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November 7, 2005

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Penn Researchers Utilize MRI for Early Diagnosis of Schizophrenia
New Way of Using MRI May Show Us What the Naked Eye Cannot See

(Philadelphia, PA) - Researchers may have discovered a new way that may ultimately assist in the early diagnosis of schizophrenia - by utilizing MRI to study the patient's brain. Researchers at the **University of Pennsylvania Health System** (UPHS) looked for subtle brain abnormalities that cannot be seen by the human eye. A study examined the entire brain, looking at distributed patterns of abnormalities rather than differences in specific regions of the brain.

"In this study, we used high-dimensional shape transformations in which we compared a brain image with a template of a normal brain. Through this comparison, we then determined where and how the patient's brain differed from healthy controls," explained **Christos Davatzikos, PhD**, Director of the Section of Biomedical Image Analysis in the Department of Radiology at Penn. "These methods are able to identify abnormalities that could not be detected by human inspection of the images created via MRI. And, up until now, structural MRI has typically been used to diagnose physical anomalies like stroke or tumors, but it has not been helpful for diagnosis of psychiatric diseases."

Davatzikos says, "MRI produces images which are traditionally read mostly by radiologists. Now, we can do a quantitative reading of these images - bringing out information that is not obvious to the eye; one can think of computer readings as computational scanners. It's a second level that says 'analyze this image and produce another image that highlights subtle abnormalities in the brain.' This is fundamentally new information now that we can use for a larger spectrum of diseases and look for early diagnosis and prevention - such as the teen at risk for developing schizophrenia."

The results of the study demonstrate that sophisticated computational analysis methods can find unique structural brain characteristics in schizophrenia patients, with a predictive accuracy of more than 83%. Recently, Davatzikos and his group announced that further analysis of this data with even more sophisticated classification methods achieved a 91% predictive accuracy for diagnosis of schizophrenia via MRI (MICCAI 2005 meeting, Palm Springs, CA).

"This is the first time this level of predictive power of MRI for classification of schizophrenia is demonstrated in a study of this magnitude," adds Davatzikos. "This tells us there are unique patterns we can use and explore when we want to diagnose patients with schizophrenia. However, the biggest value for this new diagnostic tool will be for early detection before clinical manifestation of the disease. For this, we will need to examine teenagers at risk."

Schizophrenia commonly presents in late adolescence or early adulthood thereby disrupting normal

development and attainment of education and achieving independence. "If the disease can be detected early, intervention can ameliorate its potential effects. For example, brain systems implicated in schizophrenia include those required for learning and memory. Knowing that these systems have reduced volume in an individual could justify cognitive remediation efforts that will palliate the deficits and allow better adaptation," said **Raquel Gur, MD, PhD**, Director of the Schizophrenia Center with the Department of Psychiatry at UPHS, who performed the studies supported by NIMH.

Davatzikos further explains, "If you can diagnose schizophrenia early, utilizing MRI along with other tools like genetic disposition, behavioral profiles and functional imaging -- before a patient actually develops the disease -- we can try to delay the onset of the disease and hopefully have a better outcome for the rest of their life."

"Despite the high accuracy with the MRI classified patients and healthy controls, the diagnosis of schizophrenia is based on the clinical presentation," says Gur. "However, it is time for mental health professionals to think of neuroimaging as an important diagnostic tool that merits further research."

The results of this study are published in the November 2005 issue of the "JAMA - Archives of General Psychiatry." You will be able to access it on-line at: <<http://archpsyc.ama-assn.org/>> (The article is titled "Whole-Brain Morphometric Study of Schizophrenia Revealing a Spatially Complex Set of Focal Abnormalities").

The name of this study is "Computer-Based Detection of Complex Patterns of Brain Abnormality in Schizophrenia, Using MRI." NIMH grants funding supported this study.

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