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Ablative Brain Surgery : Methods and its Significance

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Opinion Article

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DESCRIPTION

Brain tissue is surgically removed using a variety of techniques in ablative brain surgery, commonly referred to as brain lesioning, to treat neurological or psychological diseases. The Latin term ablatus, which means "taken away," is the root of the English word "ablation." Ablative brain surgery, however, typically involves damaging tissue while keeping it in place rather than removing brain tissue. It results in permanent lesions. A few target nuclei are available for deep brain stimulation and ablative surgery. The motor thalamus, the globus pallidus, and the subthalamic nucleus are those nuclei.

French physiologist Pierre Flourens (1774–1867) is credited with developing ablative brain surgery. He experimented with animals by removing various components of their neural systems and then observing the results. For instance, it was supposed that the region would govern arm motions if an animal could not move its arm after a certain section was removed. Experimental ablation was the name given to the procedure of removing a portion of the brain. Flourens claimed to have discovered the region of the brain that managed respiration and heart rate through experimental ablation. In neurobiology, ablative brain surgery is frequently employed as a research technique. For instance, the functions of all the deleted areas may be inferred through ablation of specific brain regions and observation of variations in animals who have undergone behavioural testing. Animal research uses experimental ablation. Due to the irreparable impacts and harms brought on by the lesion and by the ablation of brain tissues, such research on humans is seen as unethical.

Methods

A stereotactic device is used to drill holes into an animal's skull and insert an electrode or a short tube known as a cannula into the brain during an experimental ablation. The intended area of the brain may become damaged if electricity is conducted through the electrode, which is known as a brain lesion. Additionally, substances that can harm the area of interest can be injected into the cannula. The researcher can forecast the function of the damaged brain segment by contrasting the animal's prior behaviour with that following the lesion. Recently, it has been demonstrated that lasers may effectively remove both cerebral and cerebellar tissue. For instance, MRI-guided laser ablation provides for high levels of lesion placement and size precision with minimal to no thermal injury to surrounding tissue. One of the first to employ this MRI guided technique to efficiently and precisely remove and cure brain lesions is The Texas Children's Hospital. One patient at this facility who no longer experiences regular seizures as a result of the efficacy of this treatment is a good example. Brain, prostate, and liver cancers can also be eliminated with MRI-guided laser ablation. Ablative brain surgery alternatives include heating and freezing.

Sham lesions

Researchers can use sham lesions to administer a placebo lesion to animals used in ablation experiments. Anytime a cannula or electrode is inserted into brain tissue, the tool itself inflicts unintentional extra injury. Simple positioning of the lesioning tool in the same location as it would be in a real lesion constitutes a sham lesion; no chemical or electrical action is involved. By controlling for the damage done apart from the planned lesion, this technique enables researchers to accurately compare to an appropriate control group.

Excitotoxic neoplasms

When an excitatory amino acid is injected into the brain *via* a cannula, it causes an excitotoxic lesion. The amino acid is used to kill neurons by essentially stimulating them to death. An example of an excitatory amino acid utilized in this kind of injury is kainic acid. The specificity of this lesion is a key advantage. The chemicals are selective in that they do not damage the surrounding axons of nearby neurons, but only the target neurons.

Radio frequency abrasions

In the brain tissue, electrodes cause Radio Frequency (RF) lesions. An alternating current with an extremely high frequency is known as RF current. The method by which the current moves through tissue generates heat, which kills nearby cells. Contrary to excitotoxic lesions, RF lesions completely damage the area around the electrode tip.

According to Dr. Charles O'Brien, the incorrect approach to treating addictions is to do ablative brain surgery on the nucleus accumbens. But according to Dr. John Adler, ablation can reveal important details about how the nucleus accumbens functions.