

The Influence and Enlightenment of Neuroimaging Science on Psychiatric Teaching

Zhixin Chang*

The Third People's Hospital of Hulunbuir City (The Mental Health Center of Hulunbuir City), Hulunbuir 022150, Inner Mongolia Autonomous Region, China

*Corresponding author: Zhixin Chang, changzhixin06@126.com

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Abstract: Psychiatry belongs to the category of cognitive neuroscience, with its development being greatly influenced by neuroscience. Currently, undergraduate teaching in psychiatry still adopts the teacher-centered indoctrination model, leading to ineffective integration of neuroimaging science into the teaching process. In order to improve the quality of psychiatric talent training, the talent training model needs to be adjusted. This article analyzes the current situation of psychiatric teaching, outlines neuroimaging science, summarizes the impact of neuroimaging science on psychiatric teaching, and analyzes the strategies for applying neuroimaging science in psychiatric teaching, with the hope to provide a guideline for relevant teachers.

Keywords: Neuroimaging science; Psychiatry; Teaching strategies

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1. Introduction

The teaching content of psychiatry includes mental health and psychiatry, with the main teaching goal of cultivating high-quality psychiatric professionals who meet the community's needs. Currently, many problems exist in the teaching of psychiatric medicine in China, such as outdated and backward teaching methods, inappropriate teaching content, low classroom participation, and insufficient practical opportunities, which in turn affect students' learning and hinder the development of psychiatric medicine in China. To this end, teachers need to adjust and improve their teaching concepts and integrate neuroimaging science into psychiatric teaching in order to promote the continuous improvement of teaching quality.

2. Analysis of the current situation of psychiatric medicine teaching

Psychiatry is a relatively young profession with numerous problems in the actual teaching process. First of all, there are problems with the structure of psychiatric medicine courses. In some colleges and universities, there are many core courses and hours and fewer elective courses in psychiatric medicine. The imbalance between the two can affect students' knowledge structure and learning effects. Secondly, the teaching of psychiatry is mainly

based on theoretical knowledge, and students have insufficient opportunities to participate in clinical practice, which is inconducive to the improvement of their practical skills^[1]. Lastly, the knowledge system of psychiatric medicine is relatively old and has not been updated in a timely manner. The classroom teaching model is still based on teacher explanations, with students' learning focused on understanding, memorizing, and imitating relevant knowledge, thus their independent thinking skills cannot be improved. There are also certain problems in the teaching and evaluation methods of psychiatric medicine. Most colleges and universities still focus on the assessment of theoretical knowledge without assessing students' practical skills, which in turn affects the improvement of their practical skills^[2].

3. An overview of neuroimaging science

Neuroimaging science mainly refers to the science of using imaging technology to study and analyze the nervous system. Its main technologies include functional imaging, molecular imaging, structural imaging, etc. Currently, commonly used structural imaging technologies in neuroimaging science mainly include magnetic resonance imaging (MRI), computed tomography (CT), single-photon emission computed tomography (SPECT), positron emission tomography (PET), etc. Molecular imaging technologies mainly include mass spectrometry imaging, optical imaging, etc. Neuroimaging science can be used in the diagnosis and treatment of neurological diseases such as Parkinson's disease, brain tumors, and cerebrovascular diseases, as well as in neuroscience fields such as research on brain structure and function, nerve cell metabolism, and signal transduction^[3,4].

4. Impact of neuroimaging science on psychiatric teaching

Most studies include psychiatry within the scope of cognitive neuroscience, thus the development of psychiatry is closely related to the development of the field of neuroscience^[5]. In recent years, with the advancement of science and technology, functional neuroimaging and cognitive neuroscience technologies have become increasingly advanced, and their impact on psychiatric medicine has gradually deepened.

The author believes that the impact of neuroimaging science on psychiatric medicine is mainly reflected in the following aspects. Firstly, a large number of studies believe that patients with mental illnesses often do not have obvious brain tissue defects in traditional imaging examinations such as CT and MRI. Therefore, neuroimaging science has a limited role in the diagnosis of mental illnesses. Teachers rarely explain relevant content about neuroimaging science in psychiatric teaching. With the gradual advancement of medical research, the correlation between neuroimaging science and technology and psychiatric medicine has gained increasing recognition, and a large amount of objective evidence has confirmed that mental diseases are related to brain tissue lesions^[6]. In the 1970s, researchers conducted brain CT examinations on schizophrenia patients, and the results showed that their bilateral ventricles were significantly enlarged. This study provided an effective basis for psychopathological research on schizophrenia. Since then, researchers have imaged the brains of patients with various types of mental illnesses, analyzed whether there are abnormalities in their brain tissues, and made many research progress^[7]. In recent years, molecular imaging technology, MRI imaging, CT, PET, SPECT, optical imaging, and other technologies have been gradually improved, and their application scope has been significantly expanded. Researchers utilize such technologies to detect the condition of brain tissue in patients with mental illness, and the results show that there are obvious imaging changes in specific areas of the brain tissue of patients such as abnormalities in the anterior hippocampus of patients with early psychosis, lack of white matter in patients with schizophrenia, and reduction of gray matter in the frontotemporal lobe and limbic areas. Based on this, it can be considered that the onset of mental illness has a certain material basis. At present,

neuroimaging science has become an important tool for scientific researchers to understand neurological diseases. Through the application of related technologies, the diagnostic standards of mental diseases can be improved, and the risk and treatment effects of the disease can be evaluated^[8]. Secondly, there are problems such as overlapping clinical syndromes and unclear subjective diagnostic criteria in the psychiatric diagnosis process. Most of the diagnostic criteria of the existing syndrome are general descriptions of clinical symptoms, which also leads to the diagnosis of mental illness being inconsistent with most biological model definitions and obvious differences in biological measurement of disease diagnosis. When doctors carry out diagnostic teaching, students often cannot accurately understand the relevant content, which hinders the improvement of their professional skills. In recent years, brain tissue imaging technology has gradually developed. The application of technologies related to neuroimaging science to the diagnosis of mental diseases has been attempted and achieved good results. The role of medical imaging technology in the field of psychiatric medicine has become increasingly prominent. Based on this, some studies have proposed incorporating objective indicators such as brain tissue imaging changes and biomarkers into the diagnosis of mental illness, and classifying them based on the indicators. The latest machine learning technology and model recognition technology are very useful in the detection of neuroimaging data. The application value is becoming increasingly prominent, the accuracy of biomarker detection has been significantly improved, and accurate diagnosis of mental disorders and other diseases can be achieved through the comprehensive application of related technologies^[9]. At present, technologies such as deep learning and statistical cluster analysis have shown great advantages in the research and evaluation of neurological diseases. Such technologies can transform the traditional machine learning model and use continuous nonlinear transformation to obtain the optimal expression scheme in the original data. Diffuse and subtle changes can be detected through techniques such as complexity detection and high-level abstraction, thereby achieving specific analysis of brain tissue^[10].

5. Strategies for applying neuroimaging science to psychiatric teaching

5.1. Application of case-oriented teaching model in psychiatric teaching

At present, the scope of application of neuroimaging science in psychiatric medicine is gradually expanding. People's understanding of the causes, pathological characteristics, and physiological characteristics of mental diseases is gradually deepening. The diagnosis and treatment of major functional mental diseases are increasingly closely related to neuroimaging science. At the same time, most medical schools have yet to include neuroimaging science-related content in the training and education of psychiatrists, which has affected the improvement of teachers' comprehensive abilities. To this end, teachers need to modify their teaching concepts, optimize teaching content, introduce cases into the teaching process, and combine neuroimaging science with psychiatric teaching content to improve learning effects^[11].

During the specific teaching of psychiatric medicine, teachers can combine the content of neuroimaging science with teaching cases to help students accurately understand the relevant content. For example, in the process of explaining major depression, a typical mental illness, teachers can provide imaging images of the patient's brain tissue, and guide students to observe and analyze various areas of the patient's brain, focusing on the forehead and forelimb circuits, and analyze the anatomy, defects, and functional deficiencies of the brain tissue. At the same time, teachers can provide comparative images of the brain tissue of patients with severe depression who are taking medication and those who are not taking medication. Students are guided to observe the reduction of gray matter in the prefrontal lobe and limbic areas of patients with severe depression who are not taking medication, as well as the bilateral superior and inferior frontal gyri, lateral middle temporal gyrus, hippocampus, bilateral parahippocampal gyrus, and other areas, and also to summarize changes in subcortical

brain tissue, such as hippocampal shrinkage, etc. ^[12]. Through this teaching model, students can understand the imaging characteristics of brain tissue in patients with severe depression, and realize that the onset of mental diseases is related to changes in brain tissue contours and internal cortical thickness. Imaging examinations can improve mental health and the accuracy of disease diagnosis.

At the same time, teachers can also integrate the teaching content of neuroimaging science into comprehensive teaching of various mental diseases, so that students can deeply understand the differences between various diseases. For example, in the process of explaining bipolar disorder, the teacher informed the students that the disease is also called manic depression. The patient with this disorder has characteristics related to schizophrenia and depression. The brain tissue has certain defects in imaging examinations, with main manifestations of posterior buckles, abnormal gray matter area in the belt and posterior cortical areas, abnormal anatomical structures in the hippocampus and amygdala, etc. The reasons for such changes are related to the physiological and pathological changes caused by bipolar disorder. Patients with bipolar disorder also have a certain degree of abnormalities in resting MRI examination results, which are specifically manifested as connectivity and regional abnormalities in the cortex, thalamus, striatum, and other parts of the body. Patients with schizophrenia have more severe defects in the corticothalamic system. Through this contrasting teaching model, students can accurately understand the differences in imaging manifestations of patients with different mental illnesses, thereby strengthening their understanding and memory of relevant knowledge. Teachers can also put relevant content of neuroimaging science teaching on online teaching channels such as WeChat public platform, guide students to use their spare time to study the imaging characteristics of various mental diseases, and conduct online case discussions with students to answer students' questions, and integrate online and offline teaching to achieve satisfactory teaching effects ^[13].

In addition, unlike the teaching of conventional imaging medicine, the various diseases involved in psychiatric medicine are mostly characterized by brain defects and abnormal brain function. Most patients exhibit normal overall brain anatomy and minimal brain tissue lesions, necessitating quantitative analysis for detection. To this end, teachers need to explain the specific methods of non-invasive quantitative analysis during imaging examinations, so that students can understand the changing characteristics in the function and structure of brain tissue in patients with mental illness. In order to achieve the above teaching goals, teachers need to rationally use big data, distributed cloud computing, and other technologies, appropriately design cases, formulate scientific teaching procedures, establish imaging databases, and strengthen teaching data protection.

5.2. Presentation of medical imaging data in multiple ways

At present, functional MRI is widely used in the evaluation of brain tissue structure and function in patients with mental illness, and has achieved good application results. Relevant studies have shown that when the human body completes specific tasks, blood oxygen levels can change, which can lead to abnormalities in emotional, sensory, and cognitive brain circuits. It is believed that related neural activities are reduced or increased ^[14]. Through the application of functional MRI, the assessment of neural circuits and neuronal activities can be completed in a non-invasive approach, thereby deepening people's understanding of brain tissue and behavioral systems. With the advancement of medical technology, the cost of functional MRI examinations has been significantly reduced, and the number of clinical studies has gradually increased. For this reason, teachers can introduce relevant cases and combine psychiatric medicine with MRI explanations to deepen students' understanding of various mental illnesses.

In recent years, the development of event-related potentials, electroencephalography, magnetoencephalography, visual evoked potentials, and other technologies has created favorable conditions

for the application of neuroimaging technology in the field of psychiatric medicine. Teachers can combine the above technologies with interactive three-dimensional (3D) models to explain mental science, neurology, and other knowledge, and use 3D visualization teaching mode to help students understand the neural circuit characteristics of patients with mental illness, so as to optimize students' learning experience and improve teaching effects. In addition, teachers can also use simulated patients to teach psychiatric medicine, present imaging images and detection data of mental illness patients on the simulation platform, and guide students to communicate with patients in order to deepen students' understanding of relevant knowledge and improve students' interest in learning psychiatric knowledge. This type of teaching model has relatively high requirements for teachers. To this end, it is necessary to conduct in-depth research on various advanced neuroimaging science and technologies, and formulate reasonable teaching plans based on the teaching content and students' characteristics in order to obtain satisfactory teaching effects^[15].

6. Conclusion

Psychiatric medicine teaching involves the diagnosis and treatment of various mental illnesses, in which neuroimaging science plays an irreplaceable role. To this end, teachers need to actively change their teaching concepts, improve teaching strategies based on existing problems in teaching, and combine psychiatric teaching content with neuroimaging science to help students understand the brain tissue characteristics in patients with mental illness so that students can master correct diagnosis and efficacy evaluation standards, thereby improving their overall quality.

Disclosure statement

The author declares no conflict of interest.

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