**APPROACH TO NEUROLOGIC DIAGNOSIS**

By: Joseph Broderick, M.D.

OBJECTIVES

1. To use a clinical case to illustrate the clinical approach to a patient with a neurological problem.

2. To review how the knowledge of the temporal course and location of the problem can help point to the likely underlying pathology.

Approaching a clinical problem requires answering three very basic questions:

1. Is there a lesion involving the nervous system?

2. Where is the lesion?

3. What is the (histopathologic) nature of the lesion?

The first question is undeniably the most difficult one to answer. One can only make that judgment after attaining a vast familiarity with not only clinical neurology, but other disciplines of medical practice as well (and even then it cannot always be made with certainty). With time, as the variety of manifestations of an altered nervous system becomes less foreign, you will become more confident in stating whether certain symptoms are or are not neurologic in origin.

To arrive at an anatomic diagnosis (i.e., to answer the question where in the nervous system particular signs and symptoms arise) requires an understanding of the complex organization of the nervous system and the ability to translate the patient's description and your observations of dysfunction to a particular area (or areas) within the nervous system.

Having localized a lesion to a particular area of the nervous system, one must then (and only then) speculate as to the nature of that particular lesion. As you will soon see, a particular set of symptoms, whether due to an infarct (stroke), tumor, abscess, etc., may present with very similar findings and it is an assessment of the way in which these symptoms evolved (the temporal profile) which enables one to predict the histopathologic changes responsible for the observed abnormality.

ANATOMIC DIAGNOSIS:

Neurologic anatomic diagnosis may be highly sophisticated and precise, and a physician trained in this skill may be able to clinically localize a lesion in the nervous system to within millimeters of its actual site. While this type of skill is laudable, it is more than is required of even the practicing neurologist. In most clinical cases, it is sufficient for proper patient management to decide merely whether the responsible lesion is located in one of several gross anatomic levels and whether the presumed lesion is to be found on the right side, left side, midline, or is widespread over several levels. Disorders of the neuromuscular system occur at one or more of the following levels:

 Supratentorial

 Posterior fossa

 Spinal canal and vertebral column

 Peripheral nervous system

PATHOLOGIC DIAGNOSIS:

In describing lesions of the nervous system, we must consider two major parameters:

1. The morphology of the lesion: This includes a description of the gross and histologic appearance of the abnormal area, and making a judgment as to whether the pathologic process is a:
	1. Non-Mass: One, which alters cellular function in the area of the lesion but isn't significantly interfering with neighboring cell performance. In this case, the lesion itself is not, by virtue of its size or volume, compressing, destroying, or damaging nearby structures.
	2. Mass: One which not only alters cellular function in the area of the lesion, but also is of sufficient size and volume to interfere with neighboring function by compressing, destroying or damaging them.
2. The topography of the lesion: This includes a description of the location of the observed pathologic process and a judgment as to whether the abnormality is:
	1. Focal: Localized to a single well-defined and circumscribed anatomic area.
	2. Diffuse: Distributed over wide areas of the nervous system.

By integrating the morphologic and topographic descriptions, one can arrive at a precise pathologic diagnosis. When we see patients clinically, we do not have the benefit of tissue examination, yet based on the signs and symptoms and their evolution, we must proceed to make the same inferences as to the nature of the responsible pathologic lesion.

The neurologic examination is our clinical method for topographic analysis. Based on the signs of abnormal functioning, we can establish the presumed topographic distribution of the responsible lesion; i.e., we can determine where the lesion is located and whether clinically it appears to be well-localized (focal) or diffusely involving neural structures.

Upon reviewing a patient protocol, it is on the basis of the history obtained that we can make some judgment about the histopathologic nature of a responsible lesion.

The factors which we seek and abstract from the history and utilize in making this hypothesis are often referred to as the temporal profile of the disorder. This consists primarily of an assessment of how rapidly the disorders can be classified temporally in the following terms:

1. Acute: Onset and evolution within minutes.
2. Subacute: Onset and evolution within days.
3. Chronic: Onset and evolution within months.

Additionally, at the time we see the patient, we can also make a decision as to whether the disease process is one which is:

1. Transient: Produces symptoms which then resolve completely.
2. Improving: Produces symptoms which have reached their maximum intensity and now show evidence of partial (or more rarely, complete) resolution.
3. Progressive: Produces symptoms which have been worsening and likely will continue to do so.
4. Stationary: Has at some time in the past produced symptoms which, over a period of observation, have shown no significant change.

Finally, we may make a general observation based both on the history and examination as to whether the disorder is as follows:

1. Focal: Seems to involve a single, circumscribed area of the nervous system. In this case, we must state the area.
2. Multifocal: Seems to involve more than one specific and definable area of the nervous system. (Note: this term is included in this discussion for reasons of completeness. These disorders are not common, and we will not, for this course, be further concerned with this subdivision.)
3. Diffuse: Seems to involve large portions of the nervous system in a more-or-less uniform fashion.

For the purposes of recognizing and understanding clinical disease, it is sufficient to become familiar with six basic types of pathologic changes that occur within the nervous system:

1. Degenerative Disease: Characterized by a chronic, diffuse, and progressive temporal profile.
2. Neoplastic Disease: Chronic, focal, progressive.
3. Vascular Disease: Several types may be focal (infarct, intraparenchymal hemorrhage) or diffuse (anoxic encephalopathy; subarachnoid hemorrhage); mass (intraparenchymal hemorrhage), non-mass (SAH, anoxic encephalopathy, infarct); usually nonprogressive, but may show other temporal features. It is, however, almost always acute in onset.
4. Inflammatory Disease: The body's response to foreign pathogens will vary with the organism; it is usually rapid, but not sudden. The profile is therefore usually subacute in onset and progressive. The process may be diffuse (e.g., meningitis, encephalitis) or focal (abscess).
5. Toxic-Metabolic Disease: Usually diffuse, but depending on the specific etiologic agent, may present as acute, subacute, or chronic.
6. Traumatic Disease: Usually focal, but depending on the agent and the extent of secondary changes, may be acute, subacute, or chronic in evolution.

OBJECTIVES:

When confronted with a clinical patient problem, the student must be able to utilize the information given to answer the following four questions:

1. The signs and symptoms contained in the protocol are most likely the manifestation of disease at which of the following levels of the nervous system?
	1. Supratentorial
	2. Posterior fossa
	3. Spinal canal and/or vertebral column
	4. Peripheral neuromuscular system
	5. More than one level
2. Within the level you have selected, the responsible lesion is most likely:
	1. Focal - on the right side of the nervous system
	2. Focal - on the left side of the nervous system
	3. Focal - but involving midline structures and/or both sides of the nervous system
	4. Non-focal and diffusely located
3. The principle pathologic lesion responsible for the symptoms is most likely:
	1. Some form of mass lesion
	2. Some form of non-mass lesion
4. The etiology of the responsible lesion is most likely:
	1. Vascular
	2. Degenerative
	3. Inflammatory
	4. Neoplastic
	5. Toxic-metabolic
	6. Traumatic

In addition, given any item (symptom, signs, constellation of symptoms, laboratory data, etc.) contained in a patient protocol, you will be expected to state, describe, or define the mechanism (i.e., physiologic, anatomic, pathologic, biochemical, etc.) by which the phenomenon is produced.

Also, as neurologic practitioners, you will be expected to be able to describe the pathology of the responsible lesion, and at times (when possible) apply to the clinical presentation a specific pathologic diagnosis.

NEUROLOGIC DIFFERENTIAL DIAGNOSIS:

The development of a neurologic differential diagnosis and the selection of appropriate neurodiagnostic tests are predicated upon the principles outlined above. Based upon the history and physical examination, a hypothesis is raised which can be formulated in terms of the following questions:

1. Is there a disorder of the nervous system?
2. If so, is it located:
	1. at the supratentorial, posterior fossa, spinal, or peripheral levels or is it diffuse and involving more than one level?
	2. focal on the right side, left side, midline, or diffuse and non-focal?
3. If one of the above, is the lesion most likely
	1. mass or non-mass?
	2. vascular, neoplastic, traumatic, degenerative, etc.

Often in clinical medicine, the problems are not clearly defined, and even after a careful history and examination, one is left with several alternative hypotheses which can be formulated as above. These alternative hypotheses constitute the neurologic differential diagnosis. Appropriate tests are therefore selected which will be best suited to substantiate or eliminate each of the hypotheses.

Examples of these formulations may be one of the following:

1. If the patient has a disorder of the nervous system, it is likely supratentorial, focal right, mass, neoplasm. (In this situation, tests are selected to determine whether or not the patient has a lesion in the area suspected).
2. The patient does have a disorder of the nervous system, but I am uncertain whether it is:
	1. Supratentorial, focal right, non-mass, vascular

OR

* 1. Posterior fossa, focal left, non-mass, vascular

(Here, one would need to select those tests which would help with localization).

1. The patient does have a disorder of the nervous system, but I am uncertain whether it is involving:
	1. More than one level, diffuse, non-mass, or vascular (SAH)

OR

* 1. More than one level, diffuse, non-mass, inflammatory (meningitis)

(In this case, one needs to select tests to help resolve the pathologic nature of the lesion).

Each patient presents with their own particular problems in differential diagnosis and may raise only a single hypothesis which needs confirmation, or many hypotheses, each of which needs investigation before one can reach a tentative conclusion (diagnosis).

Appropriate tests are selected for each patient in accordance with the issues raised in differential diagnosis—and by considering the safest, most efficient, most economical, and least traumatic way of resolving the problem at hand.

The general principles to be applied are the following:

1. Always give the patient the benefit of the doubt when deciding about functional (non-neurologic) vs. organic (neurologic) disease—and rule out organic disease first.
2. Always try to rule out a focal disorder before deciding the problem is non-focal.
3. Always try to rule out a mass lesion before deciding the problem is non-mass.
4. Always try to rule out treatable/reversible disease before considering non-treatable diseases.
5. Once having decided on an anatomic-pathologic diagnosis, search for the underlying pathophysiologic mechanism (chemical, hematologic, etc.) which produced the lesion.
6. Always consider whether doing a study will:
	1. Be of benefit to the patient;
	2. Alter what you will do for the patient;
	3. Pose a risk to the patient greater than any benefit derived.

SUMMARY OF THE MOST IMPORTANT TEMPORAL AND SPATIAL FEATURES OF THE MAJOR DISEASE CATEGORIES

