trigeminus.

Symptoms which are not so generally recognized but which are of the greatest importance in diagnosis are those in which the afferent impulses travel centrad over the sympathetics, the efferent impulses expressing

themselves through various nerves as follows: (10) Flushing of the ear, through the third cervical nerves. (11) Dilatation of the pupil, through the upper sympathetic nerves, taking their origin from Budge's center in the lower cervical and upper dorsal portions of the cord. (12) Spasm of muscles of the shoulder girdle and diaphragm, through cervical motor nerves second to eighth (see No. 7 above). (13) Lessened motion of the chest wall, partly due to muscle spasm as in No. 12 above, through cervical motor nerves, second to eighth. (14) Pain (superficial) above second rib anteriorly and spine of scapulae, through cervical sensory nerves, third, fourth, and fifth. (15) Pain (deep) in muscles of shoulder girdle, through cervical sensory nerves second to eighth. (16) Degeneration of skin and subcutaneous tissue above second rib anteriorly and spine of scapulae, through cervical sensory nerves third, fourth, and fifth. (17) Degeneration of the muscles of the shoulder girdle, through the cervical sensory and motor nerves second to eighth. Aside from these there are countless reflexes which still remain to be described.

Such a classification permits us to assign different values to different groups of symptoms. Symptoms of Group I may be present in toxemia no matter what the source and consequently, alone, cannot be relied on as having diagnostic value. Those of Group II express themselves in structures which are in reflex connection with the lung, through both the sympathetics and the vagus of the parasympathetic system. Many of these have important diagnostic weight now that we know the nerve paths. Their diagnostic importance is increased, however, when smyptoms of Group I are also present, or when the latter have been previously present. They also have suggestive value when combined with those of Group III. Group III is particularly suggestive, either alone or in combination with Groups I and II.

It will be seen from this discussion that being able to classify the symptoms according to their etiology simplifies diagnosis very much, because we are able to assign the entire group of symptoms to only three factors. When we take into consideration the difference in irritability of the various neurons of the body, even though they belong to the same system and are subject to the

same type of stimuli, we can then understand the variability of symptoms and explain why it is that one symptom is present at one time and not at another, and why one symptom presents in one case and not in another. It is exceedingly rare to find all symptoms of the toxic group or all of the reflex group present at the same time; but we find now one and now another, and it is the combination of various reflex symptoms and various toxic symptoms that furnishes the basis for deciding what organ is the seat of the inflammation.

Those symptoms which have the greatest localizing value are the motor and sensory (pain) disturbances which appear in the skin, subcutaneous tissue and skeletal muscles as a result of mediation between the sensory and motor spinal nerves and the stimulus which comes from the lung over the sympathetic nerves. This is evident because spasm and pain as symptoms of visceral disease are expressed for the most part in definite groups of muscles or definite portions of muscles, and definite skin zones, according to embryologic segmental relationships. The reflexs rarely spread beyond their natural segments unless the stimulus is very strong.

This shows that there are certain symptoms which are common to many diseases and certain others which point to the involvement of some definite organ. In pulmonary tuberculosis there are no symptoms in Group I which are suggestive of an inflamed lung, but the flushed face in Group II is suggestive. Slight flushing sometimes appears in intestinal troubles also; but its origin can usually be determined by other accompanying symptoms. If the flushing is due to the lung, laryngeal irritation with hoarseness and cough are usually present, and increased tonus in the muscles of the shoulder girdle will usually be found. The reflexes as expressed in the larynx and heart and gastro-intestinal canal are of themselves of no localizing value. The location of pain, whether superficial or deep, is suggestive and when combined with symptoms of Groups I and II, make an inflammation of the lung almost certain.

In many common diseases we do not know how to classify the symptoms; in fact, in many of them we are not even able to recognize the symptoms; but if only

we will bear in mind how they are produced, and that any change in function can be translated into terms of nerve action, we shall then eventually be able to work out relationships in what at present seem to be wholly disconnected actions.

As a basis for understanding diseases it will be necessary in the first place to work out the nerve connections of all important organs so that the various reflexes from them may be recognized; and in the second place to know the disturbances which take place in the internal secretions. It will then further be necessary to understand how changes in the normal chemical substances of the body, as well as pathologic chemical substances of which toxins may be taken as an example, gaining access to the blood stream, act in the disturbance of equilibrium. Then secondary reactions which result from these primary effects, such as the changes in blood chemistry and disturbances in various systems of the body, such as respiratory and circulatory, must be assigned to the definite causes which are responsible for them. The effect of psychic stimuli in the production of symptoms and even diseased conditions must be assigned the important place that it deserves along with that of physical stimuli. Such a program requires that the same zeal and energy, the same scientific spirit, that has been given to the prosecution of investigations in the physical laboratories now be directed to the patient in an attempt to understand his reactions, for there is a patient who has the disease as well as a disease which has the patient.

Reprinted from the Transactions of Section on Practice of Medicine of the American Medical Association, 1921