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Commentary

Neuroradiology and Neuropsychiatry: A New Alliance

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Neuroradiologists who received their medical training 10 or more years ago may be surprised to observe the publication of articles describing the application of neuroradiologic techniques to psychiatric patients, as represented by the article by Degreef et al (1) in this issue of the *AJNR*. For many years, psychiatric illnesses were traditionally regarded as "functional;" that is, they were defined as psychiatric by their lack of any identifiable neurobiologic mechanism.

However, that traditional teaching is now disappearing from the repertoire of most up-to-date departments of psychiatry, which now tend to emphasize the importance of identifying the neural substrates of normal and abnormal cognitive and emotional functions. Unfortunately, few neuroradiologists will find time to learn about this exciting "new" scientific psychiatry. (It is in fact not really new: although few physicians are aware of the fact, Nissl, Brodmann, and Alzheimer were all psychiatrists.) The content of the article by Degreef et al makes it clear that psychiatry has returned to its original foundations, which are in disciplines such as neuroanatomy, neuropathology, and neurophysiology. For many psychiatrists in the 1990s, neuroimaging techniques such as magnetic resonance (MR) imaging, single photon emission computed tomography (SPECT), or positron emission tomography (PET) are simply in vivo applications of these disciplines.

Why is psychiatry moving its emphasis from the analytic couch to the radiologic couch? Several factors have converged to prompt psychiatrists to perceive the brain as the organ that expresses the functions of the mind, and, therefore, as the site of the various forms of psychopathology that they study and treat. First, an enormous range of medications has been developed to treat mental illnesses; these medications work on the central nervous system. To understand how these medications mediate their effects, psychiatrists must understand neuropharmacology, neurochemistry, and neurophysiology. Second, the discipline of cognitive neuroscience has burgeoned, giving us a treasure of insights about functions crucial to psychiatry, such as the mechanisms of memory, language, thinking, attention, emotion, and appetitive drives; to understand how their patients remember, think, speak, and feel, psychiatrists must understand neural circuits, neurotransmitters, and the molecular basis of memory. Third, a host of studies of the neurobiology of mental illness have accumulated, providing unequivocal evidence that mental illnesses ranging from anxiety disorders to Alzheimer disease are physical in origin, caused by aberrations in "body parts" that are largely at the molecular level, such as genes, neuroreceptors, or G proteins; to understand why their patients have developed mental illnesses, psychiatrists must understand these neurobiologic mechanisms.

Much of the evidence to support this paradigm shift in psychiatry has in fact come from the application of neuroradiologic techniques. The first computed tomography (CT) study of schizophrenia was published in 1976; since then, more than 50 studies have been completed, with more than 80% demonstrating that schizophrenic patients have structural abnormalities such as ventricular or sulcal enlargement, which can be objectively measured or rated in blinded and controlled studies (2–5). It is now clear that these early CT studies are a confirmation of observations made much earlier using postmortem brain tissue or pneumoencephalography (6). MR imaging is now being used to examine the brain in vivo to look for more specific lesions that were observed in earlier postmortem studies, such as abnormalities in the hippocampus, thalamus, or basal ganglia (7–15). Increased levels of focal signal hyperintensities have been reported re-

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peatedly in affective disorder (17–19). A study of monozygotic twins discordant for schizophrenia has shown that the ill twin can be distinguished from the normal twin in a majority of cases when scans are read blindly (16). SPECT and PET studies have shown a variety of findings in mental illnesses, such as decreased posterior temporoparietal blood flow in Alzheimer disease, hypofrontality in schizophrenia, anterior temporal foci in panic disorder, and increased metabolic activity in frontal and basal ganglia regions in obsessive-compulsive disorders (4, 5, 20–23).

These advances have dramatically changed the training of psychiatrists, as well as their clinical practice and their research. They now see neuroscience as their primary basic science, modification of brain chemistry and metabolism as one of their primary modes of treatment, and the brain as the organ that they are treating. (Good psychiatrists also recognize that they are treating people, and that sensitive counseling and psychotherapy are also a fundamental part of their speciality.)

These advances have also changed the nature of psychiatric research, as is clearly evidenced by the Degreef et al article (1) published in this issue of the *AJNR*. Psychiatrists such as those on the Hillside team recognized the potential for using neuroimaging techniques as probes to study the pathophysiologic mechanisms that may produce mental illness. When imaginative questions are asked, as in this particular paper, investigators can begin to examine issues such as the role of neurodevelopmental abnormalities in psychosis. Combining knowledge of MR with knowledge of developmental anatomy and clinical psychopathology, these investigators point out that a small clue visible in the septum pellucidum may lead the trained mind to explore the potential relevance of other sites, such as the septohippocampal system and other limbic structures, which are developmentally and gestationally related. This is an example par excellence of the potential for turning MR from a clinical diagnostic tool into a powerful scientific probe that can be used to explore possible neural mechanisms that may produce the symptoms of major mental illnesses.

Not surprisingly, psychiatrists are now increasingly aware of the relevance of neuroradiology to research and to clinical diagnosis and patient care, and they are increasingly likely to order studies and seek neuroradiologic consultation. Although CT, MR, or SPECT will not ordinarily establish a diagnosis, since there are no pathognomonic findings as yet for most mental illnesses, assessment of the structural and functional integrity of the brain may assist in differential diagnosis or provide useful information about prognosis. Clinical neuroscientists involved in research are fascinated with the power of neuroradiologic techniques as probes to explore the brain in vivo and to determine mechanisms and causes of mental illness. A new alliance is being forged between neuroradiology and neuropsychiatry, disciplines that share an interest in the most interesting organ in the human body. This alliance provides an exciting opportunity to explore the last frontier in medicine in the 1990s, identified by Congress as the "Decade of the Brain."

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