Functional Imaging in Neurology

New powerful technologies are being developed everyday in the field of neurology to provide not only opportunities to study the brain system in-depth, but it is also useful in diagnosing diseases and accessing brain health. Neuroimaging enables us to look into the brain in-depth, assesses how the brain works and how various activities impact the brain. With the help of Neuroimaging, we could have various access throughout neuroscience and the brain's functions. Technologies have enabled investigator's in-depth study of cognitive neuroscience over the past 25 years. These technologies provide access to how the brian functions and better yet efficiently look into brain injury or patients with traumatic stroke, and other brain injuries or diseases. This research is important because a greater understanding of the brain and how it developed could potentially lead to better developments of effective treatments.

Functional Magnetic Resonance (fMRI) is a form of imaging that is utilized to investigate the structure and functions of the brain as well as the metabolism, detecting blood flow and oxygen levels. Function imaging attempts to measure brain activity, changes in brain metabolism, and detecting changes associated with blood flow. A Functional Magnetic Resonance Imaging scanner uses a powerful magnetic field to detect brain activity. When an area becomes more active, there is an increase of blood flow within that region. While taking advantage of activated neurons which require more oxygen from red blood cells, detecting these changes by indirectly measuring an alteration in the blood flow and electrical activity, fMRI assesses brain activity while finding brain abnormalities. fMRI utilizes MR imaging to measure the tiny changes in blood flow that take place when a certain part of your brain is working.

Functional Magnetic Resonance Imaging has been utilized exceptionally in the studies of cognitive neuroscience as well as in the field of medicine.

Positron Emission Tomography, also known as PET, uses a radioactive tracer to visualize and measure changes within the metabolic changes in the brain. PET measures higher brain activity. The radioactive tracer attaches to the glucose in the bloodstream, since the glucose is a fuel for the brian it accumulates higher brain activity. PET scan is able to see these tracers contained in the brain and how they move around and function, this allows specialists to see troubled spots where glucose is not being produced properly in the brain. The PET scan can evaluate diseases and disorders such as seizures, Alzheimer's, and tumors.

Magnetic resonance imaging, or MRS is another medical imaging technique to measure the chemical composition of the brain. The MRS system uses an MRI system to measure the metabolic concentration of the brian. Distinguishing the chemical properties of certain areas of the brain, MRS detects various chemicals by their different vibrations frequencies, MRS creates a graph displaying types of chemicals distinguished in the brain or other organs.

Magnetoencephalography (MEG) is a test that measures the magnetic fields of the neuron's electrical activity. Identifying and locating the malfunctioning neurons in the brain, doctors utilize MEG to assess the health of the nerve cells and control them, evaluating both spontaneous brian activity. MEG allows doctors to assess areas such as epilepsy sources, sensory and motor areas, and language and vision.

Computerized tomography, (CT) scan is a series of x-ray images that are converted to sectional images of the brain. CT is a medical imaging technique used to obtain internal images of the brain and body. CT scans aid in finding certain types of brain injuries, locate brain

swelling or bleeding, identifying cancer, and revealing structural brain changes from schizophrenia.

Electroencephalography (EEG) test measures brain waves, recordes an electrogram measuring the spontaneous electrical activity of the brian. ELectrodes are attached to the scalp, detecting the electrical activity in the brain and sending it to a computer which creates graphs containing the measurements and records of brain activity. EEG's provide brian specialists information of the brain activity, detecting issues such as epilepsy, head injuries, sleep disruption and anxiety.

Near-infrared spectroscopy (NIRS) monitors the brain's oxygen saturation. NIRS utilizes infrared light to detect variations in hemoglobin oxygen levels in the bloodstream. NIRS is utilized to monitor brain oxygen levels during cardiac surgery and brian function and oxygen levels in preterm infants in a neonatal intensive care unit (NICU) setting.

Transcranial magnetic stimulation (TMS) is a technological magnetic stimulation which involves applying a series of short magnetic pulses to stimulate nerve cells in the areas of the brain that are known to be associated with major depression. This is a common treatment for depression sometimes called repetitive TMS (rTMS) because of the repetitive magnetic pulses being sent into the brain.

Overall, there are multiple imaging techniques and technologies in neurology to aid and assist doctors and specialists to see inside the brain and to understand relationships between different areas and functions of the brain, assisting in identifying disorders and diseases associated within the brian, neuroimaging aids in-depth study of the brain and its functions, an essential tool for researchers studying neurological disorders. Critical for studying brain changes associated with neurological disorders, and evaluating therapeutic interventions, with this unique

technology, specialists, neuroscientists, doctors and researchers can not only expand their knowledge in research and diagnostics of the brain, but potentially produce interventions and therapeutics for neurological disorders and diseases.

Reference

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Functional Imaging in Neurology Summary

There are various neuroimaging techniques which enable us to explore the brain and the field of neuroscience efficiently. These include technologies such as functional magnetic resonance imaging (fMRI), positron emission tomography (PET), electroantennography (EEG), magnetoencephalography (MEG), near infrared spectroscopy (NIRS), Magnetic resonance imaging (MRS), computerized tomography (CT), and transcranial magnetic stimulation (TMS). These new and powerful technologies enhance our knowledge of the brain and its functions and relationships within the brain which assist specialists to investigate and discover complex neurological disorders and diseases. With the assistance of modern technology in medicine, imaging in neurology is an impactful method in expanding our ongoing research and diagnostics of the brain, the most complex organ, and continuing discoveries and creating therapeutic interventions.